

# LIQUID LEVEL SWITCHES – Installation, Operation and Compatibility Guide

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To ensure the best performance from your equipment it is important that the attached liquid level switch is installed and maintained correctly.



This document provides an overview of SST Sensing's liquid level switches including mounting information, operating principle and fluid compatibility.

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## 1 DEFINITIONS

The following definitions apply to WARNINGS, CAUTIONS and NOTES used throughout this manual.



### **WARNING:**

The warning symbol is used to indicate instructions that, if they are not followed, can result in minor, serious or even fatal injuries to personnel.




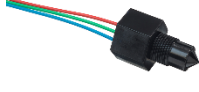




### **CAUTION:**

The caution symbol is used to indicate instructions that, if they are not followed, can result in damage to the equipment (hardware and/or software), or a system failure occurring.

**NOTE:** Highlights an essential operating procedure, condition or statement.

## 2 TECHNICAL SPECIFICATIONS

The following table summarises the key technical specifications. Refer to the appropriate datasheet for more in-depth information (see [REFERENCE DOCUMENTS](#)).

Switch	Voltage Range	Temperature Range	Output Current	Output Type	Output Logic
<b>Optomax Digital</b> 	4.5 to 15.4V <sub>DC</sub>	-25 to + 80°C or -40 to +125°C	Up to 100mA	Push Pull	High in Air Low in Air PWM
<b>Optomax Industrial</b> 	4.5 to 15.4V <sub>DC</sub> or 8 to 30 V <sub>DC</sub>	-25 to + 80°C or -40 to +125°C	Up to 1A	N-Type P-Type Push Pull	High in Air Low in Air
<b>Optomax Industrial Glass</b> 	4.5 to 15.4V <sub>DC</sub> or 8 to 30V <sub>DC</sub>	-40 to +125°C	Up to 1A	N-Type P-Type Push Pull	High in Air Low in Air
<b>LLHP</b> 	4.5 to 15.4V <sub>DC</sub> or 10 to 45V <sub>DC</sub>	-25 to + 80°C or -40 to +125°C	Up to 800mA	N-Type P-Type Push Pull	High in Air Low in Air
<b>LLHT</b> 	12 to 28V <sub>DC</sub>	-25 to 100°C or -40 to + 140°C	Up to 200mA	N-Type P-Type	High in Air Low in Air
<b>Optomax Basic<sup>a</sup></b> 	3.3 to 24V <sub>DC</sub>	-25 to + 80°C	4mA	Phototransistor output for customer to interface to their system	

**NOTE:** If you need a switch other than those listed above, contact [SST Sensing](#); we will be happy to discuss your requirements.

<sup>a</sup> Designed primarily for price sensitive, high volume OEM applications; power supply and microcontroller not supplied with this switch.

### 3 INSTALLATION

To ensure the best performance from your product, it must be installed correctly.

#### 3.1 General Guidelines

Optical liquid level switches should be mounted from the side or from the bottom for best results.

**NOTE:** Mounting from the top down is not normally advised as false readings can be caused by liquid droplets clinging to the sensing tip. However, if the liquid viscosity is low, then pointing downwards is often fine. Additionally, if the application is a high level alarm and its activation results in the machine shutdown for example, pointing downwards may be acceptable.

If you wish to mount in this position, contact [SST Sensing](#) to discuss the implications.

Avoid mounting positions where ambient light is likely to point directly at the sensing tip, as false readings can occur.

Switch performance can be affected by reflective surfaces in front of the sensing tip. Contact [SST Sensing](#) if you wish to use a switch within 10mm of a reflective surface (see **NOTE**).

