

Level | Pressure | Flow | Solenoid Valves

sensors, controls
and fluidic systems



OUR EXPERIENCE

YOUR SOLUTION


Gems[™]
Sensors & Controls

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 product solution 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 Repeatability and Reproducibility
- Design Verification and Validation
- Corrective and Preventative Action (CAPA)
- Lean Tools
- 8D Problem Solving Methodology

From standard or custom configured components to engineered integrated sub-assemblies to complete fluidic systems Gems is dedicated to being your one source for all of your fluidic sensing and control needs.

Inside this catalog is the most comprehensive selection of fluid sensors and controls offered by any manufacturer. If you don't see exactly what is needed for your specific application give us a call. Working together our sales and engineering resources will help you to solve your most challenging application problems. Whether it's modifying a standard component, working with your design or creating a completely new sensor, control or system our goal is to produce a quality product that is cost effective, minimizes complexity, and improves the overall value and performance of your equipment.

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

Call us today — 800-378-1600

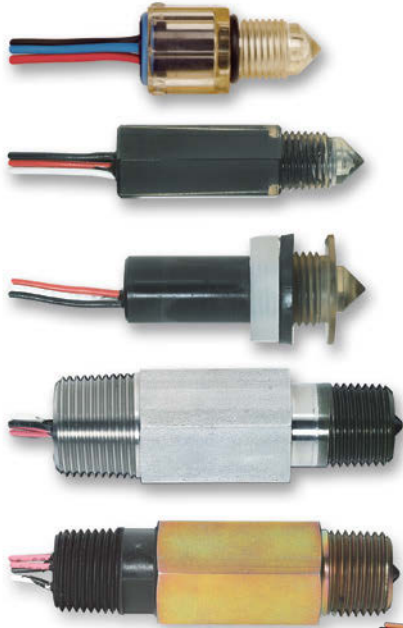


■ Switches

Electro-Optic

Section A

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.



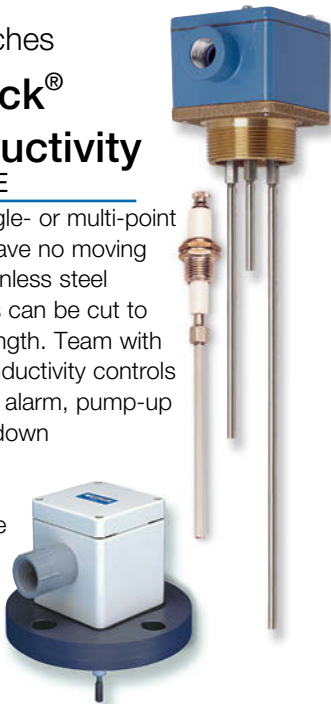
■ Switches

Warrick®

Conductivity

Section E

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.

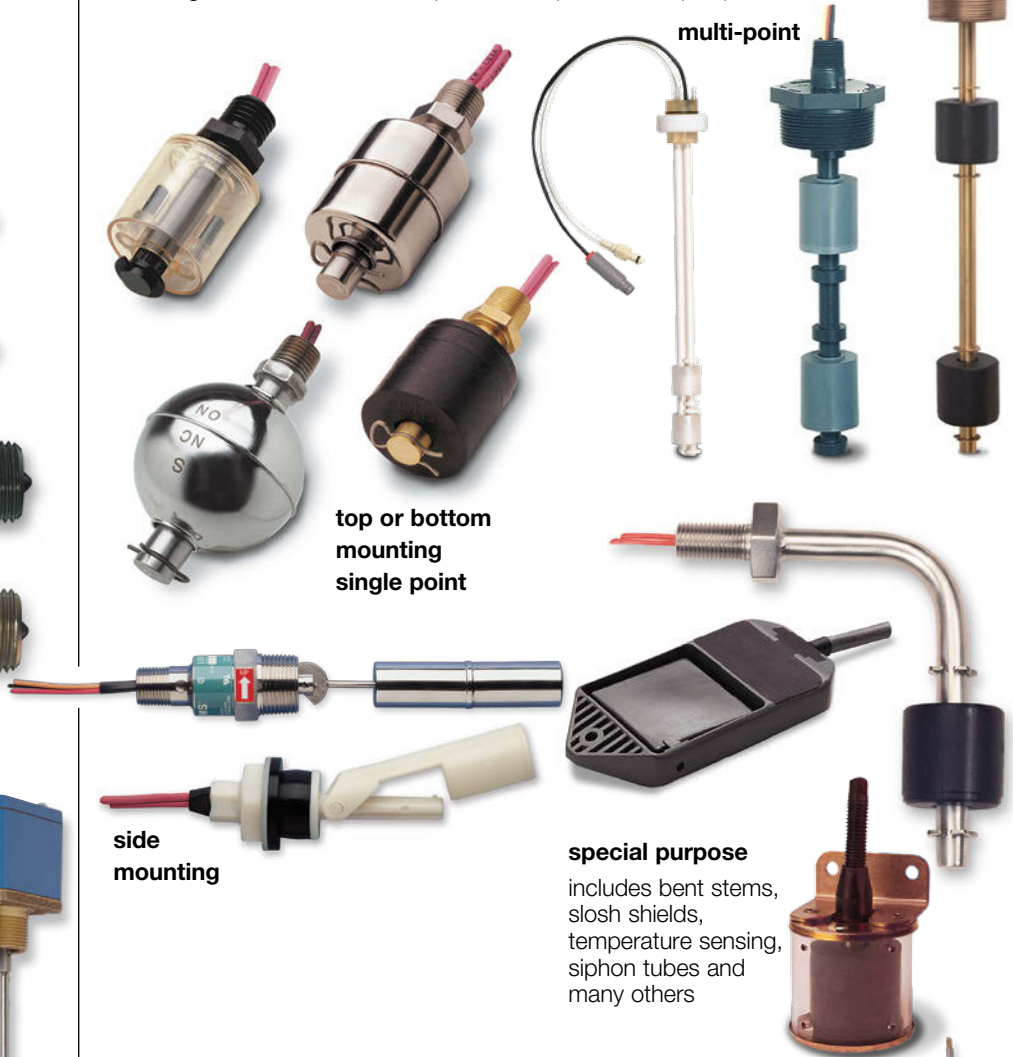


■ Switches

Float

Section A & B

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).



multi-point

top or bottom mounting
single point

side mounting

special purpose
includes bent stems, sash shields, temperature sensing, siphon tubes and many others

■ Switches

High Purity

Section A

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

Section A & C

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 26 feet (8 m). Also available for small tanks less than 4 ft. (1.2 m). Made of polypropylene, PVDF, PFA.



■ Indicators

DIPTAPE™ and DRUMTAPE™

Section D

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

Section A

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.



■ Switches

Capacitive

Section A

Gems Capacitance sensors are frequency-tuned for liquid detection. Most are non-contact models that sense from outside a fluid vessel's wall, and offer adjustability to operate accurately with both aqueous and non-aqueous liquids.

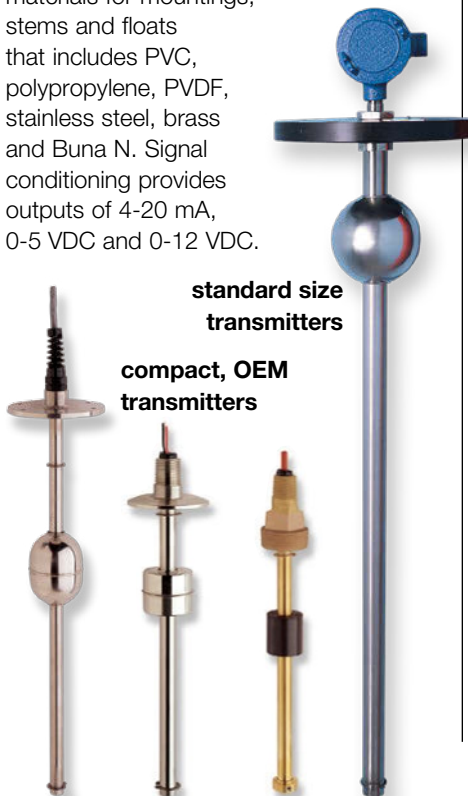


■ Transmitters

Float

Section C

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.

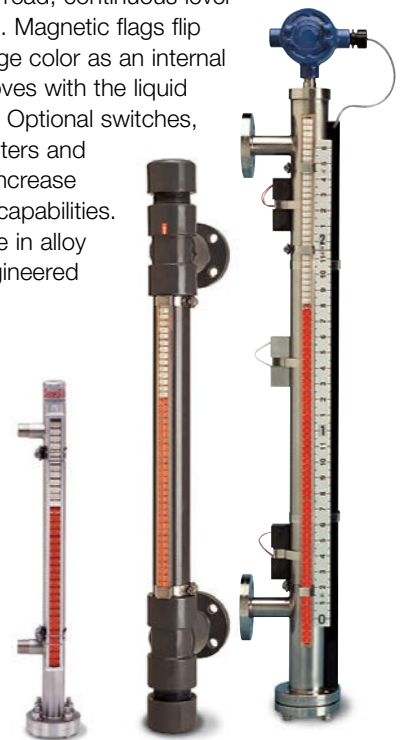


■ Visual Level Indicators

SureSite®

Section D

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.

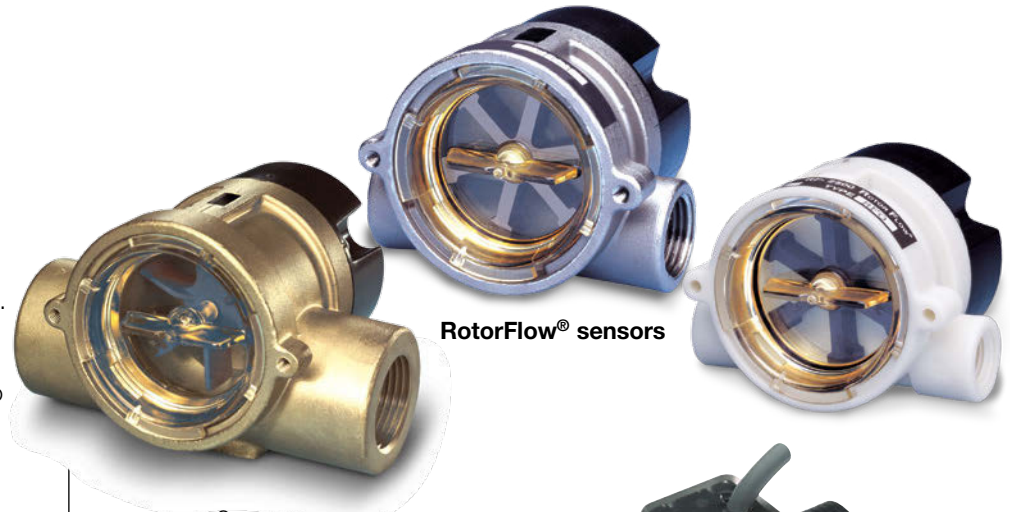


■ Sensors/Indicators

Paddle Wheel

Section F

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

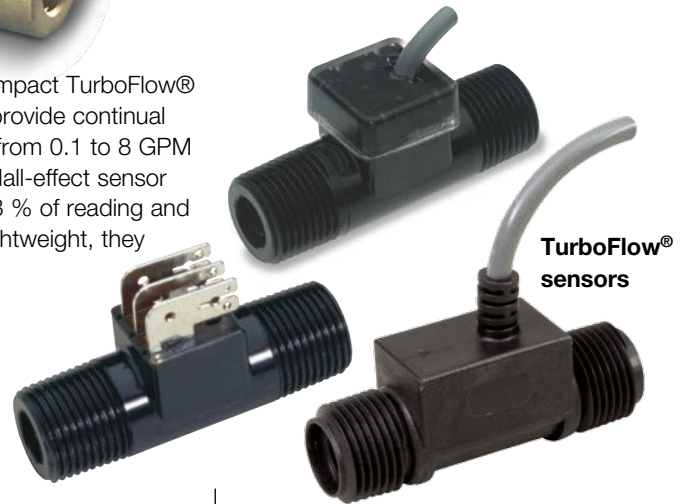
Piston

Section G

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.



TurboFlow® sensors

■ Switches

Paddle

Section G

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.

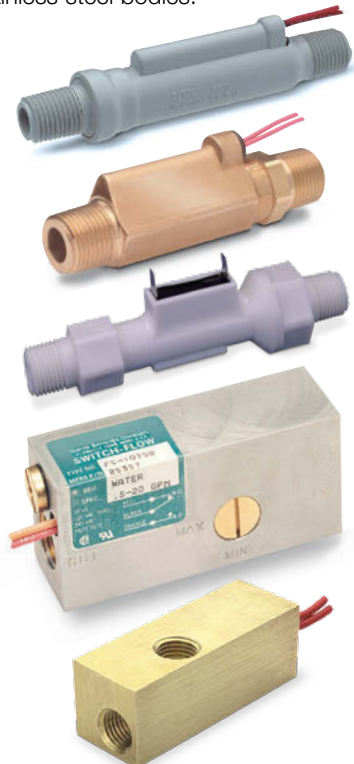


■ Switches

Shuttle

Section G

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).



PRESSURE SENSORS

■ Transducers

Sputtered Thin Film Section H

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 Section H

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

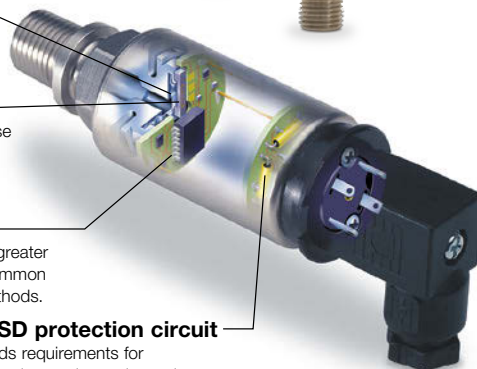
Stability and high sensitivity allow use of our thicker diaphragm. 17-4 PH SS sensor beam is laser welded for distortion-free construction.

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.

■ Switches

Piston/Diaphragm Section I



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 Section H



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 Section I



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 Section H

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.

Valves

General Purpose

Section J

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:



Valves

Cryogenic Valves to -320°F (-196°C)

Section J

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.



Valves

Isolation for High Purity or Aggressive Fluids

Section J

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:



Proximity Switches

PRX Series

Section K

Monitor proper closure of doors and access panels as part of an automated process with these compact sensors. Gems offers a broad selection of versatile, low cost, general purpose proximity sensors designed for dry applications such as security systems and door/panel interlocks. Our PRX Series proximity switches are available in a wide range of size and mounting configurations. PRX series switches, hermetically sealed for long lasting performance, have no standby power requirements and no moving parts. They are easy to install for a variety of applications.



■ Solid-State

Intrinsically Safe Relays and Controls

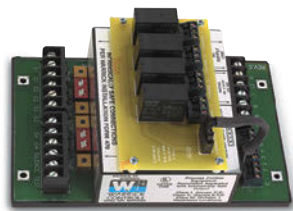
Section L & E

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**



**Warrick® Series
47 4-channel
relay alarm
panel control**



**SAFE-PAK® relays
& Zener barriers**

■ Electrical

Standard and Custom Warrick® Panels

Section E

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**



DMS-470/570 Series

■ Solid-State

Standard Relays and Conductivity Level Controls

Section E

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**



■ Transmitters

Receivers

Section D

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**



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Designers...Welcome To The Gems Catalog

As you make use of this Engineer's Resource book, you'll see we've gone to great lengths to provide you with the essential information required to make critical decisions. Of course, final product selection can be optimized through consultation with your local Gems Representative or Sales Partner, or directly with our GEMS applications engineers.

Our product design staff is always interested in new applications for GEMS sensors, so remember, if you can't find a product that looks like a perfect fit, give us a call. Gems can develop prototypes designed specifically for your application.

Because we want you to succeed in your application of Gems sensor components, we encourage you to read the following reminders and keep them in mind as you review product selection.

Important Points To Remember:

- At Gems, prototypes are our speciality. We strongly recommend prototyping for any application where doubt exists concerning the product or equipment specification.
- Gems products must be maintained and installed in strict accordance with the National Electrical Code and the applicable Gems Product Instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
- For hazardous area applications involving such things as, but not limited to, ignitable mixtures, combustible dust and flammable materials, use an appropriate explosion-proof enclosure or intrinsically safe interface device.
- Please adhere to the pressure and temperature limitations shown throughout this catalog. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of Gems products. Take care in the proper selection of materials of construction, testing is required.
- NSF-approved sensors are made of materials approved for potable water applications according to Standard 61.
- Stainless steel is generally regarded as safe by NSF and FDA.
- Life expectancy of switch contacts varies with application. Contact Gems if life cycle testing is required.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
- Our sensors must not be field-repaired.
- Physical damage sustained by product may render it unserviceable.
- Approvals listed in this catalog are for standard products only.

Common Icons in This Catalog

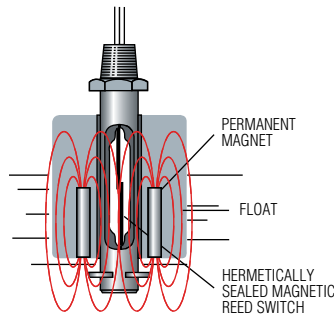
- ⚡ In-Stock Products
- 🌡️ Integrated Temperature Sensor Option Available
- 🔒 Explosion-Proof Junction Box Option Available
- 🛡️ Lexan® Slosh Shield Option Available

GEMS Application Information: 800-378-1600

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.

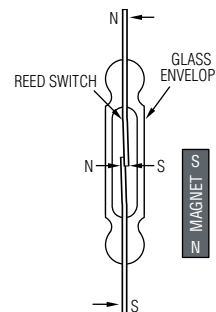


Contents	Page Start
Small Size	
Engineered Plastic.....	A-2
Alloy.....	A-8
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Engineered Plastic.....	A-12
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Leak Detection.....	A-22

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.

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



FDA
CE
UL US

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

Polypropylene Float (Hollow)



CE
UL US

Features a low specific gravity float offering broad chemical compatibility.

Polypropylene Float (Solid)



CE
UL US

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

Buna N Float



CE
UL US

Ideal for oils and fuels.

ALL-PVDF



UL US
CE
FDA

Wetted materials of construction comply with FDA food contact regulations.

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

New 3/4" Polypropylene Float



UL US
CE

See next page for details.



RoHS Compliant:

All LS-3 Series level switches featured on this page and the next are in compliance with EU-directive 2011/65/EC.

Common Specifications

Approvals: U.L. Recognized – File No. E45168; CSA Listed – File No. 30200. CE Declaration Available Upon Request.

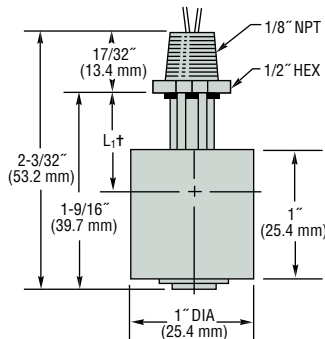
NSF materials are NSF 169 Standard compliant. For NSF approved level switches contact Gems.

RoHS – In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.

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.

For LS-3 Micro: 20 VA, 140 VAC/200 VDC

Dimensions – 1" Float Models only



† L₁ = Actuation Level
(see chart on next page)

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 ¹	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	42295 ⚡
Polypropylene ²	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	142505 ⚡
							3/8"-16	Lead Wires	171517 ⚡
							G 1/8"-28	Cable	171518
Polypropylene ³ NSF Std. 169 (Kynar float retaining clip)	Polypropylene ³ (Hollow) NSF Std. 169	1"	13/16" (20.6 mm)	.60	50 psi (3 bar)	-40°F to +225°F (-40°C to +107°C)	M12x1.75	Cable	189739
							1/8" NPT	Lead Wires	209475
							3/8"-16	Lead Wires	209455
Polypropylene ²	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	209460
							3/8"-16	Lead Wires	209465
							M12x1.75	Cable	116826 ⚡
Nylon	Buna	1"	13/16" (20.6 mm)	.45	150 psi (10 bar)	-40°F to +176°F (-40°C to +80°C)	1/8" NPT	Lead Wires	171514 ⚡
							M12x1.75	Cable	189787
PVDF	PVDF	1"	1/2" (12.7 mm)	.86	50 psi (3 bar)	-40°F to +250°F (oil) (-40°C to +121°C [oil])	1/8" NPT	Lead Wires	162745 ⚡
							M12x1.75	Cable	189786
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	173250 ⚡

Notes:

- Based on a liquid specific gravity of 1.0.
- All Polypropylene units carry a Kynar[®] retaining clip. Accessories Available in OEM Quantities: Jam Nut, Gaskets, and Slosh Shields.
- NSF 169 Approved unit, for water use only.

⚡ – Stock Items.

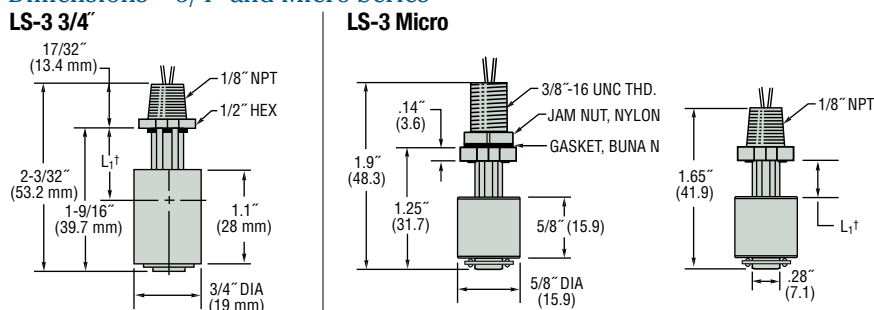
Miniature and Micro Floats for Tiny Tanks

Our smallest LS-3 Series switches yet!

Small yes, but with BIG performance. No other miniature float switches match 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. Switches are made from FDA compliant materials.



Dimensions – 3/4" and Micro Series



† L₁ = Actuation Level (see chart below)

Series	Stem and Mounting Material	Float Material	Actuation Level ¹	Min. Liquid Sp. Gravity	Pressure Max. @ 70°F (21°C)	Operating Temperature	Electrical Termination	Mounting Type	Switch Logic	Part Number
LS-3 3/4" ²	Polypropylene ²	Polypropylene (Solid)	7/16" (11.1 mm)	.95	100 psi (6.9 bar)	-40°F to +212°F (-40°C to +100°C)	Lead Wires or Cable	1/8" NPT	N.C./N.O.	201540
	Nylon	Buna	11/16" (17.5mm)	.85	150 psi (10.3 bar)	-40°F to +250°F (oil) (-40°C to +121°C [oil])	Lead Wire		Reverse Float Position	177818
LS-3 Micro	Polypropylene	Polypropylene (Hollow)	3/8" (9.5 mm)	.95	50 psi (3 bar)	-40°F to +176°F (-40°C to +80°C)	PVC Jacketed Lead Wires 24"-26"	1/8" NPT	N.O.	247135
									N.C.	247137
								3/8"-16	N.O.	246985
								Straight	N.C.	246986

Notes:

- Based on a liquid specific gravity of 1.0.
- Utilizes a Kynar[®] retaining clip.

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

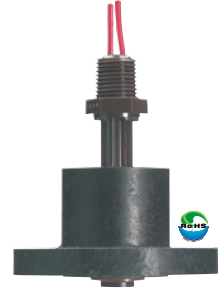
Compact, all-polypropylene switch with slosh shield is ideal for use with turbulent liquids in small tanks. FDA compliant materials.

Part No. 46999
Bottle Level

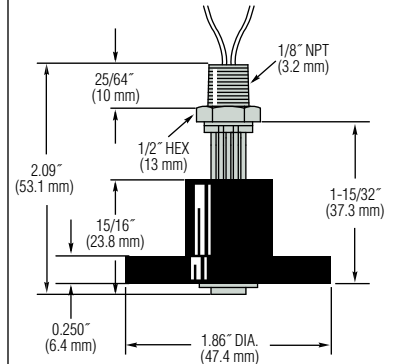
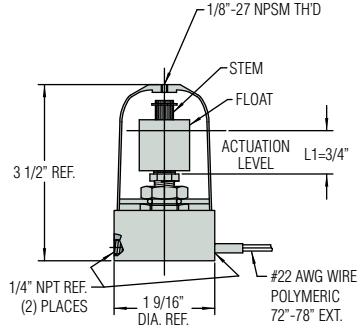
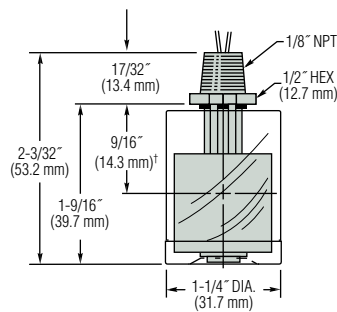


For external mounting on tanks too small to accommodate internally mounted switches. (See note below)

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 ⚡
Materials			
Stem and Mounting	All Polypropylene (Including Shield ⁴)	Polysulfone	All Polysulfone (Including Collar)
Float	Polypropylene (Solid)	Polysulfone	Buna N
Other Wetted	—	Brass, Aluminum, Polycarbonate, Viton A	Epoxy
Min. Liquid Sp. Gr.	.90	.75	—
Operating Temperature	-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)
Pressure, PSI, Max.³	150	50	
Switch¹, SPST	20 VA, N.C./N.O. Dry ²	20 VA, N.C. Dry	
Electrical Termination	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.

† L₁ = 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.

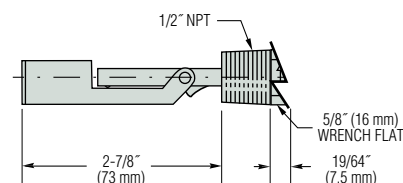
Specifications

Wetted Materials	Polypropylene
Min. Liquid Specific Gravity	0.55
Operating Temperature	-40°F to +250°F (-40°C to +121°C)
Operating Pressure	100 psi @ 70°F, max.
Float Arc Envelope	1.50"
J-Box with 5A Relay	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.

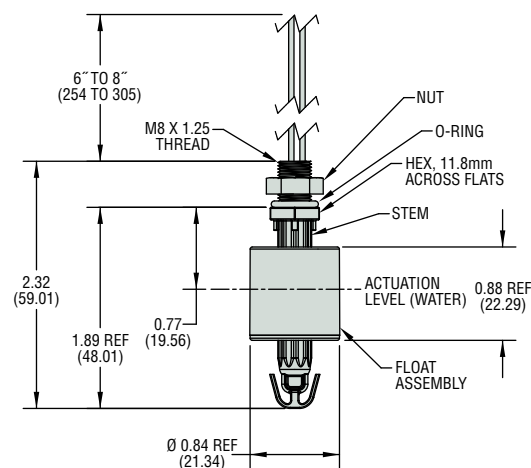
Specifications

Wetted Materials	Polypropylene
Stem and Float	Polypropylene
O-Ring	EPDM
Mounting Threads	M8 x 1.25"
Min. Liquid Specific Gravity	0.70
Operating Temperature	0°F to 175°F (-17°C to +79°C)
Operating Pressure	0 to 5 psig (0 to 0.3 bar)
Electrical Termination	22 AWG, 6"-8" PVC Jacketed Lead Wires (Black)
Switch Operation	N.O. Dry (May be converted to N.C. Dry by inverting float on stem)
Mounting Attitude	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>Polypropylene, Nylon or Versaplast™.</p>	<p>Polypropylene, Nylon or Versaplast™.</p>	<p>Polypropylene or Nylon; conduit connection.</p>
<p>ZIP CORD LEADWIRES, 24" EXTENDED 3.84" (97.5 mm) GASKET (WHITE BUNA N INCLUDED) 5/8"-11 THREAD LOCKING NUT (NYLON) 2-3/4" (69.8 mm)</p>	<p>ZIP CORD STYLE 24" LEADWIRES 4-1/4" (108 mm) 5/8" (16 mm) 2-7/8" (73 mm) 5/8" HEX 1/2" NPT</p>	<p>LEAD WIRES, 24" EXTENDED 1/2" NPT 4-1/2" (114 mm) 5/8" (16 mm) WRENCH FLAT 19/64" (7.5 mm) 2-7/8" (73 mm)</p>

Common Specifications

Switch Rating*: SPST, 20VA

Lead Wire Gauge: No. 22 AWG

Mounting Attitude: Horizontal.

RoHS: In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.

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

Approvals

Material	CE	UL Recognized File No. E45168	cUL Recognized	CSA Listed-File No. 30200	NSF Listed Mat. Std. 169
Nylon	X	X	X	X	
Polypropylene	X	X	X	X	X
Noryl®	X	X	X		X
Versaplast™	X	X	X		

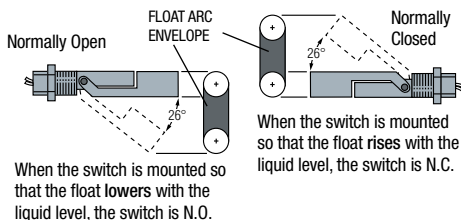
Media Compatibility

Media	LS-7 Compatible Types
Oil, Fuel, Hydrocarbons	Nylon
Broad Range of Chemicals and Water	Polypropylene
Limited Chemicals and Water	Noryl®
Oil, Antifreeze, High Temperatures, Corrosive Fluids, Various Chemicals	Versaplast™

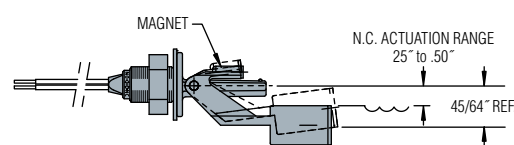
Switch Operation

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).

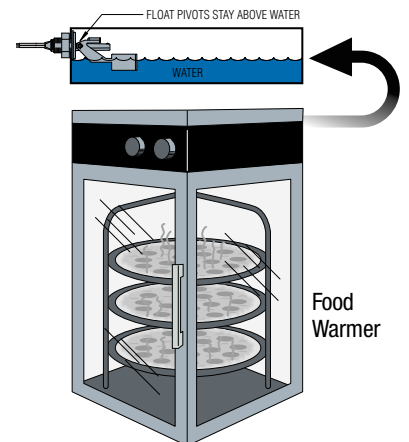
Types 3, 5, 7, 10 and 13



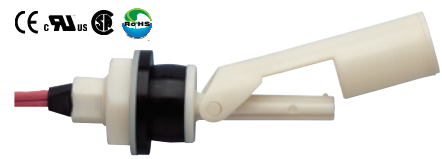


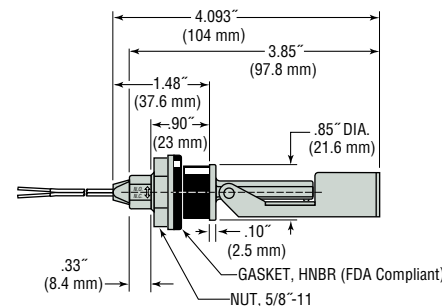
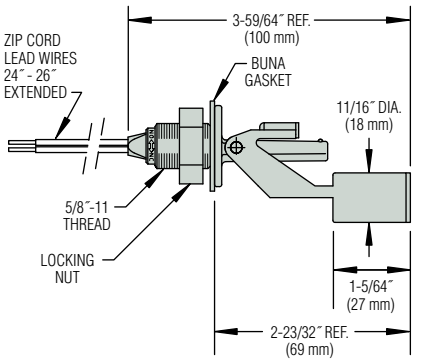
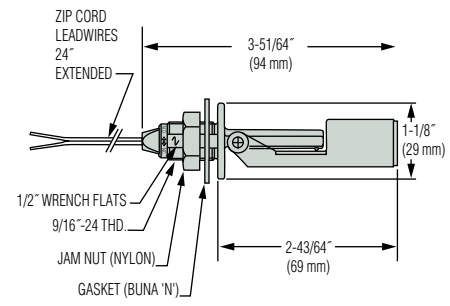
Type 12 – N.C. "Drop Float" Design



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 NSF approval for use in potable water, and are supplied with FDA-approved Buna gaskets.



- ▶ Nylon is ideal for oils and fuels.
- ▶ NSF Standard 169 polypropylene is ideal for potable water and broad chemicals.
- ▶ Versaplast™ is ideal for corrosive fluids, hot water, antifreeze, chemicals and oils.

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 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 (6.8 bar @ 20°C)	2.20	165570 ⚡
	Polypropylene			.55	-40°F to +225°F (-40°C to +107.2°C)			164520 ⚡
	Versaplast™			.80	-40°F to +250°F (-40°C to +121.1°C)			182600
5	Polypropylene	TPE†		.55	-40°F to +225°F (-40°C to +107.2°C)	100 psi @ 70°F (6.8 bar @ 20°C)	1.25	131100 ⚡
	Nylon			.65	-40°F to +250°F (-40°C to +121.1°C)			140620 ⚡
	Versaplast™	Teflon®	.80	-40°F to +300°F (-40°C to +148.9°C)	177100 ⚡			
5 - BSP	Versaplast™	TPE†		.80	-40°F to +250°F (-40°C to +121.1°C)	100 psi @ 70°F (6.8 bar @ 20°C)	1.25	189422
7	Polypropylene	TPE†		.55	-40°F to +225°F (-40°C to +107.2°C)	100 psi @ 70°F (6.8 bar @ 20°C)	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 (3.4 bar @ 20°C)	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 (6.8 bar @ 20°C)	.70	191080 ⚡
13	Polypropylene	TPE†		.55	-40°F to +225°F (-40°C to +107.2°C)	100 psi @ 70°F (6.8 bar @ 20°C)	2.20	197050

* Polysulfone and Ryton® R-4 are available upon request.
 † Thermoplastic Elastomer Zip Cord, 22 AWG.
 Note: NSF 169 Versions available. Contact factory.

See alloy versions on next page.

⚡ – Stock Items.

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.

Common Specifications



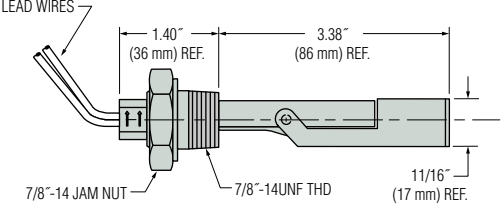
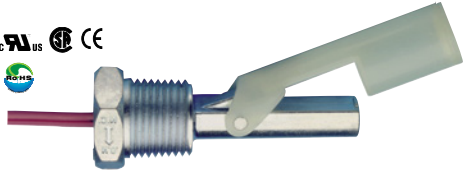

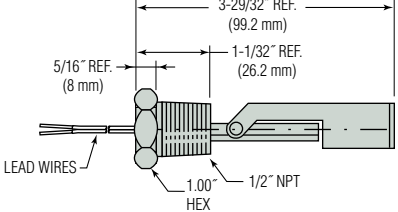


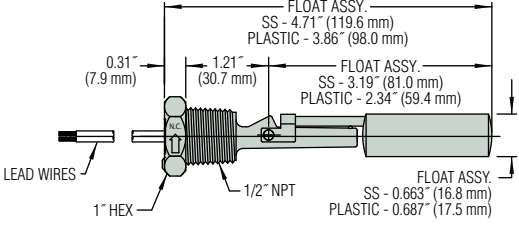


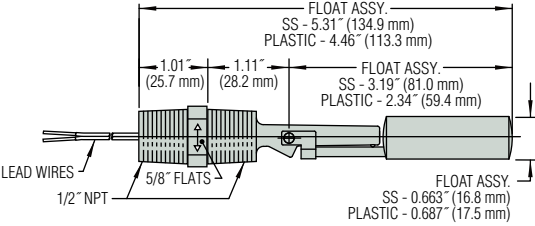


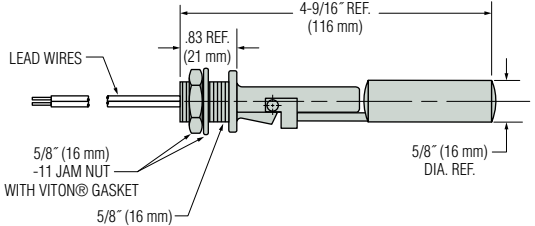
Switch Rating*: SPST, 20VA

Lead Wire: 22 AWG, 24"-27" Extended

Mounting Attitude: Horizontal.

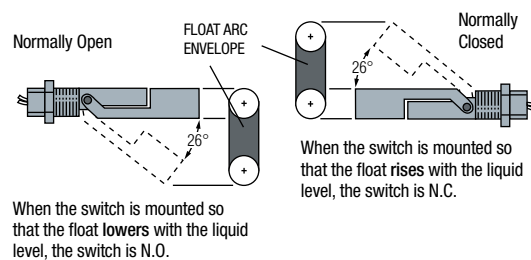
RoHS: In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.

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

<p>Type 6 External Mounting</p>	 <p>CE </p> <p>Zinc alloy body with polypropylene or nylon float. SAE Mounting.</p>	 <p>LEAD WIRES</p> <p>1.40" (36 mm) REF.</p> <p>3.38" (86 mm) REF.</p> <p>7/8"-14 JAM NUT</p> <p>7/8"-14UNF THD</p> <p>11/16" (17 mm) REF.</p>
<p>Type 8 External Mounting</p>	 <p>cULus  CE</p> <p>Zinc alloy body with nylon or polypropylene float.</p>	 <p>3-29/32" REF. (99.2 mm)</p> <p>5/16" REF. (8 mm)</p> <p>1-1/32" REF. (26.2 mm)</p> <p>LEAD WIRES</p> <p>1.00" HEX</p> <p>1/2" NPT</p>
<p>Type 9 External Mounting</p>	 <p>cULus  CE</p> <p>316 Stainless Steel body with 316 SS, nylon or polypropylene float.</p>	 <p>0.31" (7.9 mm)</p> <p>1.21" (30.7 mm)</p> <p>FLOAT ASSY. SS - 4.71" (119.6 mm) PLASTIC - 3.86" (98.0 mm)</p> <p>FLOAT ASSY. SS - 3.19" (81.0 mm) PLASTIC - 2.34" (59.4 mm)</p> <p>LEAD WIRES</p> <p>1" HEX</p> <p>1/2" NPT</p> <p>FLOAT ASSY. SS - 0.663" (16.8 mm) PLASTIC - 0.687" (17.5 mm)</p>
<p>Type 9 External Mounting</p>	 <p>cULus  CE</p> <p>316 Stainless Steel body with 316 SS, nylon or polypropylene float.</p>	 <p>1.01" (25.7 mm)</p> <p>1.11" (28.2 mm)</p> <p>FLOAT ASSY. SS - 5.31" (134.9 mm) PLASTIC - 4.46" (113.3 mm)</p> <p>FLOAT ASSY. SS - 3.19" (81.0 mm) PLASTIC - 2.34" (59.4 mm)</p> <p>LEAD WIRES</p> <p>5/8" FLATS</p> <p>1/2" NPT</p> <p>FLOAT ASSY. SS - 0.663" (16.8 mm) PLASTIC - 0.687" (17.5 mm)</p>
<p>Type 11 Internal Mounting</p>	 <p>cULus  CE</p> <p>316 Stainless Steel body with 316 S.S. float.</p>	 <p>.83" REF. (21 mm)</p> <p>4-9/16" REF. (116 mm)</p> <p>LEAD WIRES</p> <p>5/8" (16 mm) -11 JAM NUT WITH VITON® GASKET</p> <p>5/8" (16 mm) -11 THD</p> <p>5/8" (16 mm) DIA. REF.</p>

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	TPE [†]	.65	-40°F to +250°F (-40°C to +121°C)	100 psi @ 70°F	1.36	155660 ⚡
		Polypropylene		.75	-40°F to +225°F (-40°C to +107°C)	100 psi @ 70°F	1.36	179870
8	Zinc Alloy*	316 S.S.	TPE [†]	.80	-40°F to +250°F (-40°C to +121°C)	300 psi @ 70°F	1.43	249315
		Nylon		.65	-40°F to +250°F (-40°C to +121°C)	100 psi @ 70°F	1.40	160950 ⚡
		Polypropylene		.55	-40°F to +225°F (-40°C to +107°C)	100 psi @ 70°F	1.40	162795 ⚡
	316 Stainless Steel	316 S.S.	TPE [†]	.80	-40°F to +250°F (-40°C to +121°C)	300 psi @ 70°F	1.43	249315
		Nylon		.65	-40°F to +250°F (-40°C to +121°C)	100 psi @ 70°F	1.40	247390
		Polypropylene		.55	-40°F to +225°F (-40°C to +107°C)	100 psi @ 70°F	1.40	247380
9	316 Stainless Steel	316 S.S.	TPE [†]	.80	-40°F to +250°F (-40°C to +121°C)	300 psi @ 70°F	1.43	164870 ⚡
		Nylon		.65	-40°F to +250°F (-40°C to +121°C)	100 psi @ 70°F	1.40	164850 ⚡
		Polypropylene		.55	-40°F to +225°F (-40°C to +107°C)	100 psi @ 70°F	1.40	164860 ⚡
11	316 Stainless Steel		Teflon [®]	.80	-40°F to +250°F (-40°C to +121°C)	300 psi @ 70°F	1.65	179445

[†]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>$L_1 = 9/16"$ (14.2 mm) N.O.; $13/16"$ (20.6 mm) N.C.</p>		<p>$L_1 = 1/2"$ (12.7 mm) N.O. and N.C.</p>		<p>$L_1 = 5/8"$ (15.7 mm) N.O.; $3/4"$ (19.1 mm) N.C.</p>	
<p>$L_1 = 37/64"$ (14.5 mm) N.O.; $53/64"$ (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 CSA Listed – File No. 30200. RoHS – In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.

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.

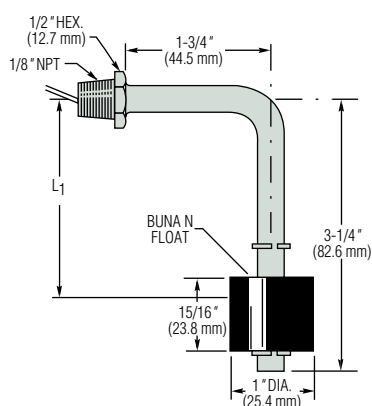
** Higher pressures are temperature dependent.

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

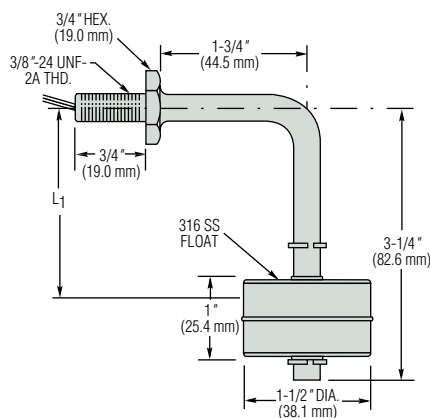
These units perform in liquids with specific gravities as low as .45; switches protrude into tank less than 3 inches.

Dimensions

Type I – 1/8" NPT



Type II – 3/8-24" Thread



Type II version shown.

Typical Wiring Diagram



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

L₁ 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

RoHS – In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.

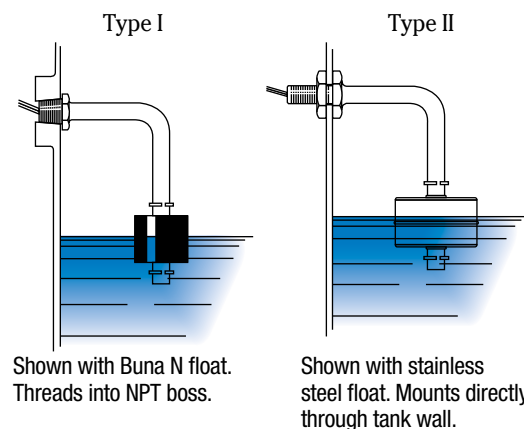
Switch* SPST: 20 VA, 120-240 VAC. Switch is N.O. (Dry), but available N.C. (Dry).

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).

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, 21/32" (16.7 mm), 1/4" NPT, 5/8" HEX (15.9 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, 13/16" (20.6 mm), 1/4" NPT, 21/32" HEX (16.7 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), ACTUATION LEVEL, 2-1/2" REF. (63.5 mm), 1-31/32" REF. (50.0 mm), #174105. FLOAT, #174106. RETAINING CLIP, 1-1/8" DIA. REF. (28.5 mm), 5/16" DIA. REF. (7.9 mm).</p>

†L_s = 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).

RoHS: In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.

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)† 1-3/4" (44.5 mm) 2-13/32" (61.1 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)† 1-3/4" (44.5 mm) 2-13/32" (61.1 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>

†L₁ = 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.
RoHS – In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.

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			20 VA, N.O.	01811 ⚡
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-1800 100 VA switches are not U.L. Recognized.

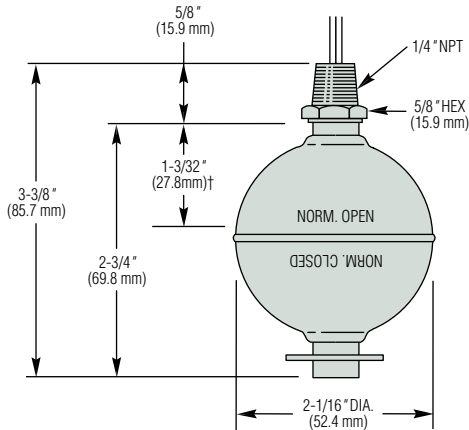
*** LS-1900 100VA unit is UL Resistive Rated.

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



†L₁ = 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
RoHS – In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.
(Part No. 79999 is U.L. Recognized RoHS Compliant 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 ¹	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	01950 ⚡
				-40°F to +480°F (-40°C to +249°C)		SPST, 100 VA ²	26717 ⚡
						SPST, 20 VA	79999 ⚡

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.

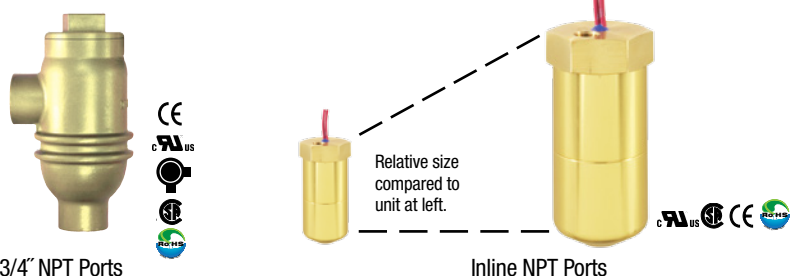
Large Size – Alloys

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-27

- Adjustable Volume
- Indoor Outdoor
- Solid-State



Dimensions

LS-800-5 – Brass and Stainless Steel	LS-159000
<p>†L₁ = Switch actuation level, nominal (based on a liquid specific gravity of 1.0).</p>	<p>Switch operation is NC as shown. May be changed to NO by inverting float on stem, or by mounting unit with lead wires down.</p>

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. RoHS – In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.

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 ₁	Switch*	Part Number
	Housing	Stem and Mounting	Float						
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
			S.S. ARMCO H-15-7 MO					750	SPST, 100 VA
	316 Stainless Steel	316 S.S.	Beryllium Copper	.90	600 @ 70°F		See Dimensions	SPST, 20 VA	172988
			Viton®						.50
LS-159000	Aluminum	Brass	Beryllium Copper	.90	600 @ 70°F	See Dimensions	SPST, 20 VA	144080	
			Viton®					.50	250 @ 70°F

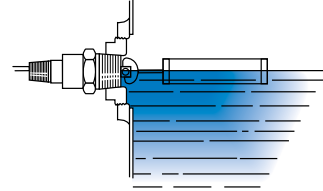
*See "Electrical Data" on Page X-5 for more information. DPDT relay information is with Dimensions above.

Large Size – Alloys

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

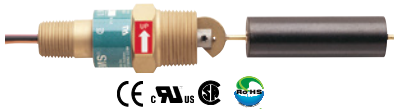
These units solve the problem of point level sensing in tanks with inaccessible tops or bottoms, or at intermediate locations in larger tanks. Operation is positive and dependable. The float pivots with changing liquid level, displacing a shuttle which magnetically actuates a hermetically sealed switch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

Typical Installation

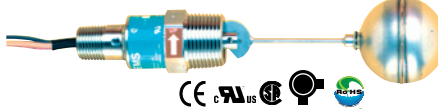


**UL Approved
Explosion-Proof**

LS-2050 Series – Brass and Buna N



LS-2050 Series – All-Stainless Steel



LS-52100 Series – All Stainless Steel

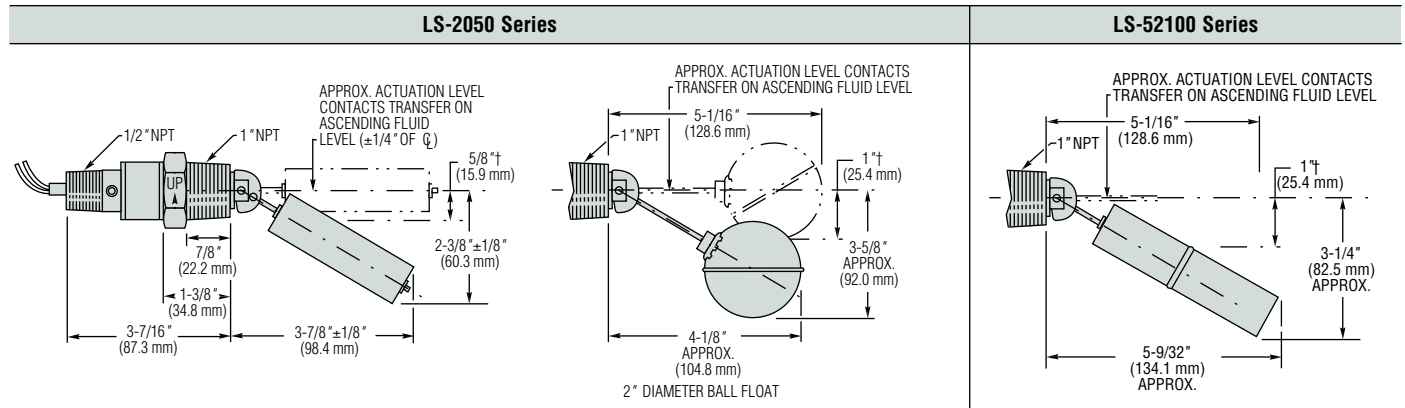


General purpose materials designed to provide reliable service in oils and water.

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



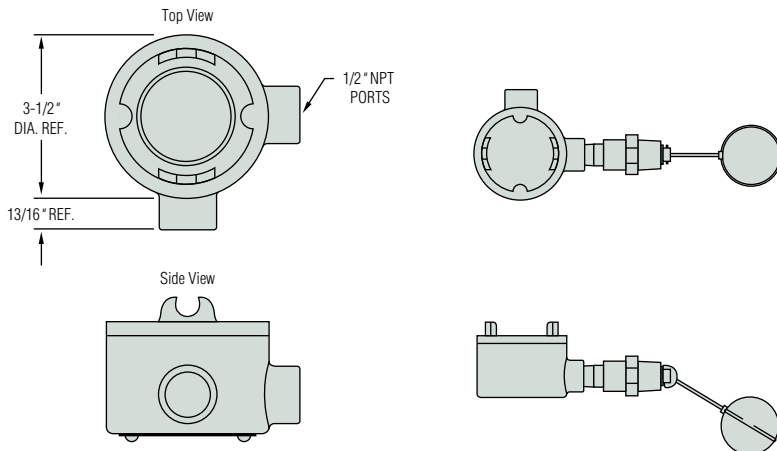
† Approximate de-actuation level, nominal (based on a liquid specific gravity of 1.0).

* 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-27

- Adjustable Volume
- Indoor Outdoor
- Solid-State



Common Specifications

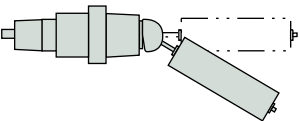
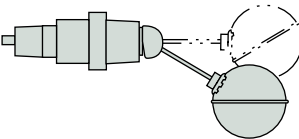
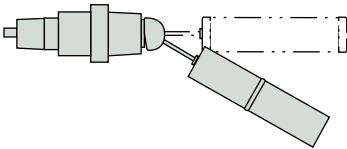
Electrical Termination: No.18 AWG, 24" L., Polymeric Lead Wires.

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.


RoHS – In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.

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 ¹	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	30288 ⚡	—	—
	316 Stainless Steel	316 Stainless Steel	Stainless Steel, Teflon®, Ceramic	SPDT, 20 VA	30290 ⚡	175650	55690
				SPST, 100 VA, N.O. ^{2,4}	48068	—	—
				SPST, 100 VA, N.C. ^{2,4}	48069	—	—
LS-52100	316 Stainless Steel	304 Stainless Steel	430 Stainless Steel, Teflon®, Ceramic	SPDT, 20 VA	52100 ⚡	—	121753
				SPST, 100 VA, N.O. ³	116971	—	—
				SPST, 100 VA, N.C. ³	116972	—	—

Notes

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

⚡ – Stock Items.

LEVEL SWITCHES – SINGLE POINT

Large Size – Alloys

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

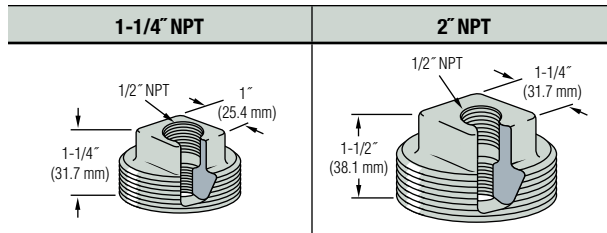
GEMS FABRI-LEVEL™ units can be custom-assembled in minutes from standard components, right in your plant. Simple instructions are furnished with kits.

FABRI-LEVEL™ Components

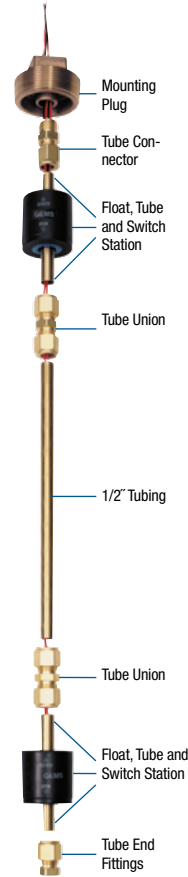
How to Order: Specify Part Number and quantity of each component required.

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 ⚡



RoHS Compliant:

All LS-3 Series level switches featured on this page and the next are in compliance with EU-directive 2011/65/EC.

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				
Float Dimensions									
Operating Temperature			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)		
Pressure, PSI, Max.			150				750		
Min. Media Specific Gravity			.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)	—	24579	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
Function	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.	
Material	Part Numbers					
Brass (Nylon Ferrule)	24633 ⚡	24412 ⚡	24553 ⚡	24631	25199 ⚡	24637
All-316 Stainless Steel	24634 ⚡	24413 ⚡	24554 ⚡	24632	25204	24638

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.

RoHS: In compliance with EU-directive 2011/65/EC requirements for chemicals and substances.

How To Order

Specify Kit Number and quantity.

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

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>27/32" (21.4 mm) 1/4" NPT 5/8" HEX (15.9 mm) 1-1/2" (38.1 mm) † 5-3/32" (129.4 mm) 4-1/4" (108 mm) 1-3/4" (44.5 mm) 1-1/4" DIA. (31.75 mm) Wire diagram on page B-21</p>	<p>1-1/16" (27.0 mm) 1/4" NPT FLOAT CUSHION 4-1/4" (108 mm) 3-3/16" (81.0 mm) 1-1/4" (31.8 mm) † 1-13/16" (46.1 mm) FLOAT CUSHION 1-7/8" DIA. (47.6 mm) 3/16" DIA. (4.7 mm)</p>	<p>2-1/2" (63.5 mm) 1-3/4" (44.5 mm) 9/32" DIA. (7.1 mm) 2 HOLES 3-3/16" (81 mm) 2-9/16" (65 mm) 1-3/8" ± 1/4" (34.9 mm) † SLOSH SHIELD CUT AWAY 2-19/32" DIA. (66 mm)</p>
Electrical Termination	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_s = 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 ¹		Part Number
	Stem and Mounting	Float	Other Wetted				Level SPST	Temperature ³	
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, 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 ² , N.O.		43980 ⚡
							50 VA ² , 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

t_L = 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.

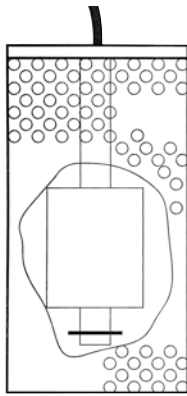
Leak Detection Sensors

- ▶ 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



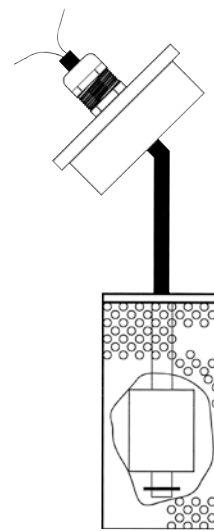
Designed for use in the annular space of double wall fiberglass tanks to detect the presence of conductive liquid. When combined with Warrick DMS or TA alarm panel, DWP-25 sensors can detect the presence of water or other conductive liquids in normally dry annular spaces.

DFP-25



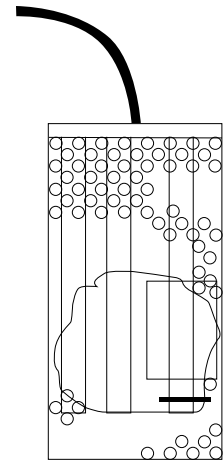
Designed for use in the annular space of double wall fiberglass tanks to detect hydrocarbon liquids. When hydrocarbons are present, a hydrocarbon wax pellet dissolves and closes a springloaded switch to signal a leak. This sensor is not reusable after exposure to hydrocarbons.

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-27 and E-28 respectively.

Applications

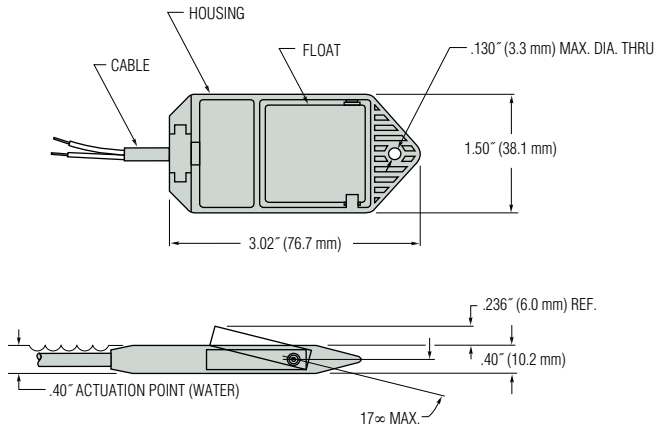
- Above Ground Storage Tanks
- Underground Storage Tanks
- Sumps
- Dry Annular Spaces

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

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 25 ft. Extended

Approvals: UL Recognized

How to Order – Select Part Number based on mounting option

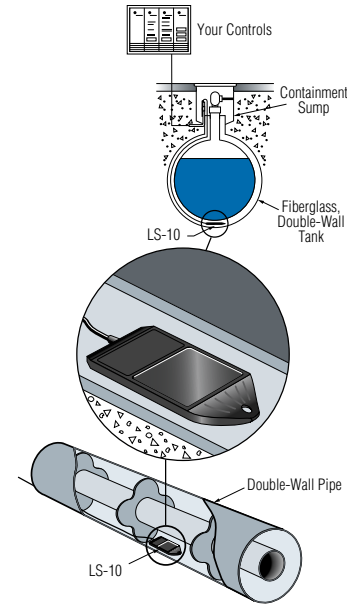
Series Number	Mounting Option	Part Number
LS-10	25' PVC Jacketed Cable	156000 ⚡

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.



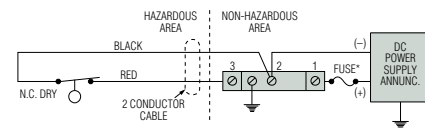
Typical Applications

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

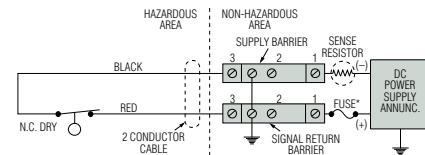


Typical Wiring Diagrams

Non-Isolated System—Single Zener Barrier

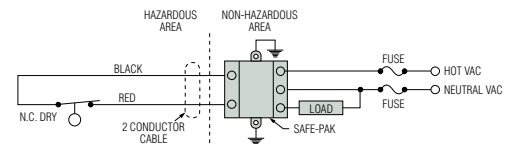


Isolated System - Dual Zener Barrier



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

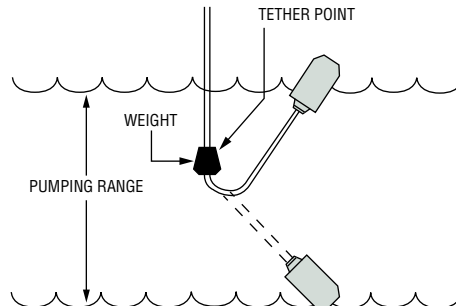
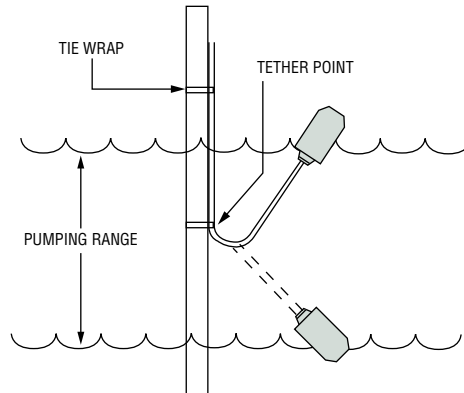
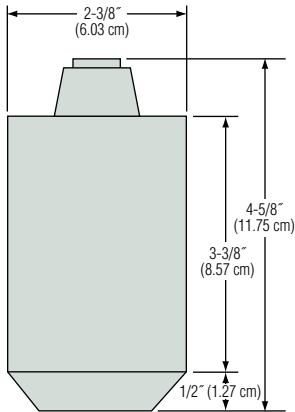
- ▶ Non-Mercury Switch
- ▶ Sealed Cable
- ▶ Impact & Corrosion Resistant ABS Shell
- ▶ N.O., N.C., SPDT Contacts
- ▶ Various Cable Lengths
- ▶ Color Coded Body

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

Cord	2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC 1/2 hp
Contact Design	SPST, Normally Open or Normally Closed Common with N.O. & N.C. (form C)
Temperature Rating	
Dry	32°F to 194°F (0°C to 90°C)
Water Resistant	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Cert. RoHS – In compliance with EU-directive 2011/65/EC requirements for chemicals and substances

Dimensions

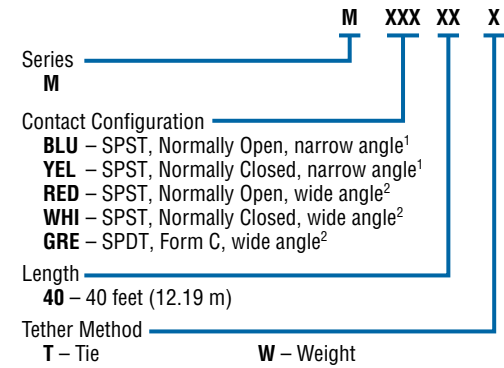


Applications

- 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	7762360
Weight	7762381

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.

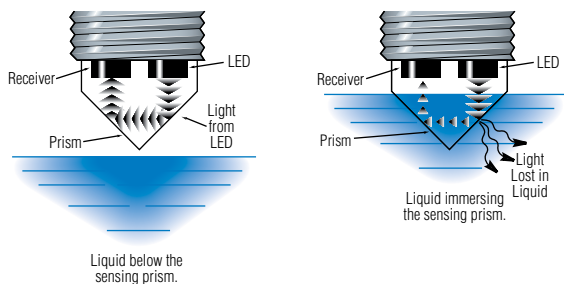
Level switches are suitable for high, low or intermediate level detection in practically any tank, large or small. Installation is simple and quick through the tank top, bottom or side. Solid state-switching ensures dependability over long service life.

The sensor offers ±1mm 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.

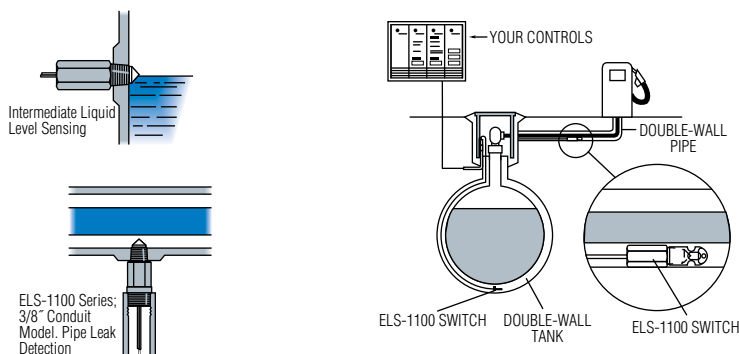


Reflective Surface

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

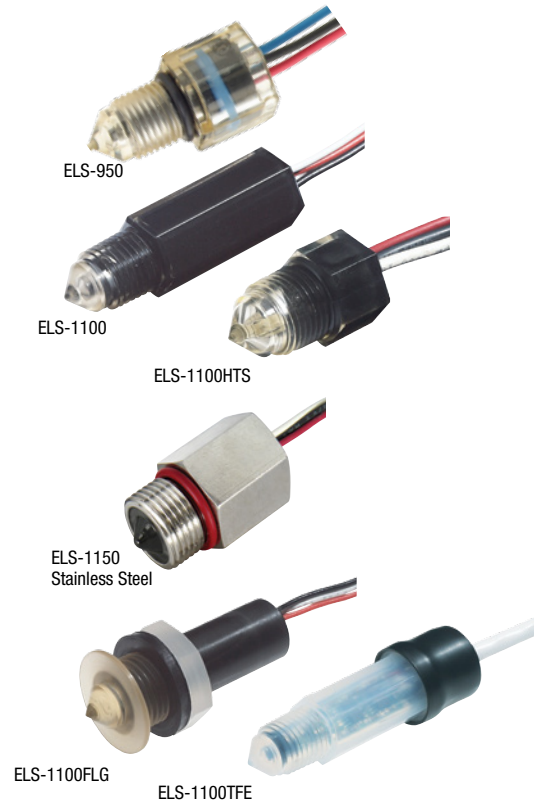
Typical Applications

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



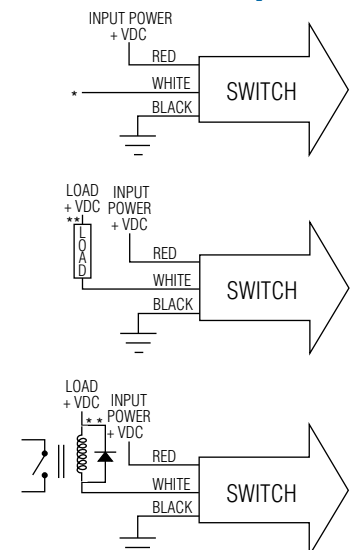
Contents	Page Start
Engineered Plastic	A-26
Alloy	A-31
Opto-Pak	A-35

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 Sensors

The ELS-950 Series represents Gems' smallest electro-optic level sensors 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 offering excellent temperature and pressure capabilities.

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

Specifications

Materials	
Housing	Polysulfone (Contact Gems for alternative material types)
Prism	Polysulfone
O-Ring	Fluorocarbon (1/4" MNPT - None)
Electronics	Over-molded TPE
Operating Pressure	0 to 250 PSI (0 to 17 bar) maximum
Operating Temperature*	-40°F to +230°F (-40°C to 110°C)
Current Consumptions (No Load)	
5 VDC	4 mA No Load
12 VDC	10mA No Load
Output	Sink 40 mA max., up to 30 VDC
Repeatability	±1 mm
Lead Wires	3x TPE Insulated; 22 AWG
Approvals	
CE, UL file No. E108913	
IP66/67 Rating	
ROHS Compliant	

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

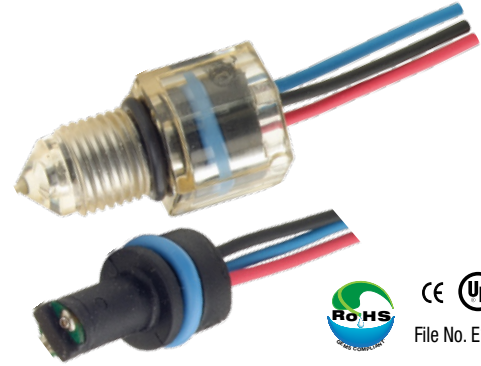
How To Order

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

* Supplied with standard fluorocarbon o-ring.

⚡ - Stock Items.

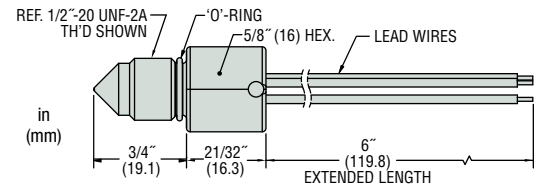


File No. E108913

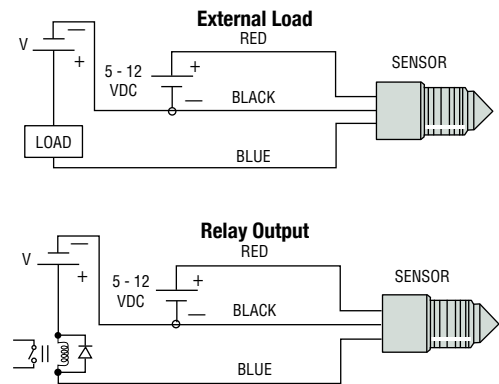
Typical Applications

- 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

Dimensions



Wiring Diagrams



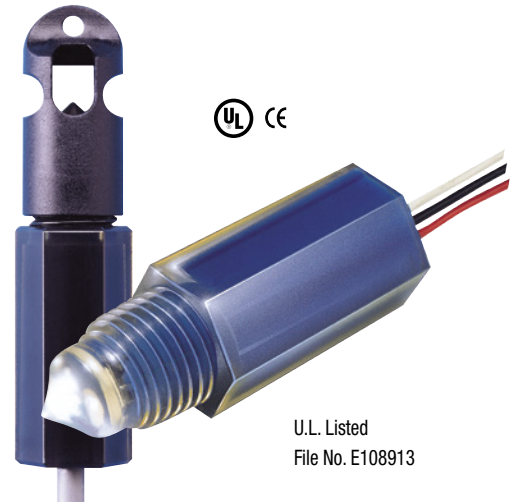
General Purpose ELS -1100 Series Satisfies Most Applications

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

Materials	
Housing and Prism	Polysulfone or Nylon
Operating Pressure	0 to 150 PSI, Maximum
Operating Temperature*	0°F to 176°F (-17.8°C +80°C)
Current Consumption	18 mA, Approximately
Output†	TTL/CMOS Compatible. Open Collector Output May Sink 40 mA UP TO 30 VDC.
Repeatability	±1 mm
EMI Susceptibility	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.



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
Electrical Termination				
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-33.



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

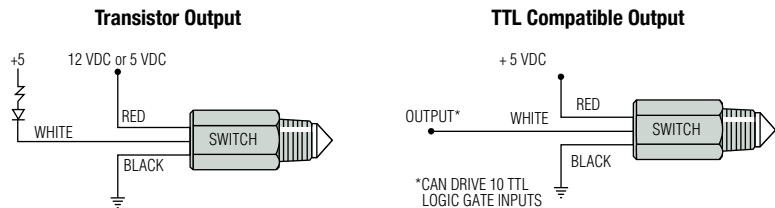
- Coolant reservoir monitoring
- Medical diagnostic and sterilizer equipment
- Low lubricant warning on machine tools
- Low level warning in hydraulic reservoirs

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



How To Order

HT Series

Specify Part Number based on Input and Output Condition required.

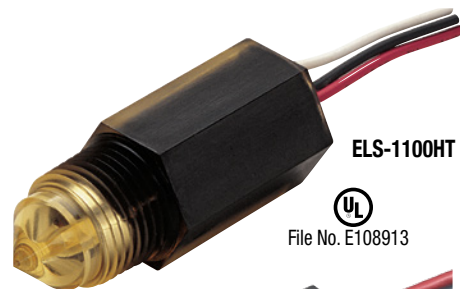
Input Power	Probe Condition at Current Sink	
	Wet	Dry
5 VDC	153061	153062
12 VDC*	153063	153064

*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.

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



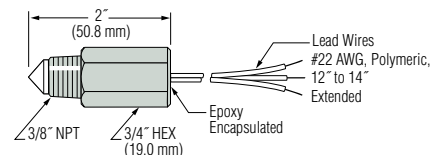
ELS-1100HTS



File No. E108913

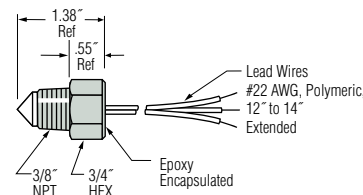
Dimensions

HT Series

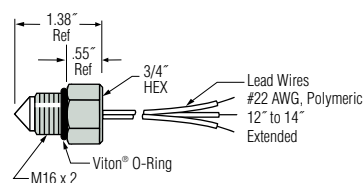


HTS Series

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-33.



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

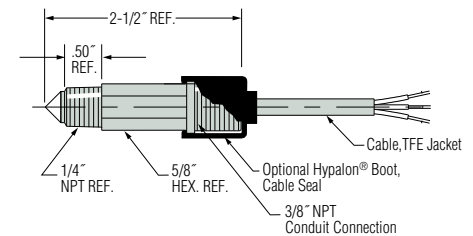
Materials	
Housing and Prism	Teflon®
Operating Pressure	0 to 150 PSI, Maximum
Operating Temperature*	0°F to 176°F (-17.8°C +80°C)
Input Voltage	10 - 28 VDC
Current Consumption	18 mA, Approximately
Output†	TTL/CMOS Compatible. Open Collector Output May Sink 40 mA Up to 30 VDC.
Repeatability	±1 mm
EMI Susceptibility	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	187595	173800 ⚡
Dry	185600	173700

ELS-1100FLG Flange Mounting for Installations Without Threaded Holes

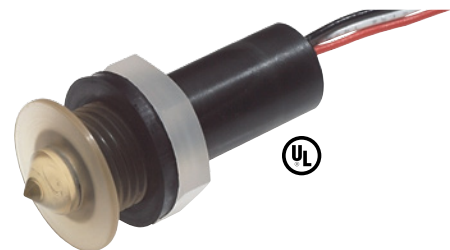
The easy solution for thin wall tanks ($\leq 1/4$ " thick): ELS-1100FLG Series. No threads needed with these flanged units. Slip through a .75" hole and tighten the jam nut; Viton® gasket forms a tight seal. Ideal for sheet metal, molded plastic tanks and medical applications where elimination of exposed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

Specifications

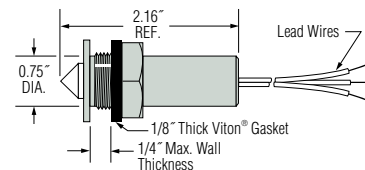
Materials	
Housing and Prism	Polysulfone
Operating Pressure	0 to 150 PSI, Maximum
Operating Temperature*	0°F to 176°F (-17.8°C +80°C)
Input Voltage	10 - 28 VDC
Current Consumption	18 mA, Approximately
Output†	TTL/CMOS Compatible. Open Collector Output May Sink 40 mA Up to 30 VDC.
Repeatability	±1 mm
EMI Susceptibility	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	187575	187590
10-28 VDC	187585	187580

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-33.



NOTES

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows of small squares.

ELS-950M Series Rugged Electro-Optic Level Sensors

The ELS-950M Series represents Gems' most compact alloy-housed electro-optic level sensors. They monitor a broad range of media including OHV type fluids.

Our UL-approved design features a brass housing, fused glass prism, and TPE insulated wires. They provide a durable, watertight, and environmentally resistant assembly, ideally suited for use in harsh environments including outdoors and engine bays. They offer excellent temperature and pressure capabilities. The ELS-950M is excellent for industrial OEMs requiring a solid-state sensor for small space and high temperature environments.

Specifications

Materials	
Housing	Brass
Prism	Fused Glass
O-Ring	Fluorocarbon (1/4" MNPT - None)
Electronics	Over-molded TPE
Operating Pressure	0 to 250 PSI (0 to 17 bar) maximum
Operating Temperature*	-40°F to +230°F (-40°C to 110°C)
Current Consumptions (No Load)	
5 VDC	4 mA No Load
12 VDC	10mA No Load
Output	Sink 40 mA max., up to 30 VDC
Repeatability	±1 mm
Lead Wires	3x TPE Insulated; 22 AWG
Approvals	CE, UL file No. E108913 IP66/67 Rating

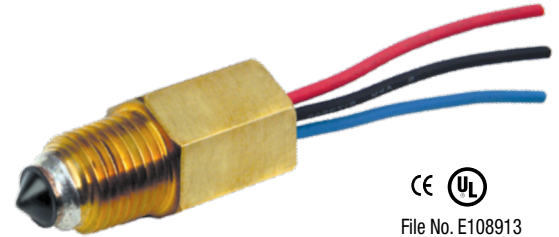
* These switches are not for use in freezing liquids or steam/high condensation environments. Contact Gems for alternative solutions.

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	232175	232171	232179
	Dry	6 inches	232176	232172	232180
12 VDC ±10%	Wet	6 inches	232177	232173	232181
	Dry	6 inches	232178	232174	232182

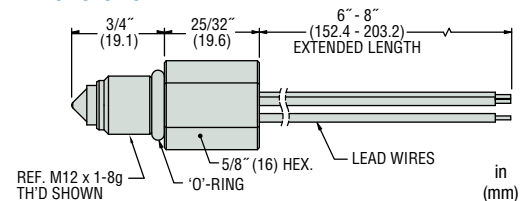
* Supplied with standard fluorocarbon o-ring.



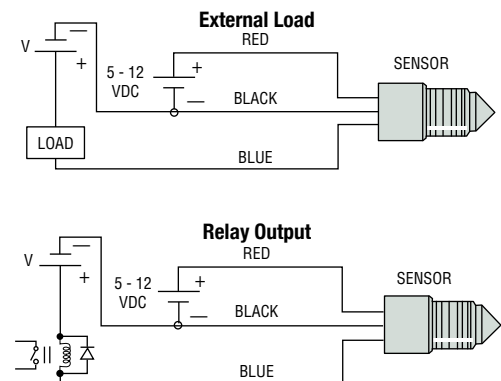
Typical Applications

- Coolant reservoir monitoring and warning
- Low lubricant warning on machine tools, generator sets, on- or off-highway vehicles
- Low level warning in hydraulic reservoirs
- Leak detection for drip pans

Dimensions



Wiring Diagrams



ELS-1150

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

The enhanced ELS-1150 series is the highest performing electro optic level switch from Gems Sensors. The ELS-1150 features a microprocessor 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. 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 in Oil and Gas. The sensors are most commonly used for low, high and intermediate level detection in a variety of media.

The stainless steel version (ELS-1150SS) is excellent for application requiring corrosion resistance and is ideal for acids, solvents and dielectric water applications. An explosion proof version, ELS-1150XP, is excellent for applications in Oil & Gas that require small, accurate level sensing of constant media (ie. hydraulic fluid or coolant).

Contact our factory experts for additional ordering information and options.

Applications

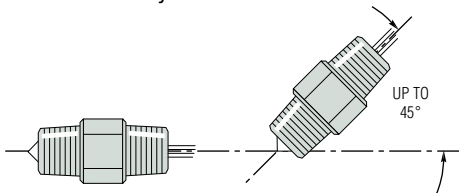
- Hydraulic and lubricating oil reservoirs
- Corrosive liquids such as: acids, solvents, and dielectric water applications
- Critical fluid level monitoring on machine tools, compressors, chillers and other industrial OEM equipment
- Medical Equipment; Anesthesia, Histology

Specifications

Mounting	1/2" NPT, 3/4"-16 Straight Thread
Materials	
Housing	Nickel-Plated Carbon Steel or Stainless Steel
Prism	Fused Glass
Operating Pressure	0 to 2500 PSI, Maximum
Operating Temperature*	-40°F to +257°F (-40°C to +125°C)
Input Voltage	5-28 VDC ±5%
Current Consumption	~1 mA
Output	Open Collector/Emitter Output, 100 mA Sink @ 30VDC, Max.; 100 mA Source, Max.
Electrical Termination	22 AWG, Polymeric, 12" to 14" Extended Lead Wires
Approvals	CE, UL File E31926

Mounting Attitude

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

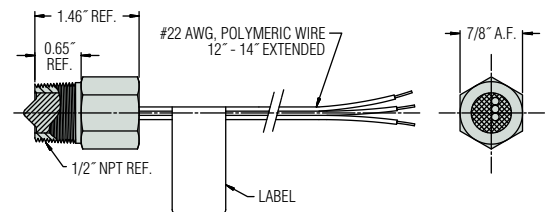


ELS-1150

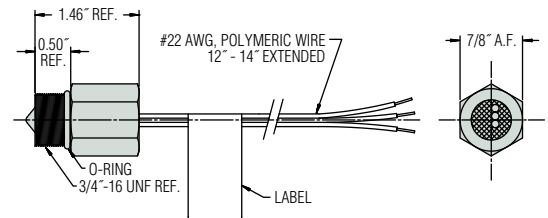


Dimensions

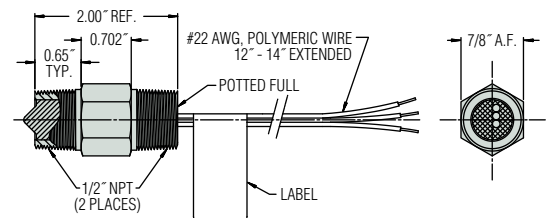
1/2" NPT Mounting



3/4" - 16 Straight Thread Mounting

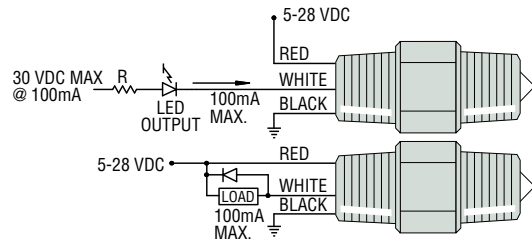


1/2" NPT Conduit



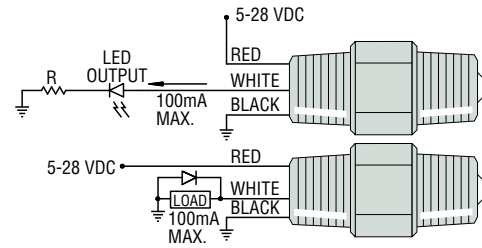
Wiring Diagrams - Typical

Sinking



Note: Inductive loads must be diode suppressed.

Sourcing



How To Order

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

Housing Material	Output Configuration	Operation	1/2" NPT Mounting	3/4" - 16 Straight Thread	1/2" NPT Conduit
Nickel Plated Steel	Sink	Wet	229251	232716	229182
		Dry	229252	232717	229183
	Source	Wet	229253	232718	229184
		Dry	229254	232719	229185
Stainless Steel	Sink	Wet	229255	232721	229186
		Dry	229256	232722	229187
	Source	Wet	229257	232723	229188
		Dry	229258	232724	229189

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-35.



ELS-1150XP

FM-Approved Explosion-Proof

The explosion-proof ELS-1150XP series is designed for use in areas containing flammable bases or vapors in quantities sufficient to produce explosive or ignitable mixtures. It is FM-Approved for use with virtually all hydrocarbon based liquids, as well as with combustible atmospheres containing dusts of coal, coke, flour, starch or other grain.

These solid-state level sensors are available in nickel-plated carbon steel or stainless steel. The strong fused glass prism eliminates leak potential and is capable of handling high temperature and pressure applications up to 5000 psi. The compact size of the sensor makes them ideal candidates for monitoring the small, pressurized vessels found in oil, gas and petrochem environments.

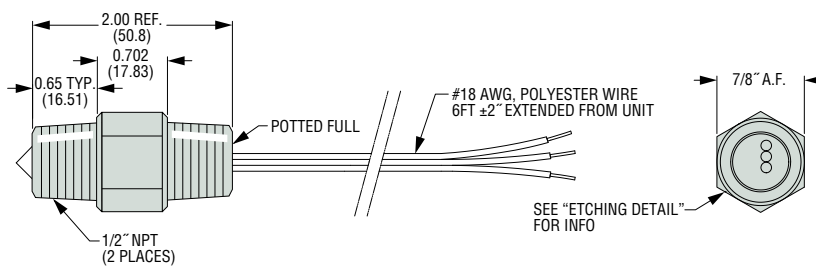
Applications

- Storage Tank Level Monitoring
- Remote Level Monitoring
- Chemical Injection
- Well Head Automation

Specifications

Mounting	1/2" NPT
Materials	
Housing	Nickel-Plated Carbon Steel or Stainless Steel
Prism	Fused Glass
Operating Pressure	0 to 5000 PSI, Maximum (10000 PSI Proof)
Operating Temperature	-40°F to +257°F (-40°C to +125°C)
Input Voltage	5-28 VDC ±5%
Current Consumption	~1 mA
Output	Open Collector Output, 100 mA Sink @ 30VDC, Max.; 100 mA Source, Max.
Electrical Termination	18 AWG, Polyester, 6ft ±2" Extended Lead Wires
Approvals	FM Approved Class I, Div. I Groups A, B, C, D Class II/III, Groups E, F, G

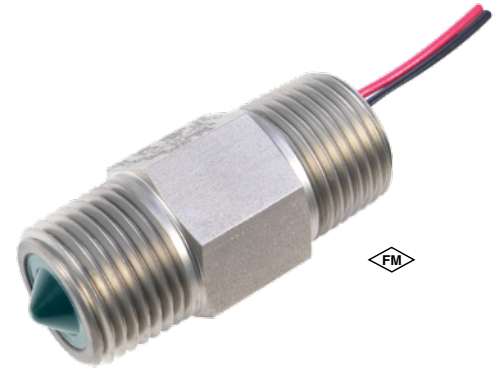
Dimensions



How To Order

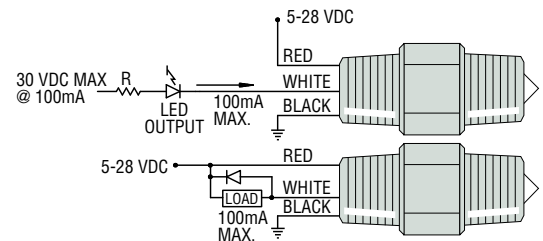
Specify Part Number based on Output Logic State and material required.

Output Logic State	Nickel-Plated Steel Housing	Stainless Steel Housing
Wet - Sink	227201	227257
Dry - Sink	227202	227256
Wet - Sourcing	227203	227255
Dry - Sourcing	227204	227254

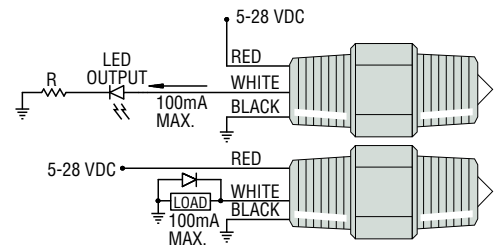


Wiring Diagrams - Typical

Sinking



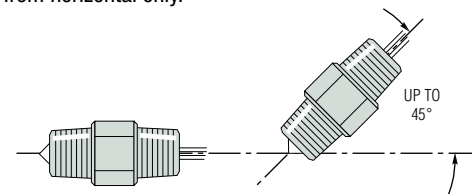
Sourcing



Note: Inductive loads must be diode suppressed.

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-35.



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.

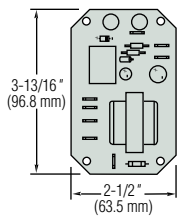
Specifications

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

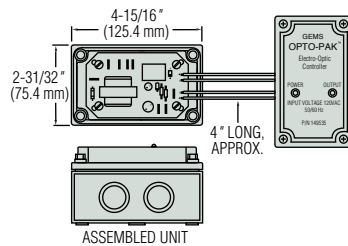
*Ten (10) 1/4" female spade connectors (not shown) shipped loose with each unit.

Dimensions

Open Circuit Board Type



NEMA 4X Type



Green and Red LEDs indicate power and output status.

Typical Applications

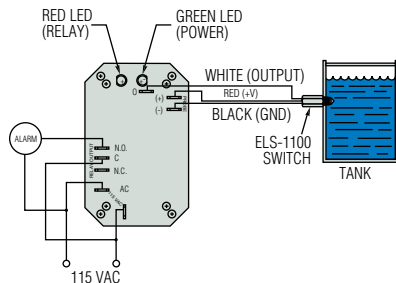
Works with 12V units:

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

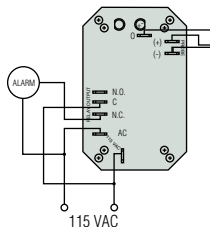
Output Light State When Liquid is Present

Wet Sink	OFF
Dry Sink	ON
Sensor Not Connected	ON

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

Compatible Plastic Bottle Materials	Polyethylene (PE), Polypropylene (PP) Polycarbonate (PC), ABS, Styrene, PVC, and others
Bottle Materials Not Recommended	Teflon® family, or Any Foamed Core Plastics
Min. Bottle Diameter for Round Bottles	3" (76.2 mm)
Bottle Wall Thickness	0.04" to 0.15" (1.0 mm to 3.8 mm)
Termination of Sensor	Mini USB Style Connector to Electronics
Input Power Supply (volts)	4.75 to 5.25 VDC (Optional Voltage Regulator available for 6 to 32 VDC.)
Power Consumption (current)	<40mA Typ. @ 5 VDC
Calibration	No User Calibration Required. Pre-configured for Container Materials, Wall Thickness, & Output Options. Works on Bottle Materials or Wall Thickness Without User Input.
Output Configuration	Open Collector; 40 mA, Max.
Switch Condition	Normally Open/Normally Closed
Standard Response Time	2 msec.
Delay Range	0 to 60 Seconds, Standard is No Delay, Optimal is 0 to 60 Seconds.
RFI/EMI Susceptibility	3v/m
Agency Approvals	UL 508 Listed (File E 305671), CE & IEC 61326 (RFI/EMI)
Operating Temperature	
Sensor	32°F to 158°F (0°C to 70°C)
Electronics	32°F to 149°F (0°C to 65°C)
Repeatability	±0.039" (±1 mm)
Accuracy	±0.063" (±1.6 mm)
Sealing Capability	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 m²] = 1 Rayl:
Water Z = 1.5 MRays; Air Z = 0 MRays



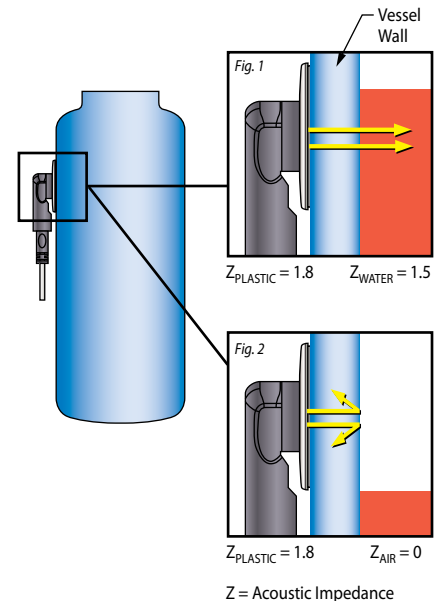
U.S. Patent
7,360,417



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

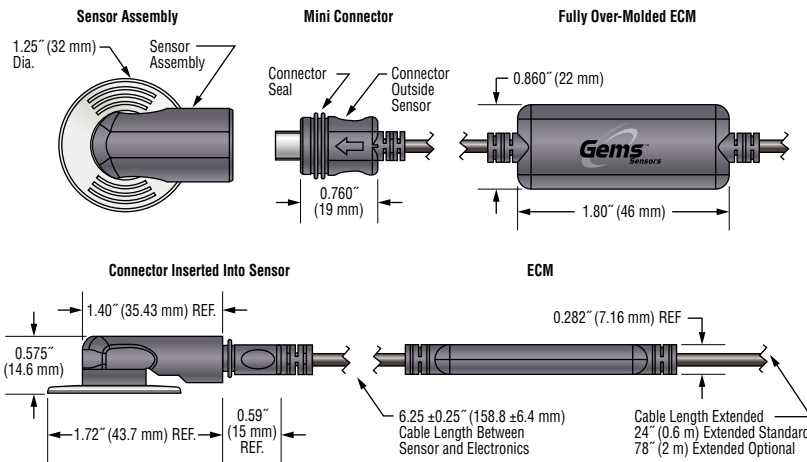




Super Simple Installation

- 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



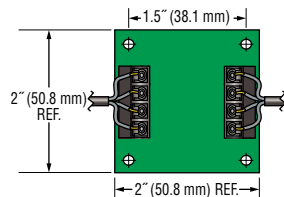
Features

- 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

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



Connection Type	Part Number
Header	219445
Solder	218699

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)		.01" 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.

WIF-1250 Water in Fuel Sensor

- ▶ Designed for OHV and Generator Set applications
- ▶ Compact size, easy to install
- ▶ Operates in plastic or metal tanks
- ▶ Reliable and affordable OEM solution
- ▶ Solid-State – no moving parts

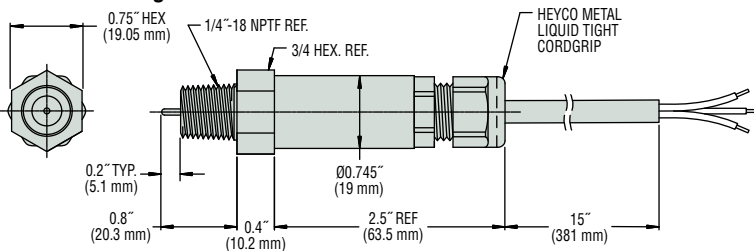
The WIF-1250 sensor is an innovative, no-moving-parts solution specifically designed to detect the presence of water in fuel. The sensor is an ideal solution for OEM's of off-highway vehicles, locomotive and generator sets. It is also ideal for use with fuel filters. Based on reliable conductivity technology, WIF-1250 sensors are built from robust nickel plated steel for compatibility with temperatures up to 257°F (125°C), and are suited for the most challenging environments or applications. A 5-second delay circuit prevents "slosh" actuation. The sensor is easily mounted in any position.

Specifications

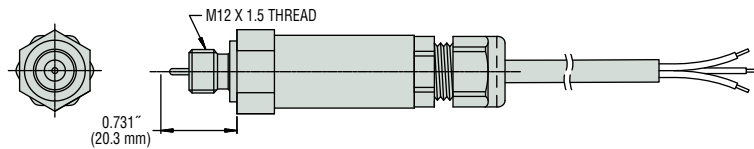
Housing Materials	Nickel plated steel, electrolytic nickel plated & fused glass conductivity pin insulator
Sensing Element Length	0.2" (5.1 mm)
Operating Pressure	750 PSI (51.7 bar) @ 70°F (21°C)
Operating Temperature	-40°F to 257°F (-40°C to 125°C)
Sensitivity	10,000 Ohms (fluid resistance)
Slosh Dampening	5 seconds
Supply Voltage	8 to 32 V DC
Current Consumption	<20 mA
Output	Open collector, sinking output
Output Load Capability	250 mA max.
Electrical Connection	20 AWG 3-Conductor Cable, 15" (381 mm)
Approvals	CE

Dimensions

1/4" NPT Mounting



M12x1.5 Mounting

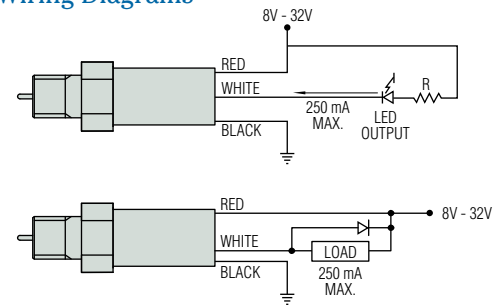


Typical Applications

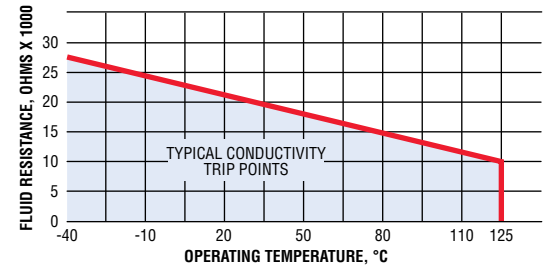
To detect water in:

- Fuel filters
- Diesel fuel storage tanks

Wiring Diagrams

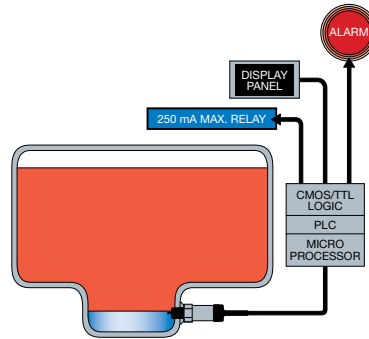


Resistance vs. Operating Temperature

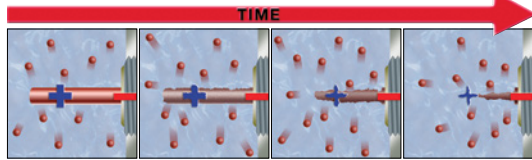


Operating Principle

WIF-1250 liquid level sensors are solid-state devices designed to detect the presence or absence of water in fuel. Each sensor contains integral, high-temperature-rated electronics that generate an alternating voltage to a probe tip. The presence of water completes the circuit which, in turn, changes the condition of the transistor output. Output options vary and can be used to actuate relays, indicator lights or LEDs, as well as to interface with CMOS/TTL logic, PLCs or microprocessors.

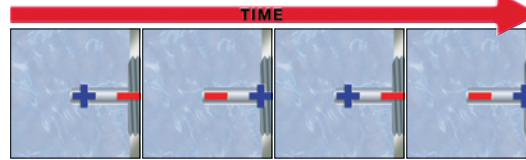


Conventional Conductivity Probe



When a single potential (DC Voltage) is applied to a probe submerged in conductive liquid, metal from that probe will be lost over time via electrolysis.

Gems WIF-1250 Probe



Gems applies extra circuitry to produce an alternating potential (alternating +/- DC square wave). Metal lost in one state is retrieved in the alternating state, resulting in virtually zero probe material loss.


How to Order

Select Part Number based on Mounting Thread and Switch Logic.

Probe Condition at Current Sink	Part Numbers	
	1/4" NPT	M12x1.5
Wet	238737	238856
Dry	238773	238855

LEVEL SWITCHES – SINGLE POINT

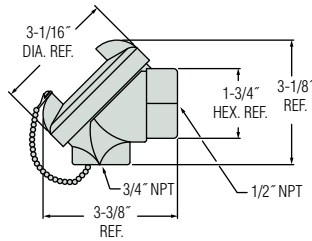
Junction Boxes

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.

LEVEL SWITCHES – SINGLE POINT

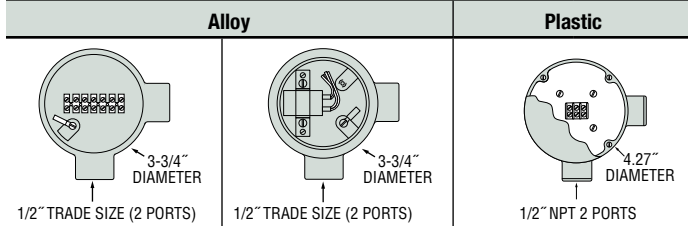
Explosion-Proof J-Boxes



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

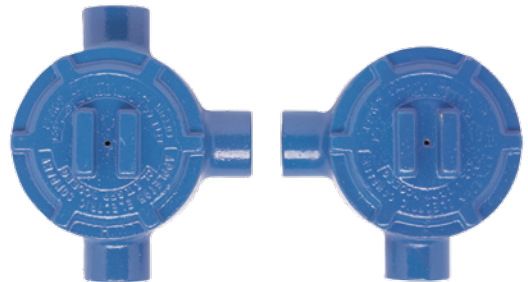


Non-Explosion Proof J-Boxes



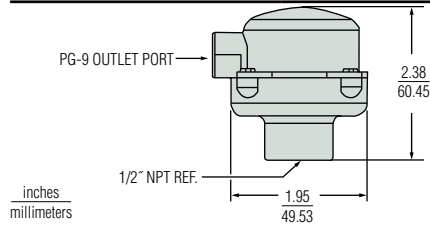
	Alloy		Plastic	
Type	3-pin	7-pin	3-pin	7-pin
Part Number	113873	113877	113850	118828

⚡ – 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
Specifications	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.
Part Number	181410	180417



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

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
Sensor Material	Glass Filled Nylon
Cable	78.74" (2 meter), 3 Wire PVC
Shock	30g, 11ms
Vibration	55Hz, 1mm amplitude in all planes
Electrical	
Supply Voltage	5-48 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 (Except at Frequency 803-805 MHz), RoHS

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	230079
		Dry	230081
Non-Water Based, Not Conductive (shielded sensor)	3/8"	Wet	228830
		Dry	229855

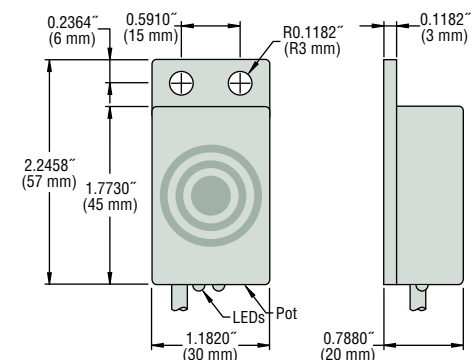


Typical Applications

Fluid Monitoring:

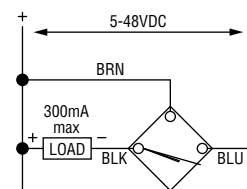
- Waste
- Reagents
- Diluent
- Detergent/Wash
- Coolant
- Printing Ink

Dimensions

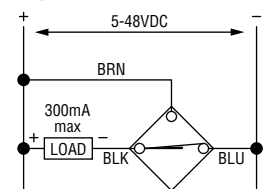


Wiring Diagram

Wet Sink



Dry Sink



CAP-150 Series – Capacitive Level Sensor

- ▶ For non-metallic containers
- ▶ Non-intrusive level sensing
- ▶ Optional Sight Glass Bracket
- ▶ Potentiometer for sensitivity adjustment

The CAP-150 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-150 may also be used as a proximity sensor to detect the presence of solids such as pulp & paper.

Specifications

Performance	
Nominal Sensing Distance, Sn	0.2" (5mm)
Repeat Accuracy - (% of Sn)	<2%
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
Termination	78.74" (2 meter), 3 Wire PVC
Shock	30g, 11ms
Electrical	
Supply Voltage	5-48 VDC
Continuous Switching Current	300 mA
Voltage Drop	<2 VDC
Current Consumption	<10 mA
Switching Frequency	100 Hz, maximum
Overload Protection	No
Short Circuit	Yes
Reverse Polarity Protection	Yes
Approvals	CE

How To Order

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

Fluid Properties	Sensor Material	Flush Mountable	Sensing Range	Shielded	Sink/Source	Logic	Part Number
Aqueous, Conductive (Unshielded Sensor)	Delrin® Body with Valox® Sensor Face	No	2-8mm	No	Sink	Wet	239890
						Dry	239891
					Source	Wet	241366
						Dry	241367
Non-Aqueous, Non-Conductive (Shielded Sensor)	Ni-Plated Brass Body with Valox® Sensor Face	Yes	1-5mm	Yes	Sink	Wet	240607
						Dry	240612
					Source	Wet	241368
						Dry	241369

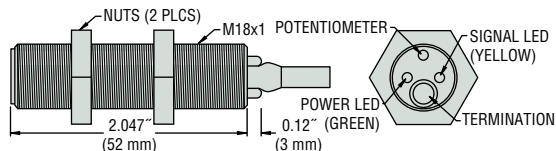


Typical Applications

Fluid Monitoring:

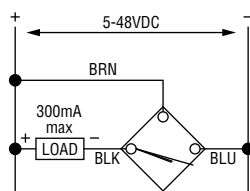
- Waste
- Reagents
- Diluent
- Detergent/Wash
- Coolant
- Printing Ink

Dimensions

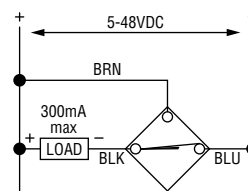


Wiring Diagram

Wet Sink



Dry Sink

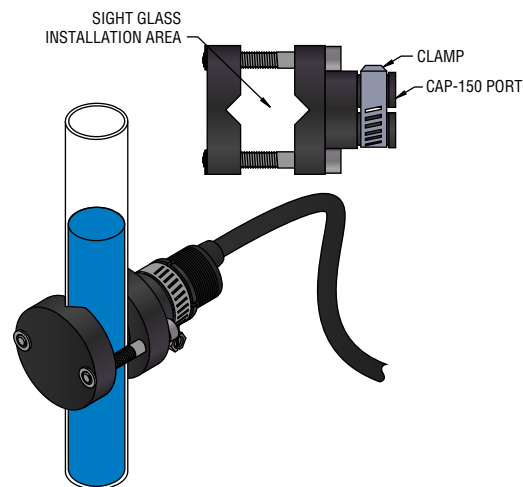


Convert Simple Sight Glass into Switch Actuation Device

- For glass tubing 1/4" to 1" Dia.

Use this easy-to-install clamp with the CAP-150 to provide liquid level sensing and switch actuation along the length of sight glasses 1/4" to 1" in diameter.

Part Number: 240836



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	0.118" (3mm)
Sensing Range	0-0.118" (0-3mm)
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
Max. Pressure	150 psi (10.3 bar)
Electrical	
Supply Voltage	5-48 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 (Except at Frequency 803-805 MHz), RoHS

How To Order

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

Fluid Properties	Container Material	Wet/Dry Sink	Part Number
Water Based, Conductive (unshielded sensor)	Non-Metallic	Wet	230077
		Dry	230078
Non-Water Based, Not Conductive (shielded sensor)	Non-Metallic or Metallic	Wet	230082
		Dry	230083

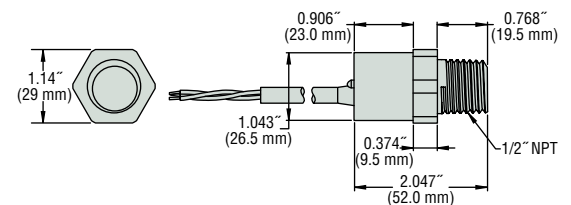


Typical Applications

Fluid Monitoring:

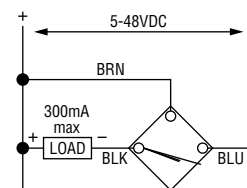
- Waste
- Reagents
- Diluent
- Detergent/Wash
- Coolant
- Printing Ink

Dimensions

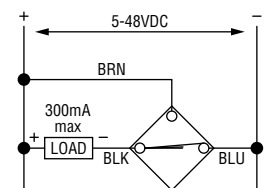


Wiring Diagram

Wet Sink



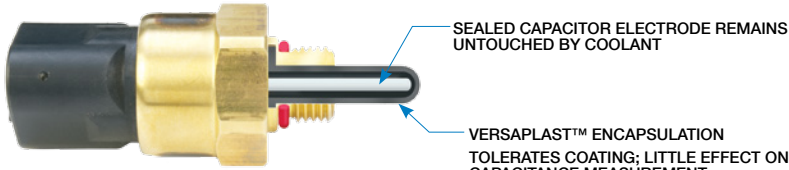
Dry Sink



CAP-300 Series – Capacitive Level Sensor

- ▶ Durable sealed design – IP67
- ▶ Developed for the most rugged aqueous applications
- ▶ Tolerates coolant coating
- ▶ Small size – 2" (51 mm) long
- ▶ Available in Stainless Steel for Food & Beverage Applications

The CAP-300 capacitive level sensor is one of our most durable and reliable point level sensors. The versatile CAP-300 is the ideal OEM solution for power generation equipment, off-highway vehicles, generators, Food & Beverage, Medical, Rail and HVAC applications, and excels in coolant monitoring. With nearly zero maintenance, the sensor mounts in any position, is compact, tolerates coating, remains reliable even in standby mode, and is compatible with temperatures up to 257°F (125°C). For use where sloshing occurs, or the reservoir's attitude changes frequently, Gems offers a variety of actuation delays.



Specifications

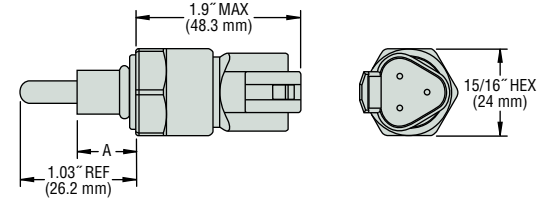
Mountings	1/4" NPT, 1/2"-20 per SAE J1926-3, M12x1.0-8g, M12x1.5 ISO 6149-3, 1/2" NPT
Materials	
Housing	Brass or 316L Stainless Steel*
O-Ring	EPDM
Probe Tip	Versaplast™
Operating Pressure	Up to 100 PSIG
Operating Temperature	
Common	-40°F to +257°F (-40°C to +125°C)
Cable Versions	-4°F to +158°F (-20°C to +70°C)
Supply Voltage	9 to 32 VDC
Current Consumption	15mA max. (no load)
Output	Open collector, sinking or sourcing output, 9-32 VDC, 30mA max.
Electrical Termination	3-pin Deutsch, 18 AWG Type SXL flying leads or 18 AWG PVC Cable
Sensing Element Length	1.03" (26.2mm) Max. (including thread length)
Approvals	CE, IP67, RoHS

* NSF Approved material of construction

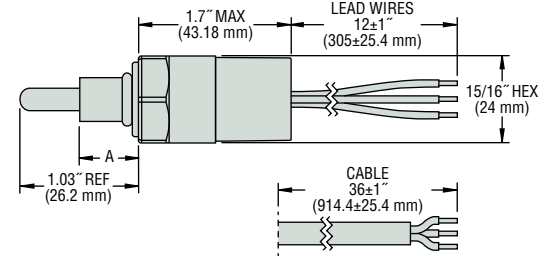


Dimensions

Deutsch® Connector



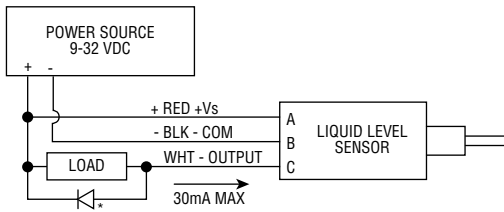
Lead Wires or Cable



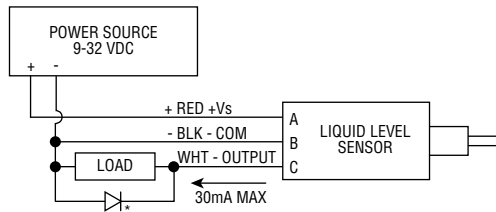
		A DIM. REF.	EPDM O-Ring
Thread Sizes	1/2"-20	0.43" (10.9 mm)	3-905
	M12x1-8g	0.54" (13.5 mm)	2-110
	M12x1.5	0.53" (15.2 mm)	9.3 x 2.2 mm
	1/4"-18NPT	0.62" (15.7 mm)	None
	1/2"-14NPT	0.62" (15.7 mm)	None

Wiring Diagram

Sinking



Sourcing



* For inductive loads, use diode suppression.

How To Order

Select a Part Number based on mounting type, connection and actuation condition.

Actuation Condition	Electrical Connection	Thread Sizes						
		Brass				316L Stainless Steel		
		1/4"-18 NPT (male)	1/2"-20 per SAE J1926-3	M12x1.5 Stud End Per ISO6149-3	M12x1.0-8g	1/2"-14 NPT (male)	1/4"-18 NPT (male)	1/2"-14 NPT (male)
Wet Sink	Integral 3-pin Deutsch® DT04-3P Connector	240640	240700	240800	240900	242970	244510	244540
	12" 18 AWG SXL Flying Leads	240660	240720	240820	240920	242975	244515	244545
	36" PVC Cable	240680	240740	240840	240940	242980	244520	244550
Dry Sink	Integral 3-pin Deutsch® DT04-3P Connector	240650	240710	240810	240910	242985	244525	244555
	12" 18 AWG SXL Flying Leads	240670	240730	240830	240930	242990	244530	244560
	36" PVC Cable	240690	240750	240850	240950	242995	244535	244565
Wet Source	Integral 3-pin Deutsch® DT04-3P Connector	240645	240705	240805	240905	242971	244511	244541
	12" 18 AWG SXL Flying Leads	240665	240725	240825	240925	242976	244516	244546
	36" PVC Cable	240685	240745	240845	240945	242981	244521	244551
Dry Source	Integral 3-pin Deutsch® DT04-3P Connector	240655	240715	240815	240915	242986	244526	244556
	12" 18 AWG SXL Flying Leads	240675	240735	240835	240935	242991	244531	244561
	36" PVC Cable	240695	240755	240855	240955	242996	244536	244566

Optional Delay

Delays are useful when the liquid being sensed is subject to frequent sloshing or the reservoir's attitude changes significantly. For low quantities, Gems offers a 5- and 10-second delay ($\pm 1/2$ second). Gems will customize the delay up to 99 seconds for large volume OEM applications. Please call Gems for more information.

LEVEL SWITCHES - SINGLE POINT

XLS-1 — Ultrasonic Level Sensor

- ▶ No Moving Parts
- ▶ Zero Maintenance
- ▶ Ignores Condensation on Sensor
- ▶ Will Not Sense Foam as Liquid
- ▶ Microcontroller-Based Electronics

XLS-1 ultrasonic level sensors are compatible with water-based and hydrocarbon-based liquids, and are perfect for applications where condensation may affect other sensing technologies. The XLS-1 is an ideal solution for sensing liquid level in generators, water tanks, radiators, printers, and other industrial applications. XLS-1 ultrasonic level switches expand the Gems catalog of solid-state level sensors.

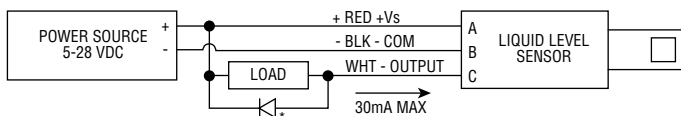
Specifications

Probe Length	1.25" (including threads)
Fluid Compatibility	Water, Water-based medias, Hydrocarbon-based chemicals, not compatible with high-viscosity liquids
Materials	
Housing	316L Stainless Steel
O-Ring Seal*	EPDM; NBR, Silicon, Kalrez® or Chemraz® available (Consult Factory)
Connector Housing	30% Glass-filled Polyester
Performance	
Accuracy	±1 mm from centerline
Repeatability	±1 mm
Temperatures	
Fluid	-40°F to +257°F (-40°C to +125°C)
Ambient	-40°F to +185°F (-40°C to +85°C)
Pressures	
Operating	0 to 250 psig
Burst	1000 psig
Environmental	
Ingress	IP67 Per IEC60529 IP6K9K Per DIN40050-9 (sensor only)
Vibration	Per IEC 60068-2-6; 20 m/s ² , 10-55 Hz; MIL-STD-202G, Method 204D, 10G, 57-2000 Hz
Shock	Per IEC 60068-2-27; 15G, 11ms
Audio Frequency Immunity	Per MIL 461D, CS101
EMC Immunity	IEC 61326-1; EN61000-4-(2 thru 6)
Input Power	5-28 VDC regulated power, max supply current 20 mA
Outputs	Open collector, sinking or sourcing output Open collector specs 30 VDC, 30mA max
Electrical Interface	3 Pin Deutsch DT Series Connector, 18 AWG wire or cable
Mechanical Interface	1/4" NPT, 1/2" NPT, M12x1.0, M12x1.5, 1/2"-20, G1/4", others available upon request
Mounting Orientation	Mounted Horizontally ±60 degrees
Approvals	CE (EMC 2004/108/EC) and RoHS, UL/cUL Recognized
Calibration	None required

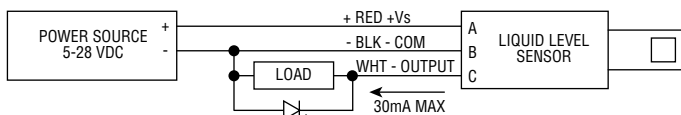
* Where applicable.

Wiring Diagram

Sinking



Sourcing

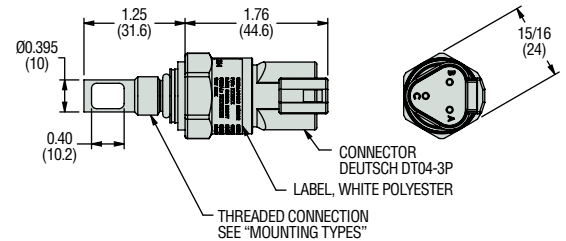


* For inductive loads, use diode suppression.

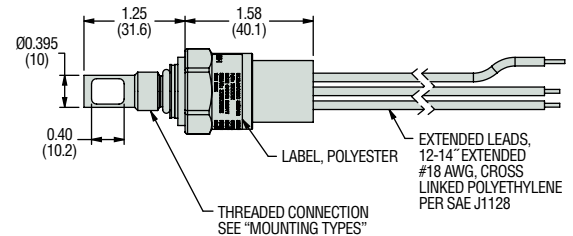


Dimensions

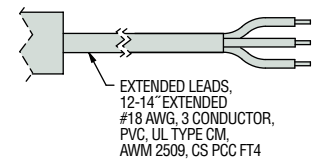
3-PIN Deutsch Connector



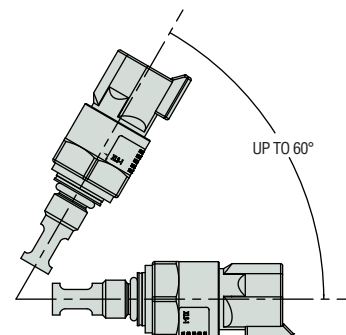
3-Wire Output



PVC Cable



Mounting Attitude



Mounting Types

SAE

1/2"-14 NPT	1/4"-18 NPT	1/2"-20 per SAE J1926-3
<p>1/2"-14 NPT PER ANSI B2.1-1968</p>	<p>1/4"-18 NPT PER ANSI B2.1-1968</p>	<p>See Note 1</p>

BSP & Metric

M12 x 1.0	M12 x 1.5 per ISO6149-3	G1/4"-19 BSPP
<p>See Note 1</p>	<p>See Note 1</p>	<p>See Note 2</p>

inch (mm)

How To Order

Select a Part Number based on mounting type, connection and actuation condition.

