

SLS-1500 Liquid Flow Meter

Compact Flow Meter for Industrial Applications

- Liquid flow rates up to 40 ml/min
- 20 ms response time
- High chemical compatibility
- Modular electrical interface



Product Summary

The SLS-1500 liquid flow meter enables precise, non-invasive measurements of dynamic liquid flow rates up to 40 ml/min bi-directionally. Excellent biocompatibility is ensured by the exclusive use of high-performance stainless steel, PTFE and PEEK for the wetted parts. The flow path of the SLS-1500 liquid flow sensor is formed by an especially thin-walled, straight tube which assures excellent sensitivity.

Interface Options

- | | |
|----------------|------------------------------|
| Digital | Analog |
| - I2C-Bus | - Voltage output (0-10 V) |
| - RS485-Bus | - Additional operation modes |
| - USB Cable | |

For more information on communication, please refer to page 2 of this document.

1 Sensing Performance

Table 1: Performance of SLS-1500 (all data for medium H₂O, 23°C, 1 bar_{abs} unless otherwise noted)

Parameter	SLS-1500	Unit
Full scale flow rate	40	ml/min
Sensor output limit ^a	65	ml/min
Accuracy ^b (whichever error is larger)	5 0.25	% of measured value % of full scale
Repeatability ^b (whichever error is larger)	0.5 0.025	% of measured value % of full scale
Temperature coefficient (additional error per °C; whichever is larger)	0.25 0.00625	% measured value / °C % full scale / °C
Mounting orientation sensitivity ^c	<0.1	% of full scale
Flow detection response time τ_{63}	20	ms
Response time on power-up	25	ms
Operating temperature	+5...+50 (+41...+122)	°C (°F)
Ambient storage temperature ^d	-10...+60 (+14...+140)	°C (°F)
Recommended maximum operating pressure	12 (175)	bar (psi)
Burst pressure	25 (360)	bar (psi)

^aFlow rate at which the sensor output saturates, see section 2 for performance specification between full scale and saturation point.

^bAccuracy respectively repeatability below ± 20 ml/min. See the charts in section 2 for the accuracy respectively repeatability specifications between ± 20 ml/min and full scale.

^cMaximum additional offset when flow channel is vertical.

^dNon-condensing, flow path empty.

2 Specifications Charts

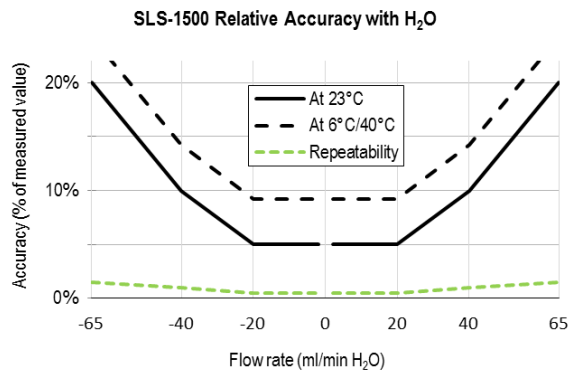


Figure 1: Sensor accuracy and repeatability (% of measured value) across the sensor's flow range

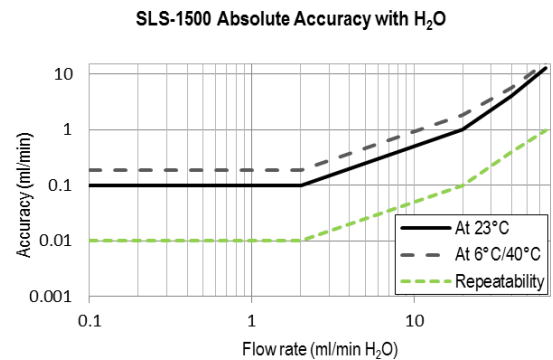


Figure 2: Sensor accuracy and repeatability (ml/min) across the sensor's flow range

3 Communication with the Liquid Flow Meter

The SLS-1500 flow meter shows bidirectional, linear transfer characteristics. The product comes fully calibrated for water.

Digital sampling time at 16 bit resolution: 74 ms
Digital sampling time at 9 bit resolution: 1 ms

3.1 Electrical Specifications

This section describes electrical specifications when connecting directly to the sensor's M8 connector for I²C communication. The preferred mode of communication is via the SCC1 interface cables. See the respective SCC1 datasheets for further details.