**NOTE:** If you are installing an LLG switch, avoid reflective surfaces within 50mm of the sensing tip.

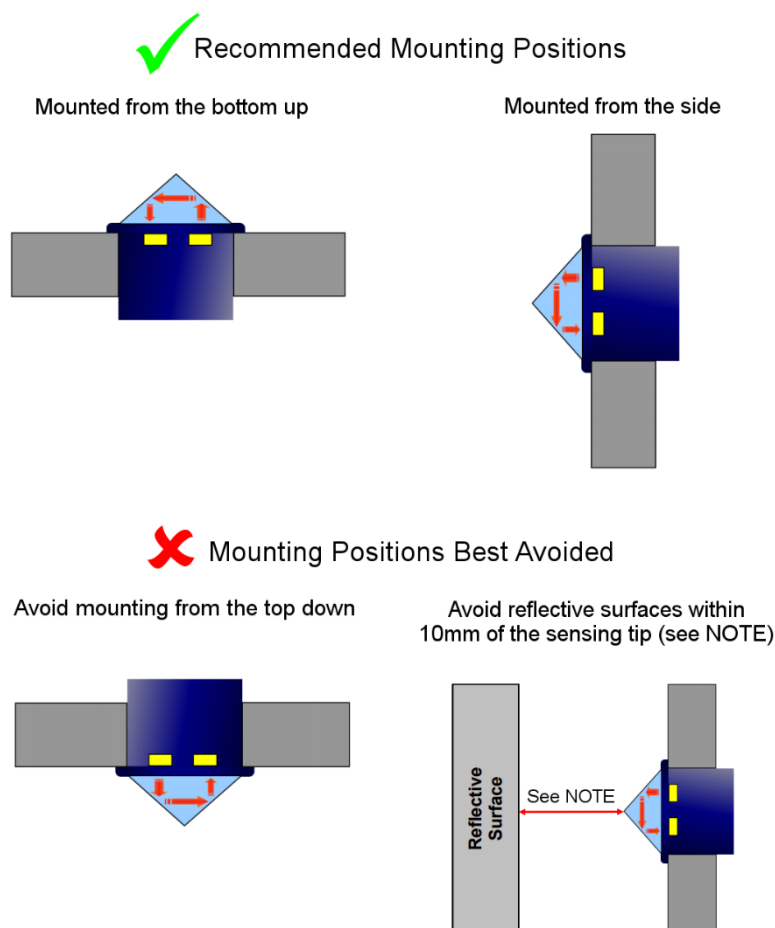


Figure 3-1 - Example Mounting Positions

## 3.2 Electrical Connections



### CAUTION:

- Do NOT immerse the wires in fluid, over time, this will result in irreparable damage to the switch.
- Take care when connecting loads. The minimum load impedance should not exceed  $V_s/\text{max output current}$ . Check the relevant datasheet BEFORE installation.
- Shorting the output to  $V_s$  or  $0V$  will result in irreparable damage to the switch.
- Do NOT install the switch suspended from the cable.
- Avoid exerting excessive tensile force on the cable (e.g. tugging).

The liquid level switch termination configuration varies depending on the range and selection ordered (refer to the specific datasheet for more detail); in general, connect as follows:

### Optomax Digital, Industrial and Glass Tip Ranges

- $V_s$  Red
- Output<sup>b</sup> Green
- $0V$  Blue

### LLHP Range<sup>c</sup>

- $V_s$  Red
- Output<sup>b</sup> Green or white
- $0V$  Blue or black

### LLHT Range<sup>c</sup>

- $V_s$  Brown
- Output<sup>b</sup> Black
- $0V$  Blue

### Optomax Basic Range

- 3-wire version
  - LED Anode Red
  - Output<sup>b</sup> Green
  - $0V$  Blue
- 4-wire version
  - LED Anode Red
  - Output<sup>b</sup> Green
  - $0V$  LED Blue
  - $0V$  Phototransistor Black

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<sup>b</sup> Refer to the datasheet for output logic details.

<sup>c</sup> Brad Harrison connector available as an alternative to the cable / flying lead options.