Actuation Condition	Electrical Connection	Mounting Type					
		M12 x 1.0 (TYPE 10) ¹	1/2"-14 NPT (TYPE 12)	1/4"-18 NPT (TYPE 14)	M12 x 1.5 per ISO6149-3 (TYPE 15) ¹	1/2"-20 per SAE J1926-3 (TYPE 20) ¹	G1/4"-19 BSPP (TYPE 24) ²
Wet Sink	Integral 3-pin Deutsch® Connector	247670	247690	247700	247680	247660	250010
	18 AWG, 12"-14" Extended Flying Leads	247740	247780	247800	247760	247720	250020
	12"-14" PVC Cable	247750	247790	247810	247770	247730	250030
Dry Sink	Integral 3-pin Deutsch® Connector	247675	247695	247715	247685	247665	250005
	18 AWG, 12"-14" Extended Flying Leads	247745	247785	247805	247765	247725	250015
	12"-14" PVC Cable	247755	247795	247815	247775	247735	250025
Wet Source	Integral 3-pin Deutsch® Connector	250830	250820	250840	250850	250870	250890
	18 AWG, 12"-14" Extended Flying Leads	250930	250920	250940	250950	250970	250990
	12"-14" PVC Cable	251030	251020	251040	251050	251070	251090
Dry Source	Integral 3-pin Deutsch® Connector	250835	250825	250845	250815	250875	250895
	18 AWG, 12"-14" Extended Flying Leads	250935	250925	250945	250855	250975	250995
	12"-14" PVC Cable	251035	251025	251045	250915	251005	250955

Notes:

1. Supplied with EPDM O-ring. Consult factory for alternate O-ring materials.
2. Designed for use with Dowty Bonded Seal. Not supplied.

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

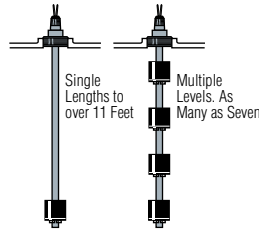
GEMS Custom Length level switches are extremely versatile. Within this section you'll find level switches that are configured to your custom specifications at the GEMS factory.

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

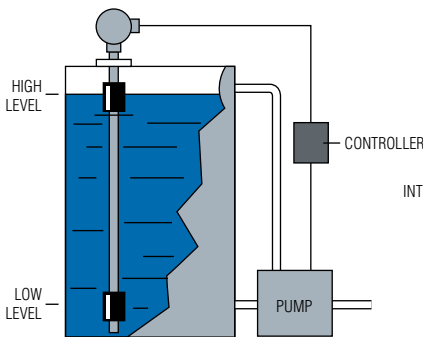
GEMS Custom Length models can be configured with "up to seven" independent switch actuation levels, depending on the series type. These "multi-station" units offer the most practical way to monitor multiple liquid level points within a single tank. Only a single entry point into the tank is required, 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.



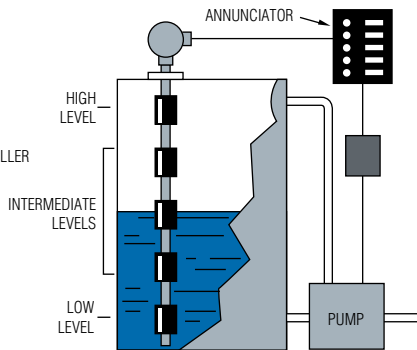
Typical Application

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

Pump-Up/Pump-Down Operations



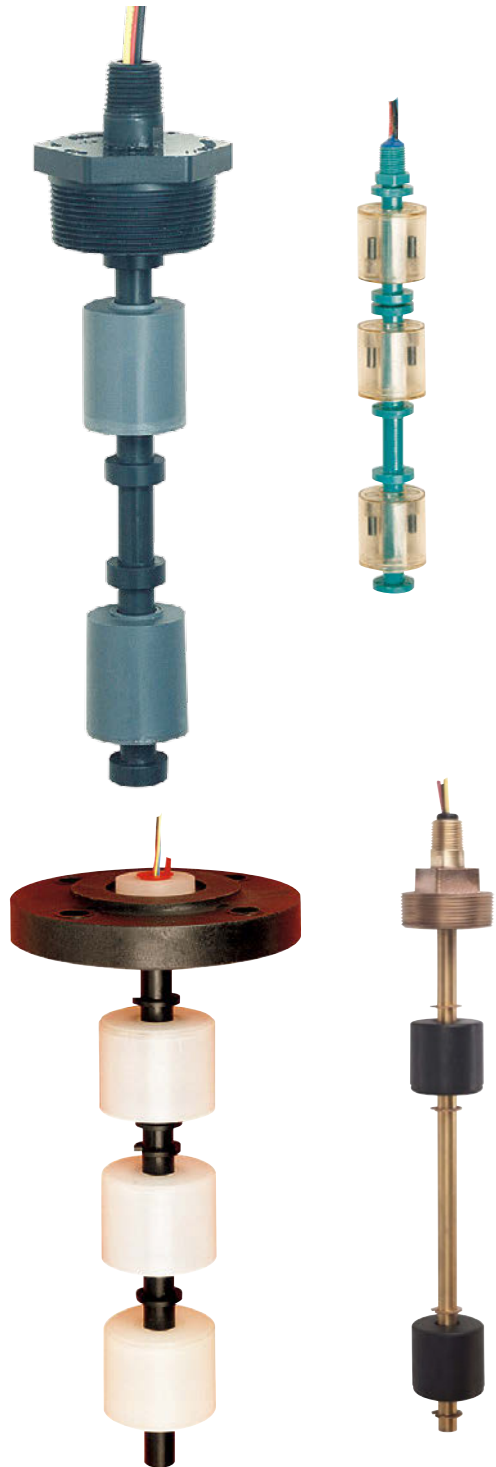
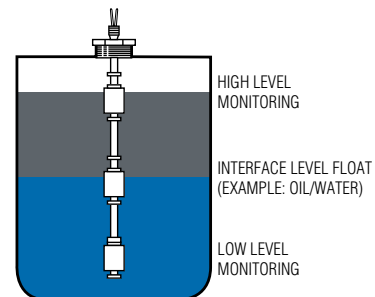
Pump-Up/Pump-Down with Intermediate Level Indication



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

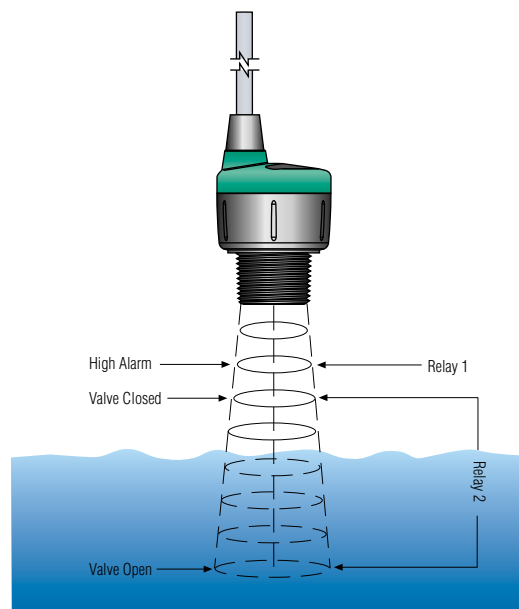
How Ultrasonic Monitoring Works

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
Small Size Engineered Plastic	
LS-300 Series.....	B-3
LS-300TFE Series.....	B-7
LS-350 Series.....	B-10
Small Size Alloy	
LS-700 Series.....	B-14
Large Size Plastic	
LS-800PVC Series.....	B-18
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All LS-800 Series Models.....	B-26
UCL-510 Ultrasonic Transmitter/Multipoint Switch.....	
	C-29



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



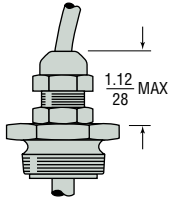
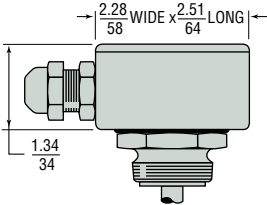
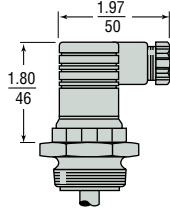
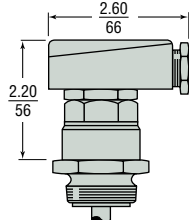
NPT Threads		Straight Threads		
Type 21 1/8" NPT 	Type 22 1" NPT 	Type 31 3/8" - 24 	Type 32 1-5/16" - 12 	Type 33 5/8" - 11
Metric Threads		Compression Types		
Type 41 G 1/4" (1/4" - 19 BSP) 	Type 42 G 1" (1" - 11 BSP) 	Type 51 M12 x 1.5 Straight Thread 	Type 71' 5/8" - 11 	Type 11 No Mounting
Flange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

Stem, Mounting and Collar Material	Polysulfone, Noryl®
Max Length (L_0)	20 inches (50 cm) Tolerance of $L_0 = \pm 1/16"$ (2 mm)
Mounting Position	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: $\frac{\text{inches}}{\text{millimeters}}$

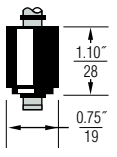
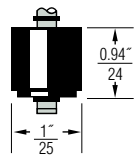
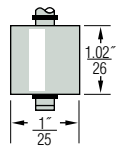
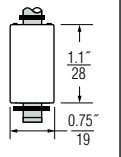
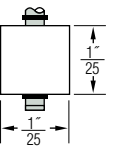
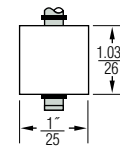
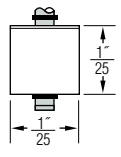
2. Electrical Connections

	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			4
Group II			2			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		PVDF		
	3/4"	1"		Solid Foamed	Hollow – 20% Glass Filled			
Float Dimensions								
Part Number	187553	39049	39005	197732	119455	145730	239292	174515
Float Material Suitable for...	Oil, Fuels		Water-based Liquids	Broad Chemical Use		Low Specific Gravity Liquids		Highest Temperature
Operating Temperature ¹	Water: to 180°F (80°C) Oil: to 221°F (105°C)		Oil: -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)		-40°F to +250°F (-40°C to +121°C)
Pressure, psi (bar) Max. ²	300 (21)	250 (17)	50 (3.5)	100 (6.9)	150 (10)	50 (3.5)	100 (7)	50 (3.5)
Min. Media Specific Gravity	0.70	0.50	0.75	0.95	0.90	0.60	0.37	0.86

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.

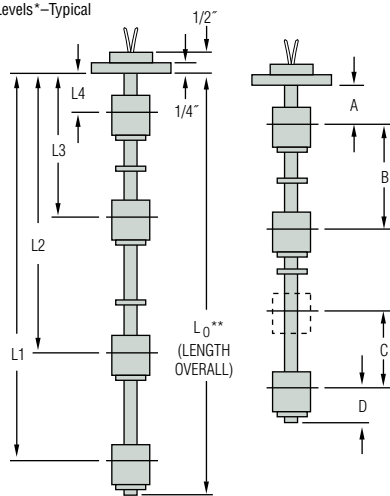
Approvals: LS-300 Series switches are U.L. Recognized – File No. E45168; CSA Listed – 30200.

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 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 B-3 for L_0 reference point.

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

5. Wiring Group

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

*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
Buna N – 0.75" (P/N 187553)	11/16" (17 mm)	1-7/16" (11.1 mm)	1/8" (3 mm) Minimum	7/8" (22 mm)
Buna N – 1" (P/N 39049)	.69" (18 mm)			.81" (21 mm)
Polysulfone (P/N 39005)	.56" (14 mm)			0.95" (24 mm)
Solid P.P. – 0.75" (P/N 197732)	0.5" (13 mm)	1.5" (38 mm)		1.19" (30 mm)
Solid P.P. – 0.97" (P/N 119455)	0.43" (11 mm)			1.13" (29 mm)
Hollow P.P. – 1" (P/N 145730)	0.62" (16 mm)			0.88" (22 mm)
Hollow P.P. – 1.58" (P/N 239292)	0.63" (16 mm)	1.70" (43 mm)		0.98" (25 mm)
PVDF (P/N 174515)	0.63" (16 mm)	1.5" (38 mm)		1.13" (29 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 $\pm 1/8"$ (3 mm).

 <p>Photocopy This Form 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 _____ Street _____ City _____ State _____ Zip _____ Date Required ____/____/____ Shipping Method: _____ Phone (____) _____ Partials Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No Fax (____) _____ Quantity Needed _____ Date Required ____/____/____ Shipping Method: _____ Partials Accepted: <input type="checkbox"/> Yes <input type="checkbox"/> No
--	--

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.

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

Product Parameters

1. Mounting Type:

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

4. Electrical Rating:

- | | |
|---|--|
| <input type="checkbox"/> 010 – SPST, 10VA | <input type="checkbox"/> 020 – SPST, 20VA |
| <input type="checkbox"/> 050 – SPST, 50VA | <input type="checkbox"/> 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 187553
- Buna-N – P/N 39049
- Polysulfone – P/N 39005
- Solid Foamed Polypropylene – P/N 197732
- Solid Foamed Polypropylene – P/N 119455
- Hollow Polypropylene – P/N 145730
- Hollow Polypropylene – P/N 239292
- PVDF – P/N 174515

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 ____/____/____



ORDER IT!

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Easy online ordering too!



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
Extended Leads	#22 AWG Teflon® Wire or #24 AWG PVC Jacketed Cable	

* Available on Mounting Type 22 only.

3. Float Types

Float Material	PTFE	PVDF
Float Dimensions		
Operating Temperature	+32°F to +212°F (0°C to 100°C)	-40°F to +250°F (-40°C to 121°C)
Pressure, PSIG (bar), Max. at Ambient Temperature	25 (1.7)	50 (3.4)
Min. Liquid Specific Gravity	0.90	0.86

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

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:

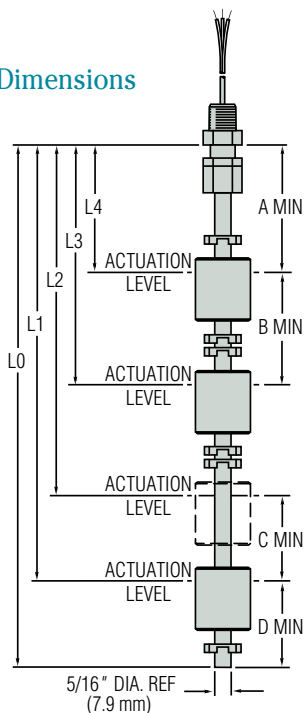
1. Other wiring options available. Consult factory.
2. Consult Factory for load information.

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	$\frac{1-3/4}{44.5^*}$	$\frac{2}{50.8}$	$\frac{1/8}{3.2}$	$\frac{1-5/8}{41.3}$
PVDF	$\frac{1-3/4}{44.5^*}$	$\frac{2}{50.8}$	$\frac{1/8}{3.2}$	$\frac{1-7/16}{36.5}$

$\frac{\text{inch}}{\text{mm}}$

*Mounting Type 22 (1" NPT) requires a minimum "A" dim. of 2-1/16" (52.4mm)

LEVEL SWITCHES - MULTI POINT

<p align="center">FAX IT! 860-747-4244</p> <p>Photocopy This Form Use one form for each product type you are selecting. This form may also be completed online at gemssensors.com 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-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: _____ | 5. Viscosity: _____ SSU |
| 2. Pressure: Minimum _____ psig Maximum _____ | 6. Tank Material: _____ |
| 3. Temperature: Minimum _____ °F Maximum _____ | Tank Depth: _____ |
| 4. Specific Gravity: Minimum _____ Maximum _____ | 7. Unit is Mounted In: <input type="checkbox"/> Tank Top <input type="checkbox"/> 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. <input type="checkbox"/> Group I Wiring | <input type="checkbox"/> Group II Wiring |
| B. <input type="checkbox"/> 10 VA | <input type="checkbox"/> 20 VA |
| <input type="checkbox"/> 50 VA | <input type="checkbox"/> 100 VA |

5. Actuation Level Dimensions:

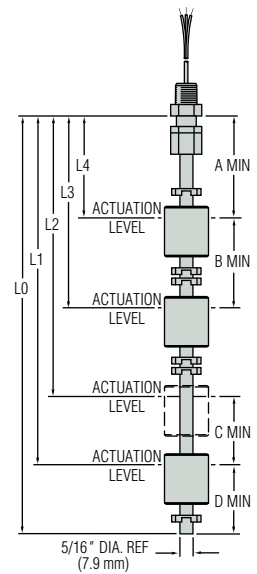
Actuation Level	Distance to Actuation Level – Inches*	SPST Switch Operation** (Check Type)	
		N.O.	N.C.
L4			
L3			
L2			
L1***			

* 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.



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

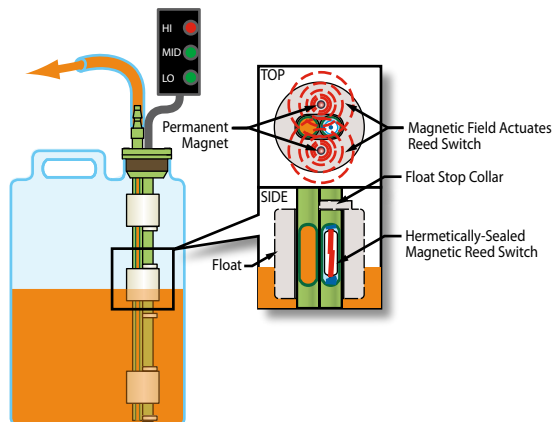
Specifications

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

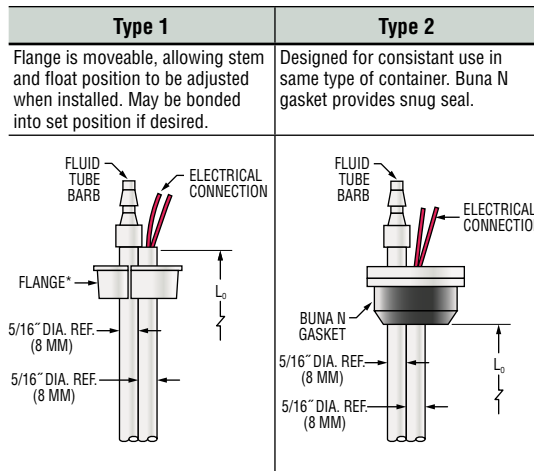
ORDER IT!
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LEVEL SWITCHES - MULTI POINT

1. Mounting Types

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



Mounting Hole Dia.	1.20"/1.25" (30.5 mm/31.75 mm)	1.31"/1.32" (33.3 mm/33.5 mm)
Stem, Mounting and Collar Material	Polysulfone	Polysulfone with Buna N Gasket
Pressure Rating (mounting)	Atmosphere (Not recommended for pressurized applications)	
Fluid Barb	Compatible 3/16" I.D. Hose (Options available)	
Max Length (L_0)	15 inches (38 cm) \pm 1/16" (2 mm)	
Mounting Position	Vertical \pm 30° Inclination	
Mounting Compatibility	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
Part Number	128642	130893
Liquid Suitability	Oil-Based	Water-Based
Min. Media Specific Gravity	0.75	0.98
Operating Temperature	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.

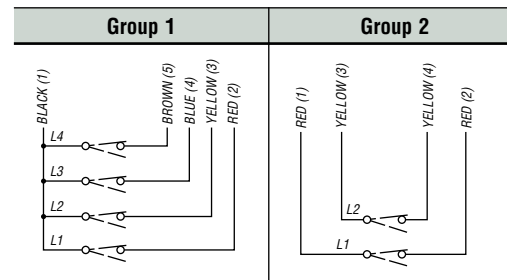
Group II Wiring: 1 or 2 Actuation Levels.

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

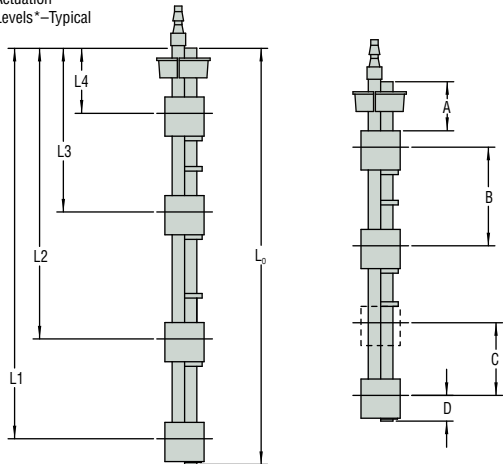
Type 1: Lead Wires, 24" to 26" (610 mm, Min.)

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

6. Actuation Level Dimensions

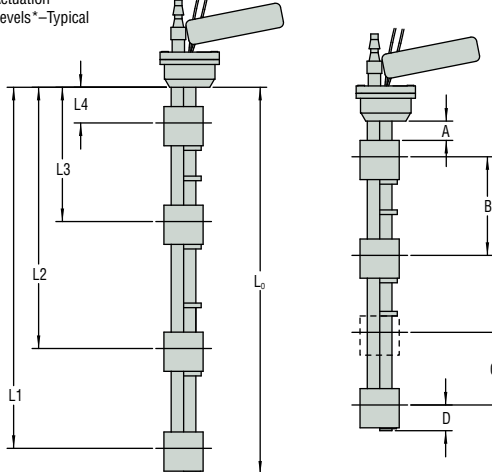
Type 1

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 B-11 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			
Buna N	3/4" (19 mm), Min.	3/4" (19 mm)	1-3/4" (45 mm)	1/8" (3 mm)	15/16" (24 mm)
Polysulfone	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>Photocopy This Form 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>1. Liquid Media: _____</p> <p>2. Pressure: Minimum _____ <input type="checkbox"/> psig <input type="checkbox"/> bar Maximum _____</p> <p>3. Temperature: Minimum _____ <input type="checkbox"/> °F <input type="checkbox"/> °C Maximum _____ <input type="checkbox"/> °F <input type="checkbox"/> °C</p> <p>4. Specific Gravity: Minimum _____ Maximum _____</p> | <p>5. Viscosity: _____ SSU</p> <p>6. Tank Material: _____</p> <p>Tank Depth: _____</p> <p>7. Unit is Mounted In: <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 ____/____/____



ORDER IT!

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_0) 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 ¹	Type 3 1" NPT ¹	Type 4 3-5/8" Dia. Flange
Type 5 1-5/16-12UNF-2A	Type 6 3/8-24	Type 7 1-1/4" NPT ^{1,2}	

Stem and Mounting Material	Brass or 316 Stainless Steel	
Max Length	48 inches (121.9 cm) – 21” Max On Bent Stem Versions (Consult Factory)	
Mounting Position	Vertical ± 30° Inclination	
Float Stops³	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings	
Pressure Rating, PSI, Max.⁴	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.

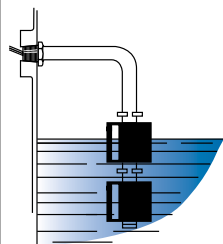


Optional Mountings

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

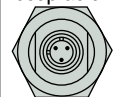
Bent Stem (LS-77700)

Used when tank top or bottom is inaccessible.

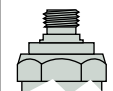


Integral Receptacle

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
Compatible Mounting Types	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
Float Dimensions				
Part Number	187553	39049	133764	145730
Operating Temperature	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)
Pressure, PSI, Max.	300*		1000*	50 PSI @ 70°F*
Min. Liquid Specific Gravity	0.65	0.45	0.65	0.65

*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.

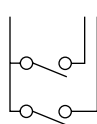
Lead Wires: #22 AWG, 24" L., PTFE.

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

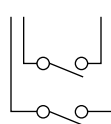
Typical Wiring Diagrams

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	
Common Wire	Black	None	
	NO/NC	SW Com.	NO/NC
L1	Red	Red	Red
L2	Yellow	Yellow	Yellow
L3	Blue	Blue	Blue
L4	Brown		
L5	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**

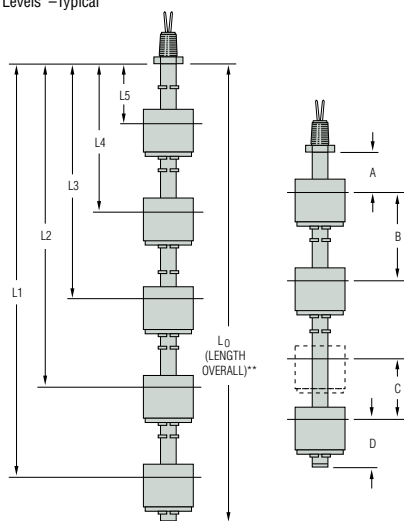


Polypropylene	316 Stainless Steel**				
1, 2, 3, 4, 5, 6, 7	1, 4, 6	1, 3, 4, 5, 6, 7	1, 4, 5, 6, 7	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5, 6, 7
197732	60241	141750	156900	136550	158369
-40°F to +250°F (-40°C to +121°C)	-40°F to +300°F (-40°C to +149°C)**				
100	100	275	600	400	150
0.95	0.70	0.85	0.90	1.10	.85

** 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 L₀ (overall unit length) are measured from inner surfaces of mounting plug or flange.

** Length Overall (L₀) = L₁ + 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
39049	11/16" (17.5 mm)	1-5/8" (41.3 mm)	1/8" (3.2 mm) Min.	3/4" (19.1 mm)
60241	9/16" (14.3 mm)	1-15/16" (49.2 mm)		15/16" (23.8 mm)
133764	3/4" (19.0 mm)	1-1/2" (38.1 mm)		7/8" (22.2 mm), N.O. 1-3/16" (30.2 mm), N.C.
136550	5/16" (7.9 mm)	1-7/8" (47.6 mm)		1-11/16" (42.9 mm)
141750	1/2" (12.7 mm)	1-9/16" (39.7 mm)		1-1/8" (28.6 mm)
145730	5/8" (15.9 mm)	1-3/8" (34.9 mm)		13/16" (20.6 mm)
156900	9/16" (14.3 mm)	1-9/16" (39.7 mm)		13/16" (23.8 mm)
158369	5/8" (15.9 mm)	1-7/8" (47.6 mm)		1-3/8" (34.9 mm)
187553	11/16" (17.5 mm)	1-7/16" (36.5 mm)		7/8" (22 mm)
197732	1/2" (12.7 mm)	1-3/8" (34.9 mm)		1" (25.4 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>Photocopy This Form Use one form for each product type you are selecting. This form may also be completed online at gemssensors.com 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.

- Liquid Media:** _____
- Pressure:** Minimum _____ psig Maximum _____
- Temperature:** Minimum _____ °F Maximum _____
- Specific Gravity:** Minimum _____ Maximum _____
- Viscosity:** _____ SSU
- Tank Material:** _____
Tank Depth: _____
- 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 (L₀) _____ 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.



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
Mounting and All Wetted Parts	PVC		
Operating Temperatures	0°F to 125°F (-17.8°C to 51.7°C)		
Pressure, PSI, Max.	15 @ 70°F (21°C)		
Max. Length (Lo)	60 inches (152.4cm)		
Mounting Position	Vertical ±30° Inclination		

2. Float Type

Float Material	PVC*	Buna N
Float Dimensions		
Float Part Number	16306	142251
Min. Liquid Specific Gravity	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.):

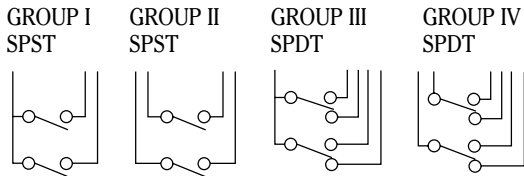
SPST: 20 VA or 100 VA

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.

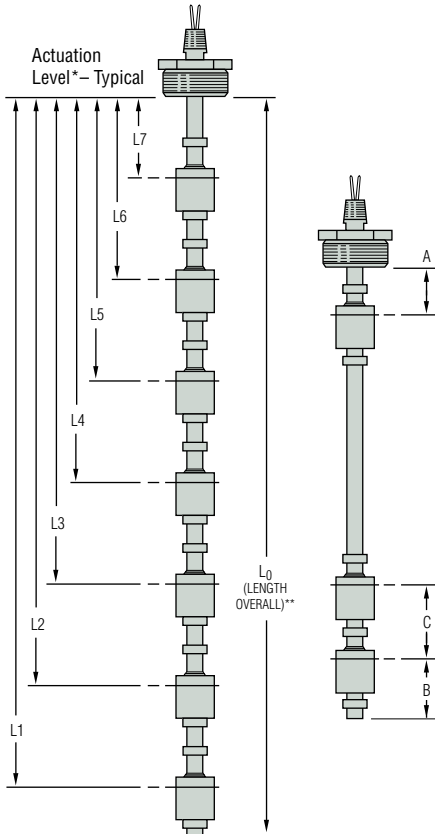


Wiring Color Code

Wiring	SPST Switches			SPDT Switches 20 VA				
	Group I	Group II		Group III		Group IV		
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			
L4	Brown	Brown	Brown					
L5	Orange							
L6	Gray							
L7	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.

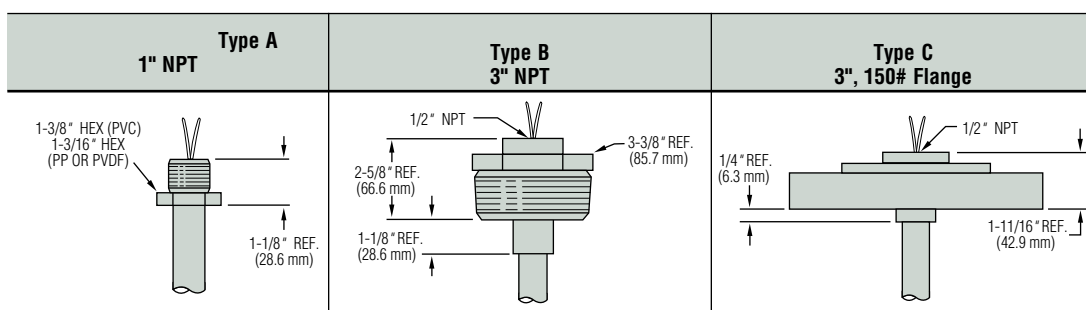
1. Mounting Types

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.



CE

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 Easy online ordering too!*



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			
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.

LEVEL SWITCHES – MULTI POINT

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.):

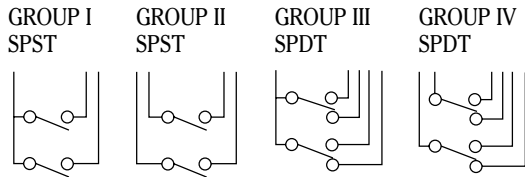
SPST: 20 VA or 100 VA

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.

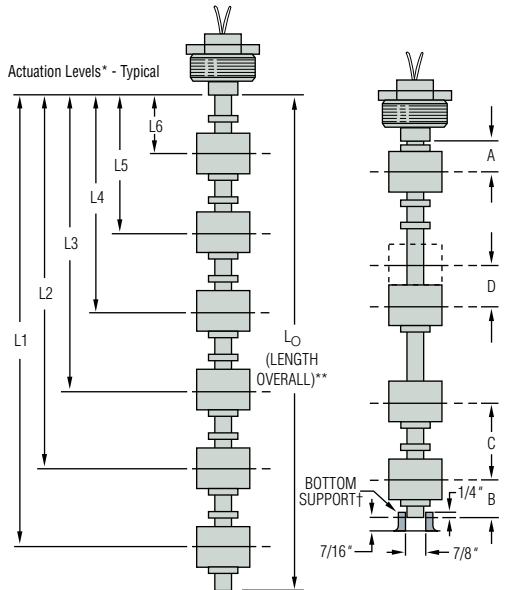


Wiring Color Code

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 L₀ (overall unit length) are measured from inner surfaces of mounting plug or flange.

** Length Overall L₀ = L₁ + 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
Stem and Mounting Material	Brass or 316 Stainless Steel			Flange: Carbon Steel or 316 S.S. Stem: 316 S.S.
Max Length (Lo)	36" (91.4 cm)	60" (152.4 cm)	140" (355.6 cm)	
Mounting Position	Vertical ± 30° Inclination			
Float Stops*	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.



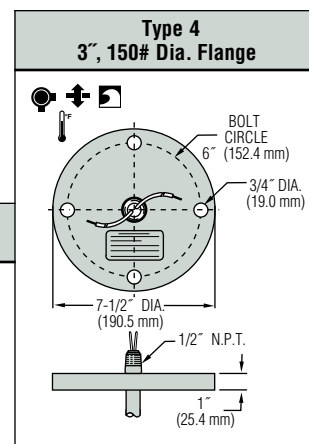
ORDER IT!

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Easy online ordering too!

UL Approved
Explosion-Proof



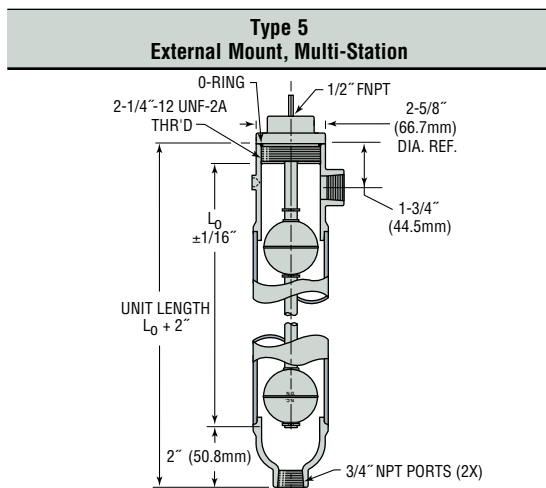
LEVEL SWITCHES – MULTI POINT



LS-800 Series - Continued

1. Mounting Types - continued

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



Housing Material	Brass	316 Stainless Steel
Stem and Mounting	Brass	316 Stainless Steel
Port Sizes	3/4" NPT	
Max. Length (L₀)	120" (305 cm)	
Float Stops*	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		
Compatible Mounting Types	2	1, 3, 4, 5	3, 4, 5 (Units >72")	1, 3, 4, 5 (Units ≤72")	3, 4, 5 (Units >72")	1, 3, 4
Float Dimensions						
Part Number	26032	10558	24864	14569	15666	138935
Operating Temperature	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)		
Min. Media Specific Gravity	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)				
			150		750	300	120

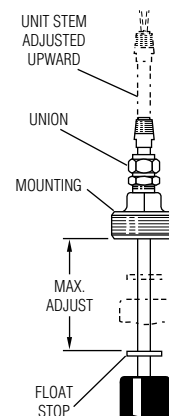
Review the Compatible Mounting Type row in the "Float Types" table above this matrix for produceable mounting/float combinations. Not all combinations implied by this Pressure Rating Chart are possible or recommended.

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

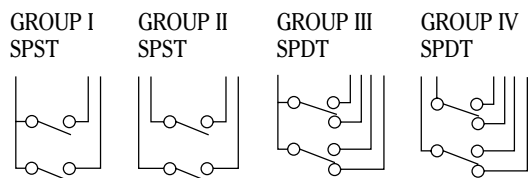
SPDT: 20 VA

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

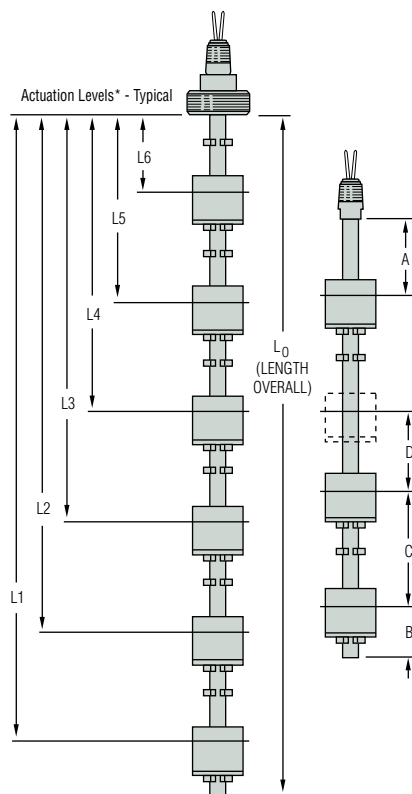
Tinted area designates U.L. Recognized wiring configurations.

Wiring	SPST Switches			SPDT Switches 20 VA				
	Group I	Group II		Group III		Group IV		
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:

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 $L_0 = L_1 + \text{Dimension B}$.

See Mounting Types for Maximum Length values.

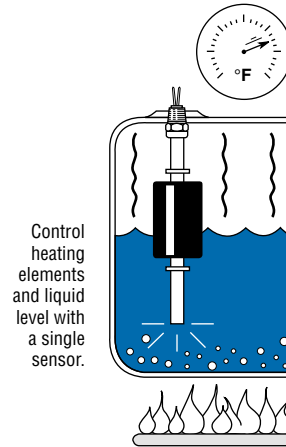
Optional Integrated Temperature Sensors

- ▶ 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.

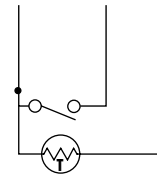
Alpha @ 25°C: -4.39%/°C

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

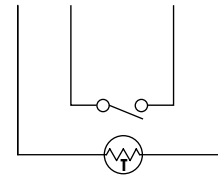
How to Order

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.

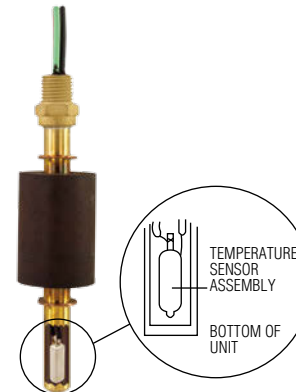
Use these switches to set off High/Low temperature alarms. Or, combine with GEMS relays to control tank heating and cooling, motor-operated valves, etc.

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)

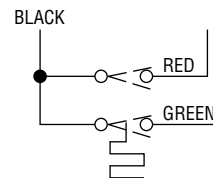
Note:

- 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.

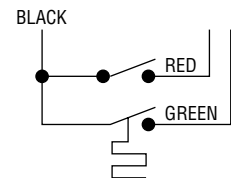


Note: End of unit stem must be submerged a minimum of 2-3/4” for level switch actuation.


Typical Wiring Diagram



GROUP I



GROUP II

 <p>Photocopy This Form 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 (____) _____
--	--

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.

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

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) ¹	SPST Switch Operation ² (Check Type)	
		N.O.	N.C.
L6			
L5			
L4			
L3			
L2			
L1 ³			

Notes:

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

- B.** Length Overall (L₀) _____ 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.

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-300, 700 and 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.

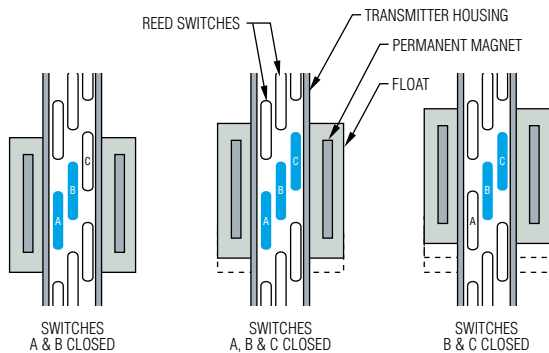
Typical Applications

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

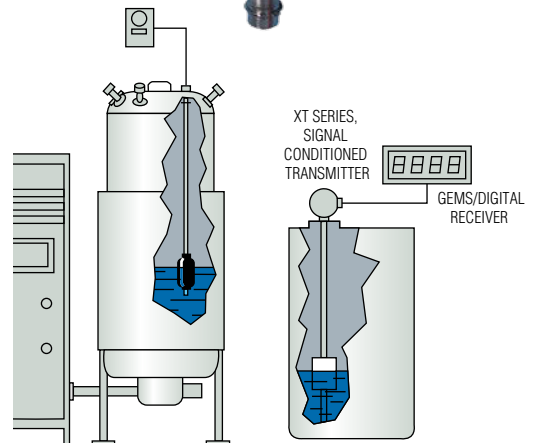
Operating Principle

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.

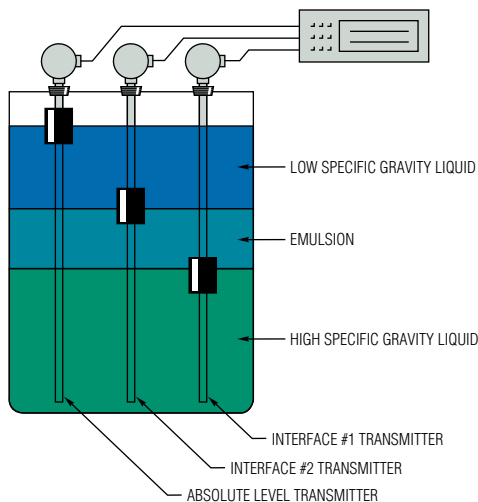


What does this mean to you?

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-23, 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.

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.

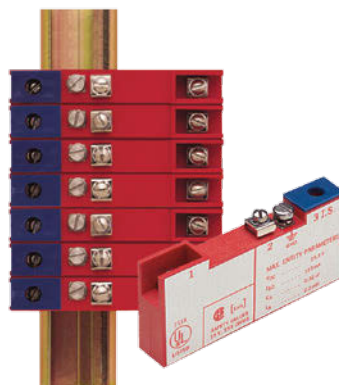
Selection Guide

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	XM- & XT-700 XM-800/860
				Signal Conditioned	XT-800/860
	50 psi (3.4 bar)	Engineered Plastic	1/4 inch (6.4 mm)	10-30 VDC Proportional	XM- & XT-300 XMP-800
				Signal Conditioned	XTP-800
	300 psi (2 bar)	Alloy	1/2 inch (12.7 mm)	0-12 VDC Proportional	XM-860
				Signal Conditioned	XT-860
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	XM-66400 XM-36490
				Signal Conditioned	XT-66400 XT-36490
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	XM-66400
				Signal Conditioned	XT-66400

Notes:

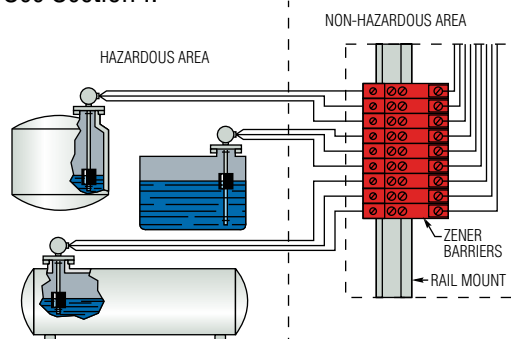
1. Proportional Voltage = DC voltage proportional to liquid level and source voltage.
Ex. 5 VDC input, 0-5 VDC output.
2. Signal Conditioned = Regulated 0-5 VDC, 0-10 VDC, 0-12 VDC and 4-20 mA outputs.

Contents	Page Start
XM/XT-300 Series	C-3
XM/XT-700 Series	C-6
XM/XT-800 Series	C-9
XM/XT-860 Series	C-12
XMP/XTP-800.....	C-16
XT-1000.....	C-19
CT-1000.....	C-21
XM/XT-36490.....	C-23
XM/XT-66400.....	C-23
Signal Conditioning Modules.....	C-26
Receivers	D-24



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, 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.

Small Size – Engineered Plastics

XM/XT-300 Engineered Plastics Series

Brings Continuous Output to Shallow Tanks

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

- ▶ All-Plastic Wetted Parts
- ▶ 4mm Resolution
- ▶ Indicating Length to 14" (35.5 cm); Stem Length to 20" (50 cm)
- ▶ U.L. Pending

Designed for the high quantity needs of the OEM, XM/XT-300 Series transmitters are the ideal level sensor for shallow tanks and reservoirs. Compact and versatile, these plastic level sensors offer a broad choice of mountings and float materials. The following pages illustrate the various design parameters available to configure custom XM/XT-300 Series Sensors.

1. Mounting Types

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



LEVEL SENSORS – CONTINUOUS



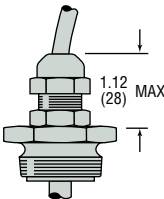
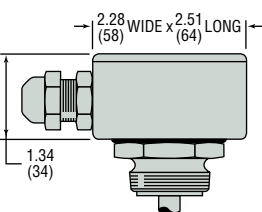
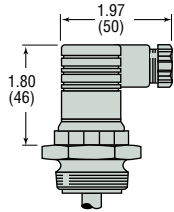
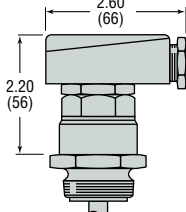
NPT Threads		Straight Threads		
Type 21 1/8" NPT 	Type 22 1" NPT 	Type 31 3/8" - 24 	Type 32 1-5/16" - 12 	Type 33 5/8" - 11
Metric Threads		Compression Types		
Type 41 G 1/4" (1/4" - 19 BSP) 	Type 42 G 1" (1" - 11 BSP) 	Type 51 M12 x 1.5 Straight Thread 	Type 71' 5/8" - 11 	Type 11 No Mounting
Flange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

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

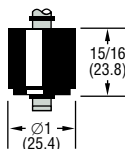
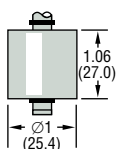
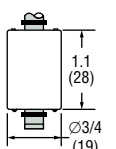
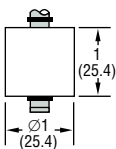
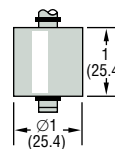
Notes:
1. Type 71 mounting to be used with 3/4" diameter float only.
2. Not recommended for pressure applications.

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

3. Float Types

Float Material	Buna N	Polysulfone	Polypropylene		PVDF	
			Solid Foamed	Hollow – 20% Glass Filled		
Float Dimensions						
Part Number	39048	39005	231500	119455	145730	174515
Float Material Suitable for...	Oil, Fuels	Water-based Liquids	Broad Chemical Use		Low Specific Gravity Liquids	Broad Chemical Use
Operating Temperature ¹	Water: to 180°F (80°C) Oil: -40°F to +221°F (-40°C to +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)	-40°F to +250°F (-40°C to +121°C)
Pressure, psi (bar) Max. ²	250 (17)	50 (3.5)	Atmospheric	250 (17)	50 (3.5)	50 (3.5)
Min. Media Specific Gravity	0.45	0.75	0.95	0.90	0.60	0.86


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: $\frac{\text{inches}}{\text{millimeters}}$

Also Available

XM/XT-350 Combination Siphon and Level Transmitter
Contact Gems for more details. **800-378-1600**

 <p>Photocopy This Form 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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XM/XT-300 Engineered Plastics Custom Length, Float Type Level Transmitter 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 _____ <input type="checkbox"/> psig <input type="checkbox"/> bar Maximum _____
3. Temperature: Minimum _____ <input type="checkbox"/> °F <input type="checkbox"/> °C Maximum _____ <input type="checkbox"/> °F <input type="checkbox"/> °C
4. Specific Gravity: Minimum _____ Maximum _____ | 5. Viscosity: _____ SSU
6. Tank Material: _____
Tank Depth: _____
7. Unit is Mounted In: <input type="checkbox"/> T – Top Mounted <input type="checkbox"/> B – Bottom Mounted |
|--|--|

Product Parameters

1. Mounting Type (select one):

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

2. Electrical Connections:

✓*	Type	Description	Compatible Mounting Types
	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

* Select one

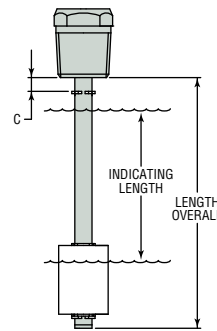
3. Float Type (select one):

- Buna-N – P/N 39048
- Polysulfone – P/N 39005
- Solid Foamed Polypropylene – P/N 119455
- Solid Foamed Polypropylene – P/N 231500
- Hollow Polypropylene – P/N 145730
- PVDF – P/N 174515

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

For use by Gems Sensors & Controls Quote: \$ _____ Date Quoted: ____/____/____

5. Dimensions:



C: Minimum distance from bottom of mounting to upper float stop.

XM Series = 0.25" (6.4 mm)
 XT Series = 1.0" (25.4 mm)

Provide values for both items and check the box next to the most critical value.

- Indicating Length _____ Inches Millimeters
 Length Overall _____ Inches Millimeters

6. Output:

XM-300

- Proportional Voltage
Planned Input Voltage _____
- Resistive (Quantity Dependent)
Preferred Value @ Maximum Indication _____ Ohms
Preferred Value @ Minimum Indication _____ Ohms

XT-300

- 2-Wire, Loop Powered 4-20mA Output (Insert Mounted)
- Note: "C" dimension = 1" minimum



Small Size – Alloys

XM/XT-700 Series Combines Durability of Metal With a Compact Design for Restricted Spaces

- ▶ Stainless Steel or Brass Mountings and Stems
- ▶ 4mm Resolution
- ▶ Indicating Length to 14" (35.5 cm); Stem Length to 20" (50 cm)

These compact units feature the rugged durability of stainless steel or brass construction in a lightweight package. Ideal for tanks less than 2 feet.

XM/XT-700 Series transmitters are exceptionally versatile because of the many useful options available.

ORDER IT!
 Ordering is Easy! See Page C-8.
 Easy online ordering too!

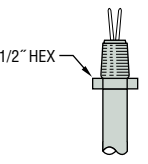
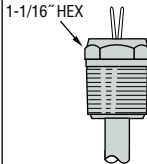
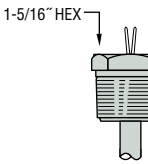
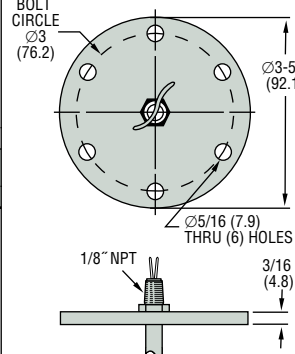
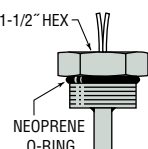
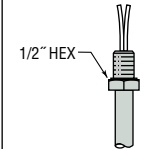
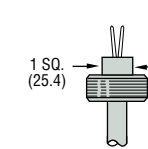


LEVEL SENSORS – CONTINUOUS

1. Mounting Types

Each mounting type can be configured with stem lengths (L_0) 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 ¹	Type 3 1" NPT ¹	Type 4 3-5/8" Dia. Flange
			
Type 5 1-5/16-12UNF-2A	Type 6 3/8-24	Type 7 1-1/4" NPT ¹	
			

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

Stem and Mounting Material	Brass or 316 Stainless Steel	
Max Length	20" (50 cm)	
Mounting Position	Vertical $\pm 30^\circ$ Inclination	
Float Stops²	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings	
Pressure Rating, PSI, Max.³	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. 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.

3. 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.

2. Float Types

Float Materials	Polypropylene		
	Hollow	Foamed	Molded
Compatible Mounting Types	1, 3, 4, 5, 6, 7	1, 3, 4, 5, 6, 7	1, 2, 3, 4, 5, 6, 7
Float Dimensions			
Part Number	145730	119455	231500
Operating Temperature	-40°F to +221°F (-40°C to +105°C)	-40°F to +221°F (-40°C to +105°C)**	-40°F to +200°F (-40°C to +95°C)
Pressure, PSI, Max.	50	250	Atmospheric
Min. Liquid Specific Gravity	0.65	0.90	0.95

Float Materials	Buna N	Nylon	Polysulfone	316/316L SS
Compatible Mounting Types	1, 3, 4, 5, 6, 7	1, 3, 4, 5, 6, 7	1, 2, 3, 4, 5, 6, 7	1, 3, 4, 5, 6, 7
Float Dimensions				
Part Number	39048	220488	39005	233580
Operating Temperature	Water: to 180°F (82.2°C) Oil: -40°F to +221°F (-40°C to +105°C)	Water: to 180°F (82.2°C) Oil: -40°F to +300°F (-40°C to +149°C)	-40°F to +221°F (-40°C to +105°C)**	-40°F to +400°F (-40°C to +204°C)**
Pressure, PSI, Max.	300*	50	50	275
Min. Liquid Specific Gravity	0.45	0.70	0.75	0.85

* De-rated with temperature.

** -40°F to 300°F (Standard Construction)

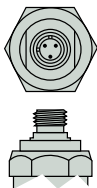
301°F to 400°F (Ceramic Potting Construction Required)

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

Options

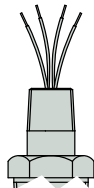
Integral Receptacle

3-5 Pin miniature receptacle for mounting Type 2, 3 or 7; eliminates splicing and eases connections.



Conduit Adapter


A 1/2" MNPT conduit is available for Mounting Type 2, 3, 4, 5 & 7. Select from list of options on the Check List.



Also Available

XM/XT-750 Combination Siphon and Level Transmitter

Contact Gems for more details. **800-378-1600**

 <p>Photocopy This Form 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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XM/XT-700 Types Custom Length Float Type Level Transmitters

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: <input type="checkbox"/> Tank Top <input type="checkbox"/> Tank Bottom |
|---|--|

1. Series Type:

XM/XT-700

2. Mounting Type and Materials:

A. Mounting Type (select one):

- Type 1 Type 2 Type 3 Type 4
 Type 5 Type 6 Type 7

Options

- 3-5 Pin Receptacle (Types 2, 3 or 7 only) 1/2" MNPT Conduit Adapter (Types 2, 3, 4, 5 or 7 only)

B. Mount and Stem Material (select one):

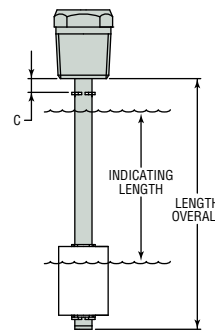
- Brass
 316 Stainless Steel

3. Float Part Number:

4. Electrical Connections (select one type plus length value):

- Lead Wire: Length 12" 24" Other _____
 Cable: Length 12" 24" Other _____
 Other _____

5. Dimensions:



C: Minimum distance from bottom of mounting to upper float stop.

XM Series = 0.25" (6.4 mm)
XT Series = 1.0" (25.4 mm)

Provide values for both items and check the box next to the most critical value.

- Indicating Length _____ Inches Millimeters
 Length Overall _____ Inches Millimeters

6. Output:

XM-700

- Proportional Voltage
 Planned Input Voltage _____
 Resistive (Quantity Dependent)
 Preferred Value @ Maximum Indication _____ Ohms
 Preferred Value @ Minimum Indication _____ Ohms

XT-700

- 2-Wire, Loop Powered 4-20mA Output (Insert Mounted)
 Note: "C" dimension = 1" minimum

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

Additional minimum charges may apply on special orders.

For use by Gems Sensors & Controls Quote: \$ _____ Date Quoted: ____/____/____



ORDER IT!

Ordering is Easy! See Page C-11.
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



Lengths to 12 ft!



LEVEL SENSORS – CONTINUOUS

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

Stem Material	Brass or 316 Stainless Steel	316 Stainless Steel	
Mounting Material	Brass or 316 Stainless Steel	Carbon Steel or 316 Stainless Steel	316 Stainless Steel
Float Stop Material	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings		
Operating Temperature* 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		
With Stem Mounted Signal Conditioners	+5°F to +160°F (-15°C to +70°C)		
Operating Pressure	Dependent on Float Type; See Next Page		
Overall Length, Max.	72" (183 cm) Tubing; 144" (366 cm) Pipe (Types 3 & 4 only)		

* Consult factory for higher temperature ranges.

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

2. Float Types

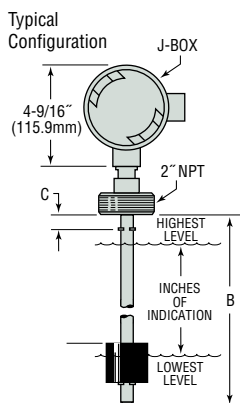
Based on the overall length required by your tank, select from two main subsets of floats below; further refine selection based on material and performance parameters.

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

Notes:

1. @ Ambient Temperature
2. Recommended for Type 2 mounting only.
3. 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
164255	2.0" (50.8)
43359	2.5" (63.5)
156490	2.062" (52.4)
43590	3.437" (87.3)
69654	2.687" (68.3)
52084	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-26.

Series	Input Voltage	Output Signal	Part Number	Electrical Termination	Compatible Mountings				
					Type 1	Type 2	Type 3	Type 4	Type 6
XM-800	10 to 30 VDC	Proportional Voltage	—	Lead Wires (3), #22 AWG, 24" (60.9 cm), PTFE Jacket	•	•	•	•	•
XT-800	8 to 24 VDC*	0-5 VDC	51965	Lead Wires, #22 AWG, 24" (60.9 cm), PTFE Jacket	•	•	•	•	•
	14 to 30 VDC*	0-12 VDC	51970		•	•	•	•	•
	8 to 24 VDC*	0-5 VDC	52536	Junction Box		•	•	•	•
	15 to 30 VDC*	0-12 VDC	52537			•	•	•	•
	10 to 40 VDC	4-20 mA	52555			•	•	•	•
4-20 mA		112300 ⚡	Panel Mount with Plug-in Base	•	•	•	•	•	
	7 to 24 VDC*	4-20 mA	239896	Lead Wires (2), #22 AWG, 24" (60.9 cm), PTFE Jacket	•	•	•	•	•

* Stem mounted.
 ⚡ = Stock item

 <p>Photocopy This Form 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 (____) _____
--	--	--

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)

3. Materials:

- a. Stem:
 Brass¹ 316 Stainless Steel
- b. Mounting:
 Brass¹ 316 Stainless Steel
 Carbon Steel (Type 4 flange only)
- c. Collar Float Stops²:
 Brass 316 Stainless Steel

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)

4. Float Type¹:

Match to Overall Length of Transmitter Stem

To 72 Inches	Over 72 Inches
<input type="checkbox"/> 164255 – Buna N ²	<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. Stainless Steel float required for FM Approved Explosion Proof units.
 2. Recommended for Type 2 mounting.

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.

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)
 239896 (4-20 mA – stem)



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.

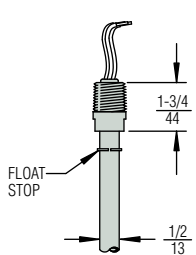
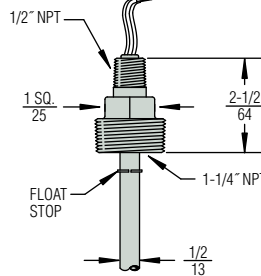
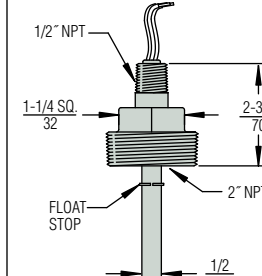
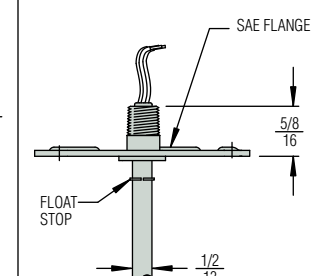
Gems XM-860 Advantages

- 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
			
Stem Material	Brass or 316 Stainless Steel		Brass
Mounting Material	Brass or 316 Stainless Steel		Brass
Float Stop Material	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings		
Stem Length	24 inches (610 mm), Max.		
Output Wiring	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-15.
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 = ± 2.75
Low Resistance = 33 ± 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 _{Lead}	R	R _{Lag}	Unit
P1	0	100	0	Ohms

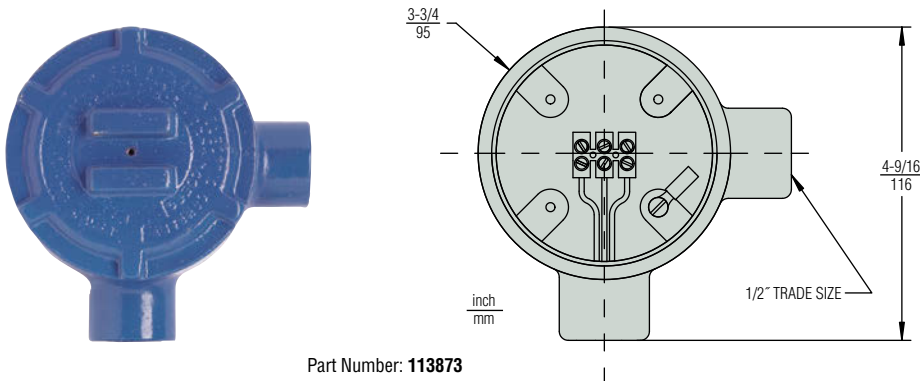
$$\text{Total Indicating R} = R_{\text{Lead}} + (A \text{ (In.)} * R) + R_{\text{Lag}}$$

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

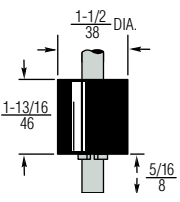
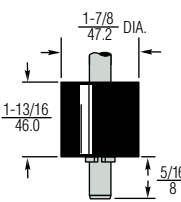
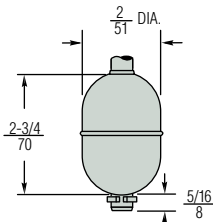
- A. Non-Rated Units.** Supplied with lead wire output; junction box optional. (See below.)
- B. Explosion-Proof Rated Units.** Supplied from factory with explosion-proof junction box.
- C. Intrinsically-Safe Rated Units.** Supplied with lead wire output; junction box optional. (See below.)
- D. Optional 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			
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").

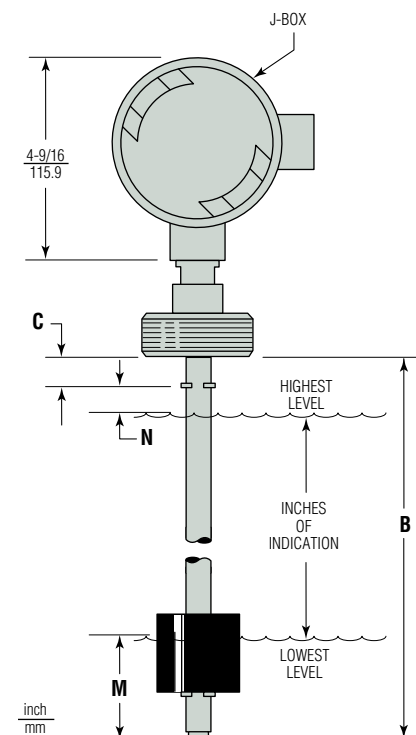
Float Factors


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>Photocopy This Form 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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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>1. Liquid Media: _____</p> <p>2. Pressure: Minimum _____ psig Maximum _____ psig</p> <p>3. Temperature: Minimum _____ °F Maximum _____ °F</p> <p>4. Specific Gravity: Minimum _____ Maximum _____</p> | <p>5. Viscosity: _____ SSU</p> <p>6. Tank Material: _____</p> <p>Tank Depth: _____</p> <p>7. Unit is Mounted In: <input type="checkbox"/> Tank Top <input type="checkbox"/> Tank Bottom</p> <p>8. Moisture Protection Required? <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 ¹ (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: ____/____/____



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!
Ordering is Easy! See Page C-18.
Easy online ordering too!

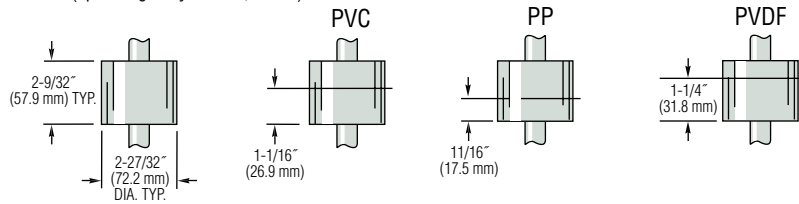


LEVEL SENSORS – CONTINUOUS

	Type A 1" NPT	Type B 3" NPT	Type C 3" 150# Flange
XMP-800 Dimensions			
XTP-800 Dimensions			
Stem, Mounting and Float Stop Material	PVC, Polypropylene or KYNAR® (PVDF)		
Operating Temperature	See Chart, Next Page		
Operating Voltage	10-30 VDC		
Overall Length, Max.	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")

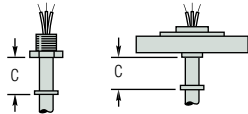
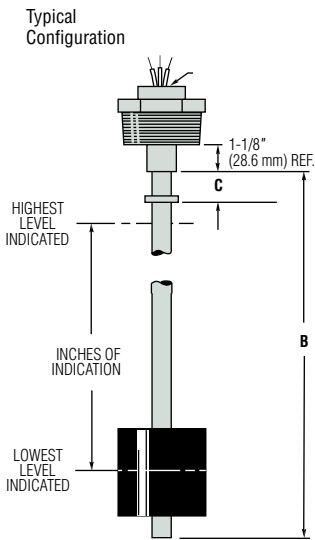


Material	Min. Liq. Specific Gravity	Part Number	Maximum Pressure vs. Temperature							
			0°F (17.8°C)	70°F (21.1°C)	100°F (37.8°C)	125°F (51.7°C)	140°F (60.0°C)	170°F (76.7°C)	200°F (93.3°C)	210°F (98.9°C)
PVC	.60	61326	50 PSI	50 PSI	35 PSI	20 PSI	10 PSI			
Polypropylene	.40	61327	50 PSI	50 PSI	40 PSI	35 PSI	30 PSI			
PVDF	.75	61328	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



"C" Dimension begins at point where stem meets the mounting.

- 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
61326	3.5" (88.9)
61327	3.5" (88.9)
61328	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-26.

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*	51965	Lead Wires, #22 AWG, 24" (60.9 cm), PTFE Jacket	•	•	•
	14 to 30 VDC	0-12 VDC*	51970		•	•	•
	8 to 24 VDC	0-5 VDC	154687	ABS Junction Box		•	•
	15 to 30 VDC	0-12 VDC	154685			•	•
	10 to 40 VDC	4-20 mA	116970			•	•
		4-20 mA	112300 ⚡	Panel Mount with Plug-in Base	•	•	•

* Stem mounted.

⚡ = Stock item

 <p>Photocopy This Form Use one form for each product type you are selecting. This form may also be completed online at gemssensors.com 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	

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.

- | | |
|---|--|
| 1. Liquid Media: _____ | 5. Viscosity: _____ SSU |
| 2. Pressure: Minimum _____ psig Maximum _____ psig | 6. Tank Material: _____ |
| 3. Temperature: Minimum _____ °F Maximum _____ °F | Tank Depth: _____ |
| 4. Specific Gravity: Minimum _____ Maximum _____ | 7. Unit is Mounted In: <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

3. Mounting and Stem Material:

- PVC Polypropylene PVDF

4. Float Type:

- 61326 – PVC 61327 – Polypropylene 61328 – PVDF

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)

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

Quote: \$ _____ Date Quoted: ____/____/____



XT-1000 Series

Magnetostrictive Level Sensors

- ▶ 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 4,000 mm), it is compatible with a variety of tank dimensions. It also comes in the following versions:

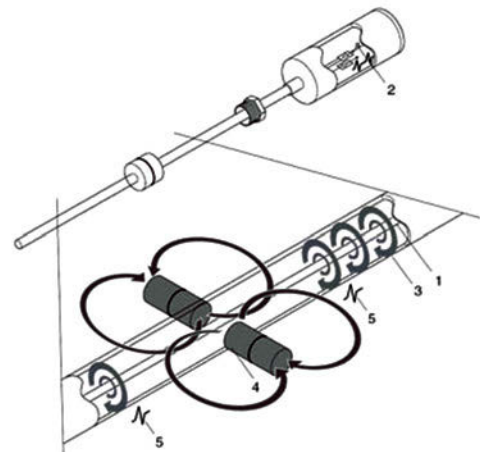
The explosion-proof version of the level sensor can be installed in potentially explosive atmospheres in which electrical equipment of category 1 (zone 0) or category 1/2 (zone 0/1) are required. Operating on the digital HART protocol, the HART level sensor is able to output the position of the first, second or both floats.

Specifications

Housing	
Protection Type	IP 68
Material	Stainless Steel
Cable Diameter	0.19" to 0.394" (5 to 10 mm)
Probe Tube	
Diameter	0.472" (12 mm)
Material	Stainless Steel 316 Ti; Hastelloy C
Length	8" to 157" (200 to 4,000 mm)
Electrical	
Connection	2-wire
Supply	10 to 30 VDC
Current Signal	4 to 20 mA
Error Message	Adjustable to 3.6 or 21.5 mA
Measuring Accuracy	
Filling Level	Up to 0.020" (0.5 mm)
Resolution	Up to 0.04" (0.1 mm)
Analog Part	$\pm 0.1\%$ / K, resolution better 0.5 μ 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	1
2" NPT	316 Stainless Steel	Threaded	2
3" - 150#		Flange	3
G 1/2"		Threaded	4
DN 25 PN6 DIN		Flange	5
DN 50 PN6 DIN		Flange	6

* 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)	11
≥0.60			316 Ti	2.05" (52 mm)	02
≥0.70	145 psi (10 bar)	Cylinder	C276	1.81" (46 mm)	12
	232 psi (16 bar)				07
≥0.85	290 psi (20 bar)	Ball	316 Ti	1.69" (43 mm)	09
≥0.95	725 psi (50 bar)				03

Temperature Ranges

Ambient	-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)	1
Low	-85°F to +257°F (-65°C to +125°C)	4
High	-40°F to +482°F (-40°C to +250°C)	3
Highest	-40°F to +842°F (-40°C to +450°C)	5

How to Order

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

XT-1000 - **0** - **XXXX** - **XX** - **X** - **X** - **X** - **X** - **X**

Signal Current
0 - 4-20 mA

Probe Lengths
Probe Length is 8-157 inches or 200-4000 millimeters, and may be specified in either unit. Label with "in" when using inches, or with "mm" when using millimeters.

Length Ordering Code Examples:
12 inches = **12in**; 125 inches = **125in**
2830 millimeters = **2830mm**; 350 millimeters = **350mm**

Float Type
00 - None
02 - Ball dia. 2.05" (52 mm), 316 Ti, 290 psi (20 bar), ≥ 0.60 SG
03 - Ball dia. 1.69" (43 mm), 316 Ti, 725 psi (50 bar), ≥ 0.95 SG
07 - Cylinder dia. 1.69" (43 mm), 316 Ti, 232 psi (16 bar), ≥ 0.70 SG
09 - Ball dia. 1.69" (43 mm), 316 Ti, 290 psi (20 bar), ≥ 0.85 SG
10 - Ball dia. 2.05" (52 mm), 316 Ti, 580 psi (40 bar), ≥ 0.70 SG
11 - Ball dia. 1.99" (50 mm), Titanium, 290 psi (20 bar), ≥ 0.50 SG
12 - Cylinder dia. 1.81" (46 mm), C276, 145 psi (10 bar), ≥ 0.70 SG

HART
0 - None
1 - Hart Protocol

Certificate
0 - None
1 - Ex (ATEX)¹

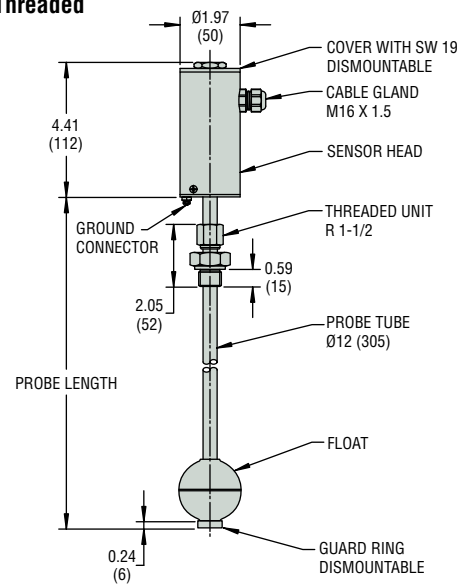
Medium Temperature Range
1 - Standard Temperature
3 - High Temperature
4 - Low Temperature
5 - Highest Temperature

Mounting Type
0 - None
1 - R 1-1/2" Threaded, Brass
2 - 2" NPT Threaded, 316 Stainless Steel
3 - 3" 150# Flange, 316 Stainless Steel
4 - G 1/2" Threaded, 316 Stainless Steel
5 - DN 25 PN6 DIN Flange, 316 Stainless Steel
6 - DN 50 PN6 DIN Flange, 316 Stainless Steel

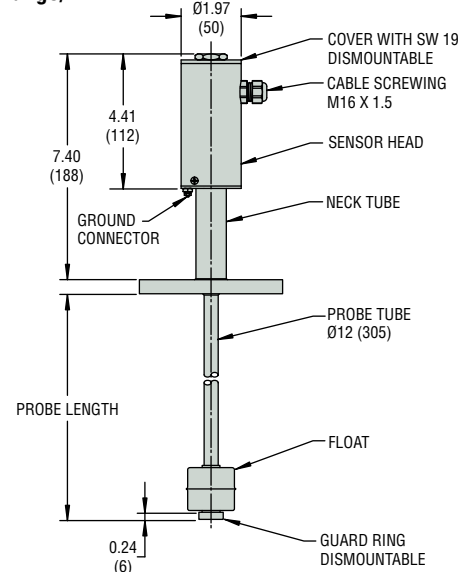
Note:
1. The explosion-proof version of the level sensor can be installed in potentially explosive atmospheres in which electrical equipment of category 1 (zone 0) or category 1/2 (zone 0/1) are required. Operating on the digital Hart Protocol, the Hart level sensor is able to output the position of the first, second or both floats.

Dimensions – in. (mm)

Threaded



Flange/DIN



CT-1000 Series

Potentiometric Level Sensors

- ▶ Suitable in all electrically conductive liquids
- ▶ Resolution better than $\pm 0.039''$ (1mm)
- ▶ Micro-controlled measurement analysis
- ▶ 2-wire terminal (4-20mA)
- ▶ Measuring result independent of pressure, temperature and density
- ▶ Filling level or separating layer coverage
- ▶ Very short measuring times
- ▶ Hart protocol version 6.0
- ▶ Temperature range up to 390°F (200°C)
- ▶ Pressure up to 2,175 PSI (150 bar)—at room temperature
- ▶ Lengths from 8' to 19.7' (0.2 to 6 meters)

The high precision and robust level sensor is designed for use in continuous filling level measurement or continuous separating layer coverage. It is suitable for all electrically conductive liquids.

Specifications

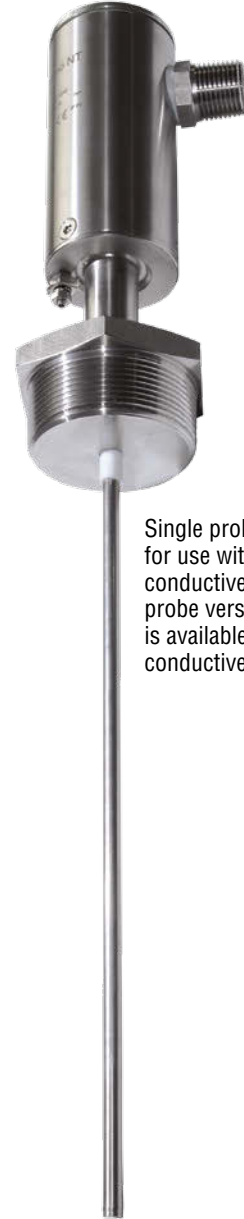
Housing	
Protection Type	IP 68
Material	Stainless Steel (Options: Hastelloy®, Tantalum, Titanium) ¹
Cable Diameter	0.2" to 0.4" (5 to 10 mm)
Probe Tube	
Diameter	0.236" (6 mm)
Material	Stainless Steel - 316 TI
Length	8' to 19.7' (0.2m to 6m)
Pressure Range	2175 PSI (150 bar) @ 68°F (20°C) 362 PSI (25 bar) @ 302°F (150°C)
Temperature	
Ambient	-13°F to +176°F (-25°C to +80°C)
Process	Normal Temp: -40° to 257°F (-40° to 125°C) ²
Electrical	
Connection	2-wire
Supply	10 to 30 VDC
Current Signal	4 to 20 mA
Error Message	Adjustable to 3.6 or 21.5 mA
Measuring Accuracy	
Linearity	$\pm 1\%$
Filling Level	Better than $\pm 0.039''$ (1mm)
Resolution	$< 0.004''$ (0.1mm)
Analog Part	$\pm 0.1\%$ (20°C) + 0.005% / °K
Interfaces	
	4-20 mA (2-wire technology) HART Communication Protocol USB

Notes:

1. Please contact Gems for alternate housing materials.
2. High temperature version (to 392°F / 200°C) available. Please contact Gems.

Operating Principle

The sensor works according to the potentiometric measuring principle. By means of the micro-controlled sensor electronics the current impulses are transmitted through the sensor electrode which is electrically insulated from the tank or external tube. This leads to a linear voltage drop on its electrical resistance. If the sensor electrode is dipped into a conductive liquid ($\geq 1 \mu\text{S/cm}$) an electrical connection to the environment is created. The electrical potential is proportional to the filling level and is measured via a counterelectrode or the tank wall. In order for the input resistance of the measuring electronics to be big enough compared to the electrical resistance of the medium the conductivity of the liquids has to be $\geq 1 \mu\text{S/cm}$.



Single probe version for use with electrically-conductive tanks. A dual probe version (not shown) is available for non-conductive tanks.

Mounting Types

Size	Material	Mounting Type	Code
2" NPT	316 Stainless Steel	Threaded	2
3" - 150# ANSI		Flange	3
R 3/4"		Threaded	4
R 1/2"		Threaded	5
R 1"		Threaded	6

How to Order

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

CT-1000 - 0 - **XXXX** - **X** - **X** - 1 - 0 - **X** - **XXX**

Probe Lengths

Probe Length is 8-236 inches or 200-6000 millimeters, and may be specified in either unit. Label with "in" when using inches, or with "mm" when using millimeters.

Length Ordering Code Examples:

12 inches = **12in**; 125 inches = **125in**

2830 millimeters = **2830mm**; 350 millimeters = **350mm**

Rod Type

0 - 1 Rod

1 - 2 Rods (for non-conductive tanks)

Mounting Type

2 - 2" NPT Threaded, 316 Stainless Steel

3 - 3" 150# Flange, 316 Stainless Steel

4 - R 3/4" Threaded, 316 Stainless Steel

5 - R 1/2" Threaded, 316 Stainless Steel

6 - R 1" Threaded, 316 Stainless Steel

HART

0 - None

1 - HART Protocol

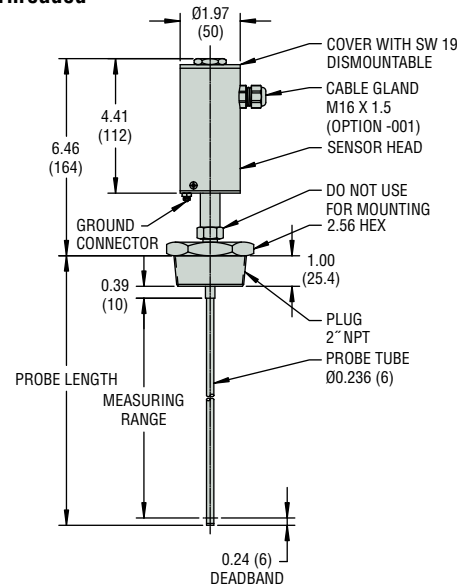
Options

001 - Cable Gland

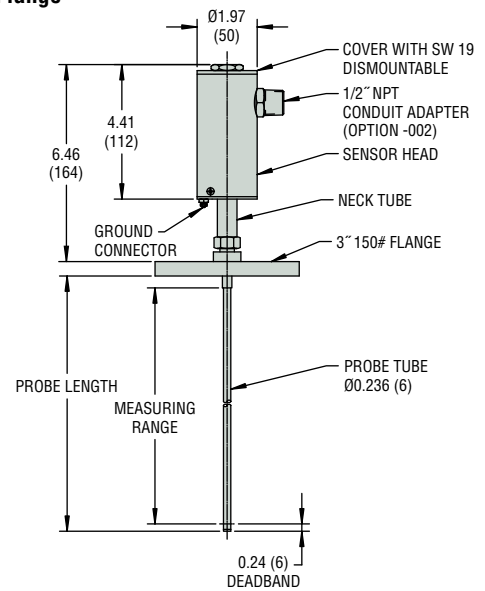
002 - 1/2" NPT Conduit Adapter

Dimensions – in. (mm)

Threaded



Flange



ORDER IT!

Ordering is Easy! See Page C-25.
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.

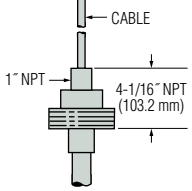
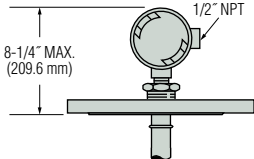
* Contact GEMS about solutions for deeper tanks.

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)	

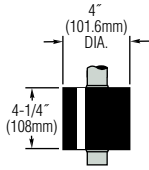
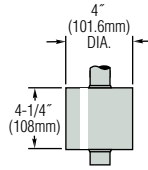
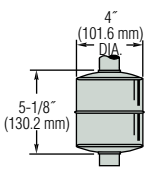
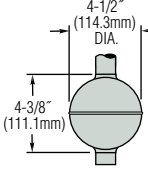
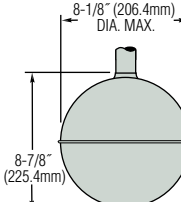
Note: XM/XT-36490 will be manufactured with matching Stem and Float Stop material. Consult factory for longer lengths.

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

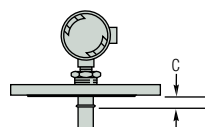
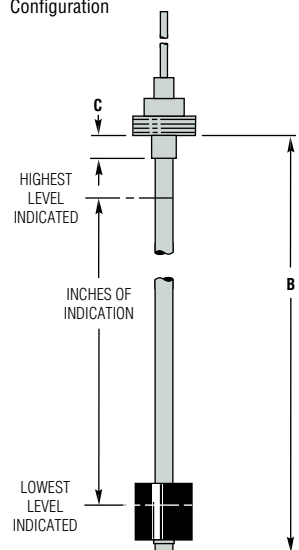
Material	Buna N	4" Dia. Syntactic Foam	4" Dia. Stainless Steel	4-1/2" Dia. Stainless Steel	8" Dia. Stainless Steel**
Float Dimensions					
Part Number	32230	31830	125520	35560	38609
Minimum Liquid Specific Gravity	0.59	0.87	0.57	0.78	0.53
Operating Temperature	-40°F to +180°F (-40°C to +82°C)	-40°F to +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-26.

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>Photocopy This Form 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 (____) _____
--	--

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.

- | | |
|---|--|
| 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: <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: ____/____/____

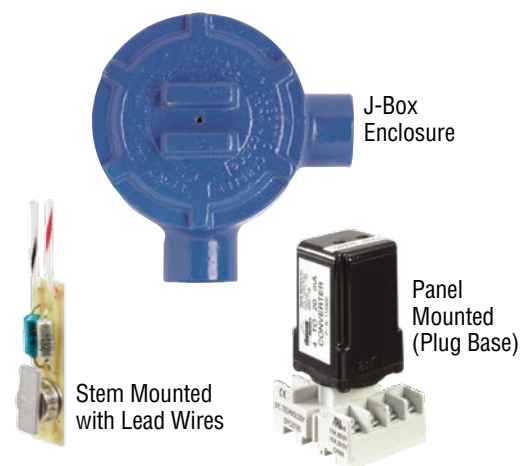


Signal Conditioning Modules, 0-5 VDC, 0-12 VDC and 4-20 mA Outputs

Provide signal conditioning as an integral part of the XT-Series Transmitters

- ▶ Stem Mounted
- ▶ J-Box Enclosed
- ▶ Panel Mounted
- ▶ 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)

System Accuracy	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.
Operating Temperature	+5°F to +160°F (-15°C to +71°C)
Storage Temperature	-40°F to +212°F (-40°C to +100°C)
Output Temperature Coefficient (% of full scale, max.)	±0.00388%/°F (±0.007%/°C)
20 mA Types	To within ±1% of 16 mA

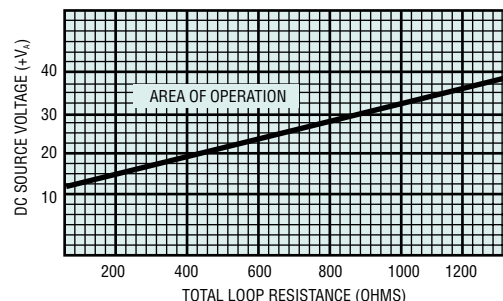
Power Supply Module

Input Power	Part Number
115 VAC, 60 Hz	52560
230 VAC, 60 Hz	52570

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.

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_A) 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 XT-Series sensor being used.

Electrical Termination Method	Output Signal	Input Voltage	Module Part Numbers For:		
			XT-800, XT-860 Series	XTP-800	XT-36490 XT-66400
Stem Mount, Lead Wires #22 AWG, Teflon® Jacket, 24" Length	0-5 VDC	8-24 VDC	51965	51965	—
	0-12 VDC	14-30 VDC	51970	51970	—
Junction Box	0-5 VDC	8-24 VDC	52536	154687	52532
	0-12 VDC	15-30 VDC	52537	154685	52533
	4-20 mA	10-40 VDC	52555	116970	52550
Panel Mount with Plug-In Base	4-20 mA	10-40 VDC	112300 ⚡	112300 ⚡	112300 ⚡

⚡ = Stock item

NOTES

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows.

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-29
UCL-520.....	C-31



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

Range	49.2" (1.25 m)
Accuracy	0.125" (3 mm)
Resolution	0.019" (0.5 mm)
Beam Width	2" (5 cm)
Dead Band	2" (5 cm)
Supply Voltage	24VDC (loop)
Loop Resistance	400Ω max.
Consumption	0.5W
Signal Output	4-20 mA, two-wire (when loop powered)
Contact Type	(4) SPST relays 1A
Loop Fail-Safety	4 mA, 20 mA, 21 mA, 22 mA or hold last
Relay Fail-Safety	Power loss: Hold last; Power on: Open, close or hold last
Hysteresis	Selectable
Configuration Software	PC Windows® USB 2.0
Temp. Comp.	Automatic over range
Process Temp.	20°F to 140°F (-7°C to +60°C)
Ambient Temp.	-31°F to +140°F (-35°C to +60°C)
Pressure	MWP = 30 PSI
Enclosure	Type 6P encapsulated, corrosion resistant & submersible
Encl. Material	PC/ABS FR
Strain Relief Mat.	Santoprene®
Trans. Material	PVDF
Cable Length	48" (1.2 m)
Cable Jacket Mat.	Polyurethane
Process Mount	1" NPT (1" G)
Mount. Gasket	Viton®
Classification	General Purpose
Approvals	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

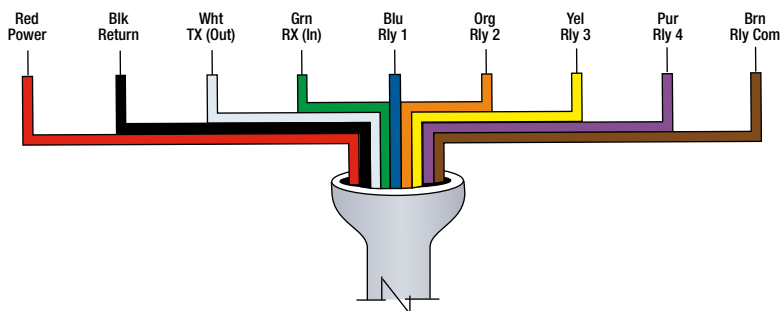
The UCL-510 provides a non-contact alternative to our float and conductivity probes multipoint level switches. It combines 4 built in SPST relays, with a selectable hysteresis that eliminates relay chatter from turbulent media. Additionally, non-contact sensors are immune to the performance issues influenced 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

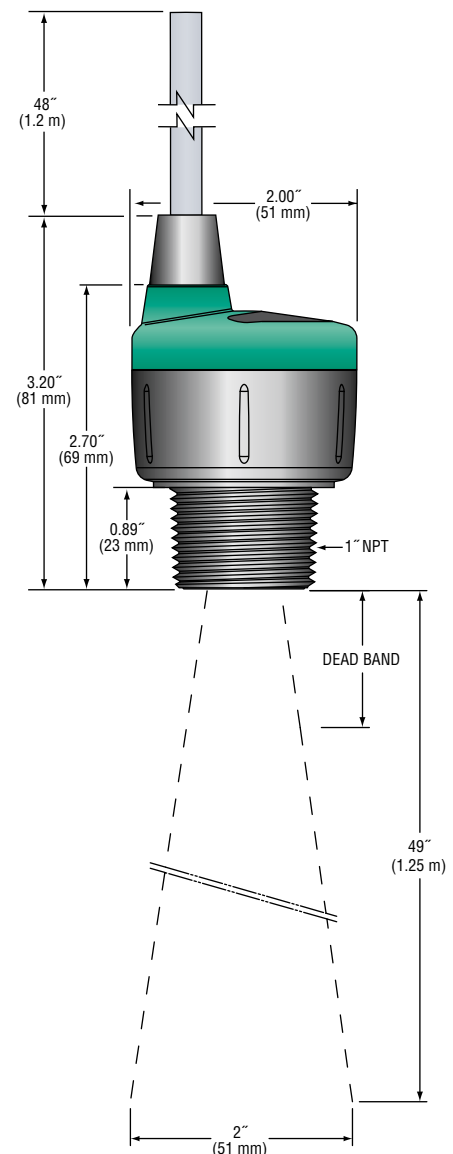
Configuration Software

- Free download @ GemsSensors.com/software
- 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



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

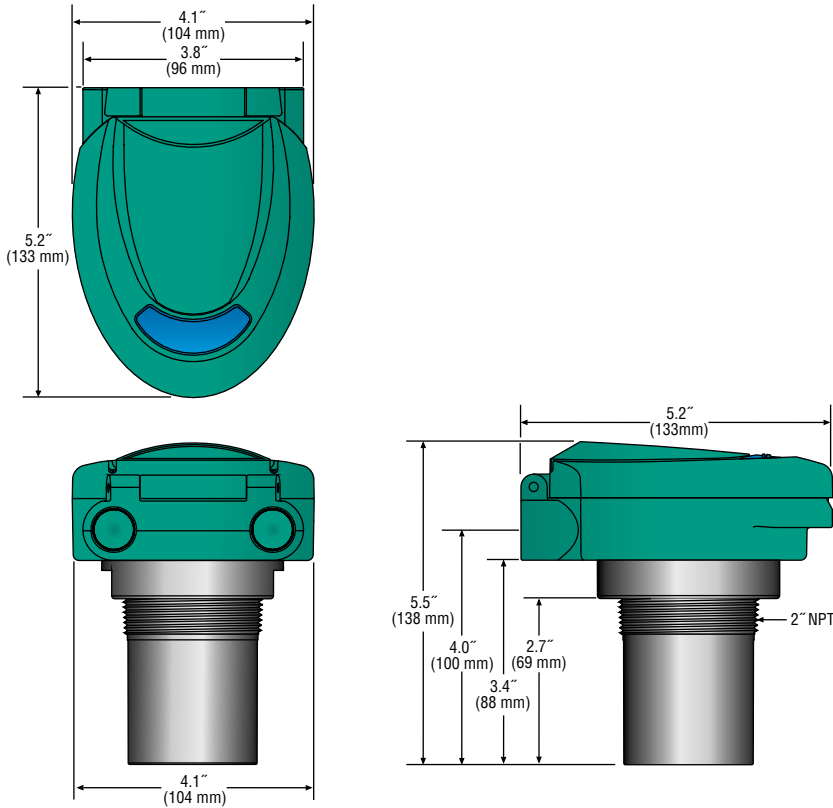
Range	6' to 26.2' (1.8 m to 8 m)
Accuracy	± 0.2% of span in air
Resolution	0.039" (1 mm)
Beam Width	3" (7.6 cm) dia.
Dead Band	8" (20 cm)
Display Type	LCD, 6-digit
Display Units	Inch, cm or percent
Display Mode	Air gap or liquid height
Memory	Non-volatile
Supply Voltage	12-28 VDC
Loop Resistance	500 Ohms @ 24 VDC
Signal Output	4-20 mA, two-wire
Signal Invert	4-20 mA or 20-4 mA
Calibration	Push button
Fail-Safety	Selectable 4 mA, 20 mA, 21 mA, 22 mA or hold
Process Temp.	-7°F to +140°F (-20°C to +71°C)
Temp. Comp.	Automatic
Electronics Temp.	-40°F to +160°F (-40°C to +71°C)
Pressure	30 PSI (2 bar) @ 25°C, derated @ 1.667 PSI (0.113 bar) per °C above 25°C
Enclosure Rating	NEMA 4X (IP65)
Enclosure Vent	Water tight membrane
Enclosure Material	PC/ABS FR
Trans. Material	PVDF
Process Mount	2" NPT (2" G)
Mount. Gasket	Viton®
Conduit Entrance	Dual, 1/2" NPT
Classification	General Purpose
CE Compliance	EN 61326 EMC



Typical Applications

- Water and Waste Water
- Petrochemical
- Health Care
- Mining
- Cleaning
- HVAC
- Chemical
- Semiconductor
- Agriculture
- Electric Power
- Water Parks/Swimming Pools

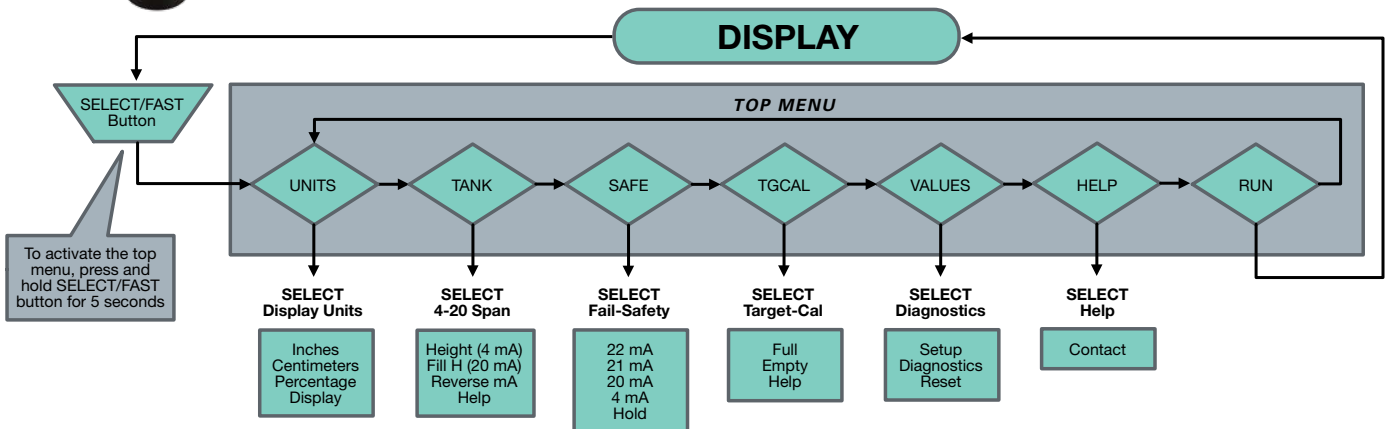
Dimensions



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

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows.

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.

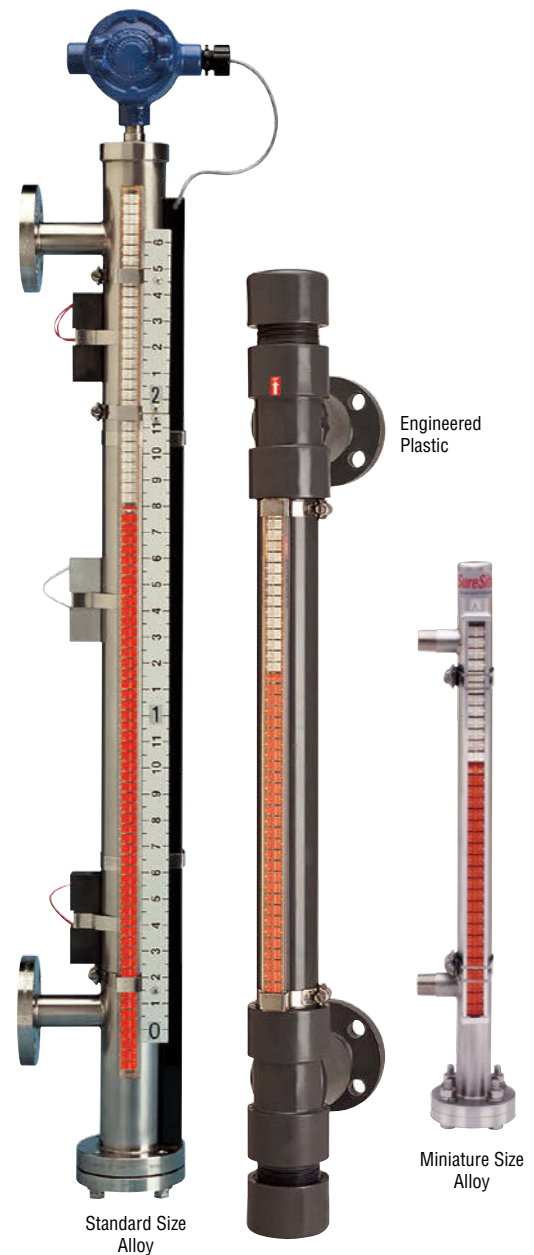
- Low Maintenance—No glass to break, durable housings
- OSHA Friendly—Accident incidence reduction
- Reduced Workload—Quick and easy viewing shortens monitoring chores
- EPA Friendly—Fewer seals and no glass protect against spillage
- Multi-Purpose—Not single purpose as with sightglasses; can replace 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.

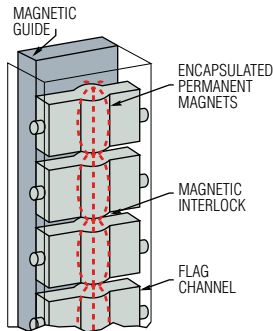


SureSite Indicators Are Superior To Other Magnetic Type Indicators. Here's Why:

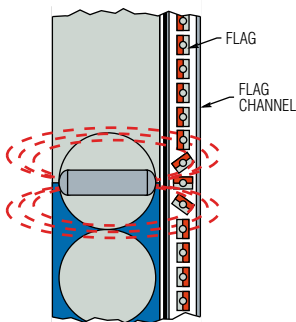
It begins with a patented Flag Assembly and integrated Magnetic Guide

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.

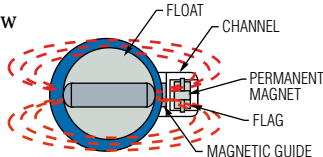
Flag Channel Assembly (partial close-up)



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

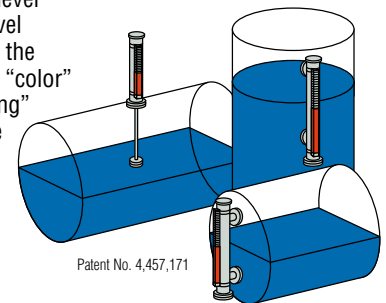
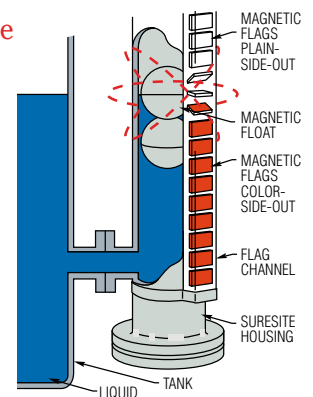
Gems High Performance SureSite Indicators are manufactured to fill these requirements.

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.



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. All of our Sales Partner locations, along with their fax numbers, are conveniently located on the Web at 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

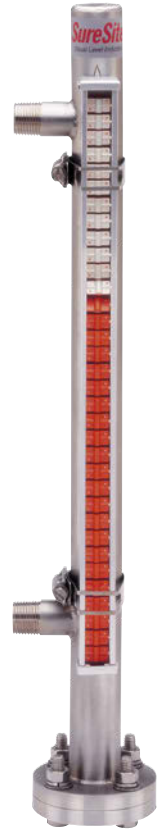
- ▶ Lengths to over 20 feet (6.1 meters)
- ▶ 316 Stainless Steel construction
- ▶ Pressures to 400 PSI (27 bar) – Temperature to 400°F (204°C)

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



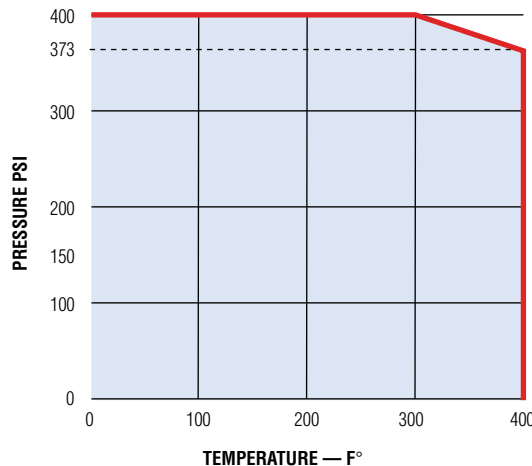
	Type AM	Type BM	Type CM	Type DM
	Top and Bottom Process Connections	Side and Side Process Connections	Top and Side Process Connections	Side and Bottom Process Connections
Typical Lengths*	C to C = L + 7.72" (196 mm)	C to C = L	C to C = L + 3" (76 mm)	C to C = L + 5" (127 mm)
Flag Material	Plastic (300°F/148.9°C) or Aluminum (400°F/204°C)			
Length of Indication (Uninterrupted)	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	Socket Butt	Removable Butt	
		Female	Male	Female	Male					
Standard Connections	T1	T10	T2	T3	T11	T12	T19	T20	T18	T13
Sanitary Connections							T7	T8		

	Blind	NPT		Flange	Sanitary Flange	Buttweld Nipple
		Male	Female			
S1	S2	S3	S4	S5	S6	

	Blind	NPT				Flange		Weld		
		Fixed		Removable		Fixed	Removable	Socket Butt	Removable Butt	
		Female	Male	Female	Male					
Standard Connections	B1	B10	B2	B3	B11	B12	B19	B20	B18	B13
Sanitary Connections							B7	B8		

— 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 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>FAX IT! 860-747-4244</p> <p>Photocopy This Form Use one form for each product type you are selecting.</p> <p><small>This form may also be completed online at gemssensors.com 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>1. Pressure: Operating _____ psig Maximum _____ psig</p> <p>2. Temperature: Operating _____ °F Maximum _____ °F</p> <p>3. Liquid Media: _____</p> | <p>4. Specific Gravity @ Operating Condition: _____</p> <p>5. Viscosity: _____ SSU</p> <p>6. Application Location: <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 T	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 Sa	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 Sb	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	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 ____/____/____



ORDER IT!

Ordering is Easy! See Page D-9.
Easy online ordering too!

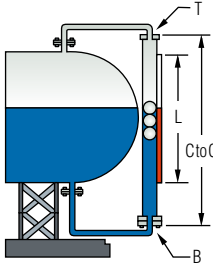
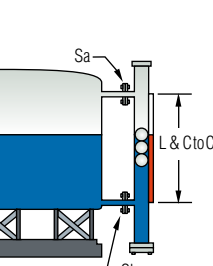
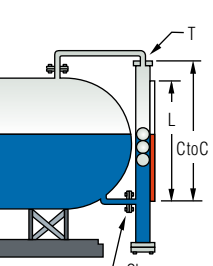
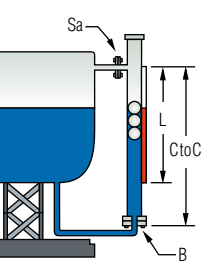
Standard Alloy Versions – Standard Size

- ▶ 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				
Typical Lengths*	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)
Flag Material	Plastic (300°F/148.9°C) or Aluminum (750°F/399°C)			
Length of Indication (Uninterrupted)	240" (610 cm)			
Minimum Specific Gravity	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.

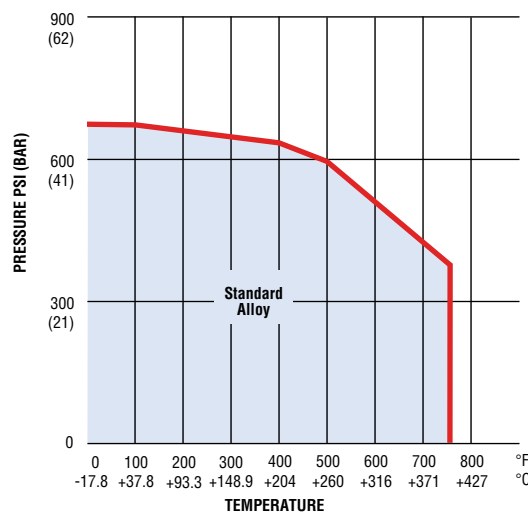
2. Material

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

LEVEL INDICATORS – VISUAL

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	SIDE	B	Blind		NPT				Flange	
						Fixed	Removable	Fixed		Removable		Fixed	Removable
								Male	Female	Female	Male		
						S1	S2	S3	S4				

SIDE	Sa	SIDE	Sb	SIDE	B	Blind		NPT				Flange	
						Fixed	Removable	Fixed		Removable		Fixed	Removable
								Female	Male	Female	Male		
						B1	B2	B3	B5	B6	B8	B9	B10

— 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

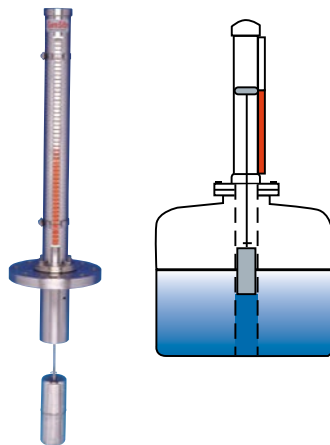
- S1. No connection
- S2. MNPT nipple
- S3. FNPT coupling
- S4. ANSI flange



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 for further details.

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**.



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

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.

- | | |
|---|--|
| 1. Pressure: Operating _____ psig Maximum _____ psig | 4. Specific Gravity @ Operating Condition: _____ |
| 2. Temperature: Operating _____ °F Maximum _____ °F | 5. Viscosity: _____ SSU |
| 3. Liquid Media: _____ | 6. Application Location: <input type="checkbox"/> Indoors <input type="checkbox"/> Outdoors |

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 T	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"/> Other _____	<input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> Other _____		
Side Sa	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"/> Other _____	<input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> Other _____		
Side Sb	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"/> Other _____	<input type="checkbox"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> Other _____		
Bottom 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"/> Other _____	<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.)

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: ____/____/____
Standard SureSite / p3of3 / 3-APR-14



ORDER IT!

Ordering is Easy! See Page D-12.
Easy online ordering too!

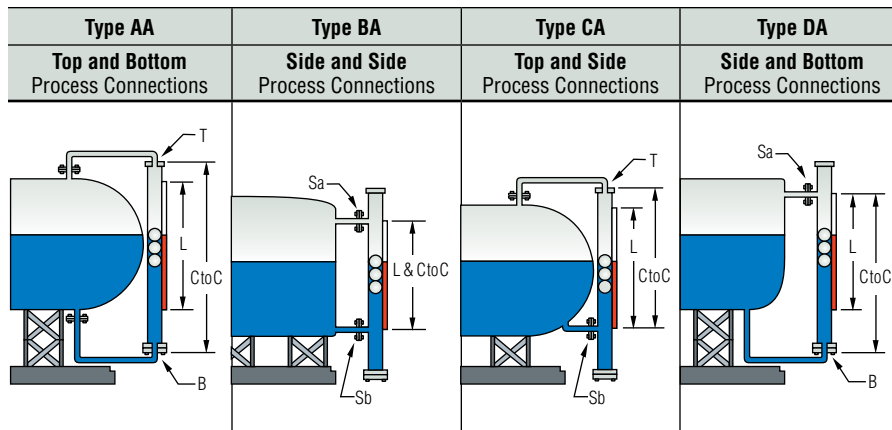
High Performance Versions – Standard Size

- ▶ Designed to meet the requirements of ASME B31.3 "normal" fluid service*
- ▶ 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
Typical Lengths†	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)
Flag Material	Plastic (300°F/148.9°C) or Aluminum (750°F/399°C)			
Length of Indication (Uninterrupted)	240" (610 cm)			
Minimum Specific Gravity	0.39			

† Dimensions vary due to connections, material and specific gravity.

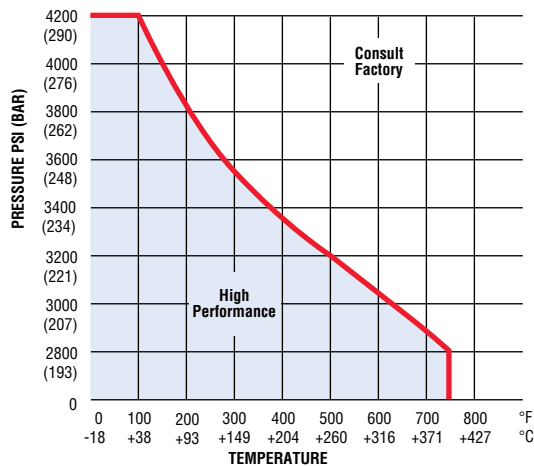
2. Material

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
TOP  T	T15	T16	T17	T19	T20	T22	T23	T24	T25	T26	T27	T28
SIDE  Sa		T29			T30	T32		T33			T34	T35
SIDE  Sb												
BOTTOM  B	B15	B16	B17	B19	B20	B22	B23	B24	B25	B26	B27	B28
		B29			B30	B32		B33			B34	B35

	Blind		NPT		Flange		Weld	
	Male	Female	Male	Female	Socket	Butt	Socket	Butt
	S1	S2	S3	S4	S5	S6	S7	

— 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>FAX IT! 860-747-4244</p> <p>Photocopy This Form Use one form for each product type you are selecting.</p>	<p>This is a <input type="checkbox"/> Request for a Quote Name _____ <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 (____) _____ <input type="checkbox"/> No</p>
---	--

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>1. Pressure: Operating _____ psig Maximum _____ psig</p> <p>2. Temperature: Operating _____ °F Maximum _____ °F</p> <p>3. Liquid Media: _____</p> | <p>4. Specific Gravity @ Operating Condition: _____</p> <p>5. Viscosity: _____ SSU</p> <p>6. Application Location: <input type="checkbox"/> Indoors <input type="checkbox"/> Outdoors</p> |
|---|---|

Physical Configuration

- | | |
|---|---|
| <p>1. Mounting Configuration Types:
 <input type="checkbox"/> Type AA <input type="checkbox"/> Type BA <input type="checkbox"/> Type CA <input type="checkbox"/> Type DA</p> <p>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-11.</p> | <p>2. Housing and Float Material – Housing: 316L/SS
 <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"/> 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"/> 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"/> 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"/> 150# (RF) <input type="checkbox"/> 600# (RF) <input type="checkbox"/> 900# (RF) <input type="checkbox"/> Other _____

- | | |
|---|--|
| <p>4. Length of Visual Indication – L: _____ inches (240", Max.).
 Connection to Connection Dimension – C to C: _____ inches.</p> <p>5. Flag Type
 Plastic flags available to 300°F (149°C). Specify aluminum flags for temperatures of 301°F to 750°F (149°C to 399°C).
 <input type="checkbox"/> Plastic (Orange and White) <input type="checkbox"/> Aluminum (Black and Silver)
 <input type="checkbox"/> Non-Standard; Specify: _____ consult factory.</p> | <p>6. <input type="checkbox"/> ASME Certification Required</p> <p>Special Instructions (Materials, Connections, etc.)

 _____</p> |
|---|--|

Accessories (Pages D-16 to D-18)

- | | |
|---|---|
| <p>1. Transmitters (Continuous Electrical Indication):
 <input type="checkbox"/> Low Temperature – 300°F (149°C) <input type="checkbox"/> Explosion-Proof
 <input type="checkbox"/> High Temperature – 750°F (399°C)</p> <p>2. J-Box/Signal Conditioners Accessories:
 <input type="checkbox"/> Terminal Strip <input type="checkbox"/> 4-20 mA Output
 <input type="checkbox"/> 0-12 VDC Output <input type="checkbox"/> 0-5 VDC Output</p> <p>3. Power Supply: <input type="checkbox"/> 115 VAC (Input) /24 VDC (Output) (Optional)
 <input type="checkbox"/> 230 VAC (Input) /24 VDC (Output)</p> | <p>4. Switch Modules (Single Point): _____ Quantity (only if required)
 a. <input type="checkbox"/> SPST <input type="checkbox"/> SPDT <input type="checkbox"/> DPDT 120 VAC <input type="checkbox"/> DPDT 24 VDC
 b. <input type="checkbox"/> Standard – 300°F (149°C) <input type="checkbox"/> Explosion Proof
 <input type="checkbox"/> High Temperature – 750°F (399°C)</p> <p>5. Indicating Scales:
 <input type="checkbox"/> Feet and Inches <input type="checkbox"/> Inches <input type="checkbox"/> Metric <input type="checkbox"/> Blank
 <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: ____/____/____



ORDER IT!

Ordering is Easy! See Page D-15.
Easy online ordering too!



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
L = Length of Visual Indication				
Typical Lengths*	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)
Flag Indicator Material	Plastic			
Length of Indication, Max.	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

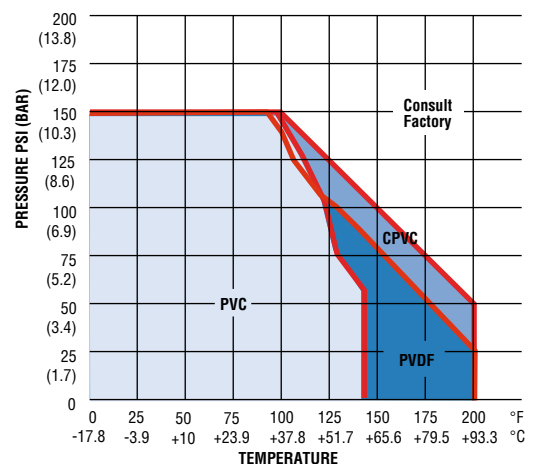
Select desired material from those tabulated below. Mark the Code Number on your OrderIt! Check List. The pressure/temperature performance parameters are specified in the charts at right. Consult the factory with pressure/temperature requirements that fall outside the parameters shown here.

Materials	Code
Housing & Float	
PVC	1
Clear PVC Housing/ PVC Float	1A*
CPVC	2
PVDF	4












* 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
		T1	T2	T3	Female T4	Male T5	Male T6		
									

SIDE  Sa	Blind		NPT		Flange
	S1	Male		Female	S4
		S2	S3	S3	
					

BOTTOM  B	Blind			NPT				Flange	
	Fixed	Removable		Fixed		Removable		Fixed	Removable
		B1	B2	B3	Female B4	Male B5	Male B6		
									

— 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.

LEVEL INDICATORS – VISUAL

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) | Sa & Sb (Sides) |
| T/B 1. Welded cap | S1 – Blind–No Connection |
| T/B 2. Threaded cap (PVC/CPVC only) | S2 – MNPT nipple |
| T/B 3. Fixed flange/blind mating flange | S3 – FNPT coupling |
| T/B 4. Welded coupling/FNPT | S4 – ANSI flange |
| 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 | |

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: 0.9em;">Use one form for each product type you are selecting.</p>	<p>This is a <input type="checkbox"/> Request for a Quote Name _____</p> <p style="padding-left: 20px;"><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: 20px;"><input type="checkbox"/> No</p>
---	--

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.

- | | |
|---|---|
| <p>1. Pressure: Operating _____ psig Maximum _____ psig</p> <p>2. Temperature: Operating _____ °F Maximum _____ °F</p> <p>3. Liquid Media: _____</p> | <p>4. Specific Gravity @ Operating Condition: _____</p> <p>5. Viscosity: _____ SSU</p> <p>6. Application Location: <input type="checkbox"/> Indoors <input type="checkbox"/> Outdoors</p> |
|---|---|

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 T	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 Sa	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 Sb	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	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: ____/____/____

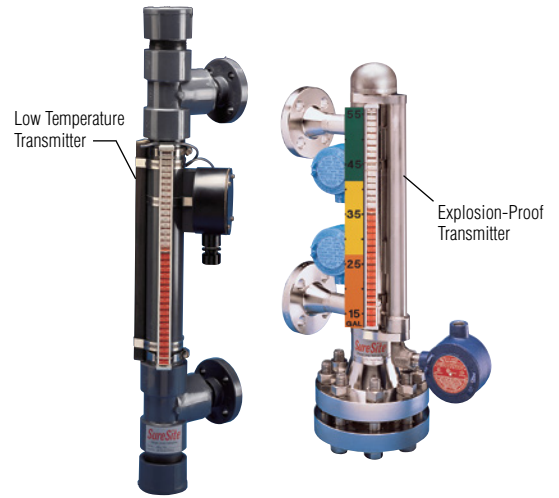


Continuous Electrical Output Transmitters for all SureSite Indicators



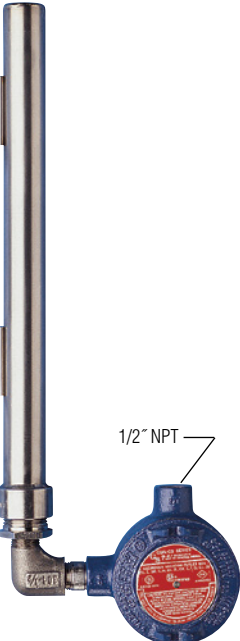
Broaden the SureSite Indicator's capabilities; add one of these transmitters. You can have visual indication and a continuous electrical output too without additional tank penetrations. Use them to know what's in your tank remotely, send the signal to your controller, schedule your next inventory.

These transmitters are compatible with the readout displays at the end of this Section (D-28 to D-30) 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).



