LIQUID LEVEL SWITCHES – Selection Guide

This document provides an overview of liquid level switches; you will find information regarding important features such as housing and thread types, dimensions, working voltages and best suited applications of particular switch types.

NOTE: This document is not intended to replace the product datasheets which are referenced within.
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1 THINGS TO CONSIDER

Optical liquid level switches do not measure the liquid level, instead they detect the presence or absence of liquid.

There are a number of things to consider when choosing a liquid level switch:

**Mounting position;** where the switch is to be mounted can narrow the selection field, for example, is space a restrictive factor?

**Application;** where the switch is to be used can narrow the selection field:
- Food or beverage application?
- Medical or chemical handling?

**Environmental factors;** the environment in which your switch will be working has a direct bearing on the material type you should select. Fluid type and temperature are key factors; for example, is the liquid corrosive; high or low temperature?

IBA offers three housing material options depending on switch type; Polysulfone, Trogamid® (EU food-contact grade) or stainless steel.

Again, depending on switch type, IBA offers three tip material options; Polysulfone, Trogamid® (EU food-contact grade) or glass.

**NOTE:** If you need a switch other than those listed in this document, contact IBA-Sensorik; we will be happy to discuss your requirements.

Refer to **AN-0041, Liquid Level Switches – Installation, Operation and Compatibility Guide** for a list of compatible fluids. These lists are not exhaustive, IBA recommends testing a sample sensor in the fluid you intend operating in, refer to **AN-0041** for details of the test procedure.

**NOTE:** Typical applications are listed throughout this document; they are given as examples only; they are NOT the only applications in which the switches operate. Contact IBA-Sensorik if you require assistance identifying the most suitable switch to suit your needs.
2  SWITCH TYPES

There are six switch ranges within the liquid level family; Optomax Digital, Optomax Industrial, Optomax Industrial Glass, LLHP, POS and Optomax Basic. The following gives a brief overview of the switch, refer to 3 SPECIFICATIONS starting on page 3-1 for further details:

2.1 Digital Range
Operating voltage: 4.5V to 15.4V<sub>DC</sub>

Operating temperature range: -25°C to + 80°C or -40°C to +125°C

Typical applications: Best suited for low power signalling of liquid presence/absence.

2.2 Industrial Range
Operating voltage: 4.5V to 15.4V<sub>DC</sub> or 8V to 30V<sub>DC</sub>

Operating temperature range: -25°C to + 80°C or -40°C to +125°C

Typical applications: Designed where high power signalling of liquid presence/absence is required, or, operation at higher (industrial) voltages. Industrial range switches are capable of driving high power loads, and are able to (depending on output type) sink/source up to 1A.

2.3 Industrial Glass Range
Operating voltage: 4.5V to 15.4V<sub>DC</sub> or 8V to 30V<sub>DC</sub>

Operating temperature range: -40°C to +125°C

Typical applications: All the technical capabilities of the Optomax Industrial Range with the added benefits of a stainless steel housing and glass sensing tip, allowing the sensor to be used in harsh chemical environments.
2.4 HP (High Performance) Range

**Operating voltage:** 4.5V to 15.4V\(_{dc}\) or 10V to 45V\(_{dc}\)

**Operating temperature range:** -25°C to +80°C or -40°C to +125°C

**Typical applications:** Comes in a rugged metal housing, designed for aggressive environments. Capable of withstanding high and low temperatures and with options for high switching currents. They have multiple output configurations and several thread types available, or, if required can be supplied with a custom thread type.

2.5 POS Range

**Operating voltage:** 12V to 28V\(_{dc}\)

**Operating temperature range:** -25°C to 100°C or -40°C to +140°C

**Typical applications:** With its stainless steel housing and Simax crystal glass sensing tip, the POS range is ideally suited for use in harsh chemical environments.