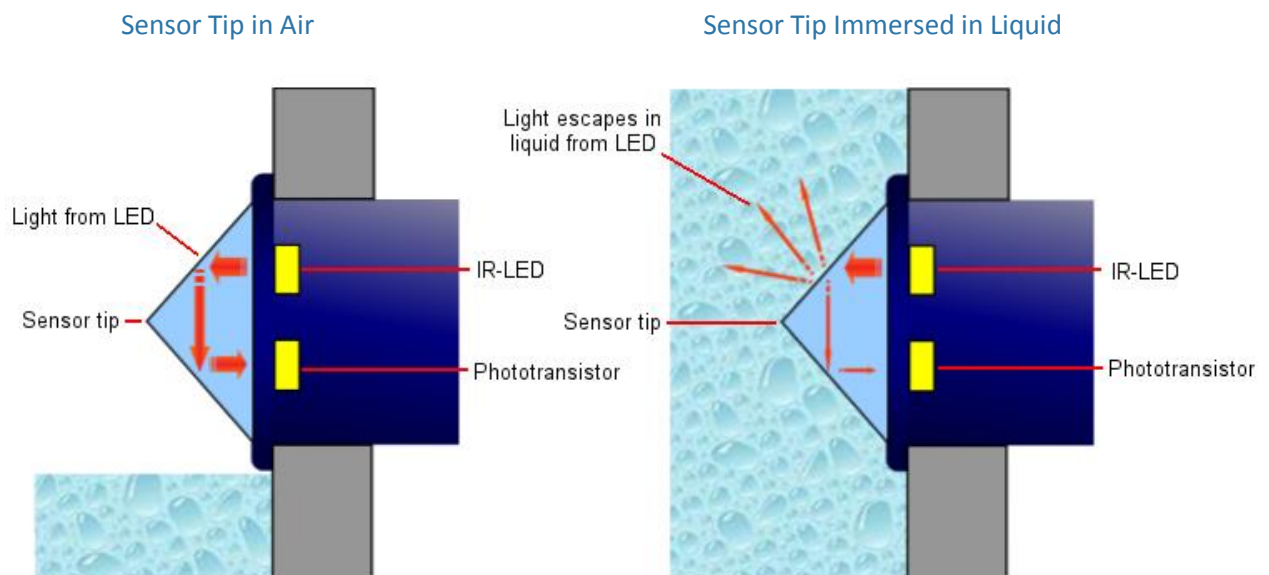
## 4 OPERATION

Optical liquid level switches do not measure the liquid level, instead they detect the presence or absence of liquid. For an overview of the switches refer to [AN-0061, Liquid Level Switches – Selection Guide](#), more detailed spec information is contained in the switch datasheets; refer to [REFERENCE DOCUMENTS](#) for details.

### 4.1 Operating Principle Overview

Optical liquid level switches use an infra-red LED and phototransistor accurately positioned at the base of the sensor tip.

When the tip is in air, infra-red light reflects internally round the tip to the phototransistor providing strong optical coupling between the two. When the sensor tip is immersed in liquid, the infra-red light escapes from the tip causing a reduction in the amount of light at the phototransistor which makes the output change state.



## 4.2 Fluid Compatibility Guide

The environment in which the liquid level switch is operating influences the life of the product. To ensure the switch does not fail prematurely, the following material/fluid compatibility should be noted:

### 4.2.1 Polysulfone

Whilst the following list may be used as a guide and gives common industrial fluids that are typically acceptable, we recommend that before use you check that the fluid you wish to use this device in is compatible with Polysulfone. Refer to [4.3 Test Process](#) on [page 4-4](#).

Acetic acid – Glacial	Glycerol
Acetic acid – 10%	Heptane
Ammonia – 88	Hydrochloric acid – 10%
Ammonium Hydroxide – 10%	Hydrochloric acid conc.
Ammonium Chloride – 10%	Hydrogen Peroxide
Aviation spirit	Isopropanol
Benzene	Iso-Octane
Benzoic acid	Kerosene
Bleach	Linseed oil
Brine	Magnesium Sulphate
Butane	Methanol
Calcium Nitrate	Motor oil
Calcium Hypochlorite	Nitric acid 10%
Carbon Tetrachloride	Oils - Vegetable
Chromic acid	Oxalic acid
Copper Sulphate	Petroleum Ether
Creosote	Potassium Hydroxide – 10%
Cyclohexane	Potassium Hydroxide – 50%
Cyclohexanol	Silicone fluids
Detergent solutions	Silver Nitrate
Diesel fuel	Soap solution
Diethylamine	Sodium Chloride
Diethyl Ether	Sodium Hydroxide – 10%
Diethyl Phthalate	Sodium Hydroxide – 50%
Edible fats & oils	Sulphuric acid – 10%
Ethanol – 50%	Transformer oil
Ethyl Alcohol	Turpentine
Ethylene Glycol	Varnish
Ferric Chloride	Water
Formaldehyde	White Spirit
Formic acid	



#### 4.2.2 Trogamid®

Whilst the following list may be used as a guide and gives common industrial fluids that are typically acceptable, we recommend that before use you check that the fluid you wish to use this device in is compatible with Trogamid® (EU food-contact grade). Refer to [4.3 Test Process](#) on [page 4-4](#).