LEVEL INDICATORS – VISUAL

	Low Temperature Transmitter	Explosion-Proof Transmitter	Explosion-Proof / High Temperature Transmitter
			
Compatible SureSite Types	Plastic and Standard Alloy Units	Mini Alloys	Standard Alloy and High Performance Alloy Units
Operating Temperature, Max.	+300°F (149°C)	+300°F (149°C)	+750°F (399°C)
Housing Materials	Polysulfone	316 Stainless Steel	
Output Termination	Cable	Junction Box (Feralloy Iron)	
Transmitter Resolution		3/8" (9.5 mm)	
Accuracy		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)



Operating Temperature	+5°F to +160°F (-15°C to +71°C)
Storage Temperature	-40°F to +212°F (-40°C to +100°C)
Output Temperature Coefficient (% of full scale, max.)	±0.00388%/°F (±0.007%/°C)
4-20 mA Types	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_A) 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	86156	52536
	0-12 VDC	15-30 VDC	85997	52537
	4-20 mA	10-40 VDC	86158	152800
 Panel Mount with Plug-In Base	4-20 mA	10-40 VDC	112300 ⚡	112300 ⚡

⚡ = Stock item



J-Box Enclosure

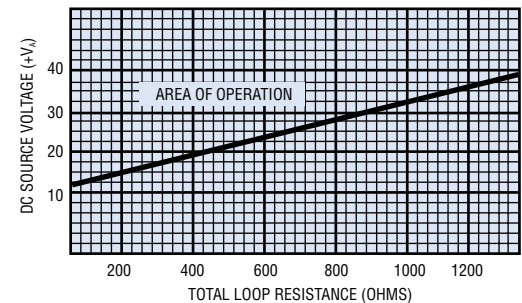


Panel Mounted (Plug Base)

Power Supply Module

Input Power	Part Number
115 VAC, 60 Hz	52560
230 VAC, 60 Hz	52570

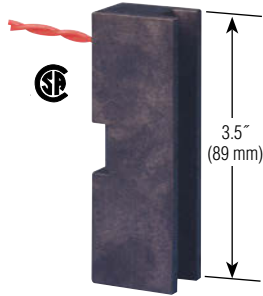
Operates on 115 VAC or 230 VAC inputs to supply a regulated 24 VDC to the signal conditioned transmitter where external VDC power is not available. Maximum Load: 70 mA.



LEVEL INDICATORS – VISUAL

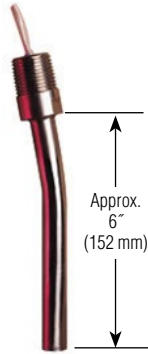
Switch Modules Provide High-, Low- or Intermediate-Level Alarms or Control Logic

Standard Switch Modules



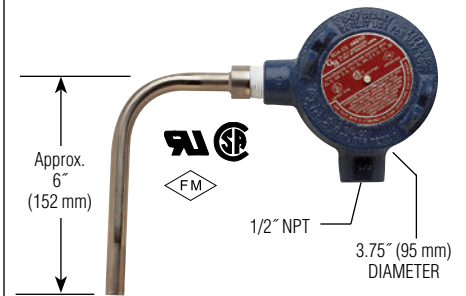
- CSA Approved
- Includes Stainless Steel Mounting Clamp
- Polysulfone Housing
- Withstands Temperatures to 300°F (148.9°C)
- Connection: 1/4" FNPT

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



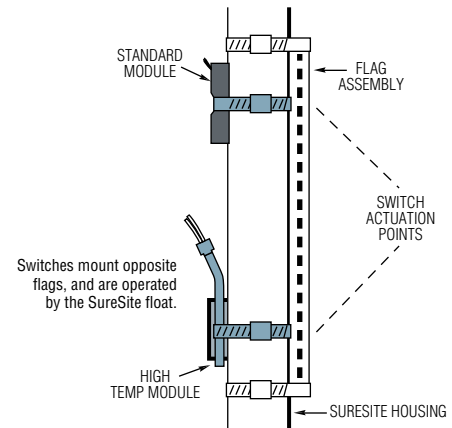
- UL, CSA, FM Approved
- Withstands Temperatures of 750°F (399°C)
- J-Box Terminated
- Stainless Steel Construction
- Includes Stainless Steel Mounting Clamp

Switch Logic (All Models)

	Lead Wires Up	Switch closes on rising level and remains closed until opened by falling level.	For Intrinsic Safety... These switch modules can be rendered intrinsically safe with the use of GEMS SAFE-PAKS® and Zener Barriers. See Section L.
	Lead Wires Down	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.

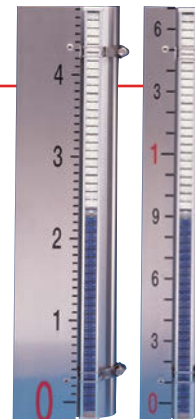
⚡ = Stock item

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.



LED Transmitter Versions – Miniature Size

- ▶ LED indicators ideal in low or no ambient light
- ▶ Integral transmitter with choice of signal conditioned output
- ▶ Lengths to 10 feet (3 meters)
- ▶ Pressures to 400 PSI (27 bar) – Temperature to 300°F (149°C)

These Mini SureSite Indicators excel where zero and low ambient light make visual indicators difficult to read. These mini indicators feature all the benefits of a SureSite, like safe and durable stainless steel process fluid containment, while combining a continuous output transmitter with a bright LED channel.

The LED indicator assembly integrates a continuous level transmitter reducing overall footprint. A variety of signal conditioners provide the output you require. Forget the flashlights and squinting required to view antiquated sightglasses.

Typical Applications

- Pharmaceuticals • Medical Equipment • Food and Beverages
- Marine • Rail • Boilers

Specifications

Indication Length	5" to 120" (13 to 305 cm) in 0.5" (13 mm) increments
Media	Waters, Coolants, Light Oils, Diesel, Hydraulics
Specific Gravity	Minimum 0.8 SG to 1.2 SG
Materials	
Chamber Housing	316/316L Stainless Steel
Float	316/316L Stainless Steel
Shroud	Polycarbonate
O-Ring (Wetted)	Viton®, unless otherwise specified
J-Box Enclosure	Die cast Aluminum
Reliability and Durability	Expected 10 year service life
Performance	
Resolution	3/8" (9.5 mm)
Accuracy	±1/2" (13 mm)
Output Signal	4-20 mA to within ±3% of full scale
Temperature Ranges	
Process	-40°F to +300°F (-40°C to +149°C)
Ambient	-40°F to +160°F (-40°C to +71°C)
Operating Pressure	Vacuum to 400 psig (27.6 bar)
Environmental	Enclosure: NEMA 4X IP65 (Water Resistant)
Input Power	20 to 28VDC, @100mA. Consult Factory for other voltages
Outputs	4-20 mA continuous current loop (3 wire) 0-5 V continuous (3 wire) 0-10 V continuous (3 wire)
Mechanical Interface	Custom configured for tank (per mini SureSite offering), 1/2" NPT to junction box
Mounting Orientation	
Unit Positions	AM-L, BM-L, CM-L, DM-L
Shroud Position	See Selection Guide; Step 2 for Codes
Calibration	Field Adjustment Null and Span/Factory Calibrated



ORDER IT!

Ordering is Easy! See Page D-22.
Easy online ordering too!

1. Mounting Configuration Type

Based on process connection locations.

	Type AM-L Top and Bottom Process Connections	Type BM-L Side and Side Process Connections	Type CM-L Top and Side Process Connections	Type DM-L Side and Bottom Process Connections
<p>L = Length of Visual Indication</p> <p>C to C = Length between process connections.* Gems will aid in determining this value.</p>				
Typical Lengths*	C to C = L + 9.5" (241 mm)	C to C = L	C to C = L + 6" (152 mm)	C to C = L + 6" (152 mm)
Length of Indication (Uninterrupted)	120" (305 cm), Maximum			

* Formula provided is for approximation only. Final dimensions will vary due to connections type, position, cable or junction box location, and specific gravity of process liquid. Gems will confirm final dimensions before manufacturing.

2. LED Transmitter Assembly Location

Position relative to process connection location. All illustration views are from the top. Codes with "+" indicate views when 3/4" side ports are used.

Transmitter Assembly Location Code						
A	A+	B	C	D	E	E+

Approximate angle of view - 270°

3. J-Box Location

Drawings are typical, and for reference only. Final, specific locations are determined at time of manufacture.

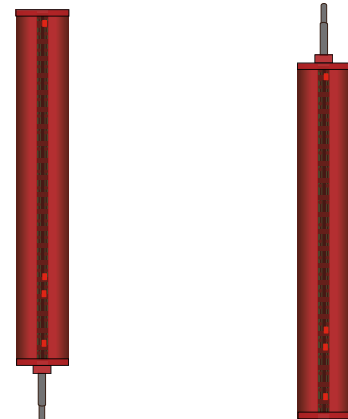
J-Box Location Code		
1 Side Mount Below Bottom Port	2 Side Mount Above Top Port	3* Top Mount

* Requires a Blind Fixed Top Connection. See Connection Code T1 in the chart on next page.

LED Assembly Cable Egress

For J-Box Location 1, LED Transmitter Assembly cable will egress from the bottom of the assembly.

For J-Box Locations 2 and 3, the cable will egress from the top of the assembly.



LEVEL INDICATORS - VISUAL

4. Connection Codes
(See complete descriptions below)

	Blind	NPT				Flange		Weld		
		Fixed		Removable		Fixed	Removable	Socket Butt	Removable Butt	
		Female	Male	Female	Male					
Standard Connections	T1	T10	T2	T3	T11	T12	T19	T20	T18	T13
Sanitary Connections							T7	T8		

	Blind	NPT		Flange	Sanitary Flange	Buttweld Nipple
		Male	Female			
S1	S2	S3	S4	S5	S6	

	Blind	NPT				Flange		Weld		
		Fixed		Removable		Fixed	Removable	Socket Butt	Removable Butt	
		Female	Male	Female	Male					
Standard Connections	B1	B10	B2	B3	B11	B12	B19	B20	B18	B13
Sanitary Connections							B7	B8		

— 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 prompt delivery.

Note: Gems recommends a removable top and/or bottom connection for float access.

Connection Code Descriptions

Please provide all connections when completing the **OrderIt!** 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

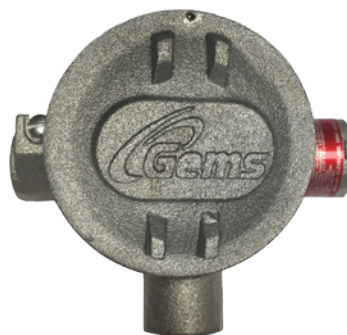
- T/B 12. Standard fixed flange/mating flange with MNPT nipple
- T/B 13. Standard fixed flange/mating flange with butt weld nipple
- T/B 18. Welded cap with butt weld nipple
- T/B 19. Welded cap with ANSI flange
- T/B 20. Standard fixed flange/mating reducing flange spool with ANSI flange

Sa & Sb (Sides)

- S1. No connection
- S2. MNPT nipple
- S3. FNPT coupling
- S4. ANSI flange
- S5. Sanitary flange
- S6. Buttweld nipple

5. Signal Conditioner Assemblies

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. Consult LED SureSite Installation, Operation and Maintenance bulletin.



<p>FAX IT! 860-747-4244</p> <p>Photocopy This Form Use one form for each product type you are selecting.</p> <p><small>This form may also be completed online at gemssensors.com 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 Email _____</p>
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LED SureSite Indicator/Transmitter, Alloy Versions – Miniature Size LED Process Conditions

This information is essential to the accurate and proper operation of your SureSite® Visual Level Indicators. Please complete fully and accurately.

- | | |
|---|---|
| <p>1. Pressure: Operating _____ psig Maximum _____ psig</p> <p>2. Temperature: Operating _____ °F Maximum _____ °F</p> <p>3. Liquid Media: _____</p> | <p>4. Specific Gravity @ Operating Condition: _____</p> <p>5. Viscosity: _____ SSU</p> <p>6. Application Location: <input type="checkbox"/> Indoors <input type="checkbox"/> Outdoors</p> |
|---|---|

Physical Configuration

1. Mounting Configuration Types:

- Type AM-L Type BM-L Type CM-L Type DM-L
- Length of Visual Indication – **L:** _____ inches (120", Max.)
- Connection to Connection – **C to C:** _____ inches (calculated)

2. LED Transmitter Assembly Location:

- 1/2" Side Ports: A B C D E
- 3/4" Side Ports: A+ C E+

3. J-Box Location:

- 1 2 3

4. 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-21.**

Top T	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"/> 150# RF <input type="checkbox"/> 300# RF <input type="checkbox"/> Other _____
Side Sa	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"/> 150# RF <input type="checkbox"/> 300# RF <input type="checkbox"/> Other _____
Side Sb	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"/> 150# RF <input type="checkbox"/> 300# RF <input type="checkbox"/> Other _____
Bottom 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"/> 150# RF <input type="checkbox"/> 300# RF <input type="checkbox"/> Other _____

5. Supply/Conditioner:

- Supply Voltage: 5 VDC 12 VDC 24 VDC
- Output: 4-20mA 0-5 VDC 0-10 VDC

Special Instructions (Materials, Connections, etc.)

6. O-Ring Material:

- Viton® (Standard) Ethylene Propylene
- Other _____

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

Quote \$ _____ Date Quoted ____/____/____

Special Instructions (Materials, Connections, etc.)



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.

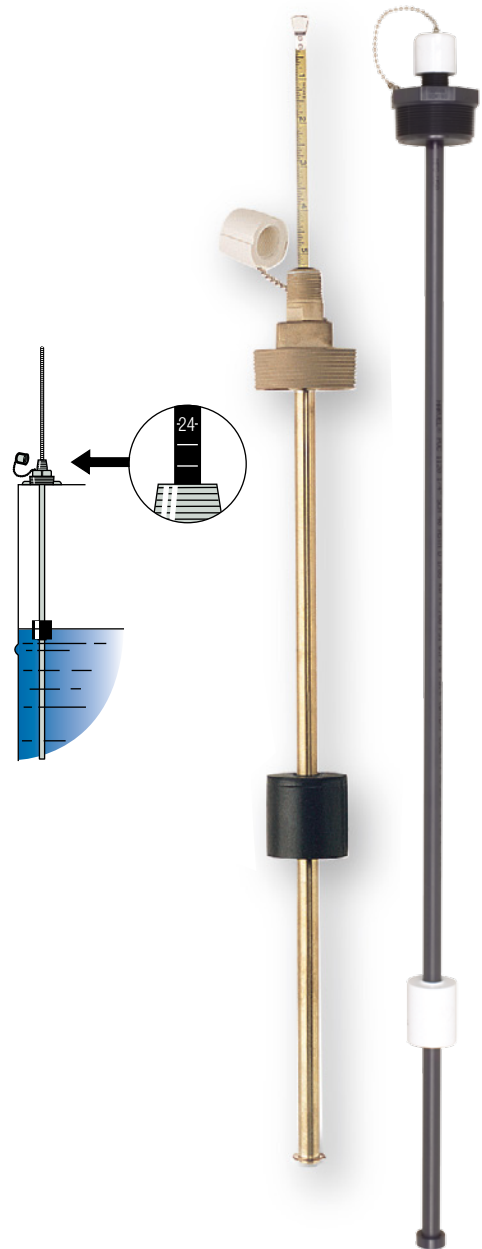
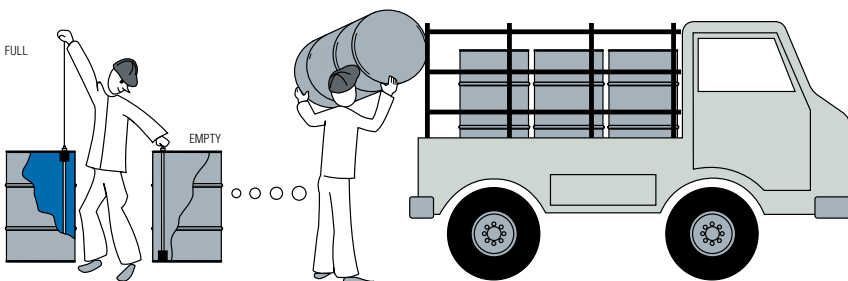
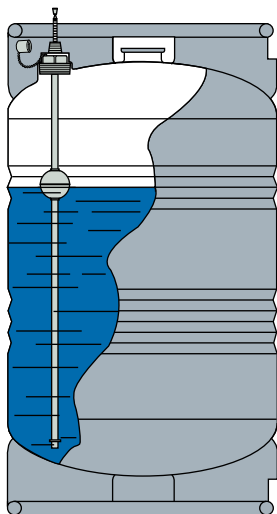
Custom-configurable DIPTAPE Indicators described on the following pages are available in a broad range of materials and mounting types in lengths to six feet (1.8 m). For lengths six to ten feet, consult factory.

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-24
Engineered Plastic Versions	D-25
Alloy Versions	D-26

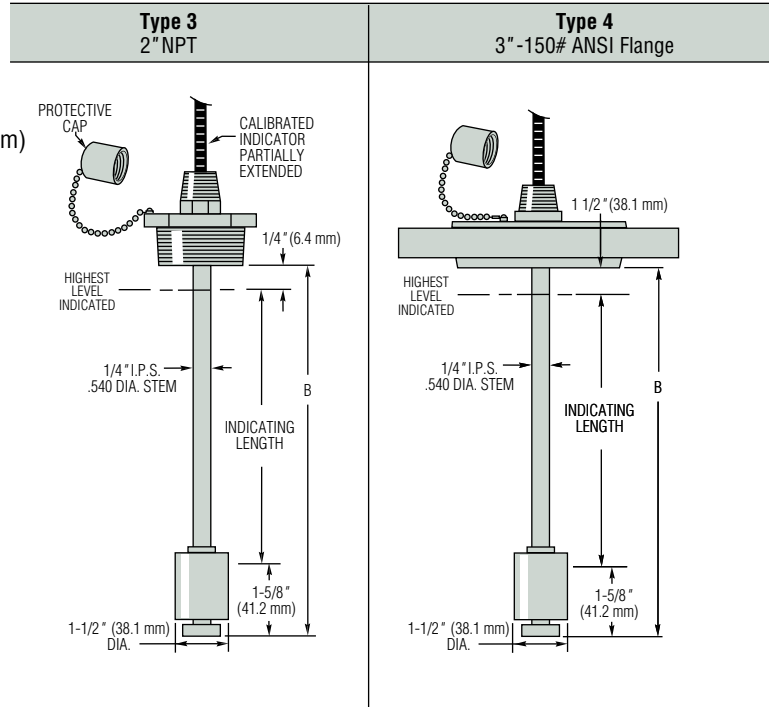
All-PVC Versions Are Economical for Light Duty

- ▶ 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)



Stem, Float and Mounting Material	PVC
Min. Liquid Specific Gravity	0.65
Operating Temperatures	0°F to +140°F (-17.7°C to 60°C)
Operating Pressure, Max.	15 psi (1 bar)
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.

Ordering Is Easy

1. To specify DIPTAPE Level Indicators, start by photocopying the OrderIt! Product Check List located on Page D-27.
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-27.
 Easy online ordering too!

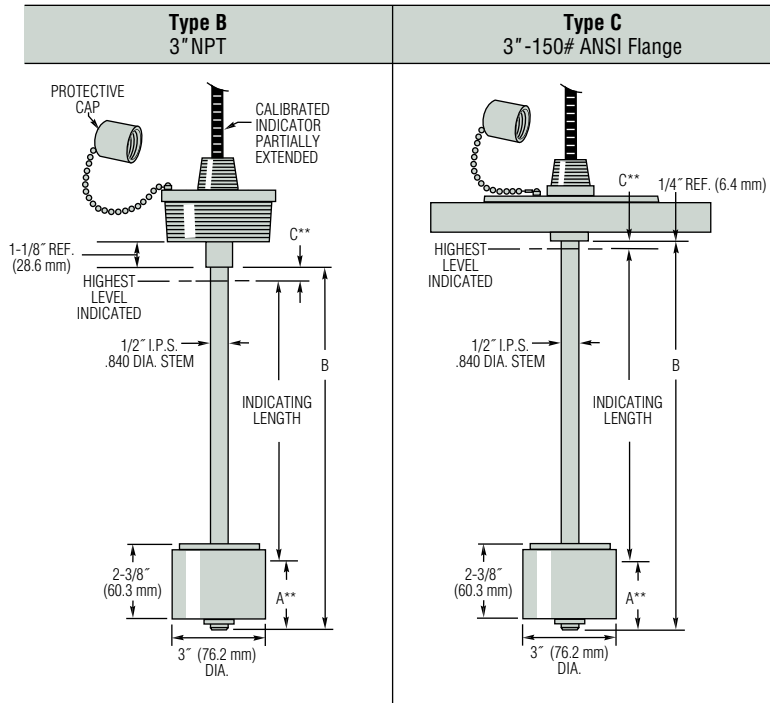
- ▶ Temperatures to 140°F (60°C)
- ▶ Pressures to 50 PSI (3.4 bar)

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-27.
Easy online ordering too!

DIPTAPE™ Indicators – Alloy Versions

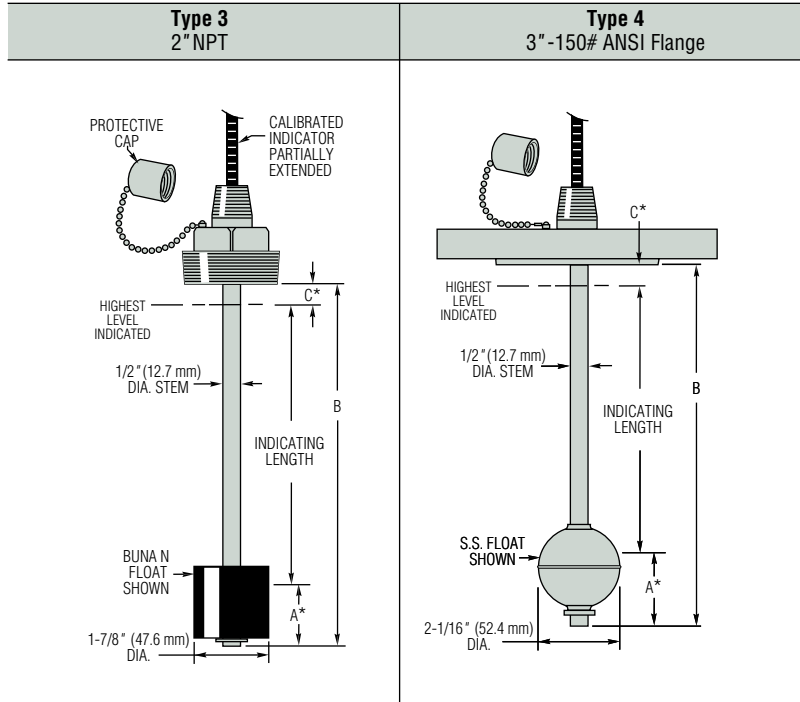
- ▶ Temperatures to 300°F (148°C)
- ▶ Pressures to 750 PSI (52 bar)

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

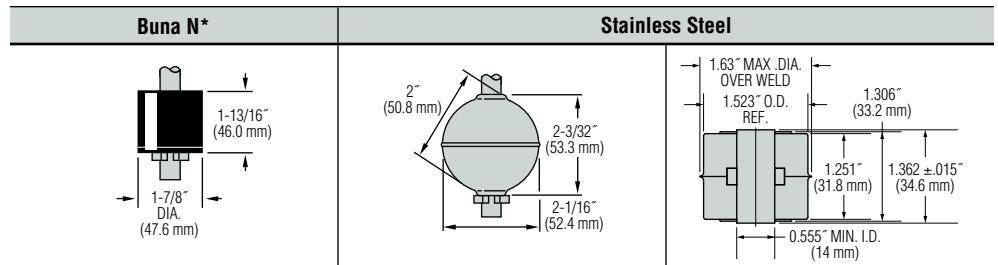
Note: Dimensions “C” and “A”
are dependent on float selected.
See Float Types below.



Stem and Mounting Material	Brass or 316 Stainless Steel	316 Stainless Steel Stem with Carbon Steel or 316 Stainless Steel Flange
Indicating Length**	6" to 72" (15.2 cm to 182.9 cm)	
Std. Indication Markings	1/16" or 1 mm increments	

* Dimensions listed below, under “Float Types.”
** For longer lengths, please contact factory.

2. Float Types

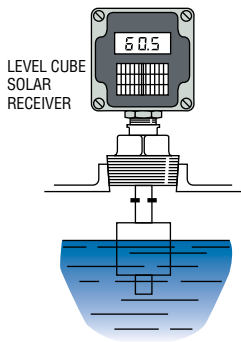


	Buna N*	Stainless Steel	
Float Part Number	73710	73709	138935
Min. Liquid Specific Gravity	0.45	0.67	0.67
Operating Temperatures	Oil: -40°F to +230°F (-40°C to +110°C) Water: to 180°F (+82.2°C)	-40°F to +300°F (-40°C to +148.8°C)	-40°F to +220°F (-40°C to +104°C)
Operating Pressure, Max.	300 psi (21 bar) max. @ 77°F (25°C)	750 psi (52 bar) Mounting Type 3 150 psi (10 bar) Mounting Type 4	150 psi (10 bar)
“A” Dimension (From Mounting Types)	1-1/4" (31.7 mm)	1-3/8" (34.9 mm)	1" (25.4 mm)
“C” Dimension (From Mounting Types)	11/16" (17.5 mm)	3/4" (19.05 mm)	9/16" (14.3 mm)

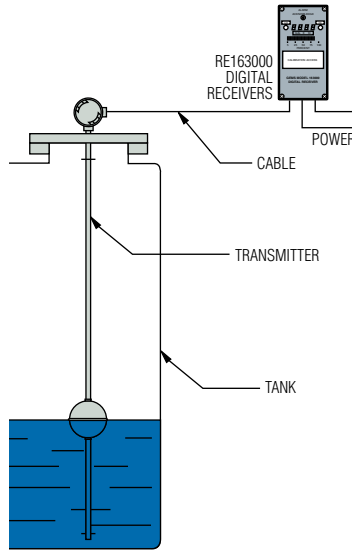
*Other Wetted Material: Hysol.

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.



LEVEL INDICATORS – VISUAL

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.

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
3-Digit Level Cube Receivers	Wall or Transmitter	None	9V Battery, 9 VDC / 117 VAC, Solar	XM-Series (1/4" or 1/2" Resolution), and SureSite Transmitters
RE163000	Panel or Wall	2 Alarm	90-120 VAC, 20-50 VDC	All Continuous Transmitters, SureSite Transmitters, Pressure Transmitters

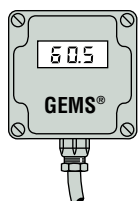
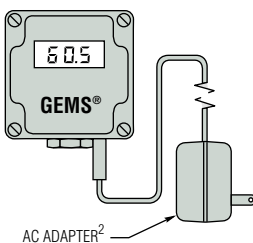
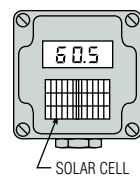
*Mounting Definitions:
 Wall: Mounted **onto** a surface; i.e., wall, bulkhead, deck, etc.
 Panel: Mounted **into**, and approximately flush with, a surface through a cutout.
 Transmitter: Mounted directly to the top of the transmitter.

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
		
Part Numbers: 118600—Cable Output 119250—1/2" NPT	Part Numbers: 118620—Cable Output 119270—1/2" NPT	Part Numbers: 118610—Cable Output 119260—1/2" NPT

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

Housing Material	Polycarbonate, NEMA-4X, watertight*
Cable Distance from Transmitter	100 feet, Max.
Operating Temperature	+23°F to 131°F (-5°C to +55°C)
Accuracy	± 2%

*Except for 9 VDC/117 VAC Powered Units which are not watertight.

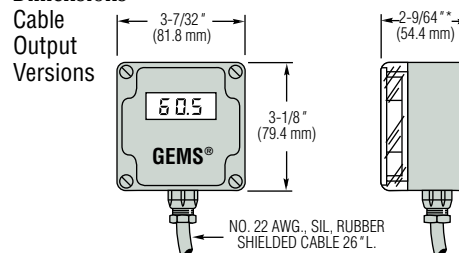
How To Order – Standard Models

Style	Mounting	Part Number
9-V Battery	Cable Output	118600
	1/2" NPT	119250
9 VDC / 117 VAC	Cable Output	118620
	1/2" NPT	119270
Solar	Cable Output	118610
	1/2" NPT	119260

NPT or Cable Mounted

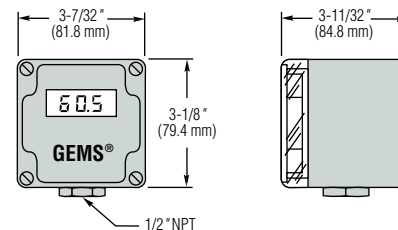


Dimensions

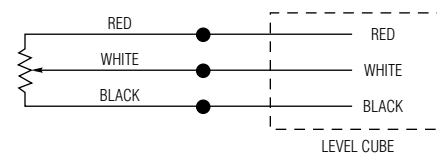


* P/N 118600 9-V Battery = 3-11/32" (84.8 mm) only.

1/2" NPT Versions



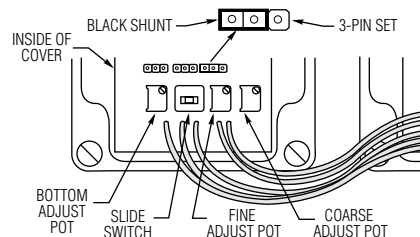
Typical Wiring Diagram



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.

LEVEL INDICATORS – VISUAL

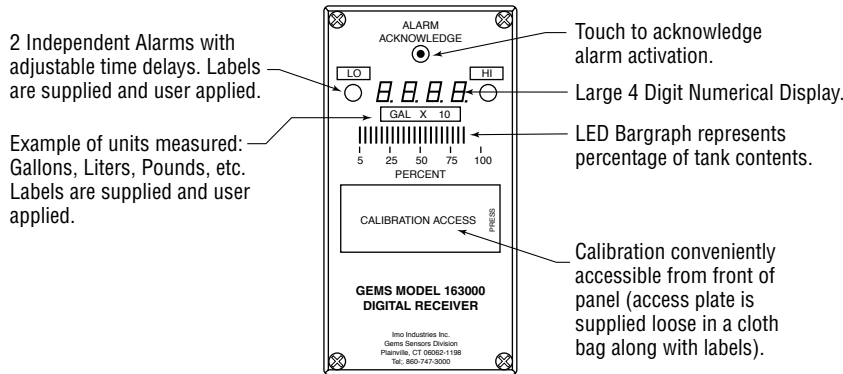
Digital Bargraph Display Receivers - 163000 Series

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.

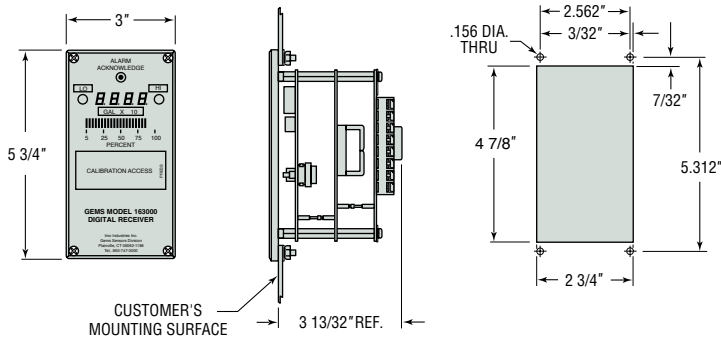
Specification

Input Signal	4-20mA, Proportional Voltage*, Serial
Accuracy Over Given Range	± 1.0%
Operating Voltage	24VDC or 115VAC
Operating Temperature	32°F to 122°F (0°C to 50°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.

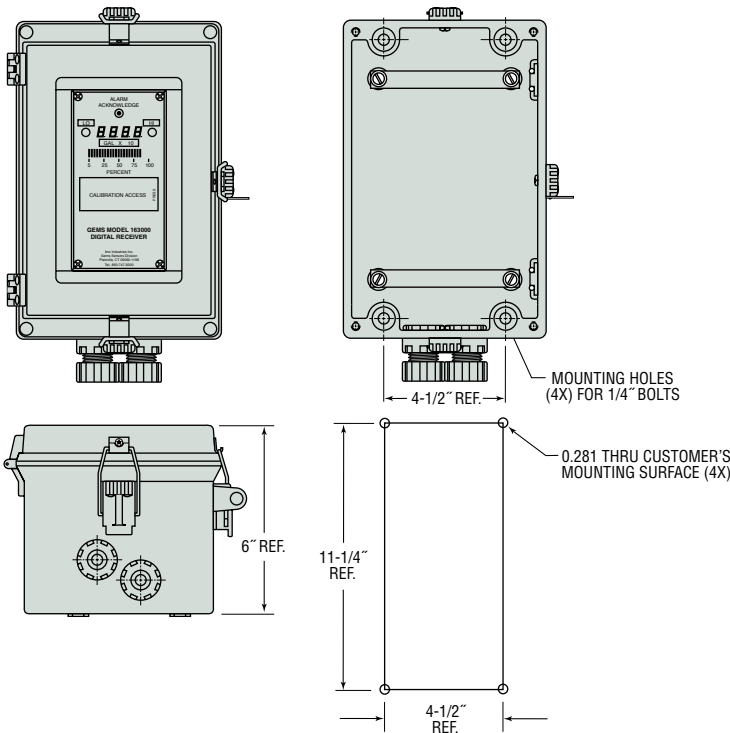
Dimensions

Panel Mounting Receivers

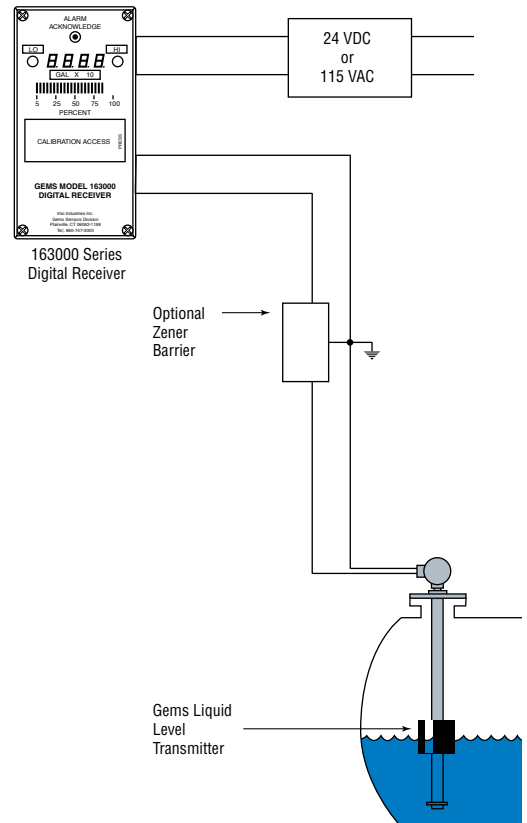


Static Sensitive.
Handling Precautions Required.

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.

LEVEL INDICATORS - VISUAL

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.

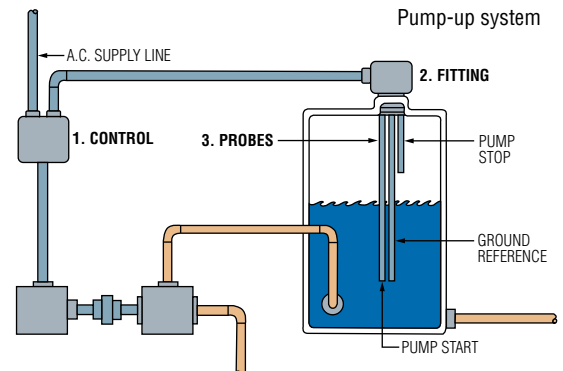
3. Probes. The probe is a sensor that extends downward from the fitting, with the tip positioned precisely at the level where the control should be activated.

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-10
Relay Output	E-12
Intrinsically Safe Controls	E-14
Multi-Function Controls	E-16
Fittings and Probes	E-17
Panel Controls and Alarms	E-26

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

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 16, 16D, 16M, 16DM, 16VM	Series 17	Series 27, 37	Series 47	Series 67	Series 26, 26M	Series 19MR	Series DF
50	—	—	—	—	—	—	—	—
450	—	—	—	—	—	—	—	—
1,500	—	—	—	—	—	—	—	—
3,000	—	—	4000	—	—	—	—	—
3,300	—	5000	—	—	—	—	—	—
4,700	10000	3500	—	—	4000	900	—	900
7,000	—	—	—	—	—	—	—	—
10,000	5700	1750	900	—	2400	600	—	600
11,000	—	—	—	—	—	—	5500	—
19,000	—	—	—	—	—	—	3000	—
20,000	—	—	—	—	—	—	—	—
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 & Material Selection

Liquid or Material	Sensitivity-Conductivity		Probe Material	
	Ohms/cm	Micro-Mhos/cm	Good ¹	Better ²
Acids ³	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

Contact Design	
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)
Contact Rating (120. 240 VAC)	
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
Mode of Operation	Direct/Inverse, factory set
Sensitivity	
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
Primary Voltage	24 VAC, 120 VAC, 240 VAC (+10%/-15%) 208/240: 187 V min. to 255 V max. VAC 50/60 Hz
Secondary Voltage	
Series 16M	12 VAC, 1.5 mA
Series 16HM	12 VDC
Series 16DM & 16VM	12 VAC, 1.5 mA
Temperature	-40°F to +150°F (-40°C to +65°C)
Approvals	U.L. 508 File #E44426
Terminal Style	Screw connector
Options	Time Delays



Series 16M/16HM

Series 16DM/16VM

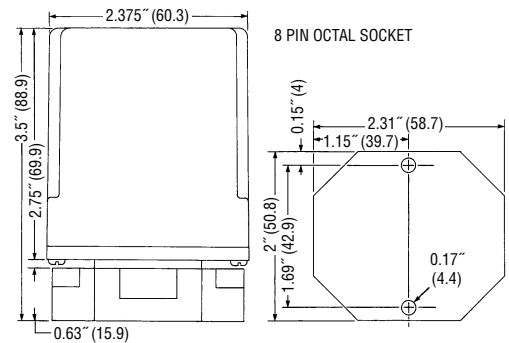


Applications

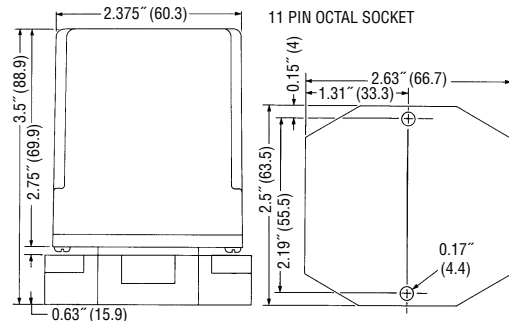
- Single-Level Service
- Point Level
- Valve Control
- Differential Service
- Alarms
- Pump Control

Dimensions

Series 16M & 16HM



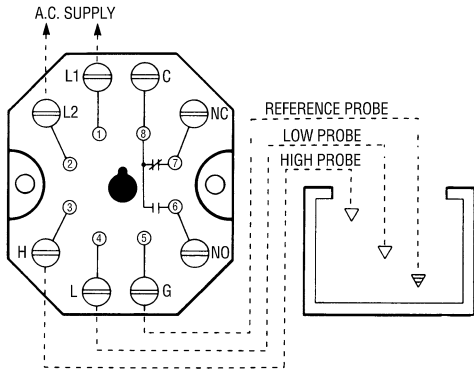
Series 16DM & 16VM



Note: Controls also available with DIN mount socket.

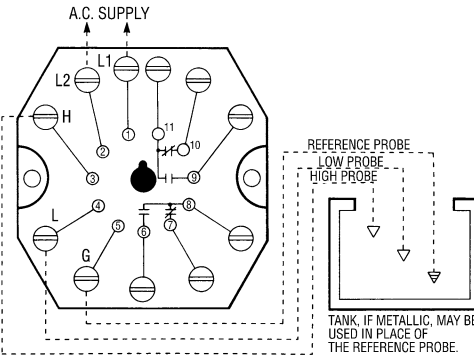
Wiring

Series 16M & 16HM

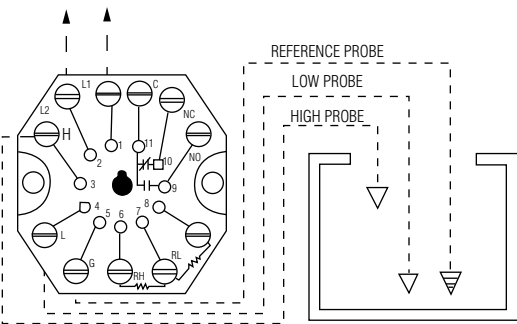


Note: For single level service, use "H" and "G" connections.

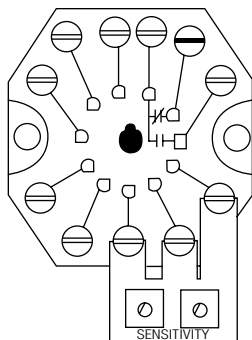
Series 16DM



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

- | | | | | | | | | |
|--|------------|----------|----------|----------|----------|----------|-----------|-----------|
| | 16M | X | X | X | X | X | XX | XX |
|--|------------|----------|----------|----------|----------|----------|-----------|-----------|
- Series **16M** General Purpose;
 - Mode of Operation **X**

Direct	Inverse
A – 4.7K	K – 4.7K
B – 10K	F – 470K
C – 26K	L – 10K
D – 50K	G – 1M
	M – 26K
	N – 50K
	P – 100K
	R – 470K
	S – 1M
 - Supply Voltage **X**
1 120 VAC; **2** 240 VAC; **3** 24 VAC; **8** 208/240 VAC
 - Socket Style* **X**
A 8 Pin Octal **M** Module Only
B 8 Pin DIN
 - Enclosure **X**
0 None; **1** NEMA 1; **4** NEMA 4
 - Time Delay (increasing level) Option **X**
00-90 seconds
Blank 0 seconds
 - Time Delay (decreasing level) Option **X**
00-90 seconds
Blank 0 seconds
 - Time Out Option **XX**
See page E-11, Chart A

*See page E-11 for descriptions.

16 HM, 16DM or 16VM Series

- | | | | | | | | |
|--|-------------|----------|----------|----------|----------|-----------|-----------|
| | 16HM | X | X | X | X | XX | XX |
|--|-------------|----------|----------|----------|----------|-----------|-----------|
- Series **16HM** High Sensitivity;
16DM DPDT Load Contact;
16VM Field Selectable Sensitivity¹
 - Mode of Operation² **X**

Direct	Inverse
A – 4.7K ⁴	K – 4.7K ⁴
B – 10K ⁴	F – 470K ⁴
C – 26K ⁴	L – 10K ⁴
D – 50K ⁴	G – 1M ⁴
E – 100K ⁴	M – 26K ⁴
	N – 50K ⁴
	P – 100K ⁴
	R – 470K ⁴
	S – 1M ⁴
	T – 3M ³
	W – 5.5M ³
	Z – 0-700K ^{5,7}
 - Supply Voltage **X**
1 120 VAC; **2** 240 VAC; **3** 24 VAC; **8** 208/240 VAC
 - Socket Style **X**
A 8 Pin Octal (16M & 16HM), 11 Pin Octal (16DM & 16VM);
B DIN Mount; **M** None, Module Only⁶
 - Enclosure **X**
0 None; **1** NEMA 1; **4** NEMA 4
 - Time Delay (increasing level) Option **X**
01-20 seconds; **0V** variable (16VM only)
 - Time Delay (decreasing level) Option **X**
01-20 seconds; **0V** 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

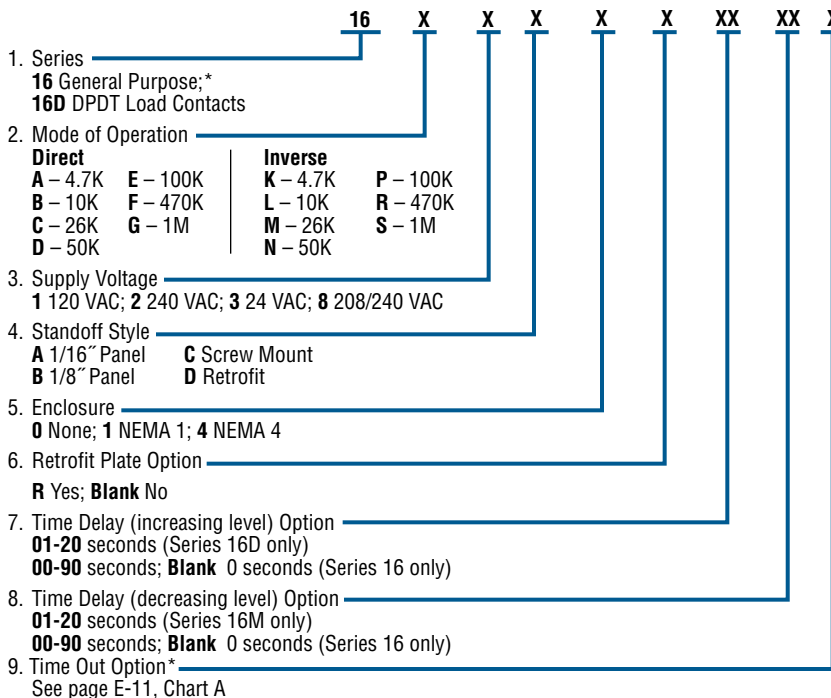
Same features and specifications as Series 16, but these controls also have DPDT load contacts to eliminate the need for slave relays.

Specifications

Contact Design	
Series 16	1 N.O. & 1 N.C. (1 form C)*
Series 16D	2 N.O. & 2 N.C. (2 form C)
Contact Rating (120, 240 VAC)	
Series 16	10 amp Resistive 1/3 hp*
Series 16D	5 amp Resistive 1/10 hp
Mode of Operation Direct/Inverse, factory set	
Sensitivity 0-1M ohm, factory set	
Primary Voltage 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	
Secondary Voltage 12 VAC, 1.5 mA	
Temperature -40°F to +150°F (-40°C to +65°C)	
Approvals U.L. 508 File # E44426	
Terminal Style Spade connection	
Options 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.

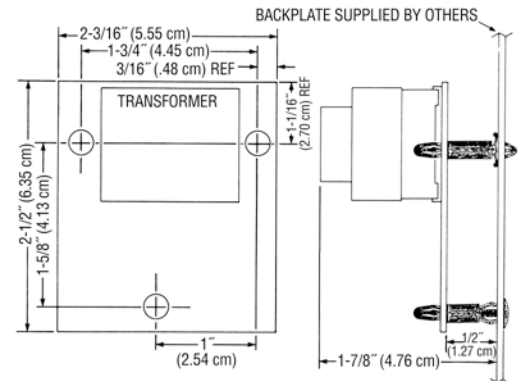


Series 16

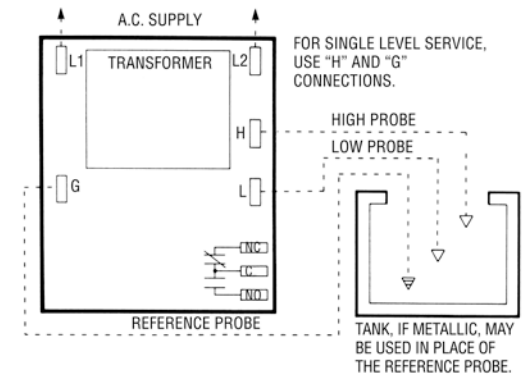
Applications

- 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

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.

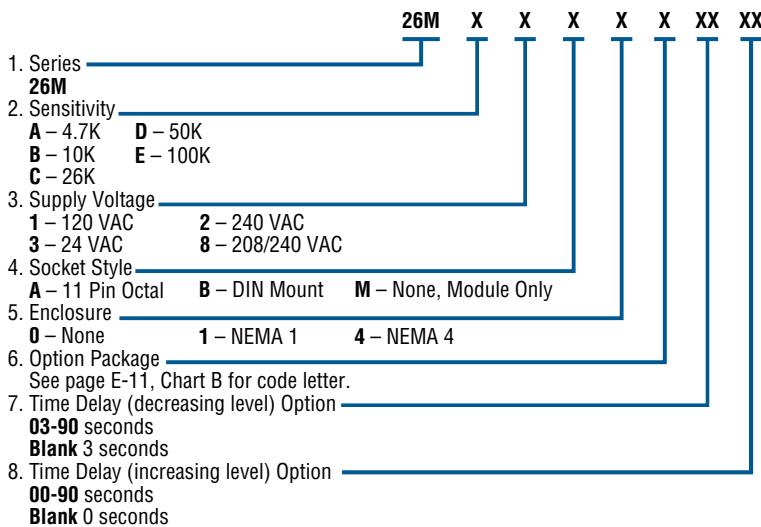
Specifications

Contact Design	1 N.O. & 1 N.C. (powered)
Contact Rating (24/120/240VAC)	10 amp Resistive 1/3 hp
Mode of Operation	Direct
Sensitivity	0 - 26K ohm, factory set
Primary Voltage	24 VAC, 120 VAC, 240 VAC ¹
Secondary Voltage	12 VAC
Temperature	-40°F to +150°F (-40°C to +65°C)
Approvals¹	U.L. 353 File # MP1430
Terminal Style	Screw connector
Options	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.

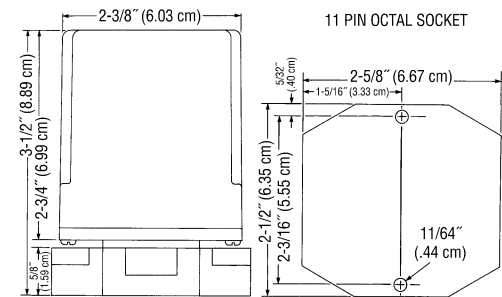


Socket Details and Option Availability are located on web site.

Applications

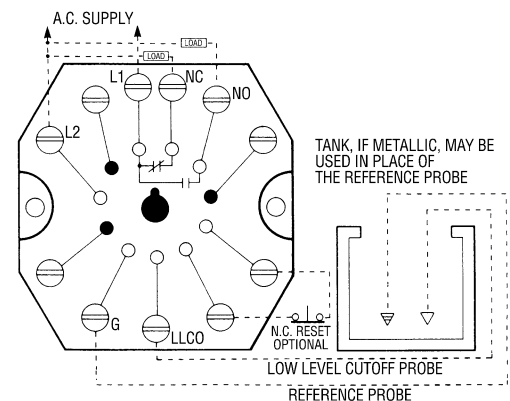
- Low-Water Cutoff
- Point Level
- Alarms

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.

Series 26 Low Water Cutoff – Standoff Mount

- ▶ Meets CSD1 Requirements
- ▶ Non Powered Contacts
- ▶ Time Delays Available
- ▶ LED Monitoring
- ▶ Test Feature
- ▶ AC Current Minimizes Electrolysis
- ▶ 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. Optional Test Feature available allows LLCO circuit to be tested without draining the water level in the boiler. Built-in 3 second time delay is standard. Up to 90 seconds available for increasing and decreasing levels.

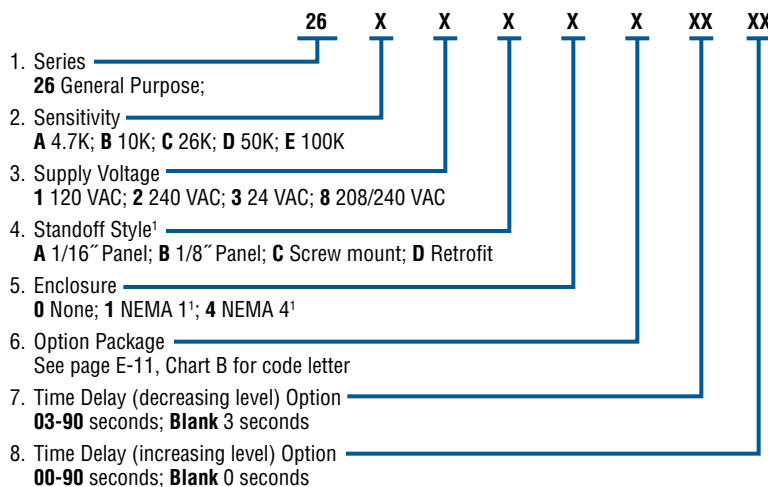
Specifications

Contact Design	1 N.O. & 1 N.C. (1 form C)
Contact Rating	10 amp Resistive 1/3 hp at 120, 240 VAC
Mode of Operation	Direct
Sensitivity	0-100K ohm, factory set
Primary Voltage	120 VAC, 240 VAC ¹ , 24 VAC, 208/240 VAC (+10%/-15%) 50/60 Hz
Secondary Voltage	12 VAC, 1.5 mA
Temperature	-40°F to +150°F (-40°C to +65°C)
Approvals¹	U.L. 353, U.L. 508 File # MP1430
Terminal Style	Spade connection
Options	Time Delays, Power Outage, Retrofit Plate, Test Feature, 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.



Notes:
1. Standoff Style **D** only.

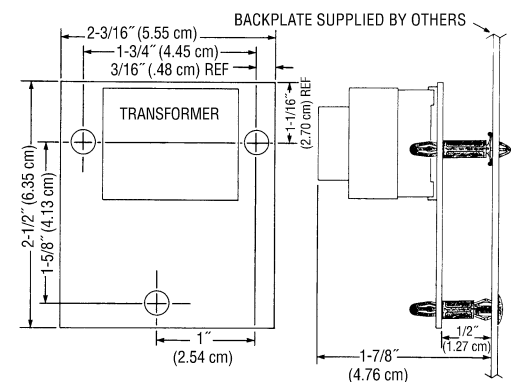
Socket Details and Option Availability are located on web site.



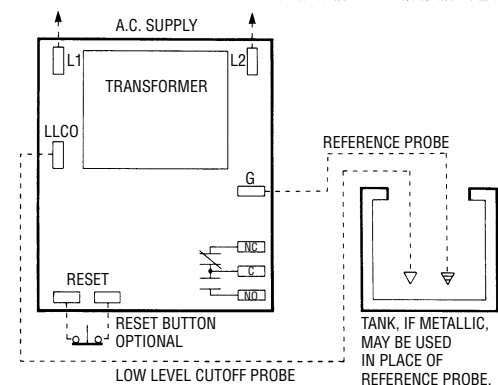
Applications

- Low-Water Cutoff
- Point Level
- Valve Control
- Single-Level Service
- Alarms
- Pump Control

Dimensions



Wiring



WARRICK CONDUCTIVITY SENSORS

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"
- ▶ 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

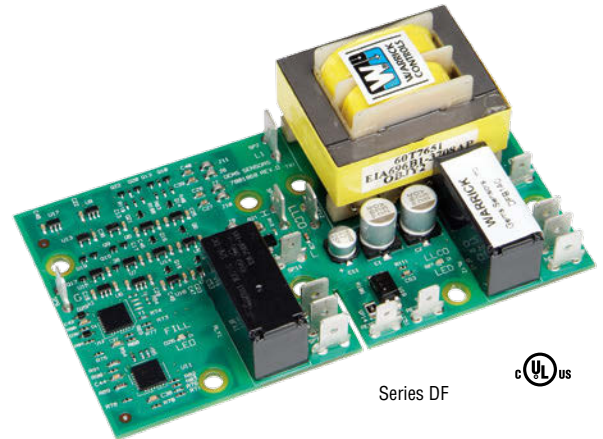
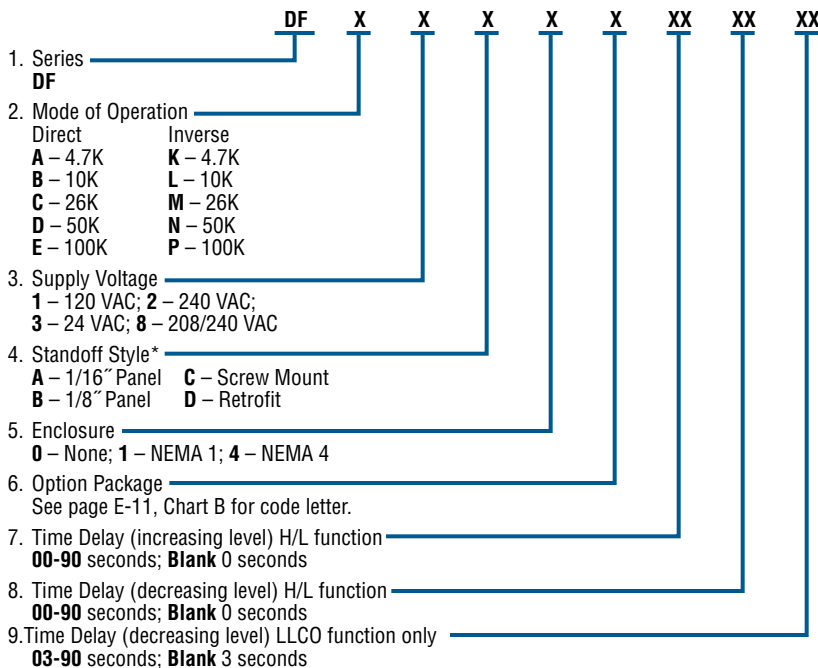
Contact Design	1 N.O. & 1 N.C. (1 form C) extra function
Contact Rating (120, 240 VAC)	10 amp Resistive 1/3 hp
Mode of Operation	H/L Direct/Inverse, LLCO – factory set
Sensitivity	0-26K ohm, factory set
Primary Voltage	120 VAC, 240 VAC ¹ , 24 VAC (+10%/-15%) 208/240: 187 V min. to 255 V max. VAC 50/60 Hz
Secondary Voltage	12 VAC
Temperature	-40°F to +150°F (-40°C to +65°C)
Approvals	U.L. 508 File # E44426, U.L. 353 File # MP1430
Terminal Style	Spade connection
Options	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.

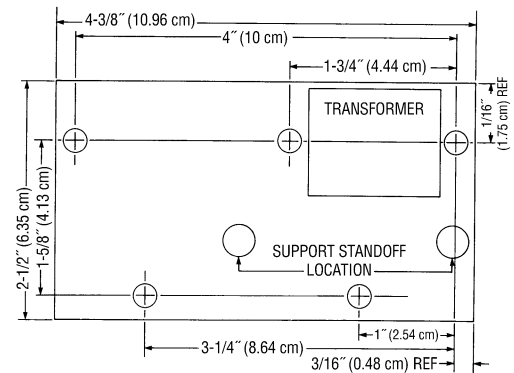


Series DF

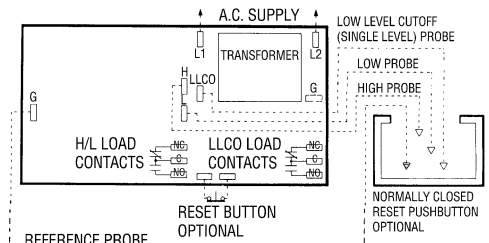
Applications

- 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.

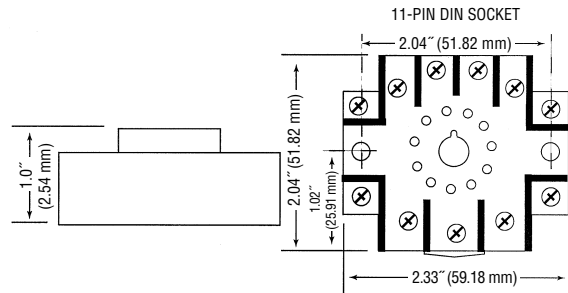
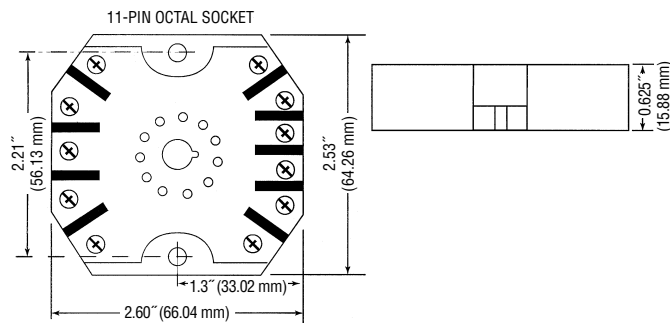
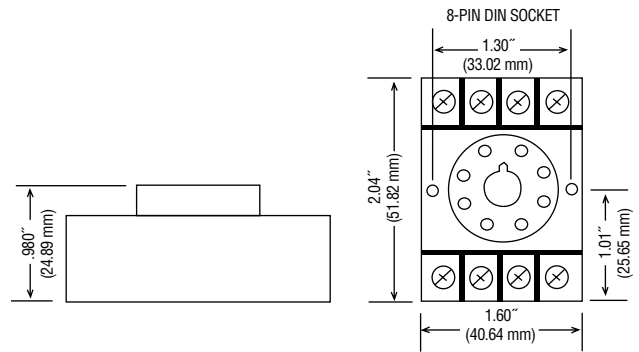
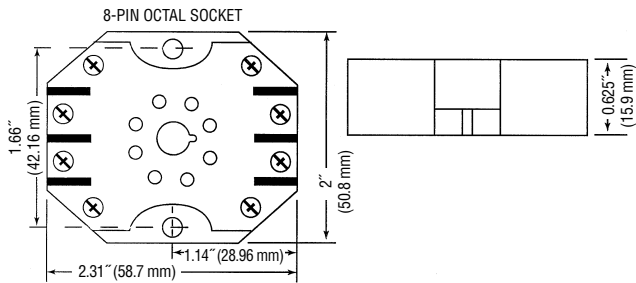
Socket Details and Option Availability are located on web site.

Sockets and Standoffs – 16, 26 and DF Series Only



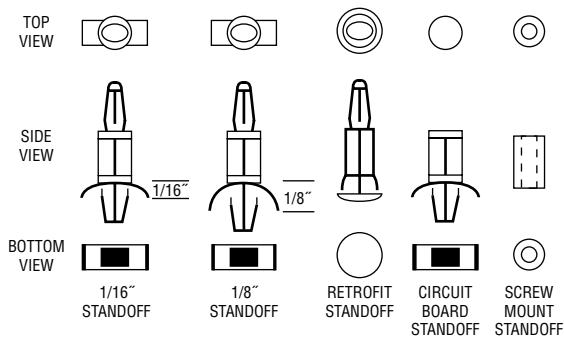
Sockets

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
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

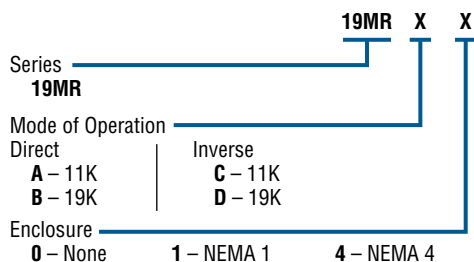
Direct Motor Load of 30 Amps @ 240 VAC

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.

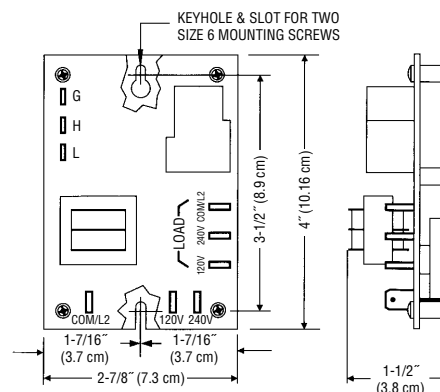


Series 19MR

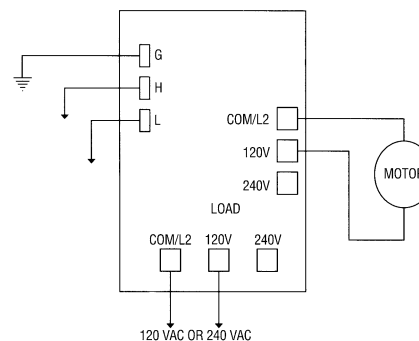
Applications

- 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.

WARRICK CONDUCTIVITY SENSORS

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.

Contact Design	SPDT 1 N.O. & 1 N.C. (1 form C), non-powered contacts
Contact Rating	5 amp @ 30 VDC or 120 VAC Resistive 1/8 hp
Mode of Operation	Direct/Inverse, factory set
Sensitivity	0 - 1M ohm maximum, factory set
Primary Voltage	12 VDC, 24 VDC, negative ground (±20%)
Supply Current	40 mA when relay energized, 10 mA w/relay de-energized
Secondary Voltage	12 VDC
Terminal Style	Screw connector
Temperature	-50°F to +150°F (-46°C to +65°C)
Options	Time Delay



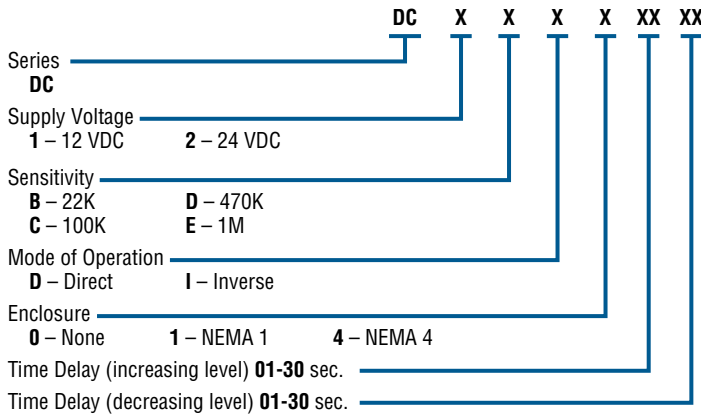
Series DC

Applications

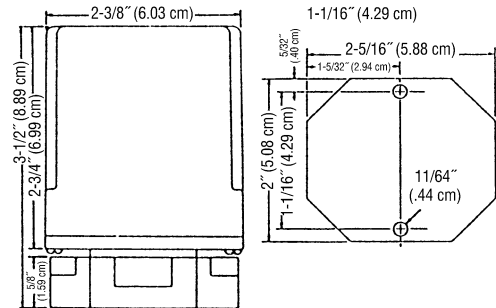
- Single and Differential Service
- Solar and Wind Powered Pumps
- Portable Cleaning Equipment
- Battery-Powered Level Control
- Well Pumps
- Remote Reservoirs
- Remote Irrigation
- Onboard Ship Level Control

How to Order

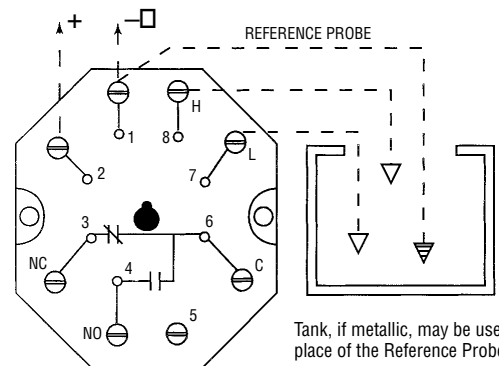
Use the **Bold** characters from the chart below to construct a product code.



Dimensions



Wiring



Tank, if metallic, may be used in place of the Reference Probe.

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-CSA 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.

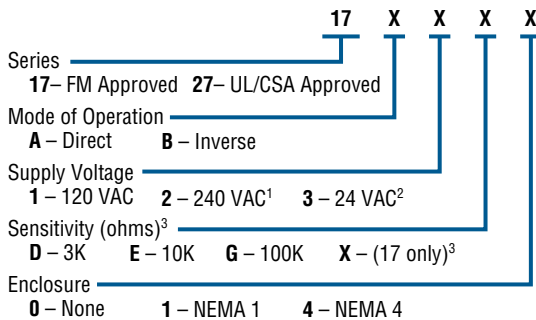
CSA Certified for Class 1, Groups A, B, C and D; Class II, Groups E, F and G; Class III

Specifications

Contact Design	
Series 17	1 N.O. & 1 N.C. Isolated Contacts
Series 27	1 N.O. & 1 N.C. (1 form C)
Contact Rating (24/120/240VAC) 8 amp Resistive	
Mode of Operation Direct/Inverse, factory set	
Sensitivity	
Series 17	0-470K ohm, field adjustable
Series 27	0-100K ohm, factory set
Primary Voltage	
Series 17	24 VAC, 120 VAC, 240 VAC (+10%/-15%) 50/60 Hz
Series 27	120 VAC, 240 VAC (+10%/-15%) 50/60Hz
Secondary Voltage	
Series 17	13 VAC, 4 mA
Series 27	11 VAC, 2.3 mA
Temperature -40°F to +150°F (-40°C to +65°C)	
Approvals	
Series 17	FM File # 1G9A1.AX
Series 27	U.L. 913 File # E44570; CSA #2174246
Connections All screw type connections	

How to Order

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



Notes:

1. 240V standard in Series 17. Non-standard, but available in Series 27.
2. 24V available only in Series 17.
3. 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

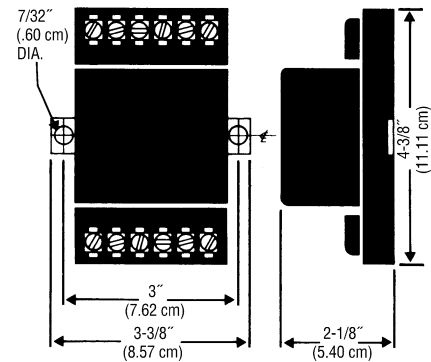


Series 27

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. Listed

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.

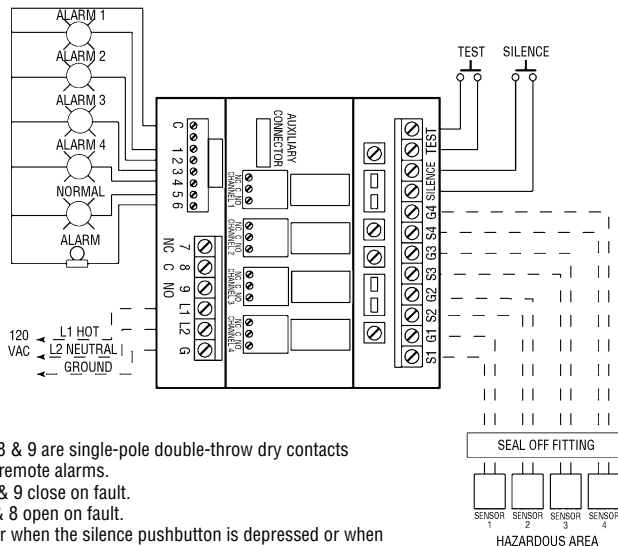
Approved for Class I, II, III, Division 1, Groups C, D, E, F, G hazardous atmospheres, Series 47 controls supply four channels which can be used with conductivity liquid level sensors or dry contact sensors.

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.

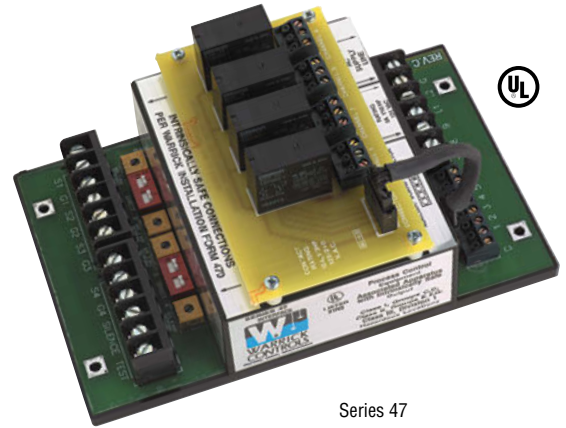
Alarm Specifications

Contact Design	SPDT 1 N.O. & 1 N.C.
Master Alarm Contact Rating (30VDC, 120/240VAC)	5 amp Resistive, 1/10 hp
Indicator Contacts	Powered 120 VAC 25mA
Indicator Contacts for Audible Alarm	Powered 120 VAC 5A
Auxiliary Contacts (optional)	SPDT 120 VAC 10A (not powered)
Sensitivity	0-50K ohm maximum specific resistance
Primary Voltage	120 VAC (+10%/-15%) 50/60 Hz
Secondary Voltage	12 VAC @ 6mA RMS
Temperature	-40°F to +150°F (-40°C to +65°C)
Approvals	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.

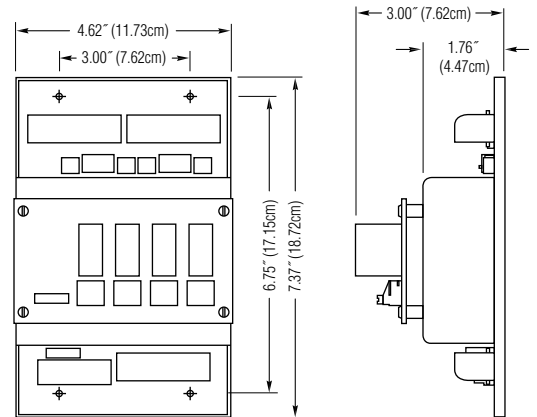


Series 47

Applications

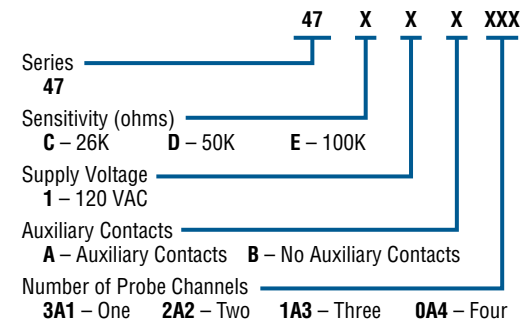
- Hazardous Atmospheres
- Monitoring and Control
- Storage Tank Alarm Panels
- Input for Computer
- Input for Phone Dialer

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.

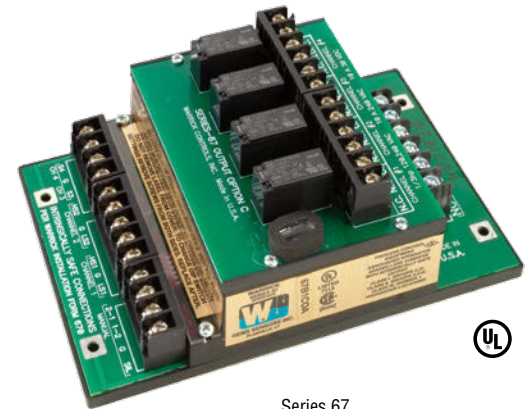
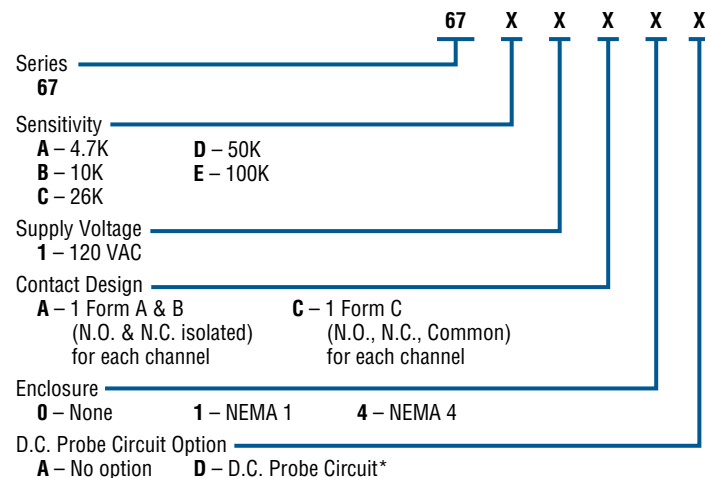
Designed for hazardous applications, its low cost, integrated features and compact size also make it ideal for non-hazardous applications.

Specifications

Contact Design	Standard N.O., N.C. (form C); Optional N.O., N.C.
Contact Rating (30VDC, 120/240VAC)	10 amp (style C); 5 amp (style A)
Primary Voltage	120 VAC, 50/60 Hz
Secondary Voltage	12 VAC @ 6mA RMS
Sensitivity	4.7K - 100K ohms maximum specific resistance, factory set
Temperature	-40°F to +150°F (-40°C to +65°C)
Approvals	U.L. 913 File # E44570

How to Order

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

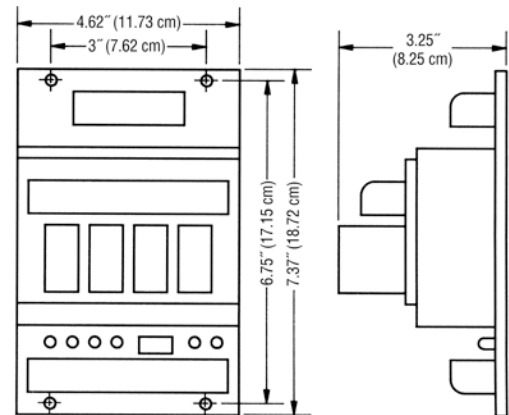


Series 67

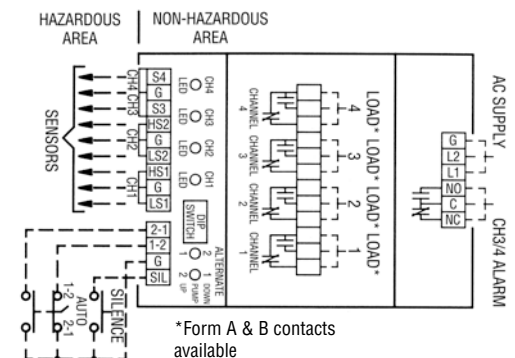
Applications

- 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.



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-20	E-20	E-19	E-19	E-23	E-23	E-18	E-18	E-25	E-25	E-24	E-21	E-21	E-20	E-18	E-22	E-22
Body Options	Flange			•	•													
	Pipe Thread	•			•			•										
	Flat Mount		•		•													
	Side Chamber					•	•											
	Non-Contact Electrodes											•						
	Food Grade Connection									•	•							
	Bracket Mount											•						
Fitting Body Material Options	Brass	•	•	•		•		•										
	PVC		•	•	•													
	1018 Carbon Steel			•														
	Stainless Steel	•		•														
	Forged Steel			•														
	Nylon									•	•							
	Cast Iron	•				•	•	•				•						
Housing Material	Coated Aluminum	•	•	•		•	•	•				•						
	Polycarbonate				•													
Number of Probes	1 to 3		•					•										
	1 to 4					•	•			•	•							
	1 to 7	•		•	•							•						
Electrodes	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
Probe Quantity	1, 2 or 3	1	1
Mounting Size	1" NPT	3/8" NPT or 5/8" NF/NFE	1/8" NPT
Materials			
Body	Case iron or red brass	316 stainless steel	316 stainless steel
Terminal Housing	Diecast aluminum, epoxy coated (optional)	—	—
Probe	316 stainless steel	316 stainless steel	316 stainless steel
Insulation	Teflon®	Teflon®	Teflon®
Probe Diameter	3/16"	1/4"	3/16"
Pressure/Temperature	0 psig @ 500°F	250 psig @ 406°F	150 psig @ 365°F
Approvals	—	U.L. File #MP2489, Vol. 1 Sec. 1; CSA; FM	U.L. File #MP2489
Use the Bold characters from the chart below to construct a product code.	<p>Series 3J</p> <p>Number of Probes: 1 – One 2 – Two 3 – Three</p> <p>Body Material¹: B – Cast Iron C – Red Brass</p> <p>Housing: 0 – None 1 – Optional Housing</p> <p>Length of Probes²: A – All probes 10-1/4" C – For lengths less than 10-1/4" indicate length as inches in decimal form</p>	<p>Series 3H</p> <p>Thread: 1 – 3/8" – 18 NPT 2 – 5/8" – 18 UNF 3 – 5/8" – 24 UNEF</p> <p>Sleeve¹: B – Teflon® 3/4" Long</p> <p>Length (Feet)²: 1 – One 2 – Two 3 – Three</p>	<p>Series 3L</p> <p>Connection Size: 1 – 1/8" NPT</p> <p>Insulator Length: D – Teflon® 1-1/4"</p> <p>Length in Inches^{1, 2}: 02 – Two 06 – Six 10 – Ten 03 – Three 07 – Seven 11 – Eleven 04 – Four 08 – Eight 12 – Twelve 05 – Five 09 – Nine</p>
Notes	<ol style="list-style-type: none"> Probes are stainless steel. Custom options available. Consult factory. 10-1/4" maximum 	<ol style="list-style-type: none"> Longer Teflon® sleeves are available. Contact factory or your representative Custom probe and insulation lengths are available. Contact your representative. 	<ol style="list-style-type: none"> 12" maximum Indicate fractional inches in decimal form (01.75 = 1-3/4")

WARRICK CONDUCTIVITY SENSORS







Top Mounting Fixtures – General Purpose

Series	3F	3G																									
																											
Mounting Connection	Flange — 4.5" to 7.5" Dia.	NPT, Flange, Bracket (Plate)																									
Probe Quantity	1 thru 7	1 thru 7																									
Description	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.																									
Materials																											
Terminal Housing	Die-cast aluminum, epoxy coated	Polycarbonate																									
Body	Forged steel, red brass, 316 S.S., 1018 C.S, PVC	PVC																									
Probe Insulation	Teflon®	Teflon®																									
Pressure/Temperature	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)																									
Approvals	CSA	—																									
Dimensions	<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>1</td> <td>1</td> <td>4-1/2"</td> <td>1/2" NPT</td> <td>2-1/4 x 2-1/4 x 2-1/4</td> </tr> <tr> <td>2-3</td> <td>2</td> <td>6"</td> <td>1/2" NPT</td> <td>3-1/4 x 3-1/4 x 2-3/8</td> </tr> <tr> <td>4</td> <td>2-1/2</td> <td>7"</td> <td>1/2" NPT</td> <td>3-1/4 x 3-1/4 x 2-3/8</td> </tr> <tr> <td>5-7</td> <td>3</td> <td>7-1/2"</td> <td>3/4" NPT</td> <td>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																							
How to Order	<p>Use the Bold characters from the chart at right to construct a product code.</p> <p>Electrode Probes are ordered separately.</p> <p>Series 3F X X</p> <p>Number of Probes 1 thru 7</p> <p>Body Material</p> <p>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 3G X X X</p> <p>Number of Probes 1 thru 7</p> <p>Base Size and Style</p> <p>A – 2" Flange (6" O.D.)³ E – 2" NPT³ 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</p> <p>1 – 316 S.S. Inserts for Use with 1/4" Rod Extensions⁴ 2 – Tapered Probe Assembly⁵ 3 – Wire-Suspended Probes⁶</p>																									
Compatible Electrode Probes (order separately)	3R, 3W ¹ , 3Y ²	3R, 3T, 3W ¹ , 3Y ²																									

Notes:

- Requires 3Z1B Adapter and 3Z1A Wire.
- Requires 3Z1B Adapter.
- Maximum 4 probes.
- Order 3R rods separately. See page E-21.
- Order 3T rods separately. See page E-21.
- Order 3W/3Y probes separately. See page E-22.

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.)	250 psig @ 406°F 500 psig @ 75°F		
U.L. File #MP2489, Vol. 1 Sec. 1; CSA	CSA File #LR11644	U.L. File #MP2489, Vol. 1 Sec. 1; CSA		
	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 3E</p> <p>Number of Probes 1 thru 7</p> <p>Body Material</p> <p>A – Cast Iron</p> <p>B – Red Brass</p> <p>C – 316 Stainless Steel</p>	<p>Series 3N</p> <p>Number of Probes 1 thru 3</p> <p>Body Material</p> <p>A – PVC</p> <p>B – Red Brass</p> <p>C – 316 Stainless Steel</p>	<p>Series 3B</p> <p>Thread</p> <p>1 – 3/8" - 18 NPT</p> <p>2 – 5/8" - 18 UNF</p> <p>3 – 5/8" - 24 UNEF</p> <p>Metal Parts</p> <p>B – 316 Stainless Steel</p>		
3R, 3W ¹	3R, 3W ¹	3R solid rod (up to 4') 3W ¹ or 3Y ² (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

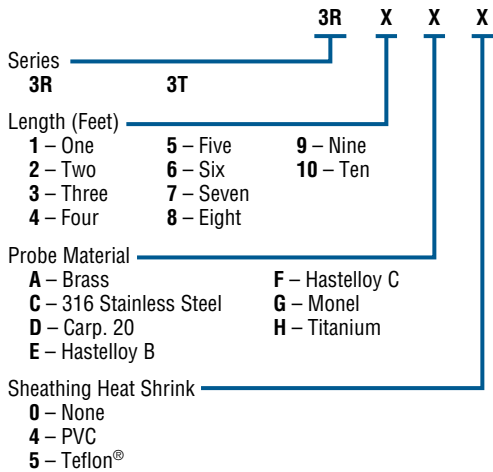
For general purpose use, Series 3R probes are metallic rods with threaded ends that screw into a fitting that extends vertically down into the liquid. Available in a variety of materials for different applications. 3T tapered rods are also available.

Specifications

Style	
Series 3R	1/4" (.64 cm) threaded rod
Series 3T	1/4" (.64 cm) tapered rod
Material	Brass, Hastelloy C, Monel, 316 stainless steel, titanium, Carp. 20
Sheathing (optional)	PVC heat shrink 200°F (93°C), Teflon® heat shrink 350°F (177°C)

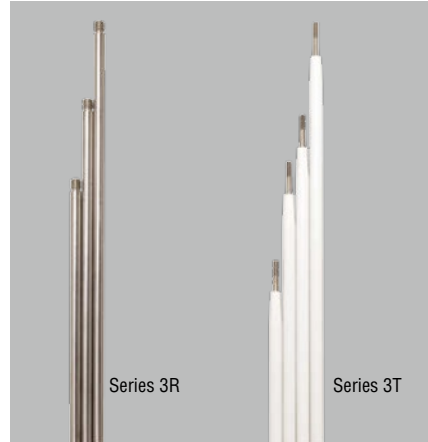
How to Order

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.

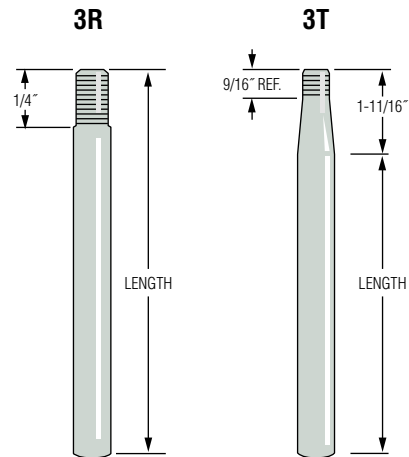


Applications

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.

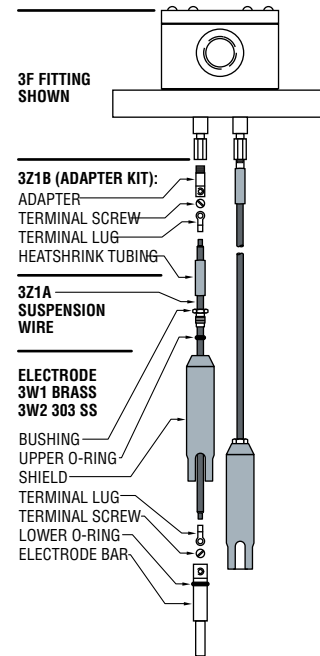
Length (Feet)	Part Number
500	3Z1A-500
1000	3Z1A-1000
5000	3Z1A-5000
Custom	3Z1A-XX

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

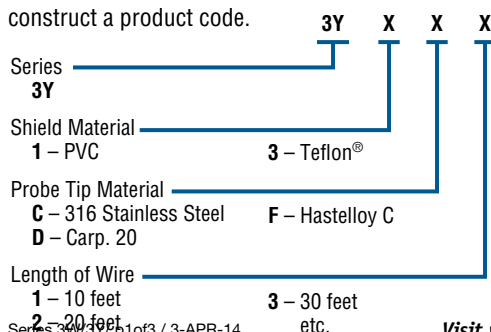
Series 3Y wire suspended probes consist of metallic bars within a protective plastic shield, designed to be suspended in liquid. Series 3Y suspension wires are PVC or Teflon® insulated for use in corrosive liquid applications. 7/8" (2.22 cm) diameter x 3-1/2" (8.90 cm) length.

Specifications

Style	Wire suspended
Tip Material	Carp. 20, Hastelloy C, 316 stainless steel
Shield Material	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

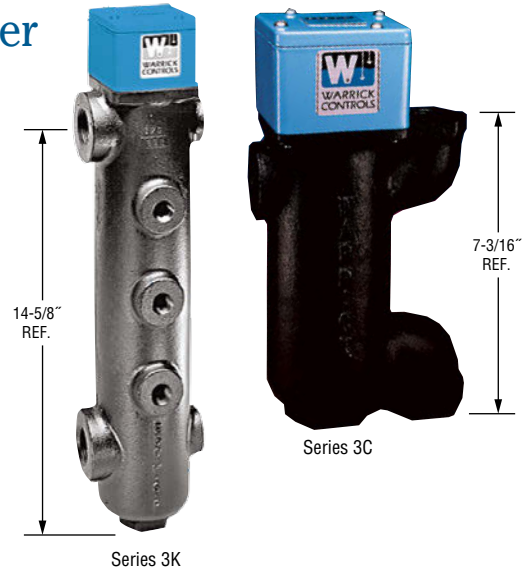
Series 3C – Short External Mount Side Chamber

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

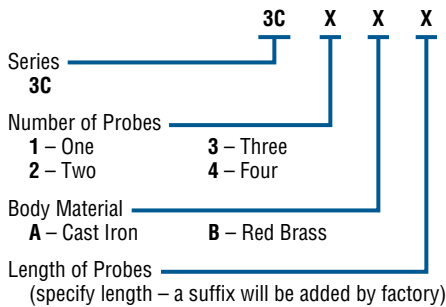
Probes	1 thru 4, with 316 Stainless Steel/Teflon® wetted parts
Body Material	
Series 3C	Cast iron, red brass
Series 3K	Cast iron
Pressure/Temperature	250 psig (17.2 bar) @ 406°F (200°C) (saturated steam)
Probe Length	
Series 3C	1-1/2" to 6" (3.81 cm to 15.24 cm)
Series 3K	1-3/4" to 13" (4.45 cm to 33.02 cm)
Approvals	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.

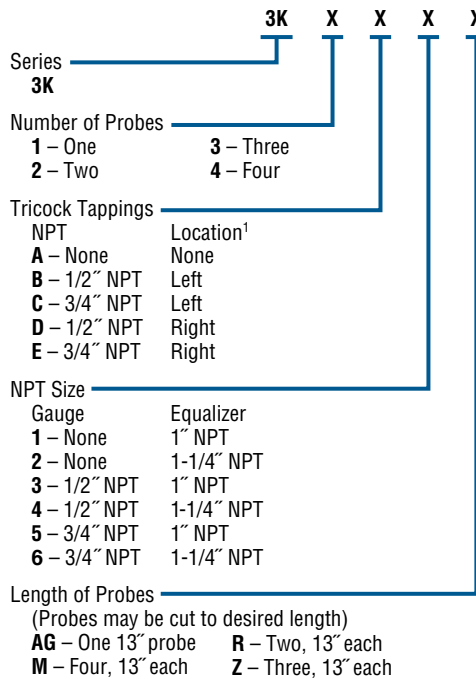


Notes:

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).

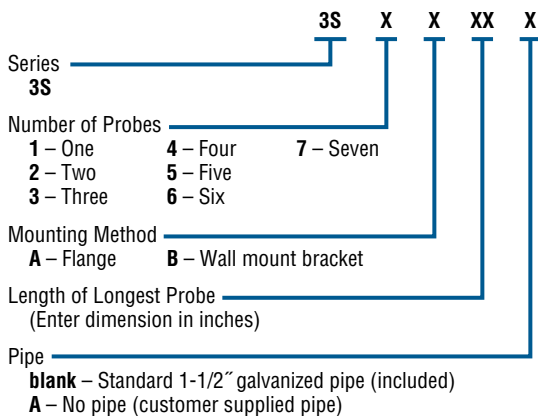
When mounted in a sump, the pipe and bulb assembly is acted on by the hydrostatic pressure exerted by the liquid outside the bulb. Assuming the density of the liquid outside is equal to water, the height of the water inside the bulb will equal the height outside.

Specifications

Probes	1 thru 7
Materials of Construction	Cast iron, galvanized pipe, stainless steel, neoprene
Type of Connection	3" flange (7-1/2" O.D.), or bracket
Terminal Housing	Die-cast aluminum, epoxy coated
Pressure	Atmosphere
Temperature	-40°F to +212°F (-40°C to +100°F)

How to Order

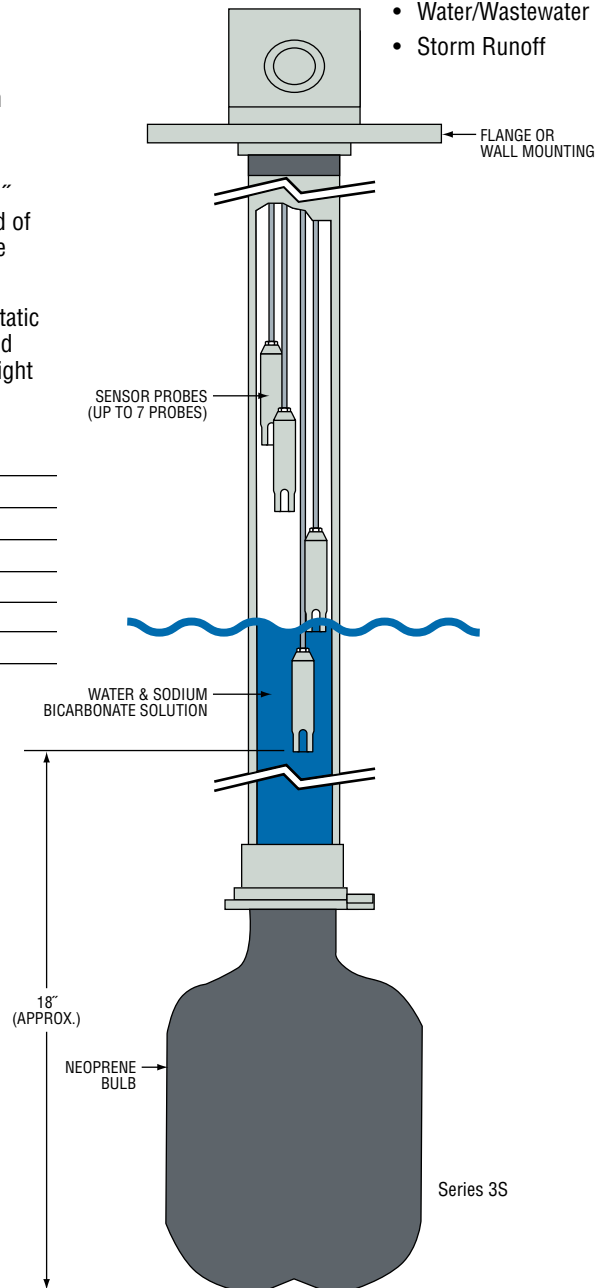
Use the **Bold** characters from the chart below to construct a product code.



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.

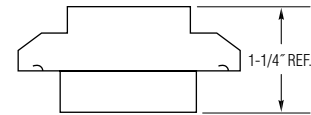
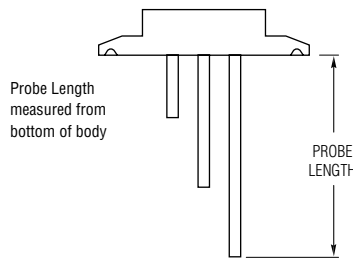
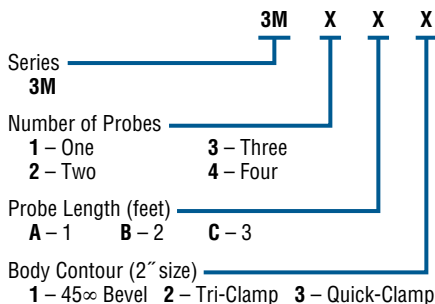
Series 3MT fittings are similar to 3M fittings, except they also feature Teflon®-covered probes with polished tips to meet the most demanding application requirements.

Specifications

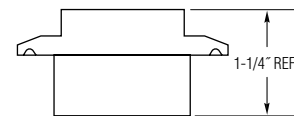
Probes	1 thru 4
Body Contour	45° bevel, Tri-Clamp, Quick Clamp
Body Material	Type 66 Nylon
Probe Material	
Series 3M	316 stainless steel, cut to length by user
Series 3MT	Teflon®-covered 316 stainless steel probes. Tip polished to RA <25 microns max. spec. (factory set lengths)
Pressure/Temperature	150 psig (10.3 bar) @ 150°F (65°C)
Approvals	FDA-approved materials; CSA

How to Order Series 3M

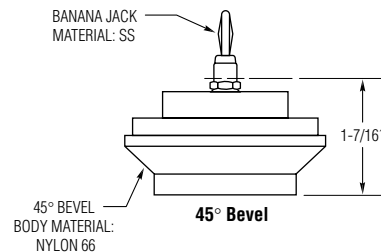
Use the **Bold** characters from the chart below to construct a product code.



Quick-Clamp



Tri-Clamp



45° Bevel

45° BEVEL
BODY MATERIAL:
NYLON 66

Components ordered separately; see bottom of page

Applications

- Food & Beverage
- Pharmaceutical
- CIP

Body Styles

How to Order Series 3MT

3MT components must be ordered separately.

Step 1. Upper Assembly*:

Select one part number.

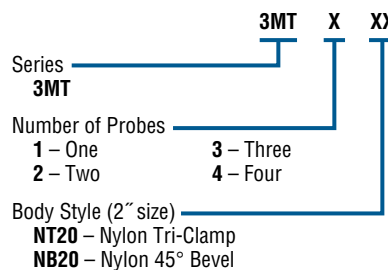
- 7790575** – 1 Probe
- 7790577** – 2 Probes
- 7790581** – 3 Probes
- 7790584** – 4 Probes

*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.



LWC-800 Series Low Level Cut Off Control

- ▶ External Mounting
- ▶ Meets CSD1 Requirements
- ▶ U.L. Recognized "Limit Control"
- ▶ Compact Size
- ▶ Options Include: Manual Reset, Power Outage Feature, and Test Feature

Gems LWC-800 is designed for boiler low-water cutoff protection, and offers the most compact package for boiler and steam generators. For added safety, the sensor assembly incorporates redundant reed switches at the actuation level. The LWC-800 Series is ideal for R.O., distilled, or deionized water systems.

Optional Features:

- Power Outage feature allows for resets after nuisance power outages;
- Reset Button feature to be used when device has been deactivated due to low water condition. A Reset is activated only after water has returned to normal level.

Specifications

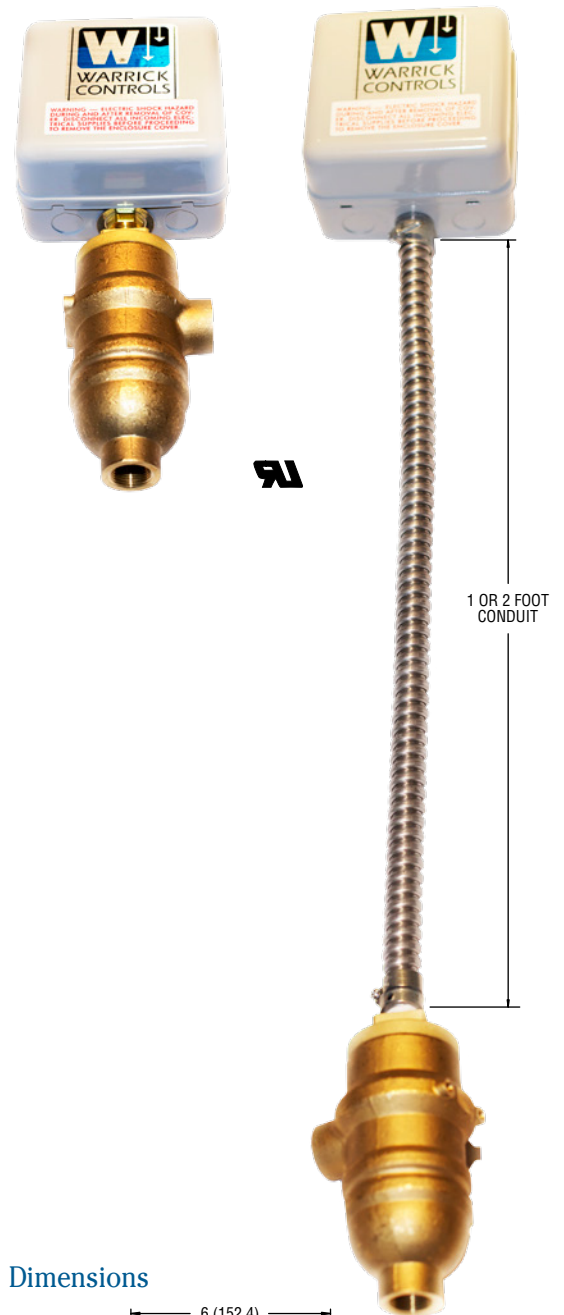
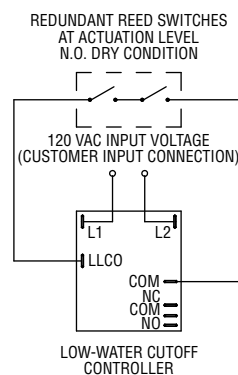
Wetted Materials	
Bottle Housing	Brass
Stem and Mounting	Brass
Float Assembly	316 Stainless Steel
O-Ring	Viton®
Retaining Ring	Beryllium Copper
Pressure Rating	150 PSI (1034 KPA)
Temperature Range	0°F to 305°F (-18°C to 151°C); 350°F (176°C) max. intermittent
Mounting Attitude	Vertical, J-Box Up
Controller	
Contacts	SPDT, Dry Contacts
Contact Ratings	10A @ 120/220/240 VAC Resistive (120°F/49°C) 1A @ 120, 208/240, 240 Resistive (150°F/66°C) 1/3 HP @ 120, 208/240, 240 VAC
Secondary Circuit	2.3 VAC RMS, <1 mA
Sensitivity	10K
Ambient Temperature	-40°F to +150°F (-40°C to +66°C)
Time Delay	0.5 Seconds on Rising Level
Approvals	UL Recognized per UL-353, Limit Controls (for supply voltages of 120 VAC or less)

How to Order

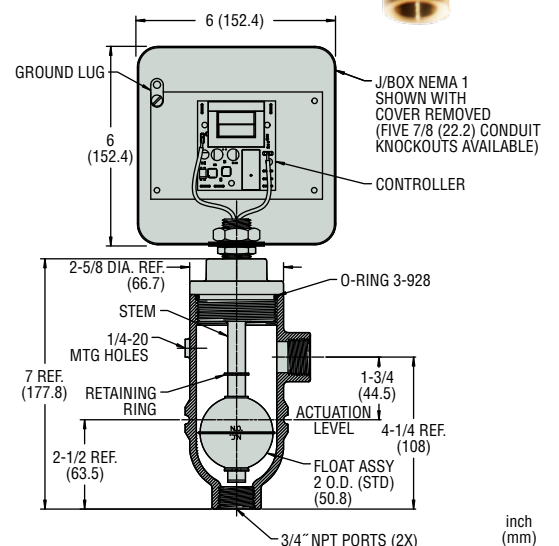
Specify Part Number based on configuration.

Description	Part Number
LWC-800 Integrated	243340
LWC-800 – 1-Foot Conduit	243345
LWC-800 – 2-Foot Conduit	243350

Switch Actuation



Dimensions



WARRICK CONDUCTIVITY SENSORS

LWC-700/720 Series Low Level Cut Off and Pump Up Control

- ▶ Internal Mounting
- ▶ Meets CSD1 Requirements
- ▶ U.L. Recognized "Limit Control"
- ▶ Compact Size
- ▶ Options Include: Manual Reset, Power Outage Feature, and Test Feature

Gems LWC-700 is designed for boiler low-water cutoff protection, and offers the most compact internally mounting package for boiler and steam generators. The 720 Series includes the low-water cutoff function and adds Pump Up control for more sophisticated and convenient automation. For added safety, the sensor assembly incorporates redundant reed switches at the actuation level. The LWC-700 and LWC-720 Series are ideal for R.O., distilled, or deionized water systems.

Optional Features:

- Power Outage feature allows for resets after nuisance power outages;
- Reset Button feature to be used when device has been deactivated due to low water condition. A Reset is activated only after water has returned to normal level.

Specifications

Wetted Materials	
Stem, Mounting, Collars	Brass or Stainless Steel
Float Assembly	316 Stainless Steel
Pressure Rating	150 PSI (1034 KPA)
Temperature Range	0°F to 305°F (-18°C to 151°C); 350°F (176°C) max. intermittent
Float Acceptable Overtravel	1/16" to 1/4" (1.6 mm to 6.5 mm) on Closure; 1/16" (1.6 mm) min. on Opening
Mounting Attitude	Vertical, J-Box Up
Controller	
Contacts	SPDT, Dry Contacts
Contact Ratings	10A @ 120/220/240 VAC Resistive (120°F/49°C) 1A @ 120, 208/240, 240 Resistive (150°F/66°C) 1/3 HP @ 120, 208/240, 240 VAC
Secondary Circuit	2.3 VAC RMS, <1 mA
Sensitivity	10K
Ambient Temperature	-40°F to +150°F (-40°C to +66°C)
Time Delay	0.5 Seconds on Rising Level
Approvals	UL Recognized per UL-353, Limit Controls (for supply voltages of 120 VAC or less)

Mounting Types

Type 1 1" NPT	Type 2 1-5/16"-12UNF-2A ¹

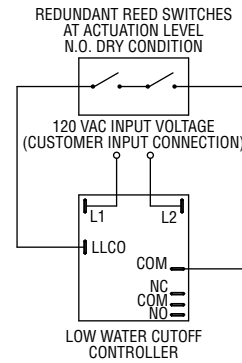
Notes:
1. Mounting plug dimensions per SAE J1926.



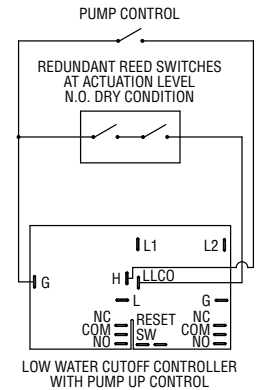
720 Series shown

Switch Actuation

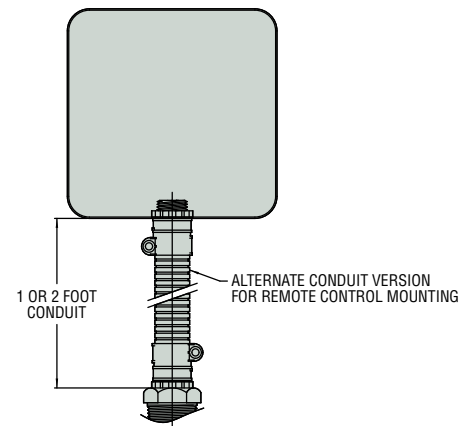
700 Series



720 Series

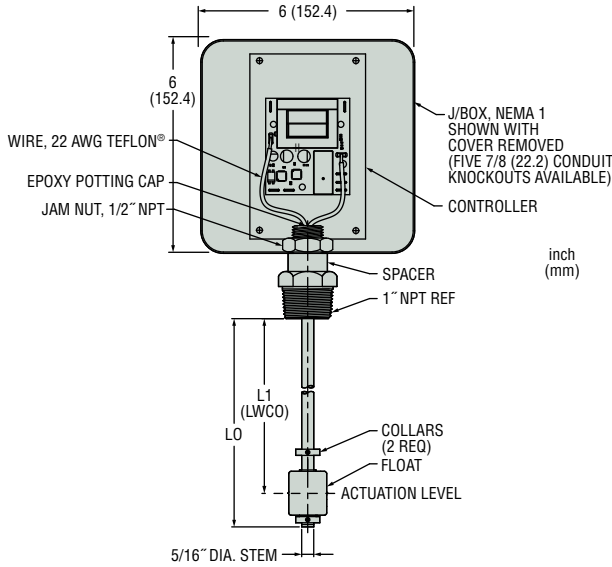


Conduit Option

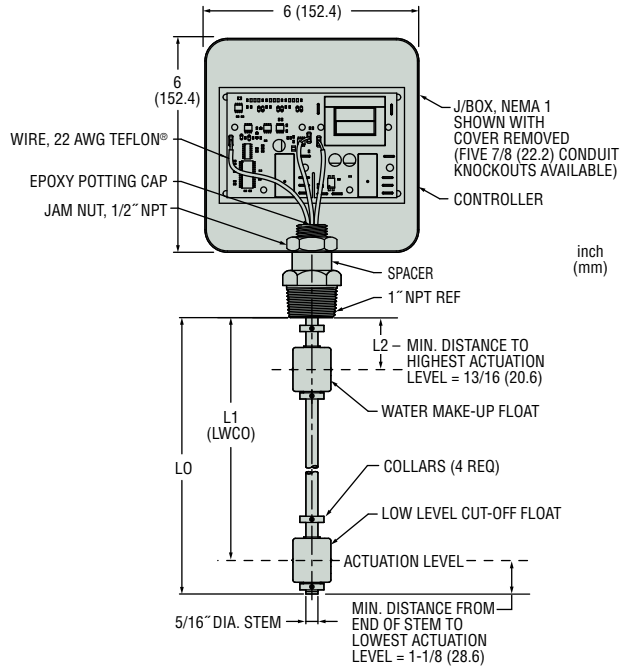


Dimensions

700 Series



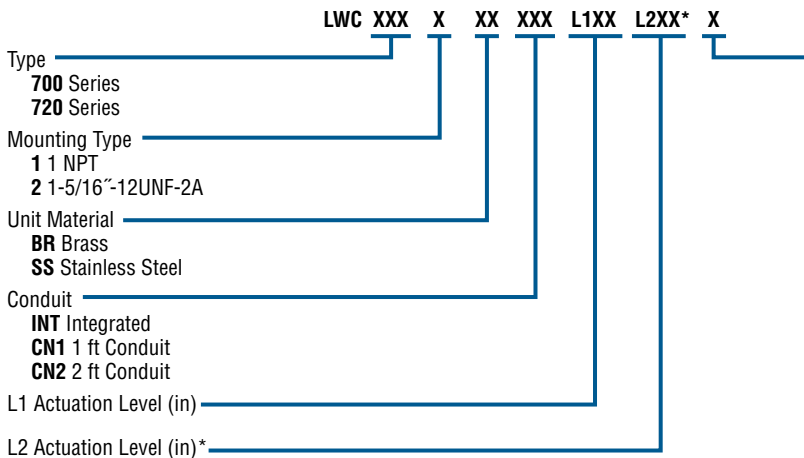
720 Series



Note: Actuation levels are calibrated on ascending fluid levels.

How to Order

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



* Used for 720 Series only; leave blank for 700 Series.

- Actuation level distances and LO (Length Overall) are measured from the inner surface of the mounting plug.
- $LO = L1 + 1-1/8"$ (28.6mm)
- L2 may be no less than 2 inches (50.8mm) from L1 actuation level.

Notes:

- Dimensions based on liquid specific gravity of 1.0.
- Tolerance on actuation levels is $\pm 1/8"$ (3.2mm).

Control Options

700 Series

Control Options			Part No. Code
N.C. Pushbutton	Power Outage	Test Feature	
•			C
	•		E
		•	B
•	•		F
•		•	Y
	•	•	Z
•	•	•	A

720 Series

Control Options			Part No. Code
N.C. Pushbutton	Power Outage	Test Feature	
•			S
	•		K
		•	B
•	•		G
•		•	Y
	•	•	Z
•	•	•	A

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.



Single-function standard panel

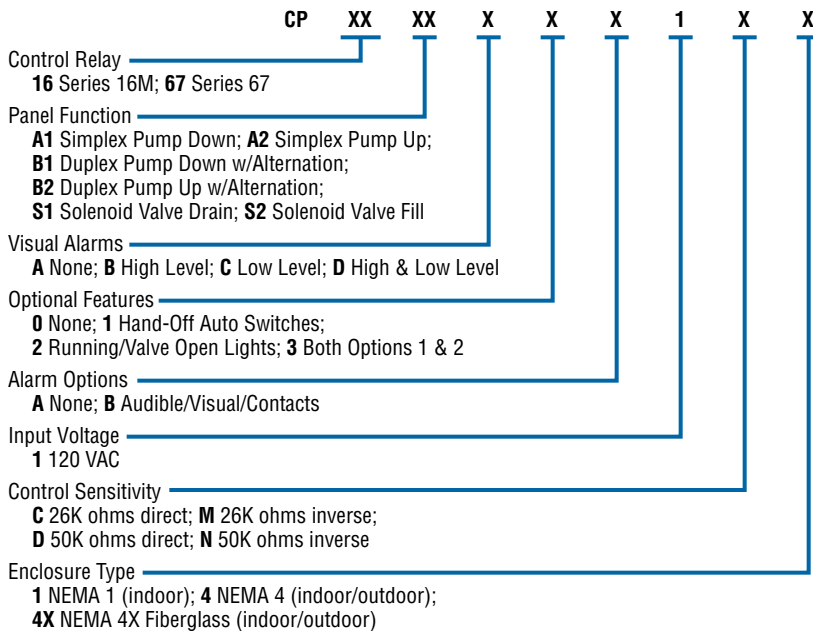


Specifications

Contact Design	SPST
Contact Rating (120 VAC)	10 amp Resistive
Primary Voltage	120 VAC (+10%/-15%) 50/60 Hz
Temperature	-40°F to +150°F (-40°C to +65°C) Ambient
Enclosure Type	NEMA 1, NEMA 4, NEMA 4X Fiberglass
Approvals	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.



Applications

- Simplex Pump Up/Down
- Duplex Pump Up/Down
- Pump Alternation
- Valve Fill & Drain

See Our Interstitial Tank Monitoring Products on page A-22.



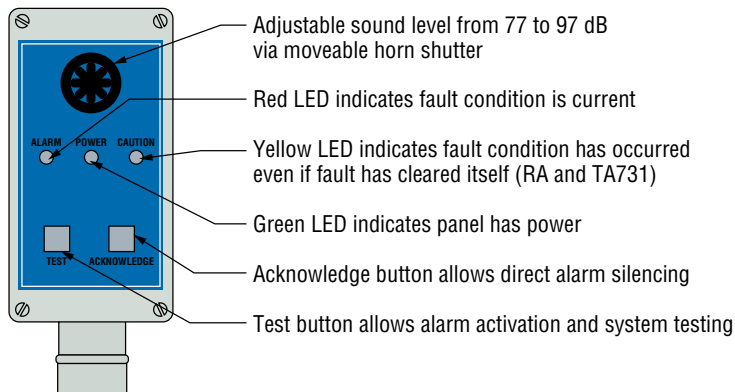
RA431 and TA73x Alarm Panels Scream Warning @ 97 dB

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

Supply Voltage	120 VAC +10%/-15%, 4.8 VA Max.
Indicators	Red, Green and Yellow Solid-State LED's
Audible Alarm	Field Adjustable From 77 to 97 dB @ 2 Feet
Enclosure	
TA Series	Polycarbonate
RA Series	NEMA 4 – Weather tight polycarbonate
Sensor Voltage	12 VAC or 12 VDC
Terminals	Size 6 Pan Head Screws with Captive Wire Clamping Plate
Temperature	-22°F to +150°F (-5.5°C to +65.5°C)
Sensitivity	0-26K Ohm Maximum Specific Resistance
Maximum Wire Run	1000 Feet (14 or 16 Gauge MTW or THHN Wire)
Conduit Connection	3/4" FNPT, PVC Material
Listings	
TA Series	U.L. 913 Intrinsically Safe, File # E44570
RA Series	U.L. 508 Motor Control, File # E138209

How To Order

Select Part Number based on switch logic and number of channels.

RA Series

Used for non-hazardous liquid monitoring applications.

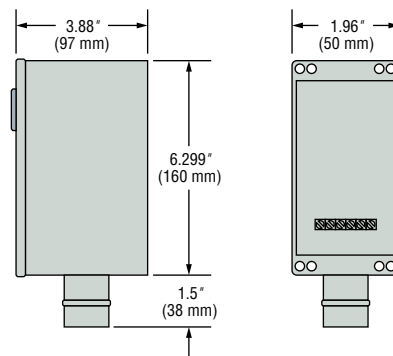
Interface Contacts	Part Number
N.O. Dry (Sensor Normally Dry)	RA-431A-0
N.C. Dry (Sensor Normally Wet)	RA-431B-0

TA Series

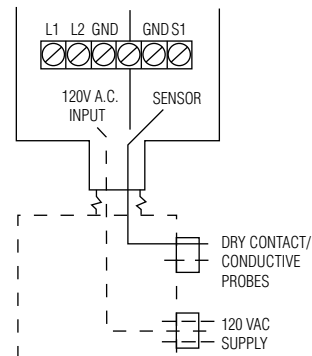
Intrinsically-safe for hazardous locations.

Interface Contacts	Number of Channels	Part Number
N.O. Dry (Sensor Normally Dry)	1	TA-731A-0
	2	TA-732A-0
N.C. Dry (Sensor Normally Wet)	1	TA-731B-0
	2	TA-732B-0

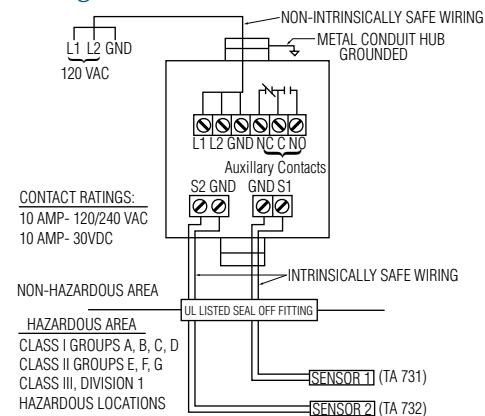
Dimensions



Wiring – RA Series



Wiring – TA Series



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.