Table 2: DC characteristics

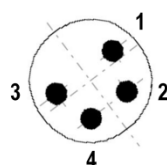
Parameter	Conditions	Min.	Typ.	Max.	Unit
Power supply DC, VDD		4.0	5.0	6.0	V
Operating current	VDD = 4.0 - 5.5 V		5.1		mA

3.2 Electrical Connector and Sensor Pinout

The flow meter is equipped with a male connector type M8, 4-pin, threaded lock according to IEC 61076-2-101 (Ed. 1)/ IEC 60947-5-2, and is compatible with Sensirion's SCC1 interface cables.

Table 3: Electrical pinout

Pin	
1	SDA (data)
2	GND
3	VDD
4	SCL (clock)



3.3 Digital Communication via RS485-Bus

The SCC1-RS485 Sensor Cable for liquid flow meters provides communication via RS485 interface for use in a demanding industrial automation environment. In addition to the standard commands available in the I²C interface of the flow meter, the incorporated microcontroller of the cable provides more complex logic such as a dispense volume totalizer, automatic dispense detection, automatic heater control and data buffer for asynchronous readout.

For further information please see the SCC1-RS485 Sensor Cable datasheet, available on www.sensirion.com/liquidflow-download.

3.4 Analog Communication

The SCC1-ANALOG Sensor Cable allows simple and quick readout of Sensirion's liquid flow meters by converting the digital flow meter reading to a 0...10 V analog voltage output. Additionally, a digital (high/low) output with two different modes of operation is available (Flow Switch / Volume Counter).

For further information please see the SCC1-ANALOG Sensor Cable datasheet, available on www.sensirion.com/liquidflow-download.

3.5 Communication via USB cable

The Sensirion SCC1-USB Sensor Cable provides an easy-to-use USB interface for laboratory and desktop use.

For further information please see the SCC1-USB Sensor Cable datasheet, available on www.sensirion.com/liquidflow-download.

3.6 Digital Communication via I²C-Bus

The SLS-1500 liquid flow meter has been designed for use with the SCC1 interface cables. For special applications, direct communication with the flow meter via the standard I²C-interface is possible. The physical interface consists of two bus lines, a data line (SDA) and a clock line (SCL) which need to be connected via pull-up resistors to the bus voltage of

the system. By default, the I²C address is set to 64 (hexadecimal: 40, binary: 1000000).

These lines can be used on 3.3 V or 5.0 V levels with a recommended clock frequency of 100 kHz. For the detailed specifications of this I²C communication, please refer to specific I²C Application Notes from Sensirion.

4 Fluidic Connection

Table 3: Fluidic Specifications and Pressure Rating

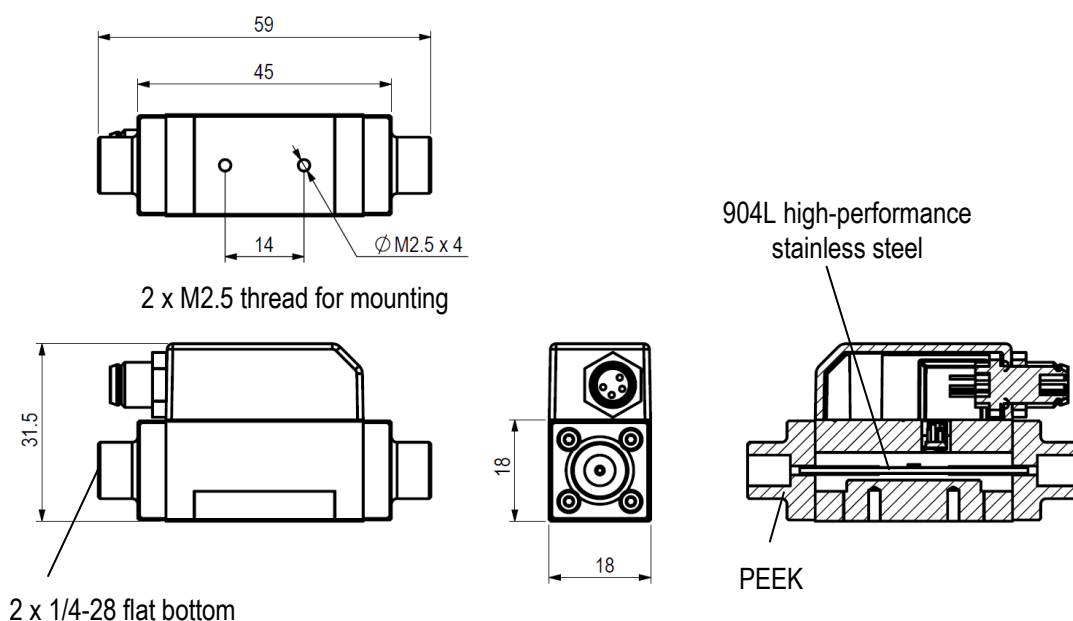
Parameter	SLS-1500
Wetted materials:	
<ul style="list-style-type: none"> Internal sensor tube material 	904L high-performance stainless steel
<ul style="list-style-type: none"> Fitting material 	PEEK
<ul style="list-style-type: none"> Sealing material 	PTFE
Fluid connector ports (fittings)	1/4-28 flat bottom 1/8" OD tubing (recommended: min 2mm ID)
Pressure drop (at 40 ml/min, H ₂ O, 23°C)	2.15 mbar
Total internal volume	~70 µl

