

Application Note Liquid Flow Sensors Sensor Selection Guide

While all of Sensirion's liquid flow sensors are based on our unique CMOSens® technology, the broad product portfolio ranges from stand-alone flow sensors to highly integratable manifold mount components and even single-use sensors. This guide aims to assist you in selecting the best fit for your application.

The decision for the right sensor is typically driven by the target flow rates and electrical interfaces, as well as special use case requirements, like e.g. a need for IPxx ingress protection. Further selection criteria include the required pressure resistance and chemical compatibility with the relevant fluids.

	Model	Wetted materials	Electrical interface	IPxx protection	Pressure	Flow range (H ₂ O) and Full Scale Flow Rate										
						nL/min	µl/min			ml/min						
						100	1	10	100	1	10		100			
Stand alone	SLG*	Fused silica, Titanium, PEEK	M8 connector for SCC1 sensor cables. 0–10 V, 4–20 mA, RS485, USB, I ² C	Yes	500–1200 bar	SLG-0150		8 µl/min								
	SLI*	Glass, PEEK, FEP			12–50 bar	SLI-0430		80 µl/min		SLI-1000		1 ml/min				
										SLI-2000		10 ml/min				
	SLS*	Stainless steel, PEEK, PTFE			12 bar							SLS-1500		40 ml/min		
	SLQ*	Quartz, PFA			12 bar							SLQ-QT500	120 ml/min			
OEM	LG16	Glass, PEEK, FEP	Standard connector, I ² C	No	12–100 bar	LG16-0150D		7 µl/min		LG16-0430D		80 µl/min				
							LG16-1000D		1 ml/min		LG16-2000D		10 ml/min			
	LS32	Stainless steel, PEEK, PTFE			12 bar							LS32-1500		40 ml/min		
	SLF3x*	Stainless steel, PPS, Epoxy			12 bar			SLF3S-0600F		2000 µl/min		SLF3S-1300F		40 ml/min		
	LPG10	Glass	Contact pads, I ² C		3 bar			LPG10-1000		1 ml/min						
Single use	LD20	PEI, LCP, Epoxy	Contact pads, I ² C	No	3 bar			LD20-0600L		333 µl/min						
										LD20-2600B		16.7 ml/min				

*Flow Sensor Kit or Evaluation Kit available on distribution

Figure 1: Sensors and their H₂O flow rates. For information on available IPA calibrations please consult the respective datasheets of the SLI, SLQ, LG16, and SLF3x liquid flow sensors.

1 Selection Process

The chapter below guides you through the necessary steps to identify the right sensor for your application and your current development stage. The relevant criteria are flow rates, electrical interface and form factor. Following the identification of the right sensor(s), compatibility checks regarding pressures and material compatibility have to be made.

1.1 Step 1: Flow Rates

Sensirion's liquid flow sensors are calibrated up to a certain full scale flow rate and kits with full scale flow rates between 8 µl/min and 120 ml/min are available. Owing to the microthermal measurement principle, Sensirion's liquid flow sensors have excellent turn down ratios and offer exceptional performance below and up to the full scale flow rate. When using pulsating flow sources, your absolute peak flow rate should sit below the full scale flow rate of the sensor of choice. We consider the absolute peak flow rate to be the highest peak in your typical flow profile. A peristaltic pump set to a flow rate of 800 µl/min, for example, will produce significantly higher peak flow rates to achieve the average flow rate of 800 µl/min.

Example: Your application requires the measurement of aqueous solutions at 250-800 µl/min. Using Figure 1, you identify the SLI-1000, LG16-1000D and the LPG10-1000 as possible candidates. The following chapters will help in choosing the correct sensor.

1.2 Step 2: Interface and Sensor Form Factor

Sensirion's liquid flow sensors can be grouped into several categories. The categories mainly differ with regard to the electrical interface, form factor, and the resulting characteristics.