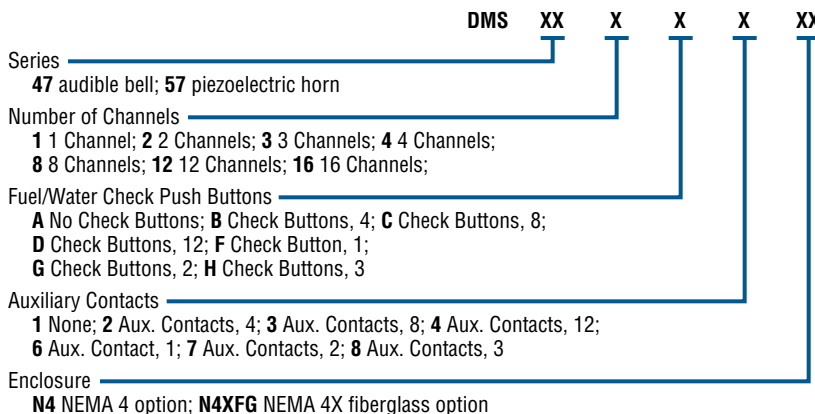
Specifications

Contact Design	SPDT (1 form C), one normally open, one normally closed
Contact Rating	120 VAC or 30 VAC, 10A, 1/3 h.p.
Sensitivity Range	0-50,000 ohms max. specific resistance
Remote Alarm Contact	Terminals; 7 N.C., 8 com, 9 N.O.
Primary Voltage	120 VAC (+10%/-15%) 60 Hz
Probe Voltage	Nominal 12 VAC @ 6ma RMS
Optional Auxiliary Contacts	One relay contact per channel
Optional "Check" Push Button Board*	Terminals: Size four (4) pan head screw with a clamping plate; will accept up to 14 AWG.
Enclosure Type	NEMA 3R; optional NEMA 4, Weather-proof; optional NEMA 4X, Fiberglass
Temperature	-40°F to +150°F (-40°C to +65.5°C)
Approval	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)

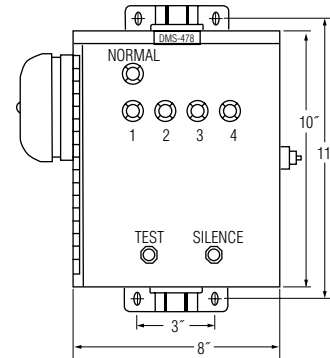
- Leak Detection
- Refill
- Overfill

Underground Fuel Storage Tanks (UST)

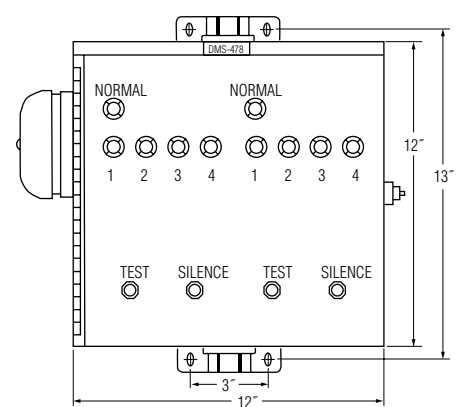
- High Level Alarm
- Piping Sumps
- Leak Detection
- Monitoring Well

Dimensions

4 Channel



8 Channel



See Our Interstitial Tank Monitoring Products on page A-22.



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 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.



WK-1 shown

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

NOTES

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows.

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

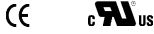
For specific flow setpoint switching, RotorFlow RFS type switches are one of the most reliable flow switches available. Setpoints are fully adjustable over the specified flow range. The dynamic operation of the rotor guards against jamming and false actuation.

RotorFlow Output Types

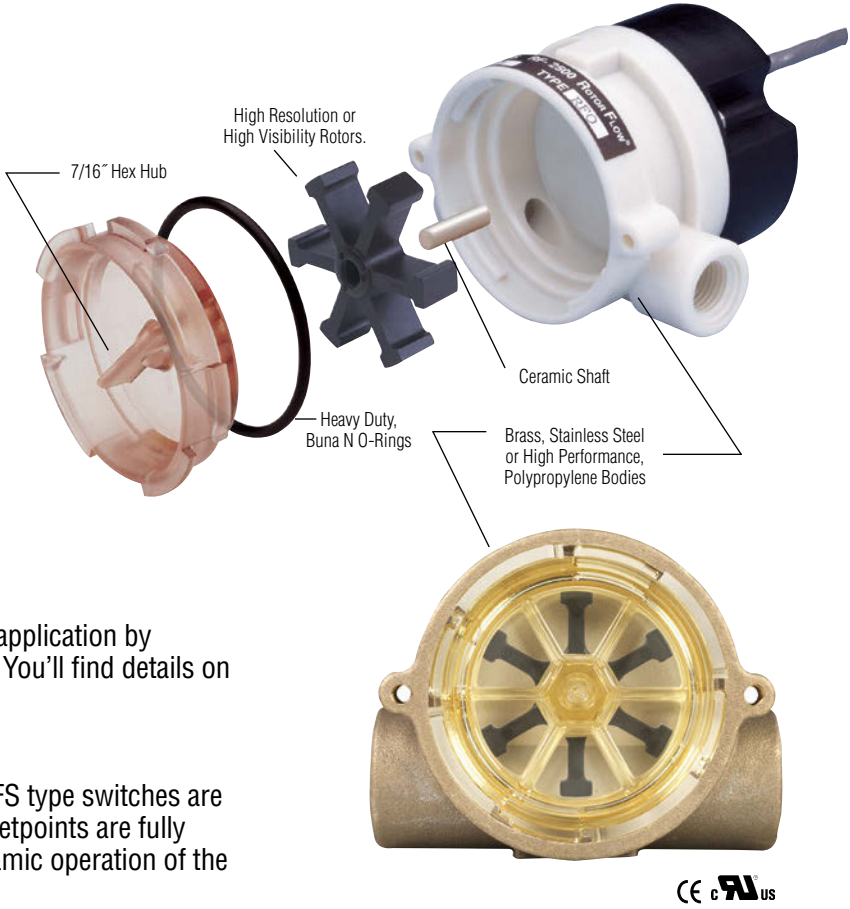
For flow rate monitoring or metering applications. RotorFlow RFO Type sensors provide a pulsed DC voltage output that is proportional to the rate of flow. The operating range of 4.5 to 24 VDC pulsed output is easily integrated into most digital logic units. RFA Type RotorFlow sensors provide a continuous 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 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

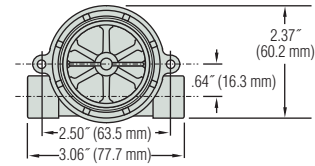
Wetted Materials	Brass, 316 Stainless Steel or Polypropylene (Hydrolytically Stable, Glass Reinforced)	
Body		
Rotor Pin	Ceramic	
Rotor	PPS Composite, Black	
Lens	Polysulfone	
O-Ring	Viton® (Alloy Bodies); Buna N (Polypropylene Body)	
Low Flow Adaptor	Glass Reinforced Polypropylene	
Operating Pressure, Maximum	200 PSIG (13.8 bar) @ 70°F (21°C), 100 PSIG (6.9 bar) Max. @ 212°F (100°C) ¹	
Brass or Stainless Steel Body		
Polypropylene Body	100 PSIG (6.9 bar) @ 70°F (21°C), 40 PSI (2.8 bar) Max. @ 180°F (82°C)	
Operating Temperature, Brass or Stainless Steel Body	-20°F to 212°F (-29°C to 100°C)	
Polypropylene Body	-20°F to 180°F (-29°C to 82°C)	
Electronics	150°F (65°C) Ambient	
Viscosity, Maximum	200 SSU	
Input Power	24 VDC or 115 VAC	
Relay Contact Ratings (SPDT)	1 Amp, 24 VDC Resistive; 0.3 Amp, 110 VAC	
Current Consumption	No Load	Load (Relay Energized)
24 VDC	20mA	35mA
115 VAC	45mA	95mA
Repeatability	2% Maximum Deviation	
Set Point Accuracy (Factory Set)	± 5%	
Set Point Differential	15% Maximum	
Electrical Termination	20 AWG PVC-Jacketed, 24" Cable. Color Codes: Red = +VAC/VDC, Black = Ground, White = N.O. Contact, Brown = N.C. Contact, Green = Common	

Note:

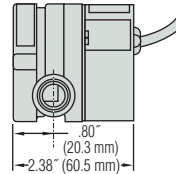
1. Optional pulsed output available with RFS. Consult factory.

Dimensions

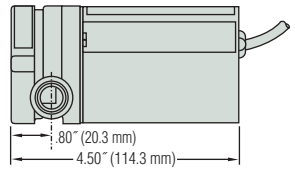
Polypropylene Bodies



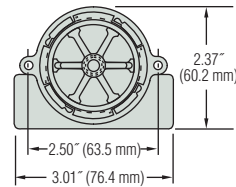
VDC



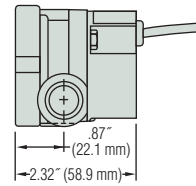
VAC



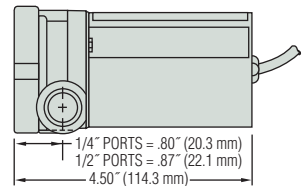
Brass and Stainless Steel Bodies - .25" and .50" Port



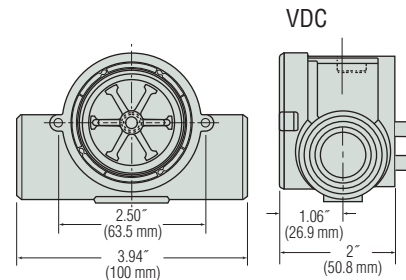
VDC



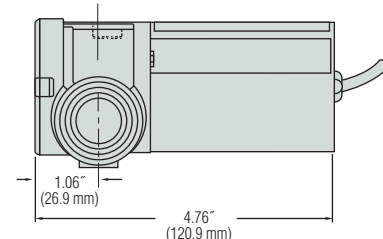
VAC



Brass and Stainless Steel Bodies - .75" and 1.00" Port



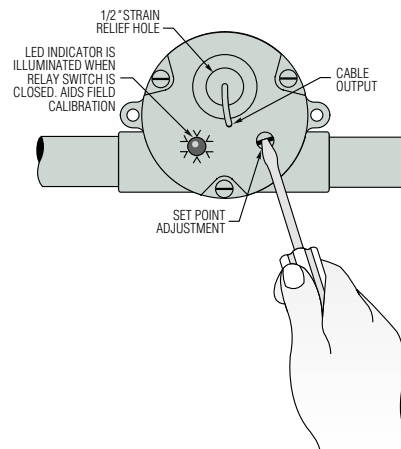
VAC



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	155425 ⚡		
				115 VAC	155876 ⚡		
	.50"	1.5 to 12.0	4.0 to 20.0	24 VDC	155485 ⚡		
				115 VAC	155886 ⚡		
Brass	.25"	0.1 to 1.0	0.5 to 5.0	24 VDC	156265 ⚡		
				115 VAC	156266 ⚡		
	.50"	1.5 to 12.0	4.0 to 20.0	24 VDC	156268 ⚡		
				115 VAC	156269 ⚡		
	.75"	–	5.0 to 30.0	24 VDC	180395 ⚡		
				115 VAC	180396 ⚡		
	1.00"	–	8.0 to 60.0	24 VDC	181688 ⚡		
				115 VAC	181689 ⚡		
9/16-18**				0.1 to 1.0	0.5 to 5.0	24 VDC	165073 ⚡
						115 VAC	165074 ⚡
.50"	1.5 to 12.0	4.0 to 20.0	24 VDC	165077 ⚡			
			115 VAC	165078 ⚡			
			.75"	–	5.0 to 30.0	24 VDC	181691 ⚡
						115 VAC	181692 ⚡
1.00"	–	8.0 to 60.0	24 VDC	181693 ⚡			
			115 VAC	181694 ⚡			

* With use of Low Flow Adapter supplied. See Page F-8 for more information.
 ** Straight thread with O-ring seal.

⚡ – Stock Items.

Special Requirements:

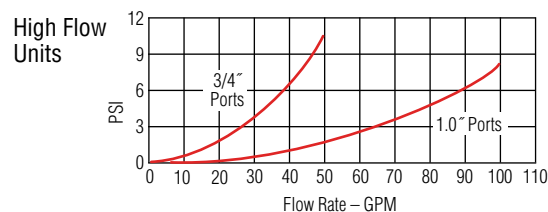
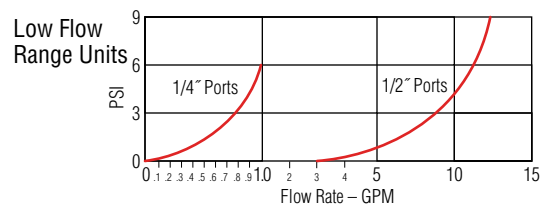
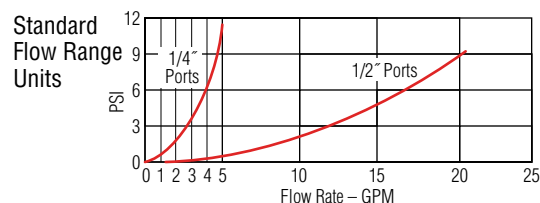
GEMS caters to OEM needs with special configurations for potable water and enhanced chemical capabilities. Consult factory for further details.

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

Wetted Materials	
Body	Brass, 316 Stainless Steel or Polypropylene (Hydrolytically Stable, Glass Reinforced)
Rotor Pin	Ceramic
Rotor	PPS Composite, Black
Lens	Polysulfone ¹
O-Ring	Viton® (Alloy Bodies); Buna N (Polypropylene Body)
Low Flow Adaptor	Glass Reinforced Polypropylene
Operating Pressure, Maximum	Optional SS Face Plate 500 PSIG
Brass or Stainless Steel Body	200 PSIG (13.8 bar) @ 70°F (21°C), 100 PSI (6.9 bar) Max. @ 212°F (100°C) ¹
Polypropylene Body	100 PSIG (6.9 bar) @ 70°F (21°C), 40 PSI (2.8 bar) Max. @ 180°F (82°C)
Operating Temperature,	
Brass or Stainless Steel Body	-20°F to 212°F (-29°C to 100°C)
Polypropylene Body	-20°F to 180°F (-29°C to 82°C)
Electronics	150°F (65°C) Ambient
Viscosity, Maximum	200 SSU
Input Power	4.5 VDC to 24 VDC
Output Signal	4.5 VDC to 24 VDC Pulse. (Sourcing) Pulse Rate Dependent on Flow Rate, Port Size and Range.
Current Consumption	8 mA, No Load
Current Source Output, Max.	70 mA
Frequency Output Range	15 Hz (Low Flow) to 225 Hz (High Flow)
Accuracy	See Table Below
Electrical Termination	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%)	155421 ⚡
	.50"	1.5 to 12.0 (±7.0%)	4.0 to 20.0 (±15.0%)	155481 ⚡
Brass	.25"	0.1 to 1.0 (±7.0%)	0.5 to 5.0 (±7.0%)	156261 ⚡
	.50"	1.5 to 12.0 (±7.0%)	4.0 to 20.0 (±15.0%)	156262 ⚡
	.75"	—	5.0 to 30.0 (±15.0%)	194761 ⚡
	1.00"	—	8.0 to 60.0 (±15.0%)	194762 ⚡
Stainless Steel	9/16"~18**	0.1 to 1.0 (±7.0%)	0.5 to 5.0 (±7.0%)	165071
	.50"	1.5 to 12.0 (±7.0%)	4.0 to 20.0 (±15.0%)	165075 ⚡
	.75"	—	5.0 to 30.0 (±15.0%)	194763
	1.00"	—	8.0 to 60.0 (±15.0%)	194764 ⚡

⚡ – Stock Items.

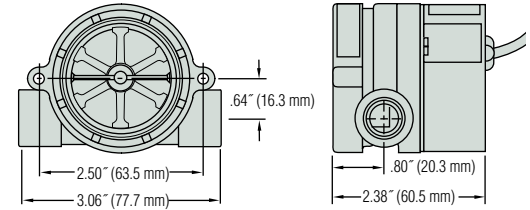


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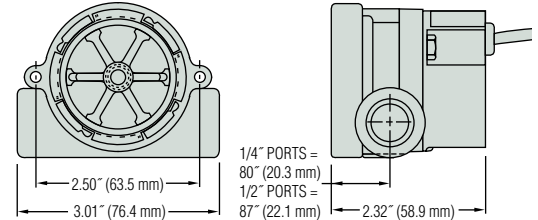


Dimensions

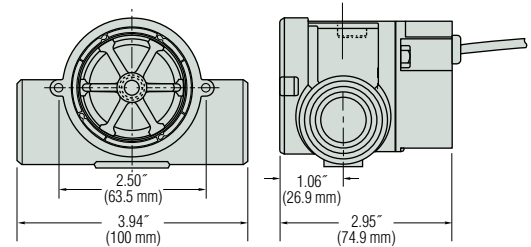
Polypropylene Bodies



Brass and Stainless Steel Bodies - .25" and .50" Ports



Brass Bodies – .75" and 1.00" NPT Ports



High Resolution

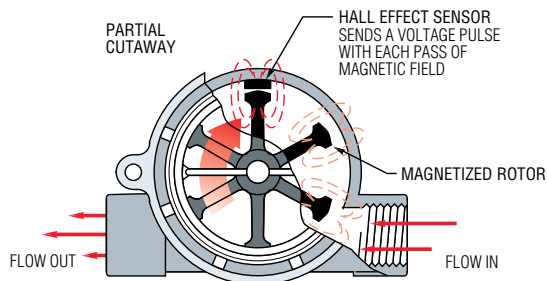
Black Rotor
PPS composite. Each of the six rotor arms is magnetized. A PTFE loaded bushing ensures long life.



Note: Improved accuracy can be achieved by calibrating the individual RFO unit.

*With use of Low Flow Adaptor supplied. See Page F-8 for more information.
**Straight thread with O-ring seal.

Operating Principle



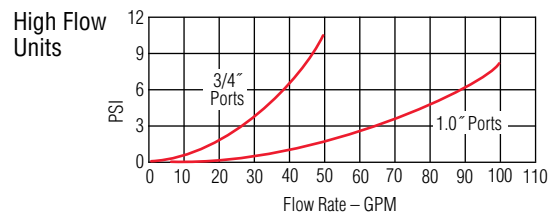
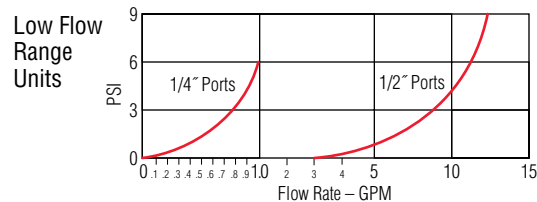
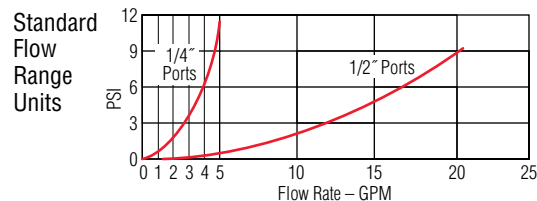
1. As liquid passes through the RotorFlow body, the magnetic rotor spins at a rate proportional to flow. This causes a series of magnetic fields (the rotor vanes) to excite the Hall Effect sensor, producing a series of voltage pulses.
2. The output pulses (RFO) are at the same voltage level as the input (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

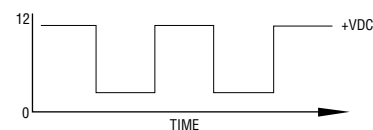
Pressure Drop-Typical



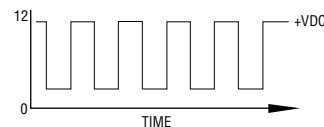
Signal Output

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

Wetted Materials	
Body	Brass, 316 Stainless Steel or Polypropylene (Hydrolytically Stable, Glass Reinforced)
Rotor Pin	Ceramic
Rotor	PPS Composite, Black ¹
Lens	Polysulfone
O-Ring	Viton® (Alloy Bodies); Buna N (Polypropylene Body)
Low Flow Adaptor	Glass Reinforced Polypropylene
Operating Pressure, Maximum	
Brass or Stainless Steel Body	200 PSIG (13.8 bar) @ 70°F (21°C), 100 PSIG (6.9 bar) @ 212°F (100°C) ²
Polypropylene Body	100 PSIG (6.9 bar) @ 70°F (21°C), 40 PSI (2.8 bar) Max. @ 180°F (82°C)
Operating Temperature	
Brass or Stainless Steel Body	-20°F to 212°F (-29°C to 100°C)
Polypropylene Body	-20°F to 180°F (-29°C to 82°C)
Electronics	150°F (65°C) Ambient
Viscosity, Maximum	200 SSU
Input Power	24 VDC, ±10%
Output Signal	0-10 VDC Analog Signal @ 1mA, Max.
Current Consumption	25 mA, Max.
Current Source Output, Max.	10 mA
Accuracy	See Table Below
Electrical Termination	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%)	230206 ⚡	0.5 to 5.0 (±7.0%)	230205 ⚡
	.50"	1.5 to 12.0 (±7.0%)	230207 ⚡	4.0 to 20.0 (±15.0%)	230201 ⚡
Brass	.25"	0.1 to 1.0 (±7.0%)	230209 ⚡	0.5 to 5.0 (±7.0%)	230202
	.50"	1.5 to 12.0 (±7.0%)	230210 ⚡	4.0 to 20.0 (±15.0%)	230203
	.75"	—	—	5.0 to 30.0 (±10.0%)	230212 ⚡
	1.00"	—	—	8.0 to 60.0 (±15.0%)	230214
Stainless Steel	9/16"-18	0.1 to 1.0 (±7.0%)	230211	0.5 to 5.0 (±7.0%)	230204
	.50"	1.5 to 12.0 (±7.0%)	230216	4.0 to 20.0 (±15.0%)	230208
	.75"	—	—	5.0 to 30.0 (±10.0%)	230213
	1.00"	—	—	8.0 to 60.0 (±15.0%)	230215

⚡ – Stock Items.

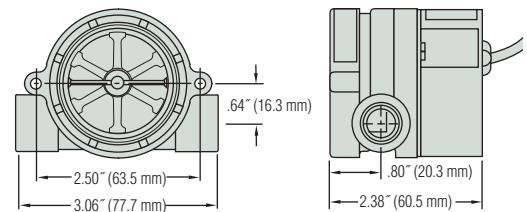


Typical Applications

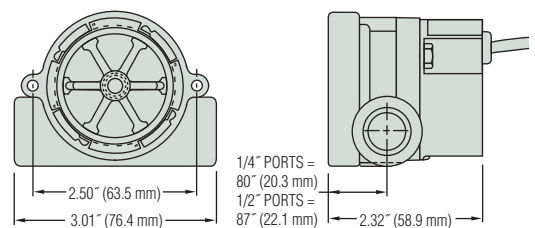
- Water Purification/Dispensing Systems
- Chemical Metering Equipment
- Lasers and Welders
- Water Injection Systems
- Semiconductor Processing Equipment
- Chillers and Heat Exchangers

Dimensions

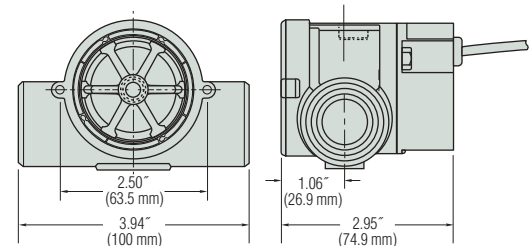
Polypropylene Bodies



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

Wetted Materials	
Body	Brass, 316 Stainless Steel or Polypropylene (Hydrolytically Stable, Glass Reinforced)
Rotor Pin	Ceramic
Rotor	High Visibility Orange, Molded Nylon
Lens	Polysulfone
O-Ring	Viton® (Brass Body); Buna N (Polypropylene Body)
Low Flow Adaptor	Glass Reinforced Polypropylene
Operating Pressure, Brass or Stainless Steel Body	
	100 PSIG (7 bar) @212°F (100°C) 200 PSIG (13.8 bar) Max. @ 70°F (21°C)
Polypropylene Body	
	100 PSIG (6.9 bar) at 70°F (21°C), 40 PSI (2.8 bar) Max. @ 180°F (82°C)
Operating Temperature, Brass or Stainless Steel Body	
	-20°F to 212°F (-29°C to 100°C)
Polypropylene Body	
	-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	155420 ⚡
	.50"	1.5 to 12.0	4.0 to 20.0	155480 ⚡
Brass	.25"	0.1 to 1.0	0.5 to 5.0	142541 ⚡
	.50"	1.5 to 12.0	4.0 to 20.0	142542 ⚡
	.75"	—	5.0 to 30.0	180392 ⚡
	1.00"	—	8.0 to 60.0	181681 ⚡
Stainless Steel	9/16" - 18**	0.1 to 1.0	0.5 to 5.0	174596
	.50"	1.5 to 12.0	4.0 to 20.0	173138 ⚡
	.75"	—	5.0 to 30.0	181682
	1.00"	—	8.0 to 60.0	181683

* With use of Low Flow Adapter supplied. See Page F-8 for more information.

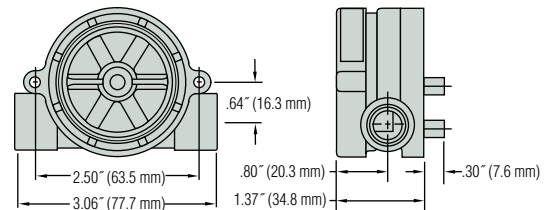
** Straight thread with O-ring seal.

⚡ – Stock Items.

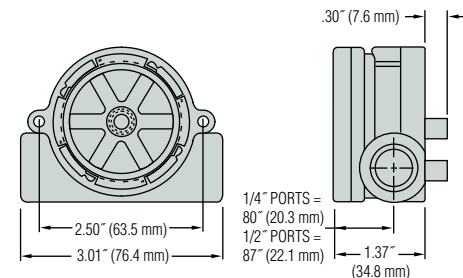


Dimensions

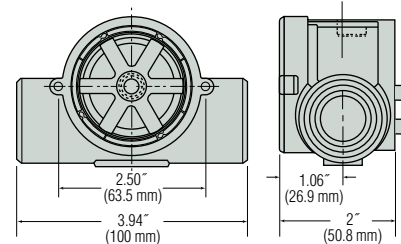
Polypropylene Bodies



Brass and Stainless Steel Bodies - .25" and .50" Ports



Brass Body – .75" and 1.00" Ports



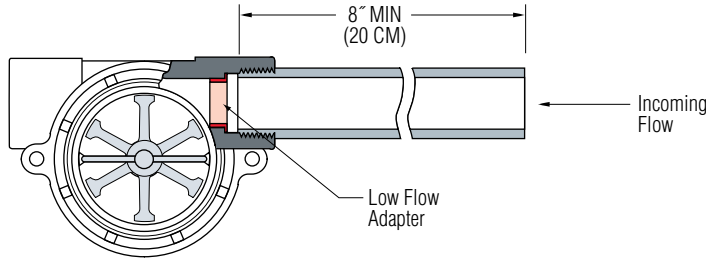
High Visibility Orange Rotor
Constructed of Molded Nylon for good general purpose compatibility with a wide range of fluids. Offers high visibility.



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.

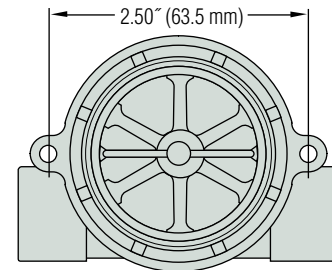
Low Flow Applications

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®	157186	157187

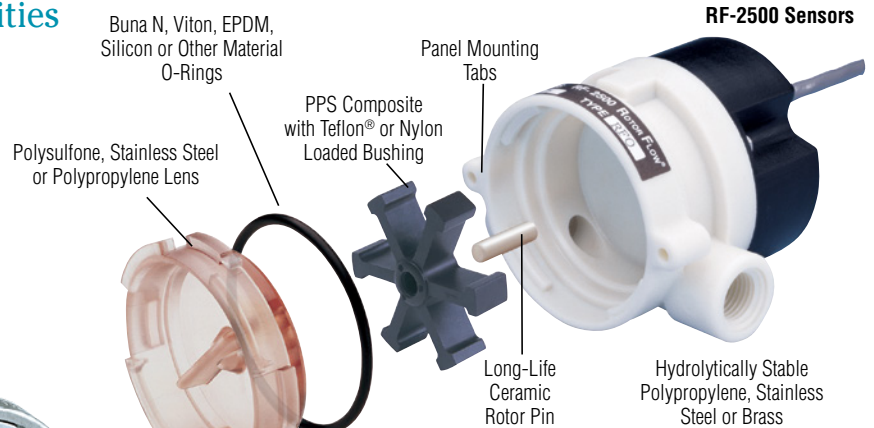
⚡ – Stock Items.

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-110M Series – TurboFlow® Economical Flow-Rate Sensors

- ▶ Low Cost Plus High Accuracy ±3% of Reading
- ▶ Measures Low Liquid Flow Rates of 0.53 to 6.6 GPM (2 to 25 LPM)
- ▶ Brass Design For Robust Applications

Gems Hall Effect turbine flow rate sensor is ideal for OEM applications involving low flow liquid monitoring. This brass-bodied version of our FT-110 series provides additional pressure capability over the engineered plastic models—up to 350 psig (24 bar). 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

Wetted Materials	
Body	Brass
Turbine	Nylon 12 Composite
Bearings	PTFE/15% Graphite
Operating Pressure	350 PSIG (24 bar)
Burst Pressure	2500 PSIG (172 bar)
Operating Temperature	-4°F to 212°F (-20°C to 100°C)
Viscosity	32 to 81 SSU (.8 to 16 Centistokes)
Filter	<50 Microns
Input Power	5 to 24 VDC @ 8mA
Output (Hz)	NPN Sinking Open Collector @ 20mA Maximum Leakage Current 10µA (Pull-Up Resistor Required)
Accuracy	±3% of Reading
Repeatability	0.5% of Full Scale
Electrical Connection	DIN 9.4mm Spacing* 24 AWG 3 ft. Cable
Inlet/Outlet Ports	3/8" NPT, G3/8 Male

* Mating DIN ordered separately.

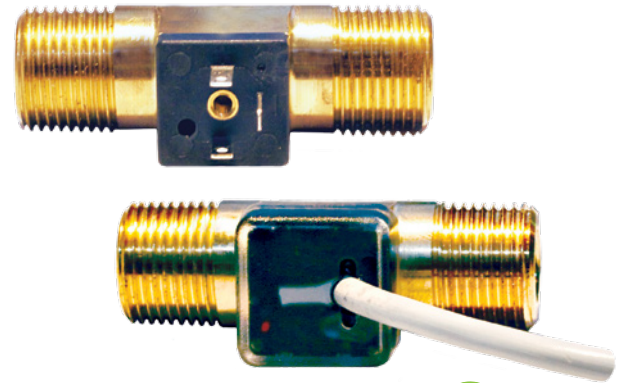
How To Order – Standard Models

Specify Part Number based on flow range.

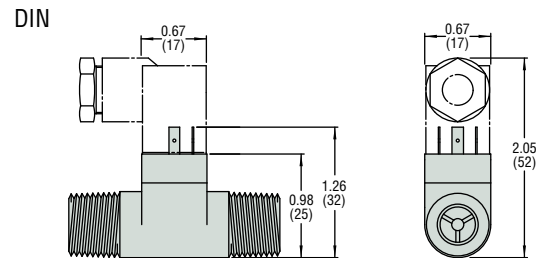
Flow Range		Pulses per		Frequency Output	3/8" NPT Part Number		G3/8 European Thread	
GPM	LPM	Gallon	Liter		Cable	DIN	Cable	DIN
.53-2.1	2-8	15900	4200	140-560 Hz	245148-C	245148-D	245150-C	245150-D
.79-6.6	3-25	3800	1000	50-417 Hz	245149-C	245149-D	245151-C	245151-D

FT-110M Accessories

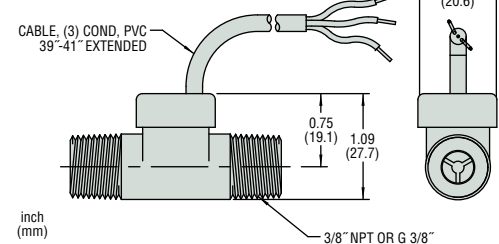
Description	Part Number
1 Meter DIN PVC Cable Assembly with 10K Pull-Up Resistor	218572
Mating DIN Connector	212404



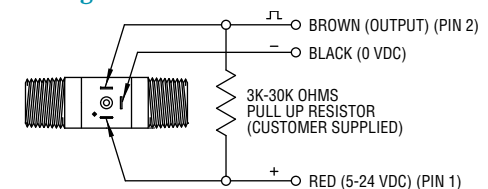
Dimensions



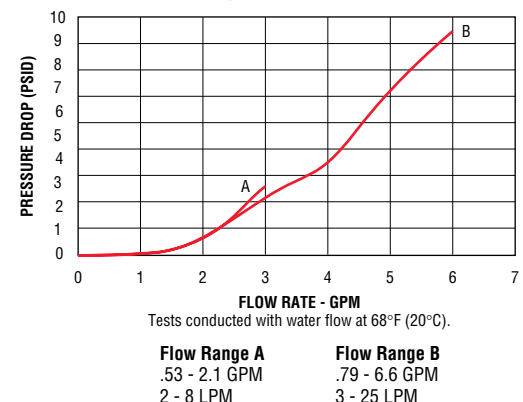
Cable



Wiring



Pressure Drop—Typical



FT-110 Series – TurboFlow® Economical Flow-Rate Sensors

- ▶ Low Cost Plus High Accuracy $\pm 3\%$ of Reading
- ▶ Measures Low Liquid Flow Rates of 0.13 to 9.2 GPM (0.5 to 35 LPM)
- ▶ Lightweight Plastic Design Enables Mounting in any Position
- ▶ O-ring Design for Manifold Mounting

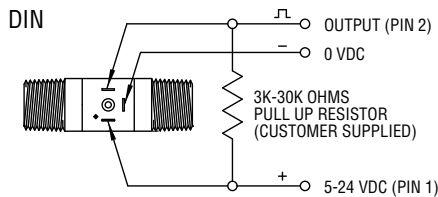
Gems Hall Effect turbine flow rate sensor is ideal for OEM applications involving low flow liquid monitoring. The low cost coupled with 1/2% repeatability makes it an ideal candidate for replacing dispensing timer systems. Unlike existing timing systems, turbine technology is not influenced by changes in system pressure caused by aging filters. The sensor's standard power and output specifications make it easy to retrofit to existing controllers.

Specifications

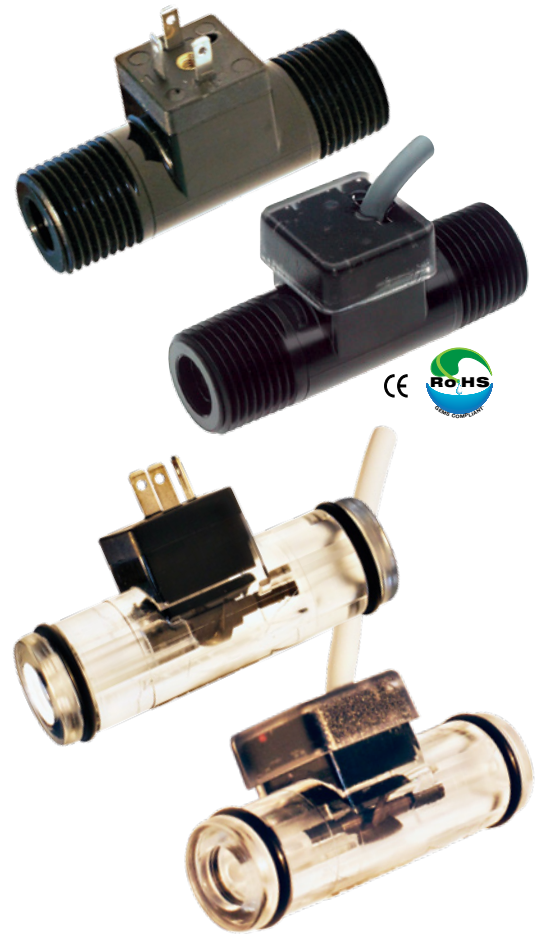
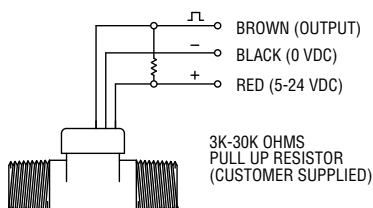
Wetted Materials	
Body	Nylon 12
Turbine	Nylon 12 Composite
Bearings	PTFE/15% Graphite
Operating Pressure	200 PSIG (13.7 bar)
Burst Pressure	2500 PSIG (172 bar)
Operating Temperature	-4°F to 212°F (-20°C to 100°C)
Viscosity	32 to 81 SSU (.8 to 16 Centistokes)
Filter	<50 Microns
Input Power	5 to 24 VDC @ 8mA
Output (Hz)	NPN Sinking Open Collector @ 20mA Maximum Leakage Current 10 μ A (Pull-Up Resistor Required)
Accuracy	$\pm 3\%$ of Reading
Repeatability	0.5% of Full Scale
Electrical Connection	DIN 9.4mm Spacing* 24 AWG 3 ft. Cable
Inlet/Outlet Ports	3/8" NPT Male G3/8 Male 17mm Tube O-Ring

* Mating DIN ordered separately.

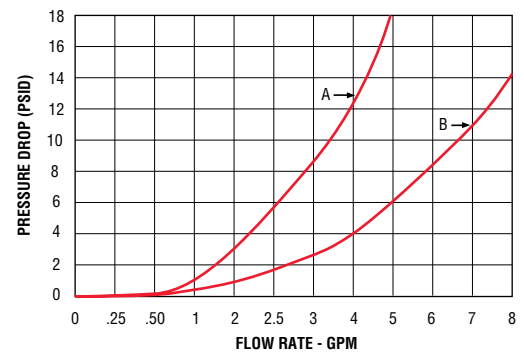
Wiring



Cable



Pressure Drop—Typical

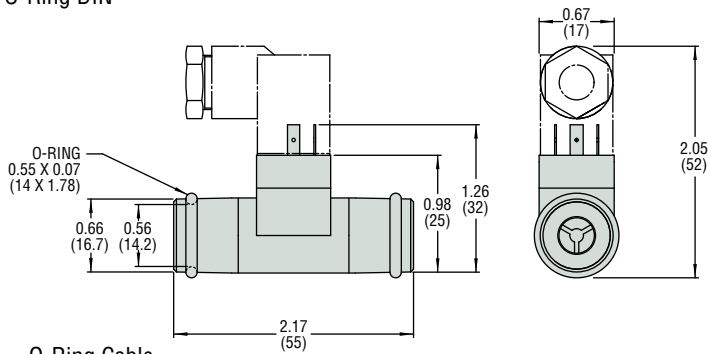


Tests conducted with water flow at 68°F (20°C).

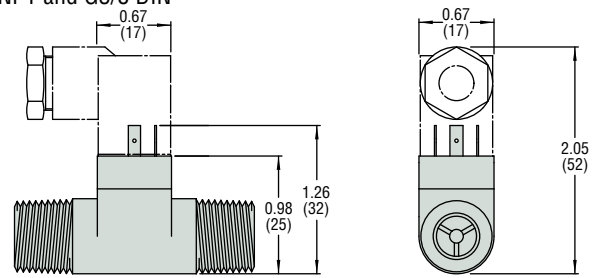
Flow Range A	Flow Range B
.13 - 2.6 GPM	.26 - 9.2 GPM
.5 - 10 LPM	1 - 35 LPM

Dimensions

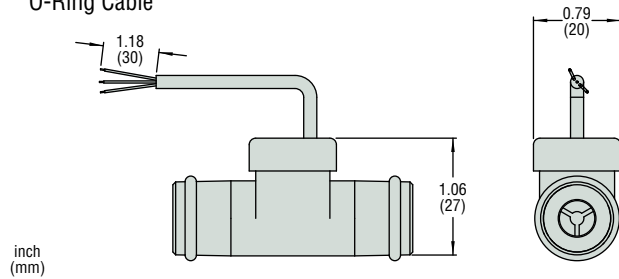
O-Ring DIN



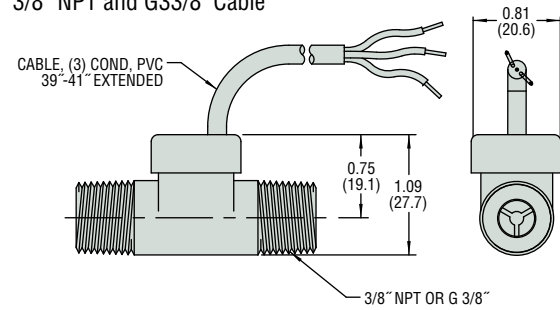
3/8" NPT and G3/8 DIN



O-Ring Cable



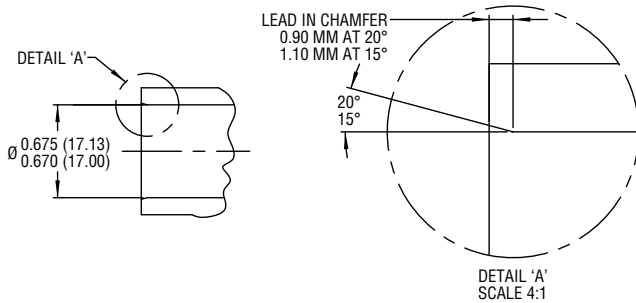
3/8" NPT and G3/8 Cable



inch
(mm)

Installation: Bore Preparation For O-Ring Port Version

Installation Bore in accordance with ISO 3601.



How To Order – Standard Models

Specify Part Number based on flow range.

Flow Range		Pulses per		Frequency Output	3/8" NPT Part Number		O-Ring Part Number		G3/8 European Thread P/N	
GPM	Liters/m	Gallon	Liter		Cable	DIN	Cable	DIN	Cable	DIN
.13-1.3	.5-5	26200	6900	58-575 Hz	173931-C	173931-D	244421-C	244421-D	173936-C	173936-D
.13-2	.5-7.5	17800	4700	39-588 Hz	173933-C	173933-D	244423-C	244423-D	173938-C	173938-D
.26-2.6	1-10	12500	3300	55-550 Hz	173932-C	173932-D	244422-C	244422-D	173937-C	173937-D
.26-4	1-15	8300	2200	37-550 Hz	173934-C	173934-D	244424-C	244424-D	173939-C	173939-D
.26-6.6	1-25	3800	1000	16.7-416 Hz	173935-C	173935-D	244425-C	244425-D	173940-C	173940-D
.53-9.2	2-35	2840	750	25-438 Hz	234265-C	234265-D	244426-C	244426-D	234266-C	234266-D

FT-110 Accessories

Consult factory for special customized OEM versions.

Description	Part Number
1 Meter DIN PVC Cable Assembly with 10K Pull-Up Resistor	218572
Mating DIN Connector	212404

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

Wetted Materials	
Body	Nylon 12 (Grilamid TR55)
Turbine	Nylon 12 Composite
Bearings	PTFE/15% Graphite
Operating Pressure	350 PSI (24 bar)
Burst Pressure	1400 PSI (97 bar)
Flow Range	.026- 65 gallons/minute 0.1-2.5 liters/minute 3.4-84.5 ounces/minute
Pulses	83,200 per gallon 22,000 per liter 650 per ounce
Frequency Output	36.6-917 Hz
Operating Temperature	-4°F to 212°F (-20°C to 100°C)
Viscosity	32 to 70 SSU (.8 to 16 Centistokes)
Filter	<50 Microns
Input Power	5 to 24 VDC
Output (Hz)	NPN Sinking Open Collector @ 20mA Maximum Leakage Current 10 μ A (3K-30K Pull up resistor required)
Accuracy	$\pm 3\%$ of Reading
Repeatability	0.5% of Full Scale
Electrical Connection	9.4mm Spacing 3-pole DIN Connector (1" high)
Inlet/Outlet Ports	1/4" NPT (1/4" G Male also available)

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

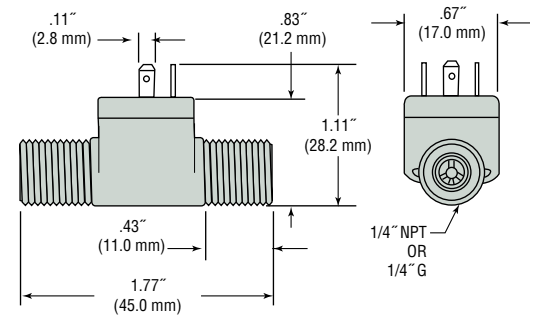
⚡ – Stock Items.

Electrical Connection

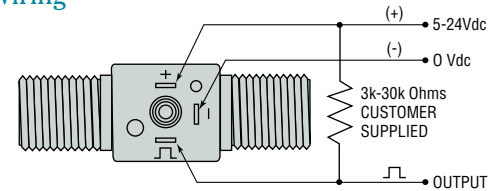
Description	Part Number
1 meter DIN PVC Cable Assembly with 10K pull-up resistor	218572
Mating DIN Connector	212404



Dimensions



Wiring

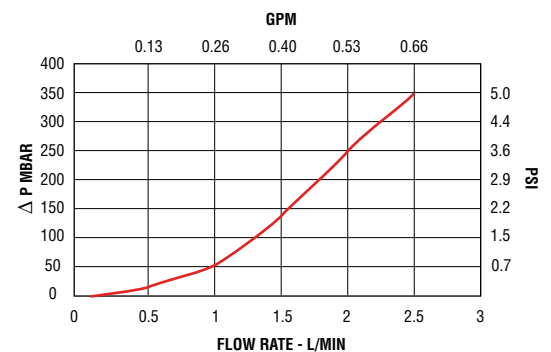


Pin Code: 1 = Output
2 = Supply
4 = Common

For Mating DIN Connector – P/N 212404

Function	DIN Termination
V+	1
-	⊕
Output	2

Pressure Drop—Typical



FT-330 Series – NSF Approved Materials

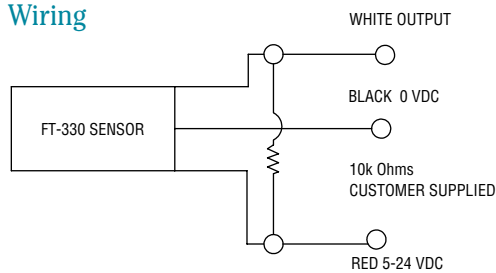
- ▶ High Accuracy: $\pm 2\%$ of reading
- ▶ High repeatability: $\pm 0.5\%$ of reading
- ▶ Overmolded electronics with integral cable strain reinforcement
- ▶ Measures flow rates from .2 to 4 GPM
- ▶ Lightweight plastic design for multiple mounting positions

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

Materials	
Body	Glass Reinforced PPO (Noryl)
Turbine	PA Composite (Nylon)
Axle	316 Stainless Steel
Bearings	Delrin® (Polyoxymethylene, POM)
Inlet/Outlet Ports	3/8" NPT Male
Pressure	
Operating	200 PSIG
Burst	1000 PSIG
Operating Temperature	-4°F to 176°F (-20°C to 80°C)
Viscosity	32 to 81 SSU (1.8 to 16 Centistokes)
Recommended Filtration	< 50 Microns
Input Power	5 to 24 VDC @ 8mA
Output (Hz)	NPN Sinking Open Collector @ 25mA Maximum leakage current 10µA (5k to 30k Pull-Up Resistor Required)
Accuracy	$\pm 2\%$ of reading
Repeatability	$\pm 0.5\%$ of reading
Electrical Connection	3 ft PVC cable #22 AWG
Approvals	NSF Std. 61 listed, RoHS

Wiring



How To Order

Specify Part Number based on flow rate measuring capability.

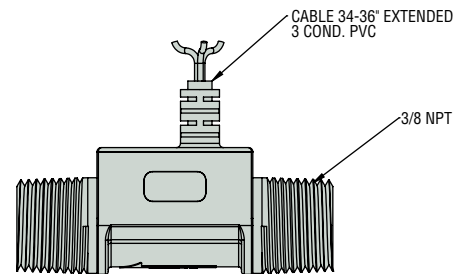
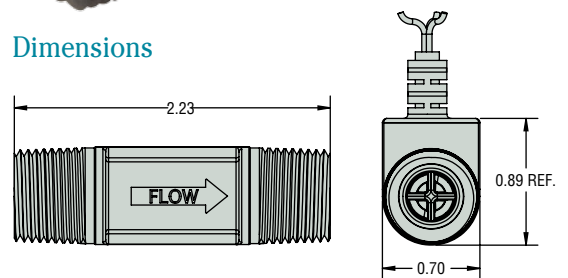
Flow Range		Frequency Out	Pulses Per Gallon	Pulses Per Liter	Part Number
GPM	LPM				
0.2 to 2	0.8 to 7.6	34 to 343 Hz	10,313	2724	226000 ⚡
0.4 to 4	1.5 to 15	29 to 343 Hz	4,994	1319	226100 ⚡

⚡ – Stock Items.

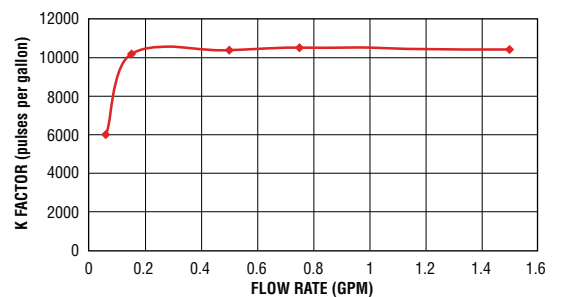


NSF approved

Dimensions

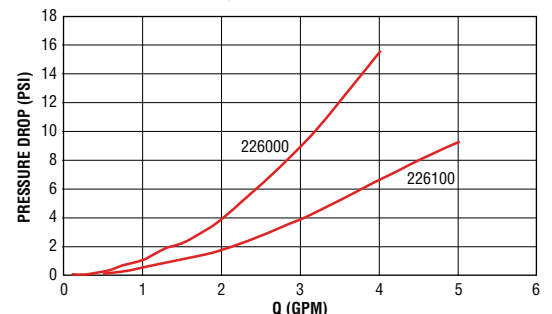


K-factor Chart* - Part Number 226000



* Consult factory for P/N 226100 K-factor chart

Pressure Drop—Typical



NOTES

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows.

Flow Switches

- ▶ Thermal Dispersion
- ▶ 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	
0.1 to 11 GPM	—	FS-600	
0.1 to 60 GPM	—	RFS-2500 Rotorflow ¹	Eng. Plastics & Alloys
0.15 to 2.0 GPM	—	FS-380	Alloys
0.25 to 2.0 GPM	—	FS-380P	Engineered Plastics
0.25 to 5.0 GPM	—	FS-500	
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	
0.5 to 20.0 GPM	1.0 to 160.0 SCFM	FS-10798	
0.5 to 100 GPM	—	FS-200	Alloys
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	

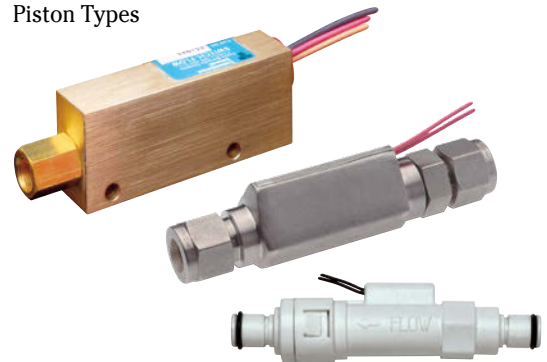
Note:
1. See Section E.

Contents	Page Start
Thermal Dispersion Type.....	G-2
Piston Type.....	G-4
Shuttle Type.....	G-18
Paddle Type	G-25

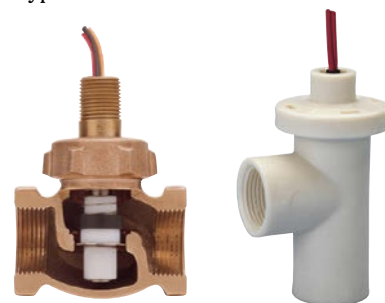
Thermal Dispersion Types



Piston Types



Shuttle Types



Paddle Types



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

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

Wetted Materials	
Probe	316L Stainless Steel
Flow Body	316 Stainless Steel
Operating Pressure (Max.)	363 PSIG (25 bar)
Operating Temperature	-14° F to 140°F (-10°C to 60°C)
Power on Delay Time	15 Seconds Max (Output On)
Response Time	10 Seconds Max.
Inlet/Outlet Ports	1/2", 3/4", 1", 1-1/2" NPT
Operating Voltage	24 Vdc or 24Vac +/- 15%
Current Consumption	Less than 50mA
Switch Contact Rating	30Vac@45mA, 42Vdc @65mA
Switch Logic	Normally Open
Ingress Protection	IP65
Set point Accuracy	15%
Set point Differential	20% (Max.)
Electrical Termination	M12 x 1 (4-Pin) (1 meter cable included)
Approvals	CE, RoHS

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 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.

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.

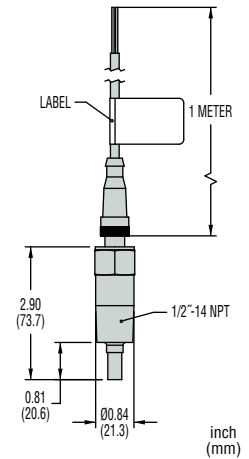
In order to make the sensor sense flow, it is necessary to heat one of the transistors in the probe. When power is applied, the tip of the probe is heated. As the fluid starts to flow, heat will be carried away from the sensor tip. Cooling of the first transistor is a function of how fast heat is conducted 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.



How To Order – Flow Switch Only

Specify Part Number based on Fluid Velocity for the FS-600 Series per the following chart.

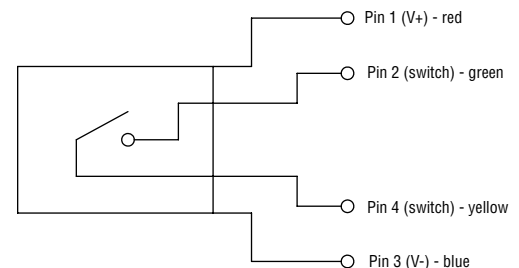
Fluid Velocity (cm/s)	Part Numbers
5	230500-5-05
10	230500-5-10
15	230500-5-15
20	230500-5-20
25	230500-5-25
30	230500-5-30
35	230500-5-35
40	230500-5-40
45	230500-5-45
50	230500-5-50
55	230500-5-55
60	230500-5-60



Notes:

- Standard calibration is in water with units in a horizontal position.
- Consult Gems for special applications.

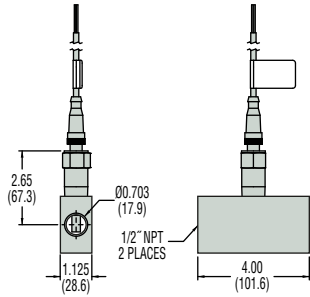
Wiring Diagram



How To Order – Flow Switch with Fitting

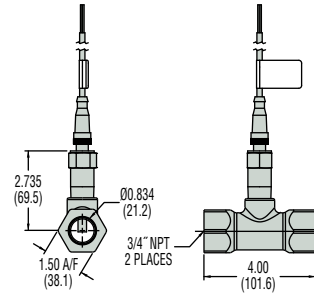
Specify Part Number based on Line Size and Flow Setting per the following chart.

1/2" NPT Port



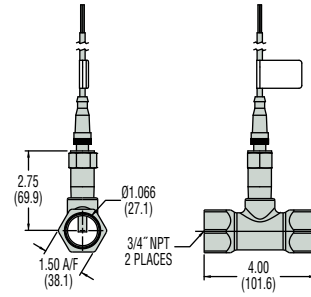
Flow Setting		Part Numbers
GPM	LPM	
0.13	0.48	230500-1-05
0.24	0.90	230500-1-10
0.35	1.31	230500-1-15
0.46	1.73	230500-1-20
0.57	2.14	230500-1-25
0.68	2.56	230500-1-30
0.79	2.98	230500-1-35
0.90	3.39	230500-1-40
1.01	3.81	230500-1-45
1.12	4.23	230500-1-50
1.23	4.64	230500-1-55
1.34	5.06	230500-1-60

3/4" NPT Port



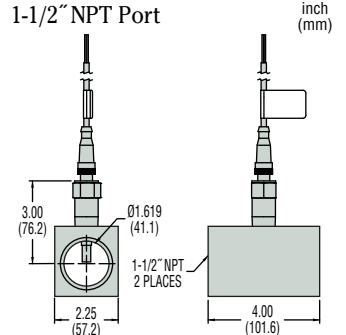
Flow Setting		Part Numbers
GPM	LPM	
0.35	1.31	230500-2-05
0.57	2.15	230500-2-10
0.79	2.99	230500-2-15
1.01	3.83	230500-2-20
1.23	4.67	230500-2-25
1.46	5.51	230500-2-30
1.68	6.00	230500-2-35
1.90	7.00	230500-2-40
2.12	8.00	230500-2-45
2.34	9.00	230500-2-50
2.57	10.00	230500-2-55
2.79	11.00	230500-2-60

1" NPT Port



Flow Setting		Part Numbers
GPM	LPM	
0.64	2.20	230500-3-05
0.97	3.20	230500-3-10
1.31	4.25	230500-3-15
1.65	5.30	230500-3-20
1.99	6.5	230500-3-25
2.32	7.5	230500-3-30
2.66	8.5	230500-3-35
3.00	9.5	230500-3-40
3.33	10.0	230500-3-45
3.67	12.0	230500-3-50
4.01	13.0	230500-3-55
4.34	14.0	230500-3-60

1-1/2" NPT Port



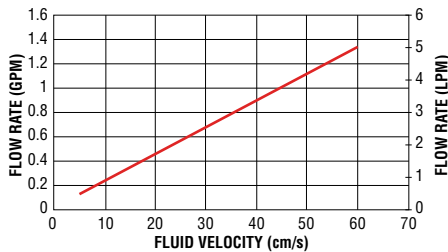
Flow Setting		Part Numbers
GPM	LPM	
1.48	5.50	230500-4-05
2.28	8.5	230500-4-10
3.07	11.6	230500-4-15
3.86	14.6	230500-4-20
4.66	17.6	230500-4-25
5.45	20.6	230500-4-30
6.0	22.7	230500-4-35
7.0	26.5	230500-4-40
8.0	30.3	230500-4-45
9.0	34.1	230500-4-50
10.0	37.9	230500-4-55
11.0	41.6	230500-4-60

Notes:

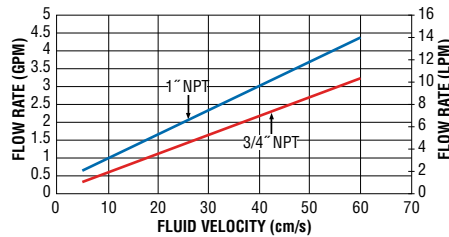
1. Setpoints based on water flow. Contact factory for setpoints of alternate media.
2. -5 through -60 = fluid velocity (cm/s)

Fluid Velocity vs. Flow Rate in GPM/LPM in Water

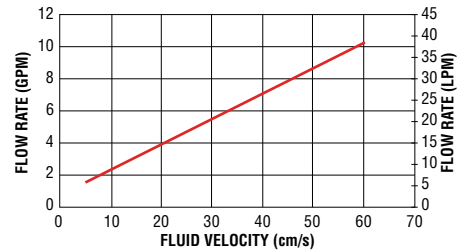
1/2" NPT Port



3/4" NPT and 1" NPT Ports



1-1/2" NPT Port



Cord Set Options — A 1 meter cord set is included with switch

Description	Part#
M12 cord Set-1 meter (Red 1, Green 2, Blue 3, Yellow 4) 22 AWG	557703-01M0
M12 cord Set-3 meter (Red 1, Green 2, Blue 3, Yellow 4) 22 AWG	557703-03M0
M12 cord Set-4 meter (Red 1, Green 2, Blue 3, Yellow 4) 22 AWG	557703-04M0
M12 cord Set-5 meter (Red 1, Green 2, Blue 3, Yellow 4) 22 AWG	557703-05M0

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...

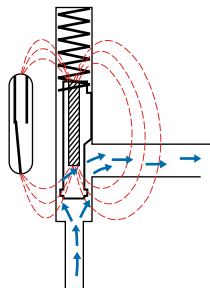
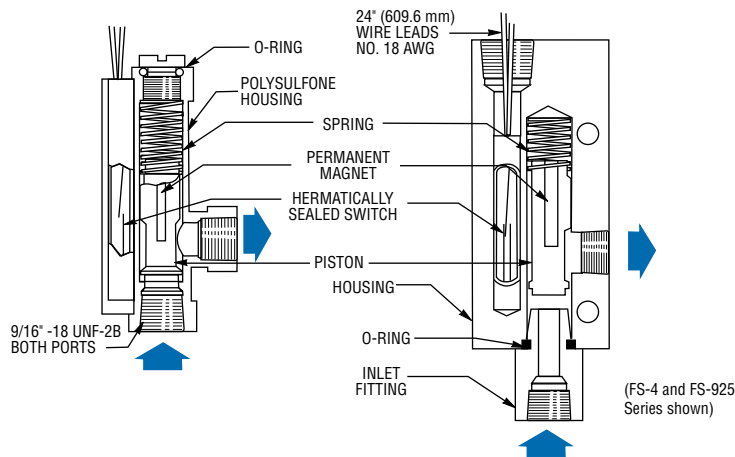
- Presses • Rotating Equipment • Conveyors • Machine Tools • Robotics

Ensure system integrity in processing and dispensing equipment on...

- Water Purifications and Filtering • X-Ray film Processing
- Beverage dispensing • Chemical additives • Gas sampling • Distilling

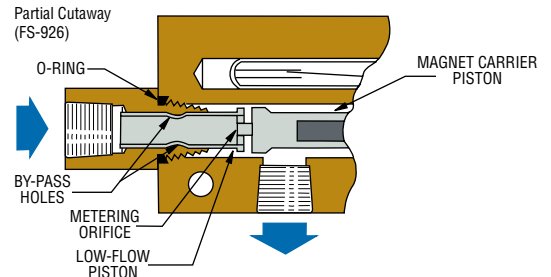
Design Data

General Operating Principles



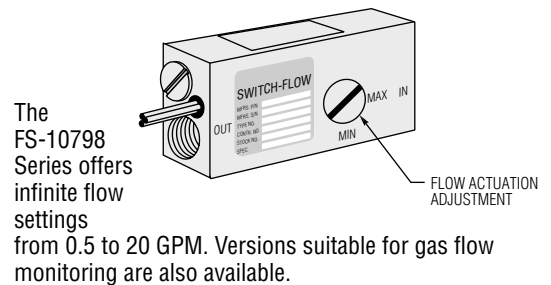
A piston, encapsulating a permanent magnet, is positioned in the flow path within the unit housing. When displaced by the pressure differential from fluid flow, this piston magnetically actuates a hermetically sealed reed switch (SPST or SPDT, depending on the series) within the unit. The piston metering 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.

Low-Flow Switches



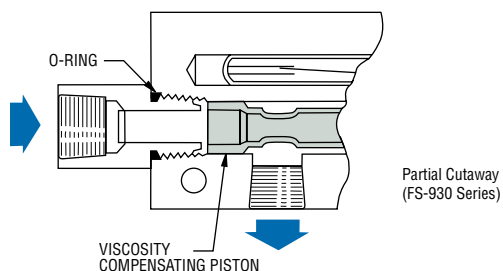
An additional, lap-fitting piston is used in GEMS FS-926 Series to accurately detect low-flow rates. Calibration is determined by one or more metering holes in the top of the low-flow piston, which regulates bypass flow, and therefore the actuation setting. When metered bypass flow is exceeded, the resultant 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



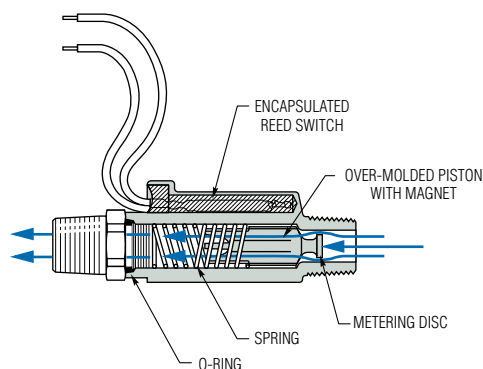
The FS-10798 Series offers infinite flow settings from 0.5 to 20 GPM. Versions suitable for gas flow monitoring are also available.

Viscosity Compensating Switches



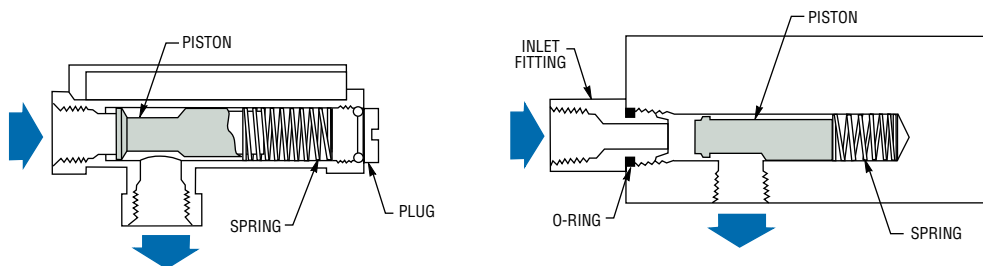
When temperatures of viscous fluids change, so do their flow properties. With viscosity lowered by increasing temperature, a greater flow is generally required to create actuation pressure differential. A unique patented piston within GEMS FS-930 Series switches accommodates these changes in fluid viscosity 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
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Molded Plastic Construction.....	G-6
FS-150 Series	
Straight-Through Flow Path, Ryton Material.....	G-7
FS-380 Series	
High Pressure Inline	G-8
FS-380P Series	
Inline – Plastic Flow	G-9
FS-480 Series	
Low Pressure Drop.....	G-10
FS-927 Series	
Miniature Brass Switches	G-11
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General Purpose.....	G-12
FS-926 Series	
Low Flow	G-12
FS-10798 Series	
Externally Adjustable	G-14
FS-930 Series	
Viscosity Compensating.....	G-16

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

Wetted Materials	
Housing and Piston	Ryton® R4
Spring	316 Stainless Steel
O-Ring	Viton®
Other Wetted Parts	
	Epoxy
Operating Pressure, Maximum	250 PSIG (17.2 bar) @ 70°F (21°C)
Operating Temperature	0°F to 225°F (-17°C to +107°C)
Set Point Accuracy	±15% Maximum
Set Point Differential	20% Maximum
Switch*	SPST or SPDT, 20 VA (SPDT: 240 VAC Max.)
Inlet/Outlet Ports	9/16" -18 UNF-2B Thread
Recommended Filtration	50 Microns or Better
Electrical Termination	
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.

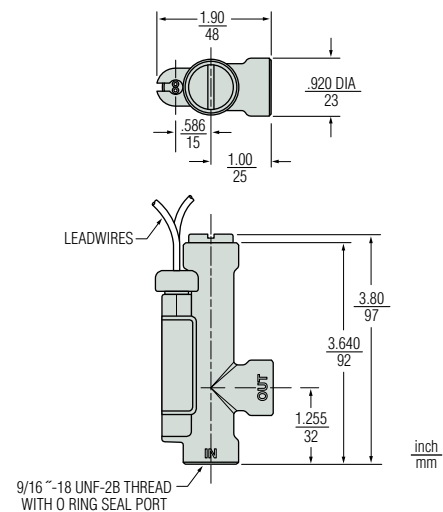
Material	Adapter Size	Part Numbers
Ryton®	1/8" NPT*	123028 ⚡
	1/4" NPT*	123029 ⚡
Polypropylene	1/4" NPT*	158602 ⚡
	1/2" Barb**	158603 ⚡

*Wrench flats provide for proper assembly.
** Accepts 1/2" I.D. flexible hose
⚡ – Stock Items.



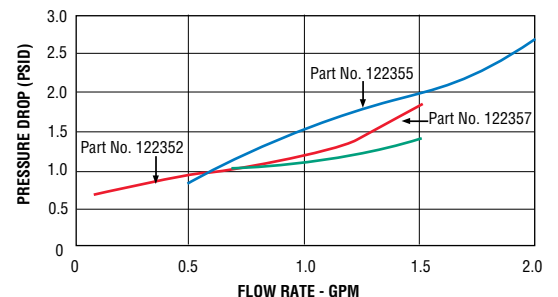
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File No. E31926
CSA Listed —
File No. LR30200

Dimensions

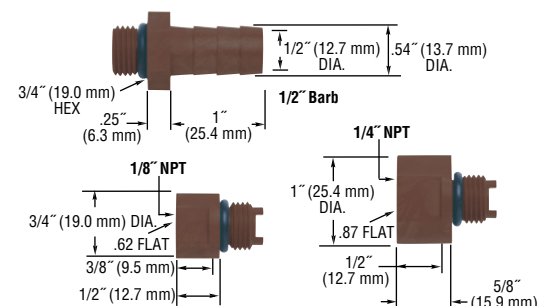


9/16" -18 UNF-2B THREAD WITH O RING SEAL PORT

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

Wetted Materials	
Housing	Polypropylene, Hydrolytically Stable, Glass Reinforced
Piston	Ryton® -R4, 316 Stainless Steel
O-Ring	Viton®
Spring	316 Stainless Steel
Operating Pressure, Maximum	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)
Operating Temperature	0°F to 212°F (-17.8°C to +100°C)
Set Point Accuracy	±15%
Set Point Differential	20% Maximum
Switch*	SPST, 20 VA
Inlet/Outlet Ports	1/2" NPT Male
Electrical Termination	1/4" Male Quick Connect Terminals (2)

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

How To Order – Standard Models

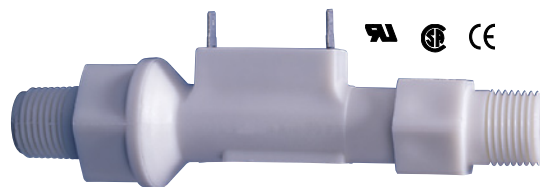
Specify Part Number based on flow setting and switch operation.

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.

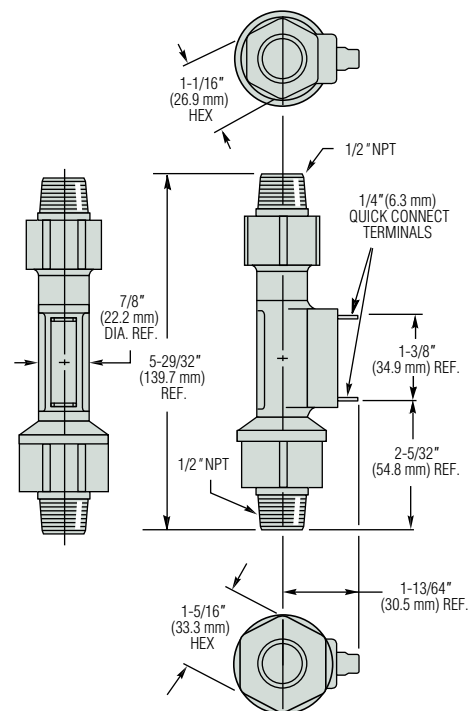


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 FILE NO. E31926
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 File No. LR30200



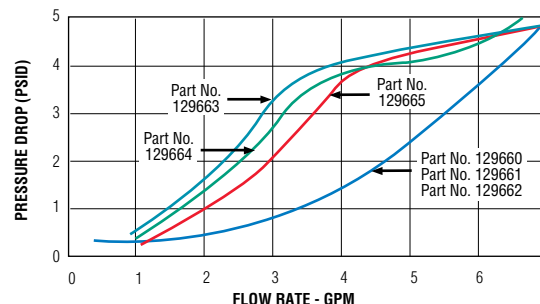
Patent #
4.996.396

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: Multiple
Primary Construction Material: Brass or Stainless Steel
Setting Type: Fixed

These rugged inline flow switches require 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.

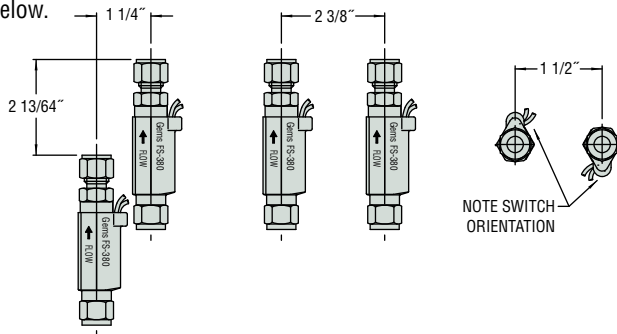
Specifications

Wetted Materials	
Housing	Brass or 316 Stainless Steel
Piston	PPS Composite, Epoxy
Spring	316 Stainless Steel
O-Ring	Fluorocarbon
Operating Pressure, Maximum	1500 PSI (107 bar); 500 PSI (34 bar) for 1/2" Barb Models
Operating Temperature	-20°F to +275°F (-28.8°C to +135°C)
Set Point Accuracy	±20% Maximum
Set Point Differential	20% Maximum
Switch*	SPST, 20VA, N.O. at no Flow
Electrical Termination	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.



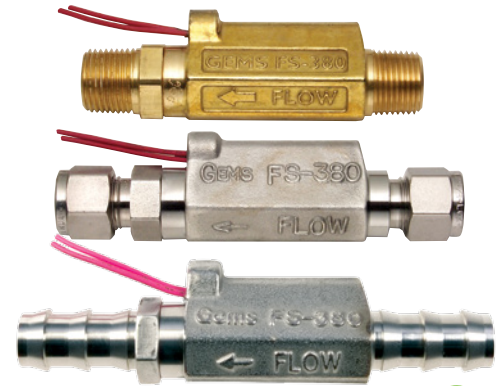
How To Order – Standard Models

Specify Part Number based on flow settings.

Flow Settings GPM ¹	Brass		Stainless Steel		
	1/2" NPT Male	3/8" NPT Male	3/8" NPT Male	3/8" Compression	1/2" Barb
0.15	—	181130 ⚡	193482 ⚡	212136	239693
0.25	192562 ⚡	168432 ⚡	179992 ⚡	177592 ⚡	239692
0.50	192563	168433 ⚡	179993 ⚡	177593	239691
1.00	192564 ⚡	168434 ⚡	179994 ⚡	177594 ⚡	239690
1.50	192566	168435	179995 ⚡	177595 ⚡	239689
2.00	192567	178353 ⚡	179996	225525	239688

⚡ – Stock Items.

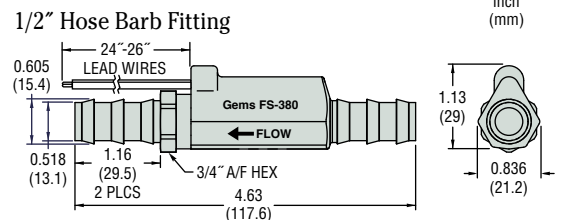
Note:
 1. Flow settings are calibrated using water @ 70°F on increasing flow with units in horizontal position. Consult factory for other fluid compatibility.



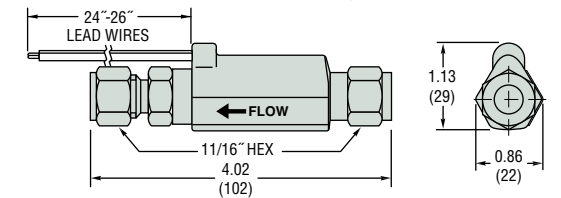
CE cULUS U.L. Recognized File No. E31926



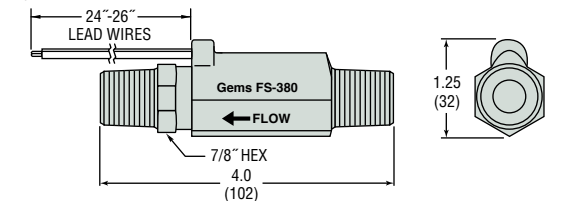
Dimensions



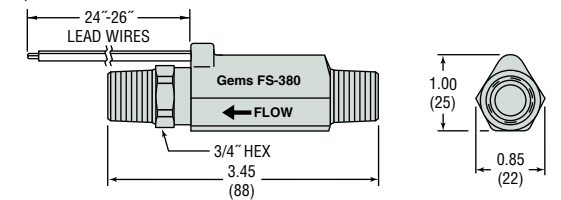
3/8" Tube End Compression Fitting



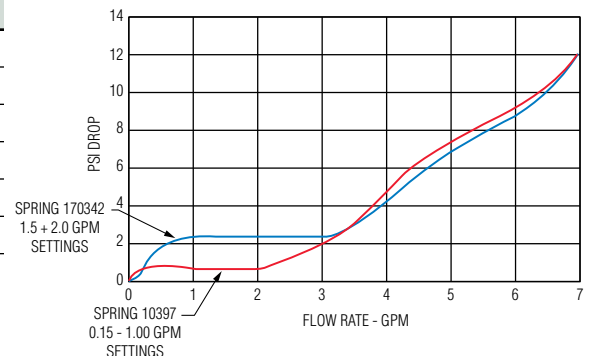
1/2" NPT Ports



3/8" NPT Ports



Pressure Drop – Typical



FS-380B Series – Compact Flow Switch 1/4" with Tube Fitting

Flow Rate Settings: 0.25 GPM to 2.00 GPM
Port Size: 1/2" NPT with 1/4" Tube Fitting
Primary Construction Material: Brass
Setting Type: Fixed

These rugged inline flow switches feature unique dual connection ports that provide 1/2" NPT and 1/4" tub fittings. They require 100 micron filtration and are less susceptible to clogging than other inline flow switches. The FS-380B is an excellent choice for semicon cooling applications where simple design and reliable operation are required.

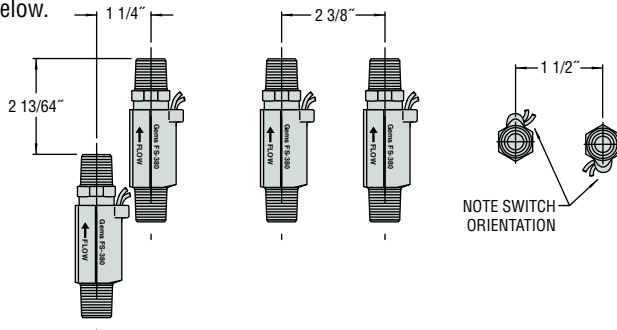
Specifications

Wetted Materials	
Housing	Brass
Piston	PPS Composite, Epoxy
Spring	316 Stainless Steel
O-Ring	Fluorocarbon
Cartridge O-Ring	EPDM
Cartridge Collet	Polypropylene
Operating Pressure, Maximum	150 PSI (10 bar)
Operating Temperature	-20°F to +275°F (-28.8°C to +135°C)
Set Point Accuracy	±20% Maximum
Set Point Differential	20% Maximum
Switch*	SPST, 20VA, N.O. at no Flow
Electrical Termination	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.

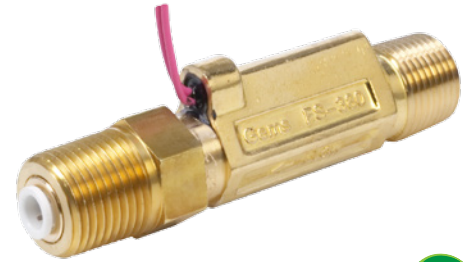


How To Order – Standard Models

Specify Part Number based on flow settings.

Flow Settings GPM ¹	Brass	
	1/2" NPT Male with 1/4" Tube Fitting	
0.25	248933	
0.50	248934	
1.00	248935	
1.50	248936	
2.00	248937	

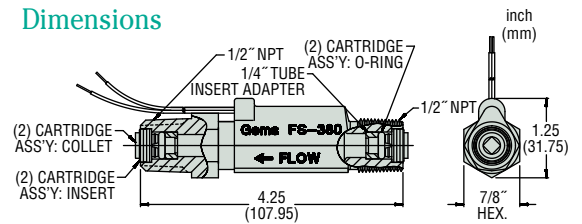
Note:
 1. Flow settings are calibrated using water @ 70°F on increasing flow with units in horizontal position. Consult factory for other fluid compatibility.



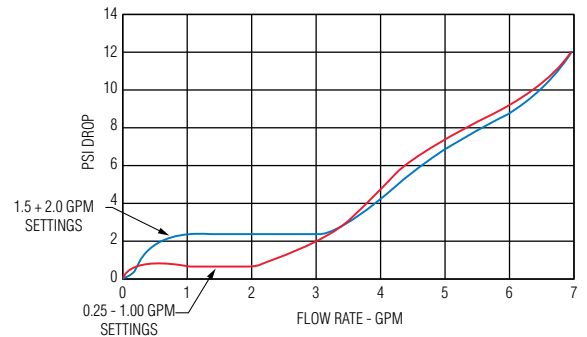
U.L. Recognized
File No. E31926



Dimensions



Pressure Drop – Typical



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

Flow Rate Settings: 0.07 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

Wetted Materials	
Housing	Glass Reinforced Polypropylene
Piston	PPS Composite
Spring	316 Stainless Steel
O-Ring	Fluorocarbon
Operating Pressure	125 PSI (8.6 bar) @ 70°F (21°C), 50 PSI (3.4 bar) @ 212°F (100°C)
Operating Temperature	0°F to 212°F (-18°C to +100°C)
Set Point Accuracy	20% of Set Point
Set Point Differential	20% Maximum
Switch*	SPST, 10VA, N.O. at no Flow
Electrical Termination	24" to 26" Polymeric Leads, 22 AWG
Filtration	100 Micron
Approvals	CUL, RoHS

*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

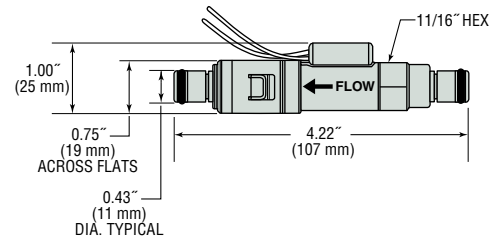
* See selection of adapters at right.
 QDC = Quick Disconnect
 ** Set point accuracy 0.06 to 0.1 GPM

⚡ – Stock Items.

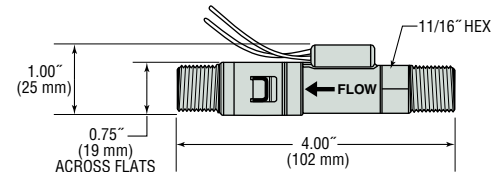


Dimensions

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.

NOTES

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows.

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

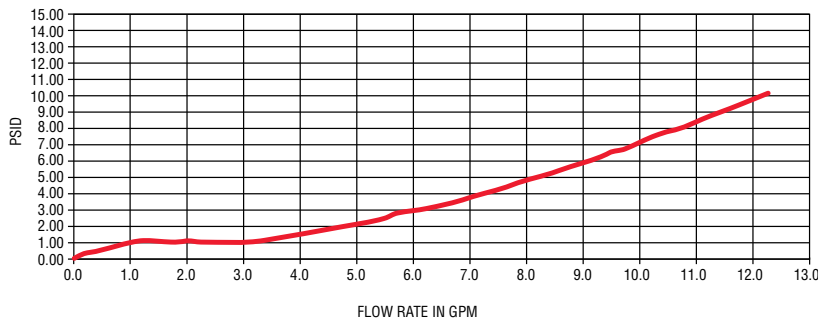
The FS-480 large-body inline flow switch delivers ample flow rates with minimal pressure drop. 25% larger than its FS-380 sibling, the FS-480 is ideal for processes that push more fluid through their systems and demand low pressure drops. Designed to accommodate the Semiconductor Industry's move to larger 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

Wetted Materials	
Housing/End Fitting	316 Stainless Steel
Piston	PPS, Epoxy
Spring	316 Stainless Steel
O-Ring	Fluorocarbon
Operating Pressure, Maximum	1000 PSI (69 bar)
Operating Temperature	-20°F to +250°F (-28.8°C to +121°C)
Set Point Accuracy	±20% Maximum
Set Point Differential	20% Maximum
Recommended Filtration	100 Micron or better
Switch*	SPST, 20VA, 120/240 VAC, N.O. at no Flow
Electrical Termination	No. 22 AWG, 24" PVC Cable

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

Pressure Drop – Typical 1.0 GPM Set Point

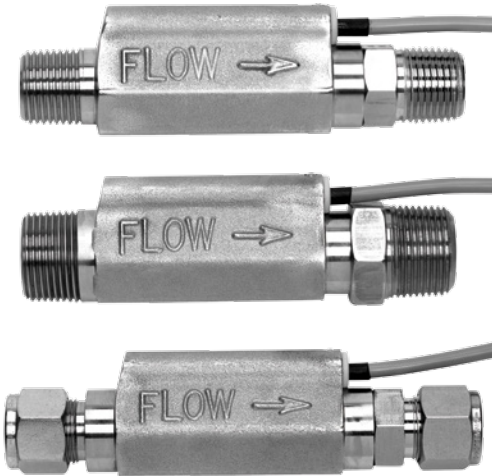


How To Order – Standard Models

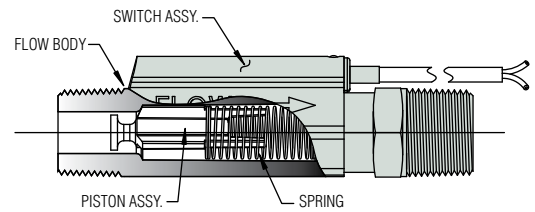
Specify Part Number based on flow settings.

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.



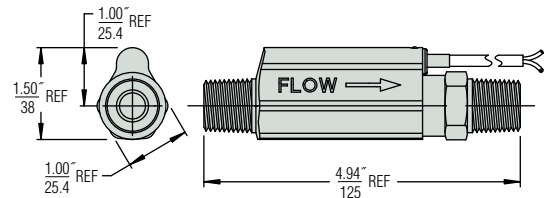
UL US File No. E31926



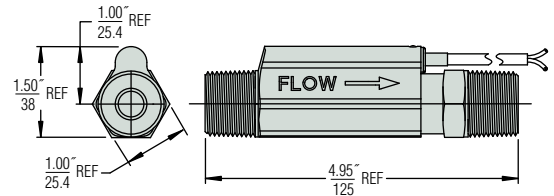
Straight design and large bore body minimizes pressure drop.

Dimensions

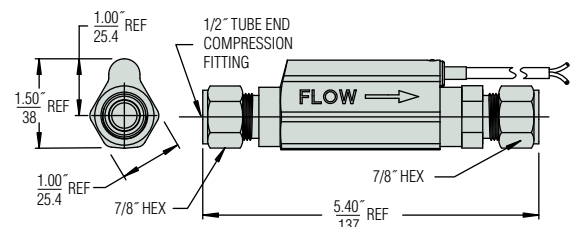
1/2" NPT Ports



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

Wetted Materials	
Housing and Piston	Brass, Stainless Steel
Spring	316 Stainless Steel
Other Wetted Parts	Stainless Steel
Operating Pressure, Maximum	1000 PSIG (69 bar)
Operating Temperature	-20°F to +200°F (-29°C to +93.3°C)
Set Point Accuracy	±15%
Set Point Differential	20% Maximum
Switch*	SPST, 20 VA
Inlet/Outlet Ports	1/4" NPT
Electrical Termination	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.

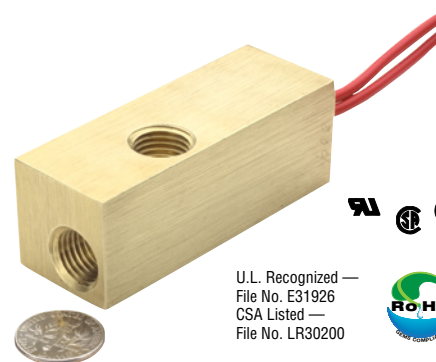
Liquids other than water: Special calibration is available from Gems for media other than water. Please consult factory with your requirements, including flow media, operating pressure, flow set point and liquid viscosity (SSU).

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

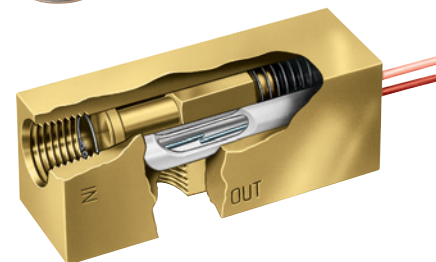
Notes:

- 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.

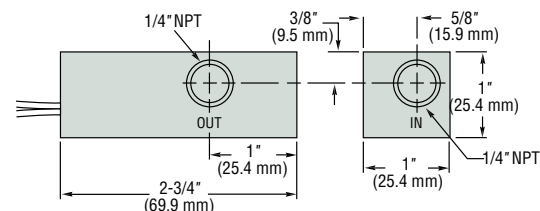
⚡ – Stock Items.



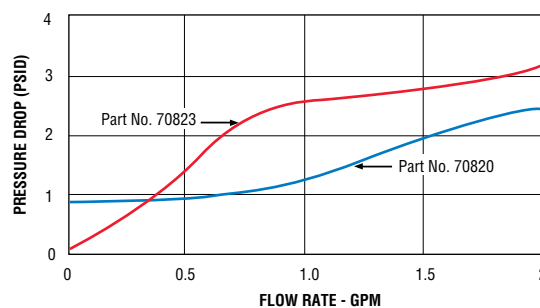
U.L. Recognized —
 File No. E31926
 CSA Listed —
 File No. LR30200



Dimensions



Pressure Drop – Typical



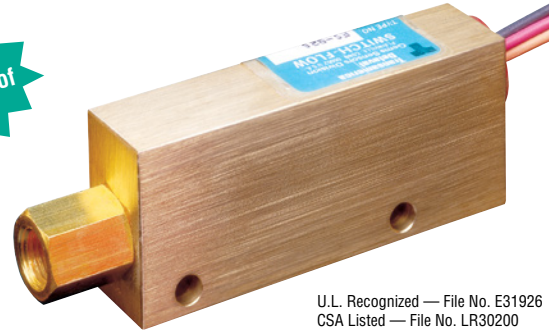
Tests conducted with units in vertical position (lead wires up) with water at +70°F (21°C).

FS-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



U.L. Recognized — File No. E31926
CSA Listed — File No. LR30200
FM Approved — File No. 1H3A2.AX
and 0A8A3AE

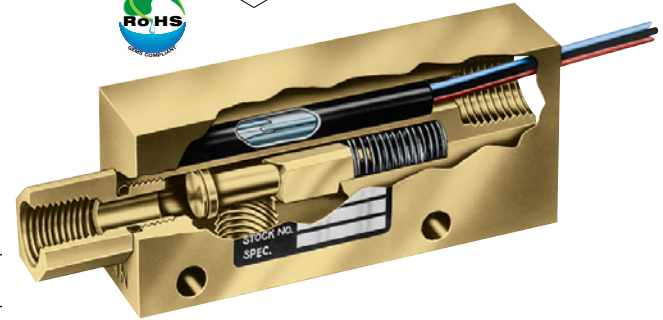
These two series of precision-calibrated switches provides reliable and consistent performance; repeatability is within 1%. FS-925 and FS-926 units are factory preset for actuation at specified flow rates.

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

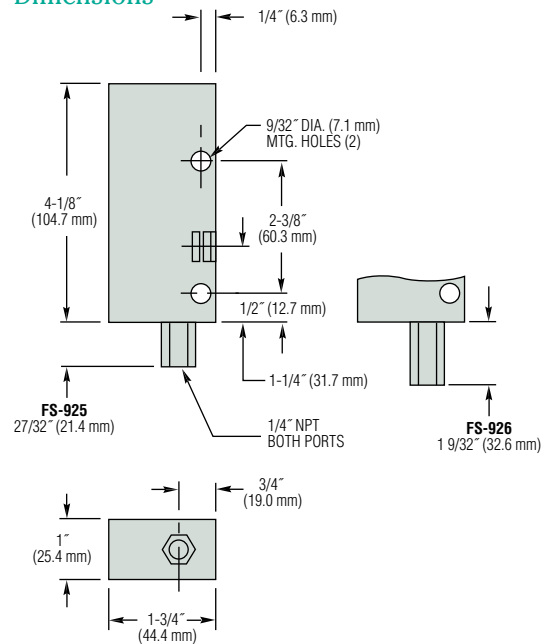
Wetted Materials	
Housing	Brass or 316 Stainless Steel
Piston	
In Brass Housing	Polysulfone for water; Brass for oil or air
Stainless Steel Housing	316 Stainless Steel
Low Flow Piston (FS-926)	Same as Housing
Spring	316 Stainless Steel
O-Ring	Viton®
Other Wetted Parts	Epoxy
Pressure Rating	
Operating, Maximum	1000 PSIG (69 bar)
Proof	2500 PSIG (172 bar)
Burst	5000 PSIG (345 bar)
Operating Temperature	
With Brass or S.S. Piston	-20°F to +300°F (-29°C to +148.9°C)
With Polysulfone Piston	-20°F to +225°F (-29°C to +107.2°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

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

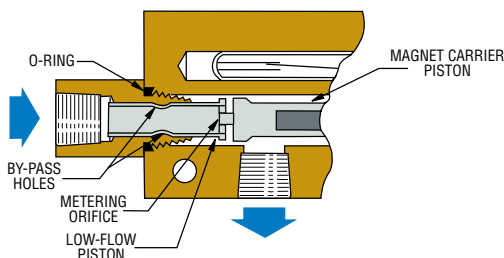


Both the FS-925 and FS-926 use a spring-loaded piston to detect positive flow with great precision. They act upon direct fluid flow and will not show "false-positive" flow indication as can happen with sensors using indirect sensing methods such as pressure measurement. The FS-926 incorporates an additional lap-fitted piston for very low flows; see below.

Dimensions



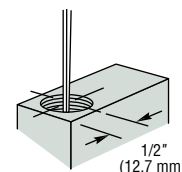
Double Piston Detects Minute Flow – FS-926



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

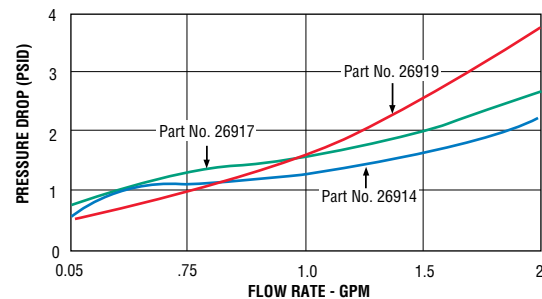
Notes:

- 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.

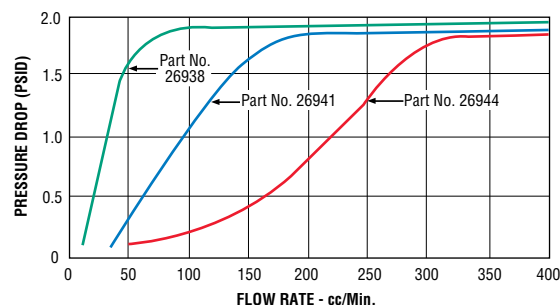
Pressure Drop - Typical

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	
Housing	Brass or 316 Stainless Steel
Piston	
In Brass Housing	Polysulfone for water; Brass for oil or air
In Stainless Steel Housing	316 Stainless Steel Only
Spring	316 Stainless Steel
O-Ring	Viton®
Other Wetted Parts	Epoxy
Pressure Rating	
Operating	1000 PSIG (69 bar)
Proof	2500 PSIG (172 bar)
Burst	5000 PSIG (345 bar)
Operating Temperature	
With Brass or S.S. Piston	-20°F to +300°F (-29°C to +148.9°C)
With Polysulfone Piston	-20°F to +225°F (-29°C to +107.2°C)
Repeatability	1% Maximum Deviation
Set Point Accuracy	±10% Maximum
Set Point Differential	15% Maximum
Switch*	SPDT, 20 VA
Inlet/Outlet Ports	1/2" NPT
Electrical Termination	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.

For 5 PSIG Line*	1 to 75 SCFM Approx.
For 100 PSIG Line	3 to 160 SCFM Approx.

* Minimum 5 PSI line pressure required.



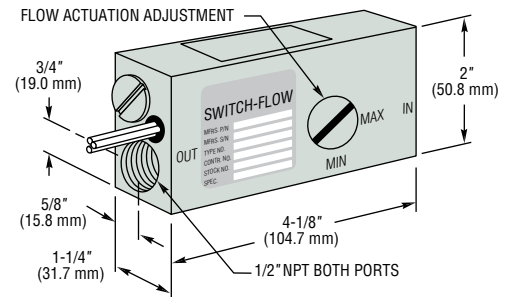
Shown with optional 1/2" conduit connector.



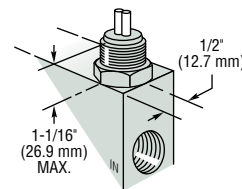
U.L. Recognized — File No. E31926
CSA Listed — File No. LR30200

Dimensions

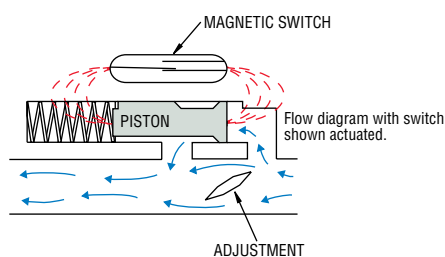
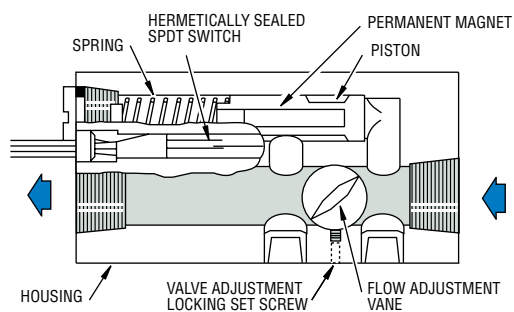
With Wire Leads and Strain Relief



With 1/2" NPT Conduit Connector



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

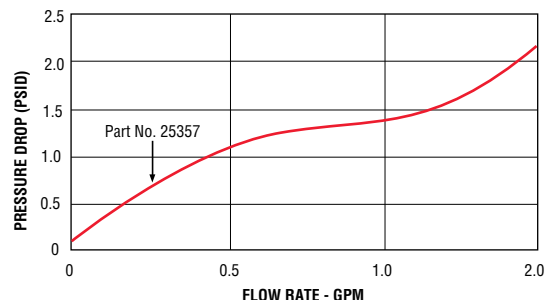
Notes:

- Temperature changes will slightly affect the standard water or gas flow settings listed. Oil flow settings will vary with temperature and viscosity.
- Use of 50 micron filtration is recommended.

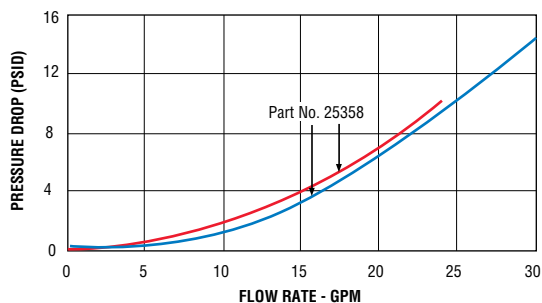
⚡ – Stock Items.

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 2000 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.



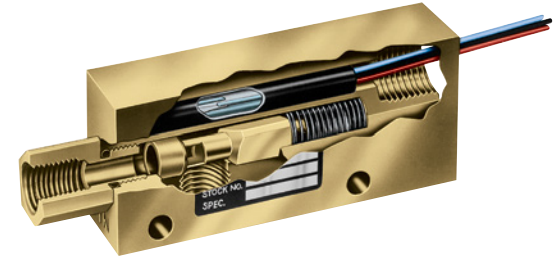
U.L. Recognized —
File No. E31926

Specifications

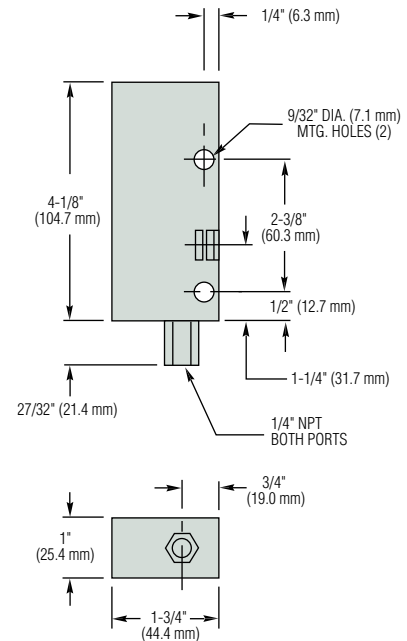
Wetted Materials	
Housing	Brass
Piston	Brass
Spring	316 Stainless Steel
O-Ring	Viton®
Other Wetted Parts	Epoxy
Pressure Rating	
Operating, Maximum	1000 PSIG (69 bar)
Proof	2500 PSIG (172 bar)
Burst	5000 PSIG (345 bar)
Operating Temperature	-20°F to + 300°F (-29°C to +148.9°C)
Repeatability	1% Maximum 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, RoHS

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

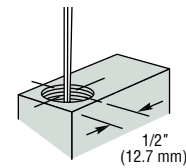
** Reference at 300 SSU set point.



Dimensions



Electrical Connection, 1/2" NPT Conduit



How To Order – Standard Models

Specify Part Number based on flow setting.

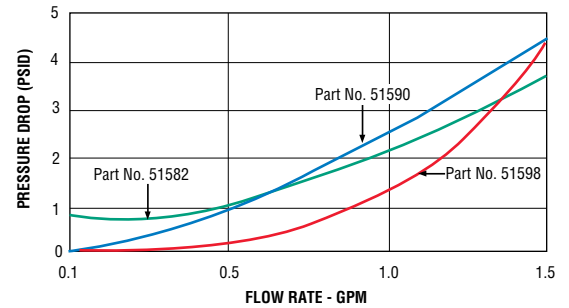
Flow Setting GPM, ±10%	Part Numbers
0.10	51582 ⚡
0.25	51586 ⚡
0.50	51590
0.75	51594
1.00	51598

Notes:

- 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 2,000 SSU.
- 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).

FS-930 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.

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...

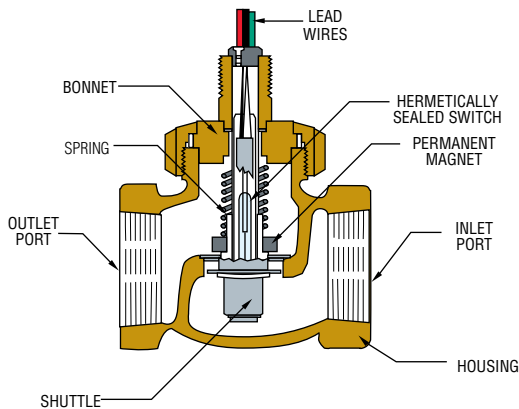
- Heat Exchangers • Semiconductor Manufacturing Equipment
- Induction Furnaces • Radio Transmitters

Assure efficient operation of process systems, including...

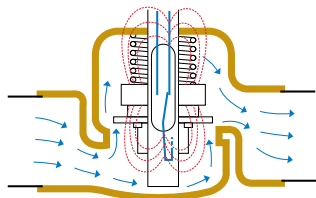
- Water Filtration and Reverse Osmosis • Chlorinators • De-icers
- Sterilizers • Evaporators

Design Data

General Operating Principle (FS-200 Series Shown)



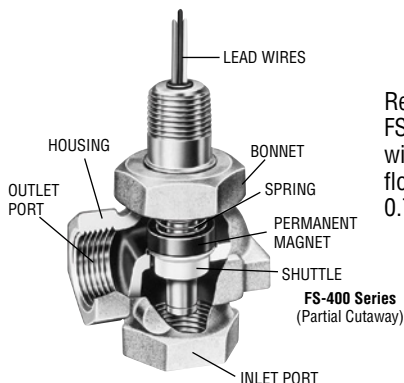
As liquid flow increases to the actuation setting, a magnet-equipped shuttle is displaced. When displaced by fluid flow, this shuttle actuates a hermetically sealed, SPDT or SPST reed switch within the unit stem. A compression spring or gravity provides shuttle return when flow decreases.



This reed switch, when actuated, can be used to operate remote alarms or indicators, or may be integrated into automatic system controls.

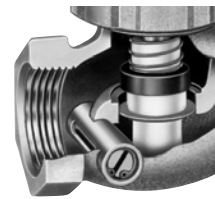
Typical flow diagram showing switch actuated.

90° Flow Path Versions

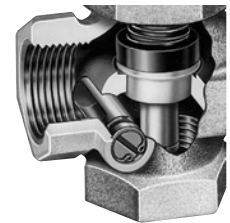


Replace an ordinary 90° pipe joint with an FS-400 Series switch to monitor liquid flow with 1% repeatability. A choice of seven flow rate actuation settings ranging from 0.75 GPM to 10.0 GPM are offered.

Adjustable Versions



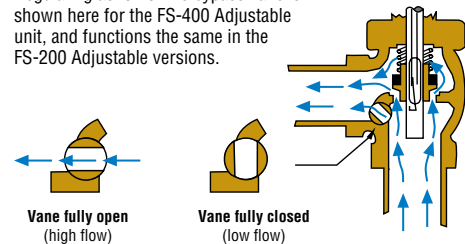
FS-200 Adjustable
(Partial view)



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.

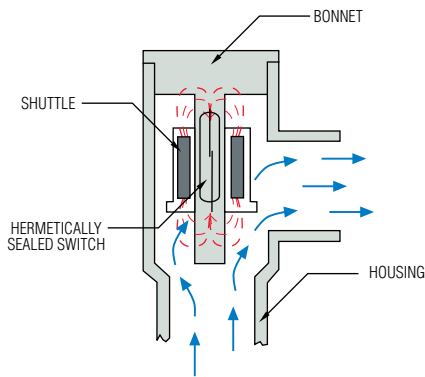
Regulating action of the bypass vane is shown here for the FS-400 Adjustable unit, and functions the same in the FS-200 Adjustable versions.



Vane fully open
(high flow)

Vane fully closed
(low flow)

All Plastic, Transparent Versions

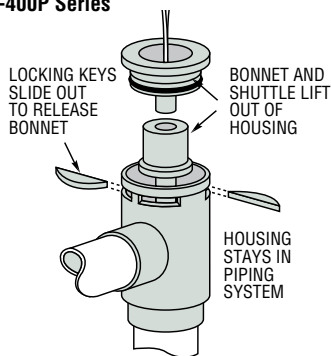


The FS-400P Series is an inexpensive alternative for plastic piping systems. Units are available in clear PVC housings. The clear version, with a bright red shuttle, provides highly visible affirmation of flow status. Low-cost, all PVC versions are for use in systems where liquid pressures are below 120 PSIG and temperatures do not exceed 120°F. An easily removed, one-piece bonnet and shuttle assembly for quick clean-out is featured.

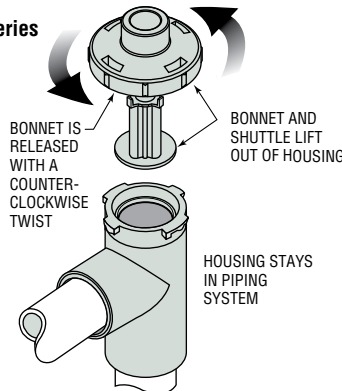
Typical Bonnet and Shuttle Removal

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-20
FS-200 Series Adjustable	
Externally Adjustable Actuation Set Point.....	G-20
FS-400 Series	
General Purpose, 90° Flow Path.....	G-22
FS-400 Series Adjustable	
Externally Adjustable Actuation Set Point.....	G-22
FS-400P Series	
Low-Cost, All PVC.....	G-23
FS-500 Series	
Low-Cost, All Polypropylene.....	G-24

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.

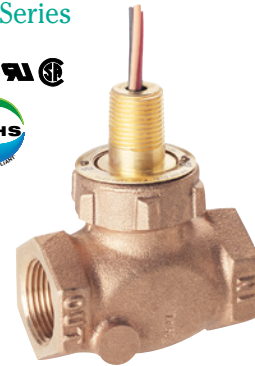
FS-200 Adjustable Series switches offer the same accuracy and are as rugged as those with fixed settings, but provide one additional feature: external adjustability. With these versatile switches your choice of flow settings is diverse within a given range. An ordinary, flat-blade screwdriver is all that's required for the actuation adjustment.

Specifications

Wetted Materials	
Housing	
FS-200	Bronze or 316 Stainless Steel
FS-200 Adjustable	Bronze
Shuttle	Teflon®
Bonnet	Bronze or Stainless Steel
Spring	316 Stainless Steel
Other Wetted Parts	Viton®, Ceramic
Pressure Rating	
Operating	400 PSIG (27.6 bar) @ 100°F (37.8°C)
Proof	800 PSIG (55.2 bar) @ 100°F (37.8°C)
Operating Temperature	
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)
Repeatability	1% Maximum Deviation
Set Point Accuracy	±10%
Set Point Differential	15% Maximum
Switch*	SPDT, 20 VA
Electrical Termination	No. 18 AWG, 24" L., Polymeric Lead Wires Red NC, Black Common, Orange NO

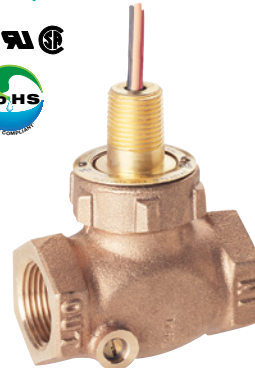
*See "Electrical Data" on Page X-5 for more information.

FS-200 Series



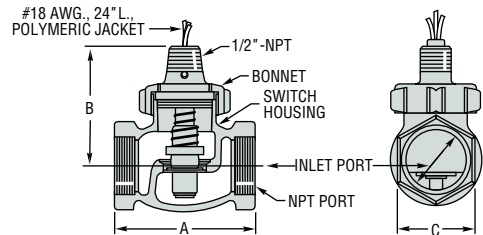
U.L. Recognized
File No. E31926
CSA Listed —
File No. LR30200
and LR22666
FM Approved —
File No. 0A8A3.AE
and 1H3A2.AX

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 ⚡

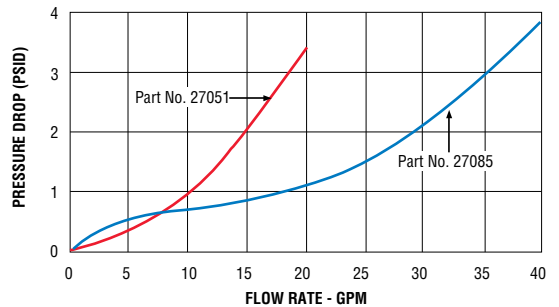
Notes:

- 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.

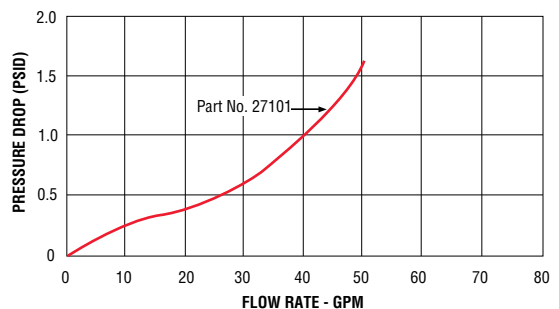
⚡ – Stock Items.

Pressure Drop - Typical

1" NPT and 1-1/2" NPT Ports

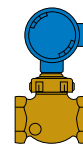


2" NPT Ports



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

Wetted Materials	
Housing	Bronze
Shuttle	Delrin®
Spring	316 Stainless Steel
O-Ring	Viton®
Other Wetted Parts	Ceramic
Pressure Rating, Maximum	
Operating	400 PSI (27.6 bar) @ 100°F (+37.8°C)
Proof	800 PSI (55.2 bar) @ 100°F (+37.8°C)
Operating Temperature	
	-20°F to +180°F (-29°C to +82.2°C)
Repeatability	
	1% Maximum Deviation
Set Point Accuracy	
	±10%
Set Point Differential	
	15% Maximum
Switch*	
	SPDT, 20 VA
Inlet/Outlet Ports	
	3/4" NPT
Electrical Termination	
	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

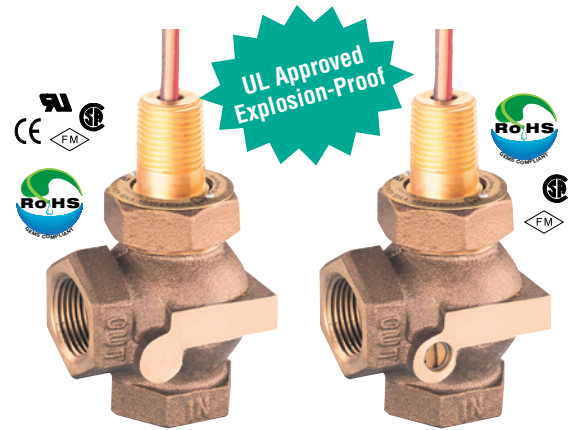
FS-400 Adjustable

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.



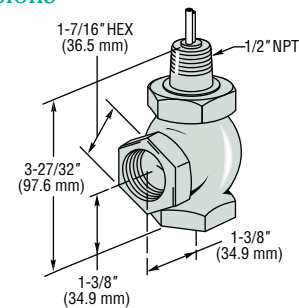
FS-400 Series

U.L. Recognized —
File No. E31926
CSA Listed —
LR30200 and LR22666
FM Approved —
File No. 0A8A3.AE and
1H3A2.AX

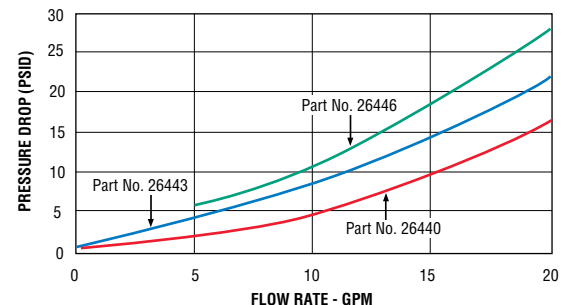
FS-400 Adjustable

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

Materials	
Housing, Shuttle and Bonnet	PVC
O-Ring	Buna N
Other Wetted Parts	Epoxy
Operating Pressure, Maximum	
	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
Operating Temperature, Maximum Clear Version	
	+120°F (+48.9°C)
Set Point Accuracy	± 20%
Set Point Differential	20% Maximum
Switch*	SPST, 20 VA N.O. @ No Flow
Inlet/Outlet Ports	3/4" or 1" IPS and 1/2" NPT
Mounting Attitude	Vertical, Inlet Down
Electric Termination	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.

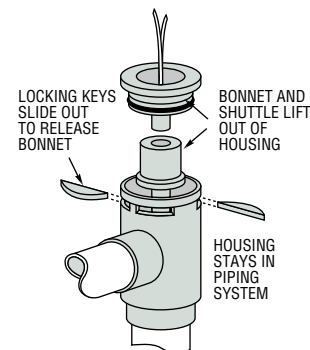
Notes:

- 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.



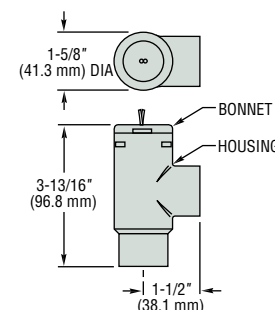
U.L. Recognized —
 File No. E31926
 CSA Listed —
 File No. LR30200



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

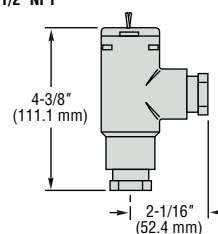
3/4" IPS Size (Both Ports)



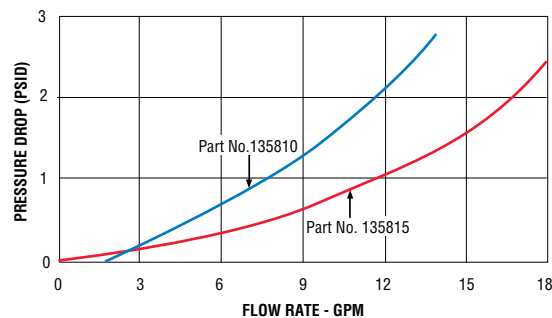
1" IPS Size (Both Ports)
 (All other dimensions are the same as 3/4" size)



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

Wetted Materials*	
Housing, Bonnet, Shuttle, Shuttle Cap	Polypropylene, Hydrolytically Stable
O-Ring	Viton® or Buna N
Spring	316 Stainless Steel
Retaining Clip	PH 15-7 Mo Stainless Steel
Operating Pressure, Maximum	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)
Operating Temperature, Maximum	0° to 212°F (100°C)
Set Point Accuracy	± 20%
Set Point Differential	± 20% Maximum
Switch**	SPST, N.O. Pilot Duty 20 VA, 120-240 VAC or VDC
J-Box with 5A Relay	
Coil	120 VAC 50/60 Hz
Contacts SPDT	5A – 240 VAC Res
	1/3 HP – 120 VAC
	5A – 28 VDC Res.
Inlet/Outlet Ports	3/4" Female NPT
Electric Termination Pilot	No. 22 AWG, 24" Zip Cord Lead Wires
J-Box	6' PVC Cable

* Materials of Construction are available for FDA or NSF Compliance.
 ** See "Electrical Data" on Page X-5 for more information.

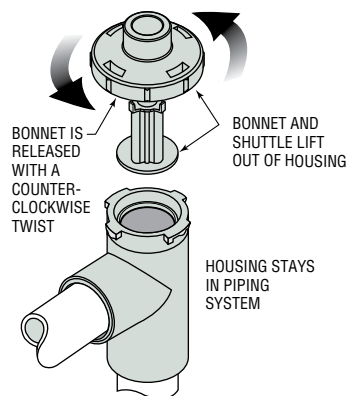
How To Order – Standard Models

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.

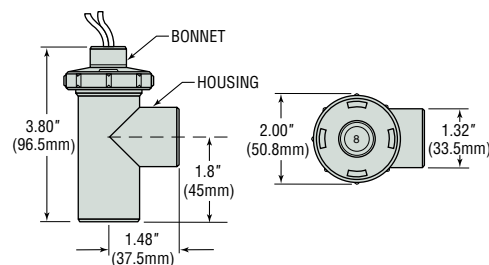
Switch Actuation Set Point GPM	Part Numbers	
	Pilot Duty	J-Box w/5A Relay
0.25	170231 ⚡	175901
0.50	170232 ⚡	175902
1.00	170233 ⚡	—
2.00	175117	—
2.50	170234 ⚡	—
5.00	170235 ⚡	—

Note: Use of 100 micron filtration is recommended.

