Float Type Level Switches

Standard or Custom Length Versions

GEMS offers a choice of hundreds of standard, single station liquid level switches. From the compact, all-plastic LS-3 Series to the rugged, all-stainless steel LS-1950 Series, each is instrument quality throughout and built for long service dependability. Sizes and materials have been carefully selected to provide you, the designer, with the greatest flexibility for applications requiring liquid level point monitoring.

With GEMS custom length level switches you have a wide variety of choices. Custom length units may be configured with a single station, or as many as seven (depending on series), in lengths from just a few inches to 10 feet. Mounting and float materials include PVC, polypropylene, Polysulfone, PVDF, brass, stainless steel and more.

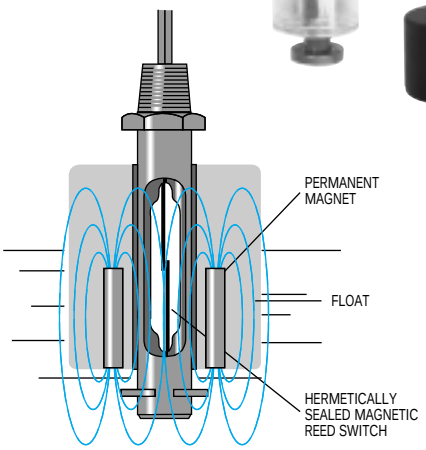
Unique Variations and Options

Need a level switch with an integrated syphon tube? Or, maybe a level switch that also provides continuous temperature output? You'll find both of these and other interesting designs inside this catalog. GEMS offers more unique "standard" variations, such as bent stems, specialized mountings and floats, or slosh shields because we've been designing and manufacturing liquid level sensors for over 40 years. Be sure to review the Accessories section for other options and system additions.

General Operating Principle

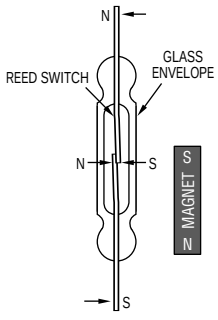
GEMS Level Switches operate on a direct, simple principle. In most models, a float encircling a stationary stem is equipped with powerful, permanent magnets. As the float rises or lowers with liquid level, the magnetic field generated from within the float actuates a hermetically sealed, magnetic reed 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 ±1/8 inch. Multi-station versions use a separate reed switch for each level point being monitored.

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



Reed Switch Reliability

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

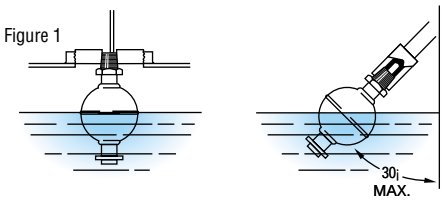


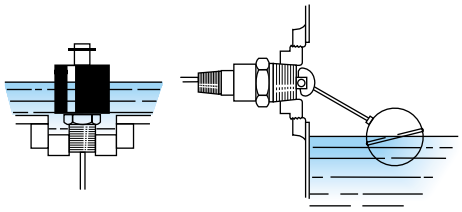
Installation and Maintenance

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.

Figure 1





Accuracy and Repeatability

The accuracy of GEMS level switches is ±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 will appear to be closed 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.

Figure 2

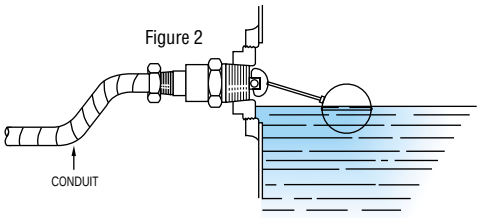
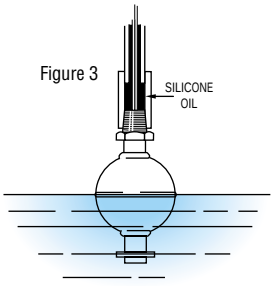


Figure 3



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 the GEMS Instruction Bulletins supplied with products for detailed installation and maintenance procedures.

Installation and Maintenance – Continued

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 (L_0).

	NPT							
	1/8″	1/4″	1/2″	3/4″	1″	1-1/4″	2″	3″
T Dim.	.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 L_0 value in place of L_1 in any of the formulas.

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.

L_1 = Switch actuation level, nominal, as measured from bottom of mounting (based on a liquid specific gravity of 1.0).