2.6 Basic Range

**Operating voltage:** 3.3V to 24V\(_{dc}\)

**Operating temperature range:** -25°C to +80°C

**Typical applications:** Designed primarily with price sensitive high volume OEM applications in mind, for example white goods, vending machines, and automotive applications. Requires a clean, protected, and stable power supply and an available microcontroller, or other circuit, to determine whether the sensor is in air or liquid based on its analogue output voltage.

**NOTE:** Power supply and microcontroller not supplied with the switch.
3 SPECIFICATIONS

The following section provides high-level switch specifications; for full details, refer to the product datasheet (see REFERENCE DOCUMENTS for details).

3.1 Digital Range

For full specification details, refer to the datasheet.

3.1.1 Mounting and Housing Types

<table>
<thead>
<tr>
<th>Housing Series</th>
<th>5x0 Series</th>
<th>2x0 Series</th>
<th>6x0 Series</th>
<th>7x0 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M10x1</td>
<td>M12x1x8g with hex nut&lt;sup&gt;a&lt;/sup&gt;</td>
<td>½” SAE with O-ring&lt;sup&gt;a&lt;/sup&gt;</td>
<td>¼” NPT</td>
</tr>
<tr>
<td>Tightening Torque</td>
<td>1.5 Nm / 13.26 in-lbs maximum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure&lt;sup&gt;b&lt;/sup&gt;</td>
<td>20 bar / 290 psi maximum</td>
<td>7 bar / 101 psi maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting Hole</td>
<td>Ø10mm</td>
<td>Ø12mm</td>
<td>Ø1/2 inch</td>
<td>Ø1/4 inch NPT threaded</td>
</tr>
<tr>
<td>Housing Material</td>
<td>Polysulfone or Trogamid&lt;sup&gt;®&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Termination</td>
<td>24AWG, 250 mm PTFE wires, 8 mm tinned</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.1.2 Product Dimensions

![Product Dimensions](image)

Figure 3-1 Product Dimensions – Digital Range

<sup>a</sup> Hex nut and O-ring sold separately.
<sup>b</sup> When correctly sealed.
3.1.3 Circuit Diagrams

Digital Output High in Air

Digital Output Low in Air

Figure 3-2 Circuit Diagrams - Digital Range
3.2  Industrial Range
For full specification details, refer to the datasheet.

3.2.1  Mounting and Housing Types

<table>
<thead>
<tr>
<th>Housing Series</th>
<th>2x0 Series</th>
<th>6x0 Series</th>
<th>7x0 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M12x1x8g with hex nut&lt;sup&gt;c&lt;/sup&gt;</td>
<td>½” SAE with O-ring&lt;sup&gt;c&lt;/sup&gt;</td>
<td>¼” NPT</td>
</tr>
<tr>
<td>Tightening Torque</td>
<td>1.5 Nm / 13.26 in-lbs maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td>7 bar / 101 psi maximum</td>
<td></td>
</tr>
<tr>
<td>Mounting Hole</td>
<td>Ø12mm</td>
<td>Ø1/2 inch</td>
<td>Ø1/4 inch NPT threaded</td>
</tr>
<tr>
<td>Housing Material</td>
<td>Polysulfone or Trogamid®</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Termination</td>
<td>20AWG, 250 mm PTFE wires, 8 mm tinned</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.2.2  Product Dimensions

**2x0 Series**

**6x0 Series**

**7x0 Series**

Figure 3-3 Product Dimensions – Industrial Range

<sup>c</sup> Hex nut and O-ring sold separately.
<sup>d</sup> When correctly sealed.
3.2.3  Circuit Diagrams

N-Type with Flyback Protection Diode
High in Air

N-Type with Flyback Protection Diode
Low in Air

N-Type with Internal 10kΩ Pull-Up Resistor
High in Air

N-Type with Internal 10kΩ Pull-Up Resistor
Low in Air

N-Type High in Air

N-Type Low in Air

P-Type High in Air

P-Type Low in Air

N&P-Type Push Pull High in Air

N&P-Type Push Pull Low in Air

Figure 3-4 Circuit Diagrams - Industrial Range
3.3 Industrial Glass Range
For full specification details, refer to the datasheet.