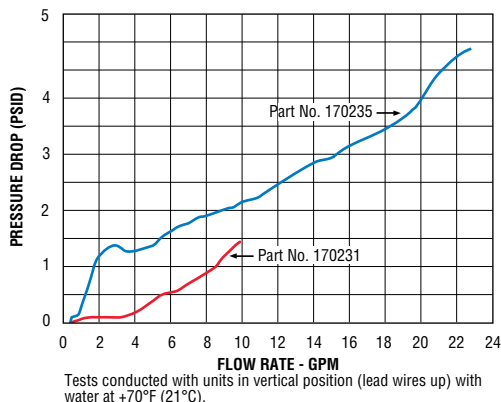
⚡ – Stock Items.



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

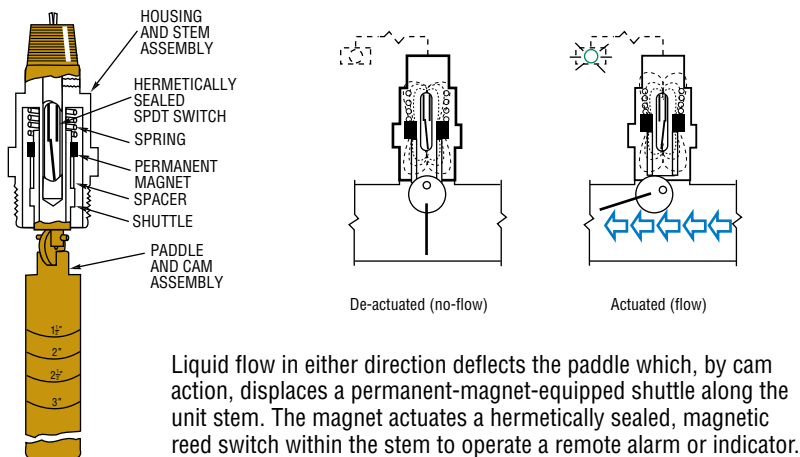
Protect high or low pressure pumps from cavitation, sense critical, reverse flow and protect...

- Valves • Pumps • Regulators

Contents	Page Start
FS-550 Series	
High Pressure, Metal Version	G-26

Design Data

General Operating Principle



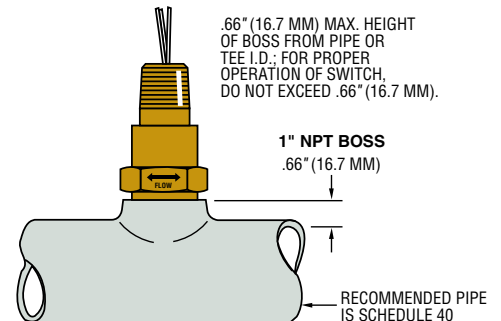
Liquid flow in either direction deflects the paddle which, by cam action, displaces a permanent-magnet-equipped shuttle along the unit stem. The magnet actuates a hermetically sealed, magnetic reed switch within the stem to operate a remote alarm or indicator.

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.

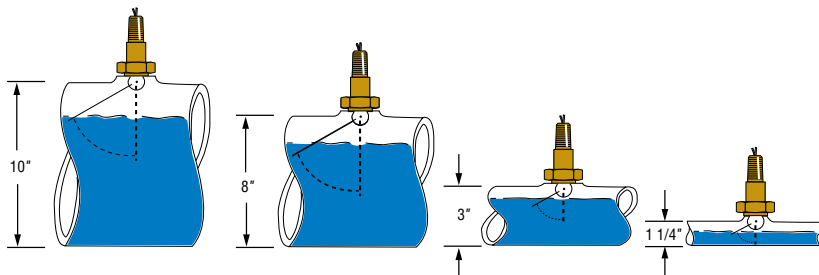
Easy Installation

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

Wetted Materials	
Housing	Brass or 316 Stainless Steel
Paddle	302 Stainless Steel
Spring	316 Stainless Steel
Other Wetted Parts	Ceramic and Teflon®
Operating Pressure, Maximum	2000 PSIG (138 bar)
Pressure Drop	3 PSIG (0.2 bar) Maximum
Operating Temperature	-30°F to + 300°F (-34.4°C to + 148.9°C)
Set Point Accuracy	± 25%
Switch*	SPDT, 20 VA
Repeatability	± 5%
Electrical Termination	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					
Short Paddle Unit	1-1/4"	5 (3)	13 (8)	22 (15)	29 (22)	—	—
Long Paddle Unit	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.

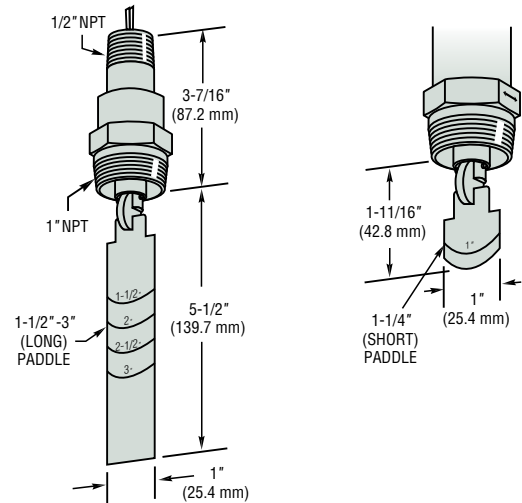
Switch Type	Paddle Length	Housing Material	Switch Operation	Part Numbers	
				Standard	3-Pin J-Box
SPDT Standard Unit	Long	Brass	N.O. or N.C.	29609	56730
		316 S.S.		29608	56729
	Short	Brass		30641	66914
		316 S.S.		30640	61189

Note: The FS-550 Switch is not recommended for use with 1" plastic tees.

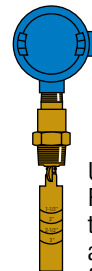


U.L. Recognized
 File No. E31926
 CSA Listed —
 File No. LR30200
 and LR22666
 FM Approved —
 File No. 0A8A3.AE
 and 1H3A2.AX

Dimensions



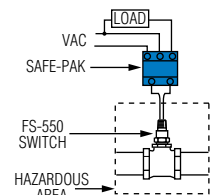
FS-550 switches are U.L. Approved for Class I, Division 2, Groups A, B, C, D hazardous areas.



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 25,000 psi (-1 to 1,600 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 25,000 psig (-1 to 1,600 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

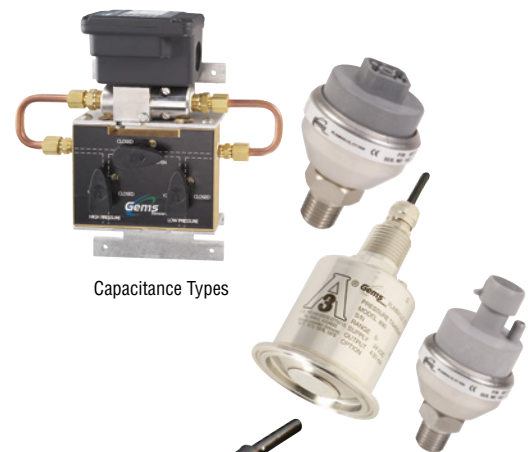
These transducers employ a micromachined silicon (MMS) diaphragm to detect pressure changes. The silicon diaphragm is protected from the media by an oil-filled 316SS isolation diaphragm; they react in tandem to process fluid pressure. MMS sensors utilize common semiconductor manufacturing techniques 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-30
Capacitance Types	H-59
MMS Types	H-75

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*	Ratiometric	Millivolt	Voltage Output	Current Output	Gauge	Absolute	Vacuum	Diff. Pressure	Submersible	Sanitary	Semiconductor	Digital Output	Sensor Technology Type	Gems Series Number
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	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	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

1700 Series-Hygienic Pressure Transmitters

- ▶ Pressure Ranges from 100 Millibar to 40 Bar
- ▶ Sanitary or G1 Process Connections
- ▶ Voltage and Current Output Models
- ▶ Temperature Cooling Options Available for 302°F or 572°F (150°C or 300°C) Operation

The 1700 series features a stainless steel diaphragm with various process connections suitable for dairy and pharmaceutical applications. The 1700 is suitable for both static and dynamic pressure measurement in the ranges from 100 millibar to 40 bar and is available with a choice of electrical outputs and connections.

Specifications

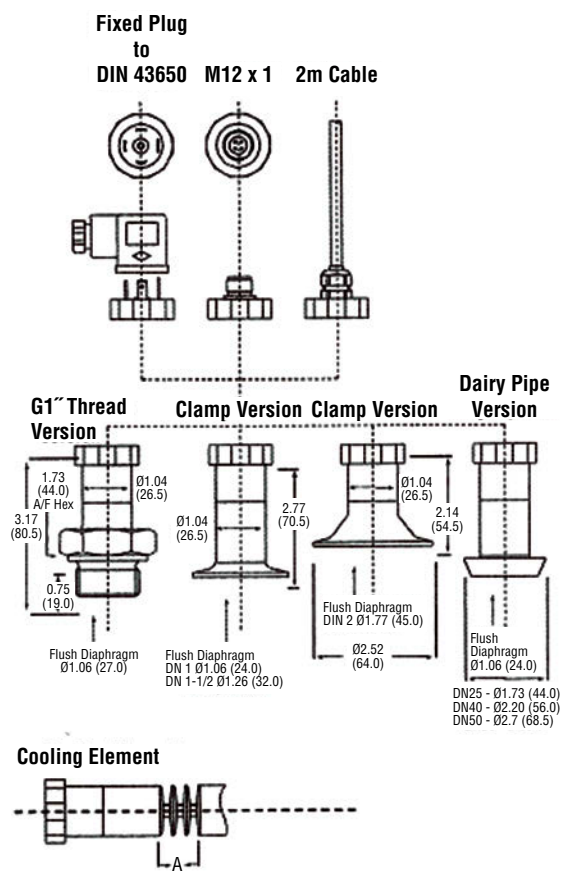
Input	
Pressure Range	0 to 600 psi (0 to 40 bar) Gauge and Absolute
Proof Pressure	>2 x Full Scale
Burst Pressure	>2 x Full Scale
Fatigue Life	Designed for more than 100 million cycles
Performance	
Long Term Drift	±0.2% span/annum
Accuracy	0.25%
Thermal Error Over Compensated Temperature	1% (0°C to 70°C), 2% for 100, 250, and 400 millibar ranges (0°C to 50°C)
Operating Temperatures	-13°F to +185°F (-25°C to +85°C) -13°F to +257°F (-25°C to +125°C) media
Zero Tolerance	1% of span
Span Tolerance	1% of span
Mechanical Configuration	
Pressure Port	see ordering chart
Wetted Parts	316 S/S: Seals Viton® (G1 thread only)
Electrical Connection	see ordering chart
Enclosure	IP65 = G (with connector fitted) IP67 = E & F
Fill Fluid	Silicon oil or food grade
Vibration	10g rms, 20 - 2000Hz
Acceleration	10g
Shock	100g 11ms
Approvals	CE, EXII 1G, E Exia IIC T4
Weight	175gm
Voltage Output Units	
Output	see ordering chart
Supply Voltage (Vs)	12 to 36Vdc
Supply Voltage Sensitivity	0.005% FS/Volt
Min. Load Resistance	10Kohm
Current Consumption	15 mA max
Current Output Units	
Output	4 - 20mA 2 wire
Supply Voltage (Vs)	12 to 36Vdc (IS units 14 - 28 volts)
Supply Voltage Sensitivity	0.005% FS/Volt
Max. Loop Resistance	(Vs-12) x 50 ohms

EMC Specifications

Emissions & Immunity according to EN61326.



Dimensions inch (mm)



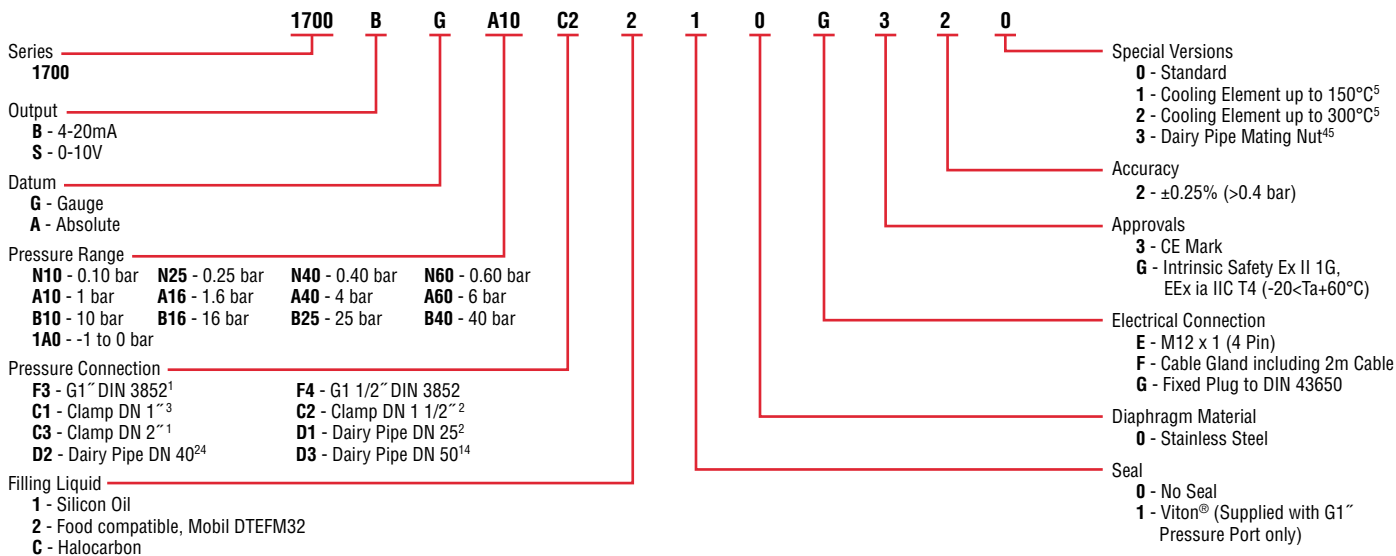
Temperature Range	Size A	Number of Cooling Fins
302°F (150°C)	0.87 (22)	2
572°F (300°C)	1.34 (34)	3

Intrinsically Safe units length increased by 1.06" (27 mm).

PRESSURE TRANSDUCERS

How to Order

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



Electrical Connections

Electrical Connection Code	2-Wire System			3-Wire System			
	Supply +	Supply -	Ground	Supply +	Supply -	Signal +	Ground
E M12 x 1 (4-pin)	1	2	4	1	2	3	4
F Cable	WH	BR	DRAIN	WH	BR	G	DRAIN
G "DIN 43650"	1	2	GROUND	1	2	3	GROUND

Cable Legend:

WH = White
 BR = Brown
 G = Green

Notes:

1. Not available for ranges ≤250mb.
2. Not available for ranges ≤400mb.
3. Not available for ranges ≤600mb.
4. For Dairy Pipe Mating Nut.
5. Please state media temperature (max 85°C) and mounting orientation.

1701 Series-Flush Diaphragm Pressure Transmitters

- ▶ Stainless Steel Wetted Parts with Flush Diaphragm
- ▶ G1/2, G3/4 or G1 Threads and Sanitary
- ▶ Voltage and Current Output Models

The 1701 series features a stainless steel flush diaphragm on a threaded process connection making it ideal for slurries, suspended solids in liquids and viscous liquids where recessed diaphragms could become blocked. The 1701 is suitable for both static and dynamic pressure measurement in the ranges from 15 PSI to 5802 PSI (1 bar to 400 bar) and is available with a choice of electrical outputs and connections.

Specifications

Input	
Pressure Range	0 to 6000 psi (0 to 400 bar) Gauge 0 to 370 psi (0 to 25 bar) Absolute
Proof Pressure	>2 x Full Scale (1.5 x for 400 bar)
Burst Pressure	>2 x Full Scale
Fatigue Life	Designed for more than 100 million cycles
Performance	
Long Term Drift	±0.2% span/annum
Accuracy	0.25%
Thermal Error	2% max
Compensated Temperature	-13°F to +185°F (-25°C to +85°C)
Operating Temperatures	-13°F to +185°F (-25°C to +85°C) -13°F to +257°F (-25°C to +125°C) media
Zero Tolerance	1% of span
Span Tolerance	1% of span
Mechanical Configuration	
Pressure Port	see ordering chart
Wetted Parts	316 S/S: Seals <100 bar Viton® >100 bar Nitrite
Electrical Connection	see ordering chart
Enclosure	IP65 = G (with connector fitted) IP67 = E & F
Fill Fluid	Silicon oil or food grade
Vibration	10g rms, 20 - 2000Hz
Acceleration	10g
Shock	100g 11ms
Approvals	CE, EXII 1G, E Exia II CT4
Weight	225gm
Voltage Output Units	
Output	see ordering chart
Supply Voltage (Vs)	14 to 36Vdc
Supply Voltage Sensitivity	0.005% FS/Volt
Min. Load Resistance	10Kohm
Current Consumption	15 mA max
Current Output Units	
Output	4 - 20mA 2 wire
Supply Voltage (Vs)	12 to 36Vdc (IS units 14 - 28 volts)
Supply Voltage Sensitivity	0.005% FS/Volt
Max. Loop Resistance	(Vs-12) x 50 ohms

EMC Specifications

Emissions & Immunity according to EN61326.

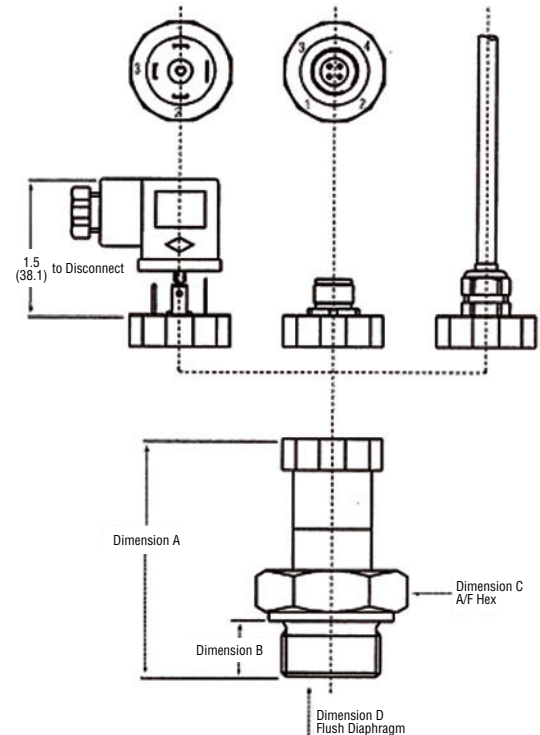


Dimensions inch (mm)

MECHANICAL CONNECTION

Inch Thread

Fixed Plug to DIN 43650 (1701X-G3) **M12 x 1 (1701X-E3)** **2m Cable (1701X-F3)**



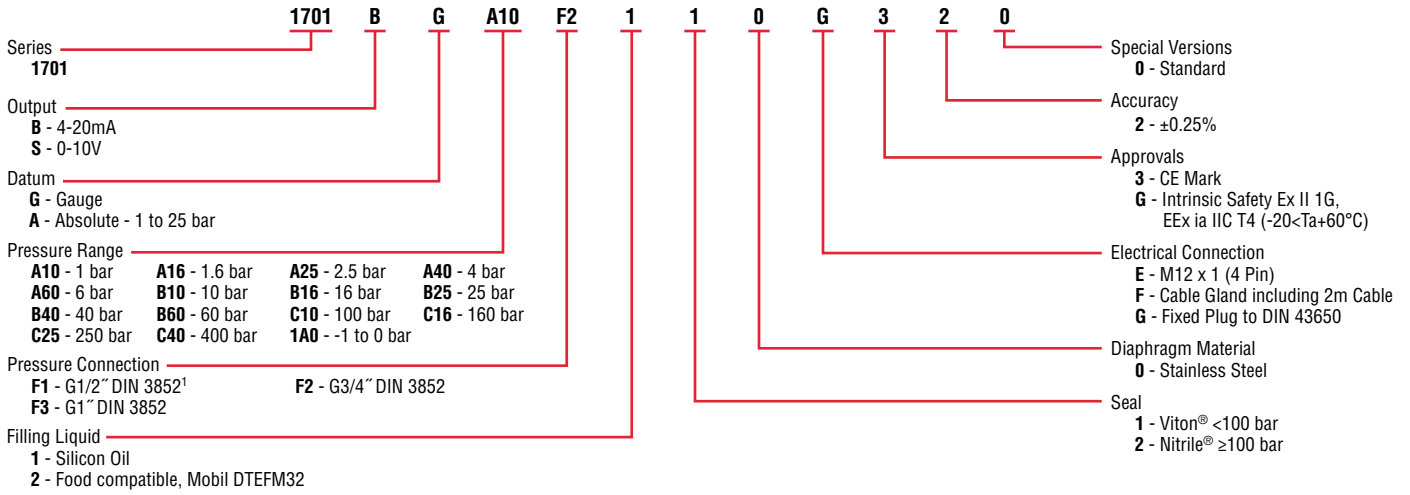
	Dim A	Dim B	Dim C	Dim D
G1/2" Thread	3.01 (76.5)	0.59 (15.0)	1.06 (27.0)	0.71 (18.0)
G3/4" Thread	3.09 (78.5)	0.63 (16.0)	1.34 (34.0)	0.87 (22.0)
G1" Thread	3.17 (80.5)	0.75 (19.0)	1.73 (44.0)	1.10 (28.0)

Intrinsically Safe units length increased by 1.06" (27 mm).

PRESSURE TRANSDUCERS

How to Order

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



Electrical Connections

Electrical Connection Code	2-Wire System			3-Wire System			
	Supply +	Supply -	Ground	Supply +	Supply -	Signal +	Ground
E M12 x 1 (4-pin)	1	2	4	1	2	3	4
F Cable	WH	BR	DRAIN	WH	BR	G	DRAIN
G "DIN 43650"	1	2	GROUND	1	2	3	GROUND

Cable Legend:

WH = White
BR = Brown
G = Green

Notes:

1. Not available for ranges ≤1.6mb.

1702 Series-Fixed Range Low Pressure Transmitters

- ▶ Pressure Ranges from 40 millibar to 1 Bar
- ▶ 316 S/S Diaphragm
- ▶ Voltage and Current Output Models
- ▶ Choice of Enclosures and Pressure Fittings

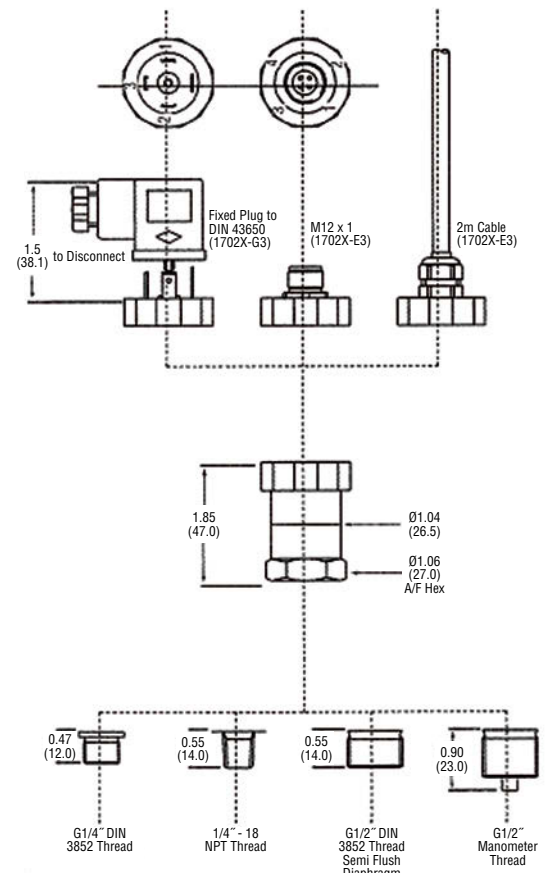
The Gems 1702 low range pressure transmitter is ideal for pneumatics, process control and chemical processes. Featuring a 316 S/S diaphragm and Viton® o-ring the 1702 is compatible with many corrosive medias. A choice of process connections makes the units suitable for direct pipe mounting whilst optional electrical outputs and connections allow interfacing with most systems.

Specifications

Input	
Pressure Range	100 mbar to 1 bG, 100 mbar to 1bA
Proof Pressure	>2 x Full Scale
Burst Pressure	>2 x Full Scale
Fatigue Life	Designed for more than 100 million cycles
Performance	
Long Term Drift	±0.1% span/annum
Accuracy	0.25%
Thermal Error Over Compensated Temperature	1% (0°C to 70°C) - 1 bar, 2% for 100 mbar to 400 mbar ranges (0°C to 50°C)
Operating Temperatures	-13°F to +185°F (-25°C to +85°C) -13°F to +257°F (-25°C to +125°C) media
Zero Tolerance	1% of span
Span Tolerance	1% of span
Mechanical Configuration	
Pressure Port	see ordering chart
Wetted Parts	316 S/S, Viton®
Electrical Connection	see ordering chart
Enclosure	IP65 = G (with connector fitted) IP67 = E & F
Vibration	10g rms, 20 - 2000Hz
Acceleration	10g
Shock	100g 11ms
Weight	140gm
Voltage Output Units	
Output	see ordering chart
Supply Voltage (Vs)	12 to 36Vdc
Supply Voltage Sensitivity	0.005% FS/Volt
Min. Load Resistance	10Kohm
Current Consumption	7 mA max
Current Output Units	
Output	4 - 20mA 2 wire
Supply Voltage (Vs)	12 to 36Vdc
Supply Voltage Sensitivity	0.005% FS/Volt
Max. Loop Resistance	(Vs-12) x 50 ohms



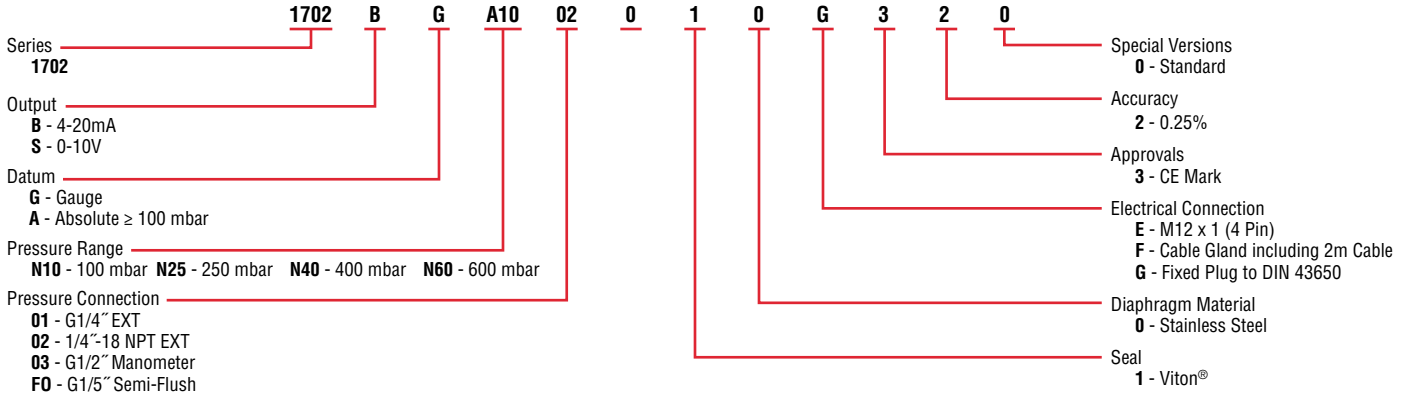
Dimensions inch (mm)



PRESSURE TRANSDUCERS

How to Order

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



Electrical Connections

Electrical Connection Code	2-Wire System			3-Wire System			
	Supply +	Supply -	Ground	Supply +	Supply -	Signal +	Ground
E M12 x 1 (4-pin)	1	2	4	1	2	3	4
F Cable	WH	BR	DRAIN	WH	BR	G	DRAIN
G "DIN 43650"	1	2	GROUND	1	2	3	GROUND

Cable Legend:

WH = White
BR = Brown
G = Green

22IC Series / 26IC Series – CSA Intrinsically Safe Industrial Pressure Transducers

- ▶ Ex II 1G; Ex ia IIC T4 Ga
- ▶ Vacuum to 6,000 PSI (400 bar); Absolute or Gauge
- ▶ Voltage and 2 Wire 4-20mA Output Models
- ▶ All Stainless Steel Wetted Parts

Certified to the latest harmonized European standard (ATEX) the 22IC and 26IC Intrinsically safe pressure transmitters are designed to withstand the rigours of the most difficult applications with an all stainless steel construction, free from seals or oil barriers.

Incorporating Gems CVD Sensors and ASIC technology the 22IC and 26IC offer long term reliability, excellent performance and long term stability ensuring long service life without routine maintenance.

Available with a wide choice of pressure fittings units can be supplied to IP65 or fully immersible to IP68 200mWG and a variety of electrical connectors.

Specifications

Input	
Pressure Range	Vacuum to 6000 psi G (400 bar) 0-363 psi Absolute (0-25 bar)
Proof Pressure	2 x Full Scale (FS) (1.5 x FS for ≥ 5000 psi, 400 bar)
Burst Pressure	>35 x FS ≤ 100 psi (6 bar); >20 x FS ≤ 1000 psi (60 bar); >5 x FS ≤ 6000 psi (400 bar)
Fatigue Life	Designed for more than 100 million FS cycles
Performance	
Long Term Drift	0.2% FS/year (non-cumulative)
Accuracy	0.25% FS typical (optional 0.15% FS)
Thermal Error	1.5% FS typical (optional 1% FS)
Compensated Temperatures	-5°F to +180°F (-20°C to +80°C)
Operating Temperatures	-40°F to +260°F (-40°C to +125°C) for elec. codes A, B, C -5°F to +180°F (-20°C to +80°C) for elec. code G -5°F to +125°F (-20°C to +50°C) for elec. codes F, M, 3
Zero Tolerance	1% of span
Span Tolerance	1% of span
Mechanical Configuration	
Pressure Port	See ordering chart
Wetted Parts	17-4 PH Stainless Steel
Electrical Connection	See ordering chart
Enclosure	316 ss, 17-4 PH ss IP65 for elec. codes A, B, C, G (with connector fitted) 3 IP67 for elec. code "F" IP68 for elec. codes M
Vibration	35g peak sinusoidal, 5 to 2000 Hz
Acceleration	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.
Shock	Withstands free fall to IEC 68-2-32 procedure 1
Approvals	Ex II 1G; Ex ia IIC T4 Ga, -4°F ≤ Ta ≤ +167°F (-20°C ≤ Ta ≤ +75°C)
Weight	Approx. 3.5 ounces (100 grams) (additional cable; 75 g/m)

Series 22IC



Series 26IC



Individual Specifications

Voltage Output units	
Output	see ordering chart
Supply Voltage (Vs)	1.5 Vdc above FS output to 25.5 Vdc
Supply Voltage Sensitivity	0.01% FS/Volt
Min. Load Resistance	(FS output / 2) Kohms
Current Consumption	approx 6 mA at 7.5V output
Current Output units	
Output	4-20 mA (2 wire)
Supply Voltage (Vs)	24 Vdc, (7-35 Vdc) above 212°F (100°C) supply
Supply Voltage Sensitivity	0.01% FS/Volt
Max. Loop Resistance	(Vs-7) x 50 ohms

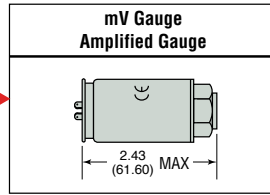
Dimensions

22IC Series

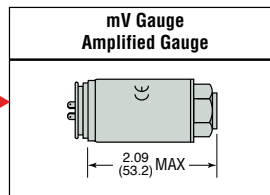
Mini 4 Pin - No Connector	
Code B	
Mini 4 Pin - With Connector	
Code A	
IP67 Cable (Waterproof)	
Code F	
IP65 or NEMA4 Cable	
Code D or 2	

26IC Series

10-6 or 8-4 Mil-C Connector	
10-6 Code C	
8-4 Code 1	
Large DIN 43650 Plug	
Code G	
Conduit Connector with Cable	
Code 3	
Conduit Connector with Flying Leads	
Code T	
Moulded, Immersible Cable	
Code M	



Maximum diameter 1.07" (27.3 mm)



Maximum diameter 1.07" (27.3 mm)

1/8-27 NPT	
Code 08	
1/4 - 1/8 NPT	
Code 02	
7/16-20 UNF-2A	
Code 04	
G 1/8 Internal	
Code 09	
G 1/4 Internal	
Code 00	
G 1/4 External	
Code 01	
G 1/4 Soft Seal	
Code 05	
G 1/2 Manometer	
Code 03	
R 1/4	
Code 0A	

Nose Cone - Black Acetal	
Code 19	
Nose Cone Sink Weight	
Code 29	Through hole Ø0.39 (10.0)

inch
(mm)

Connection Code			Voltage units				Current units (4-20mA)		
			IN+	COM	OUT+	EARTH	(+)	(-)	EARTH
A, B, G	Industrial 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	IP67 cable		R	BK	W	DRAIN	R	BK	DRAIN
1	"8-4 Bayonet"	PIN	A	C	B	D	A	B	D
3	"conduit & cable"		R	BK	W	DRAIN	R	BK	DRAIN
M	Immersible IP68 to 200m		R	W	Y	DRAIN	R	BL	DRAIN

Cable Legend:
 R = Red
 BL = Blue
 BK = Black
 W = White
 Y = Yellow

How to Order

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

22IC B G A60 01 A B U A

Series **22IC** **26IC** Performance Code

Output **B** - 4-20mA **C** - 1-6V **J** - 0.5-5.5V Accuracy/Thermal **A** - .25%/1.5%
D - 1-11V **R** - 0-5V **H** - 1-5V **B** - .15%/1.0%


Pressure Datum **A** - Absolute **G** - Gauge Cable Length³
U - No Cable Fitted
D - 3 feet (1 Meter)
E - 9 feet (3 Meters)
F - 16 feet (5 Meters)
G - 32 feet (10 Meters)
H - 49 feet (15 Meters)
J - 65 feet (20 Meters)
K - 82 feet (25 Meters)
L - 98 feet (30 Meters)
M - 131 feet (40 Meters)
N - 164 feet (50 Meters)
P - 246 feet (75 Meters)
Q - 328 feet (100 Meters)
R - 410 feet (125 Meters)
S - 492 feet (150 Meters)

Pressure Range¹ - psi **F15** - 0-15 **G60** - 0-600 **Vac** = -15 psi
F30 - 0-30 **H10** - 0-1,000 **1F5** - Vac-0
F60 - 0-60 **H15** - 0-1,500 **3F0** - Vac-15
G10 - 0-100 **H20** - 0-2,000 **6F0** - Vac-45
G15 - 0-150 **H30** - 0-3,000 **1G0** - Vac-85
G20 - 0-200 **H40** - 0-4,000 **1G5** - Vac-135
G30 - 0-300 **H50** - 0-5,000 **2G0** - Vac-185
G50 - 0-500 **H60** - 0-6,000 **3G0** - Vac-285

Pressure Range¹ - bar **A10** - 0-1 **B25** - 0-25 **Vac** = -1 bar
A16 - 0-1.6 **B40** - 0-40 **1A0** - Vac-0
A25 - 0-2.5 **B60** - 0-60 **1A6** - Vac-0.6
A40 - 0-4 **C10** - 0-100 **2A5** - Vac-1.5
A60 - 0-6 **C16** - 0-160 **4A0** - Vac-3
B10 - 0-10 **C25** - 0-250 **6A0** - Vac-5
B16 - 0-16 **C40** - 0-400 **1B0** - Vac-9
1B6 - Vac-15
2B5 - Vac-24
4B0 - Vac-39

Pressure Port² **01** - G1/4 External **08** - 1/8-27 NPT External
02 - 1/4-18 NPT External **09** - G1/8 Internal
03 - G1/2 Manometer **00** - G1/4 Internal
04 - 7/16-20 UNF to SAE J514 **0A** - R1/4 External
05 - G1/4 Ext. Soft Seal **19** - Nose Cone (26IC Only)

Electrical Connection
22IC Series
A - Industrial DIN Mating Connector Supplied
B - Industrial DIN Mating Connector Not Supplied
F - Cable Gland Metal IP67
26IC Series
C - Fixed Plug Size 10-6 Mating Plug Not Supplied
G - Fixed Plug To DIN 43650 Mating Plug Supplied
M - Immersible Max. depth 656 feet (200 meters)
1 - Fixed Plug Size 8-4 Mating Plug Not Supplied
3 - Conduit Connector 1/2NPT Ext. 1M Cable

Apparatus Protection **B** - Intrinsically safe, zener barrier, Gauge only
G - Intrinsically safe, galvanic barrier Gauge or Absolute
 II 1G
 Ex ia IIC T4 Ga, -4°F ≤ Ta ≤ 167°F (-20°C ≤ Ta ≤ +75°C)

- Notes:
1. Additional intermediate ranges available. Please consult factory.
 2. Addition Pressure Ports available. Please consult factory.
 3. Max length on 22IC-32 feet (10 Meters).
 4. Intrinsically safe transducers are available with amplified outputs only.

NOTES

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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

Input	
Pressure Range	Vacuum to 6000 psi (400 bar)
Proof Pressure	2 x Full Scale (FS) (1.5 x Fs for 400 bar, ≥ 5000 psi)
Burst Pressure	>35 x FS ≤ 100 psi (6 bar); >20 x FS ≥ 1000 psi (60 bar); >5 x FS ≤ 6000 psi (400 bar)
Fatigue Life	Designed for more than 100 million FS cycles
Performance	
Long Term Drift	0.2% FS/year (non-cumulative)
Accuracy	0.25 % FS typical (optional 0.15% FS)
Thermal Error	1.5% FS typical (optional 1% FS)
Compensated Temperatures	-5°F to +180°F (-20°C to +80°C)
Operating Temperatures	-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
Zero Tolerance	1% of span
Span Tolerance	1% of span
Response Time	0.5 ms
Mechanical Configuration	
Pressure Port	See ordering chart
Wetted Parts	17-4 PH Stainless Steel
Electrical Connection	See ordering chart
Enclosure	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 ₂ O) IP30 for elec. code "3" with flying leads
Vibration	70g, peak to peak sinusoidal, 5 to 2000 Hz (Random Vibration: 20 to 2000 Hz @ ≈20g Peak per MIL-STD.-810E Method 514.4)
Acceleration	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.
Shock	20g, 11 ms, per MIL-STD.-810E Method 516.4 Procedure I
Approvals	CE, UR (22IC, 26IC, 22CS, 26CS)
Weight	Approx. 100 grams (additional cable; 75 g/m)

Series 2200



Series 2600



Individual Specifications

Millivolt Output units	
Output	100 mV (10 mv/v)
Supply Voltage (Vs)	10 VDC (15 VDC max.) Regulated
Bridge resistance	2600-6000 ohms
Voltage Output units	
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
Current Output units	
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.

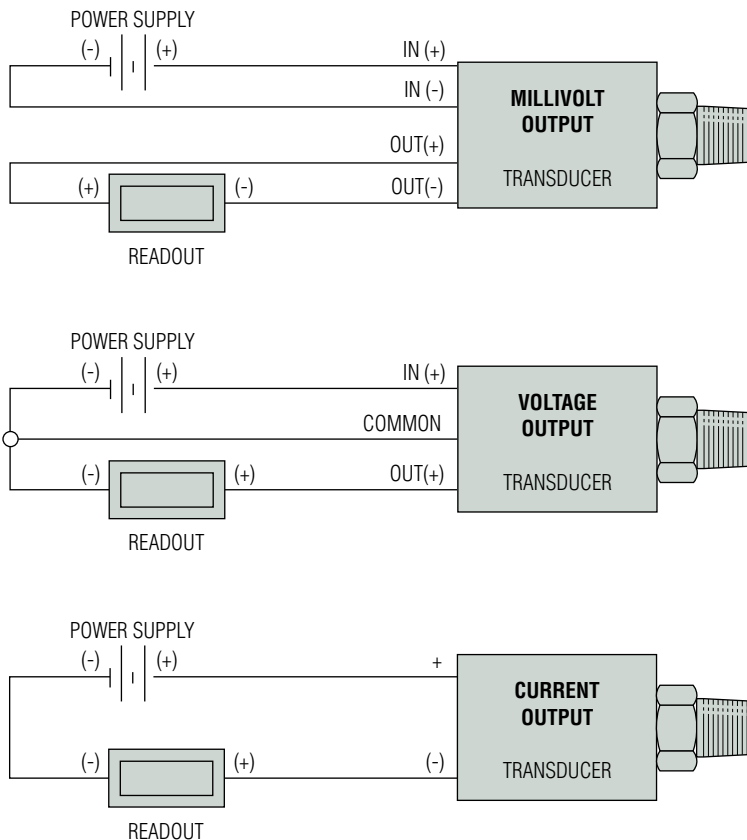
Test Data:

- 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	Y	BL	G	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


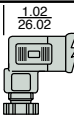
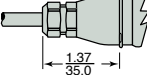
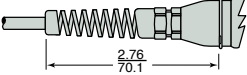
Cable Legend:

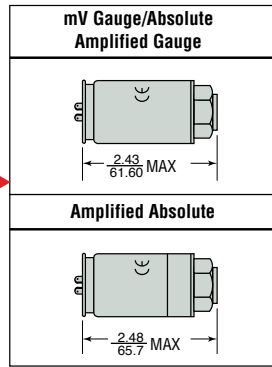
R = Red
 BL = Blue
 BK = Black
 W = White
 Y = Yellow













Dimensions

2200 Series


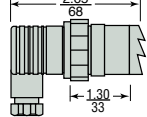

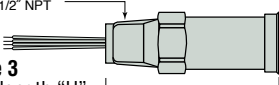
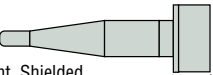
Mini 4 Pin - No Connector
Code B 
Mini 4 Pin - With Connector
Code A  1.02 26.02
IP67 Cable (Waterproof)
Code F  1.37 35.0
24 AWG Shielded PVC
IP65 or NEMA4 Cable
Code D or 2  2.76 70.1
24 AWG Shielded PVC

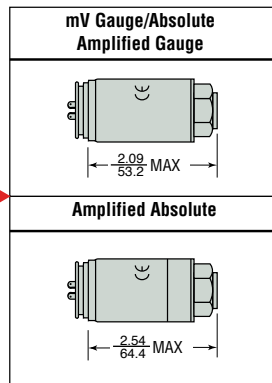


Maximum diameter 1.07" (27.3 mm)


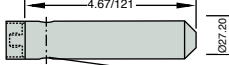
1/8-27 NPT
Code 08  0.59 15
1/4 - 18 NPT
Code 02 with snubber  0.79 20
Code OJ with snubber 
1/4-18 NPT Internal
Code 0E  0.95 24
1/2-14 NPT
Code 0H  1.02 26.0
7/16-20 UNF-2A
Code 04  0.75 19
9/16-18 UNF-2A
Code 1P  0.67 17
G 1/8 Internal
Code 09 
G 1/4 External
Code 01  0.67 17
R 1/4
Code 0A  0.79 20

2600 Series

10-6 or 8-4 Mil-C Connector
10-6 Code C  0.87 22
8-4 Code 1
Large DIN 43650 Plug
Code G  2.65 68 1.30 33
Conduit Connector with Cable
Code 3 1/2" NPT  43 1.70
24 AWG Shielded PVC
Conduit Connector with Flying Leads
Code 3 1/2" NPT with length "U"  1.70/43
Moulded, Immersible Cable
Code M 24 AWG, Vent, Shielded, Polyurethane  0.90 23



Maximum diameter 1.07" (27.3 mm)

Nose Cone - Black Acetal
Code 19  0.75 19
Nose Cone Sink Weight
Code 29  4.67/121 Through hole Ø 10.0

inch
mm

PRESSURE TRANSDUCERS

How to Order

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

<p>Series</p> <p>2200 2600</p> <p>Output</p> <p>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</p> <p>Pressure Datum</p> <p>A* - Absolute G - Gauge *Max absolute range is 25 bar. (≤ 300 psi)</p> <p>Pressure Range³ - psi</p> <table border="0"> <tr> <td>F07 - 0-7.5</td> <td>G60 - 0-600</td> <td>Vac = -15 psi</td> </tr> <tr> <td>F15 - 0-15</td> <td>H10 - 0-1,000</td> <td>1F5 - Vac-0</td> </tr> <tr> <td>F30 - 0-30</td> <td>H15 - 0-1,500</td> <td>3F0 - Vac-15</td> </tr> <tr> <td>F60 - 0-60</td> <td>H20 - 0-2,000</td> <td>6F0 - Vac-45</td> </tr> <tr> <td>G10 - 0-100</td> <td>H30 - 0-3,000</td> <td>1G0 - Vac-85</td> </tr> <tr> <td>G15 - 0-150</td> <td>H40 - 0-4,000</td> <td>1G5 - Vac-135</td> </tr> <tr> <td>G20 - 0-200</td> <td>H50 - 0-5,000</td> <td>2G0 - Vac-185</td> </tr> <tr> <td>G30 - 0-300</td> <td>H60 - 0-6,000</td> <td>3G0 - Vac-285</td> </tr> <tr> <td>G50 - 0-500</td> <td></td> <td></td> </tr> </table> <p>Pressure Range - bar</p> <table border="0"> <tr> <td>A10 - 0-1</td> <td>B25 - 0-25</td> <td>Vac = -1 bar</td> </tr> <tr> <td>A16 - 0-1.6</td> <td>B40 - 0-40</td> <td>1A0 - Vac-0</td> </tr> <tr> <td>A25 - 0-2.5</td> <td>B60 - 0-60</td> <td>1A6 - Vac-0.6</td> </tr> <tr> <td>A40 - 0-4</td> <td>C10 - 0-100</td> <td>2A5 - Vac-1.5</td> </tr> <tr> <td>A60 - 0-6</td> <td>C16 - 0-160</td> <td>4A0 - Vac-3</td> </tr> <tr> <td>B10 - 0-10</td> <td>C25 - 0-250</td> <td>6A0 - Vac-5</td> </tr> <tr> <td>B16 - 0-16</td> <td>C40 - 0-400</td> <td>1B0 - Vac-9</td> </tr> <tr> <td></td> <td></td> <td>1B6 - Vac-15</td> </tr> <tr> <td></td> <td></td> <td>2B5 - Vac-24</td> </tr> <tr> <td></td> <td></td> <td>4B0 - Vac-39</td> </tr> </table> <p>Pressure Port</p> <table border="0"> <tr> <td>08 - 1/8-27 NPT External</td> <td>09 - G1/8 Internal</td> </tr> <tr> <td>02 - 1/4-18 NPT External</td> <td>01 - G1/4 External</td> </tr> <tr> <td>0J - 1/4 NPT External w/snubber</td> <td>0A - R1/4 External</td> </tr> <tr> <td>0E - 1/4 NPT Internal</td> <td>Submersible (2600 only)</td> </tr> <tr> <td>0H - 1/2-14 NPT External</td> <td>19 - Plastic Nose Cone</td> </tr> <tr> <td>04 - 7/16-20 External (SAE #4, J514)</td> <td>29 - Sink Weight Nose Cone</td> </tr> <tr> <td>1P - 9/16-18 External (SAE #6, J1926-2)</td> <td></td> </tr> <tr> <td>1J - 7/16-20 External (SAE #4, J1926-2)</td> <td></td> </tr> </table>	F07 - 0-7.5	G60 - 0-600	Vac = -15 psi	F15 - 0-15	H10 - 0-1,000	1F5 - Vac-0	F30 - 0-30	H15 - 0-1,500	3F0 - Vac-15	F60 - 0-60	H20 - 0-2,000	6F0 - Vac-45	G10 - 0-100	H30 - 0-3,000	1G0 - Vac-85	G15 - 0-150	H40 - 0-4,000	1G5 - Vac-135	G20 - 0-200	H50 - 0-5,000	2G0 - Vac-185	G30 - 0-300	H60 - 0-6,000	3G0 - Vac-285	G50 - 0-500			A10 - 0-1	B25 - 0-25	Vac = -1 bar	A16 - 0-1.6	B40 - 0-40	1A0 - Vac-0	A25 - 0-2.5	B60 - 0-60	1A6 - Vac-0.6	A40 - 0-4	C10 - 0-100	2A5 - Vac-1.5	A60 - 0-6	C16 - 0-160	4A0 - Vac-3	B10 - 0-10	C25 - 0-250	6A0 - Vac-5	B16 - 0-16	C40 - 0-400	1B0 - Vac-9			1B6 - Vac-15			2B5 - Vac-24			4B0 - Vac-39	08 - 1/8-27 NPT External	09 - G1/8 Internal	02 - 1/4-18 NPT External	01 - G1/4 External	0J - 1/4 NPT External w/snubber	0A - R1/4 External	0E - 1/4 NPT Internal	Submersible (2600 only)	0H - 1/2-14 NPT External	19 - Plastic Nose Cone	04 - 7/16-20 External (SAE #4, J514)	29 - Sink Weight Nose Cone	1P - 9/16-18 External (SAE #6, J1926-2)		1J - 7/16-20 External (SAE #4, J1926-2)		<p>2200 B G A60 01 A 3 U A</p> <p>Performance Code</p> <p>Accuracy/Thermal A - .25%/1.5% B - .15%/1.0%</p> <p>Cable Length¹ U - No Cable Fitted^{1 2} D - 1 Metre (3 feet) E - 3 Metres (9 feet) F - 5 Metres (16 feet) G - 10 Metres (32 feet)</p> <p>Apparatus Protection 2 - mV Only Transient Protection CE Mark, UR 3 - Amplified Only RFI Protected CE Mark, UR</p> <p>Electrical Connection (See Notes)</p> <p>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</p> <p>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 Cable²</p> <p>Notes:</p> <ol style="list-style-type: none"> 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.
F07 - 0-7.5	G60 - 0-600	Vac = -15 psi																																																																								
F15 - 0-15	H10 - 0-1,000	1F5 - Vac-0																																																																								
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G20 - 0-200	H50 - 0-5,000	2G0 - Vac-185																																																																								
G30 - 0-300	H60 - 0-6,000	3G0 - Vac-285																																																																								
G50 - 0-500																																																																										
A10 - 0-1	B25 - 0-25	Vac = -1 bar																																																																								
A16 - 0-1.6	B40 - 0-40	1A0 - Vac-0																																																																								
A25 - 0-2.5	B60 - 0-60	1A6 - Vac-0.6																																																																								
A40 - 0-4	C10 - 0-100	2A5 - Vac-1.5																																																																								
A60 - 0-6	C16 - 0-160	4A0 - Vac-3																																																																								
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PRESSURE TRANSDUCERS



Table 1 - Cable Length
(2600 Series) (2200 Series select "U" through "G")

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

Note: Maximum cable length on a 2200 is 10 meters.

22CS Series / 26CS Series – CSA Intrinsically Safe Industrial Pressure Transmitters

- ▶ Ranges from 7.5 to 6000psi (0.5 to 400 bar) and 0-300psi (0-25 bar) Absolute
- ▶ Voltage and 2 Wire 4-20mA output models
- ▶ All stainless steel wetted parts

Certified by CSA for Canada and USA, the 22CS and 26CS Series intrinsically safe pressure transmitters are designed to withstand the rigors of the most difficult applications. An all-stainless steel construction, eliminates the need for seals and oil barriers that can deteriorate over time.

Incorporating Gems CVD Sensors and ASIC technology the 22CS and 26CS Series offer long term reliability, excellent performance and long term stability ensuring long service life without routine maintenance.

Available with a wide choice of pressure fittings and electrical connections rated from IP65 to fully immersible (IP68 200m WG).

Specifications

Input	
Pressure Range	Vacuum to 6000 psi G (400 bar); 300 psi Absolute (0-25 bar)
Proof Pressure	2 x Full Scale (FS) (1.5 x FS for 400 bar, ≥ 5000 psi)
Burst Pressure	>35 x FS ≤ 100 psi (6 bar); >20 x FS ≤ 1000 psi (60 bar); >5 x FS ≤ 6000 psi (400 bar)
Fatigue Life	Designed for more than 100 million FS cycles
Performance	
Long Term Drift	0.2% FS/year (non-cumulative)
Accuracy	0.25% FS typical (optional 0.15% FS)
Thermal Error	1.5% FS typical (optional 1% FS)
Compensated Temperatures	-5°F to +180°F (-20°C to +80°C)
Operating Temperatures	-40°F to +260°F (-40°C to +125°C) for elec. codes A, B, C -5°F to +180°F (-20°C to +80°C) for elec. codes G -5°F to +125°F (-20°C to +50°C) for elec. codes F, M, 3
Zero Tolerance	1% of span
Span Tolerance	1% of span
Mechanical Configuration	
Pressure Port	See ordering chart
Wetted Parts	17-4 PH Stainless Steel
Electrical Connection	See ordering chart
Enclosure	316 SS, 17-4 PH SS IP65 for elec. codes A, B, C, 3 and G (with DIN connector fitted) IP67 for elec. code F IP68 for elec. codes M
Vibration	35g peak sinusoidal, 5 to 2000 Hz
Acceleration	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.
Shock	Withstands free fall to IEC 68-2-32 procedure 1
Approvals	CSA Certified Class I, Division 1, Groups A, B, C, D Class II, Division 1, Groups E, F, G Class III When used in conjunction with a Zener safety barrier
Weight	Approx. 3.5 ounces (100 grams) (additional cable; 75 g/m)

Series 22CS



Series 26CS



Individual Specifications

Voltage Output units	
Output	See ordering chart
Supply Voltage (Vs)	1.5 VDC above FS output to 28 VDC
Supply Voltage Sensitivity	0.01% FS/Volt
Min. Load Resistance	(FS output / 2) Kohms
Current Consumption	Approx 6 mA at 7.5V output
Current Output units	
Output	4-20 mA (2 wire)
Supply Voltage (Vs)	24 VDC, (7-28 VDC)
Supply Voltage Sensitivity	0.01% FS/Volt
Max. Loop Resistance	(Vs-7) x 50 ohms

Electrical Connections

	Connection Code	mA Output			Voltage Output			
		+VE	-VE	EARTH	-VE	COMMON	EARTH	EARTH
22CS	A, B	1	2	E	1	2	2	4
	2, D, F	R	BK	DRAIN	R	BK	W	DRAIN
26CS	1	A	B	D	A	B	C	D
	C	A	B	E	A	B	C	E
	G	1	3	E	1	2	3	E
	3 (Cable)	R	BK	DRAIN	R	BK	W	DRAIN
	F (Leads)	R	BK	GR	R	BK	W	GR
	M	R	BL	DRAIN	R	W	Y	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 $<\pm 1\%$
- 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 $<\pm 1\%$

Cable Legend:

R = Red
 BK = Black
 W = White
 G = Green
 BL = Blue
 Y = Yellow

Dimensions

22CS Series

Industrial DIN Connector	
Code B	
Industrial DIN Connector (mate supplied)	
Code A	
IP67 Cable	
Code F	
24 AWG Shielded PVC	
IP65 or NEMA4 Cable	
Code D or 2	
24 AWG Shielded PVC	

Amplified Gauge	
Amplified Absolute	

Maximum diameter 1.07" (27.3 mm)

1/8-27 NPT	
Code 08	
1/4 - 1/8 NPT	
Code 02	
7/16-20 UNF-2A	
Code 04	
G1/8 Internal	
Code 09	
G1/4 Internal	
Code 00	
G1/4 External	
Code 01	
G1/4 Soft Seal	
Code 05	
G1/2 Manometer	
Code 03	
R1/4	
Code 0A	

26CS Series

10-6 or 8-4 Mil-C Connector	
10-6 Code C	
8-4 Code 1	
Large DIN 43650 Plug (mate supplied)	
Code G	
Conduit Connector with Cable	
Code 3	
24 AWG Shielded PVC	
Conduit Connector with Flying Leads	
Code M	
Code F	

Amplified Gauge	
Amplified Absolute	

Maximum diameter 1.07" (27.3 mm)

inch
mm

PRESSURE TRANSDUCERS

How to Order

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

			22CS	B	G	A60	01	A	C	U	A	
Series											Performance Code	
	22CS	26CS									Accuracy/Thermal	
Output											A - .25%/1.5% B - .15%/1.0%	
	B - 4-20mA	C - 1-6V D - 1-11V H - 1-5V G - 0.2-10.2V	J - 0.5-5.5V R - 0-5V S - 0-10V F - 0.1-5.1V									Cable Length
Pressure Datum	A - Absolute		G - Gauge								U - No Cable Fitted D - 3 feet (1 Meter) E - 9 feet (3 Meters) F - 16 feet (5 Meters) G - 32 feet (10 Meters) H - 50 feet (15 Meters) J - 65 feet (20 Meters) K - 82 feet (25 Meters) L - 98 feet (30 Meters) M - 132 feet (40 Meters) N - 164 feet (50 Meters) P - 246 feet (75 Meters) Q - 328 feet (100 Meters) R - 410 feet (125 Meters) S - 525 feet (160 Meters)	
Pressure Range ¹ - psi											Apparatus Protection	
	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-85 1G5 - Vac-135 2G0 - Vac-185 3G0 - Vac-285									C - CSA Approved Intrinsically Safe
Pressure Range ¹ - bar											Electrical Connection	
	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									22CS Series A - Industrial DIN Mating Connector Supplied B - Industrial DIN Mating Connector Not Supplied F - Cable Gland Metal IP67 2 - IP65 - NEMA4 Cable D - IP65 - NEMA4 Cable 26CS Series C - Fixed Plug Size 10-6 Mating Plug Not Supplied G - Fixed Plug To DIN 43650 Mating Plug Supplied M - Immersible Max. Depth 200 Meters 1 - Fixed Plug Size 8-4 Mating Plug Not Supplied 3 - Conduit Connector 1/2 NPT Ext. 1M Cable F - Cable Gland Metal IP67
Pressure Port ²												
	01 - G1/4 External 02 - 1/4-18 NPT External 03 - G1/2 Manometer 04 - 7/16-20UNF to SAE J514 05 - G1/4 Ext. Soft Seal	08 - 1/8-27 NPT External 09 - G1/8 Internal 00 - G1/4 Internal 0A - R1/4 External										

Notes:

1. Additional Pressure Ranges are available. Please consult factory.
2. For other Pressure Ports, please consult factory.

22FA Series / 26FA Series – CSA Intrinsically Safe Industrial Pressure Transmitters

- ▶ CSA Certified Intrinsically Safe (See Specification)
- ▶ Ranges from 7.5 to 6000psi (0.5 to 400 bar) and 0-300psi (0-25 bar) Absolute
- ▶ Voltage and 2 Wire 4-20mA output models
- ▶ All stainless steel wetted parts

Certified by CSA for Canada and USA, the 22FA and 26FA Series intrinsically safe pressure transmitters are designed to withstand the rigors of the most difficult applications. An all-stainless steel construction, eliminates the need for seals and oil barriers that can deteriorate over time.

Incorporating Gems CVD Sensors and ASIC technology the 22FA and 26FA Series offer long term reliability, excellent performance and long term stability ensuring long service life without routine maintenance.

Available with a wide choice of pressure fittings and electrical connections rated from IP65 to fully immersible (IP68 200m WG).

Specifications

Input	
Pressure Range	Vacuum to 6000 psi G (400 bar); 300 psi Absolute (0-25 bar)
Proof Pressure	2 x Full Scale (FS) (1.5 x FS for 400 bar, ≥ 5000 psi)
Burst Pressure	>35 x FS ≤ 100 psi (6 bar); >20 x FS ≤ 1000 psi (60 bar); >5 x FS ≤ 6000 psi (400 bar)
Fatigue Life	Designed for more than 100 million FS cycles
Performance	
Long Term Drift	0.2% FS/year (non-cumulative)
Accuracy	0.25% FS typical (optional 0.15% FS)
Thermal Error	1.5% FS typical (optional 1% FS)
Compensated Temperatures	-5°F to +180°F (-20°C to +80°C)
Operating Temperatures	-40°F to +260°F (-40°C to +125°C) for elec. codes A, B, C -5°F to +180°F (-20°C to +80°C) for elec. codes G -5°F to +125°F (-20°C to +50°C) for elec. codes F, M, 3
Zero Tolerance	1% of span
Span Tolerance	1% of span
Mechanical Configuration	
Pressure Port	See ordering chart
Wetted Parts	17-4 PH Stainless Steel
Electrical Connection	See ordering chart
Enclosure	316 SS, 17-4 PH SS IP65 for elec. codes A, B, C, 3 and G (with DIN connector fitted) IP67 for elec. code F IP68 for elec. codes M
Vibration	35g peak sinusoidal, 5 to 2000 Hz
Acceleration	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.
Shock	Withstands free fall to IEC 68-2-32 procedure 1
Approvals	CSA certified intrinsically safe Class I, Division 1, Group D when used with a zener safety barrier
Weight	Approx. 100 grams (additional cable; 75 g/m)

Series 22FA



Series 26FA



Individual Specifications

Voltage Output units	
Output	See ordering chart
Supply Voltage (Vs)	1.5 VDC above FS output to 28 VDC
Supply Voltage Sensitivity	0.01% FS/Volt
Min. Load Resistance	(FS output / 2) Kohms
Current Consumption	Approx 6 mA at 7.5V output
Current Output units	
Output	4-20 mA (2 wire)
Supply Voltage (Vs)	24 VDC, (7-28 VDC)
Supply Voltage Sensitivity	0.01% FS/Volt
Max. Loop Resistance	(Vs-7) x 50 ohms

Electrical Connections

	Connection Code	mA Output			Voltage Output			
		+VE	-VE	EARTH	-VE	COMMON	EARTH	EARTH
22FA	A, B	1	2	E	1	2	2	4
	2, D, F	R	BK	DRAIN	R	BK	W	DRAIN
26FA	1	A	B	D	A	B	C	D
	C	A	B	E	A	B	C	E
	G	1	3	E	1	2	3	E
	3 (Cable)	R	BK	DRAIN	R	BK	W	DRAIN
	F (Leads)	R	BK	GR	R	BK	W	GR
	M	R	BL	DRAIN	R	W	Y	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 $\pm 1\%$
- 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 $\pm 1\%$

Cable Legend:

R = Red
 BK = Black
 W = White
 G = Green
 BL = Blue
 Y = Yellow

Dimensions

22FA Series

Industrial DIN Connector	
Code B	
Industrial DIN Connector (mate supplied)	
Code A	
IP67 Cable	
Code F	
24 AWG Shielded PVC	
IP65 or NEMA4 Cable	
Code D or 2	
24 AWG Shielded PVC	

Amplified Gauge	
Amplified Absolute	

Maximum diameter 1.07" (27.3 mm)

1/8-27 NPT	
Code 08	
G1/8 Internal	
Code 09	
1/4 - 1/8 NPT	
Code 02	
7/16-20 UNF-2A	
Code 04	
G1/4 Internal	
Code 00	
G1/4 External	
Code 01	
G1/4 Soft Seal	
Code 05	
R1/4	
Code 0A	
G1/2 Manometer	
Code 03	

26FA Series

10-6 or 8-4 Mil-C Connector	
10-6 Code C	
8-4 Code 1	
Large DIN 43650 Plug (mate supplied)	
Code G	
Conduit Connector with Cable	
Code 3	
24 AWG Shielded PVC	
Conduit Connector with Flying Leads	
Code M	
Code F	

Amplified Gauge	
Amplified Absolute	

Maximum diameter 1.07" (27.3 mm)

inch
mm

PRESSURE TRANSDUCERS

How to Order

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

			22FA	B	G	A60	01	A	C	U	A	
Series											Performance Code	
	22FA	26FA									Accuracy/Thermal	
Output											A - .25%/1.5% B - .15%/1.0%	
	B - 4-20mA	C - 1-6V D - 1-11V H - 1-5V G - 0.2-10.2V	J - 0.5-5.5V R - 0-5V S - 0-10V F - 0.1-5.1V									Cable Length
Pressure Datum	A - Absolute		G - Gauge								U - No Cable Fitted D - 3 feet (1 Meter) E - 9 feet (3 Meters) F - 16 feet (5 Meters) G - 32 feet (10 Meters) H - 50 feet (15 Meters) J - 65 feet (20 Meters) K - 82 feet (25 Meters) L - 98 feet (30 Meters) M - 132 feet (40 Meters) N - 164 feet (50 Meters) P - 246 feet (75 Meters) Q - 328 feet (100 Meters) R - 410 feet (125 Meters) S - 525 feet (160 Meters)	
Pressure Range ¹ - psi											Apparatus Protection	
	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-85 1G5 - Vac-135 2G0 - Vac-185 3G0 - Vac-285									C - CSA Approved Intrinsically Safe
Pressure Range ¹ - bar											Electrical Connection	
	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									22FA Series A - Industrial DIN Mating Connector Supplied B - Industrial DIN Mating Connector Not Supplied F - Cable Gland Metal IP67 2 - IP65 - NEMA4 Cable D - IP65 - NEMA4 Cable 26FA Series C - Fixed Plug Size 10-6 Mating Plug Not Supplied G - Fixed Plug To DIN 43650 Mating Plug Supplied M - Immersible Max. Depth 200 Meters 1 - Fixed Plug Size 8-4 Mating Plug Not Supplied 3 - Conduit Connector 1/2 NPT Ext. 1M Cable F - Cable Gland Metal IP67
Pressure Port ²												
	01 - G1/4 External 02 - 1/4-18 NPT External 03 - G1/2 Manometer 04 - 7/16-20UNF to SAE J514 05 - G1/4 Ext. Soft Seal	08 - 1/8-27 NPT External 09 - G1/8 Internal 00 - G1/4 Internal 0A - R1/4 External										

Notes:

1. Additional Pressure Ranges are available. Please consult factory.
2. For other Pressure Ports, please consult factory.

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

Input	
Pressure Range	Vacuum to 6000 psi (400 bar)
Proof Pressure	4 x Full Scale (FS) (<1% FS Zero Shift)
Burst Pressure	>35 x FS <= 60 psi (4 bar); >20 x FS <= 600 psi (40 bar); >5 x FS <= 6000 psi (400 bar)
Fatigue Life	Designed for more than 100 million FS cycles
Performance	
Supply Voltage Sensitivity	0.01% FS/Volt
Long Term Drift	0.2% FS/year (non-cumulative)
Accuracy	0.5% FS typical
Thermal Error	2.0% FS typical
Compensated Temperatures	-5°F to +180°F (-20°C to +80°C)
Operating Temperatures	-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
Zero Tolerance	1% of span
Span Tolerance	1% of span
Response Time	0.5 ms
Mechanical Configuration	
Pressure Port	see ordering chart
Wetted Parts	17-4 PH Stainless Steel
Electrical Connection	see ordering chart
Enclosure	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
Vibration	70g, peak to peak sinusoidal, 5 to 2000 Hz (Random Vibration: 20 to 200 Hz @ ≈20g Peak per MIL-STD.-810E Method 514.4)
Acceleration	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.
Shock	20g, 11 ms, per MIL-STD.-810E Method 516.4 Procedure I
Approvals	CE, UR (12 ET, 16 ET Intrinsically safe)
Weight	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

Voltage Output units	
Output	See ordering chart
Supply Voltage (Vs)	1.5 VDC above span to 35 VDC
Min. Load Resistance	(FS output / 2) Kohms
Current Output units	
Output	4-20 mA (2 wire)
Supply Voltage (Vs)	24 VDC, (7-35 VDC)
Max. Loop Resistance	(Vs-7) x 50 ohms

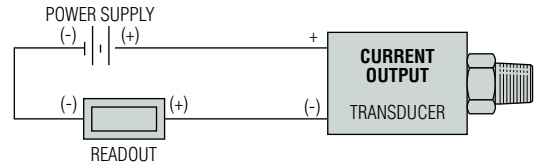
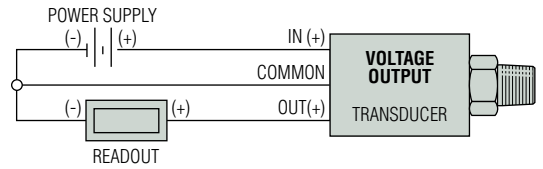
Electrical Connection Cable		Voltage Units				Current Units (4-20 mA)		
		IN+	COM	OUT+	EARTH	(+)	(-)	EARTH
A, B, G "DIN"	PIN	1	2	3	4	1	2	4
C "10-6 Bayonet"	PIN	A	C	B	E	A	B	E
D "cable"		R	BK	W	DRAIN	R	BK	DRAIN
F "IP 67 cable"		R	BK	W	DRAIN	R	BK	DRAIN
1 "8-4 Bayonet"	PIN	A	C	B	D	A	B	D
2 "cable"		R	BK	W	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:

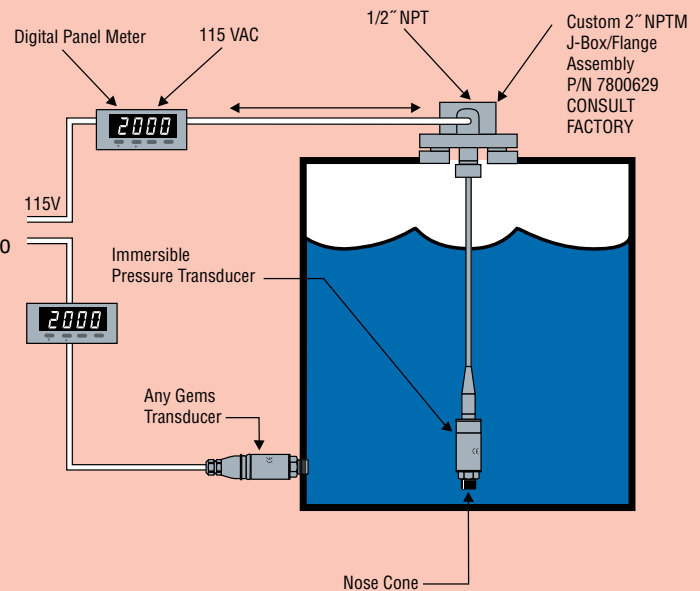
Tank Level:

$$\text{Pressure in PSI} = \text{Liquid Level (in feet)} \times (\text{Specific Gravity} \times 0.433)$$

$$\text{Pressure in PSI} = 30 \times (1.0 \times 0.433)$$

$$\text{Pressure in PSI} = 12.99 \text{ PSI}$$

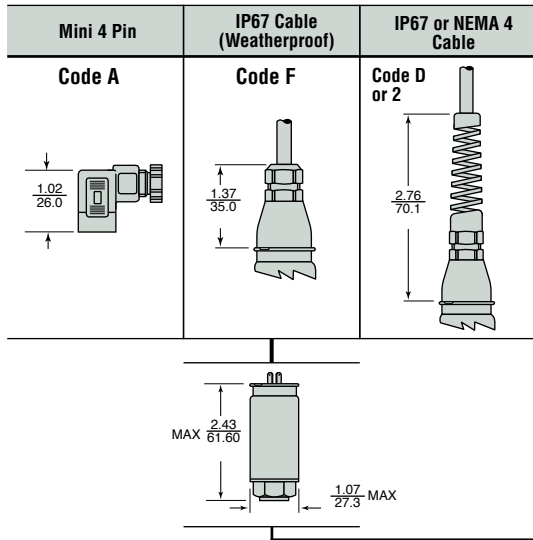
Using a Psibar Series 1200, 1600, 2200 or 2600 transducer, specify Pressure Range code **F15** (0-15 PSI).



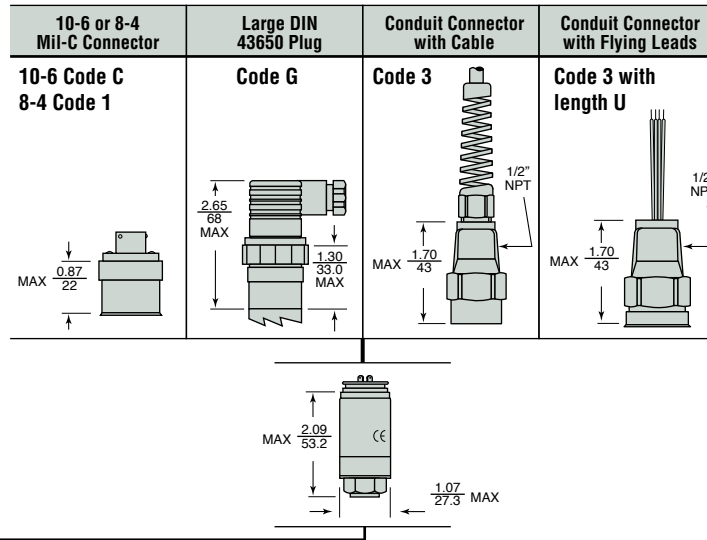


Dimensions

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
MAX 0.59/15	MAX 0.79/20	0.95/24	MAX 1.02/26.0	MAX 0.75/19	MAX 0.67/17		MAX 0.67/17	0.79/20
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: 1200, 1600, 12 ET⁴, 16 ET⁴

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 Range³ - psi: F15, F30, F60, G10, G15, G20, G30, G50; G60, H10, H15, H20, H30, H40, H50, H60; Vac = -15 psi, 1F5, 3F0, 6F0, 1G0, 1G5, 2G0, 3G0

Pressure Range³ - bar: A10, A16, A25, A40, A60, B10, B16; B25, B40, B60, C10, C16, C25, C40; Vac = -1 bar, 1A0, 1A6, 2A5, 4A0, 6A0, 1B0, 1B6, 2B5, 4B0

Electrical Connection: 1200 Series (A, B, F, 2); 1600 Series (C, 1, G, 3)

Apparatus Protection: 3, E, T

Performance Code: A

Cable Length¹: U, D

Pressure Port: 08, 02, 0J, 0E, 0H, 04, 1P, 1J; European Threads: 09, 01, 0A

Notes: 1. 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. 2. Electrical Connections "F" and "2" are 24AWG, Shielded, PVC Cable. 3. Additional Pressure Ranges are available. Please consult factory. 4. 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.) 5. Apparatus Protection Code -T is available for Electrical Connection Codes -A, -B, -G or -3 only.

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

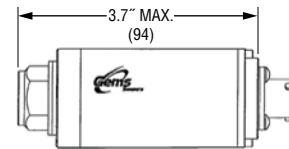
Input	
Pressure Range	0.5 to 400 bar; (7.5 to 6000 psi) Gauge and Absolute
Proof Pressure	2 x Full Scale (FS) (1.5 x FS for 400 bar, ≥ 5000 psi)
Burst Pressure	>35 x FS ≤ 100 psi (6 bar); >20 x FS ≤ 1000 psi (60 bar); >5 x FS ≤ 6000 psi (400 bar)
Fatigue Life	Designed for more than 100 million FS cycles
Performance	
Output	4-20 mA (2 wire)
Supply Voltage (Vs)	9.5 to 40 VDC (ExII 1G 9.5 to 28 Vdc)
Supply Voltage Sensitivity	0.005% of max span/Volt
Long Term Drift	0.15% of max span/year (non-cumulative)
Accuracy	0.15% FS typical
Thermal Error Typical	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
Operating Temperatures	-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
Zero Tolerance	0.15 % span, typical
Span Tolerance	0.15% span, typical
Zero Adjustment	±10% (100% at factory) by potentiometer
Span Adjustment	17% to 100% of span by potentiometer/switches
Max. Loop Resistance	(Vs-9.5) x 50 ohms
Mechanical Configuration	
Pressure Port	see ordering chart
Wetted Parts	17-4 PH Stainless Steel (1 & 1.6b 17-4 PH and 15-7 MO)
Electrical Connection	see ordering chart
Enclosure	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
Vibration	35g peak sinusoidal, 5 to 2000 Hz
Acceleration	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.
Shock	Withstands free fall to IEC 68-2-32 procedure 1
Approvals	CE, Lloyds Register, optimal EXII 1G; E Exia II CT4 (-40°C < T amb < 75°C) Cert BASEEFA 02ATEX00040X
Weight	approx. 250 grams (additional; cable 75 g/m)



Dimensions in. (mm)

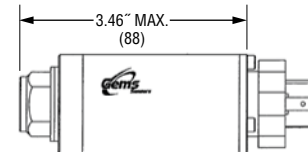
Max diameter 39mm, all models

Code C



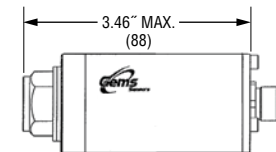
Six Pin Fixed Plug (10-6)

Code G



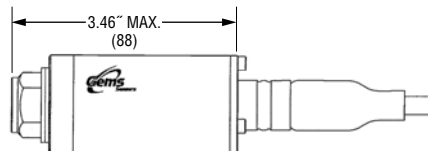
Fixed Plug to DIN 43650 Mating Connector Supplied

Code L



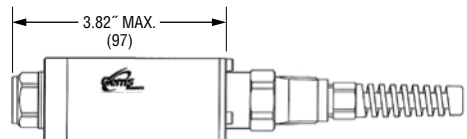
Electrical Connector M12 x 1 (5 Pin)

Code M



Immersion to 200mWG

Code 3



1/2 - 14 NPT conduit

3100 Series and 3200 Heavy Duty Series Compact OEM Pressure Transmitters

- ▶ 0–100 psi to 0–30,000 psi ranges (0–7 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.

Specifications

Performance	
Long Term Drift	0.2% FS/YR (non-cumulative)
Accuracy	
3100	0.25% FS
3200	0.5% FS for <1000 psi (60 bar)
Thermal Error	
3100	0.83% FS/100°F (1.5% FS/100°C)
3200	2% FS/100°C for <1000 psi (60 bar)
Compensated Temperatures	-40°F to +257°F (-40°C to +125°C)
Operating Temperatures	-40°F to +257°F (-40°C to +125°C)
Zero Tolerance	
3100	0.5% of span
3200	1% FS for <1000 psi (60 bar)
Span Tolerance	
3100	0.5% of span
3200	1% FS for <1000 psi (60 bar)
Response Time	1 ms
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 code G)
Vibration	40G peak to peak sinusoidal, (Random Vibration: 20 to 1000 Hz @ approx. 40G peak per MIL-STD-810E)
Shock	Withstands free fall to IEC 68-2-32 procedure 1
EMC (Radiated Immunity)	100 V/m
Approvals	CE, conforms to European Pressure Directive, Fully RoHS compliant, UL recognized files # E219842 & E174228
Weight	35 grams



Individual Specifications

Voltage	
Output (3-wire)	0 V min. to 10 V max. See under "How to Order," last page
Supply Voltage	2 Volts above full scale to 30 Vdc max @ 4.5 mA (6.5 mA on dual output version)
Source and Sinks	2 mA
Current	
Output (2-wire)	4–20 mA
Supply Voltage	8–30 Vdc
Maximum Loop Resistance	(Supply Voltage-8) x 50 ohms
Ratiometric	
Output	0.5 to 4.5 Vdc @ 4 mA (6.5 mA on dual output version)
Supply Voltage	5 Vdc ±10%

Pressure Capability

Pressure Range PSI (Bar)	Proof Pressure (x Full Scale)		Burst Pressure (x Full Scale)	
	3100	3200	3100	3200
100-300 (7-25)	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	
15,000 (1,000)			10 x FS	
25,000 (1,800)	1.40 x FS	2.50 x FS	>60,000 PSI (4,000 bar)	
30,000 (2,200)		—	1.5 x FS	

Pressure Ports

SAE Dimensions in Inches				
	Fitting Code	08 = 1/8"-27 NPT	4D = 1/8"-27 NPTF Dryseal	02 = 1/4"-18 NPT
Torque	2-3 TFFT*	2-3 TFFT*	2-3 TFFT*	2-3 TFFT*
Fitting Code	4C = 1/4"-18 NPTF Dryseal	4N = SAE J1926/2/3/8-24	1J = 7/16"-20 UNF	04 = 7/16"-20 UNF with 37° Flare
Torque	2-3 TFFT*	18-20 NM	18-20 NM	15-16 NM
			Metric Dimensions in MM →	
Fitting Code	1G = SAE 4 Female 7/16" Schraeder	1P = 9/16-18 "Heavy Duty"		01 = G1/4"-27 External
Torque	18-20 NM	18-20 NM		30-35NM
Fitting Code	05 = G1/4" A Integral Face Seal	0L = M12 x 1.5	2T = M12x1.5 HP Metal Washer Seal	0K = M14 x 1.5
Torque	30-35 NM	28-30 NM	30-35 NM	2-3 TFFT*

*NPT Threads 2-3 turns from finger tight. Wrench tighten 2-3 turns.

General Notes:

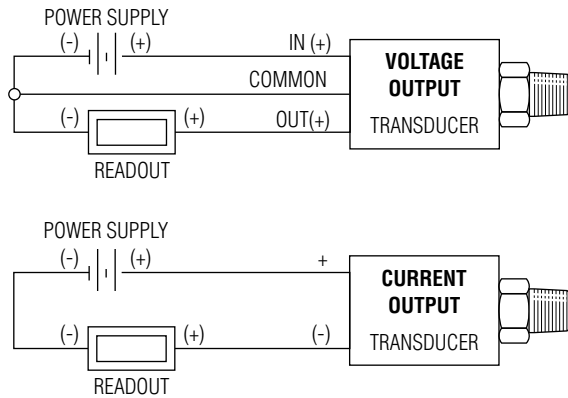
1. The diameter of all cans is 19 mm (0.748")
2. Hex is 22 mm (0.866") Across Flats (A/F) for deep socket mounting
3. O-Ring material, where applicable, is Nitrile[®] unless otherwise specified.

Electrical Connector

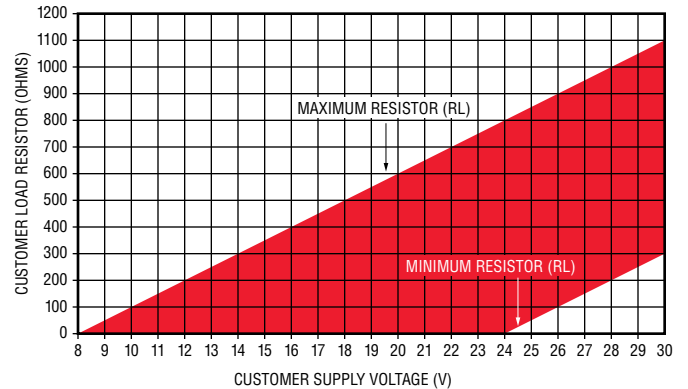
DIN 9.4 mm	M12 x 1P	Amp Superseal 1.5	Deutsch DT04-4P	DIN 43650A
<p>POLARIZING WIDE CONTACT</p>				

Code B			Code R		Code E		Code 6		Code 8		Code G	
Pin #	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode
1	V _{out 1} (pressure)	No Connect	V _{supply}	Supply	V _{supply}	Supply	V _{out}	No Connect	Ground	Return	V _{supply}	Supply
2	V _{supply}	Supply	Ground	Return	V _{out}	No Connect	Ground	Return	V _{supply}	Supply	Ground	Return
3	V _{out 2} (temp)	No Connect	V _{out}	No Connect	Ground	Return	V _{supply}	Supply	No Connect	No Connect	V _{out}	No Connect
4	Ground	Return	No Connect	No Connect	No Connect	No Connect	—	—	V _{out}	No Connect	No Connect	No Connect

Wiring Diagram



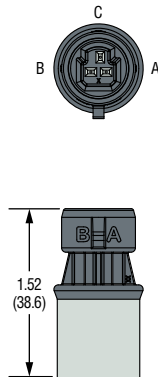
Current Output Mode (Load Resistor Range)



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_{out}	No Connect
A	Ground	Return
B	V_{supply}	Supply
—	—	—

Cable		1/2" Conduit Connection		
Code F		Code 3		
Wire Color	Voltage Mode	Current Mode	Voltage Mode	Current Mode
Red	Supply	Supply	Supply	Supply
Black	Ground	Return	Ground	Return
White	V_{out1} (pressure)	No Connect	V_{out1} (pressure)	No Connect
Green	V_{out2} (temp)	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

			3100	B	200PG	02	B	R	01	
Series	<p>3100 / 3200 - Pressure Transducer – Combination Pressure and Temperature¹ 3101 / 3201 - Temp. Output Range -40°C to 125°C 3102 / 3202 - Temp. Output Range 0°C to 100°C 3103 / 3203 - Temp. Output Range 0°C to 80°C</p>									Cable Length (For electrical connections F& 3 only)
Output	<p>B - 4-20 mA C - 1-6 V H - 1-5 V N - 0.5-4.5 V R - 0-5 V² S - 0-10 V² T - 0.5-4.5 V Ratiometric</p>									Optional Restrictor (3200 only)
Pressure Range – psi	<p>100PG - 0-100 psiG 10CPG - 0-1,000 psiG 10KPS = 0-10,000 psiS 150PG - 0-150 psiG 15CPG - 0-1,500 psiG 15KPS - 0-15,000 psiS³ 200PG - 0-200 psiG 20CPS - 0-2,000 psiS 20KPS - 0-20,000 psiS³ 300PG - 0-300 psiG 25CPS - 0-2,500 psiS 25KPS - 0-25,000 psiS³ 500PG - 0-500 psiG 30CPS - 0-3,000 psiS 600PG - 0-600 psiG 35CPS - 0-3,500 psiS 750PG - 0-750 psiG 40CPS - 0-4,000 psiS 50CPS - 0-5,000 psiS 60CPS - 0-6,000 psiS 75CPS - 0-7,500 psiS</p>									Electrical Connection ⁵
Pressure Range - bar	<p>0007G - 0-7 barG 0160S - 0-160 barS 1000S - 1,000 barS³ 0010G - 0-10 barG 0250S - 0-250 barS 1600S - 1,600 barS³ 0016G - 0-16 barG 0400S - 0-400 barS 0025G - 0-25 barG 0600S - 0-600 barS 0040G - 0-40 barG 0060G - 0-60 barG 0100G - 0-100 barG</p>									Pressure Port ⁴
										<p>00 - No Cable 01 - 1 meter 02 - 2 meters 03 - 3 meters 04 - 4 meters 05 - 5 meters</p> <p>R - Restrictor 0 - No Restrictor</p> <p>B - Industrial DIN 9.4 mm (mating connector not supplied) E - M12 x 1P (4-Pin) F - Cable version G - Large DIN R - Industrial DIN 9.4 mm (alternate pin out) 3 - 1/2" NPT Male Conduit 6 - Amp - Superseal 1.5 Series 8 - Deutsch DT04-4P 9 - Packard MetriPack</p> <p>08 - 1/8-27 NPT External 02 - 1/4-18 NPT External 04 - 7/16-20 External (SAE #4, J514) 1J - 7/16-20 External (SAE #4, J1926-2) 0E - 1/4"-18 NPT Internal 0K - M14 x 1.5 Straight 1G - Schrader SAE #4, 7/16" Internal 1P - SAE 6 (9/16"-18 UNF 2A) 4C - 1/4-18 NPTF External (Dryseal) 4D - 1/8-27 NPTF External (Dryseal) 4N - SAE 3 (3/8-24 UNF External)</p> <p>European Threads 01 - G1/4 External 05 - G1/4 External Soft Seal 0L - M12 x 1.5 (<1,000 bar, 15,000 psi) 2T - M12 x 1.5 (6g) (≥1,000 bar, 15,000 psi)</p>

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** and **-8**). Accuracy is 3.5% of temperature span. Requires additional 2mA of power.
- For use with pull-up or pull-down resistors, contact factory.
- Ranges 15,000 psi (1,000 bar) and above available with **-2T** pressure port only.
- Pressure ports **0E** and **1G** are NOT available with the Restrictor option.
- For electrical codes **F** & **3**, specify cable length in meters.



NOTES

A large grid of dashed red lines for taking notes, covering most of the page area.

31EP/EA and 32EP/EA Series Explosion Proof

- ▶ CSA Approved
- ▶ ATEX Approved

Oil & Gas equipment needs a pressure transducer that is reliable and able to withstand extreme environmental and pressure conditions. Gems Sensors explosion proof units offer an alternative to high priced, unreliable alternatives. The 31EP and 32EP are CSA approved explosion proof, and the 31EA/32EA carries the ATEX approval. They all feature all stainless steel wetted parts, a broad selection of pressure connections and a wide choice of electrical outputs—the 32 Series of each group provide higher proof pressures. Our manufacturing process includes the latest automated equipment, producing consistent sensor performance.

The compact yet rugged construction of these units makes them ideal for installation where space in a hazardous environment is at a premium.

Specifications

Performance	
Long Term Drift	0.2% FS/YR (non-cumulative)
Accuracy	0.25% FS
Thermal Error	
31EP/EA	±1.5% max., ±1% typical / 212°F (100°C)
32EP/EA	±2% max.
Compensated Temperatures	-40°F to +203°F (-40°C to +95°C)
Operating Temperatures	-40°F to +203°F (-40°C to +95°C)
Zero Tolerance, Max.	0.5% of span
Span Tolerance, Max.	0.5% of span
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
Vibration	BSEN 60068-2-6 (FC) Sine (20G) BSEN 60068-2-64 (FH) Random (14.1 Grms)
Shock	BSEN 60068-2-27 (Ea) (50G, 11ms)
Approvals	
CSA (31EP/32EP)	Class I, Division 1, Groups A, B, C and D Class I, Zone 1 Exd IIC T4 Gb Class I, Zone 1 AExd T4 Gb
ATEX (31EA/32EA)	Exd IIC T4 Gb (Ambient Temperature: -40°C to +95°C)

EMC Specifications

Emissions Tests: EN61326-1:2006 and EN61326-2-3:2006		
EN55011:2007	Radiated Emissions:	30-230MHz 30dB µV/M @10M 230-1000MHz 37dB µV/M @10M
Immunity Tests: EN61326-1:2006 and EN61326-2-3:2006		
EN61000-4-2:2009	Electrostatic Discharge:	±4Kv contact ±8Kv air
EN61000-4-3:2006	Radiated Immunity:	10V/M 80-1000MHz 3V/M 1400-2000MHz 1V/M 2000-2700MHz
EN61000-4-4:2004	Fast Transients:	±0.25, 0.5, 1Kv
EN61000-4-6:2007	Conducted Immunity:	3V 0.15 to 80MHz 80% 1KHz modulation



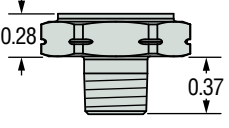
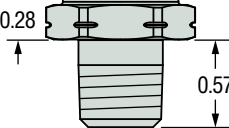
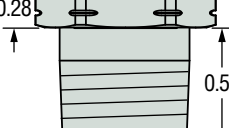
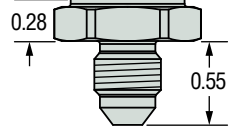
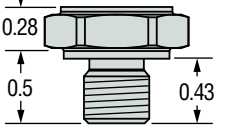
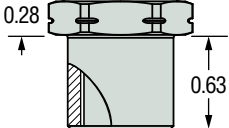
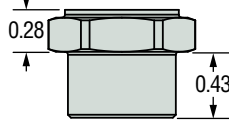
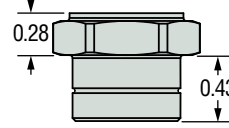
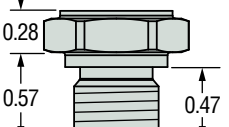
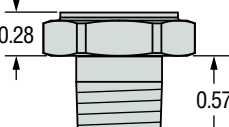
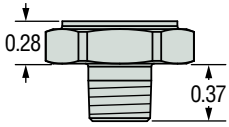
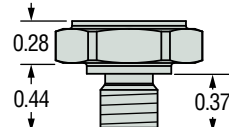
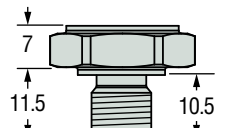
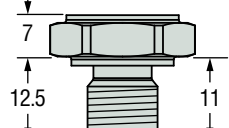
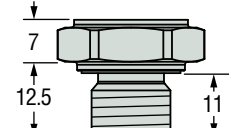
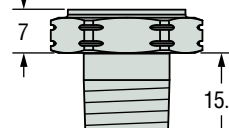
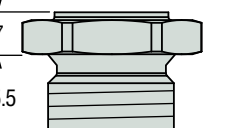
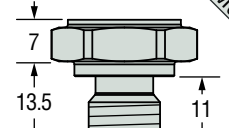
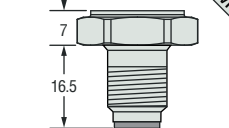
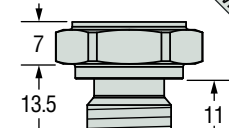
Individual Specifications

Voltage	
Output (3-wire)	0 V min. to 10 V max. See under "How to Order," last page
Supply Voltage	1 Volt above full scale to 30 V max @ 4.5 mA
Source and Sinks	2 mA
Current	
Output (2-wire)	4-20 mA
Supply Voltage	8-24 Volts measured at the input to the transducer terminals
Maximum Loop Resistance	(Supply Voltage-8) x 50 ohms
Ratiometric	
Output	0.5 to 4.5 V (Source and sink 2 mA)
Supply Voltage	5 Vdc ±10% @ 4.5 mA

Pressure Capability

Pressure Range PSI (Bar)	Proof Pressure (x Full Scale)		Burst Pressure (x Full Scale)	
	31EP/EA	32EP/EA	31EP/EA	32EP/EA
100-300 (7-20)	2.00 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	
10,000 (700)			>60,000 PSI (4,000 bar)	
15,000 (1,000)				

Pressure Ports

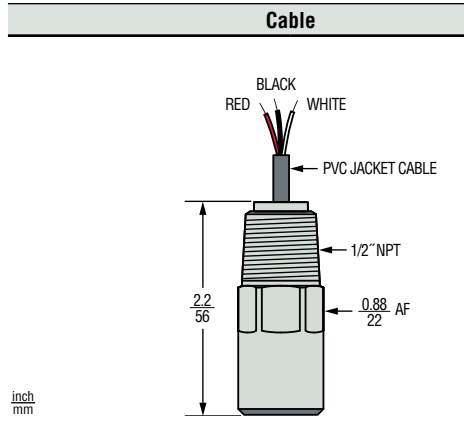
				
Fitting Code	08 = 1/8"-27 NPT	02 = 1/4"-18 NPT	0H = 1/2" NPT	04 = 7/16"-20 UNF with 37° Flare
Torque	2-3 TFFT*	2-3 TFFT*	2-3 TFFT*	15-16 NM
				
Fitting Code	1J = 7/16"-20 UNF	0E = 1/4"-18 NPT Internal	1G = SAE 4 Female 7/16" Schraeder	4B = 1/4" Female (7/16UN with Schraeder Deflator)
Torque	18-20 NM	2-3 TFFT*	18-20 NM	15-16 NM
				
Fitting Code	1P = 9/16-18 "Heavy Duty"	4C = 1/4"-18 NPT Dryseal	4D = 1/8"-27 NPT Dryseal	4N = SAE J1926/2:3/8-24
Torque	18-20 NM	2-3 TFFT*	2-3 TFFT*	18-20 NM
				
Fitting Code	0S = G1/8" A Stud (BS 5380 Port)	01 = G1/4"-27 External	05 = G1/4" A Integral Face Seal	0A = G1/4"-19 PT (JIS) or BSPT
Torque	30-35NM	30-35NM	30-35 NM	30-35NM
				
Fitting Code	4P = G1/2" A 27A/F	0L = M12 x 1.5	2T = M12x1.5 HP Metal Washer Seal	0K = M14 x 1.5
Torque	30-35NMi	28-30 NM	30-35 NM	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 0.965" (24.5 mm)
2. Hex is 0.866" (22 mm) Across Flats (A/F) for deep socket mounting, except Fitting Code 4P which is 1.063" (27 mm).

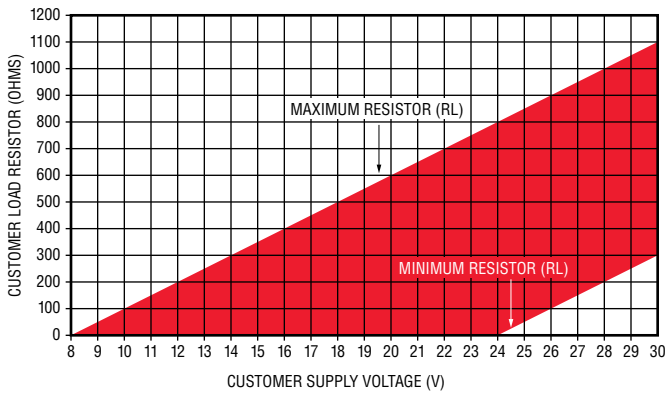
Cable-Out Type



Code S

Wire Color	Voltage Mode	Current Mode
Red	Supply	Supply
Black	Ground	Return
White	V _{out}	No Connect

Current Output Mode (Load Resistor Range)



Minimum Resistor Value = $50 \cdot (+V - 24)$ for $+V > 24V$
 Maximum Resistor Value = $50 \cdot (+V - 8)$ for $+V > 8V$

How to Order

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

		31EP	B	200PG	02	S	R	01	
Series	31EP / 32EP - CSA Approved Pressure Transducer 31EA / 32EA - ATEX Approved Pressure Transducer								Cable Length
Output	B - 4-20 mA N - 0.5-4.5 V T - 0.5-4.5 V Ratiometric	C - 1-6 V R - 0-5 V	H - 1-5 V S - 0-10 V						01 - 1 meter 02 - 2 meters 03 - 3 meters 04 - 4 meters 05 - 5 meters 10 - 10 meters
Pressure Range – psi	100PG - 0-100 psiG 150PG - 0-150 psiG 200PG - 0-200 psiG 300PG - 0-300 psiG 500PG - 0-500 psiG 600PG - 0-600 psiG 750PG - 0-750 psiG	10CPG - 0-1,000 psiG 15CPG - 0-1,500 psiG 20CPS - 0-2,000 psiS 25CPS - 0-2,500 psiS 30CPS - 0-3,000 psiS 35CPS - 0-3,500 psiS 40CPS - 0-4,000 psiS 50CPS - 0-5,000 psiS 60CPS - 0-6,000 psiS 75CPS - 0-7,500 psiS	10KPS = 0-10,000 psiS						Optional Restrictor
Pressure Range - bar	0007G - 0-7 barG 0010G - 0-10 barG 0016G - 0-16 barG 0025G - 0-25 barG 0040G - 0-40 barG 0060G - 0-60 barG 0100G - 0-100 barG	0160S - 0-160 barS 0250S - 0-250 barS 0400S - 0-400 barS 0600S - 0-600 barS 1000S - 1,000 barS ²							R - Restrictor 0 - No Restrictor
Notes:	1. For use with pull-up or pull-down resistors, contact factory. 2. Range 1,000 bar available with -2T pressure port only. 4. Pressure ports 0E and 1G are NOT available with the Restrictor option.								Electrical Connection
									S - Explosion Proof Conduit 1/2" NPT
									Pressure Port ⁴
									08 - 1/8"-27 NPT External 02 - 1/4"-18 NPT External 0H - 1/2" NPT 04 - 7/16"-20 External (SAE #4, J514) 1J - 7/16"-20 External (SAE #4, J1926-2) 0E - 1/4"-18 NPT Internal 1G - Schraeder SAE #4, 7/16" Internal 4B - 1/4" Female (7/16UN with Schraeder Deflator) 1P - SAE 6 (9/16"-18 UNF 2A) 4C - 1/4"-18 NPTF External (Dryseal) 4D - 1/8"-27 NPTF External (Dryseal) 4N - SAE 3 (3/8"-24 UNF External)
									European Threads
									0S - G1/8" A Stud (BS 5380 Port) 01 - G1/4" External 05 - G1/4" External Soft Seal 0A - G1/4"-19 PT (JIS) or BSPT 4P - G1/2" A 27A/F 0L - M12 x 1.5 (<1,000 bar, 15,000 psi) 2T - M12 x 1.5 (6g) (≥1,000 bar, 15,000 psi) 0K - M14 x 1.5 Straight

31IS Series and 32IS Heavy Duty Series Intrinsically Safe Industrial Pressure Transmitters

- ▶ Ex II 1G; Ex ia IIB T4 Ga
- ▶ The 3XIS series is certified Intrinsically Safe for use in Group IIB Hazardous Areas, Zones 0, 1 and 2
- ▶ Certification: ATEX Certificate Baseefa10ATEX0196
IECEX Certificate GB/BAS/ExTR10/0230/00

For OEMs that need intrinsically safe pressure sensors with consistent high levels of performance, reliability and stability, the 31/32IS Series sputtered thin film units offer an unbeatable price performance ratio in a small package size. Their size makes them ideal for installation where space is at a premium. They feature all stainless steel wetted parts, a broad selection of electrical and pressure connections and a wide choice of electrical outputs.

32IS Series transmitters feature a thicker diaphragm and a pressure restrictor to withstand the rigors of cavitation or extreme pressure spikes, delivering years of reliable and stable performance in pulsating applications.

Specifications

Performance	
Long Term Drift	0.2% FS/YR (non-cumulative)
Accuracy	0.25% FS
Thermal Error	
31IS	±1.5% max, ±1% typical / 212°F (100°C)
32IS	±2% max
Operating & Compensated Temperatures	
	-40°F to +176°F (-40°C to +80°C)
Zero Tolerance, Max.	0.5% of span
Span Tolerance, Max.	0.5% of span
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 code G)
Vibration	BSEN 60068-2-6 (FC) Sine (20G) BSEN 60068-2-64 (FH) Random (14.1 Grms)
Shock	BSEN 60068-2-27 (Ea) (50G, 11ms)
Approvals	
ATEX	Ex II 1G; Ex ia IIB T4 Ga, -40°F ≤ Ta ≤ +176°F (-40°C ≤ Ta ≤ +80°C)
IECEX	Ex ia IIB T4 Ga -40°F ≤ Ta ≤ +176°F (-40°C ≤ Ta ≤ +80°C)
ATEX/IECEX Common	When used in conjunction with a Zener safety barrier or Galvanic Isolation barrier. Fully RoHS Compliant
Weight	1.8 to 5.3 ounces (50-150 grams). Configuration dependant

EMC Specifications

Emissions Tests: EN61326-1:2006 and EN61326-2-3:2006	
EN55011:2007	Radiated Emissions: 30-230MHz 30dB μV/M @10M 230-1000MHz 37dB μV/M @10M
Immunity Tests: EN61326-1:2006 and EN61326-2-3:2006	
EN61000-4-2:2009	Electrostatic Discharge: ±4Kv contact ±8Kv air
EN61000-4-3:2006	Radiated Immunity: 10V/M 80-1000MHz 3V/M 1400-2000MHz 1V/M 2000-2700MHz
EN61000-4-4:2004	Fast Transients: ±0.25, 0.5, 1Kv
EN61000-4-6:2007	Conducted Immunity: 3V 0.15 to 80MHz 80% 1KHz modulation



Individual Specifications

Voltage	
Output (3-wire)	0V min. to 10V max. See under "How to Order," last page
Supply Voltage	1 Volt above full scale to 30V max @ 4.5 mA
Source and Sinks	2 mA
Current	
Output (2-wire)	4-20 mA
Supply Voltage	8-24 Volts measured at the input to the transducer terminals
Maximum Loop Resistance	(Supply Voltage – 8) x 50ohms See Graph
Ratiometric Output	
Output	0.5 to 4.5V (Source and sink 2mA)
Supply Voltage	5 Vdc ±10% @ 4.5mA

Pressure Capability

Pressure Range PSI (Bar)	Proof Pressure (x Full Scale)		Burst Pressure (x Full Scale)	
	31IS	32IS	31IS	32IS
100-300 (7-20)	3.00 x FS	3.00 x FS	40 x FS	
500-1,500 (40-100)			20 x FS	
2,000-6,000 (140-400)			10 x FS	
10,000 (700)			> 60,000 PSI (4,000 bar)	
15,000 (1,000)	2.50 x FS			
25,000 (1,800)	1.70 x FS			
30,000 (2,200)	1.40 x FS	—		

Pressure Ports

SAE

	1/8"-27 NPT	1/8"-27 NPTF Dryseal	1/4"-18 NPT	1/4"-18 NPT Internal	1/4"-18 NPTF Dryseal
Dimensions in Inches					
Fitting Code	08	4D	02	0E	4C
Torque	2-3 TFFT*	2-3 TFFT*	2-3 TFFT*	2-3 TFFT*	2-3 TFFT*

	SAE J1926/2:3/8-24	7/16"-20 UNF	7/16"-20 UNF with 37° Flare	SAE 4 Female 7/16" Schraeder	9/16-18 "Heavy Duty"
Dimensions in Inches					
Fitting Code	4N	1J	04	1G	1P
Torque	18-20 NM	18-20 NM	15-16 NM	18-20 NM	18-20 NM

BSP & Metric

	G1/4"-19 External	G1/4"-19 A Integral Face Seal	M12 x 1.5	M12x1.5 HP Metal Washer Seal	M14 x 1.5
Dimensions in MM					
Fitting Code	01	05	0L	2T	OK
Torque	30-35NM	30-35 NM	28-30 NM	30-35 NM	2-3 TFFT*

*NPT Threads 2-3 turns from finger tight. Wrench tighten 2-3 turns.

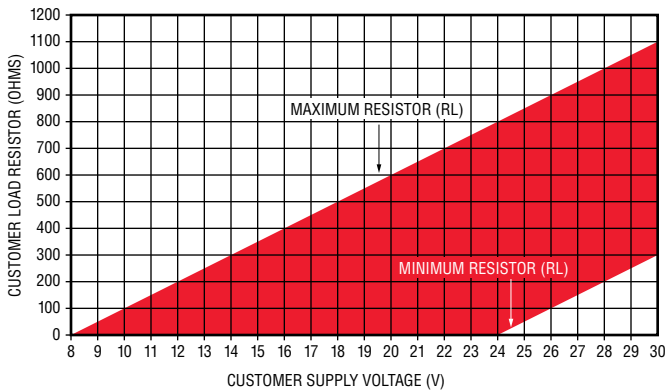
General Notes:

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

Electrical Connector

DIN 9.4 mm		M12 x 1P		Amp Superseal 1.5		Deutsch DT04-4P		DIN 43650A		
Code R		Code E		Code 6		Code 8		Code G		
Pin #	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode
1	V _{supply}	Supply	V _{supply}	Supply	V _{out}	No Connect	Ground	Return	V _{supply}	Supply
2	Ground	Return	V _{out}	No Connect	Ground	Return	V _{supply}	Supply	Ground	Return
3	V _{out}	No Connect	Ground	Return	V _{supply}	Supply	No Connect	No Connect	V _{out}	No Connect
4	No Connect	No Connect	No Connect	No Connect	—	—	V _{out}	No Connect	No Connect	No Connect

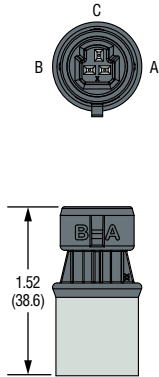
Current Output Mode (Load Resistor Range)



Minimum Resistor Value = $50 \cdot (+V - 24)$ for $+V > 24V$
 Maximum Resistor Value = $50 \cdot (+V - 8)$ for $+V > 8V$

Cable-Out Types

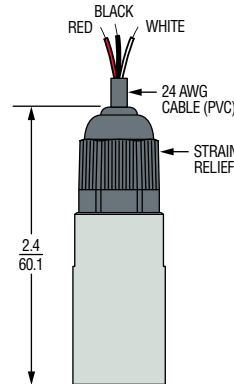
Packard MetriPack



Code 9

Pin ID	Voltage Mode	Current Mode
C	V _{out}	No Connect
A	Ground	Return
B	V _{supply}	Supply
—	—	—

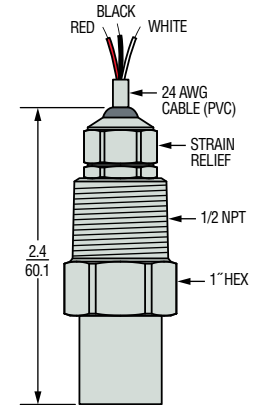
Cable



Code F

Wire Color	Voltage Mode	Current Mode
Red	Supply	Supply
Black	Ground	Return
White	V _{out}	No Connect

1/2" Conduit Connection



Code 3

Voltage Mode	Current Mode
Supply	Supply
Ground	Return
V _{out}	No Connect

How to Order

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

Series **31IS** / **32IS** - Pressure Transducer

Output **B** - 4-20 mA **C** - 1-6 V **H** - 1-5 V
N - 0.5-4.5 V **R** - 0-5 V¹ **S** - 0-10 V¹
T - 0.5-4.5 V Ratiometric

Pressure Range - psi

100PG - 0-100 psiG	15CPS - 0-1,500 psiS	10KPS = 0-10,000 psiS
150PG - 0-150 psiG	20CPS - 0-2,000 psiS	15KPS - 0-15,000 psiS ²
200PG - 0-200 psiG	25CPS - 0-2,500 psiS	20KPS - 0-20,000 psiS ²
300PG - 0-300 psiG	30CPS - 0-3,000 psiS	25KPS - 0-25,000 psiS ²
500PG - 0-500 psiG	35CPS - 0-3,500 psiS	
600PG - 0-600 psiG	40CPS - 0-4,000 psiS	
750PG - 0-750 psiG	50CPS - 0-5,000 psiS	
10CPG - 0-1,000 psiG	60CPS - 0-6,000 psiS	
	75CPS - 0-7,500 psiS	

Pressure Range - bar

0007G - 0-7 barG	0100S - 0-100 barS	1000S - 1,000 barS ²
0010G - 0-10 barG	0160S - 0-160 barS	1600S - 1,600 barS ²
0016G - 0-16 barG	0250S - 0-250 barS	
0025G - 0-25 barG	0400S - 0-400 barS	
0040G - 0-40 barG	0600S - 0-600 barS	
0060G - 0-60 barG		

Notes:

- For use with pull-up or pull-down resistors, contact factory.
- Ranges 15,000 psi (1,000 bar) and above available with **-2T** pressure port only.
- Pressure ports **0E** and **1G** are NOT available with the Restrictor option.
- For electrical codes **F** & **3**, specify cable length in meters.

Cable Length (For electrical connections F& 3 only)

00 - No Cable	03 - 3 meters
01 - 1 meter	04 - 4 meters
02 - 2 meters	05 - 5 meters

Optional Restrictor (32IS only)

R - Restrictor
0 - No Restrictor

Electrical Connection⁴

B - Industrial DIN 9.4 mm (mating connector not supplied)
E - M12 x 1P (4-Pin)
F - Cable version
G - Large DIN
R - Industrial DIN 9.4 mm (alternate pin out)
3 - 1/2" NPT Male Conduit
6 - Amp - Superseal 1.5 Series
8 - Deutsch DT04-4P
9 - Packard MetriPack

Pressure Port³

08 - 1/8-27 NPT External
02 - 1/4-18 NPT External
04 - 7/16-20 External (SAE #4, J514)
1J - 7/16-20 External (SAE #4, J1926-2)
0E - 1/4"-18 NPT Internal
0K - M14 x 1.5 Straight
1G - Schrader SAE #4, 7/16" Internal
1P - SAE 6 (9/16"-18 UNF 2A)
4C - 1/4-18 NPTF External (Dryseal)
4D - 1/8-27 NPTF External (Dryseal)
4N - SAE 3 (3/8-24 UNF External)
01 - G1/4 External
05 - G1/4 External Soft Seal
0L - M12 x 1.5 (<15,000 psi, 1,000 bar)
2T - M12 x 1.5 (6g) (>15,000 psi, 1,000 bar)

31CS Series and 32CS Heavy Duty Series CSA Intrinsically Safe Industrial Pressure Transmitters

For OEMs that need Intrinsically Safe pressure sensors with consistent high levels of performance, reliability and stability, the 31/32CS Series sputtered thin film units offer an 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 a wide choice of electrical outputs.

Our manufacturing process includes the latest automated equipment, producing consistent sensor performance.

Additionally the 32CS Series transmitters feature a thicker diaphragm and a pressure restrictor to withstand the rigors of cavitation 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.

Specifications

Performance	
Long Term Drift	0.2% FS/YR (non-cumulative)
Accuracy	0.25% FS
Thermal Error	
31CS	±1.5% max, ±1% typical / 212°F (100°C)
32CS	±2% max
Operating & Compensated Temperatures	
	-40°F to +176°F (-40°C to +80°C)
Zero Tolerance, Max.	0.5% of span
Span Tolerance, Max.	0.5% of span
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 code G)
Vibration	
	BSEN 60068-2-6 (FC) Sine (20G)
	BSEN 60068-2-64 (FH) Random (14.1 Grms)
Shock	
	BSEN 60068-2-27 (Ea) (50G, 11ms)
Approvals	CSA Certified Intrinsically Safe for use in: Class I, Division 1, Groups C and D Class I, Zone 0 Ex ia IIB T4 Ga Class I, Zone 0 AEx ia IIB T4 Ga When used in conjunction with a Zener safety barrier. Fully RoHS Compliant
Weight	1.8 to 5.3 ounces (50-150 grams). Configuration dependant

EMC Specifications

Emissions Tests: EN61326-1:2006 and EN61326-2-3:2006	
EN55011:2007	Radiated Emissions: 30-230MHz 30dB µV/M @10M 230-1000MHz 37dB µV/M @10M
Immunity Tests: EN61326-1:2006 and EN61326-2-3:2006	
EN61000-4-2:2009	Electrostatic Discharge: ±4Kv contact ±8Kv air
EN61000-4-3:2006	Radiated Immunity: 10V/M 80-1000MHz 3V/M 1400-2000MHz 1V/M 2000-2700MHz
EN61000-4-4:2004	Fast Transients: ±0.25, 0.5, 1Kv
EN61000-4-6:2007	Conducted Immunity: 3V 0.15 to 80MHz 80% 1KHz modulation



Individual Specifications

Voltage	
Output (3-wire)	0V min. to 10V max. See under "How to Order," last page
Supply Voltage	1 Volt above full scale with minimum supply of 8V; maximum 30V @ 4.5 mA
Source and Sinks	2 mA
Current	
Output (2-wire)	4-20 mA
Supply Voltage	8-24 Volts measured at the input to the transducer terminals
Maximum Loop Resistance	(Supply Voltage – 8) x 50ohms See Graph
Ratiometric	
Output	0.5 to 4.5V (Source and sink 2mA)
Supply Voltage	5 Vdc ±10% @ 4.5mA

Pressure Capability

Pressure Range PSI (Bar)	Proof Pressure (x Full Scale)		Burst Pressure (x Full Scale)	
	31CS	32CS	31CS	32CS
100-300 (7-20)	2.00 x FS	3.00 x FS	40 x FS	
500-1,500 (40-100)			20 x FS	
2,000-6,000 (140-400)			10 x FS	
10,000 (700)			> 60,000 PSI (4,000 bar)	
15,000 (1,000)	2.50 x FS			
25,000 (1,800)	1.70 x FS			
30,000 (2,200)	1.40 x FS	—		

Pressure Ports

SAE

	1/8"-27 NPT	1/8"-27 NPTF Dryseal	1/4"-18 NPT	1/4"-18 NPT Internal	1/4"-18 NPTF Dryseal
Dimensions in Inches					
Fitting Code	08	4D	02	0E	4C
Torque	2-3 TFFT*	2-3 TFFT*	2-3 TFFT*	2-3 TFFT*	2-3 TFFT*

	SAE J1926/2-3/8-24	7/16"-20 UNF	7/16"-20 UNF with 37° Flare	SAE 4 Female 7/16" Schraeder	9/16-18 "Heavy Duty"
Dimensions in Inches					
Fitting Code	4N	1J	04	1G	1P
Torque	18-20 NM	18-20 NM	15-16 NM	18-20 NM	18-20 NM

BSP & Metric

	G1/4"-19 External	G1/4"-19 A Integral Face Seal	M12 x 1.5	M12x1.5 HP Metal Washer Seal	M14 x 1.5
Dimensions in MM					
Fitting Code	01	05	0L	2T	0K
Torque	30-35NM	30-35 NM	28-30 NM	30-35 NM	2-3 TFFT*

*NPT Threads 2-3 turns from finger tight. Wrench tighten 2-3 turns.