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″

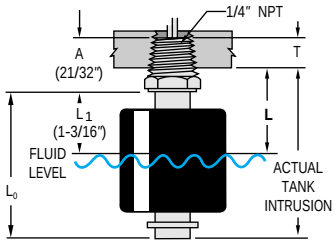
Externally Mounted - Configurable Length

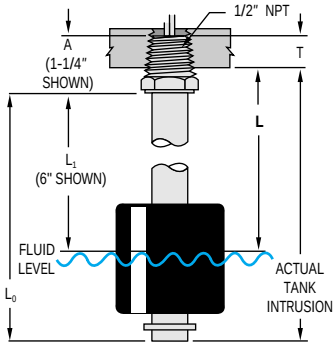
LS-700 Series (Type 3) externally mounted through a 1″ NPT hole. To calculate L dimension:

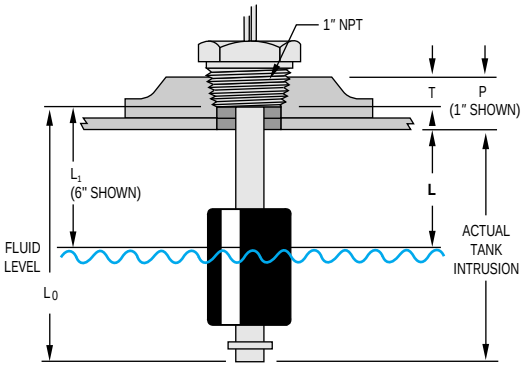
$L = L_1 - (P - T)$

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.

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, 20 VA or 50 VA as shown below.

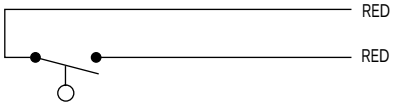
Switch Rating – Maximum Resistive Load

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 General Use	0-50	0.5	0.5
	120	.4	.4
	240	.2	.2
100*	120	.8**	N.A.
	240	.4	N.A.

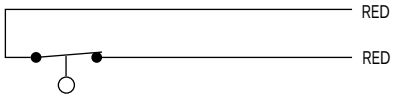
* Level switch units with 50 VA and 100 VA switches are not U.L. Recognized or CSA Approved.
** Limited to 50,000 operations.

Typical Wiring Diagrams

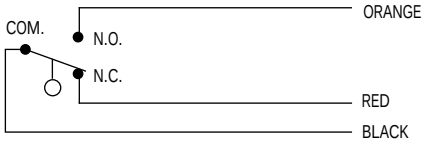
SPST, Normally Open - Dry



SPST, Normally Closed - Dry

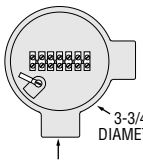
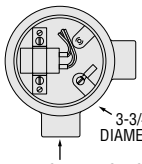
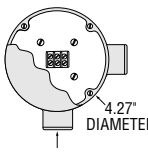


SPDT, Shown Dry



Explosion-Proofing and Intrinsic Safety

GEMS offers optional U.L. Approved, 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.

Non-Explosion Proof J-Boxes					
	Alloy			Plastic	
	 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.

For intrinsically-safe installations, nothing performs better than GEMS Zener Barriers and SAFE-PAK® Relays. These solid-state devices render the entire sensor circuit intrinsically-safe without explosion-proof enclosures. Latching version relays can control pump-up/pump-down operations. See Section N for more information.

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

Intrinsically-Safe Relays and Barriers

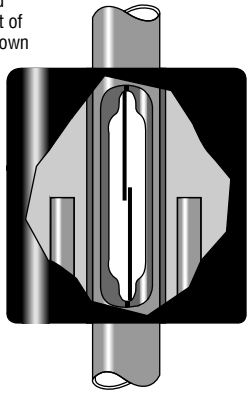
Reed Switch Protection

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 mislead by the wattage ratings of loads. Low wattage loads are often high inductive devices, making contact protection very important.

The dependable reed switch is at the heart of each level switch shown in this catalog.



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.

Figure 1
D.C. Contact Protection (Drain the Load)

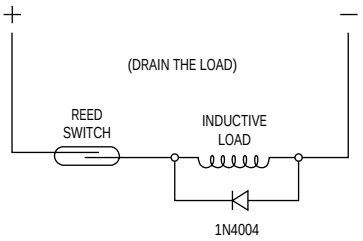
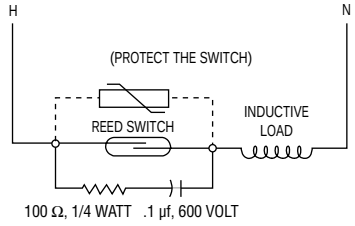


Figure 2
A.C. Contact Protection (Protect the Switch)



Notes:

1. Don't be misled by low voltage ≤10V, low current ≤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 volts Energy = 30-50 joules Peak Amps = 4000-6000