3.3.1 Mounting and Housing Types

<table>
<thead>
<tr>
<th>Housing Series</th>
<th>G2x0 Series</th>
<th>G6x0 Series</th>
<th>G7x0 Series</th>
<th>G8x0 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M12x1x8g with hex nut&lt;sup&gt;e&lt;/sup&gt;</td>
<td>¾” SAE with O-ring&lt;sup&gt;e&lt;/sup&gt;</td>
<td>¾” NPT</td>
<td>½” NPT</td>
</tr>
<tr>
<td>Tightening Torque&lt;sup&gt;f&lt;/sup&gt;</td>
<td></td>
<td>3 Nm / 26.5 in-lbs maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure&lt;sup&gt;g&lt;/sup&gt;</td>
<td>100 bar / 1450 psi maximum</td>
<td></td>
<td>600 bar / 8702 psi max.</td>
<td></td>
</tr>
<tr>
<td>Housing Material</td>
<td>Stainless steel housing with glass tip</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Termination</td>
<td>20AWG, 250 mm PTFE wires, 8 mm tinned</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.3.2 Product Dimensions

![Figure 3-5 Product Dimensions – Industrial Glass Range](image)

<sup>e</sup> Hex nut and O-ring sold separately.

<sup>f</sup> Do NOT over-tighten as this can permanently damage the sensor.

<sup>g</sup> When correctly sealed.
3.3.3 Circuit Diagrams

Figure 3-6 Circuit Diagrams – Industrial Glass Range
3.4 HP (High Performance) Range
For full specification details, refer to the datasheet.

3.4.1 Mounting and Housing Types

<table>
<thead>
<tr>
<th>Housing Series</th>
<th>2 Series</th>
<th>5 Series</th>
<th>8 Series</th>
<th>B Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>½” BSP</td>
<td>3/8” BSP</td>
<td>½” NPT</td>
<td>¾” – 16 UNJF</td>
</tr>
<tr>
<td>Pressure</td>
<td></td>
<td></td>
<td></td>
<td>25 bar / 363 psi maximum</td>
</tr>
<tr>
<td>Housing Material</td>
<td></td>
<td></td>
<td>Stainless steel housing with Polysulfone tip</td>
<td></td>
</tr>
<tr>
<td>Termination</td>
<td>Various; refer to datasheet for details</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.4.2 Product Dimensions

![Product Dimensions Diagram](image)

Figure 3-7 Product Dimensions – 921HP Range

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h When correctly sealed.
3.4.3 Circuit Diagrams

4.5V – 15.4V\textsubscript{DC}

Digital Output High in Air

Digital Output Low in Air

Figure 3-8 Circuit Diagrams - 921HP Range; 4.5V – 15.4V\textsubscript{DC}

10V – 45V\textsubscript{DC}

N-Type High in Air

N-Type Low in Air

P-Type High in Air

P-Type Low in Air

Push Pull High in Air

Push Pull Low in Air

Figure 3-9 Circuit Diagrams - 921HP Range; 10V – 45V\textsubscript{DC}
3.5 POS Range
For full specification details, refer to the datasheet.

3.5.1 Mounting and Housing Types

<table>
<thead>
<tr>
<th>Housing Series</th>
<th>POS187</th>
<th>POS287</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>G1/2” (1/2” BSPP)</td>
<td></td>
</tr>
<tr>
<td>Pressure¹</td>
<td>80 bar / 1160 psi maximum</td>
<td></td>
</tr>
<tr>
<td>Housing Material</td>
<td>Stainless steel housing with Simax crystal tip</td>
<td></td>
</tr>
<tr>
<td>Termination</td>
<td>Cable; PUR 3x0.25mm², 2m long (IP68)</td>
<td>M12x1 Brad Harrison micro (IP67)</td>
</tr>
</tbody>
</table>

3.5.2 Product Dimensions

Figure 3-10 Product Dimensions – POS Range

¹ When correctly sealed.
3.5.3 Circuit Diagrams

Figure 3-11 Circuit Diagrams - POS Range
3.6 Basic Range
For full specification details, refer to the datasheet.