1.2.1 Stand-alone Liquid Flow Sensors

Stand-alone flow sensors offer IPxx protection against dust and water ingress. They feature a standard circular 4-pin M8 electrical connector and have been designed for use with the SCC1 sensor interface cables. By combining the flow sensor with the suitable SCC1 cable, a 0 - 10 V analog voltage, 4 - 20 mA current loop, RS485, or USB interface is available. With their rugged design, the stand-alone flow sensors are ideally suited for industrial applications, laboratory setups and testing.

All stand-alone flow sensors are also available in a Flow Meter Kit, which contains the selected flow sensor, the USB and 0-10 V interface cables, a set of fluidic fittings, instructions for use, as well as a viewer and logging software.

1.2.2 OEM Sensors

OEM flow sensors are designed to be installed as an integral system component, inside an instrument. They offer reduced protection and a simpler electrical connection at the benefit of smaller size and reduced cost. Sensirion's OEM liquid flow sensors come with the digital I2C interface.

1.2.3 Single Use Sensors

Single use sensors are designed for high quantity applications with drastically reduced costs in mind. While still offering all the benefits and performance of CMOSens® technology but with a limited sensor lifetime, the simplified mechanical design and electrical connection enables cost-effective single use applications.

Example: You would like to integrate the sensor in a production line tool to monitor dispenses using analog readout. The SLI-1000 is therefore your sensor of choice. The IPxx protected housing means that minor spills are no issue and the solid M8-cable connection to our analog interface cable is ideally suited for this industrial use case.

1.3 Step 3: Pressures

Kits are available for sensors with maximum pressure ratings between 12 bar and 500 bar, with individual portfolio sensors reaching 1200 bar. Please make sure that the sensor capillary is never subjected to pressures beyond their maximum pressure rating, see the respective datasheets for details.

Example: In your application, the maximum pressure is 6 bar. You check the SLI-1000 sensor datasheet and notice that the maximum operating pressure is 15 bar. Therefore, the SLI-1000 fits for your application regarding the pressure resistance.

1.4 Step 4: Chemical Compatibility

While the sensing element is never in direct contact with the measured liquid, some chemical restrictions may arise from the wetted materials (fittings, seals and capillaries). Please see the datasheet of the sensor you have chosen for a list of the wetted materials and ensure their compatibility with your application.

Example: Again, in the SLI-1000 datasheet, you check the wetted materials: Borosilicate glass, PEEK, and FEP. None of the materials are expected to give issues with the aqueous solutions you intend to use in your application. So the SLI-1000 looks like the ideal candidate for your application.

2 Start Testing

Flow Meter Kit and/or Evaluation Kits:

To allow for straightforward testing and evaluation of our sensors, Flow Meter Kits or Evaluation Kits are available. The kits typically include a sensor, interface cable(s) and software to get you started. Some kits include fitting materials as well.



If your sensor of choice does not have a kit available, choosing the Flow Meter Kit for the stand-alone flow sensor covering the same flow range (as marked in Fig. 1) will provide an excellent test vehicle to test the performance of our sensor technology in your application.

Example: You have identified the SLI-1000 sensor as the ideal candidate for your application. In order to test it, you purchase an SLI-1000 Flow Meter Kit from one of our distribution partners:

<https://www.sensirion.com/en/about-us/company/distributors/>

3 Further information

Calibration

All our sensor families are available with calibrations for water. Some sensors are available with additional or alternative calibrations, typically for isopropyl alcohol (2-propanol, IPA). This calibration will yield more accurate results and better linearity if the main liquid components of your application are hydrocarbons such as oils, organic solvents or the like. Note that the flow ranges for water and IPA on a specific sensor may be different. See the sensor's datasheet for further details.

Customized Solutions

Many applications will be successful with our standard products and will benefit from the economies of scale of these. Some applications however require customized solutions, where the characteristics listed in Fig. 1 above give an indication of the possible degrees of freedom. Contact Sensirion for details.

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