LIQUID LEVEL SWITCHES – Installation, Operation and Compatibility Guide

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.

Contents

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.

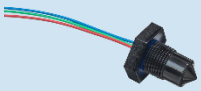
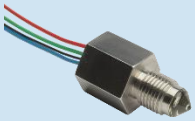
CAUTION:

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
Optomax Digital 	4.5 to 15.4V_{DC}	-25 to + 80°C or -40 to +125°C	Up to 100mA	Push Pull	High in Air Low in Air PWM
Optomax Industrial 	4.5 to 15.4V_{DC} or 8 to 30 V_{DC}	-25 to + 80°C or -40 to +125°C	Up to 1A	N-Type P-Type Push Pull	High in Air Low in Air
Optomax Industrial Glass 	4.5 to 15.4V_{DC} or 8 to 30V_{DC}	-40 to +125°C	Up to 1A	N-Type P-Type Push Pull	High in Air Low in Air
LLHP 	4.5 to 15.4V_{DC} or 10 to 45V_{DC}	-25 to + 80°C or -40 to +125°C	Up to 800mA	N-Type P-Type Push Pull	High in Air Low in Air
POS 	12 to 28V_{DC}	-25 to 100°C or -40 to + 140°C	Up to 200mA	N-Type P-Type	High in Air Low in Air
Optomax Basic[a] 	3.3 to 24V_{DC}	-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.

[a] 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 if 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.

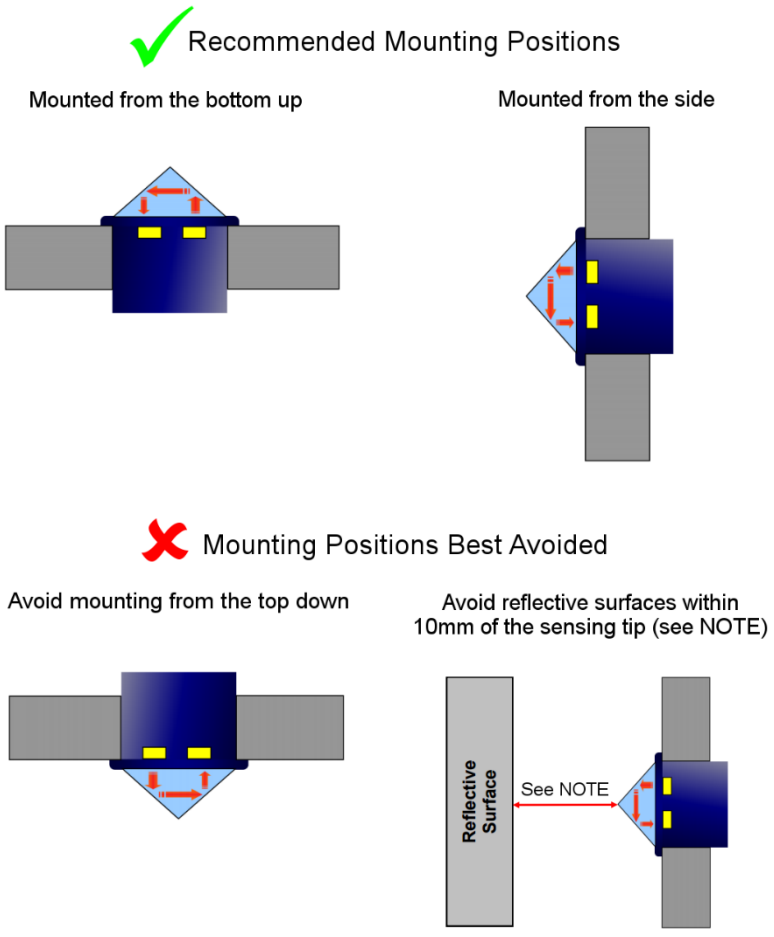


Figure 3-1 - Example Mounting Positions

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 Vs/max output current. Check the relevant datasheet BEFORE installation.
- Shorting the output to Vs 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