Acetone	Methanol
Benzene	Mountain pine oil
Break Free (lubricating oil)	Petroleum ether
Carbon tetrachloride	Potassium hydroxide (25 w/w-%)
Econa PG32 (Hydraulic fluid)	Potassium hydroxide (50 w/w-%)
Ethanol	Premium gasoline
Ethyl acetate	1,2-propane diol
Eucalyptus oil	Regular gas
Formaldehyde solution	Test fuel (M15)
Glycerine (DAB6)	Toluene
Heating oil	Xylene
Isopropanol	

#### 4.2.3 Glass

Glass tipped switches are extremely robust to most chemicals however, chemicals which will attack glass, for example Hydrofluoric acid, are to be avoided. We recommend that before use you check that the fluid you wish to use this device in is compatible with glass. Refer to [4.3 Test Process](#) on [page 4-4](#).

### 4.3 Test Process

The chemical compatibility lists are not exhaustive and customers often want to use the switches with liquids that have not been approved before. In this case, a compatibility test should be performed using a sensor made with the material (Polysulfone, Trogamid®, glass or stainless steel) you wish to use.

The test is simple and is performed as follows:

1. Submerge the sensor tip and threads in the liquid of interest. Do NOT submerge the wires.
2. Heat the liquid to the maximum expected operating temperature.  
**CAUTION:** Assuming it is safe to do so.
3. Leave the switch in this liquid at the maximum operating temperature for two weeks.
4. Remove the switch and inspect it for signs of:
  - Cracking
  - Crumbling
  - crazing
  - Melting
  - Deformation
  - Swelling

Assuming the switch appears to be unaffected, it should be tested in accordance with its operating procedure to ensure it remains functional.

If the switch passes its functional tests, then the liquid can be considered to be compatible with the switch housing material.

## 5 MAINTENANCE

### 5.1 Cleaning

If cleaning of the tip is necessary (i.e., if there is a buildup of algae or other residue), clean the outer surfaces using alcohol based cleaning agents.

**CAUTION:** If your switch is Polysulfone or Trogamid®, do NOT use chlorinated solvents such as trichloroethane as these are likely to attack the switch material.

### 5.2 Disposal

Liquid level switches contain electrical components, for this reason they must be disposed of as electrical waste. Please observe your local regulations.

## REFERENCE DOCUMENTS

Refer also to the following documents for additional information:

Part Number	Title
<b>AN-0061</b>	Liquid Level Switches – Selection Guide
<b>DS-0031</b>	Liquid Level Switches – Optomax Basic Series – Datasheet
<b>DS-0032</b>	Liquid Level Switches – Optomax Digital Series – Datasheet
<b>DS-0034</b>	Liquid Level Switches – Optomax Industrial Series – Datasheet
<b>DS-0035</b>	Liquid Level Switches – LLHT Series – Datasheet
<b>DS-0037</b>	Liquid Level Switches – High Performance (HP) Series – Datasheet
<b>DS-0130</b>	Liquid Level Switches – Optomax Industrial Glass Series – Datasheet

### CAUTION

Do not exceed maximum ratings and ensure sensor(s) are operated in accordance with their requirements.  
Carefully follow all wiring instructions. Incorrect wiring can cause permanent damage to the device. SST Sensing Ltd recommend using alcohol based cleaning agents. If your switch is Polysulfone or Trogamid®, do NOT use chlorinated solvents such as trichloroethane as these are likely to attack the switch material.

**Failure to comply with these instructions may result in product damage.**

### INFORMATION

As customer applications are outside of SST Sensing Ltd.'s control, the information provided is given without legal responsibility. Customers should test under their own conditions to ensure that the equipment is suitable for their intended application. Before use, check that the fluid in which you wish to use these devices is compatible either with Polysulfone, Trogamid®, glass or stainless steel.

For technical assistance or advice, please email: [technical@sstsensing.com](mailto:technical@sstsensing.com)

**General Note:** SST Sensing Ltd. reserves the right to make changes to product specifications without notice or liability. All information is subject to SST Sensing Ltd.'s own data and considered accurate at time of going to print.

SST SENSING LIMITED, 5 HAGMILL CRESCENT, SHAWHEAD INDUSTRIAL ESTATE, COATBRIDGE, UK, ML5 4NS  
[www.sstsensing.com](http://www.sstsensing.com) | e: [sales@sstsensing.com](mailto:sales@sstsensing.com) | t: +44 (0)1236 459 020 | f: +44 (0)1236 459 026