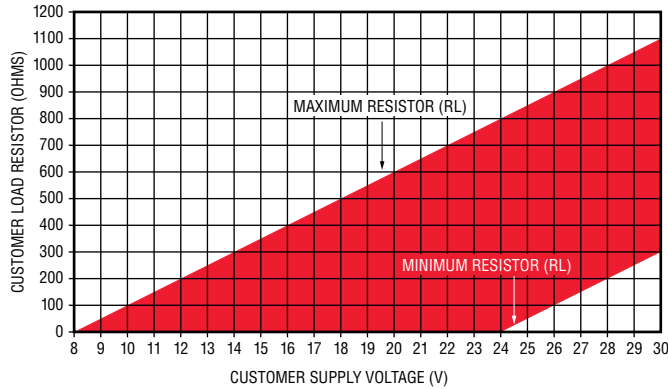
General Notes:

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

Electrical Connector

DIN 9.4 mm		M12 x 1P		Amp Superseal 1.5		Deutsch DT04-4P		DIN 43650A		
Code R		Code E		Code 6		Code 8		Code G		
Pin #	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode
1	V _{supply}	Supply	V _{supply}	Supply	V _{out}	No Connect	Ground	Return	V _{supply}	Supply
2	Ground	Return	V _{out}	No Connect	Ground	Return	V _{supply}	Supply	Ground	Return
3	V _{out}	No Connect	Ground	Return	V _{supply}	Supply	No Connect	No Connect	V _{out}	No Connect
4	No Connect	No Connect	No Connect	No Connect	—	—	V _{out}	No Connect	No Connect	No Connect

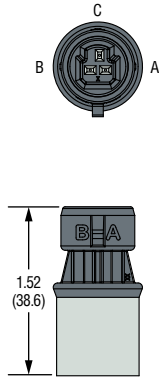
Current Output Mode (Load Resistor Range)



Minimum Resistor Value = $50 \times (+V - 24)$ for $+V > 24V$
 Maximum Resistor Value = $50 \times (+V - 8)$ for $+V > 8V$

Cable-Out Types

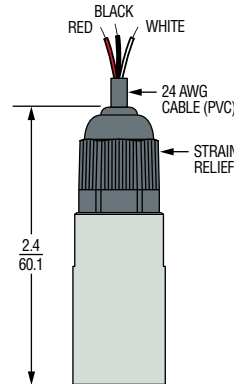
Packard MetriPack



Code 9

Pin ID	Voltage Mode	Current Mode
C	V _{out}	No Connect
A	Ground	Return
B	V _{supply}	Supply
—	—	—

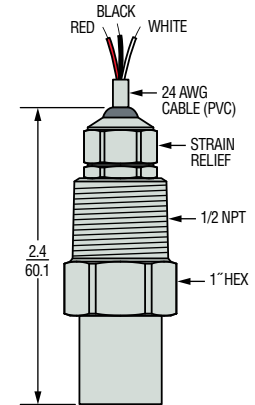
Cable



Code F

Wire Color	Voltage Mode	Current Mode
Red	Supply	Supply
Black	Ground	Return
White	V _{out}	No Connect

1/2" Conduit Connection



Code 3

Wire Color	Voltage Mode	Current Mode	Wire Color	Voltage Mode	Current Mode
Red	Supply	Supply	Red	Supply	Supply
Black	Ground	Return	Black	Ground	Return
White	V _{out}	No Connect	White	V _{out}	No Connect

How to Order

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

Series **31CS** / **32CS** - Pressure Transducer

Output **B** - 4-20 mA **C** - 1-6 V **H** - 1-5 V
N - 0.5-4.5 V **R** - 0-5 V¹ **S** - 0-10 V¹
T - 0.5-4.5 V Ratiometric

Pressure Range – psi

100PG - 0-100 psiG	10CPG - 0-1,000 psiG	10KPS = 0-10,000 psiS
150PG - 0-150 psiG	15CPG - 0-1,500 psiG	15KPS - 0-15,000 psiS ²
200PG - 0-200 psiG	20CPS - 0-2,000 psiS	20KPS - 0-20,000 psiS ²
300PG - 0-300 psiG	25CPS - 0-2,500 psiS	25KPS - 0-25,000 psiS ²
500PG - 0-500 psiG	30CPS - 0-3,000 psiS	
600PG - 0-600 psiG	35CPS - 0-3,500 psiS	
750PG - 0-750 psiG	40CPS - 0-4,000 psiS	
	50CPS - 0-5,000 psiS	
	60CPS - 0-6,000 psiS	
	75CPS - 0-7,500 psiS	

Pressure Range - bar

0007G - 0-7 barG	0160S - 0-160 barS	1000S - 1,000 barS ²
0010G - 0-10 barG	0250S - 0-250 barS	1600S - 1,600 barS ²
0016G - 0-16 barG	0400S - 0-400 barS	
0025G - 0-25 barG	0600S - 0-600 barS	
0040G - 0-40 barG		
0060G - 0-60 barG		
0100G - 0-100 barG		

Cable Length (For electrical connections F & 3 only)

00 - No Cable	03 - 3 meters	10 - 10 meters
01 - 1 meter	04 - 4 meters	
02 - 2 meters	05 - 5 meters	

Optional Restrictor (32IS only)

R - Restrictor
0 - No Restrictor

Electrical Connection⁴

E - M12 x 1P (4-Pin)
F - Cable version
G - Large DIN
R - Industrial DIN 9.4 mm (alternate pin out)
3 - 1/2" NPT Male Conduit
6 - Amp - Superseal 1.5 Series
8 - Deutsch DT04-4P
9 - Packard MetriPack

Pressure Port³

08 - 1/8-27 NPT External
02 - 1/4-18 NPT External
04 - 7/16-20 External (SAE #4, J514)
1J - 7/16-20 External (SAE #4, J1926-2)
0E - 1/4"-18 NPT Internal
0K - M14 x 1.5 Straight
1G - Schrader SAE #4, 7/16" Internal
1P - SAE 6 (9/16"-18 UNF 2A)
4C - 1/4-18 NPTF External (Dryseal)
4D - 1/8-27 NPTF External (Dryseal)
4N - SAE 3 (3/8-24 UNF External)
01 - G1/4 External
05 - G1/4 External Soft Seal
0L - M12 x 1.5 (<1,000 bar, 15,000 psi)
2T - M12 x 1.5 (6g) (≥1,000 bar, 15,000 psi)

Notes:

- For use with pull-up or pull-down resistors, contact factory.
- Ranges 15,000 psi (1,000 bar) and above available with -2T pressure port only.
- Pressure ports **0E** and **1G** are NOT available with the Restrictor option.
- For electrical codes **F** & **3**, specify cable length in meters.

4000 Series – High Performance, Long Term Stability Pressure Transducers

- ▶ Gauge, Sealed, Absolute, and Differential Pressure Models
- ▶ Submersible, High Temperature and Weather Proof Enclosures
- ▶ High Stability Achieved by Sputtered Sensing Element

The 4000 series provides exceptional levels of stability and other performance specifications in a wide variety of enclosures from submersible to differential styles. By using a sputtered sensing element, which achieves a molecular fusion of a strain gauge material, an insulating material, and the 17-4 PH ss sensing element, the 4000 series provides the most stable sensor construction possible. These sputtered sensors are packaged for harsh applications requiring long term service where precise laboratory type measurements are required.

Also in the 4000 series is a range of high performance amplified sensors with voltage and current outputs. These laboratory specification sensors utilize the same thin film sensor as 4000.

Specifications

Input		
Pressure Range	4000 series: 1 to 690 bar; 4010 series: 15 to 10,000 psi	
Proof Pressure	2 x Full Scale (FS) (1.5 x FS for Inconel ports)	
Burst Pressure	>35 x FS ≤ 150 psi (10 bar) ranges >15 x FS ≤ 1500 psi (100 bar) ranges >8 FS ≤ 10,000 psi (690 bar) ranges	
Fatigue Life	3 million FS cycles	
Common Line Pressure	max. 850 psia absolute (60 bar) differential units only	
Performance		
Output*	30mV ±1% (certificate supplied) (4010, 25 to 33 mV)	
Supply Voltage (Vs)	10 VDC Regulated (15 VDC max)	
Long Term Drift	0.06% per year non-cumulative	
Performance Code	Accuracy typical	Thermal Error typical
J	0.1 % span	1.2 % span
K	0.1 % span	0.6 % span
L	0.08 % span	0.6 % span
M	0.08 % span	0.3 % span
Compensated Temperatures	-65°F to +250°F (-54°C to +120°C)	
Operating Temperatures	-65°F to +275°F (-54°C to +135°C) for twist lock conn. "C" -65°F to +250°F (-54°C to +120°C) for cable units "D" -4°F to +122°F (-20°C to +50°C) for submersible unit "M"	
Zero Tolerance	0 mV +/- 1 mV for performance codes J & K 0 mV +/- 0.6 mV for performance codes L & M	
Bridge Resistance	2200 to 5250 ohms	
Mechanical Configuration		
Pressure Port	See ordering chart	
Wetted Parts	17-4 PH ss (optional Inconel) [17-4 PH and 15-7 Mo Stainless Steel ≤ 30 psi (1.6 bar)] Differential: dry non corrosive gas only on reference port	
Electrical Connection	See ordering chart	
Enclosure	321 ss case IP40 for elec. Code "C" gauge datum IP65 for elec. Code "C" Absolute or Sealed Datum IP66 (weatherproof) for elec. code "D" IP68 (submersible) for elec. code "M"	
Vibration	35g peak sinusoidal, 5 to 2000 Hz	
Shock	Withstands free fall to EIC 68-2-32 proc 1	
Approvals	CE	
Weight	150 grams max (excluding cable)	

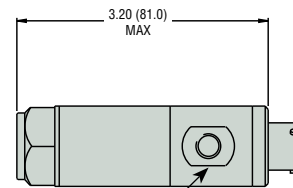
Note:
* Inconel 30 psi (2.5 bar) range output is 25 mV ±1%



Dimensions in. (mm)

Differential

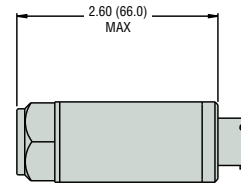
Code C



Reference port G1/8" internal to BS2779

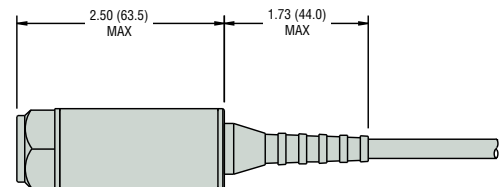
Absolute and Gauge

Code C



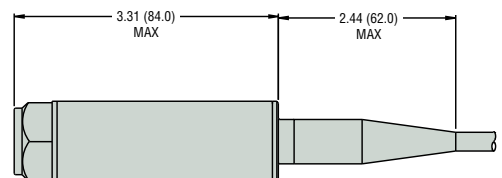
Absolute and Gauge

Code D



Absolute and Gauge

Code M



Maximum diameter 1" (25.7 mm)

4700 Series – High Performance, High Stability, with 5:1 Turndown Capability Industrial Transmitters

- ▶ Gauge, Sealed and Absolute Models
- ▶ Submersible, General Purpose and Wash Down Enclosures
- ▶ IS Models

The 4700 series provides precise laboratory type measurements in a rugged industrial package complete with turndown capabilities. Exceptional levels of stability and other performance specifications are achieved by using a sputtered sensing element, which achieves a molecular fusion of a strain gauge material, an insulating material, and the 17-4 PH ss sensing element. Sputtered or thin film technology provides years of worry free measurements under demanding real world conditions.



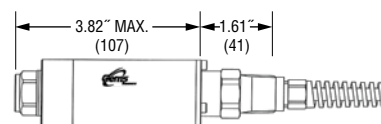
Specifications

Input	
Pressure Range	4710, 10 to 10,000 psi; 4700, 1 bar to 690 bar
Proof Pressure	2 x Full Scale (FS) for Stainless Steel Units 1.5 x FS for Inconel Units
Burst Pressure	>35 x FS ≤ 10 bar ranges >15 x FS ≤ 100 bar ranges >8 FS ≤ 690 bar ranges
Fatigue Life	3 million FS cycles
Performance	
Output	4-20 mA (2 wire)
Supply Voltage (Vs)	9.5 to 40 VDC (Ex IIG: 9.5 to 28 VDC)
Supply Voltage Sensitivity	0.005% of max. span/Volt
Long Term Drift	0.1% of max span per year non-cumulative
Accuracy	0.1 % FS typical
Thermal Error (typical)	0.8% of max span for performance code E 0.5% of max span for performance code F
Compensated Temperatures	-13°F to +167°F (-25°C to +75°C)
Operating Temperatures	-13°F to +185°F (-25°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
Zero Tolerance	0.1% FS, typical
Span Tolerance	0.1% FS, typical
Zero Adjustment	±10% (100% at factory) by potentiometer
Span Adjustment	25% to 125% of span by potentiometer
Max. Loop Resistance	(Vs-8) x 50 ohms
Mechanical Configuration	
Pressure Port	see ordering chart
Wetted Parts	17-4 PH ss (optional Inconel) [17-4 PH and 15-7 Mo Stainless Steel ≤ 1.6 bar (30 Psi)]
Electrical Connection	see ordering chart
Enclosure	318 Duplex ss, 17-4 PH ss and glass filled polyester IP40 for gauge datum & electrical conn. code C IP65 for absolute and sealed datum & elec. conn. code C IP65 for electrical connection code G IP68 for electrical connection code F
Vibration	35g peak sinusoidal, 5 to 2000 Hz
Acceleration	100g steady acceleration in any direction 0.05% FS/g for 15 psi (1 bar) range decreasing logarithmically to 0.0001% FS/g for 10000 psi (690 bar) range.
Shock	Withstands free fall to IEC 68-2-32 procedure 1
Approvals	CE, Lloyds Register, optional Intrinsically Safe EEx ia IIC T4 per ATEX, (Quality Assurance Certificate Supplied), ABS Certified
Weight	approx. 305 g (additional; cable 75 grams/m)

Dimensions in. (mm)

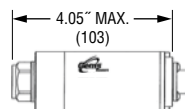
Max diameter 39mm, all models

Code 3



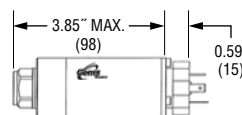
1/2 - 14 NPT conduit

Code C



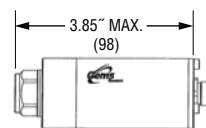
6 Pin Fixed Plug Size (10-6)

Code G



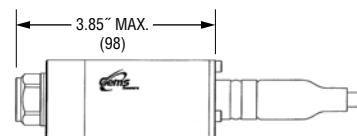
Fixed Plug to DIN 43650 Mate Supplied

Code L



5 Pin M12 x 1 Fixed Plug

Code M



Immersible IP68 to 200m WG

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
G "DIN"	1	2	4
C "10-6 Bayonet"	A	B	E
F "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	N50	G, A
0 to 1	A10	G, A
0 to 1.6	A16	G, A
0 to 2.5	A25	G, A
0 to 4	A40	G, A
0 to 6	A60	G, A
0 to 10	B10	G, A
0 to 16	B16	G, A
0 to 25	B25	G, A
0 to 40	B40	G, A
0 to 60	B60	G, A
0 to 100	C10	G, A
0 to 160	C16	G, A
0 to 250	C25	G, A
0 to 400	C40	G, A
0 to 600	C60	G, A**
0 to 690	C69	G, A**

4710 Model PSI Ranges	Range Code	Gauge (G)* Absolute (A)
0 to 10	F10	G
0 to 15	F15	G, A
0 to 30	F30	G, A
0 to 60	F60	G, A
0 to 100	G10	G, A
0 to 150	G15	G, A
0 to 200	G20	G, A
0 to 300	G30	G, A
0 to 500	G50	G, A
0 to 1000	H10	G, A
0 to 1500	H15	G, A
0 to 3000	H30	G, A
0 to 5000	H50	G, A
0 to 6000	H60	G, A
0 to 10000	J60	G, A**

* For compound ranges please consult factory
** Inconel pressure port required.

Pressure Ports - See Page H-50 for Dimensions

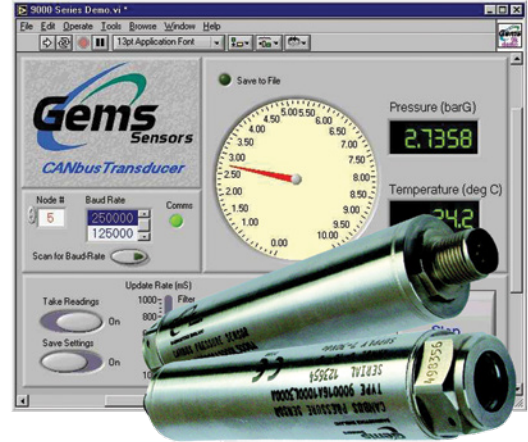
Codes		Description
SS	Inconel	
00	OK	G 1/4 internal
AO	AK	G 1/4 AT external
KO	KK	7/16-20 UNF 3A external
MO	MK	M14 x 1.5 external
PO	PK	G 1/2 AT external
BO	BK	1/4-18 NPT external
GO	GK	1/2-14 NPT external
SO	SK	7/16-20 UNJF external, MS 33656E4
Immersible		
10		Plastic nose cone
20		Nose cone with restrictor
30		Nose cone w/ss Sink Weight

PRESSURE TRANSDUCERS

9000 Series CANbus Digital Output Pressure Transducer



- ▶ High accuracy over wide operating temperature range
T.E.B. $\pm 0.2\%$ Span, -40°F to $+185^{\circ}\text{F}$ (-40°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

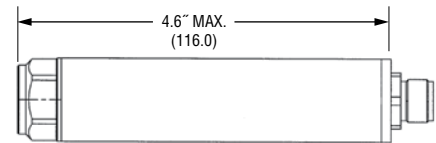


The 9000 CANBUS pressure transducer meets the demands of the test and measurement industry, including automotive and marine applications, with high levels of accuracy over a wide temperature range. The digital output in engineering units eliminates the need for user system calibration.

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)

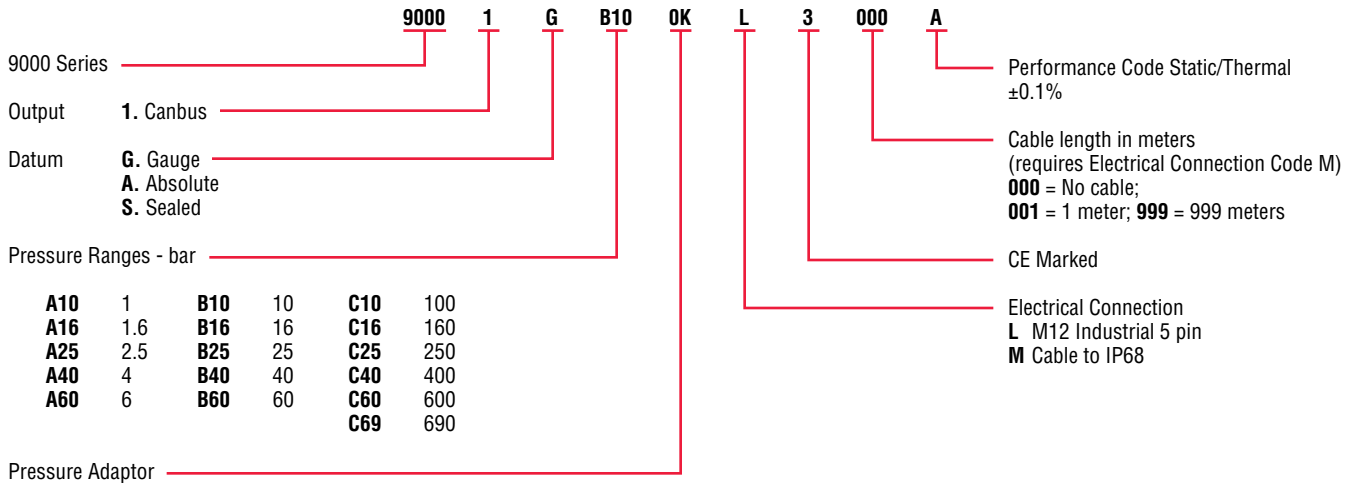


Specification

Input	
Pressure Range	0 to 1 - 0 to 690 bar
Proof Pressure	2 x FS (Inconel 1.5 x F.S.)
Burst Pressure	>35 x FS for ranges ≤ 87 psi (6 bar) >15 x FS for ranges ≥ 1450 psi (100 bar) >4 x FS for ranges ≤ 10007 psi (690 bar)
Supply Voltage	7-30 VDC
Performance	
Long Term Stability	Zero drift $<0.05\%$ Full range output non cumulative
Accuracy	$\pm 0.1\%$ Full Scale
Total Error Band	$\pm 0.2\%$ Full Scale
Compensated Temperature	-40°F to $+185^{\circ}\text{F}$ (-40°C to $+85^{\circ}\text{C}$)
Operating Temperature	-40°F to $+185^{\circ}\text{F}$ (-40°C to $+85^{\circ}\text{C}$)
Mechanical Configuration	
Pressure Port	(see table on next page)
Wetted Parts	17-4 PH or Inconel
Electrical Connection	5 pin M12 x 1, cable to IP68, others on request
Enclosure	SS
Vibration	$<0.08\%$ FRO/g 20Hz to 2000Hz, 35g
Shock	Withstands free fall to IEC 68-2-32 procedure 1
Approvals	CE Emissions EN 61000-6-4, Immunity EN 61000-6-2
Weight	<180 grams

How to Order

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



A10	1	B10	10	C10	100
A16	1.6	B16	16	C16	160
A25	2.5	B25	25	C25	250
A40	4	B40	40	C40	400
A60	6	B60	60	C60	600
				C69	690

Stainless Steel	Inconel	Description
OO	OK	G1/4 internal
AO	AK	G1/4 AT external
KO	KK	7/16-20 UNF-3A external
MO	MK	M14 x 1.5 external
PO	PK	G1/2 AT external
BO	BK	1/4-18 NPT external
GO	GK	1/2-14 NPT external
SO	SK	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

PRESSURE TRANSDUCERS

3800 Series – Pressure Transmitter

- ▶ FM and ATEX Approvals for Hazardous Locations
- ▶ 0 to 10,000 PSI (0 to 689 bar)
- ▶ Field Adjustable – 5:1 Turndown
- ▶ Compact, 316 Stainless Steel, Hermetically Sealed Enclosure
- ▶ 17-4 Stainless Steel Sensor, No O-Ring
- ▶ Dual Seal Approval
- ▶ Flush Mount Option Available

The 3800 Pressure Transmitter is a compact loop-powered (4-20 mA) transmitter, with a low power 1-5 VDC option also available. Its rugged construction makes cost of ownership low and it carries a three-year warranty. The 3800 Pressure Transmitter is suitable for hazardous locations and hostile environments. It meets applications where dependable, continuous monitoring is preferred. Zero and span are field adjusted via Gems calibration kit with USB communication cable.

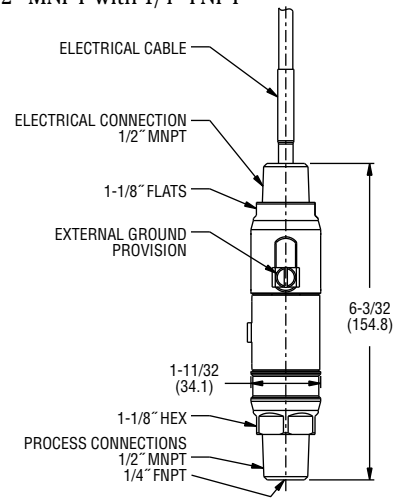
Specifications

Pressure Range	0 to 10,000 psi
Over Pressure	
0-100 psi	3x FSPR
Up to 10,000 psi	2x FSPR
Burst Pressure	
0-100 thru 0-250 psi	40x FSPR
0-500 thru 0-1,000 psi	20x FSPR
0-2,500 psi	10x FSPR
0-5,000 psi	8x FSPR
0-10,000 psi	4x FSPR
Performance	
Long Term Stability	≤±0.5% URL/year
Accuracy	±0.25% URL (BFSL) Linearity, Hysteresis and Repeatability
Response Time	≤5 ms
Turndown	5:1 (2:1 for 100 psi range)
Temperature Ranges	
Compensated	-40°F to +176°F (-40°C to +80°C)
Ambient	-40°F to +176°F (-40°C to +80°C)
Process	-40°F to +194°F (-40°C to +90°C)
Storage	-40°F to +194°F (-40°C to +90°C)
Electrical	
Supply Voltage	8-30 VDC
Output	4-20 mA or 1-5 VDC (27 mW ± 5 mW @ 9 VDC)
Loop Resistance	800 Ohms @ 24 VDC
Circuit Protection	Reverse polarity and EMI/RFI protected
Connection	
Conduit Size	1/2" MNPT
Termination	18 AWG shielded cable, 6-feet (1.8 m)
Mechanical Configuration	
Wetted Parts	17-4 PH Stainless Steel
Enclosure	316 Stainless Steel (CF8M)
Approvals	FM, ATEX, CE
Weight	1.8 lbs. (0.8 kg)

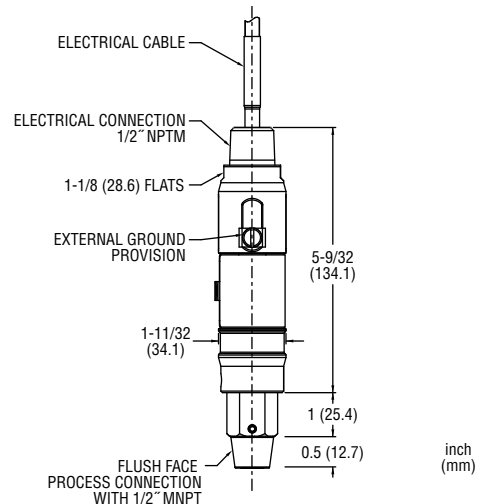


Dimensions

1/2" MNPT with 1/4" FNPT



Flush Mount – 1/2" MNPT



3820 Series – Pressure Transmitter with 30V Switching

- ▶ Combines Continuous Output with Adjustable Set Point Switch
- ▶ FM and ATEX Approvals for Hazardous Locations
- ▶ Field Adjustable – 5:1 Turndown
- ▶ Compact, 316 Stainless Steel, Hermetically Sealed Enclosure
- ▶ Stainless Steel Sensor, No O-Ring
- ▶ Dual Seal Approval
- ▶ Flush Mount Option Available

The 3820 Pressure Transmitter is a compact loop-powered (4-20 mA) transmitter, with a low power 1-5 VDC option also available. These are the same as our 3800 Series with the addition of an integrated 30V/120mA switch. The switch setpoint is specified at time of order for factory setting, yet may be also field adjusted using the Gems Calibration Kit (that will also adjust the zero and span points of the transmitter). 3820 Series Pressure Transmitters are suitable for hazardous locations and hostile environments, and are ideal for applications where dependable, continuous monitoring is required. A rugged construction makes cost of ownership low and they carry a three-year warranty.

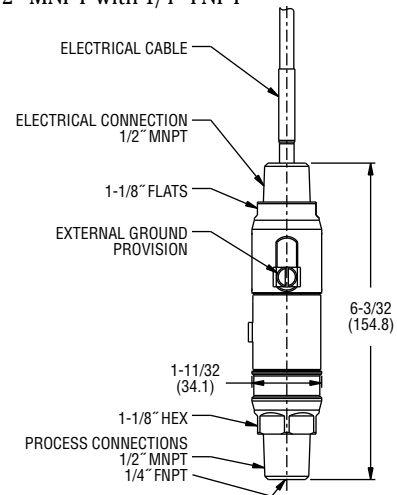
Specifications

Pressure Range	0 to 10,000 psi
Over Pressure	
0-100 psi	3x FSPR
Up to 10,000 psi	2x FSPR
Primary Switch Output	
Accuracy	±2% URL
Type	Normally Open Solid-State Relay
Electrical Rating	30V, 120 mA
Temperature Effect	±2% URL/100°F (38°C) @ -40°F to +176°F (-40°C to +80°C)
Burst Pressure	
0-100 thru 0-250 psi	40x FSPR
0-500 thru 0-1,000 psi	20x FSPR
0-2,500 psi	10x FSPR
0-5,000 psi	8x FSPR
0-10,000 psi	4x FSPR
Continuous Output	
Long Term Stability	≤±0.5% URL/year
Accuracy	±0.25% URL (BFSL) Linearity, Hysteresis and Repeatability
Response Time	≤5 ms
Turndown	5:1 (2:1 for 100 psi range)
Temperature Ranges	
Compensated	-40°F to +176°F (-40°C to +80°C)
Ambient	-40°F to +176°F (-40°C to +80°C)
Process	-40°F to +194°F (-40°C to +90°C)
Storage	-40°F to +194°F (-40°C to +90°C)
Electrical	
Supply Voltage	8-30 VDC
Output	4-20 mA or 1-5 VDC (27 mW ± 5 mW @ 9 VDC)
Loop Resistance	800 Ohms @ 24 VDC
Circuit Protection	Reverse polarity and EMI/RFI protected
Connection	
Conduit Size	1/2" MNPT
Termination	18 AWG shielded cable, 6-feet (1.8 m)
Mechanical Configuration	
Wetted Parts	17-4 PH Stainless Steel
Enclosure	316 Stainless Steel (CF8M)
Approvals	FM, ATEX, CE
Weight	1.8 lbs. (0.8 kg)

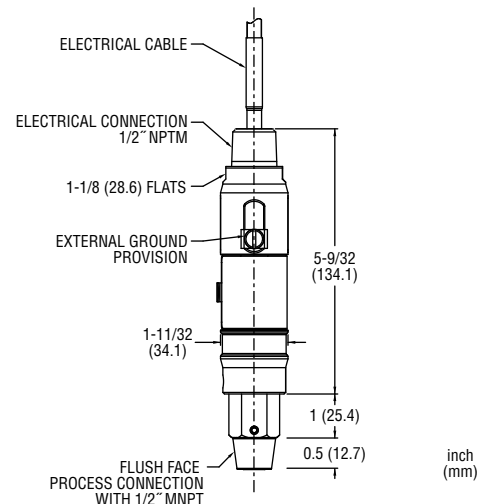


Dimensions

1/2" MNPT with 1/4" FNPT



Flush Mount – 1/2" MNPT



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 	MO	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

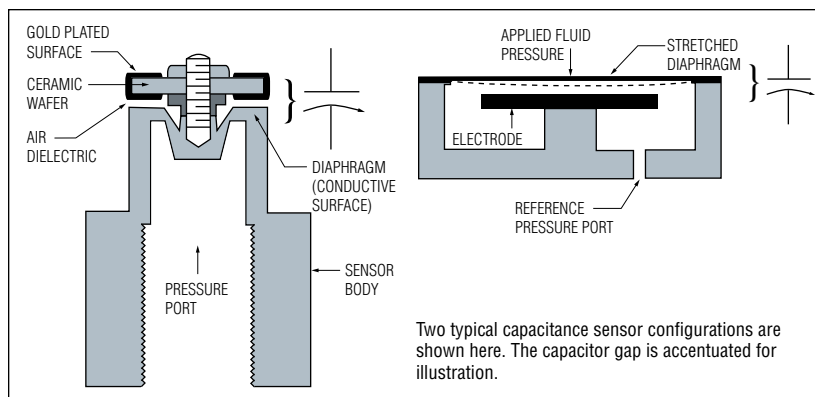
- ▶ High Accuracies
- ▶ Minimal Mechanical Motion
- ▶ Broad Range Capabilities
- ▶ Long Term Stability
- ▶ High Level Output
- ▶ Broad Media Compatibility
- ▶ High Electromagnetic Compatibility
- ▶ Resistant to Harsh Environments

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.

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3500 Series.....	H-76



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

Input	
Pressure Range	-14.7 to 10,000 psi (-1 to 690 bar)
Proof Pressure	See ordering chart
Burst Pressure	See ordering chart
Fatigue Life	>1 million cycles
Performance	
Supply Voltage (Vs)	9-30 VDC (5 VDC on 0.5-4.5 VDC units)
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	±0.015% FS/°F (±0.030% FS/°C)
Compensated Temperatures	-4°F to +176°F (-20°C to +80°C)
Operating Temperatures	-40°F to +185°F (-40°C to +85°C)
Storage Temperatures	-40°F to +185°F (-40°C to +85°C)
Zero Tolerance	1% of span
Span Tolerance	1% of span
Response Time	5 ms
Mechanical Configuration	
Pressure Port	See ordering chart
Wetted Parts	17-4 PH Stainless Steel
Electrical Connection	See Dimensions chart, next page
Enclosure	Weather-Resistant (Stainless Steel and Valox®)
Vibration	20g (MIL STD 202, Method 204, Condition C)
Shock	200g (MIL STD 202, Method 213B, Condition C)
Weight	2.3 oz

Individual Specifications

Voltage Output Units	
Output	3 Wire, see ordering chart
Current Consumption	8 mA
Min. Load Resistance	5000 ohms
Current Output Units	
Output	4-20 mA (2 wire)
Max. Loop Resistance	(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
Terminal Specifications	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.
Ordering Code	XX (cable length in feet)	A1 - Conduit / T1 - Terminal Block	H2	P1 (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
Z01	0 to -14.7	10	15	150P	0 to 150	300	1000
001P	0 to 1	2	250	200P*	0 to 200	400	2000
002P	0 to 2	4	250	250P*	0 to 250	500	2000
005P*	0 to 5	10	250	500P*	0 to 500	1000	3000
010P*	0 to 10	20	500	600P	0 to 600	1200	3000
015P	0 to 15	30	500	10CP*	0 to 1000	2000	5000
025P*	0 to 25	50	500	20CP	0 to 2000	3000	6500
030P	0 to 30	50	500	30CP	0 to 3000	4500	7500
050P*	0 to 50	100	750	50CP	0 to 5000	7500	10000
100P*	0 to 100	200	1000	10KP	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.

PRESSURE TRANSDUCERS

809H Series – 316L SS OEM Pressure Transducer

- ▶ Sensing Ranges from 0 to 1,000 psi (0 to 69 bar)
- ▶ Rugged Stainless Steel & Valox® Housings
- ▶ Ideal for High Shock & Vibration Applications
- ▶ Non-Oil-Filled Design
- ▶ Ideal for Alternative Energy Market

The 809H Series pressure transducers are designed specifically for industrial applications with demanding price and performance requirements. They offer exceptional reliability in typical industrial grade environments. 809H 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 809H Series delivers exceptional performance in extreme environmental conditions at a price that OEMs will appreciate.

Common Specifications

Input	
Pressure Range	0 to 1,000 psi (0 to 69 bar)
Proof Pressure	See ordering chart
Burst Pressure	See ordering chart
Fatigue Life	>1 million cycles
Performance	
Supply Voltage (Vs)	9-30 VDC (5 VDC on 0.5-4.5 VDC units)
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	±0.015% FS/°F (±0.030% FS/°C)
Compensated Temperatures	-4°F to +176°F (-20°C to +80°C)
Operating Temperatures	-40°F to +185°F (-40°C to +85°C)
Storage Temperatures	-40°F to +185°F (-40°C to +85°C)
Zero Tolerance	1% of span
Span Tolerance	1% of span
Response Time	5 ms
Mechanical Configuration	
Pressure Port	See ordering chart
Wetted Parts	316L Stainless Steel
Electrical Connection	See Dimensions chart, next page
Enclosure	Weather-Resistant (Stainless Steel and Valox®)
Vibration	20g (MIL STD 202, Method 204, Condition C)
Shock	200g (MIL STD 202, Method 213B, Condition C)
Weight	3.1 oz (88 grams), approx.

Individual Specifications

Voltage Output Units	
Output	3 Wire, see ordering chart
Current Consumption	8 mA
Min. Load Resistance	5000 ohms
Current Output Units	
Output	4-20 mA (2 wire)
Max. Loop Resistance	(Vs-9) x 50 ohms



1/2" Conduit



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 316L 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	Hirschmann Connector	3-Pin Packard Connector
Terminal Specifications	Standard: 2 ft. multiconductor cable. Longer lengths options. See ordering chart.	1/2" conduit connection with 3-screw terminal block.	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.
Ordering Code	XX (cable length in feet)	A1 - Conduit	H2	P1 (3-Pin)

How to Order

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

SELECT

809H - 025P - G - 2M - 11 - 02 - XXX

Series **809H** - 809H Series

Pressure Range Code

Pressures – psi

Code	Range	Proof	Burst	Code	Range	Proof	Burst
025P*	0 to 25	40	300	250P*	0 to 250	350	1500
050P*	0 to 50	75	500	500P*	0 to 500	700	2000
100P*	0 to 100	150	750	10CP*	0 to 1000	1300	3000

Note: Compound ranges are available upon request

Datum

- G** - Gauge
- S** - Sealed (available in 250 psi ranges and above)

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")
- A1** - 7/8" Hole for 1/2" Conduit*

Output

- 11** - 4-20 mA*
- 23** - 0.2 to 5.2 VDC
- 24** - 0.5-5.5 VDC*

Pressure Port

- 2M** - 1/4" NPT Male*
- J7** - 7/16" SAE Male (J1926-2)
- 1M** - 1/8" NPT Male

* Standard configuration. Minimum 25 pieces apply for all other configurations.

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 350 psi (24 bar). These units feature bleed ports that allow for total elimination of air in the line and pressure cavities.

Common Specifications

Input	
Pressure Range	0 to 100 psid (0 to 6.9 bar)
Proof Pressure	see ordering chart
Burst Pressure	see ordering chart
Common Line Pressure	350 psi (24 bar)
Fatigue Life	>1 Million Cycles
Performance	
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
Mechanical Configuration	
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

Voltage Output Units	
Output	0-5 VDC or 0-10 VDC (3 wire)
Min. Load Resistance	5000K ohms
Current Output Units	
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.

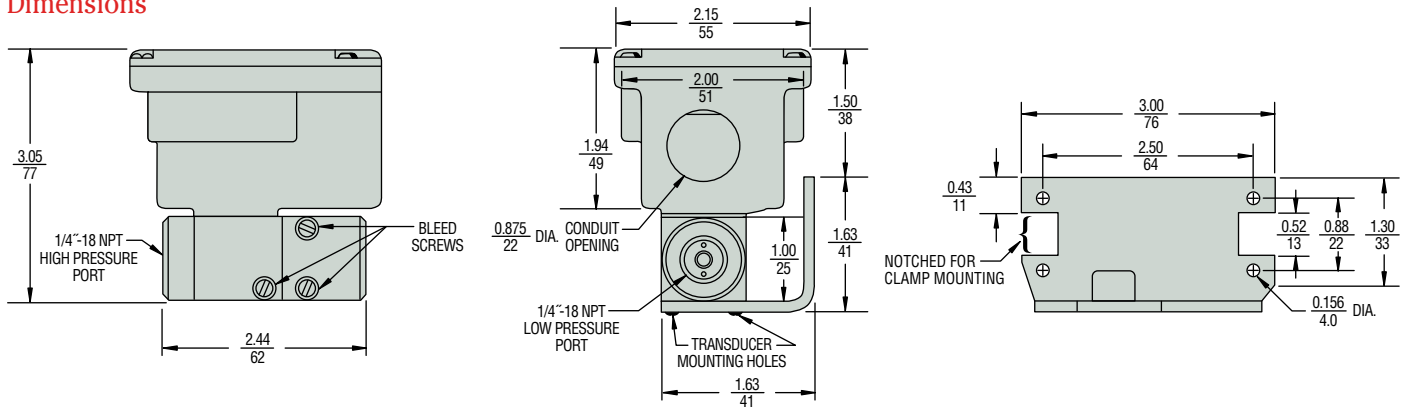
Applications

- 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.

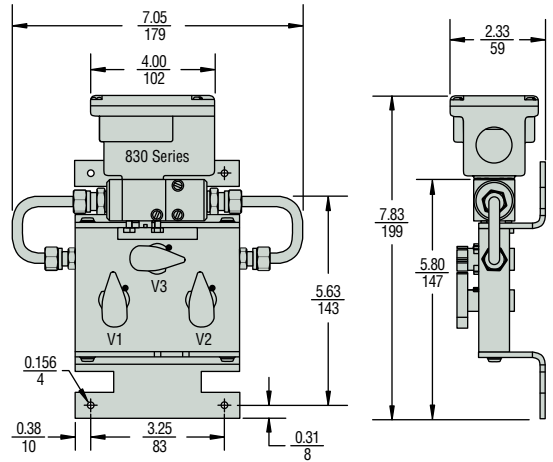
Dimensions



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.

Wetted Parts	360 Brass, Copper 122, Acetal plug valves, and Nitrile O-rings
Valve Type	90-degree on/off
Process Connections	1/4" NPTF
Dimensions	7.05" x 6.25" x 2.16" D (179 mm x 159 mm x 55mm)
Weight	2.5 lbs



How to Order

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

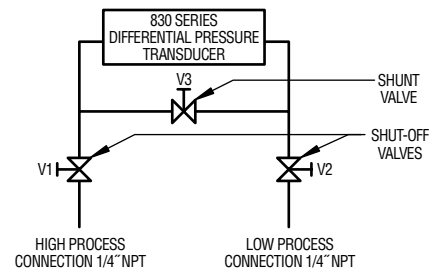
SELECT

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
001PD - 0-1	20	2.5	200	0R5PB - ±0.5	20	1.25	200
002PD - 0-2	40	5.0	200	001PB - ±1	40	2.50	200
005PD - 0-5	100	12.5	600	2R5PB - ±2.5	100	6.25	600
010PD - 0-10	100	25.0	1000	005PB - ±5	100	12.50	1000
025PD - 0-25	350	62.5	1000	010PB - ±10	200	25.00	1000
030PD - 0-30	350	62.5	1000	025PB - ±25	350	62.50	1000
050PD - 0-50	350	125.0	1000	050PB - ±50	350	125.00	1000
100PD - 0-100	350	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

Input	
Pressure Range	0 to 10,000 psig (0 to 700 bar)
Proof Pressure	See ordering chart
Burst Pressure	See ordering chart
Fatigue Life	>1 million cycles
Performance	
Supply Voltage (Vs)	9-30 VDC
Long Term Drift	0.5% FS/year
Accuracy	
<25 psi	±0.25% FS
≥25 psi	±0.13% FS
Thermal Error Zero	
<25 psi	±0.02% FS/°F (±0.036% FS/°C)
≥25 psi	±0.01% FS/°F (±0.018% FS/°C)
Thermal Error Span	
	±0.015% FS/°F (±0.027% FS/°C)
Compensated Temperatures	
	-4°F to +176°F (-20°C to +80°C)
Operating Temperatures	
	-40°F to +260°F (-40°C to +125°C)
Storage Temperatures	
	-40°F to +260°F (-40°C to +125°C)
Zero Tolerance	
	0.5% of span (adjustable)
Span Tolerance	
	1% of span (adjustable)
Mechanical Configuration	
Pressure Port	see ordering chart
Wetted Parts	17-4 PH Stainless Steel
Electrical Connection	Two 1/2" Internal Threaded Ports, Screw Terminal Strip
Enclosure	Die-Cast Aluminum, NEMA 4/IP65
Vibration	20g (MIL STD 202, Method 204, Condition C)
Shock	200g (MIL STD 202, Method 213B, Condition C)
Approvals	CE
Weight	13.4 oz

Individual Specifications

Voltage Output Units	
Output	0.1-5.1 VDC (3 wire)
Current Consumption	6 mA
Min. Load Resistance	5000 ohms
Current Output Units	
Output	4-20 mA (2 wire)
Max. Loop Resistance	(Vs-9) x 50 ohms



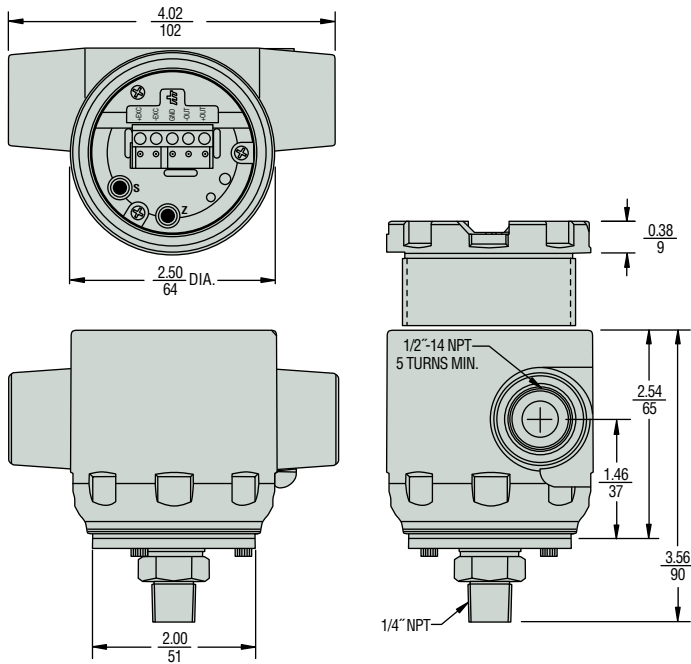
Applications

- 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
002P	0 - 2	4	250
005P	0 - 5	10	250
010P	0 - 10	20	500
015P	0 - 15	30	500
025P	0 - 25	100	500
050P	0 - 50	150	750
100P	0 - 100	300	1000
150P	0 - 150	300	1000
200P	0 - 200	450	2000
250P	0 - 250	500	2000
500P	0 - 500	1000	3000
600P	0 - 600	1200	3000
10CP	0 - 1000	2000	5000
30CP	0 - 3000	4500	7500
50CP	0 - 5000	7500	10000
10KP	0 - 10000	12000	12500

Pressures – bar			
Code	Range	Proof	Burst
1R6B	0 - 1.6	6	40
004B	0 - 4	10	50
006B	0 - 6	18	60
010B	0 - 10	30	80
016B	0 - 16	32	130
025B	0 - 25	50	170
040B	0 - 40	80	240
060B	0 - 60	120	300
100B	0 - 100	200	400
160B	0 - 160	320	500
250B	0 - 250	380	550
400B	0 - 400	600	800
700B	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

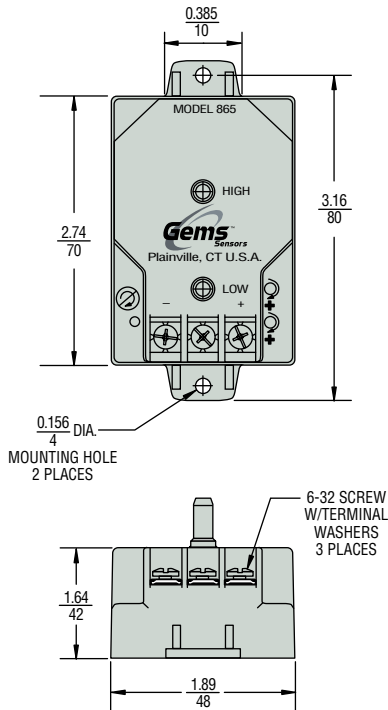
- HVAC
- Energy Management Systems
- Variable Air Volume and Fan Control (VAV)
- Environmental Pollution Control
- Static Duct and Clean Room Pressures
- Oven Pressurization and Furnace Draft Controls

How They Operate

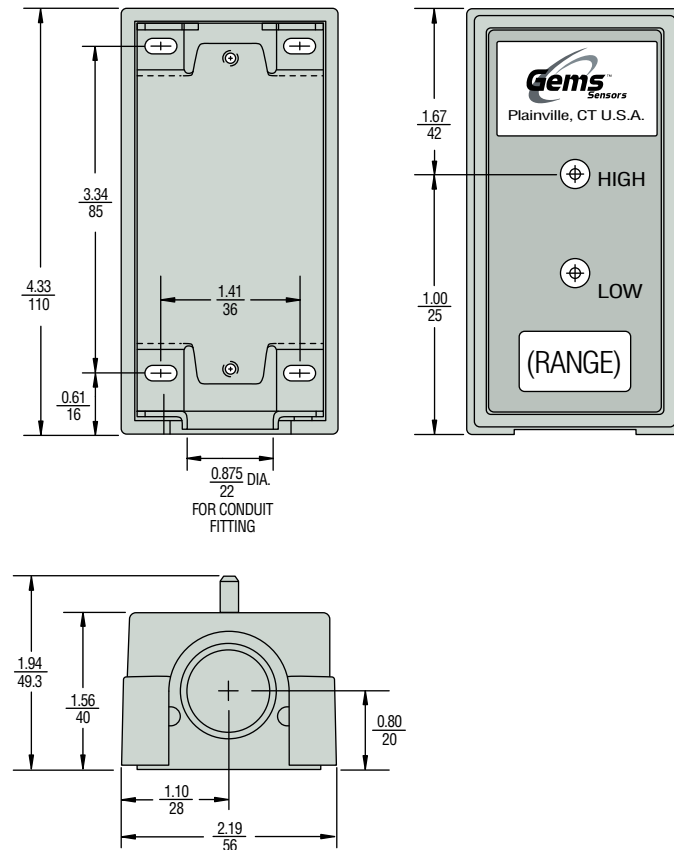
A tensioned stainless steel diaphragm and insulated stainless steel electrode, positioned close to the diaphragm, form a variable capacitor. Positive pressure moves the diaphragm toward the electrode, increasing the capacitance. A decrease in pressure moves the diaphragm away from the electrode, decreasing 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

Unidirectional		Bidirectional	
Code	Range (Inches W.C.)	Code	Range (Inches W.C.)
R25WD	0 to 0.25	OR1WB	±0.1
OR5WD	0 to 0.5	R25WB	±0.25
001WD	0 to 1.0	OR5WB	±0.5
2R5WD	0 to 2.5	001WB	±1.0
005WD	0 to 5.0	2R5WB	±2.5
010WD	0 to 10.0	005WB	±5.0
025WD	0 to 25.0	010WB	±10.0
050WD	0 to 50.0	025WB	±25.0
100WD	0 to 100.0	050WB	±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

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	
Pressure Range	See ordering chart
Proof Pressure	20 psia (30 psia for 20 psia range)
Fatigue Life	>1 million cycles
Performance	
Long Term Drift	0.25% FS/6 months
Accuracy	±0.25% FS
Thermal Error Zero	1% FS
Thermal Error Span	1% FS
Compensated Temperatures	30°F to +130°F (0°C to +55°C)
Operating Temperatures	0°F to +175°F (-18°C to +79°C)
Storage Temperatures	-65°F to +250°F (-55°C to +121°C)
Zero Tolerance	±25 mV
Span Tolerance	±50 mV
Mechanical Configuration	
Pressure Port	1/8" Tube Fitting
Wetted Parts	Stainless Steel, Alumina Ceramics, Gold, Elastomer
Electrical Connection	2 ft. Multiconductor Cable
Enclosure	Stainless Steel with Mounting Bracket
Vibration	2g from 5 Hz to 400 Hz
Acceleration	10g
Shock	50g (operating, 1/2 sine 10mg)
Approvals	CE
Weight	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



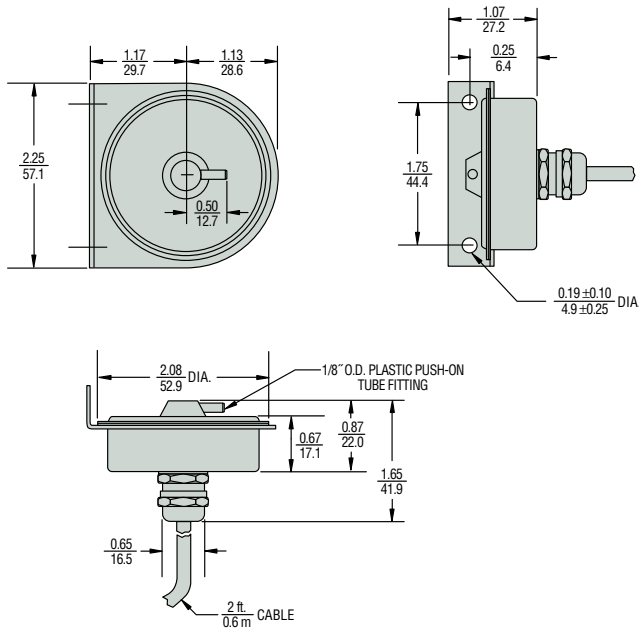
Applications

- 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.

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



CE

Applications

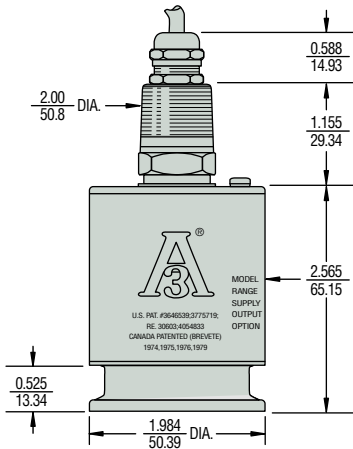
- Food Processing
- Dairy & Beverage Processing
- Pharmaceutical Processing
- Sanitary Pipelines

How They Operate

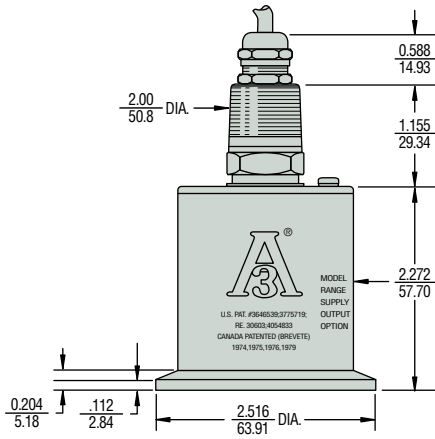
A stainless steel diaphragm and an insulated electrode form a variable capacitor. Pressure on the diaphragm alters the sensor's capacitance, which is then detected and converted to a highly accurate linear 4-20 mA signal by electronic circuitry featuring GemS' patented charge-balance principle. Low hysteresis, 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 ₂ O	Proof psig	Burst psig	Operating Range psig	Proof psig	Burst psig
1	27.7	50	100	30	1000	1200
2	55.4	100	150	60	1000	1200
5	138.4	150	200	100	1000	1200
10	276.8	150	200	300	1000	1200
15	415.2	150	200	500	1000	1500
30	830.4	150	300	1000	1250	2400
60	1160.8	180	400	-14.7 to 15	1000	1200
100	2768.0	200	400	-14.7 to 45	1000	1200
150	4152.0	225	400			
-14.7 to 15	-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

Input	
Pressure Range	0 to 415" wc (0 to 15psi)
Proof Pressure	30psi (≤ 80 "wc) 60psi (≤ 150 "wc); 100psi (>150 "wc)
Burst Pressure	45psi (≤ 28 "wc) 60psi (>28 "wc to 80"wc) 90psi (≤ 150 "wc); 145psi (>150 "wc)
Fatigue Life	10 million FS cycles
Performance	
Long Term Stability	0.25% span/annum
Accuracy	0.2% span max
Thermal Error	2% span max
Compensated Temperatures	-4°F to +140°F (-20°C to +60°C)
Operating Temperatures	
Process media	-40°F to +212°F (-40°C to +100°C)
Electrical code G & L	-15°F to +185°F (-25°C to +85°C)
Electrical code M & 3	-5°F to +120°F (-20°C to +50°C)
Zero Tolerance	1% span
Span Tolerance	1% span
Mounting Effects	0.25% span max
Response Time	5ms
Supply Voltage Sensitivity	0.01% span/volt
Mechanical Configuration	
Inconel Pressure Ports	(See Ordering Guide)
Wetted Parts	318 Duplex SS, Ceramic, Nitrile (Viton® Optional)
Electrical Connection	(See Ordering Guide)
Enclosure	Code M IP68 Submersible Code G IP65
Vibration	35g peak 5-2000 Hz, MIL STD 810, Method 514.2, Procedure I
Acceleration	100g, MIL STD 810C, Method 513.2, Procedure II
Approvals	CE, Lloyds Register, optional intrinsically safe EXII 1G; E Exia II BT4 (-20°C < T amb < 75°C)
Weight	330gms (excluding cable) (12oz)

Individual Specifications

Voltage Output units	
Output	(See Ordering Guide) (3-wire)
Supply Voltage (Vs)	9 to 35 VDC (8-35 VDC, 1-6 VDC Output)
Current Output Unit	
Output	4-20 mA (2 wire)
Supply Voltage (Vs)	9 to 35 VDC (ExII 1G 9-28 Vdc)
Max. Loop Resistance	(Vs-9)* 50 ohms



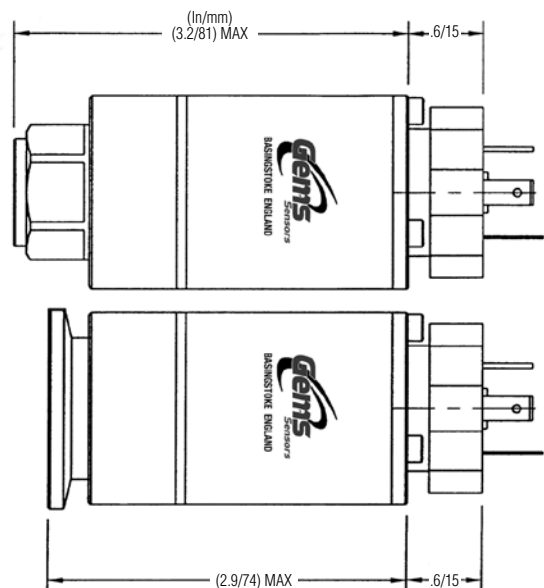
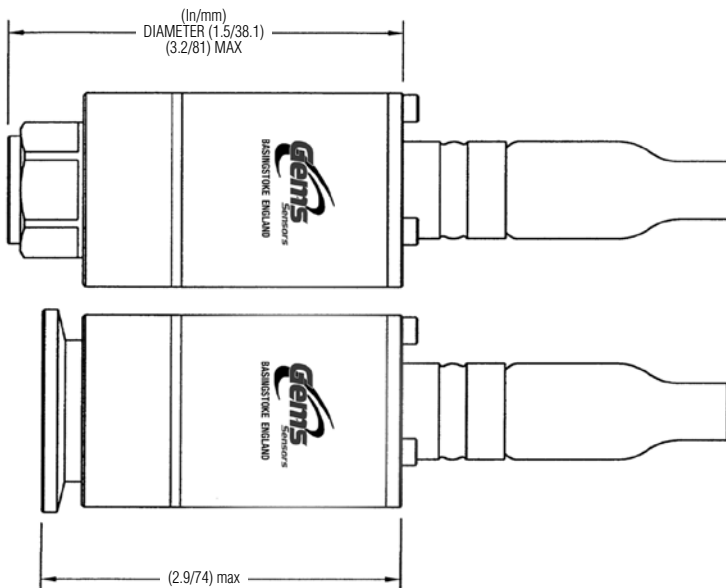
How to Order

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

SELECT

	5000	B	G	N20	OF	M	3	001	A @XXX	
1. 5000 series										10. Specify Calibration (i.e @70" wc)
2. Output:										
	B 4-20 mA	C 1-6 VDC	F 0.1-5.1 VDC	H 1-5 VDC						8. Cable Length 000 = No Cable 001 = 1 meter 999 = 999 meters
3. Pressure Datum: G gauge										7. Approvals 3 CE Marked B Zenier G Galvanic Intrinsically Safe
4. Pressure range code*										6. Electrical Connection G Fixed Plug to DIN 43650, Mating Connector Supplied L M12 x 1 (5 pin) M Immersible Cable Assembly, IP68 3 1/2-14 NPT Conduit
	M70 10 to 28" wc, 25 to 70 mbar, 0.36 - 1 psi									5. Pressure Connection OK G1/4 Internal AK G 1/4 external MK M14x1.5 external BK 1/4 - 18 NPT external KK 7/16 - 20unf - 3A external OF Open Face, KF25 Flange
	N20 29 to 80" wc, 71 to 200 mbar, 1 - 3 psi									Submersible { 19 Plastic Nose Cone
	N35 81 to 150" wc, 201 to 350 mbar, 3 - 5 psi									Nose Cones { 29 Stainless Steel Nose Cone
	A10 151 to 415" wc, 351 to 1000 mbar, 5 - 15 psi									

* specify range required at time of order
eg. 5000BGM700FM3001a@15"wc



FLANGE FACE DIAMETER (1.57/40)

PRESSURE TRANSDUCERS

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

Electrical (Current) Input/Excitation	4 to 20 mA / 5 to 33 VDC
Electrical (Voltage) Input/Excitation	DC Volts / 0 to 6 VDC DC Volts / 5 to 33 VDC
Electrical Termination	PG9 Strain Relief
Surge Suppression	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

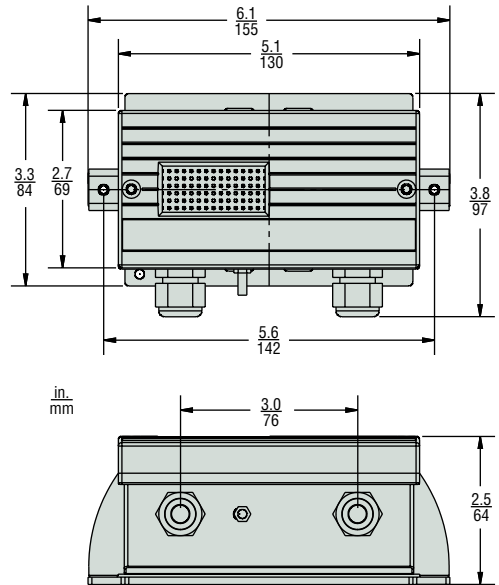


Applications

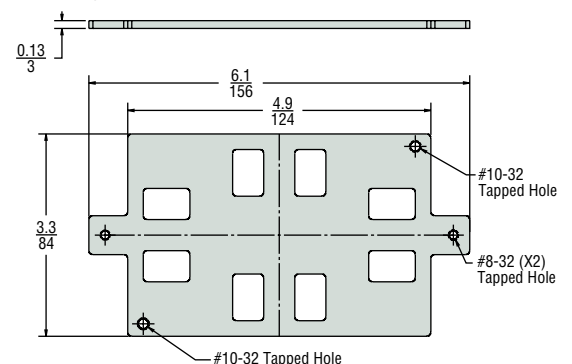
- Field Termination of Pressure Transducers
- Submersible
- Sanitary
- Underground
- Chillers

Dimensions

Front and Side View



Mounting Bracket



PRESSURE TRANSDUCERS

NOTES

A large rectangular area filled with a grid of dashed red lines, intended for handwritten notes. The grid consists of approximately 20 columns and 30 rows of small squares.

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

Input	
Pressure Range	0 to 4 to 0 to 200mWg (mA & V) 0 to 10, 20, 50,100, 200mWg (mV)
Proof Pressure	1.5 x Fs nominal range
Burst Pressure	3 x Fs
Fatigue Life	Designed for more than 100 million FS cycles
Performance	
Long Term Drift	0.2% FS/year (non-cumulative)
Accuracy	0.25% FS typical
Thermal Error	0.5% Typical 30°F to 120°F (0°C to 50°C)
Compensated Temperatures	15°F to 120°F (-10°C to +50°C)
Operating Temperatures	-40°F to +180°F (-40°C to +80°C)
Zero Tolerance	1% of span
Mechanical Configuration	
Pressure Port	G1/4" AT external fitted with nosecone
Wetted Parts	316 Stainless Steel, Polyurethane, Acetal
Electrical Connection	Polyurethane Cable
Enclosure	IP68 to 650ft (200mWG)
Vibration	35g peak sinusoidal, 5 to 2000 Hz
Shock	Withstands free fall to IEC 68-2-32 procedure 1
Approvals	CE
Weight	Approx. 100 grams (additional; cable 75 g/m)

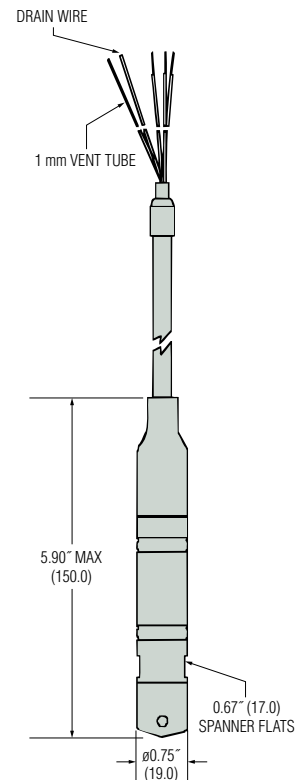
Individual Specifications

Voltage Output units	
Output	0 to 10V
Supply Voltage (Vs)	13 to 28 VDC
Supply Voltage Sensitivity	0.026% span/V
Min. Load Resistance	(FS output / 2) Kohms
Current Consumption	Approx 6 mA @ 8 VDC
Current Output units	
Output	4-20 mA (2 wire)
Supply Voltage (Vs)	24 VDC, (8-28 VDC)
Supply Voltage Sensitivity	0.026% span/V
Max. Loop Resistance	(Vs-7) x 50 ohms
Millivolt units	
Output	100mV ±1mV
Supply Voltage	10 VDC regulated (15 VDC max)
Bridge Resistance	3.5KOHM ± 20% @ 77°F (25°C)
Sink Weight	P/N 198700



CE

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	Millivolt
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

Code	Electrical Output
A	100 mV Not Rangeable
B	4-20 mA
S	0-10 VDC

9600 Series – Slimline Groundwater Monitoring Transducer

- ▶ Remote Ranging via PC Interface
- ▶ 20mm Diameter
- ▶ SDI-12 Communications Versions
- ▶ 318 S/S Wetted Parts
- ▶ Total Error Band $\leq \pm 0.1\%$ FS (23°F to 113°F [-5°C to +45°C])

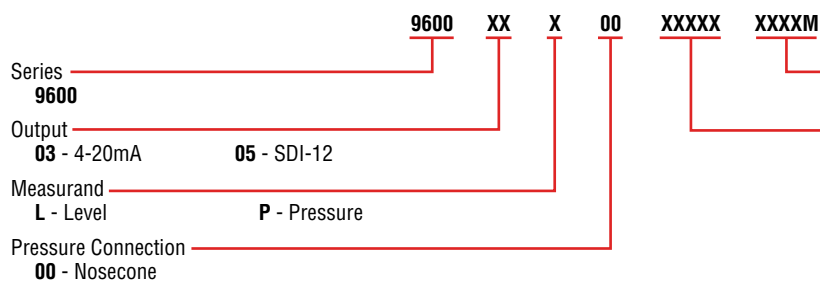
9600 Series pressure transducers meets the rigorous conditions for ground water monitoring while providing ultimate performance. 9600 Series transducers feature built-in specific gravity compensation to provide a true level reading, even when the media is subject to temperature changes over the ranges 23°F to 113°F (-5°C to +45°C). Manufactured with 318 stainless steel wetted parts, which provide excellent corrosion resistance. Reduce installation time, or recalibrate an installed unit without withdrawing it from its media, by using a cable-connected PC or hand-held interface. The SDI-12 communicating versions offer minimal current draw for battery powered applications.

Specifications

Input	
Pressure Range	0 - 3 to 0 - 100mWG
Proof Pressure	1.5 x Fs nominal range
Burst Pressure	3 x Fs
Fatigue Life	Designed for more than 100 million FS cycles
Performance	
Long Term Drift	$\pm 0.05\%$ year
Accuracy	$\pm 0.05\%$
Total Error Band	$\leq \pm 0.1\%$ Fs (23°F to 113°F [-5°C to +45°C])
Compensated Temperatures	23°F to 113°F (-5°C to +45°C)
Operating Temperatures	-13°F to +158°F (-25°C to +70°C) non-freezing
Electrical	
Output	SDI-12 (Temp output $\pm 0.9^\circ\text{F}$ [0.5°C]) or 4 - 20mA
Supply Voltage	8-30Vdc
Current Consumption	Standby less than 450 μA ; active less than 4mA average
Surge Protection	61000-4-5 $\pm 4\text{kv}$
Mechanical Configuration	
Pressure Port	Nosecone (M16 x 1.5 for calibration)
Wetted Parts	Hastelloy, 318 Stainless Steel, Polyurethane, Acetal, Polyolefin
Electrical Connection	Polyurethane Cable
Enclosure	IP68 to 200mWG
Shock	Withstands free fall to IEC 68-2-32 procedure 1
Approvals	CE
Weight	Approx. 100 grams (additional; cable 75 g/m)

How to Order

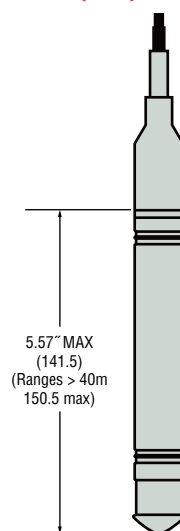
Use the **bold** characters from the chart below to construct a product code



- Cable Length: **XXXXM** - Cable length in meters (MAX 0060 for SDI-12)
- Calibrated Range:
 - XXXXM** - mWG (003M to 100M)
 - XXXXF** - FtWG (010F to 330F)
 - XXXXP** - PSI (005P to 145P)
 - XXXXB** - Bar (00B3 to 10B0)



Dimensions in. (mm)



Wiring Details

	SDI-12	mA
Red	Positive excitation	+Ve
Blue	Negative excitation	-Ve
Green	SDI-12	Comms

PRESSURE TRANSDUCERS

3500 Series

Compact Low Pressure OEM Pressure Transmitters

- ▶ 5 to 600 psi pressure ranges (0.35 to 40 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 3500 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 3500 Series makes it ideal for installation where space is at a premium.

Specifications

Input	
Pressure Range	5-600 psi (0.35-40 bar)
Proof Pressure	2x
Burst Pressure	3X
Performance	
Long Term Drift	<0.2% FS/YR
Accuracy	0.25% FS
Thermal Error, Max.	±1% / 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, Max.	±0.5% of span
Span Tolerance, Max.	±0.5% of span
Fatigue Life	Designed for more than 100 M cycles
Mechanical Configuration	
Pressure Port	See under "How to Order," last page
Wetted Parts	316L Stainless Steel
Electrical Connection	See under "How to Order," last page
Enclosure	IP67
Vibration	BSEN 60068-2-6 (FC) BSEN 60068-2-64 (FH)
Shock	BSEN 60068-2-27 (Ea)
Approvals	CE, PED, RoHS
Weight	1.23 to 1.9 ounces (35-53 grams). Configuration dependant

Individual Specifications

Voltage	
Output	0V min. to 10V max. See under "How to Order," last page
Supply Voltage (Vs)	2 Volts above full scale to 30 Vdc (24 Vdc, max. above 230°F (110°C) applications)
Source and Sinks	8 mA
Current	
Output	4-20 mA
Supply Voltage (Vs)	10-30 Vdc (24 Vdc, max. above 230°F (110°C) applications)
Maximum Load Resistance	(Supply Voltage - 10) x 50ohms
Ratiometric	
Output	0.5 to 4.5V
Supply Voltage (Vs)	5 Vdc ±10%



EMC Specifications

Emissions Tests: EN61326-1:2006 and EN61326-2-3:2006	
EN55011:2009 + A1	Radiated Emissions
Immunity Tests: EN61326-1:2006 and EN61326-2-3:2006	
EN61000-4-2:2009	Electrostatic Discharge
EN61000-4-3:2006 + A2	Radiated Immunity
EN61000-4-4:2012	Fast Burst Transients
EN61000-4-6:2009	Conducted RF Immunity

Pressure Ports

SAE

	1/8"-27 NPT	1/4"-18 NPT	7/16"-20 UNF with 37° Flare	7/16"-20 UNF	1/8"-27 NPTF
Dimensions in Inches					
Fitting Code	08	02	04	1J	4D
Torque	2-3 TFFT*	2-3 TFFT*	15-16 NM	18-20 NM	2-3 TFFT*

BSP & Metric

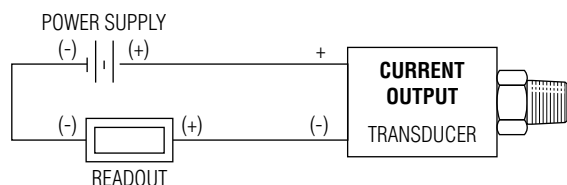
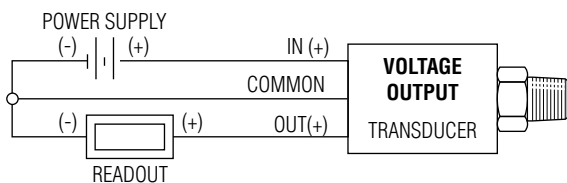
	G1/8" External	G1/4"-19 External w/O-Ring	G1/4"-19 A Integral Face Seal	M12 x 1.5 w/O-Ring
Dimensions in MM				
Fitting Code	0S	01	05	0L
Torque	22-25 NM	30-35 NM	30-35 NM	28-30 NM

* 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 (0.886") Across Flats (A/F) for deep socket mounting

Wiring Diagram



Electrical Connector

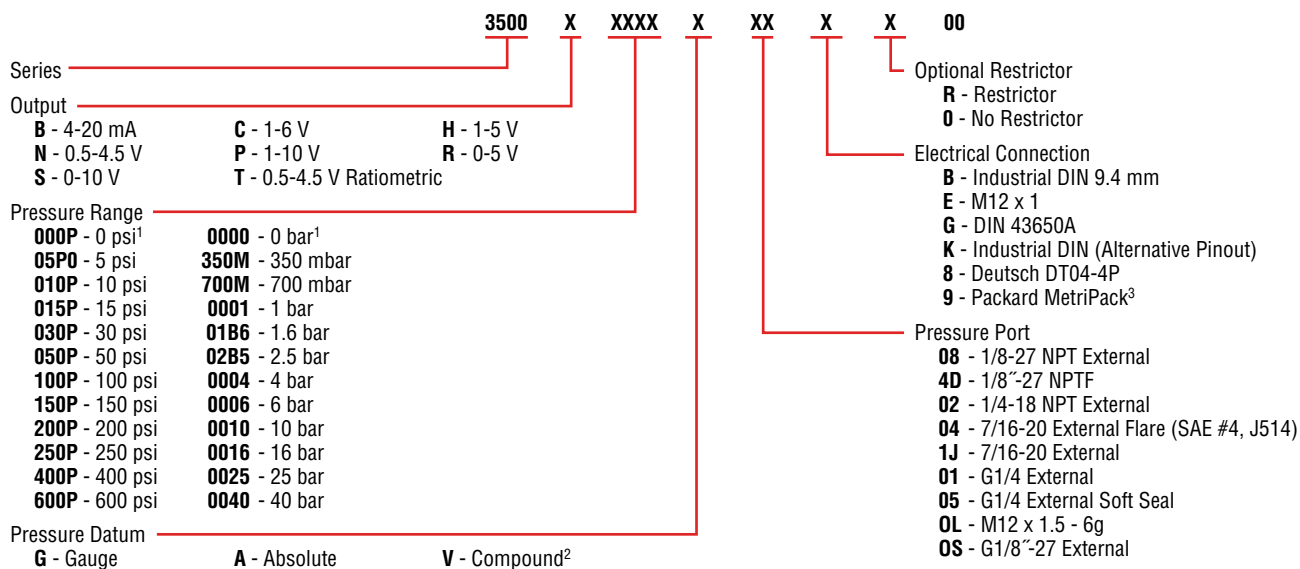
DIN 9.4 mm			M12 x 1P		Deutsch DT04-4P		DIN 43650A		Packard MetriPack				
<p>POLARIZING WIDE CONTACT</p>													
Code B		Code K		Code E		Code 8		Code G		Code 9			
Pin #	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Voltage Mode	Current Mode	Pin ID	Voltage Mode	Note
1	V_{out} (pressure)	No Connect	V_{supply}	Supply	V_{supply}	Supply	Ground	Return	V_{supply}	Supply	C	V_{out} (pressure)	MetriPack connectors may be used with 0.5-4.5V Ratiometric and 4-20 mA only.
2	V_{supply}	Supply	Ground	Return	V_{out} (pressure)	No Connect	V_{supply}	Supply	Ground	Return	A	Ground	
3	No Connect	No Connect	V_{out}	No Connect	Ground	Return	No Connect	No Connect	V_{out}	No Connect	B	V_{supply}	
4	Ground	Return	No Connect	No Connect	No Connect	No Connect	V_{out} (pressure)	No Connect	No Connect	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
557254	Large DIN 43650A	G
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 (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

How to Order

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



Notes:

1. Compound only.
2. Compound versions extend the pressure range on the low end to -15 PSIG or -1 barG respectively. Compound versions measure Gauge pressure only.
3. Compatible with mA (Code B) or Ratiometric (Code T) Output Only.

3600 Series

Electronic Pressure Switch

- ▶ Exceptional Stability Through Sputtered Thin Film Technology
- ▶ No Moving Parts – Highly Resistant to Shock and Vibration
- ▶ Ideal for Off-Highway, Mobile, Medical Gas and Demanding Industrial Applications
- ▶ Long Cycle Life
- ▶ Fully Hermetically Sealed

Built using our proven thin film sensing technology, 3600 Series solid-state pressure switches offer exceptional stability with all welded stainless steel housings to handle rough environments. The 3600 provides very accurate set points with easily customized dead-bands when required. Offered as an ideal alternative to mechanical switches, the 3600 can support highly cyclical and broad frequency response applications. The fully hermetic welded sensing area enables compatibility with a host of liquids and gases. The 3600 modular design feature allows various pressure ports and electrical connections. Switch set & reset points and time delays can be factory programmed per customer specification, and modified in the field with a USB field-programmable interface tool (sold separately).



Specifications

Performance	
Long Term Drift	<0.2% FS/YR
Switch Point Resolution	0.1% FS
Switch Point Accuracy (25°C)	±0.5%
Thermal Error	±1.8% FS max.
Compensated Temperatures	-40°F to +221°F (-40°C to +105°C)
Operating Temperatures	-40°F to +221°F (-40°C to +105°C)
Fatigue Life	Designed for more than 100 M cycles
Mechanical Configuration	
Pressure Port	See under "Pressure Ports" section
Wetted Parts	17-4 PH Stainless Steel
Electrical Connection	See under "Electrical Connector" section
Enclosure	IP67 (IP65 for electrical code B)
Vibration	BSEN 60068-2-6 (FC) BSEN 60068-2-64 (FH)
Shock	BSEN 60068-2-27 (Ea)
Approvals	CE, PED, RoHS
Weight	1.23 to 1.9 ounce (35 to 53 grams)
Electrical Parameters	
Switch Rating	700 mA Low Side Switch, 1000 mA High Side Switch
Supply Voltage	6 - 40 Volts (<8 mA without load)

EMC Specifications

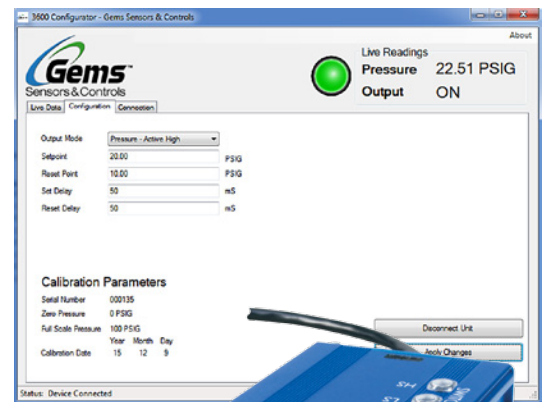
Emissions Tests: EN61326-1:2006 and EN61326-2-3:2006

Test Standard	Test
EN55011:2009 + A1	Radiated Emissions

Immunity Tests: EN61326-1:2006 and EN61326-2-3:2006

Test Standard	Test
EN61000-4-2:2009	Electrostatic Discharge
EN61000-4-3:2006 + A2	Radiated Immunity
EN61000-4-4:2012	Fast Burst Transients
EN61000-4-6:2009	Conducted RF Immunity

3600 Series Communications Interface – Optional Accessory



The Programming Interface is an easy-to-use configuration tool that allows you to view and modify the following variables for the 3600 Series pressure switches:

- Set and Reset Points
- Deadbands
- Time-on and Time-off Delays
- Switching Modes

The Communications Interface connects to your PC via an included USB cable, and allows modification of the switch parameters without the need for a calibrated pressure source. The interface is supplied with the mating cables for electrical connector options B, E, & 8, and software on a USB stick.

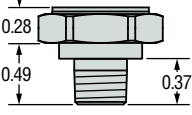
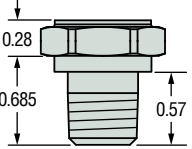
Part Number: 564555

Pressure Capability

Pressure Range PSI (Bar)	Proof Pressure (x Full Scale)	Burst Pressure (x Full Scale)
100-300 (7-25)	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)		
10,000 (700)		> 60,000 PSI (4,000 bar)
15,000 (1,000)	2.50 x FS	

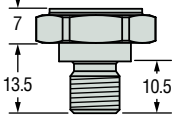
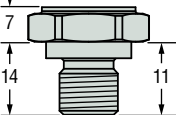
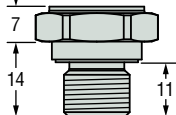
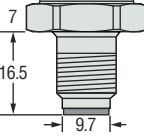
Pressure Ports

SAE

	1/8"-27 NPT	1/4"-18 NPT
Dimensions in Inches		
Fitting Code	08	02
Torque	2-3 TFFT*	2-3 TFFT*

*NPT Threads 2-3 turns from finger tight (TFFT). Wrench tighten 2-3 turns.

Metric

	G1/8" External	G1/4" External	G1/4" A Integral Face Seal	M12x1.5 HP Metal Washer Seal
Dimensions in MM				
Fitting Code	0S	01	05	2T
Torque	16.2-18.4 ft-lb 22-25 NM	22.1- 25.8 ft-lb 30-35 NM	22.1- 25.8 ft-lb 30-35 NM	22.1- 25.8 ft-lb 30-35 NM

General Notes:

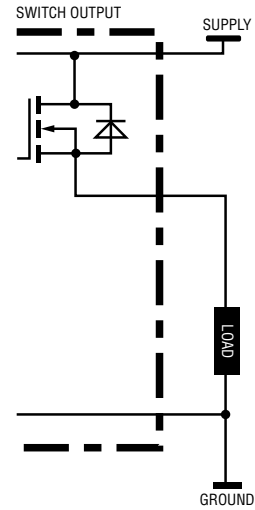
1. Electrical Connector Housing diameter is 19mm (0.748")
2. Hex is 22mm (0.886") Across Flats (A/F) for deep socket mounting
3. For other pressure connections, consult factory.

Electrical Connector

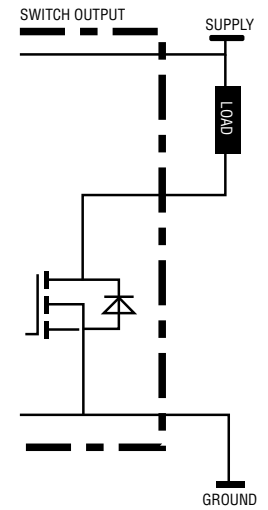
	DIN 9.4 mm	M12 x 1P	Deutsch DT04-4P
	Code B	Code E	Code 8
Pin #			
1	Digital Comms.	V_{supply}	Ground
2	V_{supply}	Digital Comms.	V_{supply}
3	Switch Output	Ground	Switch Output
4	Ground	Switch Output	Digital Comms.

Wiring Diagrams

High Side Switch (Current Sourcing)

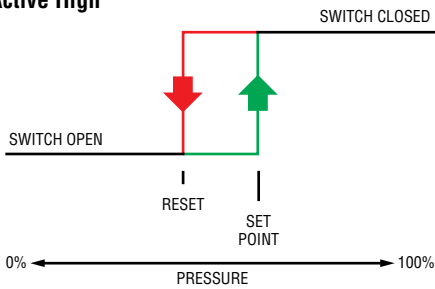


Low Side Switch (Current Sinking)

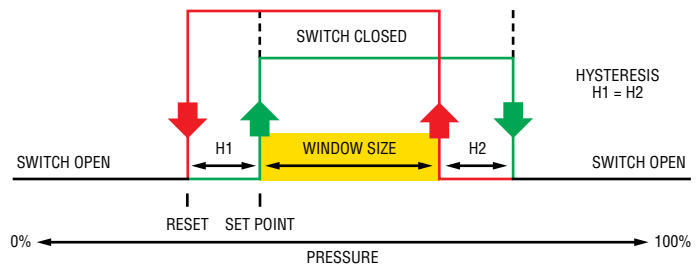


Switching Modes

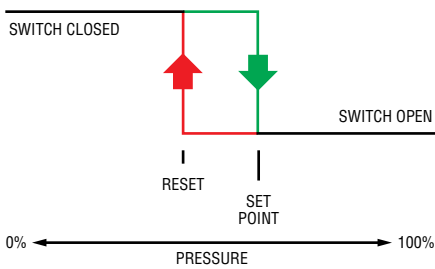
Active High



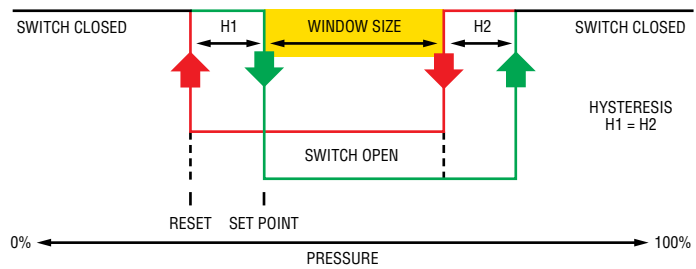
Active Window



Active Low



Inactive Window



Accessories

Part Number	Description	For Use on Elect. Code #
557230	MINI DIN Mating Connector, Strain Relief (with drive screw & gasket)	B
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 (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
564555	3600 Series Communications Interface	ALL

How to Order

Step 1: Select Hardware Configuration

Use the **bold** characters below to complete the main hardware product code for ordering.

Series **3600** **Y** **600P** **G** **01** **8** **0** - **XXXXXX**

Output
W - Low Side (Ground Switched)
Y - High Side (Supply Switched)

Pressure Range – psi
100P - 0-100 psiG **25CP** - 0-2,500 psiG
150P - 0-150 psiG **40CP** - 0-4,000 psiG
300P - 0-300 psiG **60CP** - 0-6,000 psiS
600P - 0-600 psiG **10KP** - 0-10,000 psiS
900P - 0-900 psiG **15KP** - 0-15,000 psiS¹
15CP - 0-1,500 psiG

Pressure Range - bar
0007 - 0-7 barG **0160** - 0-160 barS
0010 - 0-10 barG **0250** - 0-250 barS
0016 - 0-16 barG **0400** - 0-400 barS
0025 - 0-25 barG **0600** - 0-600 barS
0040 - 0-40 barG **1000** - 0-1,000 barS
0060 - 0-60 barG
0100 - 0-100 barG

Pressure Datum
G - Gauge
V - Compound²

Switch Configuration (See Below)
R - Restrictor
0 - No Restrictor

Electrical Connection
B - Industrial DIN 9.4 mm
E - M12 x 1
8 - Deutsch DT04-4P

Pressure Port
01 - G1/4" External
02 - 1/4"-18 NPT
05 - G1/4" A Integral Face Seal
08 - 1/8"-27 NPT
0S - G1/8"-27 External
2T - M12x1.5 HP Metal Washer Seal

Notes:
 1. Range 15,000 psi (1,000 bar) available with -2T pressure port only.
 2. Compound Ranges coded as follows.
 000PV = -15 to 0 psiG
 015PV = -15 to 15 psiG
 0001V = -1 to 1 barG etc.

Step 2: Specify Switch Configuration (See previous page for switching mode overview)

Use the **bold** characters below, and your own specified values to complete the switch setting product code.

Switching Mode **XX** **XXXXX**³ **XXXXX**³ **XXXXX**³ Part Number Addendum

Set Point Specify Set Point in PSI or Bar. Value must fall within the Pressure Range selected above.
Example: 240psi or 39bar

Reset Point Specify Reset Point in PSI or Bar. Value must fall within the Pressure Range selected above.
Example: 125psi or 70bar

Window Size Specify window size in PSI or Bar or zero for non window mode
Example: 10psi or 0bar

The parameters you define here for switch settings will be converted at the factory to a unique 6-digit identifier appended to the hardware code above. This completed Part Number will be used on paperwork from Gems, and for future reorders.

Notes:
 1. Switches will be programmed with a default 50mS switching delay. Contact factory for other settings (0-30,000mS)
 2. The above detailed switching parameters will be assigned a 6-digit part number suffix at the factory to define a unique customer configuration.
 3. Use as few or as many characters needed to specify pressure value and measuring type (psi or bar).

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.

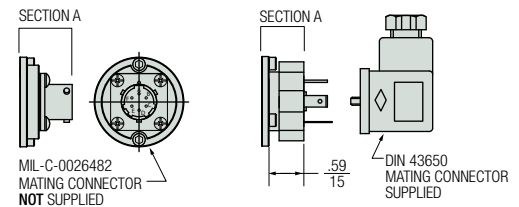
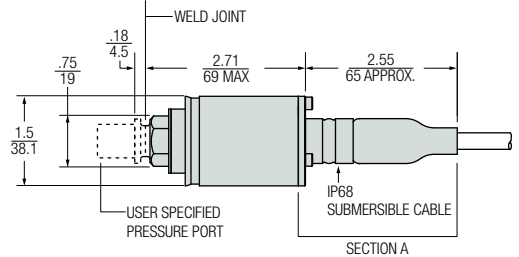
Specifications:

Operating Temperature	-40°F to +260°F (-40°C to +127°C)
Switch	Relay or Transistor
Repeatability*	.25% of Full Set point range @ 70°F (20°C)
Fatigue Life	Designed for more than 100 million FS cycles
Wetted Parts	
Diaphragm	17-4PH Stainless Steel
Fitting	316 Stainless Steel
Electrical Termination	DIN "G" IP65 10-6 MIL CONN "C" IP65 Submersible Cable "M" IP68
Supply Voltage (Vs)	24-72 VDC
Vibration	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)
Acceleration	100g steady acceleration in any direction 0.032% FS/g for 1 bar (15 psi) range decreasing logarithmically to 0.0007% FS/g for 400 bar (6000 psi) range.
Shock	20g, 11 ms, per MIL-STD-810E Method 516.4 Procedure 1
Proof Pressure	2X Full Scale
Approvals	CE (limits switch voltage to 42 VDC)
Weight, Approximate	1.0 lbs. (0.45 kg)

* Repeatability and set point of units may change due to the effects of temperature.

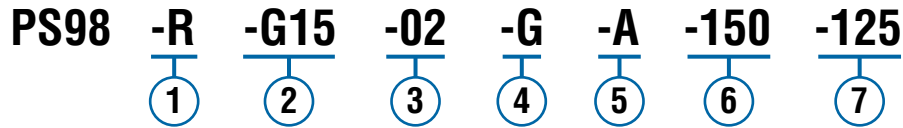


Dimensions



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 (Mating Connector Supplied)
- MXXX=IP68 Cable
(Specify length in meters; e.g. -M012)
- C=6-Pin Connector
(Mating Connector Supplied)

⑤ Circuit

- A=N.O.
- B=N.C.

⑥ Factory Set Point¹

⑦ Re-Set Point¹

Note:

1. Set Points must be within Pressure Range selected in Step 2.

Accessories

PN	Description
557254	Mating Connector for -G
165835	Mating Connector for -C

Tables 1 — Pressure Range Codes

PSI Measurement

Pressure Range Code	Pressure Range (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	0-1000
H15	0-1500
H20	0-2000
H30	0-3000
H40	0-4000
H50	0-5000
H60	0-6000

Bar Measurement

Pressure Range Code	Pressure Range (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
—	—
—	—

From 2 to 6000 PSI (40 mbar to 400 bar), GEMS Pressure Switches Cover A Wide Range of Applications

- ▶ General, Vacuum, 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 or zinc-plated steel.



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.
- OF:** Wetted Materials are ultrasonically cleaned to remove oil and debris.
- 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 and pneumatic 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 depending on fluid viscosity.

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-9
	5 to 150 psi (0.35 to 10 bar)	500 psi (35 bar)	SPST	Kapton® Diaphragm	PS31	I-11
	5 to 100 psi (0.35 to 7 bar)	500 psi (35 bar)		Elastomer Diaphragm	PS32	I-13
	50 to 300 psi (3.45 to 20 bar)	500 psi (35 bar)	SPST	Kapton® Diaphragm	PS51	I-11
				Elastomer Diaphragm	PS52	I-13
	15 to 600 psi (1.03 to 207 bar)	3000 psi (207 bar)	SPST	—	PS62	I-21
	15 to 3000 psi (1.03 to 207 bar)	6000 psi (414 bar)	SPST	—	PS61	I-17
	510 to 4350 psi (35 to 300 bar)	7000 psi (483 bar)	SPST	—	PS61P	I-19
5 to 6000 psi (0.35 to 414 bar)	7500 psi (517 bar)	SPST, SPDT, DPST, DPDT	—	PS75	I-27	
Miniature Pressure Switches	3.5 to 100 psi (0.24 to 7 bar)	350 psi (24 bar)	SPST, SPDT	—	PS41	I-15
	10 to 5000 psi (0.7 to 344 bar)	6000 psi (414 bar)	SPST, SPDT	—	PS71	I-23
	10 to 750 psi (0.7 to 52 bar)	3000 psi (207 bar)	SPST, SPDT	—	PS72	I-25
	15 to 1750 psi (1 to 121 bar)	4500 psi (310 bar)	SPST, DPDT	—	PS76	I-29
Vacuum Switches	1.5" to 15" Hg (51 to 508 mbar)	150 psi (10 bar)	SPST, SPDT	—	PS81	I-31
	5" to 28" Hg (169 to 948 mbar)	350 psi (24 bar)	SPST, SPDT	—	PS82	I-33

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. 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.

Option V: Viton® (Fluoroelastomer)

Diaphragm. Typically used with alcohols, diesters, solvents, acids and synthetic oils. Also used for high vacuum service.

Option E: EPDM (Ethylene

Propylene) Diaphragm. Typically used with phosphate ester based hydraulic fluids, brake fluids, ketones, steam and hot water.

Option N: Neoprene (Chloroprene) Diaphragm.

Typically specified for refrigerant systems.

* See individual product data sheets for temperature ranges.

PS11 – Ultra-Long Life OEM Pressure Switches

- ▶ 0.75 to 15 psi (52 to 1034 mbar)
- ▶ Factory Set or Adjustable Set Points

For low pressure applications, the longevity of our PS11 Series is hard to beat. Their snap-action microswitch resets automatically and meets or exceeds industry standards. The brass housing offers chemical resistance at an affordable price.

Specifications

Switch*	5 Amp @ 24 VDC and 250 VAC 1.0 Amp resistive 0.5 Amp inductive @ 24 VDC (-G option)
Repeatability	See Table 1
Wetted Parts	
Diaphragm	Nitrile (optional Viton®, EPDM or Kapton®)
Fitting	Brass
Housing	Brass
O-Ring	Nitrile (optional Viton® or EPDM)
Ingress Protection**	DIN 43650A IP00; Terminals IP00; Flying Leads IP00
Proof Pressure	0 psia to 150 psi (-1 bar to 10.3 bar)
Burst Pressure	300 psi (20.7 bar)
Approvals	CE, UL Approved units available
Weight, Approximate	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, IP-rated version.

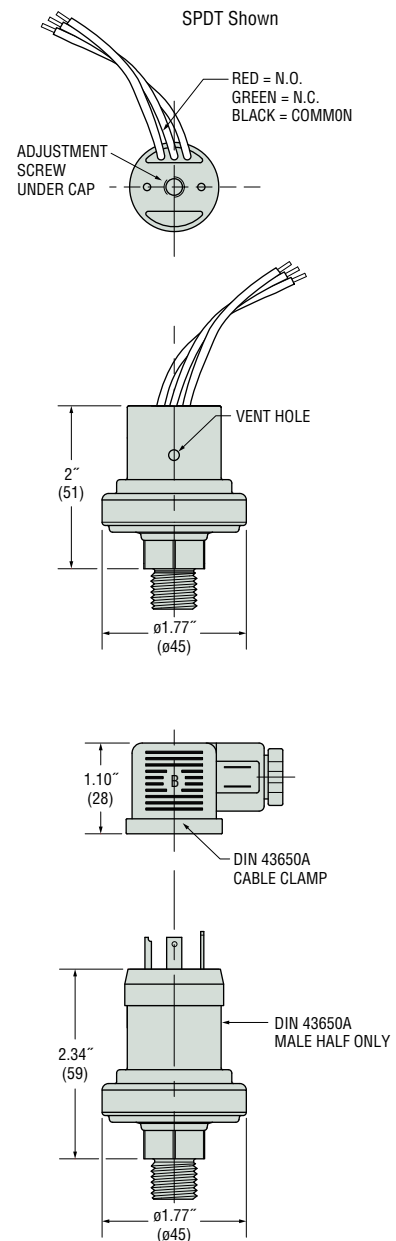
Recommended Operating Temperature Limits

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	-20°F to +250°F (-29°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.

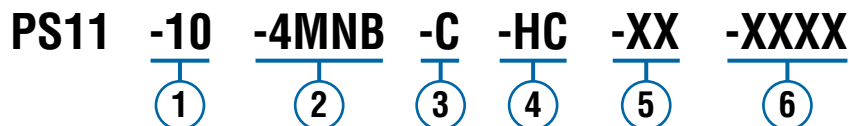


Dimensions



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 Fitting¹

- 2MNB = 1/8" NPTM Brass
- 4MNB = 1/4" NPTM Brass
- 4MGB = 1/4" BSPM Brass (G type)
- 4MSB = 7/16"-20 SAE Male, Brass

3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.
- C = SPDT

4 Electrical Termination²

- FLXX = Flying Leads³
- ELXX = 1/2" Male NPT Conduit w/Flying Leads³
- 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
- G = Gold Contacts
(for loads less than 12 mA @ 12 VDC)
- OF = Oil Free 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)⁴
- 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. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

Pressure Range Code	Pressure Range	Accuracy*	Average Deadband**
10	0.75-4 psig (51-276 mbar)	±0.15 psi (10 mbar) +4% of setting	0.2 psi (14 mbar) +9% of setting
20	3.5-15 psig (241-1034 mbar)	±0.25 psi (17 mbar) +5% of setting	0.4 psig (26 mbar) +11% of setting

* Accuracy 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

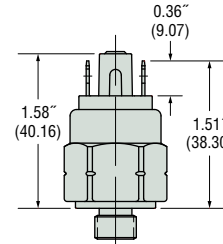
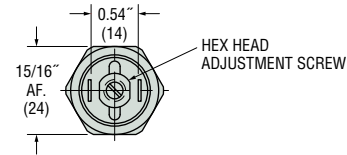
Operating Temperature	-40°F to +230°F (-40°C to +110°C)
Switch*	100 VA Max.
Repeatability	See Table 1
Wetted Parts	
Diaphragm	Teflon® Coated Kapton® (Solid Teflon® Available)
O-Ring	Nitrile (Std.) Consult factory for other materials
Fitting	Brass (optional 316 Stainless Steel)
Electrical Termination	Exposed Terminals IP00; IP option IP66
Deadband	See Table 1
Proof Pressure	500 psi (35 bar)
Burst Pressure	1000 psi (69 bar)
Approvals	CE (limits switch voltage to 42 VDC)
Weight, Approximate	Brass: 0.14 lbs. (0.06 kg)

* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.

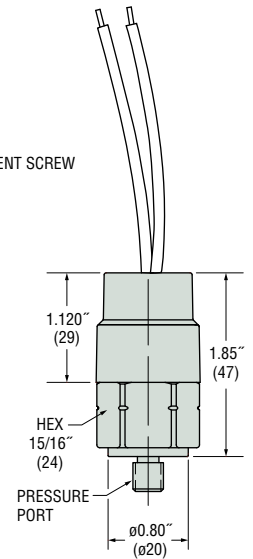


Dimensions

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 Series

PS31 or **PS51**

2 Pressure Range Code

Insert Pressure Range Code from Table 1, below.

3 Pressure Fitting¹

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 Leads²
- FLSXX** = Flying Leads w/PVC Shrink Tubing²
- CABXX** = 18 AWG PVC Cable³

6 Options

- G** = Gold Contacts
(for loads less than 12 mA @ 12 VDC)
- IP** = Ingress Protection⁴
- IPA** = Removable Silicone Seal for Set Point Adjustment⁵
- OF** = Oil Free 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)⁶
- 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. IPA protection is available only with **-FL** or **-FLS**.
6. Set Point must be within Pressure Range selected in Step 2.

Table 1 — Pressure Range Codes

PS31

Pressure Range Code	Pressure Range	Accuracy*	Average Deadband**
20	5-25 psi (0.3-1.7 bar)	±1 psi (0.07 bar) +3% of setting	2 psi (0.14 bar) +4% of setting
30	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
40	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	Accuracy*	Average Deadband**
15	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
20	150-300 psi (10.3-20.7 bar)	±4 psi (0.28 bar) +4% of setting	8 psi (0.21 bar) +5% of setting

* Accuracy 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

- ▶ 10 to 300 psi (0.69 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

Switch*	100 VA Max.
Repeatability	See Table 1
Wetted Parts	
Diaphragm	Elastomer (Nitrile standard) (Viton®, EPDM optional)
Fitting	Brass standard (optional 316 SS)
Electrical Termination	Exposed Terminals IP00; IP option IP66
Deadband	See Table 1
Proof Pressure	500 psi (35 bar)
Burst Pressure	1000 psi (69 bar)
Approvals	CE (limits switch voltage to 42 VDC)
Weight, Approximate	Brass: 0.14 lbs. (0.06 kg)

* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.

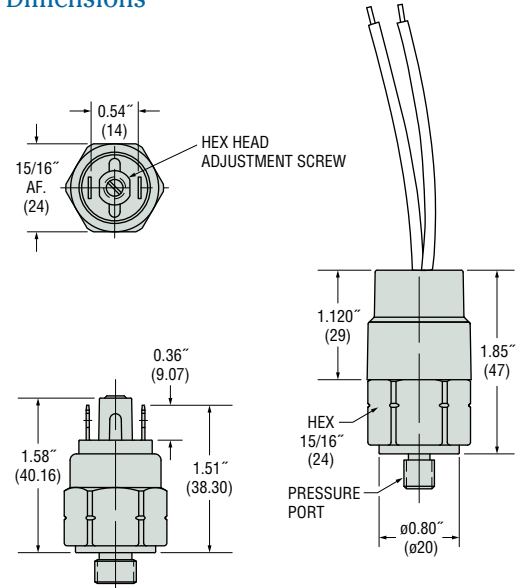
Recommended Operating Temperature Limits

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	-10°F to 230°F (-23°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.

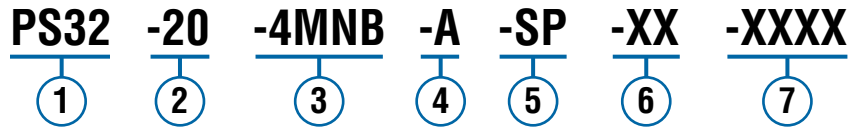


Dimensions



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 Fitting¹

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 Leads²
- FLSXX = Flying Leads w/PVC Shrink Tubing²
- CABXX = 18 AWG PVC Cable³

6 Options

- V = Viton® Diaphragm
- E = EPDM Diaphragm
- H = ECOH Diaphragm
- G = Gold Contacts
(for loads less than 12 mA @ 12 VDC)
- IP = Ingress Protection⁴
- IPA = Removable Silicone Seal for Set Point Adjustment⁵
- OF = Oil Free 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)⁶
- 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. IPA protection is available only with **-FL** or **-FLS**.
6. Set Point must be within Pressure Range selected in Step 2.

Table 1 — Pressure Range Codes

PS32

Pressure Range Code	Pressure Range	Accuracy*	Average Deadband**
20	10-25 psi (0.69-1.7 bar)	±1 psi (0.07 bar) +3% of setting	2 psi (0.14 bar) +4% of setting
30	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
40	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	Accuracy*	Average Deadband**
15	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
20	150-300 psi (10.3-20.7 bar)	±4 psi (0.28 bar) +4% of setting	8 psi (0.21 bar) +5% of setting

* Accuracy 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

► 4 to 100 psi (0.28 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

Switch	SPST; SPDT
Repeatability	See Table 1
Wetted Parts	
Diaphragm Material	Nitrile (optional EPDM, Viton® or Neoprene)
Fitting	Brass (optional 316 Stainless Steel)
Electrical Termination	DIN 43650A IP65; Terminals IP00; Flying Leads IP65; Option IP: IP66; Conduit with Flying Leads IP65
Proof Pressure	350 psi (24 bar)
Burst Pressure	700 psi (48 bar)
Approvals	CE, UL Approved units available
Weight, Approximate	Brass: 0.3 lbs. (0.14 kg)

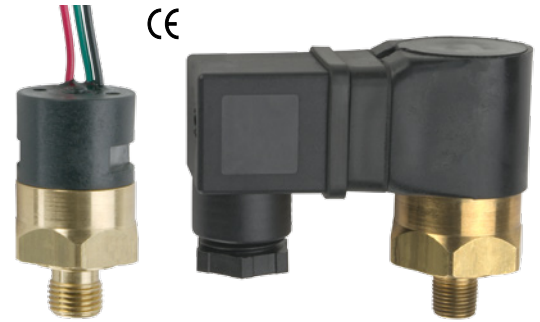
Recommended Operating Temperature Limits

Diaphragm Material	Options Selected		
	No option, -10A, -SP or -RD	-RD or -RD and -G	-SP or -10A
Nitrile	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)
Viton®	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)
EPDM	-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)
Neoprene	-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.

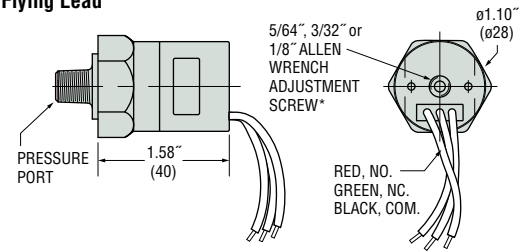
Electrical Switch Ratings

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

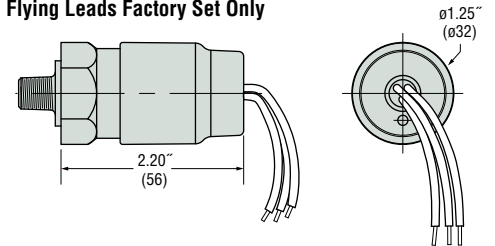
Flying Lead



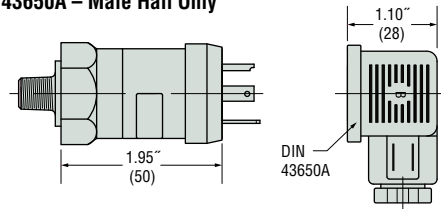
* Adjustment screw is located under protective screw.

Ingress Protection Option (IP66)

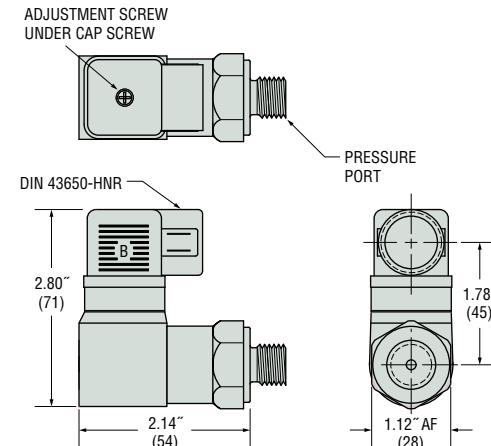
with Flying Leads Factory Set Only



DIN 43650A – Male Half Only

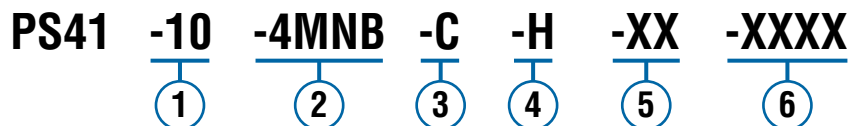


Right Angle DIN (HNR)



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 Fitting¹

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 Terminals²
- FLXX = Flying Leads³
- FLSXX = Flying Leads w/PVC Shrink Tubing³
- ELXX = 1/2" NPT Male Conduit w/Flying Leads⁴
- CABXX = 18 AWG PVC Cable⁵
 - H = DIN 43650A Male Half Only⁶
 - HR = Right Angle DIN 43650A Male Half Only⁶
 - HC = DIN 43650A 9mm Cable Clamp⁶
 - HCR = Right Angle DIN 43650A 9mm Cable Clamp⁶
 - HN = DIN 43650A with 1/2" Female NPT Conduit⁶
 - HNR = Right Angle DIN 43650A with 1/2" Female NPT Conduit⁶

5 Options⁷

- V = Viton[®] 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 Protection⁸
- OF = Oil Free 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)⁹
- 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	Accuracy*	Average Deadband**
10	4-8 psi (0.28-0.55 bar)	±0.35 psi (0.024 bar) +2% of setting	1.50 psi (0.10 bar) +7% of setting
20	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
30	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

* Accuracy 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

- ▶ 10 to 4,350 psi (0.7 to 300 bar)
- ▶ Exceptional Size-to-Pressure-Range Ratio
- ▶ Perfect for Demanding Applications

Available with enhanced ingress protection and integral electrical connections. These subminiature pressure switches are suitable for a wide range of hydraulic and pneumatic applications including medical, general industrial, fire suppression, and off highway vehicle.

Specifications

Switch*	100 VA Max.
Repeatability	See Table 2
Deadband	See Table 2
Wetted Parts (Pressure Range Codes 10-60)	
Diaphragm	Low-Temp Nitrile (optional FKM, FVMQ [Fluorosilicone] or EPDM)
Fitting	Zinc-Plated Steel (316 L Stainless Steel available)
Wetted Parts (Pressure Range Codes 70-100)	
Seal	Internally Lubricated Nitrile (optional FKM or EPDM)
Piston	Hardened alloy steel
Bearing	Proprietary plastic resistant to almost all chemicals
Fitting	Zinc-Plated Steel
Temperatures	
Fluid	See Table 1
Ambient	-40°F to +250°F (-40°C to +121°C)
Storage	-65°F to +275°F (-54°C to +135°C)
Vibration	
Sinusoidal	MIL-STD-202G, Method 204D, 173m ² /sec, 91-2000Hz, 8 hours/axis
Random	MIL-STD-202G, Method 214A, 146m ² /sec, 5-2000 Hz, 8 hours/axis
Shock, Operating	MIL-STD-202G, Method 213B, 500m ² /sec, 18X
Salt Spray	ASTM B117, 95°F (35°C) for 96 hours
Thermal Shock	-40°F to +250°F (-40°C to +121°C), 1 hour dwells, 1 minute change, 15 cycles
Life Cycle**	2 MM cycles with checks every 250k for all 10 pressure ranges. Range 10-40: 0 - 500 - 0 PSI @ ~1Hz Range 40-60: 0 - 3000 - 0 PSI @ ~1Hz Range 70-100: 0 - 6000 - 0 PSI @ ~1Hz
Approvals	CE, RoHS

* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.

** Contact Factory for life cycle on FVMQ (Fluorosilicone) diaphragm option.

Electrical Connectors

1/4" Spade	6-32 Terminal Screws	Amp Superseal 1.5	Deutsch DT04-2P	Flying Leads	Flying Leads with Shrink Tubing	Cable
Ingress Protection	IP00	IPX7 Per IEC 60529 (1 Meter Submergence) IPX9K Per DIN40050-9 (High Pressure/High Temperature Washdown) IP6KX Per DIN40050-9 (Inorganic Dust Intrusion)				



Table 1 – Recommended Fluid Temperature Limits

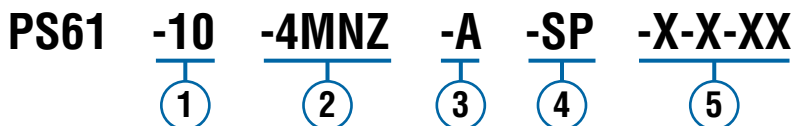
Seal Material	Range
Nitrile (Pressure Range Codes 10-60)	-22°F to +250°F (-30°C to +121°C)
FVMQ (Pressure Range Codes 10-40)	-40°F to +250°F (-40°C to +121°C)
Nitrile (Pressure Range Codes 70-100)	15°F to 250°F (-9°C to +121°C)
FKM (All Ranges)	0°F to 250°F (-18°C to +121°C)
EPDM (All Ranges)	-10°F to +250°F (-23°C to +121°C)

Notes:

1. Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.
2. Temperature performance is dependent on set point and fluid viscosity (fluids must remain free flowing liquids for Ranges 70-100).
3. Ranges 70-100 not recommended for use with gases.

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 2, below.

② Pressure Fitting¹

12L14 Zinc-Plated Steel

-2MNZ = 1/8" NPT Male

-4MNZ = 1/4" NPT Male

-2MGZ = 1/8-28 BSPP; ISO 228-G 1/8 B

(Pressure Range Codes 10-60 Only)

-4MGZ = 1/4-19 BSPP; ISO 228-G 1/4 B

-4MSZ = 7/16"-20 SAE J1926-2

-6MSZ = 9/16"-18 SAE J1926-2

-M10Z = M10 x 1.0 ISO 6149-2

-M12Z = M12 x 1.5 ISO 6149-2

-M14Z = M14 x 1.5 ISO 6149-2

316 Stainless Steel (Range 10-60 Only²)

-2MNS = 1/8" NPT Male

-4MNS = 1/4" NPT Male

-4MGS = 1/4-19 BSPP; ISO 228-G 1/4 B

-4MSS = 7/16"-20 SAE J1926-2

-6MSS = 9/16"-18 SAE J1926-2

③ Circuit

-A = SPST/N.O.

-B = SPST/N.C.

④ Electrical Termination

-SP = 2x 1/4" x 1/32" Spade, Factory Set or Adjustable³

-TS = 6-32 Terminal Screws, Factory Set or Adjustable³

-SS = Amp Superseal 1.5 Integral Male, Factory Set

-DT = Deutsch DT04-2P Integral Male, Factory Set

-FLAXX = 18 AWG Flying Leads⁴, Adjustable³

-FLFXX = 18 AWG Flying Leads⁴, Factory Set

-FLSAXX = 18 AWG Flying Leads w/PVC Shrink Tubing⁴, Adjustable³

-FLSFXX = 18 AWG Flying Leads w/PVC Shrink Tubing⁴, Factory Set

-CABXX = 18 AWG PVC Cable⁵, Factory Set

⑤ Options

-V = FKM

-E = EPDM

-F = FVMQ (Fluorosilicone; Pressure Range Codes 10-40 Only)⁶

-G = Gold Contacts

-OF = Oil Free Cleaned (Pressure Range Codes 10-60 Only; Stainless Steel Housing Required)

-RB = Rubber Boot (Shipped Loose)

-WF = Weather Pack Connector, Female P/N 12015792

-WM = Weather Pack Connector, Male P/N 12010973

-DE = Deutsch Connector, Male P/N DT04-2P-E003

-FS = Factory Set Specify Value & Rising/Falling

Notes:

1. Other fittings and materials available. Consult factory.
2. Consult factory for use with Pressure Range 70-100.
3. Use a Security hex key, 5/32" or 4mm, to adjust set point. (Tamper-resistant hex bit available as Gems P/N 249230)
4. 18" is standard. Specify lead length in inches (max. 48"). e.g. -FLA18 or -FLF30.
5. 36" is minimum. Specify cable length in inches. e.g. -CAB36 or -CAB120.
6. Consult factory for life cycle information.

Table 2 – Pressure Range Codes

Pressure Range Code	Style	Recommended Media	Pressure Range	Repeatability*	Average Deadband**	Proof Pressure	Burst Pressure
10	Diaphragm	Liquids & Gases	10-60 psig (.7-4.1 bar)	±1.5 psi (0.10 Bar) +3% of setting	12% of setting	6,000 psi (414 bar)	9,000 psi (620 bar)
20			40-150 psig(2.8-10.3 bar)	±2.5 psi (0.17 Bar) +3% of setting	13% of setting		
30			75-275 psig (5.2-19 bar)	±3.75 psi (0.26 Bar) +3% of setting	13% of setting		
40			150-500 psig (10.3-34.5 bar)	±5 psi (0.34 Bar) +3% of setting	14% of setting		
50			275-800 psig (19-55.1 bar)	±8 psi (0.55 Bar) +3% of setting	15% of setting		
60			400-1,350 psig (27.6-93 bar)	±13 psi (0.90 Bar) +3% of setting	17% of setting		
70	Piston	Liquids	510-1,235 psig (35-85 bar)	±30 psi (2.1 Bar) +4% of setting	14% of setting	7,000 psi (483 bar)	22,000 psi (1517 bar)
80			800-1,960 psig(55-135 bar)	±48 psi (3.3 Bar) +4% of setting	17% of setting		
90			1,835-3,115 psig (125-215 bar)	±110 psi (7.6 Bar) +6% of setting	21% of setting		
100			2,970-4,350 psig (205-300 bar)	±190 psi (13.1 Bar) +6% of setting	24% of setting		

* Repeatability and set point of units will vary depending on temperature, fluid viscosity, cycle rate and ramp rate. Repeatability values are based on room temperature. Long term inactuation will lead to a higher initial set point reading due to the non-linear behavior of the elastomer diaphragms or seals. Fluids with low and stable viscosities over the expected temperature range will exhibit better performance.

** Deadband values are an approximation at room temperature with nitrogen or compressed air (Ranges 10-40) or a 100 Cp fluid (Ranges 40-100). At lower temperatures and/or higher fluid viscosities the deadband will be much larger than the value shown. At high fluid temperature and a rapid cycle rate, the deadband may be lower than the approximations given. Please consult the factory if specific statistical analysis is required.

PS61P – OEM Subminiature Pressure Switch

- ▶ 510 to 4,350 psi (35 to 300 bar)
- ▶ Exceptional Size-to-Pressure-Range Ratio
- ▶ Piston Actuator with Exceptional Overpressure Capability
- ▶ Perfect for Demanding Hydraulic and OHV Applications

All new and available with the most popular electrical connector options. These subminiature pressure switches are designed for medium- to high-pressure OEM applications. They are equipped with high proof and burst pressure capabilities for demanding hydraulic applications such as forklifts, scissor lifts, and off road equipment.

Specifications

Switch*	100 VA Max.
Repeatability	See Table 1
Deadband	See Table 1
Wetted Parts	
Seal	Nitrile (optional EPDM or Viton®)
Fitting	Zinc-Plated Steel
Bearing	Proprietary plastic resistant to almost all chemicals
Piston	Hardened Alloy Steel
Temperatures	
Fluid	See Table 2
Ambient	-40°F to +250°F (-40°C to +121°C)
Storage	-65°F to +275°F (-54°C to +135°C)
Proof Pressure	7,000 psi (483 bar)
Burst Pressure	22,000 psi (1,517 bar)
Vibration	
Sinusoidal	MIL-STD-202G, Method 204D, 173m ² /sec, 91-2000Hz, 8 hours/axis
Random	MIL-STD-202G, Method 214A, 146m ² /sec, 5-2000 Hz, 8 hours/axis
Shock, Operating	MIL-STD-202G, Method 213B, 500m ² /sec, 18X
Salt Spray	ASTM B117, 95°F (35°C) for 96 hours
Thermal Shock	-40°F to +250°F (-40°C to +121°C), 1 hour dwells, 1 minute change, 15 cycles
Approvals	CE, RoHS

* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.