For more information on the fluidic connection please find: "Application Note Sensor Ports and Tubing Connections" in the Download Center on our homepage.

5 Mechanical Specifications

Table 4: Mechanical Specifications

Parameter	SLS-1500
Largest dimensions	59 x 31.5 x 18 mm
Total mass	~40 g
Inner diameter sensor tube	1.5 mm
Protection class	IP54



All dimensions in mm

6 Ordering Information

Standard shipment includes only the sensor, neither cables nor fluidic connection material. For optimum performance, Sensirion recommends using the SLS-1500 flow meter in combination with the SCC1 interface cables.

For laboratory use and technology evaluation, the Flow Meter Kit SLS-1500 can be ordered.

This laboratory-package contains:

- Liquid Flow Meter SLS-1500
- PC Software (Viewer & Data Export Tool);
- SCC1-USB Sensor Cable with USB connector for plug-and-play connection to a PC
- SCC1-Analog Sensor Cable with 0-10 V voltage output.
- Fluidic connection material for 1/4-28 flat bottom ports.

Product	Article No
SLS-1500 40 ml/min	1-101216-01
Flow Meter Kit SLS-1500	1-101154-01

Interface Cables:

SCC1-RS485 Sensor Cable Pigtail 2m	1-100804-01
SCC1-RS485 Sensor Cable Pigtail 5m	1-101122-01
SCC1-ANALOG Sensor Cable Pigtail 2m	1-101072-01
SCC1-ANALOG Sensor Cable Pigtail 10m	1-101219-01
SCC1-USB Sensor Cable 2m	1-101007-01

Important Notices

Warning, personal injury

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury (including death). Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the datasheet and application notes. Failure to comply with these instructions could result in death or serious injury.

If the Buyer shall purchase or use SENSIRION products for any unintended or unauthorized application, Buyer shall defend, indemnify and hold harmless SENSIRION and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if SENSIRION shall be allegedly negligent with respect to the design or the manufacture of the product.

ESD Precautions

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product.

Warranty

SENSIRION warrants solely to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product shall be of the quality, material and workmanship defined in SENSIRION's published specifications of the product. Within such period, if proven to be defective, SENSIRION shall repair and/or replace this product, in SENSIRION's discretion, free of charge to the Buyer, provided that:

- notice in writing describing the defects shall be given to SENSIRION within fourteen (14) days after their appearance;
- such defects shall be found, to SENSIRION's reasonable satisfaction, to have arisen from SENSIRION's faulty design, material, or workmanship;
- the defective product shall be returned to SENSIRION's factory at the Buyer's expense; and
- the warranty period for any repaired or replaced product shall be limited to the unexpired portion of the original period.

This warranty does not apply to any equipment which has not been installed and used within the specifications recommended by SENSIRION for the intended and proper use of the equipment. EXCEPT FOR THE WARRANTIES EXPRESSLY SET FORTH HEREIN, SENSIRION MAKES

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CE, RoHS, REACH and WEEE Statement

The SLS-1500 complies with requirements of the following directives and regulations:



- The device fully complies with norm EN 50081-2 (Emission Test Series), EN 50082-2 (Immunity Test Series) and ESD protection when used in combination with the SCC1-RS485 or SCC1-ANALOG Sensor Cables.
- EU Directive 1907/2006/EC concerning Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)
- EU Directive 2002/96/EC on waste electrical and electronic equipment (WEEE), OJ13.02.2003; esp. its Article 6 (1) with Annex II.
- EU Directive 2002/65/EC on the restriction of certain hazardous substances in electric and electronic equipment (RoHS), OJ01.01.2011