3.6.1 Mounting and Housing Types

<table>
<thead>
<tr>
<th>Housing Series</th>
<th>500 Series</th>
<th>200 Series</th>
<th>600 Series</th>
<th>700 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M10x1</td>
<td>M12x1x8g with hex nut(^1)</td>
<td>½” SAE with O-ring(^1)</td>
<td>¼” NPT</td>
</tr>
<tr>
<td>Tightening Torque</td>
<td>1.5 Nm / 13.26 in-lbs maximum</td>
<td>7 bar / 101 bar maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure(^a)</td>
<td>20 bar / 290 psi maximum</td>
<td>7 bar / 101 bar maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting Hole</td>
<td>Ø10mm</td>
<td>Ø12mm</td>
<td>Ø1/2 inch</td>
<td>Ø1/4 inch NPT threaded</td>
</tr>
<tr>
<td>Housing Material</td>
<td>Polysulfone or Trogamid®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Termination</td>
<td>24AWG, 250 mm PTFE wires, 8 mm tinned</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.6.2 Product Dimensions

![Product Dimensions](image)

\(^1\) Hex nut and O-ring sold separately.
\(^a\) When correctly sealed.
3.6.3 Circuit Diagrams
Three and four wire options are available. Refer to the datasheet for details on $R_{LED}$ and $R_{PULL-UP}$ resistor calculations.

![3-wire version](image1)

![4-wire version](image2)

**NOTE:** The 4-wire version provides galvanic isolation between input (IR-LED) and output (phototransistor).
# APPENDIX A – SWITCH QUICK COMPARISON TABLE

The following table provides a quick comparison of the switch’s key attributes:

<table>
<thead>
<tr>
<th>Part Number Convention</th>
<th>X601X02XX</th>
<th>HSX010XXT26</th>
<th>XXX-XXXEG00XXT26</th>
<th>XXX-XXXEG019XXT26</th>
<th>92121XXT26</th>
<th>92121HHXXT26</th>
<th>POS87X0XX-XXX</th>
<th>X805X126</th>
<th>HSM000XXT26</th>
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</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
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<td></td>
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<td></td>
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</tr>
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<td>Industrial Glass</td>
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<td>POS</td>
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<td></td>
<td>✓</td>
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<tr>
<td><strong>Housing Material</strong></td>
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<td></td>
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<td>Trogamid®</td>
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<td>¾&quot; NPT</td>
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</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>¾”-16 UNJF</td>
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<td></td>
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<td><strong>Operating Temp.</strong></td>
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<td>-25 °C to +80 °C</td>
<td>✓</td>
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<td>✓</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>-40 °C to +125 °C</td>
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<td></td>
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<td>-40 °C to +140 °C</td>
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<td>✓</td>
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<tr>
<td><strong>Supply Voltage</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4.5 to 15.4V</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td></td>
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<td></td>
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<tr>
<td>12 to 28V</td>
<td>✓</td>
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<td></td>
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<td></td>
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<td>8 to 30V</td>
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<td>10 to 45V</td>
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<td>Phototransistorмо</td>
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<tr>
<td>Push Pull</td>
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<tr>
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<tr>
<td>N-Type</td>
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<td>N-Type (10Ω pull-up)</td>
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</table>

**Key:** ✓: Standard | ✓: Customer provides

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1. Any with suitable LED current limiting resistor.

мо Phototransistor open collector. Refer to circuit diagrams on page 3-12.