Table 1 – Pressure Range Codes

Pressure Range Code	Pressure Range	Repeatability*	Average Deadband**
10	510-1,235 psi (35-85 bar)	±30 psi (2.1 bar) +4% of setting	+16% of setting
20	800-1,960 psi (55-135 bar)	±48 psi (3.3 bar) +4% of setting	+13% of setting
30	1,835-3,115 psi (127-215 bar)	±110 psi (7.6 bar) +6% of setting	+24% of setting
40	2,970-4,350 psi (205-300 bar)	±190 psi (13.1 bar) +6% of setting	+20% of setting

* Repeatability and setpoint of units will vary depending on temperature, fluid viscosity and cycle rate. Long term inactivation will lead to a higher initial setpoint reading due to the non-linear behavior of the elastomer seals. Fluids with low and stable viscosities over the expected temperature range will exhibit better performance.

** Deadband values are an approximation at room temperature with a 100 Cp fluid. At lower temperature and/or higher fluid viscosities the deadband will be much larger than the value shown.

At high fluid temperature and a rapid cycle rate, the deadband may be lower than the approximations given. Please consult the factory if specific statistical analysis is required.



Table 2 – Recommended Fluid Temperature Limits

Seal 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	-10°F to 250°F (-23°C to +121°C)

Notes:

1. Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.
2. Temperature performance is dependent on set point and fluid viscosity (fluids must remain free flowing liquids).
3. Not recommended for use with gases.

Electrical Connectors

	1/4" Spade	6-32 Terminal Screws	Amp Superseal 1.5	Deutsch DT04-2P	Flying Leads	Flying Leads with Shrink Tubing	Cable
Ingress Protection	IP00		IPX7 PER IEC 60529 (1 METER SUBMERGENCE) IPX9K PER DIN40050-9 (HIGH PRESSURE/HIGH TEMPERATURE WASHDOWN) IP6KX PER DIN40050-9 (INORGANIC DUST INTRUSION)				

How To Order

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

PS61P **-10** **-4MNZ** **-A** **-SP** **-X-X-XX**

1
 2
 3
 4
 5

1 Pressure Range Code

Insert Pressure Range Code from Table 1, below.

2 Pressure Fitting¹

12L14 Zinc-Plated Steel

- 2MNZ = 1/8" NPT Male
- 4MNZ = 1/4" NPT Male
- 4MGZ = 1/4" BSP G Style Male
- 4MSZ = 7/16"-20 SAE J1926-2
- 6MSZ = 9/16"-18 SAE J1926-2
- M10Z = M10 x 1.0 ISO 6149-2
- M14Z = M14 x 1.5 ISO 6149-2

3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.

4 Electrical Termination

- SP = 2x 1/4" x 1/32" Spade
- TS = 6-32 Terminal Screws
- SS = Amp Superseal 1.5 Integral Male
- DT = Deutsch DT04-2P Integral Male
- FLAXX = 18 AWG Flying Leads, Adjustable²
- FLFXX = 18 AWG Flying Leads, Fixed²
- FLSAXX = 18 AWG Flying Leads w/PVC Shrink Tubing, Adjustable²
- FLSFXX = 18 AWG Flying Leads w/PVC Shrink Tubing, Fixed²
- CABXX = 18 AWG PVC Cable³

5 Options

- V = Viton® Seals
- E = EPDM Seals
- G = Gold Contacts
- WF = Weather Pack Connector, Female P/N 12015792
- WM = Weather Pack Connector, Male P/N 12010973
- DE = Deutsch Connector, Male P/N DT04-2P-E003
- FS = Factory Set Specify Value & Rising/Falling

Notes:

1. Other fittings available. Consult factory.
2. 18" is standard. Specify lead length in inches (max. 48"). e.g. -FLA18 or -FLF30.
3. 36" is minimum. Specify cable length in inches. e.g. -CAB36 or -CAB120.

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

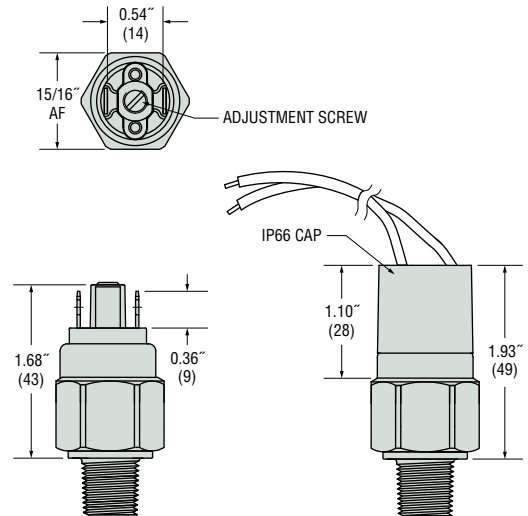
Operating Temperature	-40°F to +230°F (-40°C to +110°C)
Switch*	100 VA Max.
Repeatability	See Table 1
Wetted Parts	
Housing	Zinc-Plated Steel (optional 316L Stainless Steel)
Diaphragm	Kapton® (polyimide)
O-Ring	Nitrile (other materials available)
Electrical Termination	Exposed Terminals IP00; IP option IP66
Deadband	See Table 1
Proof Pressure	3000 psi (207 bar)
Burst Pressure	6000 psi (414 bar)
Approvals	CE (limits switch voltage to 42 VDC)
Weight, Approximate	Steel: 0.14 lbs. (0.06 kg)

* Gold contacts (option G) may be required for less than 12 VDC and 20 mA.



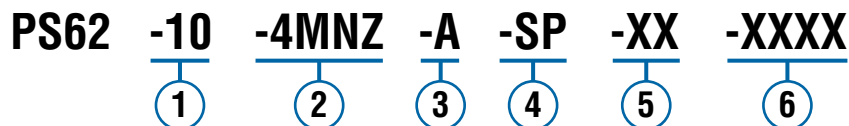
CE

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 Fitting¹

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

-M10Z = M10 x 1.0, Straight

-M14Z = M14 x 1.5, Straight

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 Leads²

-FLSXX = Flying Leads w/PVC Shrink Tubing²

-CABXX = 18 AWG PVC Cable³

⑤ Options

-G = Gold Contacts

(for loads less than 12 mA @ 12 VDC)

-IP = Ingress Protection⁴

-IPA = Removable Silicone Seal for

Set Point Adjustment⁵

-R = Restrictor (low damping coefficient) Brass

-SR = Spiral Restrictor (high damping coefficient)

12L14 Steel w/Black Oxide Finish⁶

-OF = Oil Free 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)⁷

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. IPA protection is available only with **-FL** or **-FLS**.
6. **-SR** will result in wider deadbands and lower response time.
7. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

Pressure Range Code	Pressure Range	Accuracy*	Average Deadband**
10	15-60 psi (1-4 bar)	±1.5 psi (0.10 bar) +4% of setting	3 psi (0.21 bar) +6% of setting
20	40-150 psi (3-10 bar)	±2.5 psi (0.17 bar) +4% of setting	5 psig (0.34 bar) +7% of setting
30	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
40	150-600 psi (10.3-41.4 bar)	±5 psi (0.34 bar) +4% of setting	10 psi (0.69 bar) +11% of setting

* Accuracy 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

Switch	SPST; SPDT
Repeatability	See Table 1
Wetted Parts	
Diaphragm	Nitrile (optional EPDM, Viton® or Neoprene)
Fitting	Zinc-Plated Steel (Optional 316 SS)
Electrical Termination	DIN 43650A IP65; Spade Terminals IP00; Flying Leads IP65; Conduit with Flying Leads IP65; IP option IP66
Proof Pressure	6000 psi (414 bar)
Burst Pressure	9000 psi (621 bar)
Approvals	CE, UL Approved units available
Weight, Approximate	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
Nitrile	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)
Viton®	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)
EPDM	-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)
Neoprene	-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.

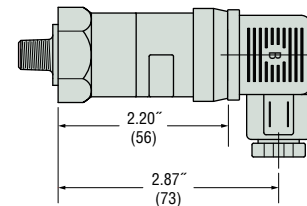
Electrical Switch Ratings

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	—

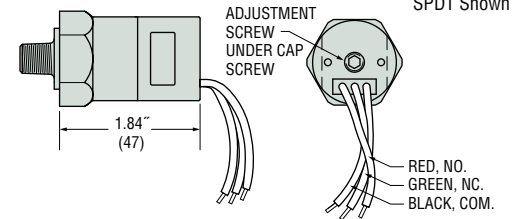


Dimensions

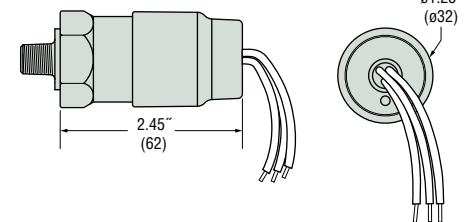
DIN 43650A with Cable Clamp



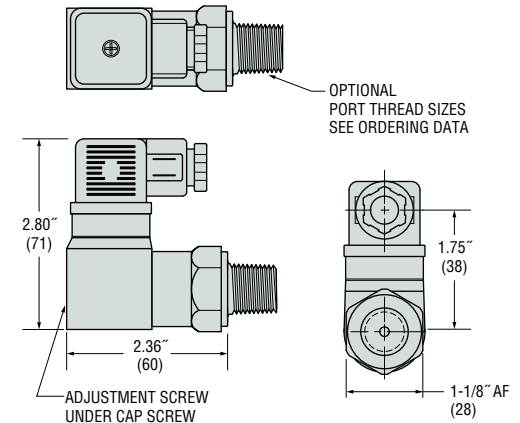
Flying Lead



IP66 Option

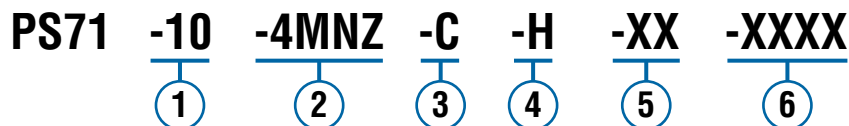


Right Angle DIN 43650A with Cable Clamp



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 Fitting¹

12L14 Zinc-Plated Steel

- 2MNZ**=1/8" NPTM
- 4MNZ**=1/4" NPTM
- 8MNZ**=1/2" 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
- M10Z**=M10 x 1.0, Straight
- M12Z**=M12 x 1.5, Straight
- M14Z**=M14 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)

③ Circuit

- A**=SPST/N.O.
- B**=SPST/N.C.
- C**=SPDT

④ Electrical Termination

- SP**=Spade Terminals²
- FLXX**=Flying Leads³
- FLSXX**=Flying Leads w/PVC Shrink Tubing³
- ELXX**=1/2" NPT Male Conduit w/Flying Leads⁴
- CABXX**=18 AWG PVC Cable⁵
 - H**=DIN 43650A Male Half Only⁶
 - HR**=Right Angle DIN 43650A Male Half Only⁶
 - HC**=DIN 43650A 9mm Cable Clamp⁶
 - HCR**=Right Angle DIN 43650A 9mm Cable Clamp⁶
 - HN**=DIN 43650A with 1/2" Female NPT Conduit⁶
 - HNR**=Right Angle DIN 43650A with 1/2" Female NPT Conduit⁶

⑤ Options⁷

- V**=Viton® 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 Protection⁸
- OF**=Oil Free Cleaned⁹
- R**=Restrictor (low damping coefficient) Brass
- SR**=Spiral Restrictor (high damping coefficient)
300 Series Stainless Steel¹⁰
- 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)¹¹
- 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	Accuracy*	Average Deadband**
10	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
20	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
30	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
40	250-1000 psi (17.2-69.0 bar)	±15 psi (1.03 bar) +2% of setting	45 psig (3.10 bar) +12% of setting
50	1000-3000 psi (69-206.8 bar)	±30 psi (2.06 bar) +3% of setting	70 psig (4.83 bar) +12% of setting
60	2500-5000 psi (172.4-344.7 bar)	±50 psi (3.45 bar) +4% of setting	140 psi (9.65 bar) +13% of setting

* Accuracy 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

- ▶ 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

Switch	SPST; SPDT
Repeatability	See Table 1
Wetted Parts	
Housing	Zinc-Plated Steel (316L stainless steel and brass available)
Diaphragm	Kapton® (polyimide)
O-Ring	Nitrile (other materials available)
Electrical Termination	DIN 43650A IP65; Spade Terminals IP00; Flying Leads IP65; Conduit with Flying Leads IP65; IP option IP66
Proof Pressure	3000 psi (207 bar)
Burst Pressure	6000 psi (414 bar)
Approvals	CE, UL Approved units available
Weight, Approximate	Steel: 0.4 lbs. (0.15 kg)

Recommended Operating Temperature Limits

Options Selected	Temperature
-RD	-40°F to +250°F (-40°C to +121°C)
No Options	-40°F to +185°F (-40°C to +85°C)
-SP or -10A	-40°F to +212°F (-40°C to +100°C)

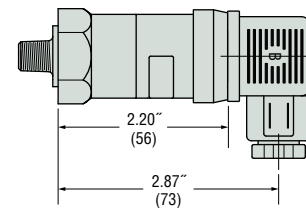
Electrical Switch Ratings

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	—

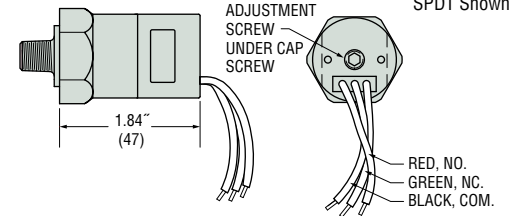


Dimensions

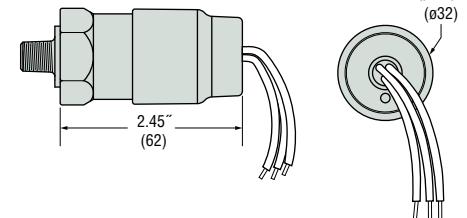
DIN 43650A with Cable Clamp



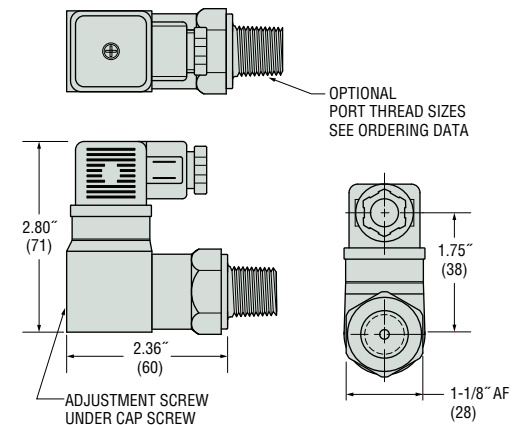
Flying Lead



IP66 Option

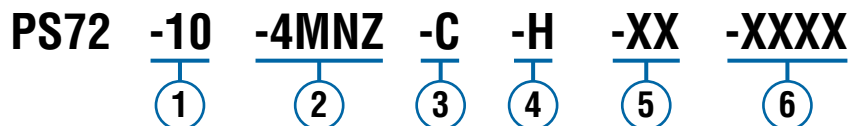


Right Angle DIN 43650A with Cable Clamp



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 Fitting¹

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 Terminals²
- FLXX**=Flying Leads³
- FLSXX**=Flying Leads w/PVC Shrink Tubing³
- ELXX**=1/2" NPT Male Conduit w/Flying Leads⁴
- CABXX**=18 AWG PVC Cable⁵
 - H**=DIN 43650A Male Half Only⁶
 - HR**=Right Angle DIN 43650A Male Half Only⁶
 - HC**=DIN 43650A 9mm Cable Clamp⁶
 - HCR**=Right Angle DIN 43650A 9mm Cable Clamp⁶
 - HN**=DIN 43650A with 1/2" Female NPT Conduit⁶
 - HNR**=Right Angle DIN 43650A with 1/2" Female NPT Conduit⁶

5 Options⁷

- 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 Protection⁸
- OF**=Oil Free Cleaned⁹
- R**=Restrictor (low damping coefficient) Brass
- SR**=Spiral Restrictor (high damping coefficient)
300 Series Stainless Steel¹⁰
- 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)¹¹
- 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	Accuracy	Average Deadband*
10	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
20	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
30	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
40	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

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

Switch	SPST; SPDT
Repeatability	See Table 1
Wetted Parts	
Diaphragm	Nitrile (optional Viton®, Neoprene or EPDM)
Fitting	Zinc-Plated Steel (optional 316 Stainless Steel)
Housing	Brass or Zinc-Plated Steel (optional 316 Stainless Steel)
Electrical Termination	DIN 43650A IP65; Conduit with Flying Leads IP65; Flying Leads IP65
Proof Pressure	7500 psi (517 bar) except range 10: 500 psi (35 bar)
Burst Pressure	9000 psi (621 bar)
Approvals	CE, UL Approved units available
Weight, Approximate	Steel: 0.6 lbs. (0.27 kg)

Recommended Operating Temperature Limits

Diaphragm Material	Circuit Codes	
	-A, -B, -C	-A, -B, -C with -RD option
Nitrile (Std)	15°F to 185°F (-9°C to +85°C)	15°F to 250°F (-9°C to +121°C)
Viton®	0°F to 185°F (-18°C to +85°C)	0°F to 250°F (-18°C to +121°C)
EPDM	-10°F to +185°F (-23°C to +85°C)	-10°F to +250°F (-23°C to +121°C)
Neoprene	-10°F to +185°F (-23°C to +85°C)	-10°F to +250°F (-23°C to +121°C)

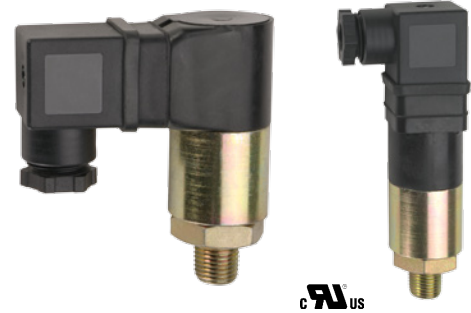
Note: Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.

Electrical Switch Ratings

Circuit Code	AC	DC
-A, -B, -C¹	5 amps @ 125/250 Volts	5 amps resistive, 3 amps inductive @ 28 Volts
-A, -B, -C²	1 amp @ 125 Volts	1 amp resistive, 0.5 amp inductive @ 28 Volts

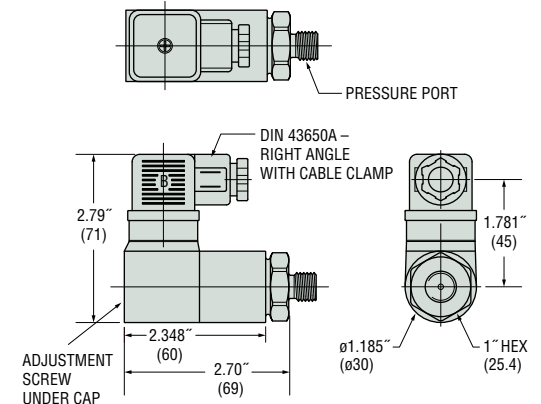
Notes:

1. Without Gold Contacts Option (-G).
2. With Gold Contacts Option (-G).

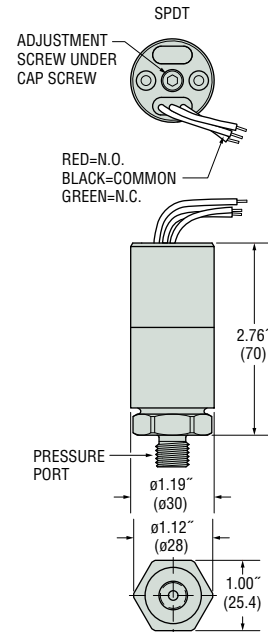


Dimensions

Right Angle DIN 43650A with Cable Clamp

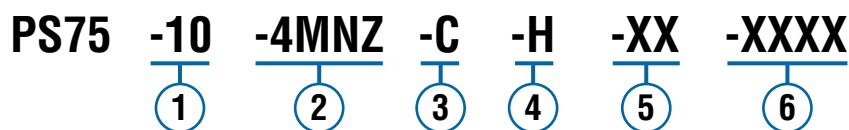


Flying Lead



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 Fitting¹

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)
- 4FNS = 1/4" NPTF
- 6MSS = 9/16"-18 SAE Male

3 Circuit

- A = SPST/N.O.
- B = SPST/N.C.
- C = SPDT

4 Electrical Termination

- FLXX = Flying Leads²
- FLSXX = Flying Leads w/PVC Shrink Tubing²
- ELXX = 1/2" NPT Male Conduit w/Flying Leads³
 - H = DIN 43650A Male Half Only⁴
 - HR = Right Angle DIN 43650A Male Half Only⁴
 - HC = DIN 43650A 9mm Cable Clamp⁴
 - HCR = Right Angle DIN 43650A 9mm Cable Clamp⁴
 - HN = DIN 43650A with 1/2" Female NPT Conduit⁴
 - HNR = Right Angle DIN 43650A with 1/2" Female NPT Conduit⁴

5 Options

- V = Viton[®] Diaphragm
- N = Neoprene Diaphragm
- E = EPDM Diaphragm
- G = Gold Contacts
(for loads less than 12 mA @ 12 VDC)
- RD = Reduced Differential (25% reduction typical)
- OF = Oil Free Cleaned⁵
- R = Restrictor (low damping coefficient) Brass
- SR = Spiral Restrictor (high damping coefficient)
300 Series Stainless Steel⁶
- 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)⁷
 - 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. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-FL30**.
3. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-EL18** or **-EL30**.
4. DIN connectors require **-C** SPDT circuit.
5. Requires stainless steel pressure fitting.
6. **-SR** will result in wider deadbands and slower response times.
7. 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	Accuracy*	Average Deadband**
10	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
20	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
30	50-150 psi (3.5-10.3 bar)	±6 psi (0.41 bar) +2% of setting	15 psig (1.03 bar) +13% of setting
40	150-650 psi (10.3-44.8 bar)	±15 psi (1.03 bar) +2% of setting	25 psi (1.72 bar) +14% of setting
50	500-1750 psi (34.5-121 bar)	±25 psi (1.72 bar) +2% of setting	55 psi (3.79 bar) +15% of setting
60	1000-3500 psi (69-241 bar)	±45 psi (3.10 bar) +3% of setting	100 psi (6.89 bar) +16% of setting
70	2500-6000 psi (172-414 bar)	±80 psi (5.51 bar) +4% of setting	200 psi (13.8 bar) +17% of setting

* Accuracy 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.

PS76 – Rugged Cylindrical Pressure Switch

- ▶ Side Mounted DIN Connection
- ▶ Top Mounted Electrical Connection
- ▶ 15 to 1750 psi (1 to 121 bar)
- ▶ Minimal Set Point Change at Low Temperature Extremes

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

Switch	SPST, SPDT
Repeatability	See Table 1
Wetted Parts	
Port Fitting	Zinc-Plated Steel (316L Stainless Steel available)
Diaphragm	Kapton® (polyimide)
O-Ring	Nitrile (other materials available)
Electrical Termination	DIN 43650A IP65; Conduit with Flying Leads IP65; Flying Leads IP65
Proof Pressure	4500 psi (310 bar) except Range 10: 500 psi (35 bar)
Burst Pressure	6000 psi (414 bar)
Approvals	CE, UL Approved units available
Weight, Approximate	Steel: 0.6 lbs. (0.27 kg)

Recommended Operating Temperature Limits

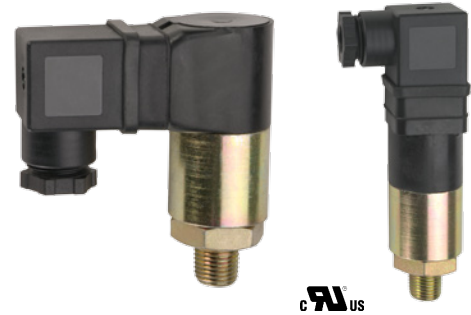
Diaphragm Material	Circuit Codes	
	-A, -B, -C	-A, -B, -C with -RD option
Teflon® Coated Kapton®	-40°F to +185°F (-40°C to +85°C)	-40°F to +250°F (-40°C to +121°C)

Electrical Switch Ratings

Circuit Code	AC	DC
-A, -B, -C ¹	5 amps @ 125/250 Volts	5 amps resistive, 3 amps inductive @ 28 Volts
-A, -B, -C ²	1 amp @ 125 Volts	1 amp resistive, 0.5 amp inductive @ 28 Volts

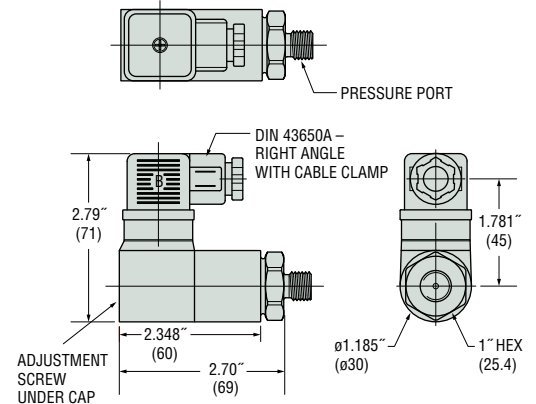
Notes:

- Without Gold Contacts Option (-G).
- With Gold Contacts Option (-G).

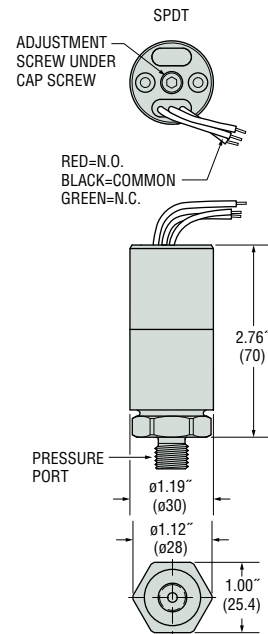


Dimensions

Right Angle DIN 43650A with Cable Clamp

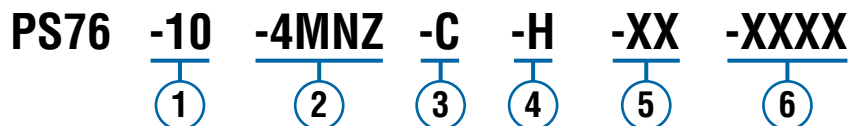


Flying Lead



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 Fitting¹

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

4 Electrical Termination

- FLXX = Flying Leads²
- FLSXX = Flying Leads w/PVC Shrink Tubing²
- ELXX = 1/2" NPT Male Conduit w/Flying Leads³
 - H = DIN 43650A Male Half Only⁴
 - HR = Right Angle DIN 43650A Male Half Only⁴
 - HC = DIN 43650A 9mm Cable Clamp⁴
 - HCR = Right Angle DIN 43650A 9mm Cable Clamp⁴
 - HN = DIN 43650A with 1/2" Female NPT Conduit⁴
 - HNR = Right Angle DIN 43650A with 1/2" Female NPT Conduit⁴

5 Options

- G = Gold Contacts (for loads less than 12 mA @ 12 VDC)
- RD = Reduced Differential (25% reduction typical)
- OF = Oil Free Cleaned⁵
- R = Restrictor (low damping coefficient) Brass
- SR = Spiral Restrictor (high damping coefficient) 300 Series Stainless Steel⁶
- 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)⁷
 - 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. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-FL30**.
3. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-EL18** or **-EL30**.
4. DIN connectors require **-C** SPDT circuit.
5. Requires stainless steel pressure fitting.
6. **-SR** will result in wider deadbands and slower response times.
7. 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	Accuracy*	Average Deadband**
10	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
20	50-150 psi (3.5-10.3 bar)	±6 psi (0.41 bar) +3% of setting	15 psig (1.03 bar) +14% of setting
30	150-650 psi (10.3-44.8 bar)	±15 psi (1.03 bar) +3% of setting	25 psi (1.72 bar) +15% of setting
40	500-1750 psi (34.5-121 bar)	±25 psi (1.72 bar) +3% of setting	55 psi (3.79 bar) +16% of setting

* Accuracy 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.

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

Switch*	5A @ 125/250 VAC, 3 Amp inductive @ 24 VDC (Std)
Repeatability	See Table 1
Wetted Parts	
Diaphragm and O-Ring	Nitrile standard (optional EPDM, Viton® or Kapton® with o-ring)
Fitting	Brass
Housing	Brass
Spring	300 Series SS
Spring Guide	Delrin®
Ingress Protection**	DIN 43650A IP00; Terminals IP00; Flying Leads IP00
Proof Pressure	0 psia to 150 psig (-1 bar to 10.3 bar)
Burst Pressure	500 psi (34.5 bar)
Approvals	CE, UL Approved units available
Weight, Approximate	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

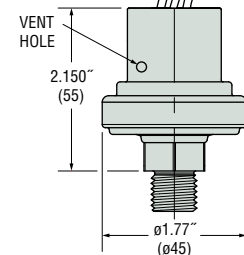
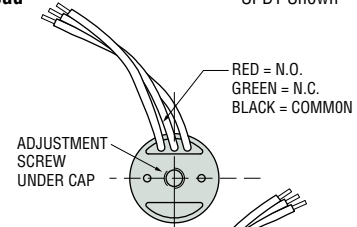
Diaphragm Material	Range
Nitrile	15°F to 250°F (-9°C to +121°C)
Viton®	0°F to 250°F (-18°C to +121°C)
EPDM	-20°F to +250°F (-29°C to +121°C)
Kapton®	-40°F to +250°F (-40°C to +121°C)

Note: Switches may function below the cold temperature limit but the set points and deadband will increase. Consult factory for details.

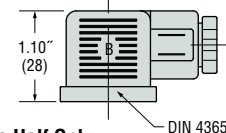


Dimensions

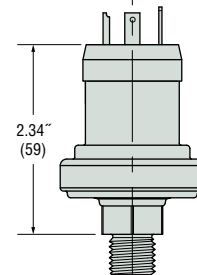
Flying Lead SPDT Shown



DIN 43650A with Calbe Clamp

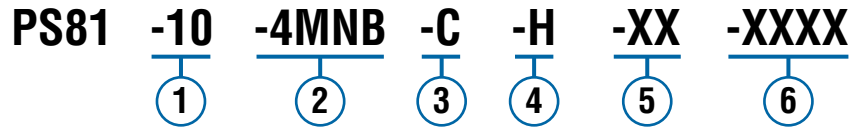


DIN 43650A Male Half Only



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 Fitting¹

- 2MNB** = 1/8" NPTM Brass
- 4MNB** = 1/4" NPTM Brass
- 4MGB** = 1/4" BSPM Brass (G type)
- 4MSB** = 7/16"-20 SAE Male, Brass

3 Circuit

- A** = SPST/N.O.
- B** = SPST/N.C.
- C** = SPDT

4 Electrical Termination

- FLXX** = Flying Leads²
- ELXX** = 1/2" NPT Male Conduit w/Flying Leads³
- H** = DIN 43650A Male Half Only⁴
- HC** = DIN 43650A 9mm Cable Clamp⁴
- HN** = DIN 43650A with 1/2" Female NPT Conduit⁴

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)
- OF** = Oil Free Cleaned

6 Fixed Set Point (optional)

- A. Specify set point **-FS**
(in Inches Hg or mBAR, see example)⁵
- 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. Other fittings available. Consult factory.
2. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-FL18** or **-FL30**.
3. 18" is standard. Specify lead length in inches (max. 48"). e.g. **-EL18** or **-EL30**.
4. DIN connectors require **-C** SPDT circuit.
5. Set Point must be within Pressure Range selected in Step 1.

Table 1 — Pressure Range Codes

Pressure Range Code	Pressure Range	Accuracy*	Average Deadband**
10	1.5-5" Hg (51-169 mbar)	±0.2" Hg (7 mbar) +3% of setting	0.3" Hg (10 mbar) +9% of setting
20	4-15" Hg (136-508 mbar)	±0.35" Hg (12 mbar) +4% of setting	0.6" Hg (20 mbar) +11% of setting

* Accuracy 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 PS41 series, are designed for demanding applications where space and/or price are strong concerns.

Specifications

Switch	SPST; SPDT
Repeatability	See Table 1
Wetted Parts	
Diaphragm Material	Nitrile standard (optional EPDM, Viton® and Neoprene)
Fitting	Brass (optional 316 Stainless Steel)
Spring	316 Stainless Steel
Electrical Termination	DIN 43650A IP65; Male Conduit with Flying Leads IP65; Flying Leads IP00; IP option IP66
Proof Pressure	0 psia to 350 psig (-1 bar to 24 bar)
Burst Pressure	700 psi (48 bar)
Approvals	CE
Weight, Approximate	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
Nitrile	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)
Viton®	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)
EPDM	-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)
Neoprene	-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.

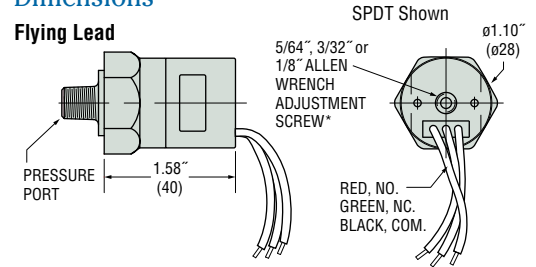
Electrical Switch Ratings

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	—



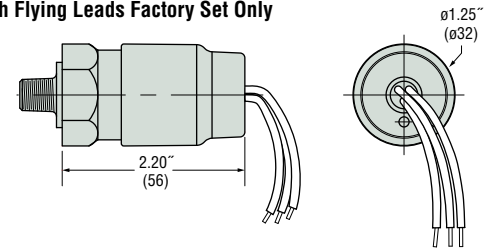
Dimensions

Flying Lead

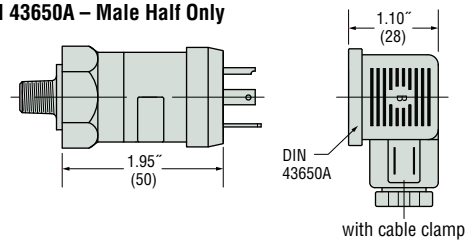


* Adjustment screw is located under protective screw.

Ingress Protection Option (IP66) with Flying Leads Factory Set Only

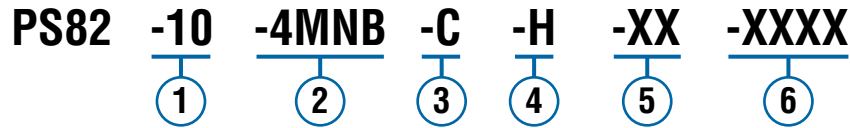


DIN 43650A – Male Half Only



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 Fitting¹

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 Leads²
- FLSXX = Flying Leads w/PVC Shrink Tubing²
- ELXX = 1/2" NPT Male Conduit w/Flying Leads³
- CABXX = 18 AWG PVC Cable⁴
- H = DIN 43650A Male Half Only⁵
- HR = Right Angle DIN 43650A Male Half Only⁵
- HC = DIN 43650A 9mm Cable Clamp⁵
- HCR = Right Angle DIN 43650A 9mm Cable Clamp⁵
- HN = DIN 43650A with 1/2" Female NPT Conduit⁵
- HNR = Right Angle DIN 43650A with 1/2" Female NPT Conduit⁵
- HM = Micro (9.4mm Spacing) DIN Style Male Half Only⁵
- SP = Spade Terminals⁶

5 Options

- 10A = 10A @ 125/250 VAC Max. Rating⁷
- V = Viton[®] 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 Protection⁸
- OF = Oil Free 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)⁹
- 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	Accuracy	Average Deadband*
10	5-15" Hg (169-508 mbar)	±0.71" Hg (24 mbar) +2% of setting	3.05" Hg (103 mbar) +7% of setting
20	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.

TM-950 – Open Thermistor Sensor

- ▶ Hermetically Sealed
- ▶ High Pressure Capability
- ▶ Direct Reading Ceramic Thermistor
- ▶ Ideal For Non-Conductive Oils & Refrigerants

The Gems TM-950 is an Open Thermistor Sensor ideal for temperature sensing in non-conductive liquids, such as oil and refrigerants. It utilizes a proprietary fused glass hermetic seal, an axial feed-through design to provide exceptional high pressure, and temperature sensing capability.



Specifications

Temperature Capability	-40°F to +250°F (-40°C to +125°C)
Referenced Temperature Range	32°F to 100°F (0°C to 38°C)
Setting Tolerance	±6°F (±3°C)
Wetted Parts	
Housing	Zinc Plated Steel
Thermistor	Ceramic, Tinned Copper
Fused Hermetic Seal	Soda Lime Glass
Spacer Disc	PTFE
Electrical Termination	Flying Leads IP65, 18 AWG PTFE Insulated, 6.5"
Maximum Pressure	450 PSIG (31 bar) ¹

Note:
1. Higher Pressure Capability Available Upon Request.

Sensor Color Codes

Color Code	Sensor Type
Green	50 Ohms
Red	100 Ohms

Typical Resistance Values at Referenced Temperatures

Media Temperature	Resistance Reading (Ohms)	
	Green	Red
@ 32°F (0°C)	124.0 – 161.0	242.1 – 321
@ 75°F (24°C)	48.5 – 59.5	97 – 121
@ 90°F (32°C)	31.5 – 42.5	65.6 – 87

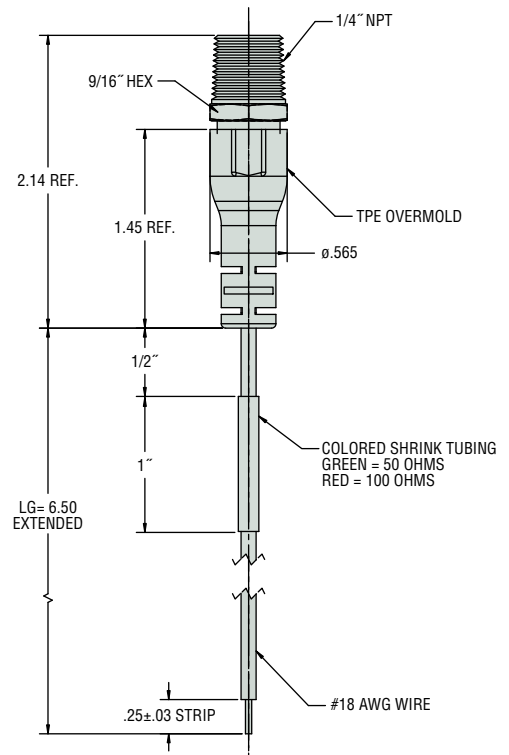
How To Order

Select Part Number based on Thermistor, Nominal Value and Shrink Tubing Color.

Nominal Thermistor Value	Shrink Tubing Color	Part Number
50 Ohm	Green	243650
100 Ohm	Red	243700

Note: Other alternate Thermistor values with R-T curves are available upon request.

Dimensions



7000 Series Compact High Pressure Temperature Sensor

- ▶ Continuous Output for Temperatures to 212°F (100°C)
- ▶ Pressures to 8,700 PSI (600 bar)
- ▶ 4-20mA Output Accommodates Numerous Systems

7000 Series sensors provide continuous temperature measurement of process fluids typically found in hydraulic and mobile vehicle applications.

High pressure capability and product packaging make it ideal for use in harsh environments.

The sensor has a 4-20mA output, with a variety of industry-standard electrical connections to simplify installation into a broad range of applications and systems.



Specifications

Performance	
Accuracy	±1.5% Full Scale
Ambient Temperatures	-13°F to +176°F (-25°C to +80°C)
Storage Temperatures	-40°F to +257°F (-40°C to +125°C)
Measurement Temperatures	See under "How to Order," last page
Measurement Rise Time	T50 = 10 Sec, T90 = 30 Sec (Water)
Operating Pressure, Max.	8,700 PSI (600 Bar)
Proof Pressure	13,050 PSI (900 Bar)
Mechanical Configuration	
Pressure Port	See under "How to Order," next page
Wetted Parts	17-4 pH Stainless Steel
Electrical Connection	See under "How to Order," next page
Enclosure	IP67
Vibration	BSEN 60068-2-6 (FC) BSEN 60068-2-64 (FH)
Shock	BSEN 60068-2-2n
Approvals	CE, RoHS
Weight	1.23 to 1.9 ounces (35-53 grams). Configuration dependant

EMC Specifications

Emissions Tests: EN61326-1:2006 and EN61326-2-3:2006

Test Standard	Test
EN55011:2007	Conducted Emissions
EN55011:2007	Radiated Emissions

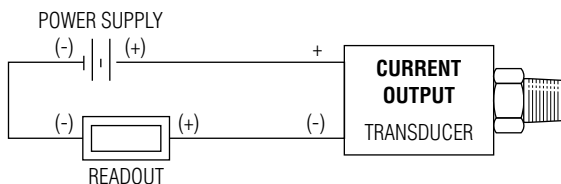
Immunity Tests: EN61326-1:2006 and EN61326-2-3:2006

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

Output Specifications

Current Output Units	
Output	4-20 mA
Supply Voltage (Vs)	8-36 Vdc
Max Load Resistance	(Supply Voltage - 8) x 50 ohms

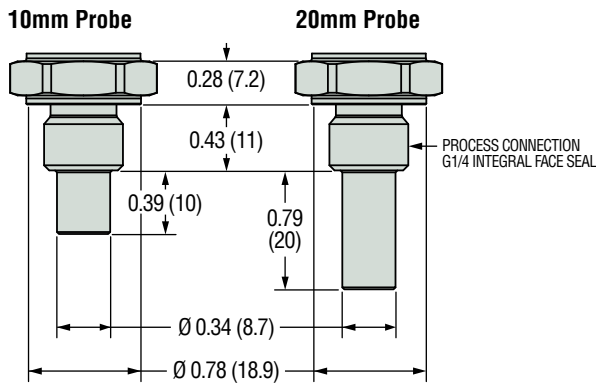
Wiring Diagram



Electrical Connector

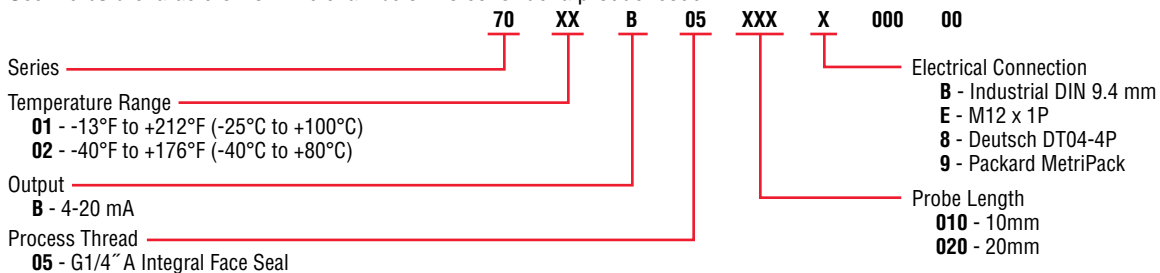
DIN 9.4 mm		M12 x 1P		Deutsch DT04-4P		Packard MetriPack	
Code B		Code E		Code 8		Code 9	
Pin #	Current Mode	Current Mode	Current Mode	Pin ID	Current Mode	Pin ID	Current Mode
1	No Connect	Supply	Return	C	No Connect	C	No Connect
2	Supply	No Connect	Supply	A	Return	A	Return
3	No Connect	Return	No Connect	B	Supply	B	Supply
4	Return	No Connect	No Connect	—	—	—	—

Process Connection



How to Order

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



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.

Contents	Page Start
General Purpose	J-5
Isolation.....	J-29
Cryogenic	J-33
Latching.....	J-37
Humidifier	J-39
Manifold Assemblies	J-40
Valve Selection Check List (ADS).....	J-41

Get Help Quick

An application data sheet (ADS), located on page J-41, 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.

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.



4 Steps to Valve Selection

The steps described in this section will help you identify and select the right valve.

Step 1 – Calculating Flow Coefficient

C_v – For Imperial Units of Measure

K_v – For Metric Units of Measure

Begin by calculating the valve Flow Coefficient (C_v or K_v) using operating pressure differential; flow rate for your application; Specific Gravity (or Liquid Density); and in some circumstances, temperature. If you already know the Flow Coefficient go directly to Step 2.

The Flow Coefficient combines the effects of all flow restrictions in the valve into a single number, and is used for both liquids and gases (non-compressible and compressible fluids):

C_v represents the quantity of water, at 68°F and in gallons per minute (GPM) that will flow through your valve with a 1psi pressure differential.

K_v represents the flow of water with temperature ranging between 5°C and 30°C through a valve in cubic meters per hour with a pressure drop of 1 bar.

Temperature Factor

Temperature is not included in the Flow Coefficient calculation for non-compressible fluids (liquids) and is only used in determining SG or Liquid Density. 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/K_v calculations.

Relationship Between C_v and K_v

C_v and K_v may be converted to one another using the formulas below:

$$C_v = 1.56 \cdot K_v$$

$$K_v = 0.853 \cdot C_v$$

Liquid Flow

Because liquids are non-compressible, their flow rate depends only on the difference between the inlet and outlet pressures (P₁ - P₂ or ΔP, pressure differential. Figure 1).

The C_v or K_v of liquid media can be determined with the equations below.

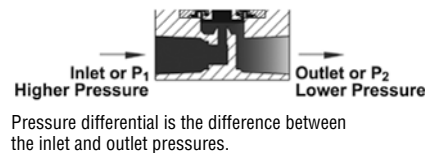
Liquid Flow Formulas

$$C_v = v \sqrt{\frac{SG}{\Delta P}} \quad K_v = v \sqrt{\frac{\rho}{\Delta P}}$$

Where:

- C_v = Valve flow coefficient
- v = Flow rate in GPM or m³/h
- ΔP = Pressure differential (PSI or bar)
- SG = Specific Gravity @ 60°F and 14.7 PSIA
- ρ = Density of liquids in kg/m³ (water = 1000)

Fig. 1: Press Differential



Gas Flow

Gases are compressible fluids and there are separate equations for high and low-pressure differential flow.

Gas Flow Coefficient Formulas

• **Low-pressure** differential flow is when $P_2 > \frac{P_1}{2}$.
Use the following equations:

$$C_v = \frac{v}{16.05 \sqrt{\frac{(P_1^2 - P_2^2)}{(SG) T}}} \quad K_v = \frac{v_g}{519} \sqrt{\frac{\rho_g T_1}{\Delta P P_2}}$$

• **High-pressure** differential flow is when $P_2 \leq \frac{P_1}{2}$.
Use the following equations:

$$C_v = \frac{v}{13.61 P_1 \sqrt{\frac{1}{(SG) T}}} \quad K_v = \frac{v_g}{259.5 P_1} \sqrt{\rho_g T_1}$$

Where:

- C_v = Valve flow coefficient
- v = Flow rate in SCFM or m³/h
- P₁ = Inlet pressure in PSIA or bar
- P₂ = Outlet pressure in PSIA or bar
- SG = Specific Gravity @ 60°F and 14.7 PSIA
- ρ = Density of gases @ 0°C and 1013 mbar in kg/m³
- T = Temperature of gas in Degree Rankine (°F + 460) or Degree Kelvin (°C + 298)

16.05 and 13.61 (519 and 259.5) are constants used in gas flow equations

C_v Example: Using Water at 68°F:

V = 3.08 GPM
P₁ = 100 PSI
P₂ = 40 PSI
SG = 1

$$C_v = 3.08 \sqrt{\frac{1}{100-40}} = .398$$

K_v Example: Using Water at 25°C:

V = 0.45 m³/h
ρ = 1
P₁ = 8.01 ABS bar
P₂ = 3.2 ABS bar
ΔP = 8.01 - 3.20 = 4.81 bar

$$K_v = 0.45 \sqrt{\frac{1}{4.81}} = .20$$

Examples: Using Air with High Differential flow where P:

Since these are high-pressure differential flow examples, we use the following equations:

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)

$$C_v = \frac{10}{13.61 \cdot 34.7 \sqrt{\frac{1}{(1) 532}}} = .49$$

V_g = 16.99 m³/h
P₁ = 2.39 ABS bar
P₂ = 1.01 ABS bar
ρ_g = 1.284 Kg/m³
T₁ = 25°C = 298°K (25 + 273)

$$K_v = \frac{16.99}{519} \sqrt{\frac{1.284 (298)}{1.38 (1.01)}} = .54$$

Step 2 – Valve Function

Identify how your valve will function in your application. Pick from the choices below.

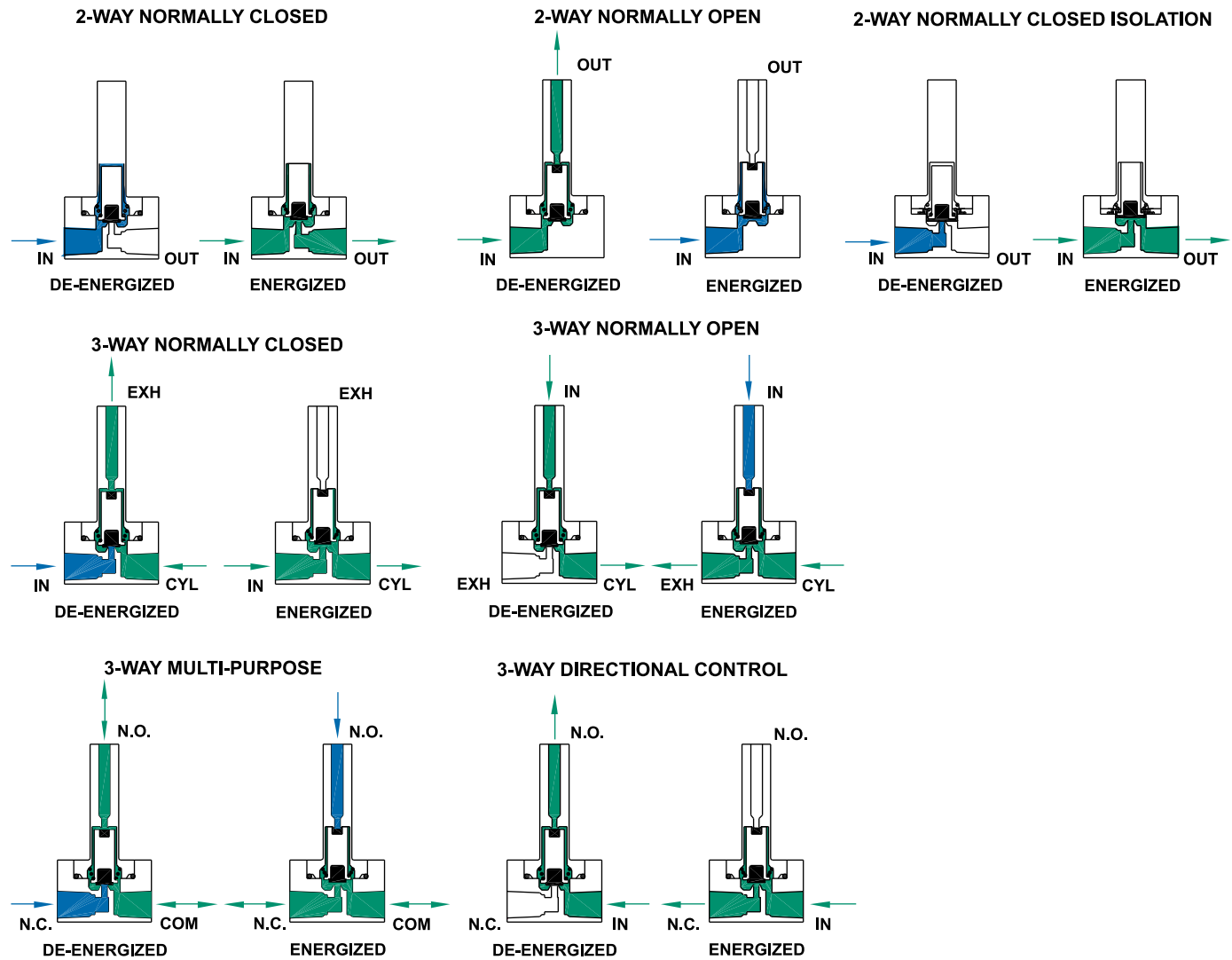
An important note regarding C_v and valve function:

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.

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 specifications needed for your application to target appropriate 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	
K _v Range	0.015 - 0.063			0.016 - 0.357		0.038 - 0.595	
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
Orifice Dia (mm)	0.813 - 1.981		0.787 - 1.321	0.813 - 3.962	1.575 - 5.334		1.194 - 9.525
Power (watt)	0.65, 2		0.5, 1, 2	6	7		10
MOPD (psi)	175	250	100	1000	400		900
MOPD (bar)	12.06	17.23	6.89	68.95	27.58		62.05
Valve Series	E, EH	G, GH	M	A	B	C	D
Pages	J-7	J-10	J-5	J-14	J-18	J-22	J-26

Isolation			Cryogenic			Latching	
Function	2-Way, Normally Closed Only			2-Way, Normally Closed Only			2- & 3-Way
Media	Gas & Liquid			Liquid			Gas & Liquid
Size	Miniature			Miniature			Miniature
C _v Range	0.020 - 0.300			0.045 - 0.440	0.040 - 0.770		0.018 - 0.43
K _v Range	0.017 - 0.256			0.038 - 0.374	0.034 - 0.655		
Port Configuration	#10-32, 1/8 NPT, 1/4 NPT, Manifold Mount			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)	0.032 - 0.156			0.046 - 0.188	0.046 - 0.250		0.032 - 0.156
Orifice Dia (mm)							
Power (watt)	4.5, 7			9	15		5 - 9
MOPD (psi)	50 (Plastic Body), 150			900	1000*		100
MOPD (bar)							
Valve Series	AS	BS	B-Cryo	D-Cryo	BL		
Pages	J-29	J-31	J-33	J-35	J-37		

*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

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.

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.

M Series – Subminiature

- ▶ MOPD: 100 PSI (6.9 Bar)
- ▶ C_v Range: 0.018 to 0.070 (K_v Range: 0.017 to 0.032)
- ▶ As Low As 0.5 Watts

The M Series implements efficient power conservation in a solenoid valve that is specifically designed for sub-miniature two- and three-way pneumatic and select liquid applications. Field proven to exceed performance requirements in battery-powered applications, the M Series can be designed for extreme low wattage conditions. With a compact size, consistent high-speed response time, and reliable operation over 200 million cycles, the M Series delivers extended performance and precision flow control in a small lightweight environment.

Typical Applications

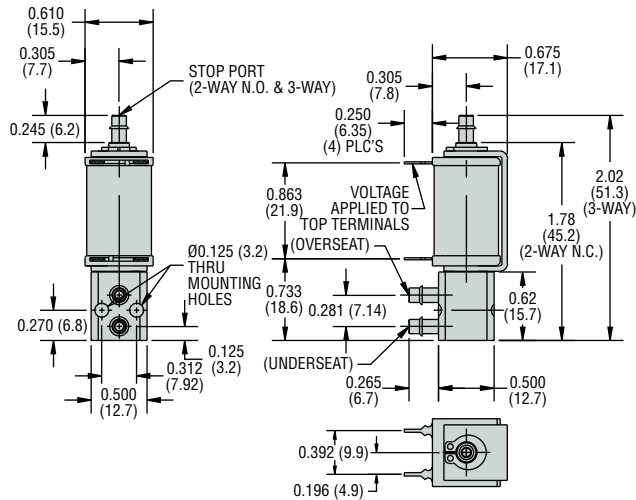
Ideal for inline PC interfacing and manifold assemblies:

- Medical and Therapeutic Healthcare
- Clinical Chemistry and Analysis Equipment
- Drop-on-Demand Printing
- Environmental Instrumentation

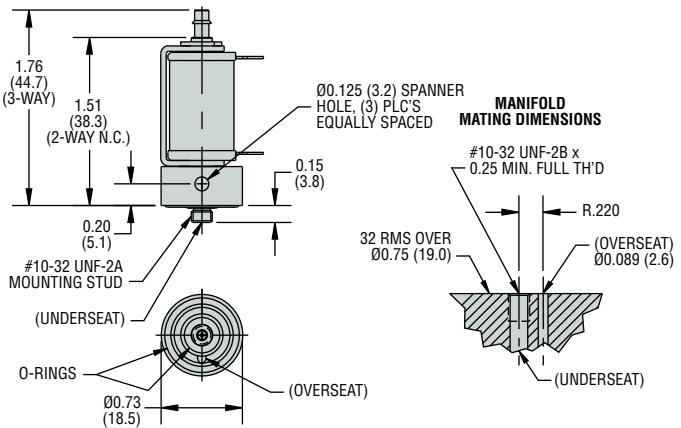


Dimensions

Threaded Port Body

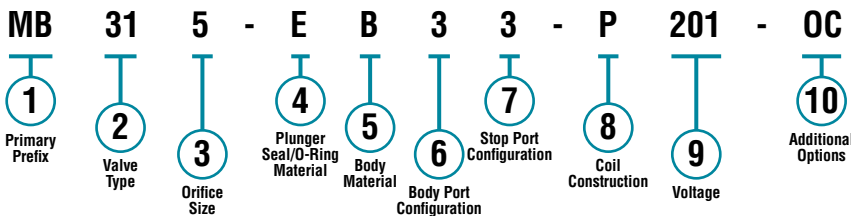


Manifold Mount Body



How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.



Note: After the Primary Prefix, any '-Code' may be blank when standard (blank) selections are specified.

Example:

MB315-EB33-P-201

1 Watt 3-Way N.C. solenoid valve with a 0.052" (1.321mm) orifice, EPDM plunger seal/o-ring, brass body, 1/8" barb body and stop port, P.C. board mount (4-pin), operating at 5 VDC, and is cleaned for oxygen use.

Part Prefix Table ①

Power Rating	Orifice		MOPD		C _v	K _v	① Primary Prefix
	inches	mm	psi	bar			
0.5 Watt	0.031	0.787	25	1.7	0.018	0.015	MA
	0.052	1.321	10	0.7	0.037	0.032	MA
1 Watt	0.031	0.787	50	3.4	0.018	0.015	MB
	0.052	1.321	25	1.7	0.037	0.032	MB
2 Watts	0.031	0.787	100	6.9	0.018	0.015	MC
	0.052	1.321	50	3.4	0.037	0.032	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" (0.79mm)
- 5 = 0.052" (1.32mm)

④ Plunger Seal / O-Ring Material

- V = Viton®
- N = Nitrile
- E = EPDM

⑤ Body Material

- B = Brass
- A = Aluminum

⑥ Body Port Configuration¹

- 0 = Face mount
- 1 = 1/16" (1.6mm) barb
- 2 = 5/64" (2.0mm) or 3/32" (2.4mm) barb
- 3 = 1/8" (3.2mm) 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 Configuration¹

- 0 = No barb (Standard for 2-way NC & 3-way free vent)^{2,3}
- 1 = 1/16" (1.6mm) barb (.031" orifice only)
- 2 = 5/64" (2.0mm) or 3/32" (2.4mm) barb
- 3 = 1/8" (3.2mm) barb

⑧ Coil Construction (Tape-Wrapped, 130°C Class B)

- U = P.C. board solderable (2-pin)
- P = P.C. board mount (4-pin)⁴
- Q = Quick connect 0.110" (2.79mm) spade
- L = Lead-wires, #26 AWG, 18" (45.7cm) 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 (0 to 914 mBar)

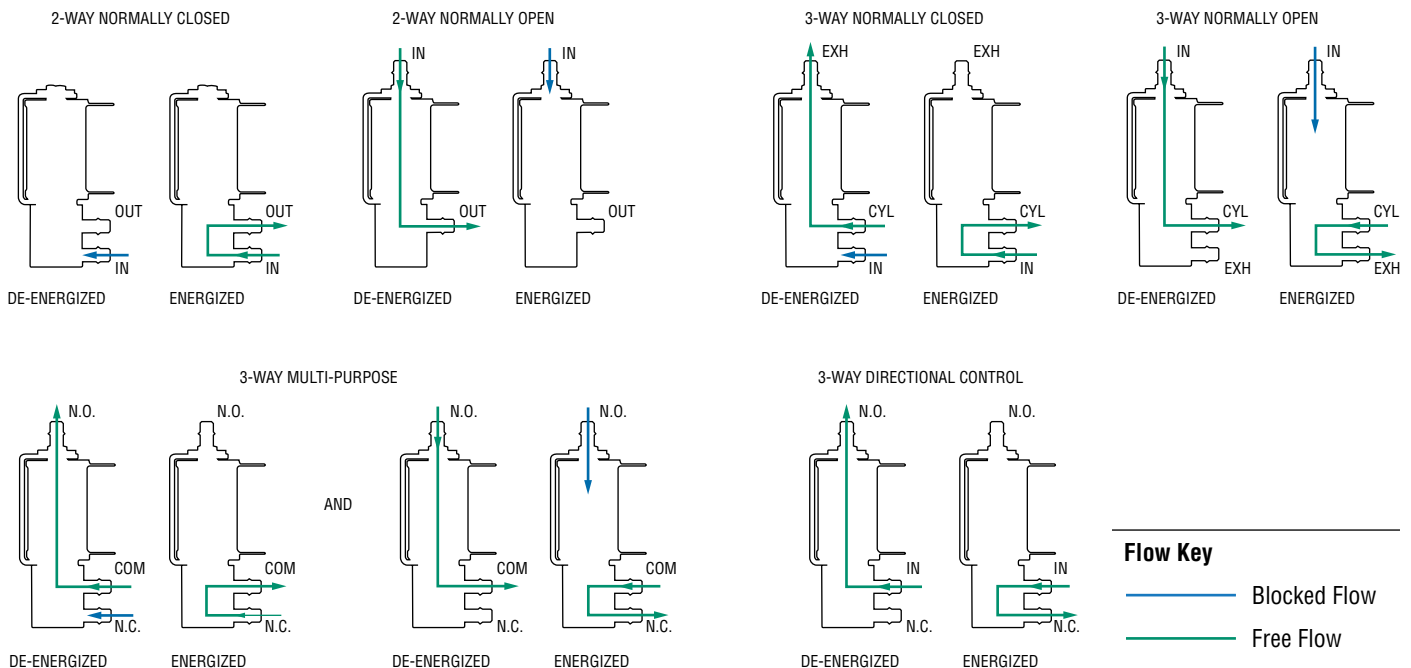
Notes

1. Barbs are brass.
2. For Stop Port Configuration, must select "0" for valve type 20 (2-way NC) and for type 30 (3-way NC Free Vent).
3. For Stop Port Configuration, must select "1" or "2" or "3" for valve types 22 (2-way NO), 31 (3-way NC Line Connect), 32 (3-way NO), 33 (3-way MP), and 34 (3-way DC). Selection "0" can not be used.
4. 2 pins near stop are active.

[†]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.

Flow Schematic



E & EH Series – Subminiature Gas

- ▶ MOPD: 175 PSI (12 Bar)
- ▶ C_v Range: 0.018 to 0.070 (K_v Range: 0.015 to 0.060)
- ▶ 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.

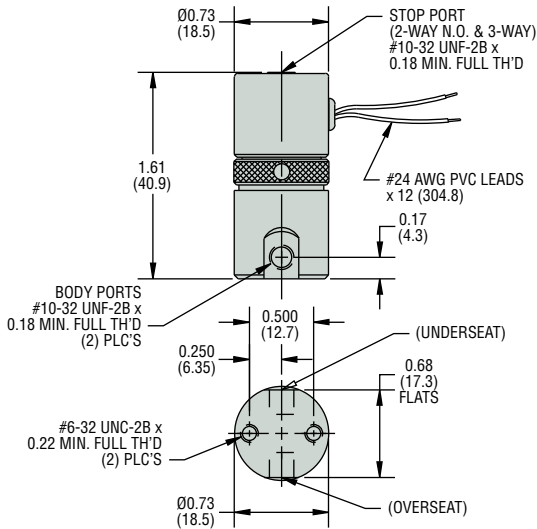
Typical Applications

- Medical and Respiratory Healthcare
- Printing Machinery and Sorting Equipment
- Automated Packaging Equipment
- Air Monitoring Systems

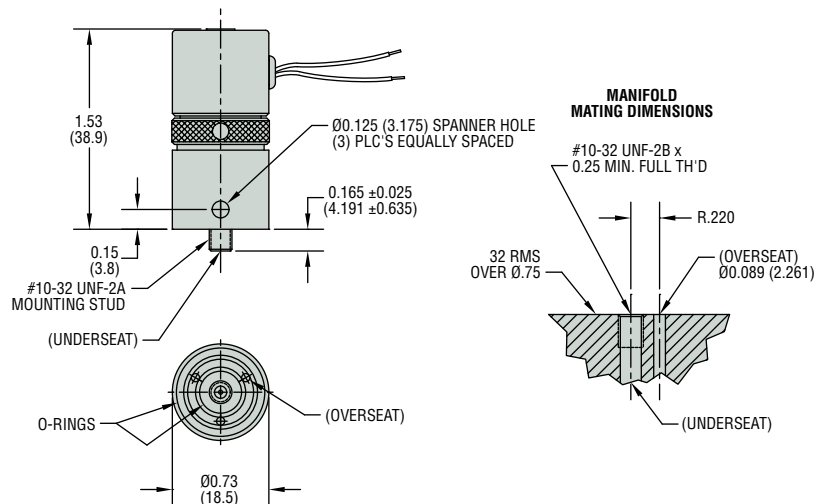


Dimensions

Threaded Port Body

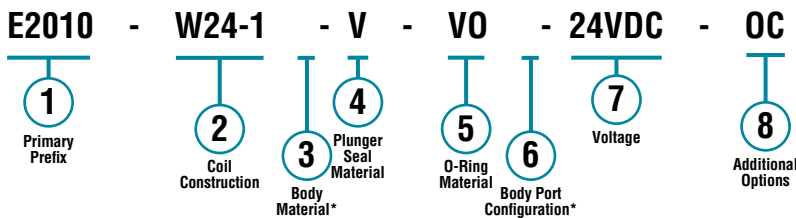


Manifold Mount Body



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" (61cm) 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		C _v		K _v		① Primary Prefix
		Body		Stop		psig	bar	Body	Stop	Body	Stop	
		inches	mm	inches	mm							
2-WAY N.C.	0.65W	1/32	0.79	—	—	125	9	0.018	—	0.015	—	E2010
		3/64	1.19	—	—	70	5	0.023	—	0.020	—	E2011
		1/16	1.59	—	—	40	3	0.036	—	0.031	—	E2012
		5/64	1.98	—	—	20	1	0.070	—	0.060	—	E2013
	2W	1/32	0.79	—	—	175	12	0.018	—	0.015	—	EH2010
		3/64	1.19	—	—	150	10	0.023	—	0.020	—	EH2011
1/16		1.59	—	—	100	7	0.036	—	0.031	—	EH2012	
		5/64	1.98	—	—	50	3	0.070	—	0.060	—	EH2013
2-WAY N.O.	0.65W	—	—	1/32	0.79	125	9	—	0.018	—	0.015	E2210
		—	—	3/64	1.19	70	5	—	0.023	—	0.020	E2211
		—	—	1/16	1.59	40	3	—	0.032	—	0.027	E2212
	2W	—	—	1/32	0.79	175	12	—	0.018	—	0.015	EH2210
		—	—	3/64	1.19	150	10	—	0.023	—	0.020	EH2211
		—	—	1/16	1.59	100	7	—	0.032	—	0.027	EH2212
3-WAY N.C. Line Connection	0.65W	1/32	0.79	1/32	0.79	125	9	0.018	0.018	0.015	0.015	E3110
		3/64	1.19	3/64	1.19	70	5	0.023	0.023	0.020	0.020	E3111
		1/16	1.59	1/16	1.59	40	3	0.036	0.032	0.031	0.027	E3112
	2W	1/32	0.79	1/32	0.79	175	12	0.018	0.018	0.015	0.015	EH3110
		3/64	1.19	3/64	1.19	150	10	0.023	0.023	0.020	0.020	EH3111
		1/16	1.59	1/16	1.59	100	7	0.036	0.032	0.031	0.027	EH3112
3-WAY N.O.	0.65W	1/32	0.79	1/32	0.79	125	9	0.018	0.018	0.015	0.015	E3210
		3/64	1.19	3/64	1.19	70	5	0.023	0.023	0.020	0.020	E3211
		1/16	1.59	1/16	1.59	40	3	0.036	0.032	0.031	0.027	E3212
	2W	1/32	0.79	1/32	0.79	175	12	0.018	0.018	0.015	0.015	EH3210
		3/64	1.19	3/64	1.19	150	10	0.023	0.023	0.020	0.020	EH3211
		1/16	1.59	1/16	1.59	100	7	0.036	0.032	0.031	0.027	EH3212
3-WAY Multi Purpose	0.65W	1/32	0.79	1/32	0.79	80	6	0.018	0.018	0.015	0.015	E3310
		3/64	1.19	3/64	1.19	40	3	0.023	0.023	0.020	0.020	E3311
		1/16	1.59	1/16	1.59	20	1	0.036	0.032	0.031	0.027	E3312
	2W	1/32	0.79	1/32	0.79	150	10	0.018	0.018	0.015	0.015	EH3310
		3/64	1.19	3/64	1.19	100	7	0.023	0.023	0.020	0.020	EH3311
		1/16	1.59	1/16	1.59	50	3	0.036	0.032	0.031	0.027	EH3312
3-WAY Directional Control	0.65W	1/32	0.79	1/32	0.79	135	9	0.018	0.018	0.015	0.015	E3410
		3/64	1.19	3/64	1.19	80	6	0.023	0.023	0.020	0.020	E3411
		1/16	1.59	1/16	1.59	45	3	0.036	0.032	0.031	0.027	E3412
	2W	1/32	0.79	1/32	0.79	190	13	0.018	0.018	0.015	0.015	EH3410
		3/64	1.19	3/64	1.19	165	11	0.023	0.023	0.020	0.020	EH3411
		1/16	1.59	1/16	1.59	80	6	0.036	0.032	0.031	0.027	EH3412

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.

② Coil Construction

- (blank) = Tape-wrapped, Class-B, with 12" (30.48cm) long lead-wires*
- W = Lead-wires, non-standard length (specify in inches)
- 1 = Encapsulated coil
- 5 = Encapsulated coil with 0.110" (2.79mm) 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" (1.59mm)

⑦ Voltage

- VDC = DC (specify voltage)
- VAC = AC rectified 2-watt only (specify voltage)

⑧ Additional Options

- OC = Cleaned for oxygen use
- QO = Quiet operation (2-way N.C.)
- VAC = Vacuum application – 0 to 29.5" Hg (0 to 1000 mBar)

* 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.

NOTES

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows.

G & GH Series – Subminiature

- ▶ MOPD: 250 PSI (17 Bar)
- ▶ C_v Range: 0.018 to 0.070 (K_v Range: 0.015 to 0.054)
- ▶ 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:

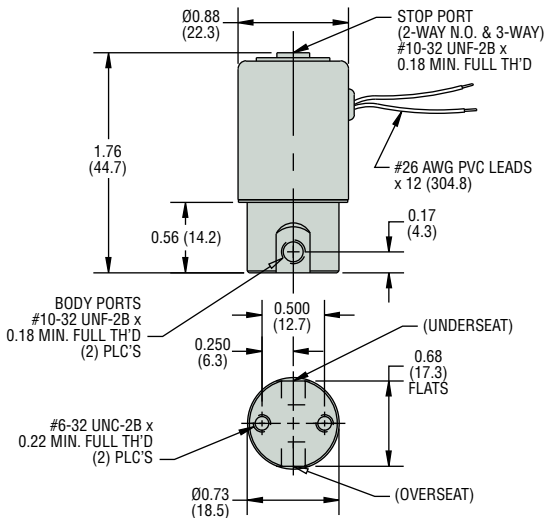
- Hospital Equipment
- Laboratory Equipment
- Air Sampling Systems

Acetal Bodies:

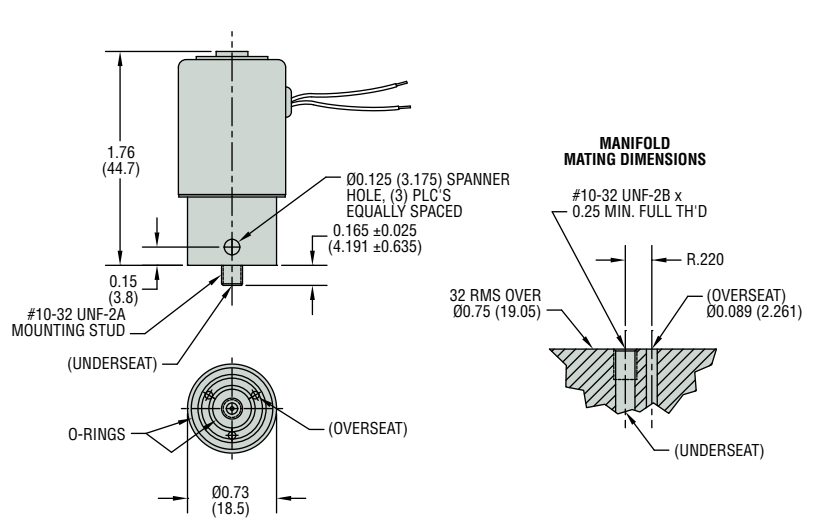
- Water Purification Systems
- Analytical Equipment

Dimensions

Threaded Port Body

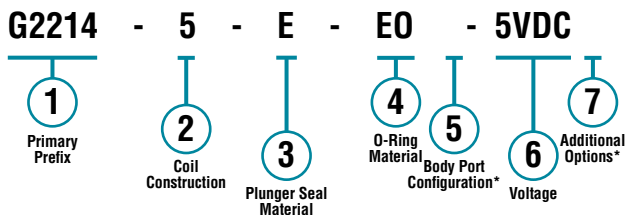


Manifold Mount Body



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 12" (30.48cm) long lead-wires, encapsulated coil with 0.110" (2.79mm) 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		C _v		K _v		① Primary Prefix
		Body		Stop		psig	bar	Body	Stop	Body	Stop	303 Stainless Steel ¹
		inches	mm	inches	mm							
2-WAY N.C.	0.65W	0.030	0.762	—	—	125	8.6	0.015	0.018	—	—	G2012
		0.040	1.016	—	—	70	4.8	0.020	0.023	—	—	G2013
		0.055	1.397	—	—	40	2.8	0.032	0.038	—	—	G2014
		0.078	1.981	—	—	20	1.4	0.054	0.063	—	—	G2015
	2W	0.030	0.762	—	—	250	17	0.015	0.018	—	—	GH2012
		0.040	1.016	—	—	175	12	0.020	0.023	—	—	GH2013
		0.055	1.397	—	—	100	6.9	0.032	0.038	—	—	GH2014
		0.078	1.981	—	—	50	3.4	0.054	0.063	—	—	GH2015
2-WAY N.O.	0.65W	—	—	0.030	0.762	125	8.6	—	—	0.018	0.015	G2212
		—	—	0.040	1.016	70	4.8	—	—	0.023	0.020	G2213
		—	—	0.055	1.397	40	2.8	—	—	0.038	0.032	G2214
		—	—	0.078	1.981	20	1.4	—	—	0.057	0.049	G2215
	2W	—	—	0.030	0.762	200	14	—	—	0.018	0.015	GH2212
		—	—	0.040	1.016	150	10	—	—	0.023	0.020	GH2213
		—	—	0.055	1.397	100	6.9	—	—	0.038	0.032	GH2214
		—	—	0.078	1.981	50	3.4	—	—	0.057	0.049	GH2215
3-WAY N.C.	0.65W	0.030	0.762	0.030	0.762	125	8.6	0.018	0.015	0.0153	0.018	G3012
		0.040	1.016	0.040	1.016	70	4.8	0.023	0.020	0.01955	0.023	G3013
		0.055	1.397	0.055	1.397	40	2.8	0.038	0.032	0.0323	0.038	G3014
		0.078	1.981	0.078	1.981	20	1.4	0.063	0.054	0.04845	0.057	G3015
	2W	0.030	0.762	0.030	0.762	200	14	0.018	0.015	0.01955	0.023	GH3012
		0.040	1.016	0.040	1.016	150	10	0.023	0.020	0.01955	0.023	GH3013
		0.055	1.397	0.055	1.397	100	6.9	0.038	0.032	0.0323	0.038	GH3014
		0.078	1.981	0.078	1.981	50	3.4	0.063	0.054	0.04845	0.057	GH3015
3-WAY N.O.	0.65W	0.030	0.762	0.030	0.762	125	8.6	0.015	0.018	0.018	0.015	G3212
		0.040	1.016	0.040	1.016	70	4.8	0.020	0.023	0.023	0.020	G3213
		0.055	1.397	0.055	1.397	40	2.8	0.032	0.038	0.038	0.032	G3214
		0.078	1.981	0.078	1.981	20	1.4	0.048	0.057	0.057	0.049	G3215
	2W	0.030	0.762	0.030	0.762	175	12	0.015	0.018	0.018	0.015	GH3212
		0.040	1.016	0.040	1.016	150	10	0.020	0.023	0.023	0.020	GH3213
		0.055	1.397	0.055	1.397	80	5.5	0.032	0.038	0.038	0.032	GH3214
		0.078	1.981	0.078	1.981	40	2.8	0.048	0.057	0.057	0.049	GH3215
3-WAY Multi Purpose	0.65W	0.030	0.762	0.030	0.762	80	5.5	0.015	0.018	0.018	0.015	G3312
		0.040	1.016	0.040	1.016	40	2.8	0.020	0.023	0.023	0.020	G3313
		0.055	1.397	0.055	1.397	20	1.4	0.031	0.036	0.029	0.024	G3314
		0.078	1.981	0.078	1.981	10	0.7	0.054	0.063	0.053	0.045	G3315
	2W	0.030	0.762	0.030	0.762	110	7.6	0.015	0.018	0.018	0.015	GH3312
		0.040	1.016	0.040	1.016	85	5.9	0.020	0.023	0.023	0.020	GH3313
		0.055	1.397	0.055	1.397	50	3.4	0.031	0.036	0.029	0.024	GH3314
		0.078	1.981	0.078	1.981	25	1.7	0.054	0.063	0.057	0.049	GH3315
3-WAY Directional Control	0.65W	0.030	0.762	0.030	0.762	135	9.3	0.015	0.018	0.018	0.015	G3412
		0.040	1.016	0.040	1.016	80	5.5	0.020	0.023	0.023	0.020	G3413
		0.055	1.397	0.055	1.397	45	3.1	0.025	0.029	0.029	0.024	G3414
		0.078	1.981	0.078	1.981	20	1.4	0.054	0.063	0.055	0.046	G3415
	2W	0.030	0.762	0.030	0.762	190	13	0.015	0.018	0.018	0.015	GH3412
		0.040	1.016	0.040	1.016	165	11	0.020	0.023	0.020	0.017	GH3413
		0.055	1.397	0.055	1.397	80	5.5	0.032	0.038	0.038	0.032	GH3414
		0.078	1.981	0.078	1.981	40	2.8	0.054	0.063	0.063	0.053	GH3415

SOLENOID VALVES

② Coil Construction

- (blank) = Tape-wrapped, Class-B, with 12" (30.48cm) long lead-wires*
W = Lead-wires, non-standard length (specify in inches)
1 = Encapsulated coil
5 = Encapsulated coil with 0.110" (2.79mm) 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)
BM = M5 x 0.8 ports
MM = Manifold mount with #10-32 threaded stud†
MM2 = Manifold mount with M5 x 0.8 threaded stud†

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 (0 to 1000 mBar)

* 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.

† 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.

NOTES

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows.



Next Day Shipping
On Many Configurations

A Series

- ▶ MOPD: 1000 PSI (69 Bar)
- ▶ C_v Range: 0.019 to 0.3 (K_v Range: 0.016 to 0.256)
- ▶ 6 Watts

The A Series gives you a highly adaptable design for practically all applications requiring flow between C_v 0.019 and 0.300 (K_v 0.016 to 0.259). 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

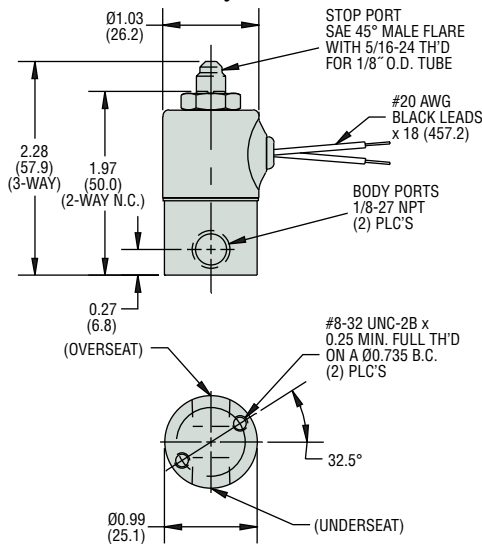
Brass Bodies:

- Industrial Applications
- Automotive
- Water Transfer Systems

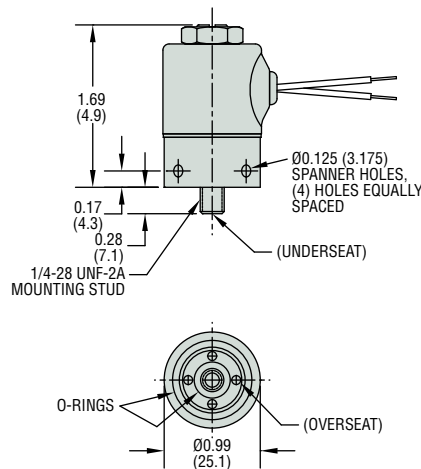


Dimensions

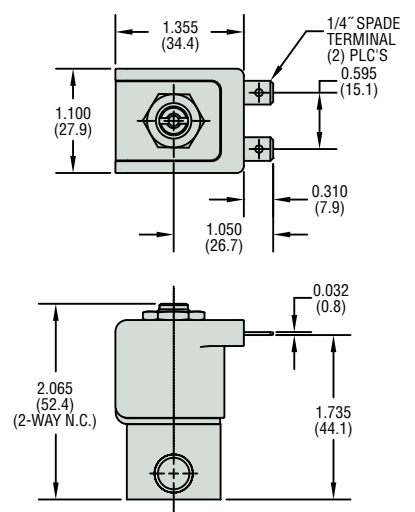
Threaded Port Body



Manifold Mount Body



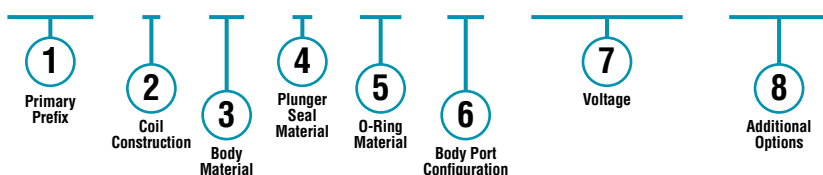
Molded Coil



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.

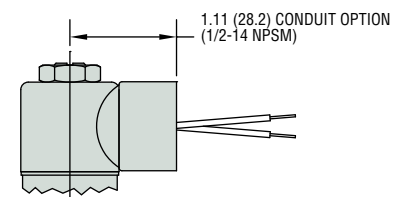
Example:

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.

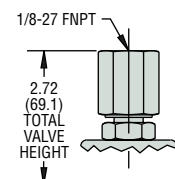
Alternate 1/2" Conduit Housing

Available on all body configurations



Stop Port

Standard on 2-way N.O.;
Option "AD" on 3-Way.





Take advantage of next day shipping by making your selections from those marked with the Lightning Bolt icon.

Part Prefix Table ①

	Orifice				MOPD		C _v		K _v		① Primary Prefix	
	Body		Stop		psig	bar	Body	Stop	Body	Stop	Grommet Housing	Conduit Housing
	inches	mm	inches	mm								
2-WAY N.C.	1/32	0.79	—	—	1000	69	0.020	—	0.017	—	A2011 ⚡	A2021
	3/64	1.19	—	—	500	34	0.035	—	0.030	—	A2012 ⚡	A2022
	1/16	1.59	—	—	300	21	0.065	—	0.055	—	A2013 ⚡	A2023
	5/64	1.98	—	—	200	14	0.090	—	0.077	—	A2014 ⚡	A2024
	3/32	2.38	—	—	175	12	0.155	—	0.132	—	A2015 ⚡	A2025
	1/8	3.18	—	—	100	6.9	0.240	—	0.205	—	A2016 ⚡	A2026
	5/32	3.97	—	—	50	3.4	0.300	—	0.256	—	A2017 ⚡	A2027
2-WAY N.O. (option AD standard)	—	—	1/32	0.79	200	14	—	0.019	—	0.016	A2211 ⚡	A2221
	—	—	3/64	1.19	150	10	—	0.040	—	0.034	A2212 ⚡	A2222
	—	—	1/16	1.59	100	6.9	—	0.075	—	0.064	A2213 ⚡	A2223
3-WAY N.C. Free Vent	1/32	0.79	1/32	0.79	200	14	0.019	0.019	0.016	0.016	A3011 ⚡	A3021
	3/64	1.19	3/64	1.19	150	10	0.040	0.040	0.034	0.034	A3012 ⚡	A3022
	1/16	1.59	3/64	1.19	100	6.9	0.070	0.040	0.060	0.034	A3013 ⚡	A3023
	1/16	1.59	1/16	1.59	75	5.2	0.070	0.070	0.060	0.060	A3014 ⚡	A3024
	3/32	2.38	3/64	1.19	50	3.4	0.170	0.040	0.145	0.034	A3015 ⚡	A3025
3-WAY N.C. Line Connection	1/32	0.79	1/32	0.79	200	14	0.019	0.019	0.016	0.016	A3111 ⚡	A3121
	3/64	1.19	3/64	1.19	150	10	0.040	0.040	0.034	0.034	A3112 ⚡	A3122
	1/16	1.59	3/64	1.19	100	6.9	0.070	0.040	0.060	0.034	A3113 ⚡	A3123
	1/16	1.59	1/16	1.59	75	5.2	0.070	0.070	0.060	0.060	A3114 ⚡	A3124
	3/32	2.38	3/64	1.19	50	3.4	0.170	0.040	0.145	0.034	A3115 ⚡	A3125
3-WAY N.O.	1/32	0.79	1/32	0.79	150	10	0.019	0.019	0.016	0.016	A3211 ⚡	A3221
	3/64	1.19	3/64	1.19	100	6.9	0.040	0.040	0.034	0.034	A3212 ⚡	A3222
	1/16	1.59	3/64	1.19	90	6.2	0.070	0.040	0.060	0.034	A3213 ⚡	A3223
	1/16	1.59	1/16	1.59	75	5.2	0.070	0.070	0.060	0.060	A3214 ⚡	A3224
	3/32	2.38	3/64	1.19	50	3.4	0.170	0.040	0.145	0.034	A3215 ⚡	A3225
3-WAY Multi Purpose	1/32	0.79	1/32	0.79	125	8.6	0.019	0.019	0.016	0.016	A3311 ⚡	A3321
	3/64	1.19	3/64	1.19	100	6.9	0.040	0.040	0.034	0.034	A3312 ⚡	A3322
	1/16	1.59	3/64	1.19	90	6.2	0.070	0.040	0.060	0.034	A3313 ⚡	A3323
	1/16	1.59	1/16	1.59	75	5.2	0.070	0.070	0.060	0.060	A3314 ⚡	A3324
	3/32	2.38	3/64	1.19	25	1.7	0.170	0.040	0.145	0.034	A3315 ⚡	A3325
3-WAY Directional Control	1/32	0.79	1/32	0.79	225	16	0.019	0.019	0.016	0.016	A3411 ⚡	A3421
	3/64	1.19	3/64	1.19	150	10	0.040	0.040	0.034	0.034	A3412 ⚡	A3422
	1/16	1.59	3/64	1.19	100	6.9	0.070	0.040	0.060	0.034	A3413 ⚡	A3423
	1/16	1.59	1/16	1.59	75	5.2	0.070	0.070	0.060	0.060	A3414 ⚡	A3424
	3/32	2.38	3/64	1.19	50	3.4	0.155	0.040	0.132	0.034	A3415 ⚡	A3425

2 Coil Construction

- (blank)** = Tape-wrapped, Class B, with 18" (45.7cm) lead wires* ⚡
- W** ___ = Tape-wrapped coil, lead wires, non-standard length (specify length)
- 1** = Encapsulated coil, Class B, lead wires
- 2M** = Over molded coil, Class F, lead wires
- 3** = Encapsulated coil, Class H, lead wires
- 3M** = Over molded coil, Class H, lead wires
- 4** = Encapsulated coil, Class B, 3/16" (4.76mm) spade terminals
- 5M** = Over molded coil, Class F, 1/4" (6.35mm) spade terminals
- 6M** = Over molded coil, Class H, 1/4" (6.35mm) spade terminals
- 10** = Externally rectified coil, AC Voltages (lead wires only) ⚡
- 11** = Tape-wrapped coil, Class H, lead wires
- 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 N.C. valves only)
- N** = Neoprene ⚡
- NS** = Nitrile (NSF/FDA, 2-way N.C. valves only) ⚡
- PF** = Perfluoroelastomer ⚡
- R** = Rulon® (2-way N.C. valves only)
- T** = PTFE
- V** = Viton® ⚡

5 O-Ring Material

- (blank)** = Nitrile* ⚡
- EO** = EPR ⚡
- NO** = Neoprene ⚡
- NSO** = Nitrile (NSF/FDA, 2-way N.C. 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" (3.18mm)
- LT** = 1/8-28 BSPT female thread (2-way N.C. valves only)
- LU** = 1/4-19 BSPT female thread (2-way N.C. 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" (2.38mm)
- BI** = Bottom over-seat port, female thread
 - max. orifice = 1/8" (3.18mm)
- BIM** = Bottom over-seat port, 1/8-27 NPT male thread
 - max orifice = 5/64" (1.98mm) 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" (3.18mm) 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)


- C203** = 12 VDC ⚡
- C204** = 24 VDC ⚡
- C301** = 120/50/60R (add Coil Option -10) ⚡
- C303** = 240/50/60R (add Coil Option -10) ⚡
- ___ **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) ⚡
- QQ** = Quiet operation (2-way valves only)
- S** = Silver shading ring
- OC** = Cleaned for oxygen use
- VAC** = Vacuum application - 0 to 29.5" Hg (0 to 1000mBar)
- 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.

 Take advantage of next day shipping by making your selections from those marked with the Lightning Bolt icon.

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.

NOTES

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows.

B Series – Modular

- ▶ MOPD: 400 PSI (28 Bar)
- ▶ C_v Range: 0.018 to 0.430 (K_v Range: 0.016 to 0.372)
- ▶ 7 Watts

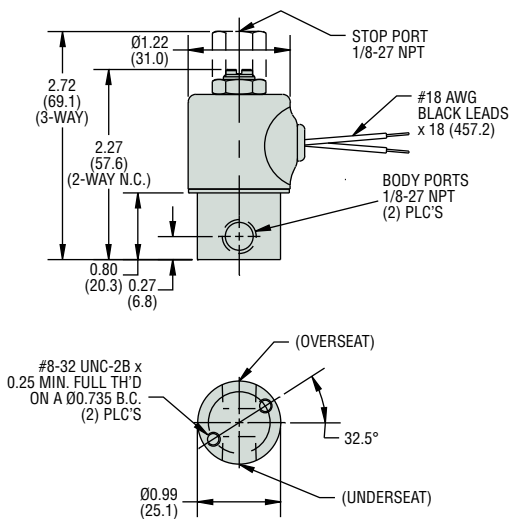
The B Series is a direct acting solenoid valve, available in 2- or 3-way functionality. Like all of our valves, the B Series has bubble tight plunger construction and is designed to last for millions of cycles in general purpose liquid, gas, and vacuum applications. The B Series is available in various 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 (K_v of 0.016 to 0.372).

Typical Applications

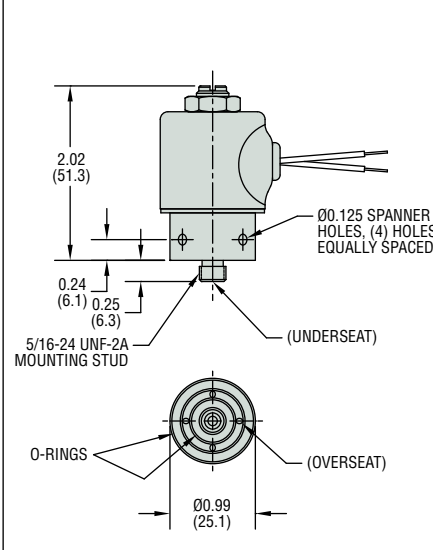
- Printing
- HVAC
- Semiconductor Equipment
- Medical Equipment

Dimensions

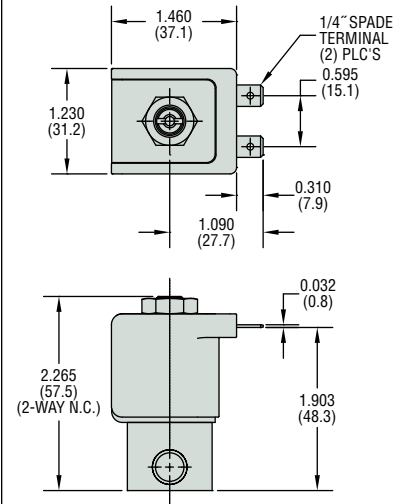
Threaded Port Body



Manifold Mount Body

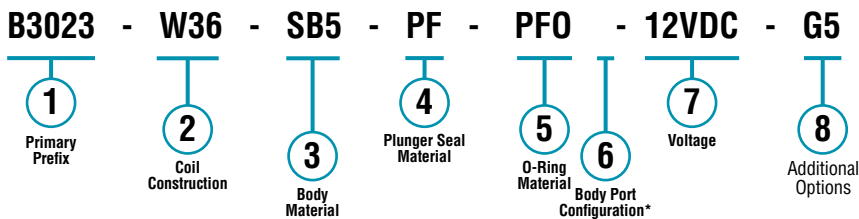


Molded Coil



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" (91cm) 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.



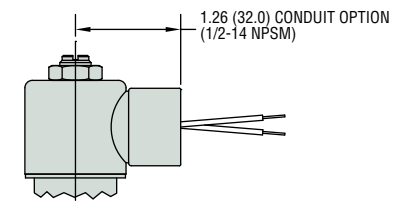
Next Day Shipping
On Many Configurations



SOLENOID VALVES

Alternate 1/2" Conduit Housing

Available on all body configurations





Take advantage of next day shipping by making your selections from those marked with the Lightning Bolt icon.

Part Prefix Table ①

	Orifice				MOPD		C _v		K _v		① Primary Prefix	
	Body		Stop		psig	bar	Body	Stop	Body	Stop	Grommet Housing	Conduit Housing
	inches	mm	inches	mm								
2-WAY N.C.	1/16	1.59	—	—	400	28	0.065	—	0.056	—	B2011	B2021
	5/64	1.98	—	—	300	21	0.090	—	0.078	—	B2012	B2022
	3/32	2.38	—	—	250	17	0.155	—	0.134	—	B2013	B2023
	7/64	2.78	—	—	200	14	0.200	—	0.173	—	B2014	B2024
	1/8	3.18	—	—	150	10	0.240	—	0.208	—	B2015	B2025
	5/32	3.97	—	—	100	6.9	0.300	—	0.259	—	B2016	B2026
	3/16	4.76	—	—	50	3.4	0.430	—	0.372	—	B2017	B2027
2-WAY N.O.	—	—	1/32	0.79	400	28	—	0.019	—	0.016	B2211	B2221
	—	—	3/64	1.19	300	21	—	0.040	—	0.035	B2212	B2222
	—	—	1/16	1.59	200	14	—	0.075	—	0.065	B2213	B2223
	—	—	5/64	1.98	150	10	—	0.090	—	0.078	B2214	B2224
3-WAY N.C. Free Vent	1/32	0.79	1/32	0.79	250	17	0.018	0.018	0.016	0.016	B3011	B3021
	3/64	1.19	3/64	1.19	175	12	0.040	0.040	0.035	0.035	B3012	B3022
	1/16	1.59	1/16	1.59	125	8.6	0.065	0.070	0.056	0.061	B3013	B3023
	5/64	1.98	5/64	1.98	100	6.9	0.090	0.090	0.078	0.078	B3014	B3024
	3/32	2.38	5/64	1.98	75	5.2	0.155	0.090	0.134	0.078	B3015	B3025
	1/8	3.18	5/64	1.98	50	3.4	0.240	0.090	0.208	0.078	B3016	B3026
	5/32	3.97	5/64	1.98	15	1.0	0.300	0.090	0.259	0.078	B3017	B3027
3-WAY N.C. Line Connection	1/32	0.79	1/32	0.79	250	17	0.018	0.018	0.016	0.016	B3111	B3121
	3/64	1.19	3/64	1.19	175	12	0.040	0.040	0.035	0.035	B3112	B3122
	1/16	1.59	1/16	1.59	125	8.6	0.065	0.070	0.056	0.061	B3113	B3123
	5/64	1.98	5/64	1.98	100	6.9	0.090	0.090	0.078	0.078	B3114	B3124
	3/32	2.38	5/64	1.98	75	5.2	0.155	0.090	0.134	0.078	B3115	B3125
	1/8	3.18	5/64	1.98	50	3.4	0.240	0.090	0.208	0.078	B3116	B3126
	5/32	3.97	5/64	1.98	15	1.0	0.300	0.090	0.259	0.078	B3117	B3127
3-WAY N.O.	1/32	0.79	1/32	0.79	200	14	0.018	0.018	0.016	0.016	B3211	B3221
	3/64	1.19	3/64	1.19	150	10	0.040	0.040	0.035	0.035	B3212	B3222
	1/16	1.59	1/16	1.59	125	8.6	0.065	0.070	0.056	0.061	B3213	B3223
	5/64	1.98	5/64	1.98	100	6.9	0.090	0.090	0.078	0.078	B3214	B3224
	3/32	2.38	5/64	1.98	75	5.2	0.155	0.090	0.134	0.078	B3215	B3225
	1/8	3.18	5/64	1.98	50	3.4	0.240	0.090	0.208	0.078	B3216	B3226
	5/32	3.97	5/64	1.98	15	1.0	0.300	0.090	0.259	0.078	B3217	B3227
3-WAY Multi Purpose	1/32	0.79	1/32	0.79	175	12	0.018	0.018	0.016	0.016	B3311	B3321
	3/64	1.19	3/64	1.19	125	8.6	0.040	0.040	0.035	0.035	B3312	B3322
	1/16	1.59	1/16	1.59	100	6.9	0.065	0.070	0.056	0.061	B3313	B3323
	5/64	1.98	5/64	1.98	75	5.2	0.090	0.090	0.078	0.078	B3314	B3324
	3/32	2.38	5/64	1.98	50	3.4	0.155	0.090	0.134	0.078	B3315	B3325
	1/8	3.18	5/64	1.98	25	1.7	0.240	0.090	0.208	0.078	B3316	B3326
	5/32	3.97	5/64	1.98	15	1.0	0.300	0.090	0.259	0.078	B3317	B3327
3-WAY Directional Control	1/32	0.79	1/32	0.79	275	19	0.018	0.018	0.016	0.016	B3411	B3421
	3/64	1.19	3/64	1.19	200	14	0.040	0.040	0.035	0.035	B3412	B3422
	1/16	1.59	1/16	1.59	150	10	0.065	0.070	0.056	0.061	B3413	B3423
	5/64	1.98	5/64	1.98	100	6.9	0.090	0.090	0.078	0.078	B3414	B3424
	3/32	2.38	5/64	1.98	75	5.2	0.155	0.090	0.134	0.078	B3415	B3425
	1/8	3.18	5/64	1.98	50	3.4	0.240	0.090	0.208	0.078	B3416	B3426
	5/32	3.97	5/64	1.98	25	1.7	0.300	0.090	0.259	0.078	B3417	B3427

SOLENOID VALVES

2 Coil Construction

- (blank)** = Tape-wrapped, Class B, with 18" (45.7cm) lead wires* ⚡
- W**___ = Tape-wrapped coil, lead wires, non-standard length (specify length)
 - 1** = Encapsulated coil, Class B, lead wires
 - 2M** = Over molded coil, Class F, lead wires (2-way N.C. only)
 - 3** = Encapsulated coil, Class H, lead wires
 - 3M** = Over molded coil, Class H, lead wires (2-way N.C. only)
 - 4** = Encapsulated coil, Class B, 3/16" (4.76mm) spade terminals
 - 5M** = Over molded coil, Class F, 1/4" (6.35mm) spade terminals (2-way N.C. only)
 - 6M** = Over molded coil, Class H, 1/4" (6.35mm) spade terminals (2-way N.C. only)
 - 10** = Externally rectified coil, AC Voltages (lead wires only) ⚡
 - 11** = Tape-wrapped coil, Class H, lead wires
- 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 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
 - max. orifice = 1/8" (3.18mm)
- 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" (3.18mm)
- BIM** = Bottom over-seat port, 1/8-27 NPT male thread
 - max. orifice = 5/64" (1.98mm), 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" (3.18mm), 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)

- C203** = 12 VDC ⚡
- C204** = 24 VDC ⚡
- C301** = 120/50/60R (add Coil Option -10) ⚡
- C303** = 240/50/60R (add Coil Option -10) ⚡
- ___ **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
- QQ** = Quiet operation (2-way N.C. only)
- S** = Silver shading ring
- OC** = Cleaned for oxygen use
- VAC** = Vacuum application - 0 to 29.5" Hg (0 to 1000mBar)
- 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.



Take advantage of next day shipping by making your selections from those marked with the Lightning Bolt icon.

NOTES

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows.

C Series – High Flow

- ▶ MOPD: 400 PSI (28 Bar)
- ▶ C_v Range: 0.019 to 0.420 (K_v Range: 0.016 to 0.357)
- ▶ 7 Watts

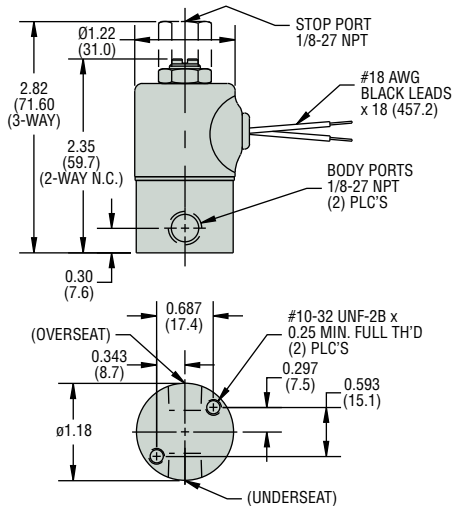
The C Series, available only in brass, is a highly durable miniature 2- or 3-way direct acting valve for applications that require a higher flow control. The C Series also utilizes a larger diameter body and larger port connections for higher C_v (K_v) valves rates. The free machining brass body allows 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

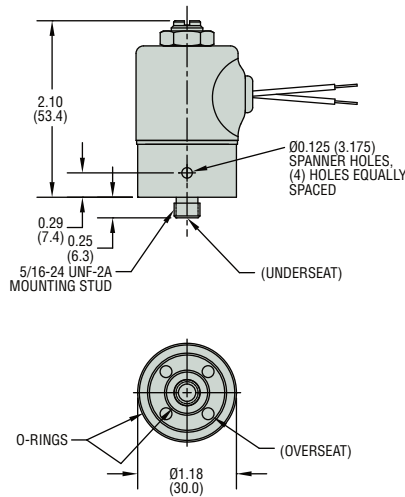
- Therapeutic Beds
- Automotive Applications
- Packaging Equipment

Dimensions

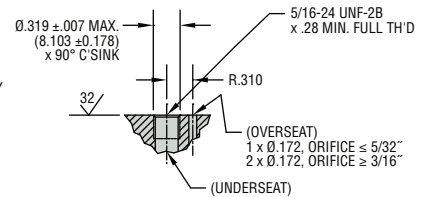
Threaded Port Body



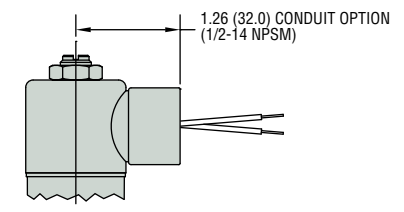
Manifold Mount Body



MANIFOLD MATING DIMENSIONS

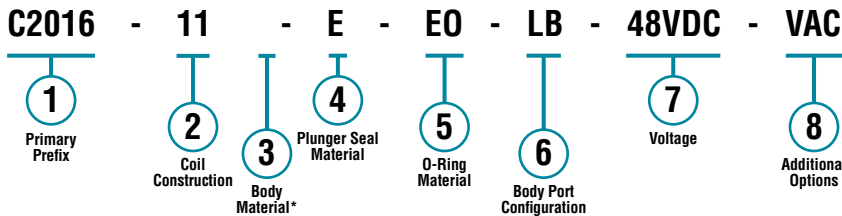


Alternate 1/2" Conduit Housing Available on all body configurations



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 (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 (0 to 1000mBar) option.



Part Prefix Table ①

	Orifice				MOPD		C _v		K _v		① Primary Prefix	
	Body		Stop		psig	bar	Body	Stop	Body	Stop	Grommet Housing	Conduit Housing
	inches	mm	inches	mm								
2-WAY N.C.	1/16	1.59	—	—	400	28	0.080	—	0.068	—	C2011	C2021
	7/64	2.78	—	—	200	14	0.180	—	0.153	—	C2012	C2022
	1/18	3.18	—	—	150	10	0.240	—	0.204	—	C2013	C2023
	5/32	3.97	—	—	100	6.9	0.300	—	0.255	—	C2014	C2024
	3/16	4.76	—	—	75	5.2	0.360	—	0.306	—	C2015	C2025
	7/32	5.56	—	—	40	2.8	0.420	—	0.357	—	C2016	C2026
2-WAY N.O.	—	—	1/32	0.79	400	28	—	0.019	—	0.016	C2211	C2221
	—	—	3/64	1.19	300	21	—	0.040	—	0.034	C2212	C2222
	—	—	1/16	1.59	200	14	—	0.075	—	0.064	C2213	C2223
	—	—	5/64	1.98	150	10	—	0.105	—	0.089	C2214	C2224
3-WAY N.C. Free Vent	1/16	1.59	1/16	1.59	125	8.6	0.080	0.075	0.068	0.064	C3011	C3021
	5/64	1.98	5/64	1.98	100	6.9	0.105	0.105	0.089	0.089	C3012	C3022
	1/8	3.18	5/64	1.98	50	3.4	0.240	0.105	0.204	0.089	C3013	C3023
	3/16	4.76	5/64	1.98	25	1.7	0.360	0.105	0.306	0.089	C3014	C3024
	7/32	5.56	5/64	1.98	VAC	1000 mbar	0.420	0.105	0.357	0.089	C3015	C3025
3-WAY N.C. Line Connection	1/16	1.59	1/16	1.59	125	8.6	0.080	0.075	0.068	0.064	C3111	C3121
	5/64	1.98	5/64	1.98	100	6.9	0.105	0.105	0.089	0.089	C3112	C3122
	1/8	3.18	5/64	1.98	50	3.4	0.240	0.105	0.204	0.089	C3113	C3123
	3/16	4.76	5/64	1.98	25	1.7	0.360	0.105	0.306	0.089	C3114	C3124
	7/32	5.56	5/64	1.98	VAC	1000 mbar	0.420	0.105	0.357	0.089	C3115	C3125
3-WAY N.O.	1/16	1.59	1/16	1.59	125	8.6	0.080	0.075	0.068	0.064	C3211	C3221
	5/64	1.98	5/64	1.98	100	6.9	0.105	0.105	0.089	0.089	C3212	C3222
	1/8	3.18	5/64	1.98	75	5.2	0.240	0.105	0.204	0.089	C3213	C3223
	3/16	4.76	5/64	1.98	40	3.4	0.360	0.105	0.306	0.089	C3214	C3224
	7/32	5.56	5/64	1.98	VAC	1000 mbar	0.420	0.105	0.357	0.089	C3215	C3225
3-WAY Multi Purpose	1/16	1.59	1/16	1.59	100	6.9	0.080	0.075	0.068	0.064	C3311	C3321
	5/64	1.98	5/64	1.98	75	5.2	0.105	0.105	0.089	0.089	C3312	C3322
	1/8	3.18	5/64	1.98	25	1.7	0.240	0.105	0.204	0.089	C3313	C3323
	3/16	4.76	5/64	1.98	10	0.7	0.360	0.105	0.306	0.089	C3314	C3324
	7/32	5.56	5/64	1.98	5	0.3	0.420	0.105	0.357	0.089	C3315	C3325
3-WAY Directional Control	1/16	1.59	1/16	1.59	150	10	0.080	0.075	0.068	0.064	C3411	C3421
	5/64	1.98	5/64	1.98	100	6.9	0.105	0.105	0.089	0.089	C3412	C3422
	1/8	3.18	5/64	1.98	50	3.4	0.240	0.105	0.204	0.089	C3413	C3423
	3/16	4.76	5/64	1.98	25	1.7	0.360	0.105	0.306	0.089	C3414	C3424
	7/32	5.56	5/64	1.98	5	0.3	0.420	0.105	0.357	0.089	C3415	C3425

② Coil Construction**(blank)** = Tape-wrapped, Class-B, with 18" (45.7cm) 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" (6.35mm) spade terminals – 3/16" (4.76mm) 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" (3.18mm)**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[†] (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 (0 to 1000 mBar)**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

* 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.

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.

NOTES

A large rectangular area filled with a grid of dashed lines, intended for handwritten notes. The grid consists of approximately 20 columns and 30 rows of small squares.



Next Day Shipping
On Many Configurations

D Series – High Flow

- ▶ MOPD: 900 PSI (62 Bar)
- ▶ C_v Range: 0.045 to 0.880 (K_v Range: 0.038 to 0.748)
- ▶ 10 Watts

For maximum flow in a miniature solenoid valve the D Series valves delivers a wide range of C_v (K_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.

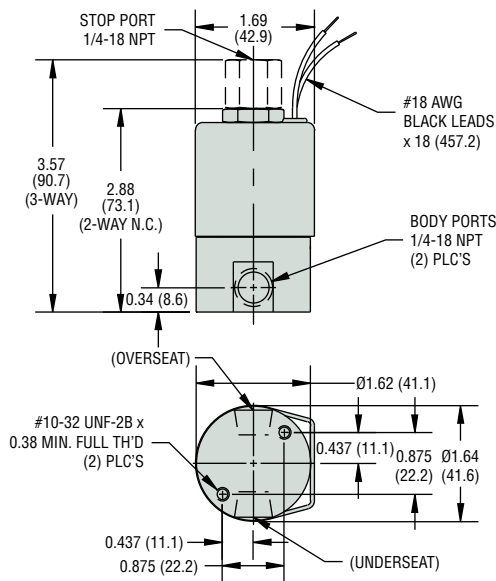


Typical Applications

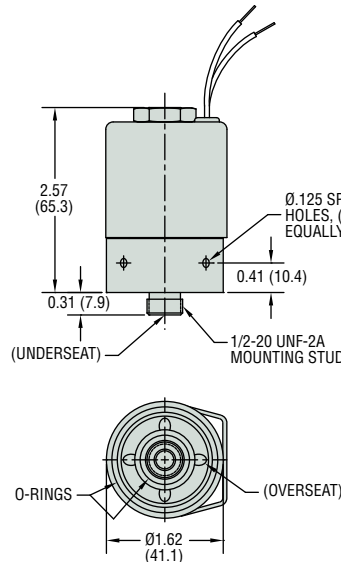
- Agriculture
- Defense
- Sterilization Equipment
- Industrial Automation

Dimensions

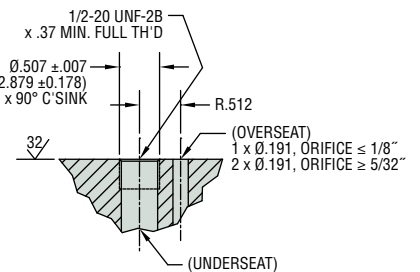
Threaded Port Body



Manifold Mount Body

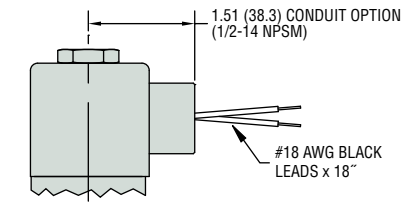


MANIFOLD MATING DIMENSIONS



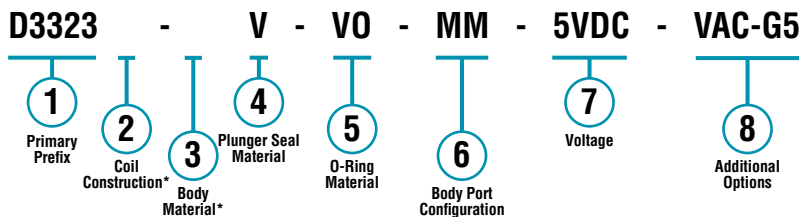
Alternate 1/2" Conduit Housing

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" (46cm) lead-wires and 303 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" (46cm) lead-wires, 303 stainless steel body, Viton® plunger seal, Viton® o-ring, manifold mount (1/2-20 UNF-2A mounting stud, max. orifice = 1/4" (35.6cm)), operating at 5 VDC, and includes vacuum application (0 to 29.5" Hg (0 to 1000mBar)) and one piece 316 stainless steel guide assembly options.

















Take advantage of next day shipping by making your selections from those marked with the Lightning Bolt icon.

Part Prefix Table ①

	Orifice				MOPD		C _v		K _v		① Primary Prefix	
	Body		Stop		psig	bar	Body	Stop	Body	Stop	Grommet Housing	Conduit Housing
	inches	mm	inches	mm								
2-WAY N.C.	3/64	1.19	—	—	900	62	0.045	—	0.038	—	D2011	D2021
	1/16	1.98	—	—	650	45	0.080	—	0.068	—	D2012	D2022
	3/32	2.38	—	—	350	24	0.150	—	0.128	—	D2013	D2023
	1/8	3.18	—	—	225	16	0.210	—	0.179	—	D2014	D2024
	5/32	3.97	—	—	130	9.0	0.380	—	0.323	—	D2015	D2025
	3/16	4.76	—	—	85	5.9	0.430	—	0.366	—	D2016	D2026
	1/4	6.35	—	—	50	3.4	0.700	—	0.595	—	D2017	D2027
	5/16	7.94	—	—	20	1.4	0.850	—	0.723	—	D2018	D2028
3/8	9.53	—	—	10	0.7	0.880	—	0.748	—	D2019	D2029	
2-WAY N.O.	—	—	3/64	1.19	900	62	—	0.045	—	0.038	D2211	D2221
	—	—	1/16	1.59	550	38	—	0.080	—	0.068	D2212	D2222
	—	—	5/64	1.98	300	21	—	0.110	—	0.094	D2213	D2223
	—	—	3/32	2.38	175	12	—	0.150	—	0.128	D2214	D2224
	—	—	1/8	3.18	110**	7.6	—	0.210	—	0.179	D2215	D2225
	—	—	5/32	3.97	60**	4.1	—	0.380	—	0.323	D2216	D2226
3-WAY N.C. Free Vent	1/16	1.59	1/16	1.59	175	12	0.080	0.080	0.068	0.068	D3011	D3021
	5/64	1.98	5/64	1.98	150	10	0.110	0.110	0.094	0.094	D3012	D3022
	3/32	2.38	3/32	2.38	125	8.6	0.150	0.150	0.128	0.128	D3013	D3023
	1/8	3.18	1/8	3.18	85**	5.9	0.210	0.210	0.179	0.179	D3014	D3024
	5/32	3.97	5/32	3.97	45**	3.1	0.380	0.380	0.323	0.323	D3015	D3025
	3/16	4.76	5/32	3.97	30**	2.1	0.430	0.380	0.366	0.323	D3016	D3026
	1/4	6.35	5/32	3.97	10**	0.7	0.700	0.380	0.595	0.323	D3017	D3027
3-WAY N.C. Line Connection	1/16	1.59	1/16	1.59	175	12	0.080	0.080	0.068	0.068	D3111	D3121
	5/64	1.98	5/64	1.98	150	10	0.110	0.110	0.094	0.094	D3112	D3122
	3/32	2.38	3/32	2.38	125	8.6	0.150	0.150	0.128	0.128	D3113	D3123
	1/8	3.18	1/8	3.18	85**	5.9	0.210	0.210	0.179	0.179	D3114	D3124
	5/32	3.97	5/32	3.97	45**	3.1	0.380	0.380	0.323	0.323	D3115	D3125
	3/16	4.76	5/32	3.97	30**	2.1	0.430	0.380	0.366	0.323	D3116	D3126
	1/4	6.35	5/32	3.97	10**	0.7	0.700	0.380	0.595	0.323	D3117	D3127
3-WAY N.O.	1/16	1.59	1/16	1.59	200	14	0.080	0.080	0.068	0.068	D3211	D3221
	5/64	1.98	5/64	1.98	175	12	0.110	0.110	0.094	0.094	D3212	D3222
	3/32	2.38	3/32	2.38	150	10	0.150	0.150	0.128	0.128	D3213	D3223
	1/8	3.18	1/8	3.18	100**	6.9	0.210	0.210	0.179	0.179	D3214	D3224
	5/32	3.97	5/32	3.97	50**	3.4	0.380	0.380	0.323	0.323	D3215	D3225
	3/16	4.76	5/32	3.97	35**	2.4	0.430	0.380	0.366	0.323	D3216	D3226
	1/4	6.35	5/32	3.97	15**	1.0	0.700	0.380	0.595	0.323	D3217	D3227
3-WAY Multi Purpose	1/16	1.59	1/16	1.59	160	11	0.080	0.080	0.068	0.068	D3311	D3321
	5/64	1.98	5/64	1.98	130	9.0	0.110	0.110	0.094	0.094	D3312	D3322
	3/32	2.38	3/32	2.38	110	7.6	0.150	0.150	0.128	0.128	D3313	D3323
	1/8	3.18	1/8	3.18	75**	5.2	0.210	0.210	0.179	0.179	D3314	D3324
	5/32	3.97	5/32	3.97	40**	2.8	0.380	0.380	0.323	0.323	D3315	D3325
	3/16	4.76	5/32	3.97	25**	1.7	0.430	0.380	0.366	0.323	D3316	D3326
	1/4	6.35	5/32	3.97	10**	0.7	0.700	0.380	0.595	0.323	D3317	D3327
3-WAY Directional Control	1/16	1.59	1/16	1.59	225	16	0.080	0.080	0.068	0.068	D3411	D3421
	5/64	1.98	5/64	1.98	185	13	0.110	0.110	0.094	0.094	D3412	D3422
	3/32	2.38	3/32	2.38	150	10.3	0.150	0.150	0.128	0.128	D3413	D3423
	1/8	3.18	1/8	3.18	110**	7.6	0.210	0.210	0.179	0.179	D3414	D3424
	5/32	3.97	5/32	3.97	60**	4.1	0.380	0.380	0.323	0.323	D3415	D3425
	3/16	4.76	5/32	4.76	40**	2.8	0.430	0.380	0.366	0.323	D3416	D3426
	1/4	6.35	5/32	3.97	20**	1.4	0.700	0.380	0.595	0.323	D3417	D3427

** DC or rectified coil only

SOLENOID VALVES

2 Coil Construction**(blank)** = Tape-wrapped, Class B, with 18" (45.7cm) 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" (6.35mm) spade terminals**10** = Externally rectified coil, AC Voltages (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)** = 303 Stainless Steel* **BB** = Brass**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" (2.38mm)**N** = Neoprene – 2-way normally closed valves only,
max. orifice = 1/4" (6.35mm) **NS** = Nitrile – NSF/FDA, max. orifice = 1/4" (6.35mm) **PF** = Perfluoroelastomer – max. orifice = 1/4" (6.35mm) **R** = Rulon® – 2-way normally closed valves only,
max. orifice = 1/4" (6.35mm)**T** = PTFE – max. orifice = 1/4" (6.35mm)**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" (7.94mm)**LD** = 3/8-18 NPT female thread**LT** = 1/8-28 BSPT female thread – max. orifice = 5/16" (7.94mm)**LU** = 1/4-19 BSPT female thread**MM** = Manifold mount – 1/2-20 UNF-2A mounting stud,
max. orifice = 1/4" (6.35mm)^{††}**OB** = Omit body (operator style)**BI** = Bottom over-seat port, female thread
– max. orifice = 1/4" (6.35mm)**BO** = Bottom under-seat port, female thread**7 Voltage[†] (see note below)****C203** = 12 VDC **C204** = 24 VDC **C301** = 120/50/60R (add Coil Option -10) **C303** = 240/50/60R (add Coil Option -10) ___ **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**S** = Silver shading ring**OC** = Cleaned for oxygen use**VAC** = Vacuum application – 0 to 29.5" Hg (0 to 1000mBar)**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.