- Vs Red
- Output[b] Green
- 0V Blue

LLHP Range[c]

- Vs Red
- Output[b] Green or white
- 0V Blue or black

POS Range[c]

- Vs Brown
- Output[b] Black
- 0V Blue

Optomax Basic Range

- 3-wire version
  - LED Anode Red
  - Output[b] Green
  - 0V Blue
- 4-wire version
  - LED Anode Red
  - Output[b] Green
  - 0V LED Blue
  - 0V Phototransistor Black

[b] Refer to the datasheet for output logic details.
[c] Brad Harrison connector available as an alternative to the cable / flying lead options.

4 OPERATION

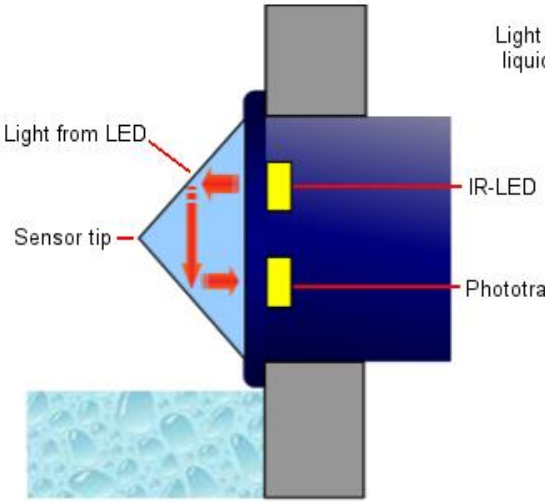
Optical liquid level switches do not measure the liquid level, instead they detect the presence or absence of liquid. For an overview of the switches refer to *AN-0061, Liquid Level Switches – Selection Guide*, more detailed spec information is contained in the switch datasheets; refer to REFERENCE DOCUMENTS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

4.1 Operating Principle Overview

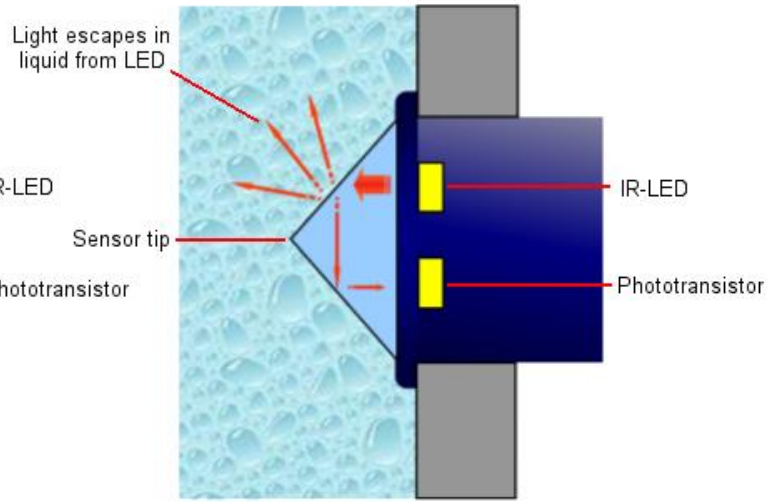
Optical liquid level switches use an infra-red LED and phototransistor accurately positioned at the base of the sensor tip.

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.

Sensor Tip in Air



Sensor Tip Immersed in Liquid



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

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

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 reside), clean the outer surfaces using alcohol based cleaning agents.

CAUTION: If your switch is Polysulfone or Trogamid®, do NOT use chlorinated solvents such as tricholoroethane 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
AN-0061	Liquid Level Switches – Selection Guide
DS-0031	Liquid Level Switches – Optomax Basic Series – Datasheet
DS-0032	Liquid Level Switches – Optomax Digital Series – Datasheet
DS-0034	Liquid Level Switches – Optomax Industrial Series – Datasheet
DS-0035	Liquid Level Switches – POS Series – Datasheet
DS-0037	Liquid Level Switches – High Performance (HP) Series – Datasheet
DS-0130	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

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