Take advantage of next day shipping by making your selections from those marked with the Lightning Bolt icon.

F Series – Model 1

High Flow, 2-Way, Direct Acting

- ▶ Normally Closed
- ▶ Line Sizes to 1" NPT
- ▶ Vibration Resistance to 9g
- ▶ Speed to 100 Cycles/Min.

These high flow solenoid valves offer broad media capability, including Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG). They are direct acting, 2-way models with primary wetted parts made of non-reactive stainless steel. They are particularly well suited to CNG compressors used at wellhead and transit booster stations.

Media

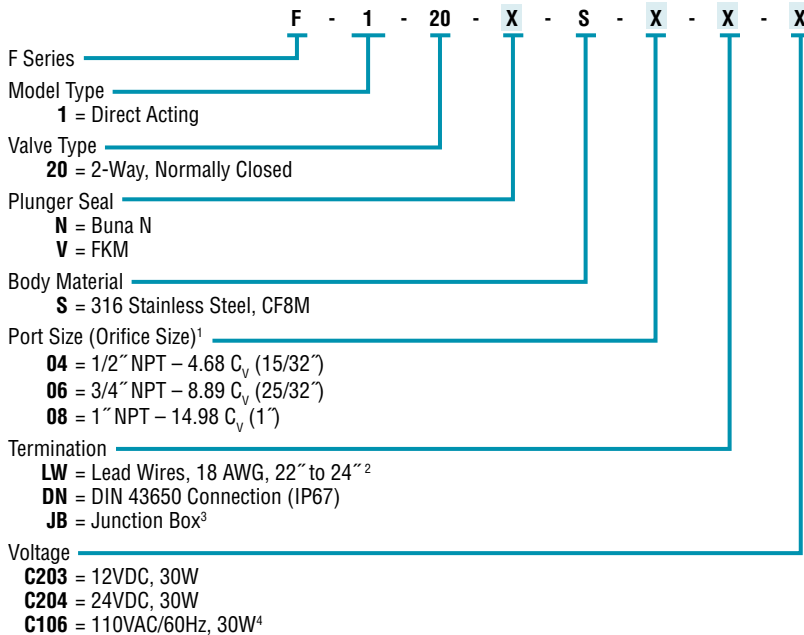
LPG, CNG, Air, Inert Gases, Water, Free Flowing Liquid, Oil, Diesel, Kerosene

Specifications

Wetted Parts	
Body Material	316 Stainless Steel, CF8M
Guide Assembly	304 Stainless Steel
Plunger, Insert	430 Stainless Steel
Spring	302 Stainless Steel
Seals	See Below
Pressure Range	0 to 145 psi (0 to 10 bar)
Fluid / Ambient Temperature	0°F to 160°F (-18°C to +71°C)
Expected Life (cycles)	>2 Million

How To Order

Example: F-1-20-V-S-06-DN-C203



Note: Dimensional drawings available. Contact Gems.

Notes:

1. C_v = Quantity of water, at 68°F and in gallons per minute (GPM) that will flow through your valve with a 1psi pressure differential.
2. Not available with 110AC Voltage option.
3. Junction Box termination is available with explosion-proof options (UL, ATEX, IECEx). Please contact Gems for details.
4. Internally rectified.

F Series – Model 2

High Flow, 2-Way, Diaphragm Operated

- ▶ Normally Closed or Normally Open
- ▶ Line Sizes to 2-1/2" NPT
- ▶ Vibration Resistance to 9g

These diaphragm operated solenoid valves offer Gems' highest flow capability for a broad range of media, including Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG). They are 2-way models, available with either N.O. or N.C. operation, and feature primary wetted parts made of non-reactive stainless steel. They are particularly well suited to CNG compressors used at wellhead and transit booster stations.

Media

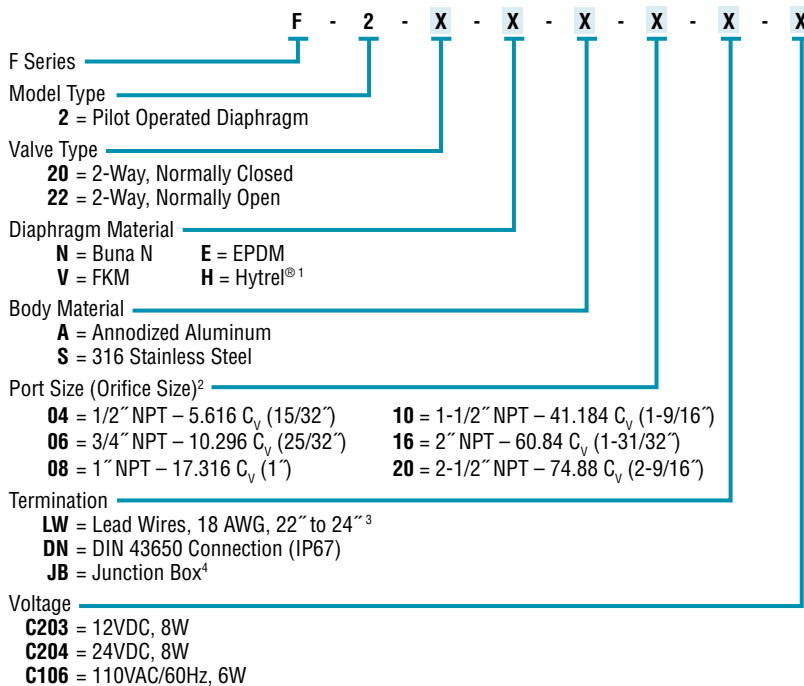
LPG, CNG, Air, Inert Gases, Water, Free Flowing Liquid, Oil, Diesel, Kerosene

Specifications

Wetted Parts	
Body Material	316 Stainless Steel, CF8M
Guide Assembly	304 Stainless Steel
Plunger, Insert	430 Stainless Steel
Spring	302 Stainless Steel
Seals	See Below
Pressure Range	7 to 145 psi (0.5 to 10 bar)
Fluid / Ambient Temperature	41°F to 176°F (5°C to 80°C)
Expected Life (cycles)	>2 Million

How To Order

Example: F-2-20-V-S-06-DN-C203



Normally Closed

Note: Dimensional drawings available. Contact Gems.

Notes:

1. Hytrel® must be selected for port sizes of 2" or greater.
2. C_v = Quantity of water, at 68°F and in gallons per minute (GPM) that will flow through your valve with a 1psi pressure differential.
3. Not available with 110AC Voltage option.
4. Junction Box termination is available with explosion-proof options (UL, ATEX, IECEX). Please contact Gems for details.

F Series – Model 3

High Flow, 3-Way, Direct Acting

- ▶ 3/2 Universal Operation
- ▶ Line Sizes to 1/2" NPT
- ▶ Suitable for Vacuum to 9.34 x 10⁻⁷ psi (10⁻⁶ torr)
- ▶ Speed to 800 Cycles/Min.

These universal 3-way solenoid valves offer exceptional flow characteristics with bubble tight shut off. Main components are non-reactive stainless steel, are vibration resistant to 9g, and provide a life expectancy exceeding ten million cycles. They are ideal for single acting actuators or cylinders, control valve actuation, or diverting and mixing fluids.

Media

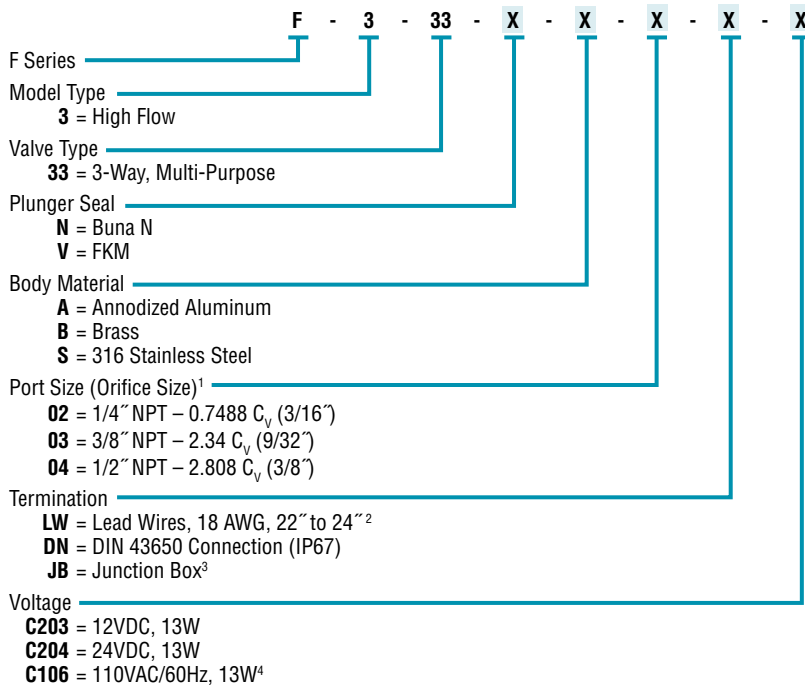
LPG, Air, Inert Gases, Water, Vacuum, Free Flowing Liquid, Oil, Diesel, Kerosene

Specifications

Wetted Parts	
Body Material	316 Stainless Steel
Guide Assembly	304 Stainless Steel
Plunger, Insert	430 Stainless Steel
Spring	302 Stainless Steel
Seals	See Below
Pressure Range	0 to 232 psi (0 to 16 bar)
Fluid / Ambient Temperature	-40°F to +176°F (-20°C to +80°C)
Expected Life (cycles)	>10 Million

How To Order

Example: F-3-33-V-04-DN-C203



Note: Dimensional drawings available. Contact Gems.

Notes:

1. C_v = Quantity of water, at 68°F and in gallons per minute (GPM) that will flow through your valve with a 1psi pressure differential.
2. Not available with 110AC Voltage option.
3. Junction Box termination is available with explosion-proof options (UL, ATEX, IECEx). Please contact Gems for details.
4. Internally rectified.

F Series – Model 4

High Pressure, 2-Way, Direct Acting

- ▶ Normally Open
- ▶ Pressure to 5802 psi (400 bar)
- ▶ Ideal for Fuel Gas Cutoff
- ▶ Vibration Resistance to 9g
- ▶ Speed to 300 Cycles/Min.

These high pressure solenoid valves offer broad media capability, including Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG). They are direct acting, normally closed, 2-way models with primary wetted parts made of non-reactive stainless steel. They are particularly well suited to CNG compressors used at wellhead, transit booster stations, and high pressure dispenser stations.

Media

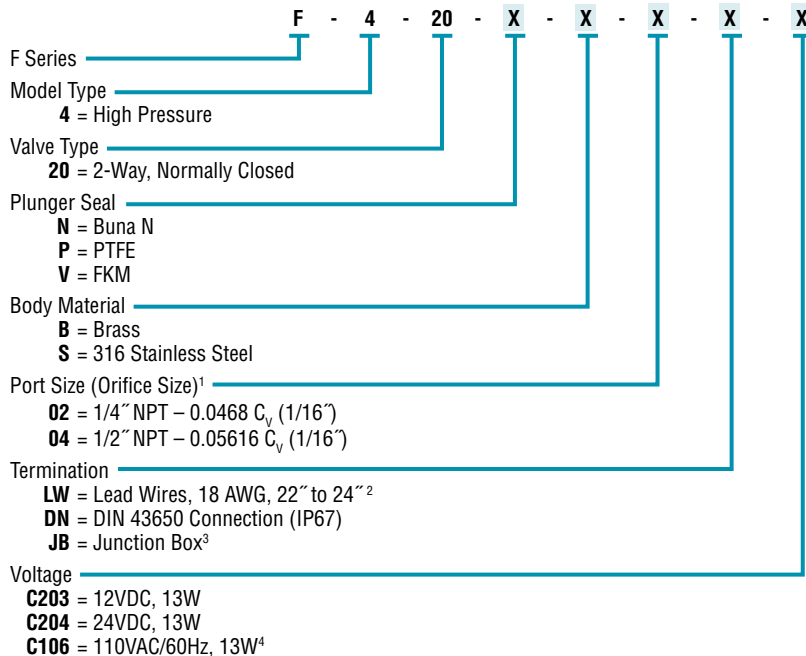
LPG, CNG, Oil, Diesel, Kerosene, Air, Inert Gases, Water, Free Flowing Liquid

Specifications

Wetted Parts	
Body Material	316 Stainless Steel
Guide Assembly	304 Stainless Steel
Plunger, Insert	430 Stainless Steel
Spring	302 Stainless Steel
Seals	See Below
Pressure Range	0 to 5802 psi (0 to 400 bar)
Fluid / Ambient Temperature	-40°F to +176°F (-20°C to +80°C)
Expected Life (cycles)	>2 Million

How To Order

Example: F-4-20-V-S-04-DN-C203



Note: Dimensional drawings available. Contact Gems.

Notes:

1. C_v = Quantity of water, at 68°F and in gallons per minute (GPM) that will flow through your valve with a 1psi pressure differential.
2. Not available with 110AC Voltage option.
3. Junction Box termination is available with explosion-proof options (UL, ATEX, IECEx). Please contact Gems for details.
4. Internally rectified.

AS Series

- ▶ MOPD: 110 PSI (7.5 Bar) Plastic Body or 150 PSI (10 Bar) Metal Body
- ▶ C_v Range: 0.020 to 0.300 (K_v Range: 0.017 to 0.256)
- ▶ 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.

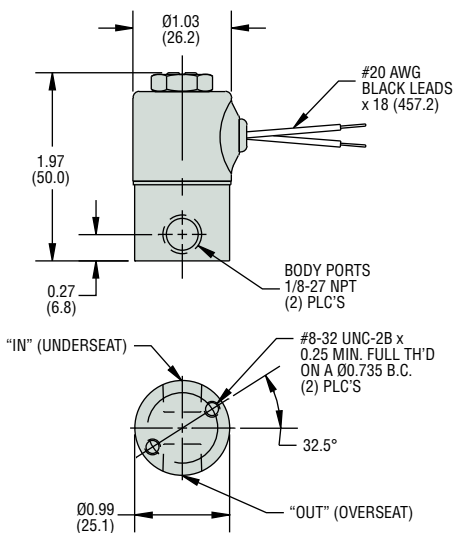
Typical Applications

- Analytical Instruments
- Clinical Diagnostic Analyzers
- Bio-Instrumentation

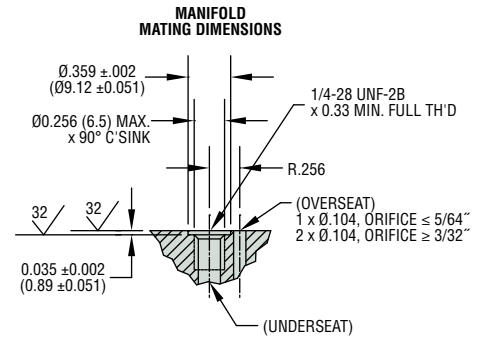
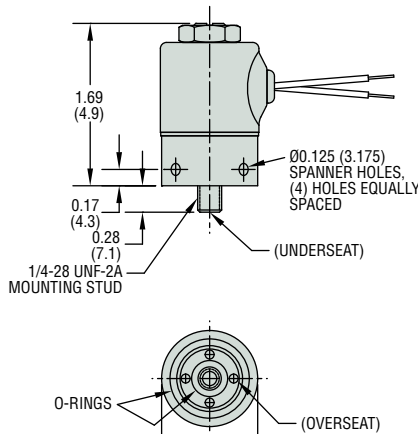


Dimensions

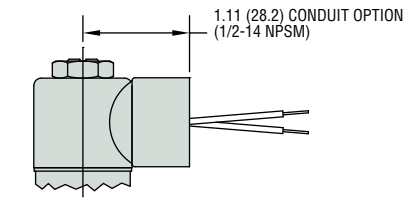
Threaded Port Body



Manifold Mount Body

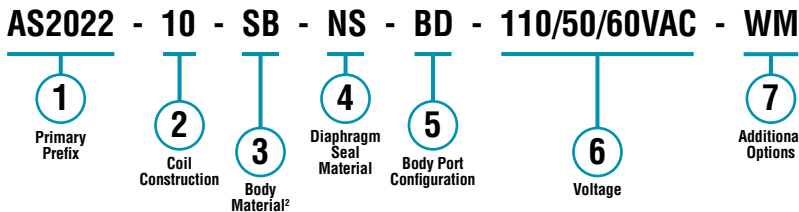


Alternate 1/2" Conduit Housing Available on all body configurations



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" (12.70mm) 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		Max Back Pressure		C _v	K _v	① Primary Prefix	
	Body		psig	bar	psig	bar	Body		Grommet Housing	Conduit Housing
	inches	mm								
303 Stainless Steel ¹	1/32	0.79	150	10	10	0.7	0.020	0.017	AS2011	AS2021
	3/64	1.19	110	7.6	10	0.7	0.035	0.030	AS2012	AS2022
	1/16	1.59	90	6.2	10	0.7	0.065	0.055	AS2013	AS2023
	5/64	1.98	70	4.8	10	0.7	0.090	0.077	AS2014	AS2024
	3/32	2.38	45	3.1	10	0.7	0.155	0.132	AS2015	AS2025
	1/8	3.18	15	1.0	5	0.3	0.240	0.205	AS2016	AS2026
	5/32	3.97	5	0.3	5	0.3	0.300	0.256	AS2017	AS2027
Polypropylene (1/8-27 NPT Female Thread body port only)	3/64	1.19	110	7.6	10	0.7	0.035	0.030	AS2032	AS2042
	1/8	3.18	15	1.0	10	0.7	0.240	0.205	AS2036	AS2046

* Other body orifice sizes may be available, consult factory.

② Coil Construction

(blank) = Tape-wrapped, Class-B, with 18" (45.7cm) 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" (4.76mm) spade terminals – 1/4" (6.35mm) 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 thread²

BD = #10-32 female straight thread – max. orifice = 1/8" (3.18mm)²

LT = 1/8-28 BSPT female thread²

LU = 1/4-19 BSPT female thread²

MM = Manifold mount (1/4-28 UNF-2A mounting stud)^{2†}

MM3 = Manifold mount (5/16-24 UNF-2A mounting stud)^{2†}

OB = Omit body (operator style)²

BI = Bottom over-seat port, female thread

– max. orifice = 1/8" (3.18mm)²

BIM = Bottom over-seat port, 1/8-27 NPT male thread

– max. orifice = 5/64" (1.98mm), brass body only²

BO = Bottom under-seat port, female thread²

BOM = Bottom under-seat port, 1/8-27 NPT male thread

– max. orifice = 1/8" (3.18mm), brass body only²

RL = 90° porting - left hand²

RR = 90° porting - right hand²

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

- 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.

† 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 (10 Bar)
- ▶ C_v Range: 0.035 to 0.300 (K_v Range: 0.030 to 0.256)
- ▶ 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.

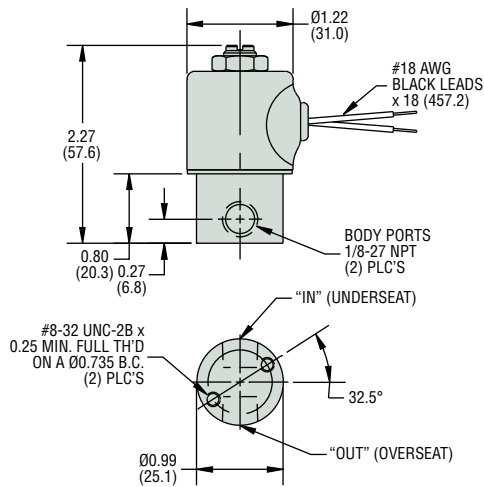
Typical Applications

- Remediation Equipment
- Clinical Chemistry Equipment
- Analytical Instrumentation

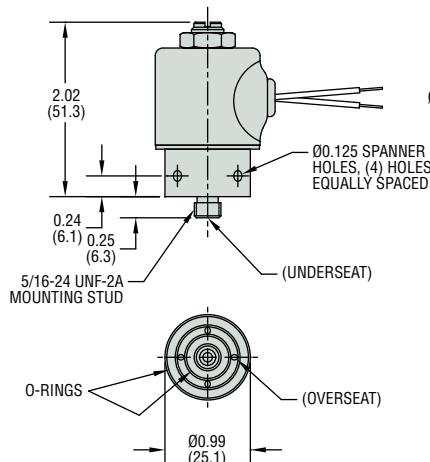


Dimensions

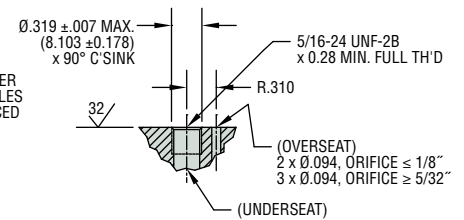
Threaded Port Body



Manifold Mount Body

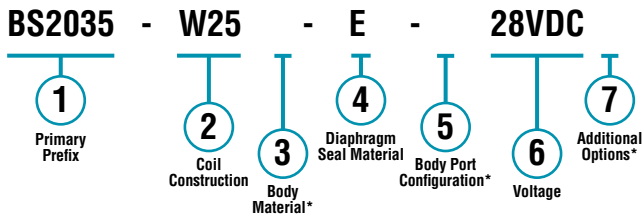


MANIFOLD MATING DIMENSIONS



How To Order

Use the **Bold** characters from the choices listed on the following page to construct a product code.



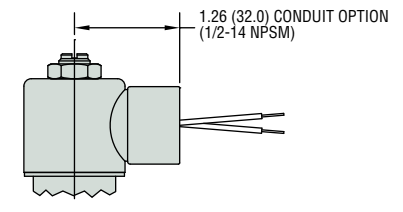
* Blank entry indicates a "Standard" selection (1/8-27NPT female thread, in this case).

Example:

BS2035-W25-E-28VDC

2-Way N.C. Polypropylene (grommet housing, 1/8-27 NPT female thread only) solenoid valve, with 25" (63.5cm) tape-wrapped coil, lead-wires, non-standard length, EPR diaphragm seal, 1/8-27 NPT female thread, operating at 28 VDC.

Alternate 1/2" Conduit Housing Available on all body configurations



Part Prefix Table ①

Body Material	Orifice		MOPD		Max Back Pressure		C _v	K _v	① Primary Prefix	
	Body		psig	bar	psig	bar			Body	
	inches	mm								
303 Stainless Steel ¹	3/64	1.19	150	10	15	0.7	0.035	0.030	BS2010	BS2020
	1/16	1.59	110	7.6	10	0.7	0.065	0.055	BS2011	BS2021
	5/64	1.98	85	6.2	10	0.7	0.090	0.077	BS2012	BS2022
	3/32	2.38	70	4.8	10	0.7	0.155	0.132	BS2013	BS2023
	7/64	2.78	25	3.1	10	0.3	0.200	0.171	BS2014	BS2024
	1/8	3.18	10	1.0	5	0.3	0.240	0.205	BS2015	BS2025
Polypropylene (1/8-27 NPT Female Thread body port only)	3/64	1.19	150	10	15	0.7	0.035	0.030	BS2030	BS2040
	1/8	3.18	10	1.0	5	0.3	0.240	0.205	BS2035	BS2045

* Other body orifice sizes may be available, consult factory.

② Coil Construction

(blank) = Tape-wrapped, Class-B, with 18" (45.7cm) 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" (6.35mm) spade terminals
- 3/16" (4.76mm) 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 thread²

BD = #10-32 female straight thread

- max. orifice = 1/8" (3.18mm)²

LT = 1/8-28 BSPT female thread²

LU = 1/4-19 BSPT female thread²

MM = Manifold mount (1/4-28 UNF-2A mounting stud)^{†2}

MM3 = Manifold mount (5/16-24 UNF-2A mounting stud)^{†2}

OB = Omit body (operator style)²

BI = Bottom over-seat port, female thread

- max. orifice = 1/8" (3.18mm)²

BIM = Bottom over-seat port, 1/8-27 NPT male thread

- max. orifice = 5/64" (1.98mm), brass body only²

BO = Bottom under-seat port, female thread²

BOM = Bottom under-seat port, 1/8-27 NPT male thread

- max. orifice = 1/8" (3.18mm), brass body only²

RL = 90° porting - left hand²

RR = 90° porting - right hand²

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.

† 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-Cryo Series

- ▶ MOPD: 900 PSI (62 Bar)
- ▶ C_v Range: 0.045 to 0.440 (K_v Range: 0.038 to 0.374)
- ▶ 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 (K_v between 0.038 and 0.374). 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.

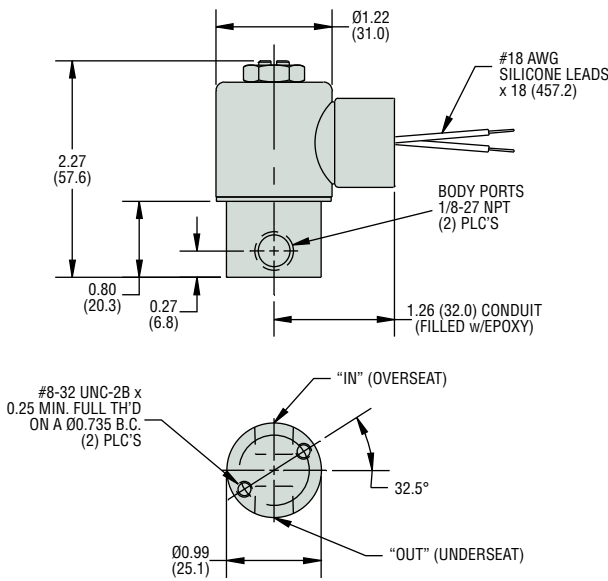


Typical Applications

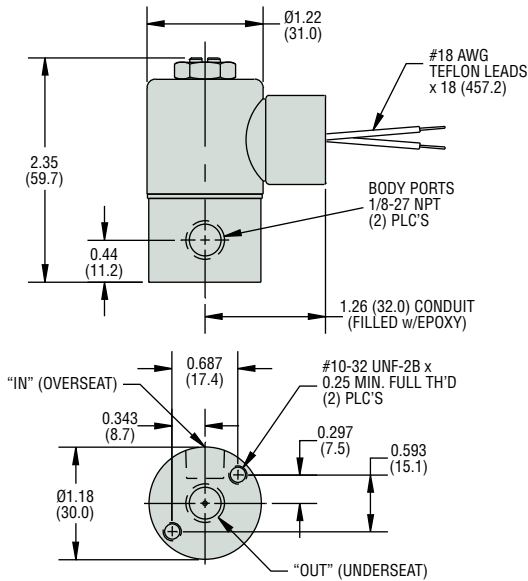
- Environmental Chambers
- Food Processing
- Laser Surgical Equipment
- Semiconductor Manufacturing

Dimensions

LN2-Liquid Nitrogen



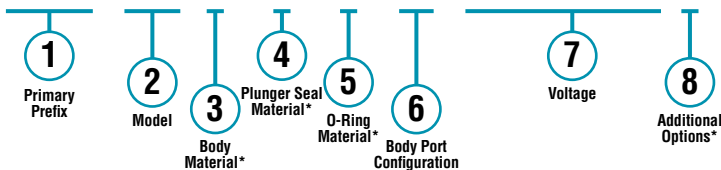
LCO2-Liquid Carbon Dioxide



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

Orifice		MOPD		C _v	K _v	① Primary Prefix		
Body		psig	bar	Body		Class 180°C (H), Encapsulated Coils		
inches	mm					Lead Wires—Filled Conduit Housing	Lead Wires—Unfilled Conduit Housing	Lead Wires—Grommet Housing
3/64	1.19	900	62	0.045	0.038	B2060	B2020	B2010
1/16	1.59	405	28	0.075	0.064	B2061	B2021	B2011
5/64	1.98	270	19	0.105	0.089	B2062	B2022	B2012
3/32	2.38	160	11	0.160	0.136	B2063	B2023	B2013
7/64	2.78	110	7.6	0.190	0.162	B2064	B2024	B2014
1/8	3.18	80	5.5	0.255	0.217	B2065	B2025	B2015
5/32	3.97	65	4.5	0.365	0.310	B2066	B2026	B2016
3/16	4.76	30	2.1	0.440	0.374	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" (3.18mm)
- 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" (3.18mm), 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 (69 Bar)
- ▶ C_v Range: 0.040 to 0.770 (K_v Range: 0.034 to 0.655)
- ▶ 15 Watts

The D-Cryo Series is a 2-way, high flow, miniature Cryogenic valve designed and built for service down to -320°F (-196°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.

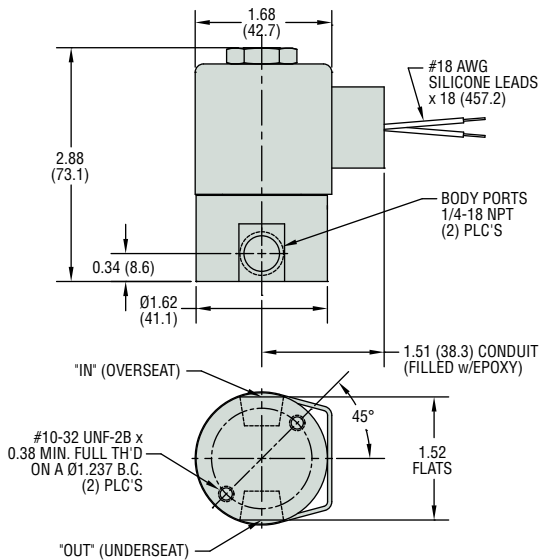


Typical Applications

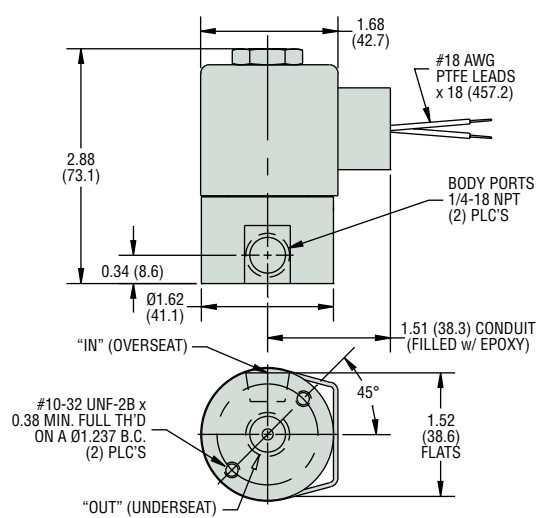
- Environmental Chambers
- Food Processing
- Laser Surgical Equipment
- Semiconductor Manufacturing

Dimensions

LN2-Liquid Nitrogen



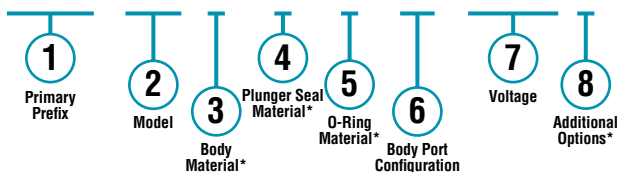
LCO2-Liquid Carbon Dioxide



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 (303 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 303 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

Orifice		MOPD		C _v	K _v	① Primary Prefix		
Body		psig	bar	Body		Class 180°C (H), Encapsulated Coils		
inches	mm					Lead Wires—Filled Conduit Housing	Lead Wires—Unfilled Conduit Housing	Lead Wires—Grommet Housing
3/64	1.19	1000	69	0.040	0.034	D2061	D2021	D2011
1/16	1.59	1000	69	0.070	0.060	D2062	D2022	D2012
3/32	2.38	640	44	0.165	0.140	D2063	D2023	D2013
1/8	3.18	375	26	0.305	0.259	D2064	D2024	D2014
5/32	3.97	185	13	0.365	0.310	D2065	D2025	D2015
3/16	4.76	130	9	0.470	0.400	D2066	D2026	D2016
1/4	6.35	40	3	0.770	0.655	D2067	D2027	D2017

② Model

- LN2 = Liquid Nitrogen model
- LCO2 = Liquid Carbon Dioxide model

③ Body Material

LN2 Only

(blank) = 303 Stainless Steel*

LCO2 Only

(blank) = 303 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
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
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.

BL Series – Latching Valve

- ▶ 2 Way or 3 Way Valves
- ▶ Low Power Requirements
- ▶ MOPD: 100 PSI (6.9 bar)
- ▶ Dual Diode Protection Optional

The BL series latching valve allows the user to pulse the valve and have it change state. The voltage does not need to be constantly applied in order to hold it in a state. These valves are ideal for controlling larger pneumatic valves in remote applications where power is limited or when the temperature of the media cannot be impacted as it flows through the valve. The larger pneumatic valves can close and open large pipes and these latching valves control them. The term Latch refers to the valve in the open state where supply pressure goes to the external valve. The unlatched state is when the supply is cut off and the external valve is exhausted to ambient.

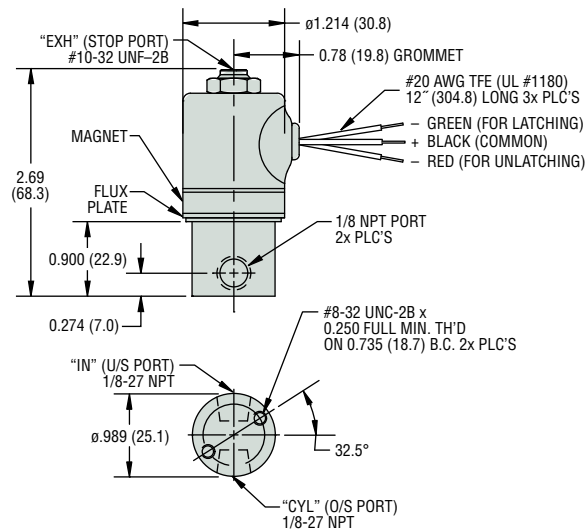


Typical Applications

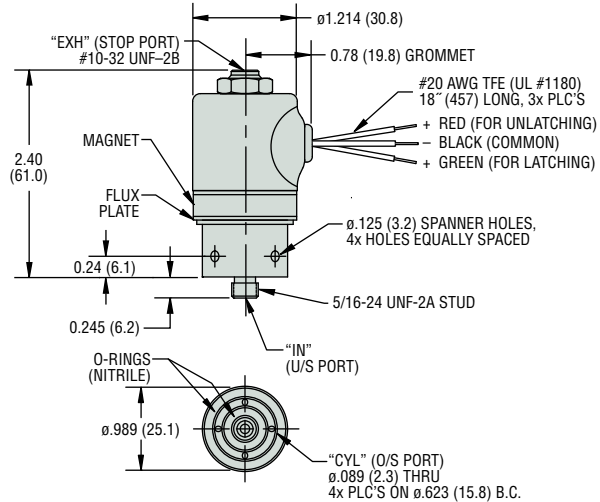
- Natural Gas Plunger Lifts
- Natural Gas Separators
- Gas Chromatography
- Irrigation Systems

Dimensions

Threaded Port Body

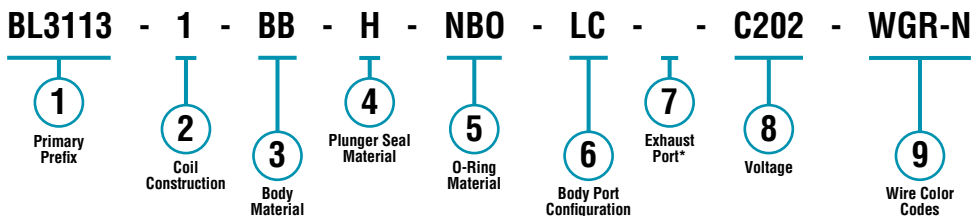


Manifold Mount Body



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 female thread, in this case).

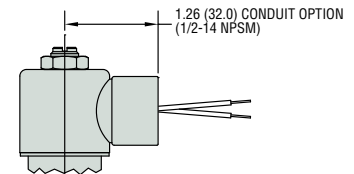
Example:

BL3113-1-BB-H-NBO-LC-C202-WGR-N

3-Way Latching valve, 18" epoxy coil, brass body, Hydrin® seal, Nitrile® o-ring, 1/8" NPT body port, free vent 6 Vdc coil, White/Common, Green/Latch, Red/Unlatch negative pulse leads.

Alternate 1/2" Conduit Housing

Available on all body configurations



Part Prefix Table ①

	Orifice				MOPD		C _v		K _v		① Primary Prefix	
	Body		Stop		psi	bar	Body	Stop	Body	Stop	Grommet Housing	Unfilled Conduit Housing
	inches	mm	inches	mm								
3-WAY	1/32	0.79	3/64	1.19	100	6.9	0.018	0.040	0.0153	0.034	BL3111	BL3121
	1/16	1.59	1/16	1.59	50	3.4	0.070	0.070	0.060	0.060	BL3113	BL3123
2-WAY	1/16	1.59	—	—	240	16.5	0.065	—	0.056	—	BL2011	BL2021
	5/64	1.98	—	—	180	12.4	0.09	—	0.078	—	BL2012	BL2022
	3/32	2.38	—	—	150	10	0.155	—	0.134	—	BL2013	BL2023
	7/64	2.78	—	—	120	8.3	0.2	—	0.173	—	BL2014	BL2024
	1/8	3.18	—	—	90	6.2	0.24	—	0.208	—	BL2015	BL2025
	5/32	3.97	—	—	60	4.1	0.3	—	0.259	—	BL2016	BL2026
	3/16	4.76	—	—	30	2.1	0.43	—	0.372	—	BL2017	BL2027

② Coil Construction

- 1 = Encapsulated Coil, Class-B (130°C), Lead Wires 18" Long, #20 AWG
- 2 = Encapsulated Coil, Class-F (155°C), Lead Wires 18" Long, #20 AWG

③ Body Material

- BB = Brass
- SB1 = 303 Stainless Steel
- SB5 = 316 Stainless Steel

④ Plunger Seal Material

- H = Hydrin®
- V = Viton®
- PF = Perfluoroelastomer

⑤ O-Ring Material

- NBO = Nitrile®
- VO = Viton®
- PFO = Perfluoroelastomer

⑥ Body Port Configuration

- LC = 1/8" NPT female ports
- LD = 1/4" NPT female ports
- MM3 = Manifold-Mount (5/16" thread stud)

⑦ Exhaust Port

- (blank) = #10-32 female thread*
- AB = 1/8" Brass Barb Fitting
- AD = 1/8" NPT Brass Adapter

⑧ Voltage

- C202 = 6 VDC, 7 Watts Latching, 5 Watts Unlatching
- C203 = 12 VDC, 9 Watts Latching, 7 Watts Unlatching
- C204 = 24 VDC, 9 Watts Latching, 7 Watts Unlatching
- C202D = 6 VDC, 7 Watts Latching, 5 Watts Unlatching with internal diodes
- C203D = 12 VDC, 9 Watts Latching, 7 Watts Unlatching with internal diodes
- C204D = 24 VDC, 9 Watts Latching, 7 Watts Unlatching with internal diodes

⑨ Wire Color Codes

- WGR-N = White common (+), Green latch (-), Red Unlatch (-)
- BRG-P = Black common (-), Red latch (+), Green Unlatch (+)
- BGR-N = Black common (+), Green latch (-), Red Unlatch (-)

* Standard selection; will be used unless otherwise specified. Standard selections are not referenced in final part number.

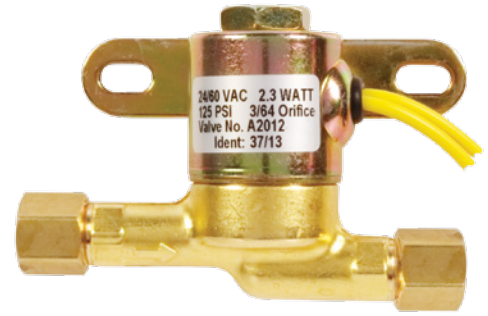
Humidifier Solenoid Valves

- ▶ MOPD: 125 PSI (8.6 bar)
- ▶ 2.3 Watts

Originally designed and manufactured for original equipment manufacturers (OEM's), the humidifier solenoid valve is now available as a replacement solenoid valve for in-home and commercial humidifiers. Available in two orifice sizes, the humidifier solenoid has a brass body and is constructed with an in-line strainer for added protection to humidifier water lines.

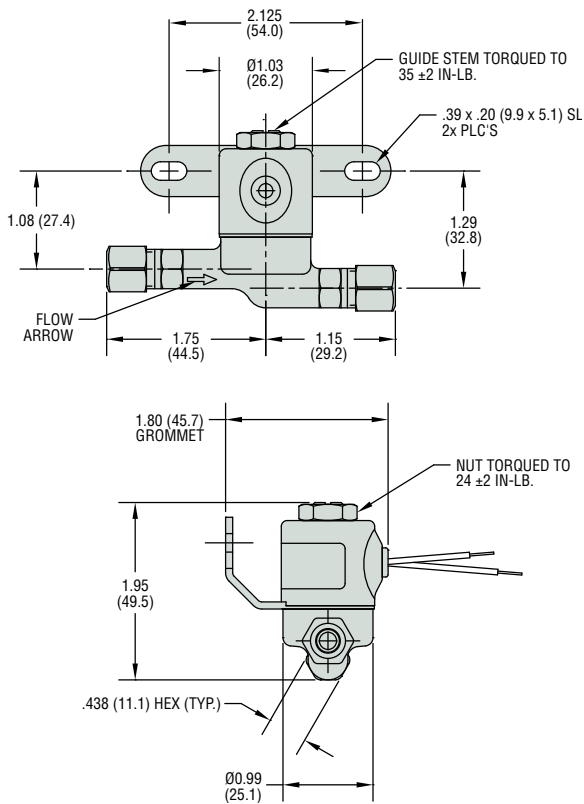
Typical Application

- Replacement solenoid valve for commercial and in-home humidifiers

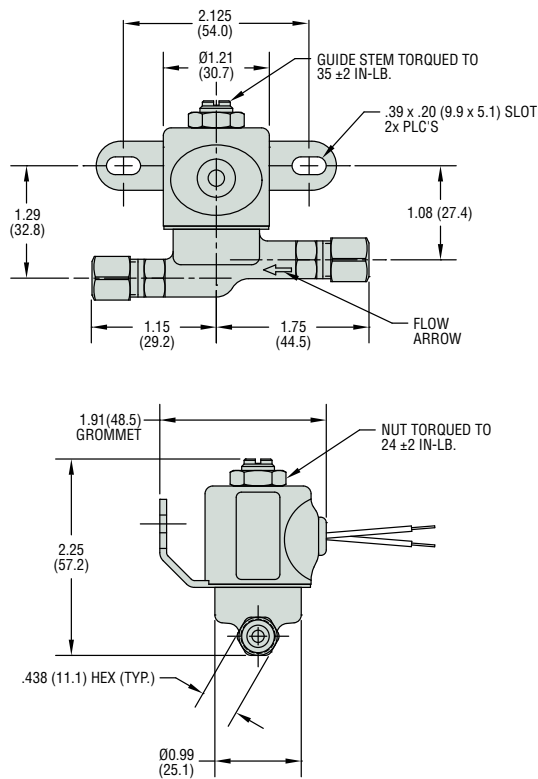


Dimensions

24V, 60Hz AC



120V, 60Hz, AC



How To Order

Orifice		Voltage (VAC)	MOPD		Part Number
inch	mm		psi	bar	
3/64	1.19	24/60	125	8.6	A2012-S150
3/32	2.38	120/60	125	8.6	B2015-S135

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.

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.



Send your ADS directly to a Gems Engineer!
 Fax#: 860-747-4244 • This form may also be completed online at gemssensors.com for RFQ.

One Cowles Road
 Plainville, CT 06062
 Toll Free: 800.378.1600

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

IMPERIAL MEASUREMENT FLOW REQUIREMENTS

C_v : Body _____, Stop _____ Orifice Diameter: Body _____, Stop _____
 Flow at the Body Orifice _____ (GPM or SCFM) with a _____ psig at the Inlet, and _____ psig at the outlet
 Flow at the Stop Orifice _____ (GPM or SCFM) with a _____ psig at the Inlet, and _____ psig at the outlet

PRESSURE

Operating Pressure _____ psig
 Max. Pressure _____ psig
 Min. Pressure _____ psig
 Max. Back Pressure _____ psig

TEMPERATURE

Media Temp. _____ °F
 Max. Media Temp. _____ °F
 Min. Media Temp. _____ °F
 Ambient Temp. _____ °F
 Max. Ambient Temp. _____ °F
 Min Ambient Temp. _____ °F

METRIC MEASUREMENT FLOW REQUIREMENTS

K_v : Body _____, Stop _____ Orifice Diameter: Body _____, Stop _____
 Flow at the Body Orifice _____ (m³/h) with a _____ bar at the Inlet, and _____ bar at the outlet
 Flow at the Stop Orifice _____ (m³/h) with a _____ bar at the Inlet, and _____ bar at the outlet

PRESSURE

Operating Pressure _____ bar
 Max. Pressure _____ bar
 Min. Pressure _____ bar
 Max. Back Pressure _____ bar

TEMPERATURE

Media Temp. _____ °C
 Max. Media Temp. _____ °C
 Min. Media Temp. _____ °C
 Ambient Temp. _____ °C
 Max. Ambient Temp. _____ °C
 Min Ambient Temp. _____ °C

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 _____

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.

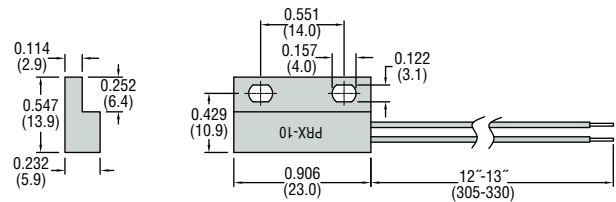
Specifications

Housing Material	ABS
Operating Temperature	32°F to 212°F (0°C to 100°C)
Switch	SPST, N.O.
Voltage, Max.	160 Vdc
Current, Max.	0.5 Amps
Vibration Resistance	10 to 55 Hz

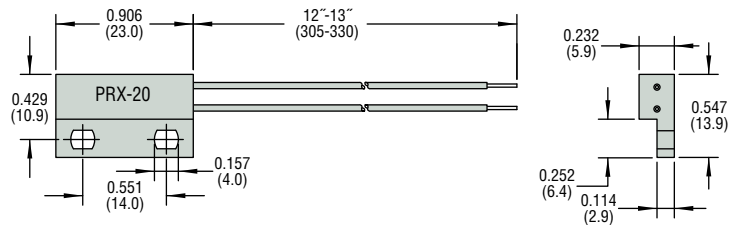
Typical Applications

- General purpose
- Household appliances
- Security systems
- Door interlocks
- Safety interlocks
- Position indication
- Equipment automation

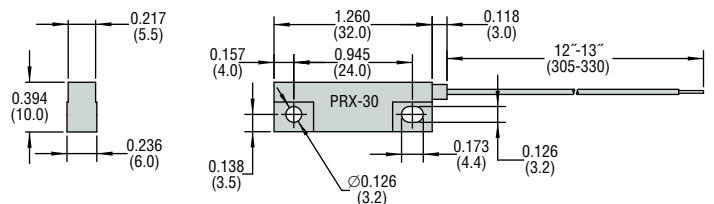
PRX-10



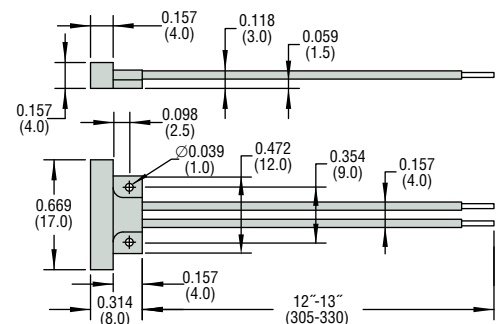
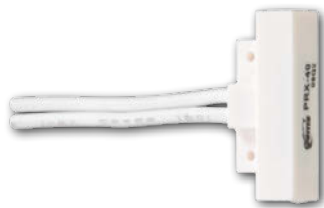
PRX-20



PRX-30

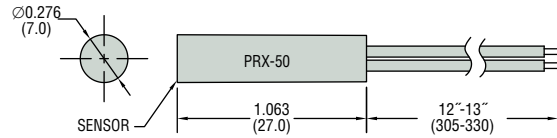


PRX-40

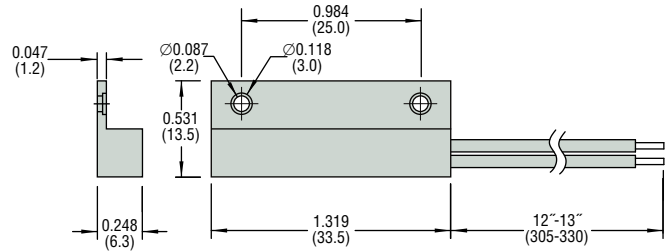


PROXIMITY SWITCHES

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.

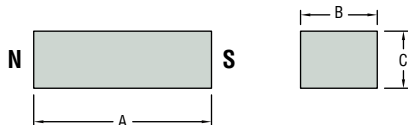
Series	Operating Temperature	Contact Rating	Switch Open Distance, Max.	Switch Close Distance, Min.	Part Number
PRX-10	14°F to 176°F (-10°C to +80°C)	10 VA	1.18 inch (30 mm)	0.63 inch (16 mm)	225951
PRX-20	14°F to 176°F (-10°C to +80°C)	10 VA	1.18 inch (30 mm)	0.63 inch (16 mm)	225952
PRX-30	14°F to 176°F (-10°C to +80°C)	10 VA	1.18 inch (30 mm)	0.63 inch (16 mm)	225953
PRX-40	14°F to 176°F (-10°C to +80°C)	10 VA	0.79 inch (20 mm)	0.35 inch (9 mm)	225954
PRX-50	14°F to 140°F (-10°C to +60°C)	10 VA	1.38 inch (35 mm)	0.71 inch (18 mm)	225955
PRX-70	14°F to 140°F (-10°C to +60°C)	50 VA	1.02 inch (26 mm)	0.47 inch (12 mm)	225956

Notes:

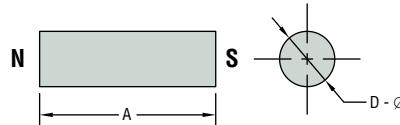
- Product options include: Lead length, Activation Magnet and 22 Gage Wire. Please contact Gems for these options.
- Lead time 2 weeks. A minimum piece order is required; please contact factory .

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

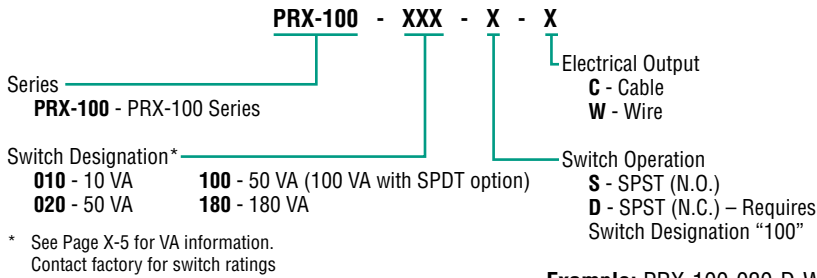
Housing Material	Noryl™ (PPO)
Operating Temperature	-40°F to +194°F (-20°C to +90°C)
Pressure	Atmospheric
Approvals	cULus File # E305671

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.



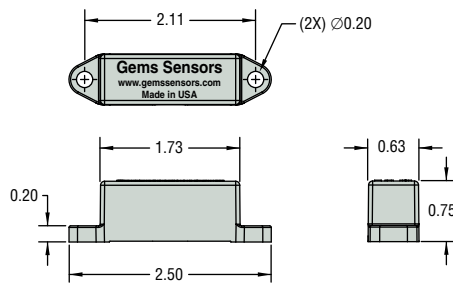
Example: PRX-100-020-D-W

Step 2: Select an Actuating Magnet to pair with Switch.

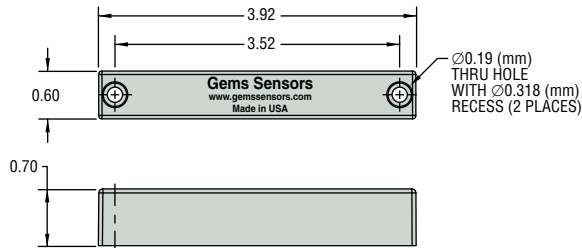
PRX-100 Series actuating magnets are available in both housed assemblies and as bare magnets (See Page K-5).

Configuration

Type 1 Assembly



Type 2 Assembly



How to Order

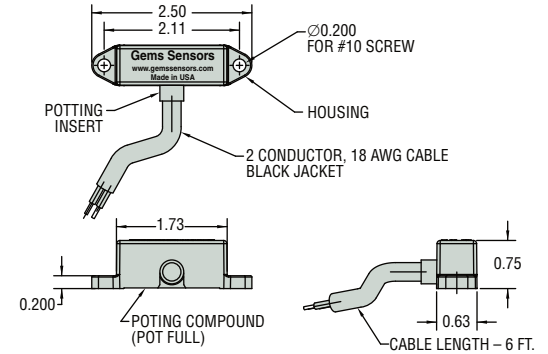
Magnets for the above Proximity Switches are ordered separately.
Select by Configuration, Magnet Type and Size.

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)	217302
	Neo N35H	1.5" (38.1 mm)	3/8" (9.5 mm)	217310
Type 2 Assembly	Alnico 5	2.5" (63.5 mm)	3/8" (9.5 mm)	217301
	Alnico 5	1.5" (38.1 mm)	3/8" (9.5 mm)	222055
	Neo N35H	1.5" (38.1 mm)	3/8" (9.5 mm)	222056

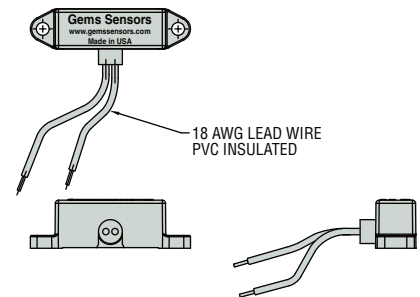


Dimensions

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.

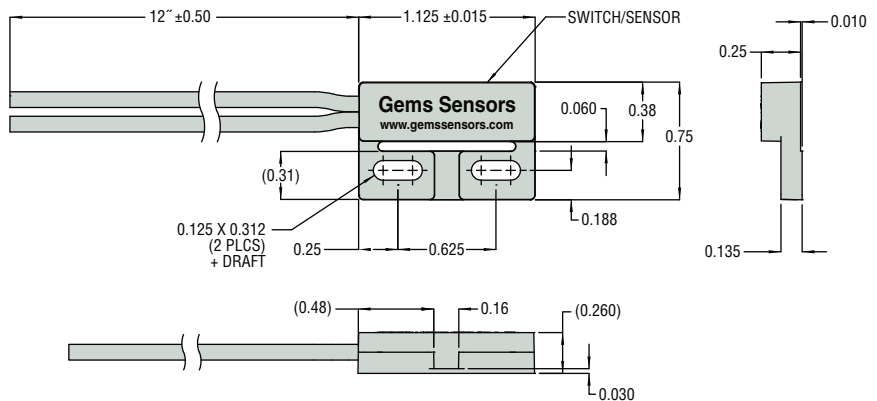
Specifications

Housing Material	Nylon 33% GF
Operating Temperature	32°F to 212°F (0°C to 100°C)
Pressure	Atmospheric
Switch	SPST, N.O.
Voltage, Max.	250 Vdc
Current, Max.	1.0 A
Approval	U.L. Recognized

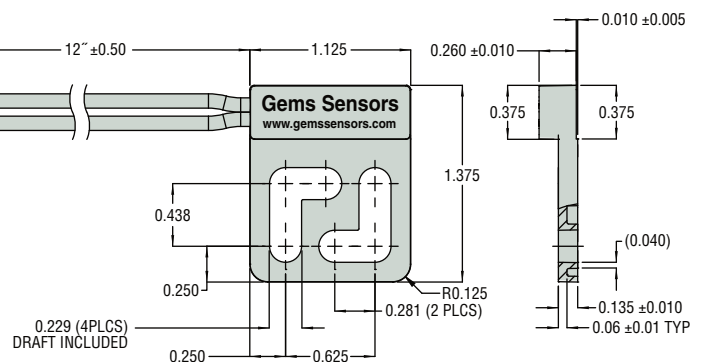
Typical Applications

- General Purpose
- Household Appliances
- Security systems
- Door interlocks
- Safety interlocks
- Position indication
- Equipment automation

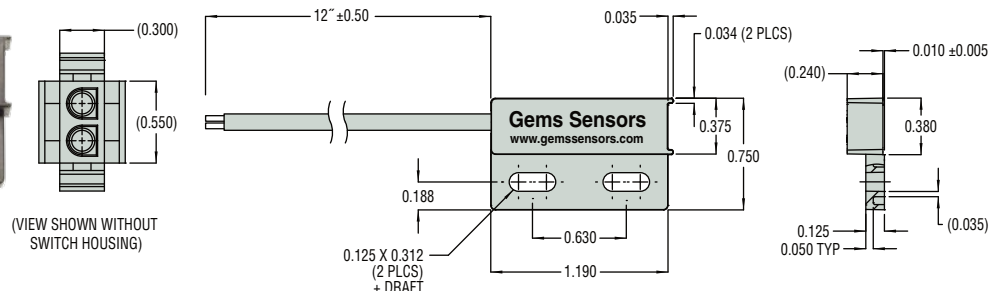
PRX-300



PRX-310



PRX-320



How To Order – Switches

Select by Part Number based on operational requirements.

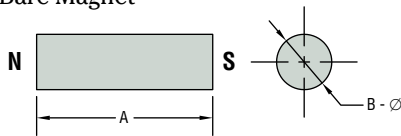
Series	Housing Material	Operating Temperature	Contact Rating	Switch Actuation Distance	Part Number
PRX-300	Nylon 33% GF	32°F to 212°F (0°C to 100°C)	50 VA	0.75 inch (19 mm)	225815
PRX-310	Nylon 33% GF	32°F to 212°F (0°C to 100°C)	50 VA	0.70 inch (17.8 mm)	225820
PRX-320	Nylon 33% GF	32°F to 212°F (0°C to 100°C)	50 VA	0.5 inch (12.7 mm)	225830

Notes:

- 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)	217311
		1.5" (38.1 mm)	3/8" (9.5 mm)	217303
		2.5" (63.5mm)	3/8" (9.5 mm)	217909
		3" (76.2mm)	1/2" (12.7 mm)	220551
	Neo N35H	1" (25.4 mm)	3/16" (4.8 mm)	217304
		1" (25.4 mm)	3/8" (9.5 mm)	217309
		1" (25.4 mm)	3/8" (9.5 mm)	220999
		1.5" (38.1 mm)	3/8" (9.5 mm)	220753

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.

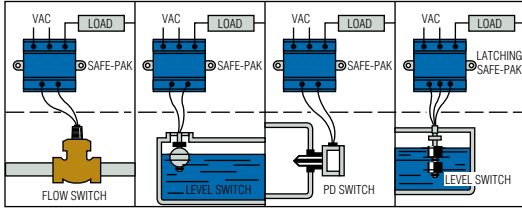
SAFE-PAK® RELAYS: These intrinsically safe units amplify sensor load-handling capabilities in a wide diversity of AC and DC control switching applications.

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	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	•	•			•	•	•	•	•	•		
Zener Barriers ²	54801	•	•	I, II	1, 2				•			L-10 and L-11	
	54803	•	•			•	•	•					
	54805	•	•			•	•	•					
	54806	•	•						•				
Zener Barriers ²	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



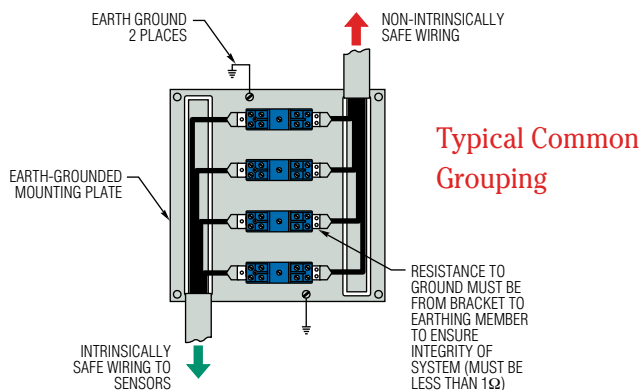
UL — Underwriter's Laboratories, Inc.



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 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.



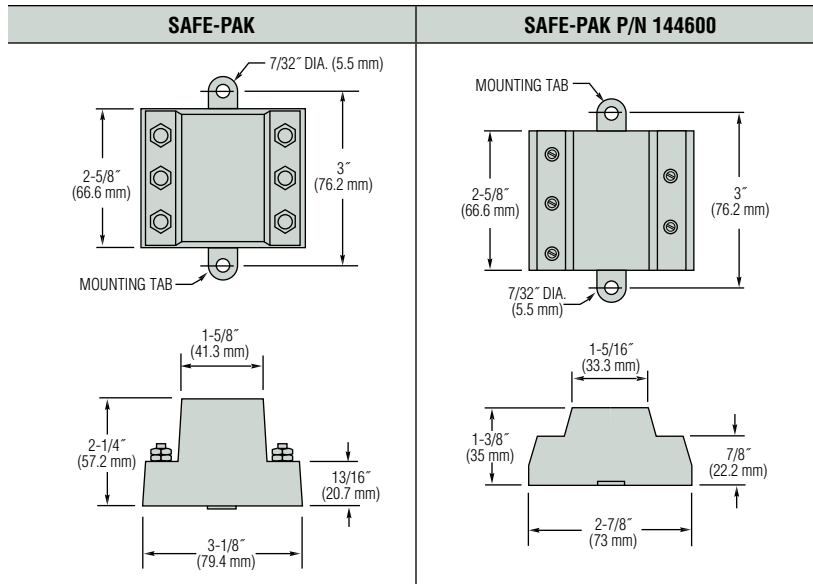
P/N
22445
25872
25873
64101



P/N
144600



Dimensions



How To Order

Select Part Number based on Relay Style, Operating Voltage and Switch Operation required.

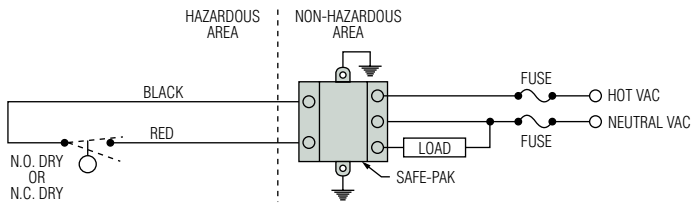
Relay Style	Operating & Load Voltage Range	Load Current Maximum	Turn-On Sensitivity (Typical) ¹	Turn-Off Sensitivity (Typical) ¹	Voltage Loss	Operating Temperature Range	Output Leakage Current Maximum	Switching Operation	Part Number
SAFE-PAK®	95 to 135 VAC	5A	400 K	1 M	2 VAC	0°F to +120°F (-17.8°C to +48.9°C)	6 mA @ 120 VAC	SPST N.O.	22445 ⁵ ⚡
	100 to 135 VAC						6 mA @ 120 VAC	SPST N.C.	25872 ⁵ ⚡
	200 to 250 VAC						12 mA @ 250 VAC	SPST N.O.	25873 ⚡
Low Sensitivity SAFE-PAK®	110 to 130 VAC	.5A @ 20 VAC ² .05A @ 200 VAC ²	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.

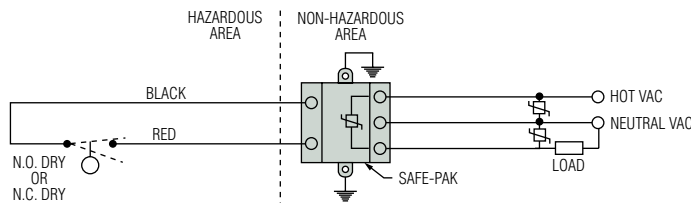
⚡ – Stock Items.

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

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, CSA and evaluated by MSHA

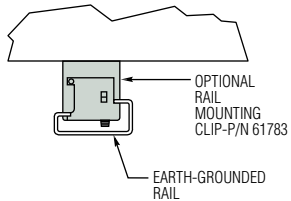
Operations such as normally open, normally closed or latching are programmed into these versatile SAFE-PAK units by the user during installation. Selection is made by simply connecting sensor wiring (and jumper wire when required) to the proper terminals on the unit as diagrammed on opposite page. All units are programmable, except where otherwise indicated.

See table on Page L-2 for specific approval information.

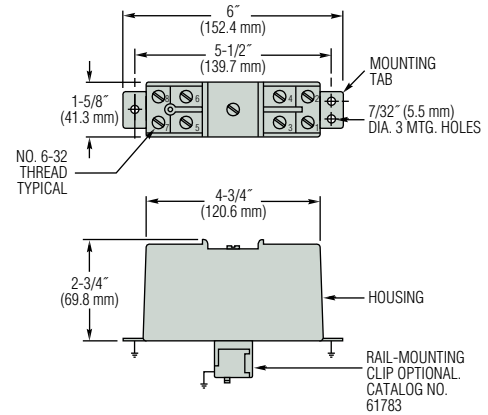
Options

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)

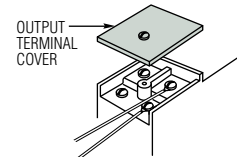


Dimensions



Protective Cover

Assures intrinsic safety integrity of sensor terminals and wiring.



Specifications

Part Number	Operating Voltage ⁴	Load Current Maximum	Load Voltage Range	Turn-On Sensitivity (Typical) ¹	Turn-Off Sensitivity (Typical) ¹	Leakage Current "Off" State, Maximum	Voltage Loss, Maximum	Transient Current ³	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.

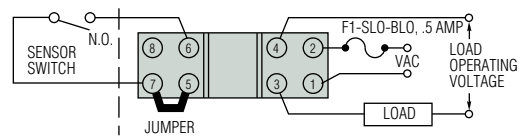
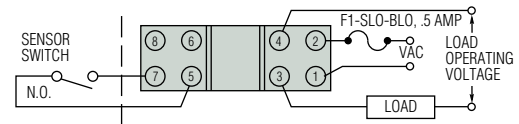
Latching “A” Operation: For refill control, momentary switch closure to terminals 5 and 7 turns Programmable Relay “on” and energizes load. Load remains “on” until the Programmable Relay turns “off” with a momentary switch closure at terminals 6 and 7. The load is then de-energized. Jumper must be connected 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.

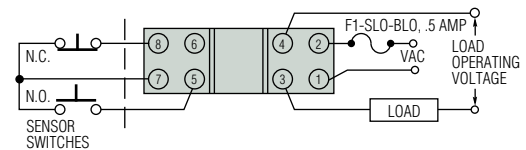
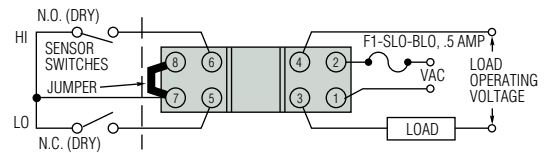
Latching “B” Operation: Momentary switch closure to terminals 5 and 7 turns Programmable Relay “on” and energizes load. Load remains “on” until the N.C. switch terminals 7 and 8 opens. The Programmable Relay turns “off” and load is de-energized. Terminal 6 and jumper are not used.

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

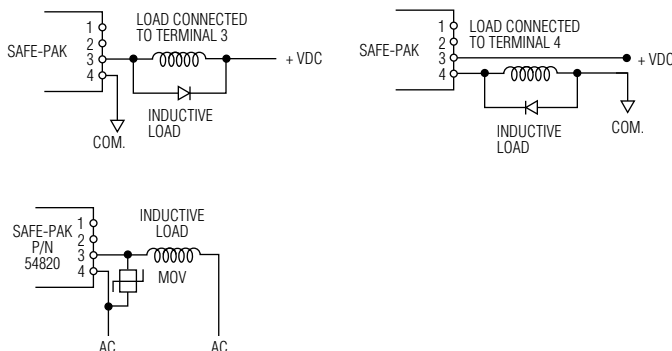


Refill Operation Shown

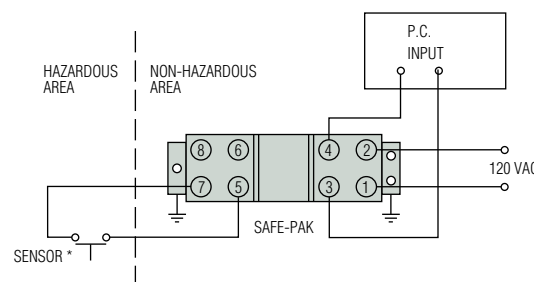


Load Consideration

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

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

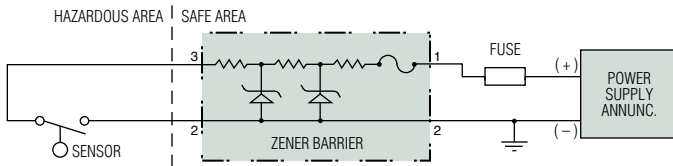
- ▶ Intrinsic safety with solid-state reliability
- ▶ Compact size streamlines installation
- ▶ Space-saving in multiples
- ▶ Encapsulated construction is impervious to dust and moisture

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.

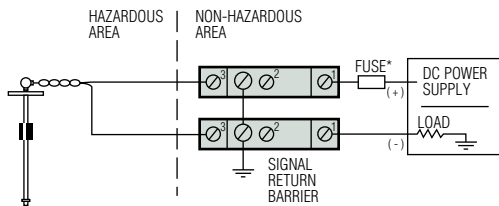
Typical Wiring Diagram



Positive single-channel Zener Barrier with negative ground.

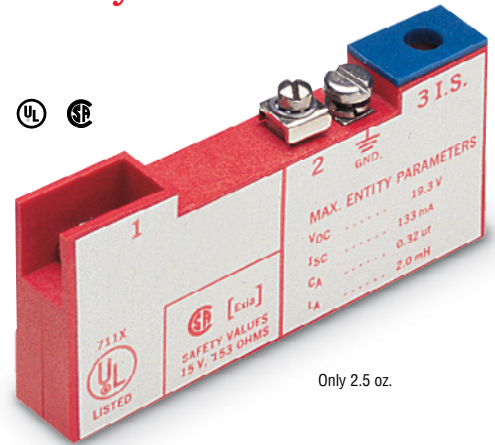
For most non-voltage-producing devices located in a hazardous area, a single Zener Barrier that is negative-earth-ground can be used for intrinsic safety. Instrumentation that produces an output (signal conditioners) usually requires two barriers, one for each "floating" lead. In this case, a dual channel 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).



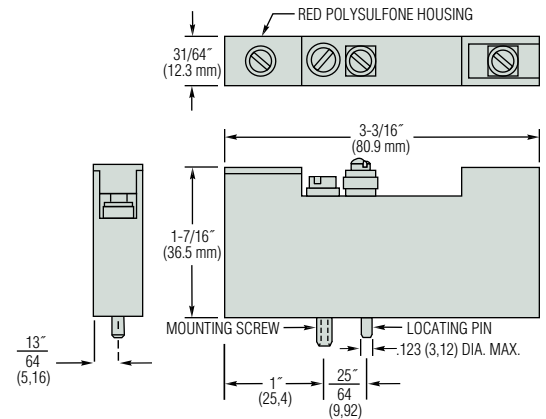
For floating leads: 65800 Series supply and return barriers for signal conditioners.

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



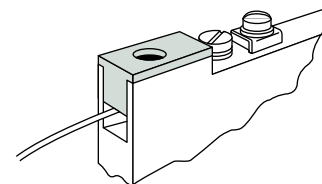
Only 2.5 oz.

Dimensions



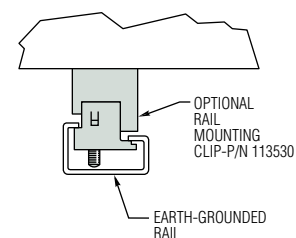
Protective Cover

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 μ f	Inductance mh	
Supply	+15	250 mA	Positive	183	A, B, C, D, E, G	0.32	2.0	111950 ⚡
	+20	125 mA		303		0.18	4.1	111952
	+24	62 mA		390		0.12	3.0	111954
	+30	62 mA		750		0.07	1.8	111956
	+18	125 mA		183	C, D, E, G	0.72	3.6	114074
	+24	62 mA		234		0.33	3.1	114072
	+27	62 mA		276		0.24	3.3	114175
	+30	250 mA		303		0.20	3.0	113000 ⚡
Signal Return	+30	250 mA		33.9	A, B, C, D, E, G	0.07	.35	114166 ⚡
Optional Rail Clip								113530 ⚡

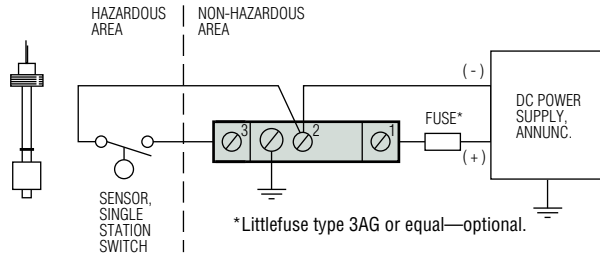
Notes:

- 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).

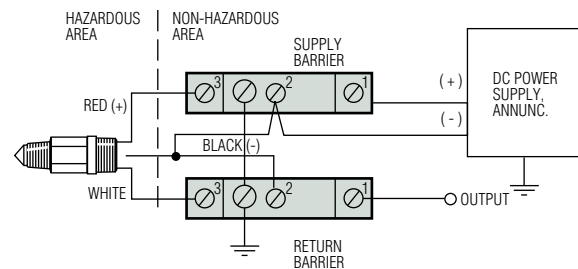
⚡ – Stock Items.

Typical Application Examples

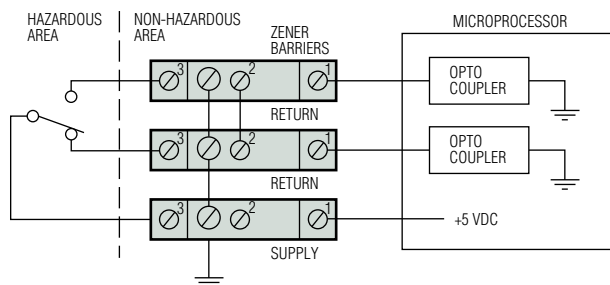
Sensors or Switches may be any non-voltage-producing device. Typical are: flow and level switches, temperature switches (thermostats), pressure switches or passive resistive transducers or transmitters. Below are typical examples.



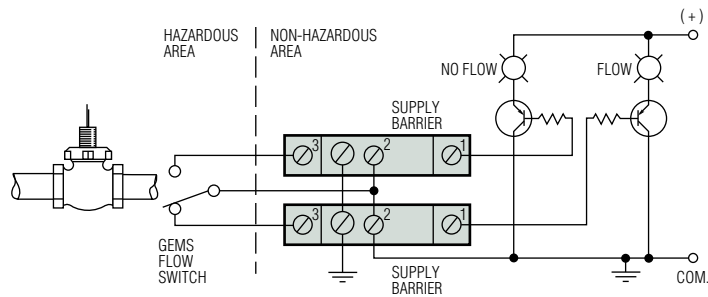
With GEMS level switch or any other non-voltage-producing device located in a hazardous area.



Supply and Return Zener Barriers used with GEMS EL5-1100 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

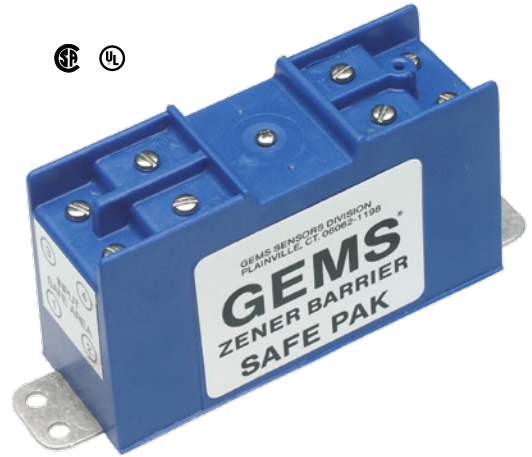
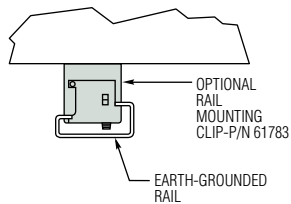
For most non-voltage-producing devices located in a hazardous area, a single zener barrier that is negative-earth-grounded (see preceding two pages) can be used for intrinsic safety.

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.

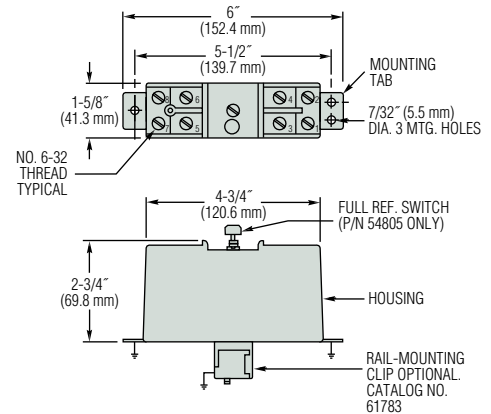
Any non-voltage-producing sensor or switch is rendered intrinsically safe for hazardous locations when properly connected to the output of these Zener Barriers. See table on Page L-2 for specific approval information.

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.

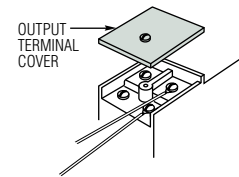


Dimensions



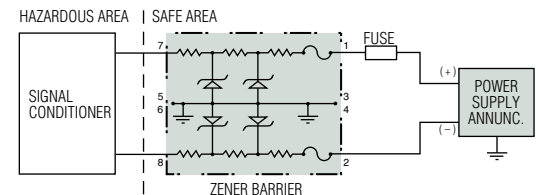
Protective Cover

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 μ f	Inductance mh	
15 VDC, 200 mA	Positive	65	D	5.6	0.7	54801
20 VDC, 100 mA	Positive	270	A, B	0.4	0.9	54803
			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	54805
			C	1.2	5.0	
			D	3.2	10.0	
30 VDC, 60 mA	Positive	275	D	2.4	6.0	54806 ⚡
Optional Rail Mounting Clip						61783

Notes:

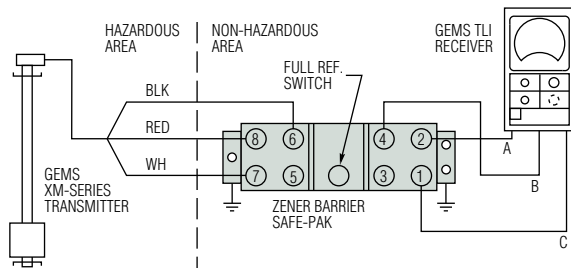
- These barriers are internally fused. If a "fault" or abnormal signal level continues for a sustained period of time, the internal fusing within the barrier will open, disconnecting the barrier. External fuses (Littlefuse Type 3AG or equal) are recommended to protect the Barrier from incorrect wiring 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

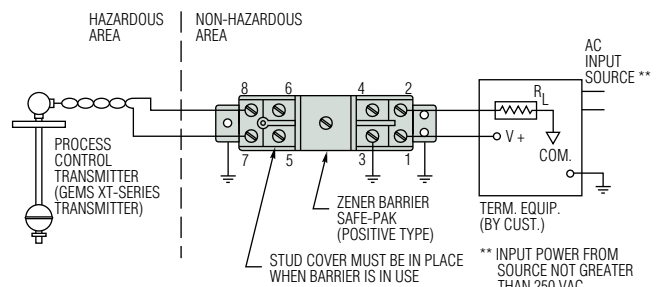
Typical Application Examples

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:

$$R_{Loop} = \frac{V_A^* - 10}{.02}; R_{Loop} = R_{SUPPLY\ BARRIER} + R_{RETURN\ BARRIER} + R_{MONITORING\ EQUIPMENT}$$

* 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

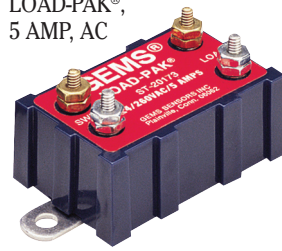
DC LOAD-PAK: Switching is by means of B+ closure. . .the DC LOAD-PAK must be wired to the polarity shown. REVERSING POLARITY WILL DESTROY THIS UNIT.

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.

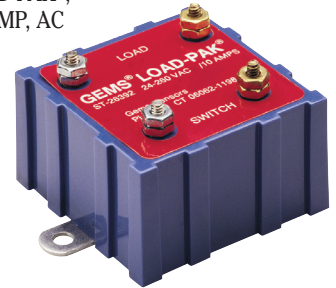
Line Transients: While random line transients will not normally harm LOAD-PAKS, they may pass current to some loads for up to 1/2 cycle duration*. AC LOAD-PAKS and the DC LOAD-PAK include transient protection. . .the SPDT-PAK does not. If load transients are a problem, the external protective circuit, 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



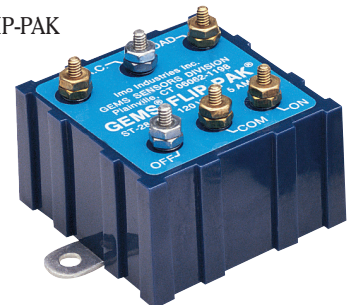
Intrinsically Safe

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 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

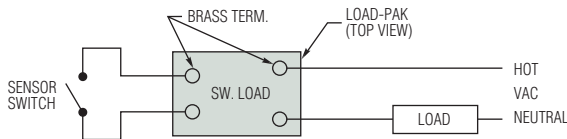
Specify Part Number based on the specifications tabulated below.

	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
Part Number	20173 ⚡	26392 ⚡	25763 ⚡	22155	28196 ⚡ / 28244
Operating & Load Voltage Range	24 to 260 VAC		6 to 48 VDC	100 to 130 VAC	100 to 130 VAC / 200 to 250 VAC
Voltage Loss	2 VAC		2 VDC	3 VAC	2 VAC
Sensor Current, Max.	20 mA		35 mA	20 mA	20 mA
Allowable Resistance in Sensor Circuit to Turn “ON” (Max.)	4 k at Nom. Volt.		0 to 4 k	4 k at Nom. Volt.	—
Leakage Current Thru Load Term.	12 mA @ 240 VAC		2 mA	20 mA	12 mA @ 240 VAC
Switching Mode	SPST, N.O.			SPST, N.O. & N.C.	SPST, N.O.
Operating Temperature	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)	

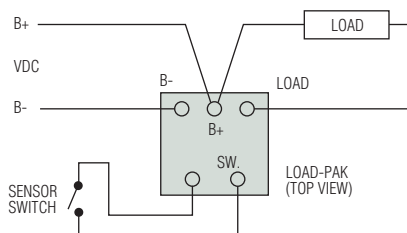
Note: All AC voltage and current specifications are RMS values unless otherwise stated.

⚡ – Stock Items

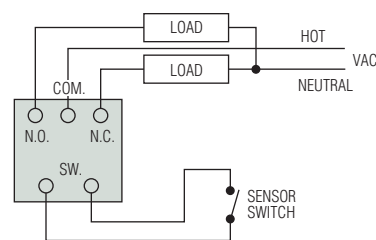
Typical Wiring



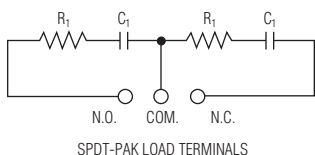
LOAD-PAK, Part Numbers 20173 and 26392 actuated by dry contact sensor to control load up to 10 amps, AC.



LOAD-PAK, Part Number 25763, actuated by dry contact sensor to control load up to 2 amps, DC.

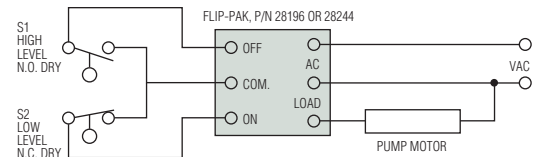


SPDT-PAK, actuated by a single sensor to control two separate loads.



R = 100 OHM,
1/4 WATT
RESISTOR
C = .05 MICROFARAD,
500 V, CAPACITOR

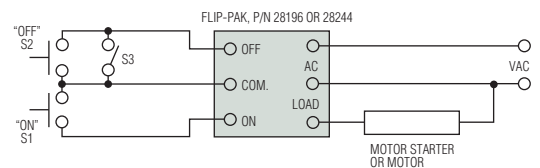
TRANSIENT PROTECTION FOR THE SPDT-PAK, The circuit shown or a properly-sized metal oxide varistor may be used.



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.

Float Type Level Switches Installation and Maintenance

APPENDIX X

Orientation

A standard NPT female boss in tank top, bottom or side is all that is required for rapid installation. Units operate normally in any attitude — from the vertical to a 30° inclination — with lead wires up or down. Standard IPS pipe extends units to any intermediate level in the tank. Figure 1.

Accuracy and Repeatability

The accuracy of many GEMS level switches is $\pm 1/8''$ (3.2 mm) of true liquid level. In order to assure the proper accuracy for your liquid, please specify the specific gravity of the media. GEMS will automatically calibrate for the submergence of the float, based on this specific gravity information. Furthermore, accuracy may be enhanced by specifying whether the circuit condition should be measured on decreasing or increasing liquid level. The repeatability of the actuation point is approximately 1/32 inch (.79 mm).

Moisture Protection

When moisture exists in conduit and extension pipes, the potential for this moisture to wick down the wire leads and into the switch assembly exists. Should this happen, the switch may fail to close due to a high resistance path through the moisture.

There are several means that can be used to prevent this from happening.

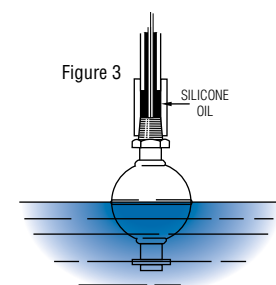
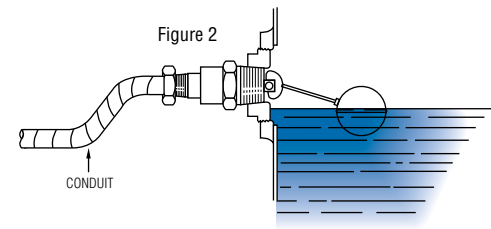
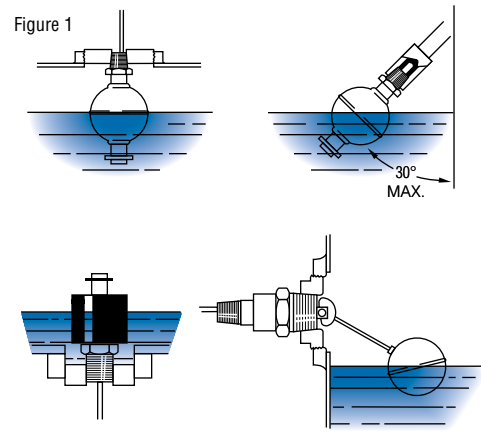
1. Pitch conduit away from the level switch when possible so that condensation will drip away from the level switch assembly. Figure 2.
2. When a vertical run of extension pipe is used to extend a level switch down from the top of the tank, a non-conductive silicone oil should be used to fill the vertical run. Alternatively, an appropriate potting may be used to fill the vertical run to occupy the space in which condensation will normally form. Figure 3.

By working closely with your GEMS representative, there are many design considerations that can help lessen the effects of moisture.

1. Consider a product such as the GEMS LS-270 Single Level Switch which has a water-tight molded cable.
2. Consider using a unit with a connector and gasket seal.
3. Consider using moisture resistant heat shrink tubing on the switch capsule assembly.
4. Consider using Scotchcast® 2114 sealing compound and electrical insulator. Part No. 157636.

A WORD OF CAUTION: Most of GEMS level products incorporate a potting cap or are fully potted. Due to the bonding characteristics of the potting to the wire leads, there is no way of assuring a water tight seal at the potting joint. Our potting cap will resist moisture to some degree, but the precautions mentioned above should be used to assure moisture doesn't enter the switch and cause a short.

Please refer to Gems Instruction Bulletins for detailed installation and maintenance procedures. Instruction Bulletins are available at www.GemsSensors.com



Thread Treatment

Sealing

When threading metal threads into a metal coupling, pipe sealant or Teflon® tape is recommended. Due to potential compatibility problems, when sealing plastic threaded units, a compatible pipe sealant such as **No More Leaks™** from Permatex® is recommended.

Tightening

When threading a plastic level switch into a metal coupling, the installer should use a suitable wrench and tighten the threads 1 to 1-1/2 additional turns past hand tight. Over torquing of the threads will result in damage to the plastic mounting plug.

The Effect of Thread Engagement on Actuation Points

The length of mounting threads engaged at installation is important in calculating switch actuation points and the actual length of stem extending into the tank. Use the chart below to find the thread engagement length (T) for a given NPT size. Factor the T dimension into any calculation of switch actuation levels (L) and overall length (L₀).

T Dim.	NPT							
	1/8"	1/4"	1/2"	3/4"	1"	1-1/4"	2"	3"
	.27"	.39"	.53"	.55"	.68"	.71"	.76"	1.20"

Examples: To solve for "L" use the formulas shown in the examples below. To calculate the Actual Tank Intrusion, substitute the L₀ value in place of L₁ in any of the formulas.

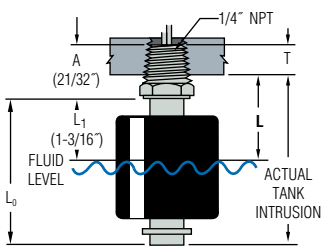
Internally Mounted – Standard Length

LS-1900 Series internally mounted through a 1/4" NPT hole.
To calculate L dimension:

$$L = L_1 + (A - T)$$

$$L = 1-3/16" + (21/32" - .39")$$

$$L = 1.46"$$



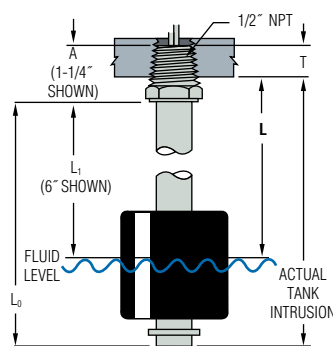
Internally Mounted – Configurable Length

LS-800 Series (Type 1) internally mounted through a 1/2" NPT hole.
To calculate L dimension:

$$L = L_1 + (A - T)$$

$$L = 6" + (1-1/4" - .53")$$

$$L = 6.72"$$



Definition of Variables Used in Examples Below

A = Mounting length.

T = Thread engagement.

P = Distance from coupling (bung) top to inside surface of tank or bracket.

L = Switch actuation level as measured from inside surface of tank or bracket to fluid surface.

L₁ = Switch actuation level, nominal, as measured from bottom of mounting (based on a liquid specific gravity of 1.0).

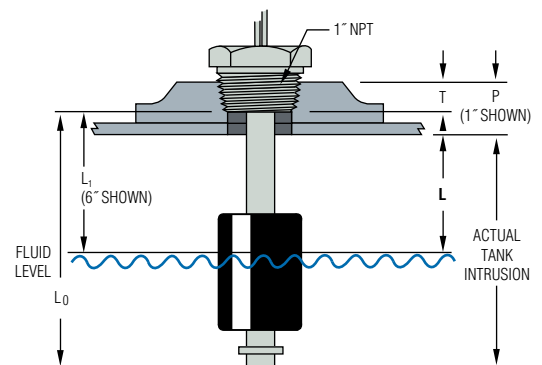
Externally Mounted – Configurable Length

LS-700 Series (Type 3) externally mounted through a 1" NPT hole. To calculate L dimension:

$$L = L_1 - (P - T)$$

$$L = 6" - (1" - .68")$$

$$L = 5.68"$$



No More Leaks is a trademark of Permatex® Industrial Corp., a subsidiary of Loctite Corp.
Teflon is a registered trademark of DuPont Corp.

Reed Switch Protection

The hermetically-sealed reed switch used in GEMS level switches are extremely rugged and designed to operate reliably for many years – 2 million cycles under ideal conditions. To achieve the maximum service life, reed switches benefit from protected electrical supply.

IMPORTANT:

- Don't be misled by the resistive ratings of the switches. Most applications involve inductive loads.
- Don't be misled by the wattage ratings of loads. Low wattage loads are often high inductive devices, making contact protection very important.

Contact Protection Requirements

When switching inductive loads such as relays, solenoids and transformers, reed switch contacts require protection in order to ensure long, dependable life. When current is interrupted, the inductance or electrical inertia of the load generates a large high frequency voltage, which appears across the switch contacts. If the voltage is large enough, it can break down the medium in the gap between them, making a conductive path. This phenomenon, called "arcing," is the spark you see. Arcing can cause the contacts to burn, weld together or stick; thus, giving unreliable performance. The purpose of protection circuits is to prevent arcing, by shorting this voltage through an alternate path.

Recommended Protection

D.C.

A 1N4004 diode (or equivalent) connected cathode-to-positive, as shown in Figure 1, is recommended. The diode does not conduct when the load is energized, but conducts and shorts out the generated voltage when the switch opens. The generated voltage always acts in series with the applied voltage.

A.C.

A resistor and capacitor, connected in parallel with the switch, as shown in Figure 2, is recommended. The capacitor is a high impedance to 60 hertz, but is essentially a short circuit to high frequencies of generated voltages.

Transient suppressors or varistors may also be used to dissipate the transient and protect the switch contacts.

Notes:

1. Don't be misled by low voltage $\leq 10V$, low current $\leq 1MA$ type of loads. These loads may require special gold plating on contact surfaces to operate reliably at these low voltage/low current levels. For long term reliable low current switching action, Gems 20VA switches should be operated at a minimum of 12V to assure contact make; e.g., break through an oxide film which may form over long periods of time.
2. Incandescent lamp loads are very destructive to reed switch applications. These type of loads have a 6-10 time the normal operating current (inrush current) when first energized. This high current level is a prime factor which decreases the life of the switch.
3. The following rating may be used for selection.

$$V_{RMS} = 130 \text{ volts} \quad \text{Energy} = 30\text{-}50 \text{ joules} \quad \text{Peak Amps} = 4000\text{-}6000$$

The dependable reed switch is at the heart of most level switch shown in this catalog.

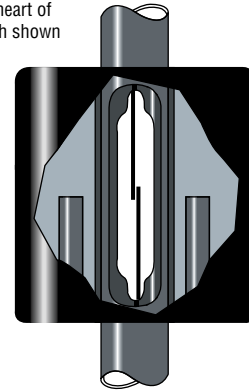


Figure 1
D.C. Contact Protection
(Drain the Load)

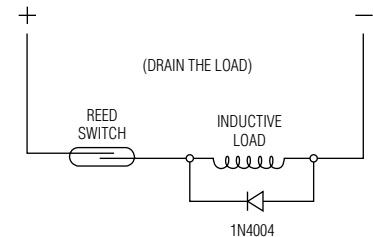
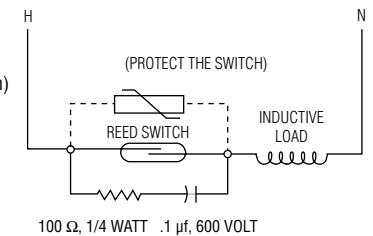


Figure 2
A.C. Contact Protection
(Protect the Switch)

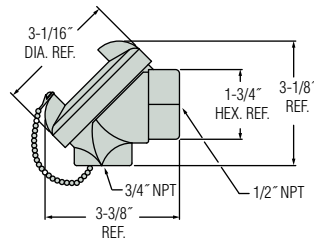


Junction Boxes

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.

Pyromation®

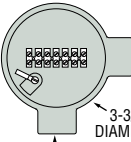
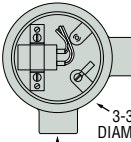
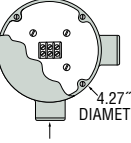



	Aluminum	Iron
Materials	Die Cast Aluminum	Cast Iron
	Stainless Steel Chain and Pin	
	EPDM Rubber Gasket (300°F/149°C Max. Service Temp.)	
Finish	Polished	Electroless Nickel Plate
Weight (approx.)	.62 lbs.	.62 lbs.
NEMA Rating	4, 13	4
Part Number	192147	198848



© Pyromation is a registered trademark of Pyromation, Inc.

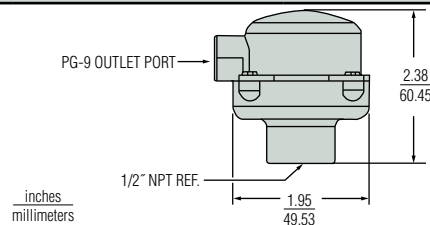
Non-Explosion Proof J-Boxes

	Alloy		Plastic		
					
	3-3/4" DIAMETER	3-3/4" DIAMETER	4.27" DIAMETER		
	1/2" TRADE SIZE (2 PORTS)	1/2" TRADE SIZE (2 PORTS)	1/2" NPT 2 PORTS		
Type	3-pin	7-pin	DPDT Relay	3-pin	7-pin
Part Number	113873 ⚡	113877 ⚡	75980	113850	118828

⚡ – 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
Specifications	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.
Part Number	181410	180417



Electrical Data

Standard reed switches in GEMS level and flow switch units are hermetically-sealed, magnetically actuated, make-and-break type. Switches are SPST or SPDT, and rated 20 VA. See the chart below for maximum load characteristics of GEMS level switches.

GEMS Sensors Inc. would be pleased to run life tests on our level or flow switches with your specific load, and issue a report indicating the approximate number of cycles that can be expected. U.L. Recognized Units: Switches showing a U.L. listing are rated for 10 VA or 20 VA as shown below.

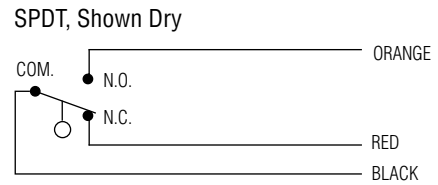
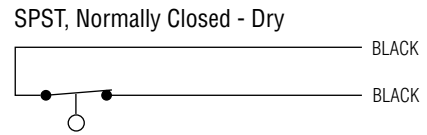
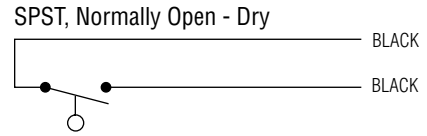
Switch Rating – Maximum Resistive Load

VA	Volts	Amps AC	Amps DC
10 General Use	0-50	.2	.13
	120	.08	N.A.
	100	N.A.	.1
20 Pilot Duty	0-30	.4	.3
	120	.17	.13
	240	.08	.06
50 ¹ General Use	0-50	0.5	0.5
	120	.4	.4
	240	.2	.2
100 ¹	120	.8 ²	N.A.
	240	.4	N.A.

Notes:

1. Level switch units with 50 VA and 100 VA switches are not U.L. Recognized or CSA Approved.
2. Limited to 50,000 operations.

Typical Wiring Diagrams



Glossary of Terms

Absolute Pressure: Pressure measured relative to absolute zero pressure. Usually stated in terms of psia, torr or mm Hg.

Air, Dry: Air that has most of the moisture removed and has not been lubricated with oil.

Air, Lubricated: Air or gas that has had an oil mist injected into the system.

Alternator: A device that alternates between two or more pumps or solenoid valves.

Ampere: The basic unit of electrical current (amp).

AST: Above Ground Storage Tank.

Atmospheric (Barometric) Pressure: The pressure caused by weight of the Earth's atmosphere. It is altitude specific and can also be influenced by localized weather systems. For this reason, standard seal level conditions are defined as 14.7 psi or 29.92 Hg of absolute pressure.

Ball Float: Type of float that has an embedded magnet.

Bar: Unit of pressure (or stress). 1 bar = 750.07mm of mercury at 0°C, lat.45°.

Bourdon Tube: An early, mechanical pressure gauge consisting of a flattened tube that tends to straighten under internal pressure; today usually used with a potentiometer to produce an electrical output.

Bubbletight Valve: No leakage past the internal seals of a valve in a 5-second soap bubble test.

Burst Pressure: The pressure at which catastrophic failure of the sensing element, mechanical interface or pressure switch enclosure is expected to occur. Because of safety concerns, a product with a burst pressure of at least twice the maximum pressure of the application should be chosen.

Valve Buzz: A persistent vibratory sound usually caused by the plunger not staying in contact with the stop (AC valves only).

Capacitive Sensing: Detection and measurement of pressure through the change in voltage across a capacitor, one plate of which is a diaphragm which deflects slightly with changes in applied pressure.

Compound Pressure: Pressure measured from full vacuum (-14.7 PSIV) to gage pressure, referencing atmosphere.

Conductive Liquid: Any liquid which allows electricity to pass through it.

Conductivity: A method for sensing liquid level. Using a special control, electrical current is passed through the liquid from one probe to another, causing the control to change state electrically.

Conformal Coating: Non-conductive coating used on circuit boards to reduce electrical shorts that may be caused by excessive humidity.

Contacts: Electromechanical components that complete or break a connection between two conductors that permit a flow of current. There are four types of contacts in Warrick controls.

SPDT: Single Pole Double Throw contacts. A common point with contact points that give one normally open and one normally closed contact (Form C contacts).

DPDT: Double Pole Double Throw contacts. Two isolated sets of contacts, each consisting of one SPDT (two Form C contacts).

N.O.: Normally Open contacts. Contact points that are open when relay is in non-powered state.

N.C.: Normally Closed contacts. Contact points that are closed when relay is in non-powered state.

Controller: A Warrick device used to regulate a process based on input parameters.

CSA: Canadian Standards Association, a testing laboratory for products sold in Canada.

Deadband: The arithmetic difference in pressure between the rising pressure (or vacuum) setpoints and the falling pressure (or vacuum) setpoints. All electromechanical pressure switches exhibit a deadband. Minimum and/ or maximum deadbands are often specified so that a pressure switch can be used as a cost effective control method in pneumatic and hydraulic systems.

De-energized Valve: The "normal" state of a valve. The condition of an electrically operated valve when no current is being applied.

Differential Pressure: The difference in pressure between two different pressures one of which is not usually defined as absolute zero pressure or atmospheric pressure.

Differential Pressure Switch: A pressure switch with two distinct pressure interfaces (ports) that electromechanically compare the pressures. All pressure switches detect differential pressure because a pressure differential must exist to generate enough force to actuate the mechanism. However, they do not have two distinct pressure interfaces.

Direct Mode: Direct Mode controls energize relays when the liquid level reaches the highest probe (typically used in pump down applications to drain vessels).

DPDT: Double Pole Double Throw contacts. Two isolated sets of contacts, each consisting of one SPDT (two Form C contacts).

Dual Function: A special Warrick unit that provides control for two separate functions. Combining a Series 16 control with a Series 26 control on a single circuit board allows one differential level control and a low-water cutoff.

Duplex: Pump system that includes motor starters for two pumps (may also include alternator).

Electrical Enclosures: Safety rated electrical boxes, which can be NEMA 1, NEMA 3, NEMA 4, NEMA 7, or NEMA 12 for Warrick products.

NEMA 1: General purpose (indoor)

NEMA 3R: Rainproof, sleet resistant (outdoor)

NEMA 4: Water tight, dust tight, sleet resistant (indoor or outdoor)

NEMA 4X: Water tight, dust tight, sleet resistant, corrosion resistant (indoor or outdoor)

NEMA 7: Class 1, Group A, B, C or D hazardous locations, air-break (indoor)

NEMA 12: Industrial use, dust tight and drip tight (indoor)

Electrode: Same as probe.

Energized Valve: When current is flowing through the coil and resulting magnetic flux is sufficient to draw the plunger up against the stop.

Fitting: Warrick control system component designed to hold one or more probes.

FM: Factory Mutual, a testing agency for products sold in the United States.

FS: (Full Span or Full Scale) The range of measured values over which a transducer is intended to measure, specified by the upper and lower limits. Ex: 0 to 100 PSIG, FS is 100 PSIG/0 to 5 VDC. FS is 5 VDC, 800-1100 MB, FS is 300 MB.

Gauge Pressure: Pressure measured relative to atmospheric pressure. Most setpoints are specified in gauge pressure because it provides an automatic method of offsetting atmospheric pressure variations caused by altitude and weather. Usually expressed in terms of psig or bar.

Ground: Point of an electric circuit that is at zero volts potential relative to the earth.

Heat Rise: The difference between the stabilized temperature of the solenoid coil when energized and the stabilized temperature when de-energized.

Housing, Conduit: Valve coil enclosure with boss for connection to electrical conduit.

Housing, Grommet: Valve coil enclosure with grommet protection of the coil leadwires.

Hysteresis: The difference in the deadband that results from changing the points at which the setpoints are determined from. For example, a pressure switch set at 30 psi on falling pressure can be checked on a test stand from 40 psig or 3000 psig. Both methods will result in slightly different results. Hysteresis is more common and more pronounced on elastomer diaphragm units.

Intrinsically Safe: Control unit that is incapable of generating a spark. This type of control is typically used to interface with equipment which is exposed to hazardous atmospheres.

Inverse Mode: Indirect (inverse) mode controls energize relays when the liquid level drops below the lowest probe (typically used in pump up applications to refill vessels).

Leak Detection: The monitoring of liquid either in an interstitial or non-interstitial environment.

Life: Usually defined as the number of pressure cycles (0 psig - desired pressure - 0 psig) that a pressure switch can endure while both maintaining its setpoint within the stated repeatability range and reliably switching the desired electrical load. Cycle life varies greatly with each application and is best determined through long term testing in the actual system. Gems frequently provides hydraulic and pneumatic life testing upon request.

Load: Motor, alarm, or solenoid that is controlled by a Warrick liquid level control system.

LWCO: Low-Water Cutoff. A control that shuts down a pump, solenoid, burner or other device when water drops below set point.

Manometer: An early instrument for measured pressure; originally, a U-shaped tube containing liquid (water, oil or mercury), one limb opening to the gas volume to be measured, the other closed or connected to a registered or recording instrument. Modern versions utilize diaphragms, bellows or other devices for sensing relative pressures.

Media: The fluid or gas which flows through a sensor or valve.

Micro-Mohs: Measurement of electrical conductivity for a liquid medium.

Module: A type of control that encases a circuit board in a plastic housing and connects quickly with an 8-pin or 11-pin socket to provide easy installation wiring.

MOPD: Maximum Operating Pressure Differential. The maximum difference between the pressure at the inlet port and the pressure at the outlet port at which a solenoid valve will operate.

Motor Starter: Contactor required to start motors and protect them from excessive current during start and run.

NEMA: National Electric Manufacturers' Association, a group which sets standards for the United States.

Millibar: (mbar) Unit of pressure generally used in a barometric measurement; 1 mbar = 100 N/m², or 10⁻³ dyn/cm².

Newton: (N) The unit of force in the International System of Units (SI); the force required to impart an acceleration of 1 m/sec² to a mass of 1 kg.

Normally Closed: (NC/SPST) A two wire or two terminal electrical switching element that allows current to flow until pressure is applied to open the circuit.

Normally Open: (NO/SPST) A two wire or two terminal electrical switching element that does not allow current to flow until pressure is applied to close the circuit.

Ohm: A unit of measurement for electrical resistance and impedance. A conductor has a resistance of 1 ohm when a current of 1 amp flows through it with a potential of 1 volt across its terminals.

Oil Water Separator: Tank which allows the natural separation of oil and water to occur and allows oil to be removed.

Operator: A solenoid valve without the valve body. The operator would be installed into a threaded, orificed cavity of a manifold having ports.

Orifice, Body: The main opening or passage in the valve body through which fluid flows.

Orifice, Stop: Valve orifice located in the stop of the guide assembly.

Oxygen Service: Application where oxygen is the media flowing through the valve. This service requires the valve be specially cleaned.

Pascal: (Pa) The standard unit of pressure (or stress) in the SI system; equal to 1 newton per square meter (1 N/m²).

P/I: Term common to process industries meaning pressure-in/current-out. (3-15 PSIG Input to 4-20 mA DC Output).

Pilot Panel: Enclosed controls which act only to signal external motor starters or starting devices.

Plunger Seal: A material that is used on the end of a plunger assembly to seal an orifice or fluid path in a valve.

Point Level: Type of level control that turns a device On or Off when liquid rises or falls below a single preset point.

Port, Cylinder: The port that provides a passage to or from the valve to a cylinder inlet port.

Port, Exhaust: The port that provides a passage to the atmosphere or exhausting piping.

Port, Inlet: The port that provides a passage from the source fluid. Also called pressure port.

Port, Normally Closed: The port closed to fluid flow when the valve is de-energized.

Port, Normally Open: The port open to fluid flow when the valve is de-energized.

Port, Outlet: The port that provides the exit from the valve for the fluid.

Port, Over Seat: The valve body port located above the body orifice.

Port, Stop: The port located in the stop of the valve.

Port, Under Seat: The valve body port located below the body orifice.

Pressure, Back: The pressure encountered by the downstream side of a system component.

Pressure Differential: The difference in pressure between two points in a system or a component.

Pressure, Operating: Actual measured pressure in a specific valve application.

Pressure, Rated: The maximum operating pressure or pressure differential which is recommended for a component or system.

Pressure Sensing Element: The portion of the pressure switch that is in contact with and moves as a result of a change in pressure of the fluid. Gems uses a diaphragm/piston hybrid pressure sensing element.

Pressure Switch: An instrument that upon an increase or decrease in pressure (or vacuum) opens or closes one or more electrical switching element at a predetermined setpoint.

Pressure Transducer: An electromechanical device for translating fluid pressure valves into voltages across a high-impedance (5k ohms or greater) load.

Pressure Transmitter: An electromechanical device for translating fluid pressure values into currents (generally 4-20mA) into a low-impedance load. (Setra transmitters are designed by the model number prefix "C").

Primary Voltage: Supply voltage requirements (normally 120 VAC, 240 VAC, or 24 VAC).

Probe: Control system component that comes into contact with liquid.

Proof Pressure: The maximum pressure that can be applied to a pressure switch without causing mechanical degradation or the setpoint to shift.

PSIA: Pounds per square inch absolute.

PSIV: Pounds per square inch vacuum.

Range: The spread between the maximum and minimum pressures between which the transducer has been designed to operate.

Rectifier, Full Wave: A device that converts the negative wave of an AC voltage into a positive wave; therefore, approximating a DC voltage and eliminating the need for a shading ring. Rectifier can either be located externally in the lead wires or internally within the housing.

Reed Switch: An assembly containing ferromagnetic contact blades, hermetically sealed in a glass tube filled with inert gas. The switch is operated by an externally generated magnetic field from a permanent magnet.

Relay: An electromechanical device used to switch an electrical load On or Off. An energized relay allows current to flow between its common and normally open contacts.

Repeatability: The limit of deviation from the desired setpoint under a given set of environmental and operational conditions.

Reset: A switch (normally closed) used to reset a low-water cutoff relay.

Response Time: Elapsed time from the initial switch "ON" until the plunger is in the fully attracted position. Elapsed time from the initial switch "OFF" until the

plunger is in the fully detracted position.

SCFH: Standard Cubic Feet Per Hour. Generally used to measure the flow rate of gases.

SCFM: Standard Cubic Feet Per Minute. Generally used to measure the flow rate of gases.

Secondary Voltage: The low voltage portion of a probe that senses the presence or absence of liquid.

Sensitivity: The threshold for determining when a control senses that a probe is in water, it is normally expressed in terms of the conductivity or resistivity of the liquid.

Setpoint: The exact pressure at which the electrical circuit controlled by the switching element changes state. Setpoints can be specified on rising or falling pressure (vacuum).

Setraceram™: A patented, ceramic/glass sensing element, used by Gems in barometric transducers and instruments requiring the highest degree of measurement precision and stability.

Shading Ring: A copper or silver component inserted into the stop of AC voltage valves. It is required to hold the plunger positively against the stop and prevent buzz.

Simplex: Pump system which includes motor starter for a single pump.

Single Pole Double Throw: (SPDT) A three wire or three terminal electrical switching element that has one normally open (NO) and one normally closed (NC) circuit with no pressure applied. It can be wired as either an NC circuit, NO circuit or both.

Socket: Connector with 8-pin or 11-pin circular pattern that is used with module type control.

Solenoid Valve's Cycle Life: A term generally used to express the total life expectancy of a valve in cycles.

Solenoid Valve's Cycle Rate: The number of times a valve is capable of opening and closing in a particular time interval, usually one second.

Solenoid Valve's Duty Cycle: The longest time that a valve is energized, followed by the shortest time that it is de-energized, expressed as a percent as follows: (On Time/(On Time + OFF Time)) x 100.

Span: The algebraic difference between the limits of the range.
Ex: .1 to 5.1 Volts DC; span is 5 VDC. Sometimes used to designate full scale output; ie 5 VDC.

SPDT: Single Pole Double Throw contacts.

System Pressure: The pressure at which a system is normally expected to operate at, not including spikes or surges.

Time Delay: The period of time that a Warrick control will wait to change state after liquid leaves the probe (on rising level, the amount of time relay will wait after liquid contacts the probe).

Torr: A unit of low pressure equal to a head of 1 mm of mercury, or 133.3 N/2.

U.L.: Underwriter's Laboratories Inc., a testing agency for products sold in the United States.

UST: Underground Storage Tank

Vacuum: Any amount of pressure that is less than the atmospheric pressure. Usually expressed in terms of millibar, "Hg or psiv.

Vacuum, Low: Pressure at less than atmospheric pressure. 0 to -15 psi, or 0 to 29.5 in. Hg vacuum, or 760 to 25 Torr range.

Vacuum, Medium: Pressure at less than atmospheric pressure. 25 to 1x10⁻⁶ Torr range.

Vacuum, High: Pressure at less than atmospheric pressure. 1x10⁻⁶ to 1x10⁻¹⁷ Torr range.

Valve Body: Part of the valve that contains the inlet and outlet ports.

Valve Coil, Insulation Class: Identification of coils according to three general temperature insulating classes - Class B (130°C), Class F (155°C), and Class H (180°C).

Valve Coil, Encapsulated: A coil and housing that are assembled and filled with epoxy. Typically required for applications where vibration or moisture conditions present a problem.

Valve Coil, Molded: A coil that is encapsulated in a suitable resin.

Valve Coil, Tape Wrapped: A coil that is wrapped with electrical tape as the final insulation layer.

Valve Coil's Duty, Continuous: A rating given to a valve coil that can be energized continuously without overheating or failure under normal operating conditions.

Valve Coil's Duty, Intermittent: A coil not designated for continuous duty service, but which will perform satisfactorily for a specific duty service.

Valve, Direct Acting: A solenoid valve in which flow is controlled as a direct result of the plunger movement.

Valve, Latching: A solenoid valve which utilizes the flux of a permanent magnet to stay in its energized position without consuming any electrical power. "Latch" means plunger is up against stop orifice. "Un-Latch" means plunger is down against body orifice.

Valve, Isolation: A solenoid valve with an internal diaphragm separating the plunger and guide assembly from the fluid passing through the valve; therefore, the fluid contacts only the valve body material and the diaphragm material.

Valve, Solenoid: An electro-mechanical device that controls fluid flow direction, pressure, or flow rate.

Valve's Cv Factor: An orifice flow rate coefficient that represents the quantity of water, at 68°F and in GPM, which will flow through a valve with a 1 psi pressure drop.

Valve's Cycle: A complete operation of a solenoid valve, i.e., opening a normally closed valve and then closing it, equals one cycle.

Vented Pressure Switch: A pressure switch, usually with a low pressure or low vacuum setting, with a means to interface with the surrounding atmosphere. The vent allows the setpoint to remain stable despite changing temperatures, altitudes and atmospheric conditions. The vent also exposes the internal mechanical and electrical mechanism to the effects of the atmosphere.

Volt: The basic unit of measurement for electromotive force or potential difference.

Voltage, Hold: The voltage, equal to or less than nominal voltage, applied to the coil after a Spike Voltage to keep the valve energized.

Voltage, Nominal: The voltage for which the valve is rated should be applied to the coil of the valve.

Voltage, Spike: The voltage, greater than nominal voltage, applied to the coil for approximately 50 milliseconds to energize the valve. The voltage is then reduced to a Hold Voltage level.

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