

LD20 Liquid Flow Sensor Series - PROTOTYPE

Disposable Flow Sensor for Biomedical Applications

- Low flow sensing up to 1200 ml/h (20 ml/min)
- Luer lock fluidic connectors
- Millisecond-fast response time



Product Summary

The LD20 liquid flow sensor series enables precise, non-invasive measurements of dynamic liquid flow rates in the low ml/h to ml/min range bi-directionally. This sensor has been designed for single-use applications in the biomedical field.

Electrical Interface

Digital

- I²C-Bus

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

1 Sensing Performance (Preliminary data, subject to change)

The following table 1 lists preliminary specifications of the current prototypes. Please contact Sensirion if different specifications are required.

Table 1: Performance of LD20 series (all data for medium H₂O, 23°C)

Parameter	LD20-xxxxL	LD20-xxxxL	LD20-2600L	Unit
H ₂ O Full scale flow rate	12 (0.2)	120 (2)	600 (10)	ml/h (ml/min)
H ₂ O Sensor output limit ^a	18 (0.3)	180 (3)	1300 (21.67)	ml/h (ml/min)
Accuracy below full scale (whichever error is larger)	tbd	tbd	7	% of m.v. ^b
	tbd	tbd	0.7	% of full scale
Repeatability below full scale (whichever error is larger)	tbd	tbd	1	% of m.v.
	tbd	tbd	0.1	% of full scale
Temperature coefficient ^c (additional error / °C; whichever is larger)	tbd	tbd	tbd	% m.v. / °C
	tbd	tbd	tbd	% full scale / °C
Mounting orientation sensitivity ^d	tbd	tbd	tbd	% of full scale
Flow detection response time τ_{63}	tbd	tbd	tbd	ms
Response time on power-up	tbd	tbd	tbd	ms
Operating temperature	+15 ... +45 (+59 ... +113)			°C (°F)
Operating pressure	3 (45)			bar (psi)
Recommended maximum use duration	7			days
Short term storage temperature ^e	-10 ... +60 (+14 ... +140)			°C (°F)
Short term storage humidity ^e	0 ... 100			% RH
Shelf life ^f	3			years

^a Flow rate at which the sensor output saturates. See section 2 for performance between full scale and saturation point.

^b Measured value

^c Additional accuracy error for temperatures deviating from 23 °C.

^d Maximum additional offset when flow channel is vertical.

^e Non-condensing, flow path empty.

^f When stored at 15°C - 35°C and 20 - 80 % r.H.

2 Specifications Charts

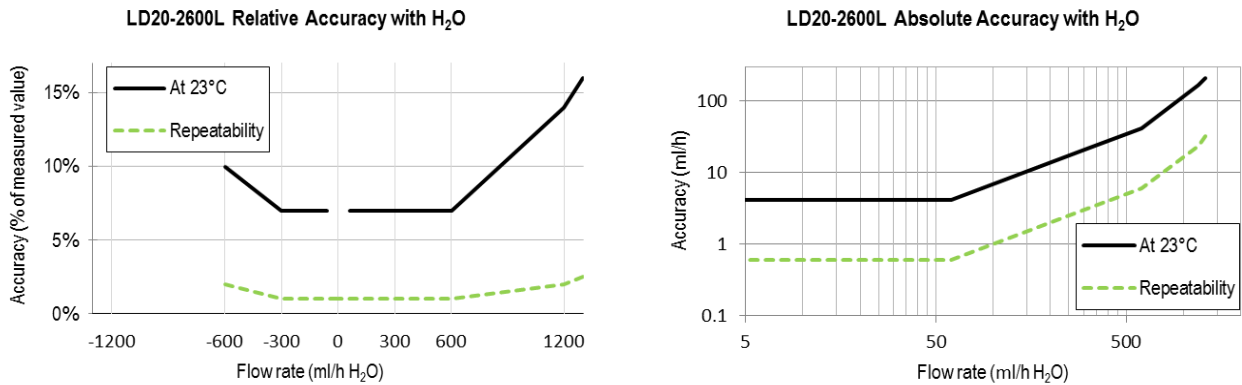


Figure 1: Liquid flow sensor accuracy and repeatability across the flow range of the LD20-2600L. Relative error in % of measured value (left) and absolute error in ml/h (right) for H₂O.

3 Communication with the Sensor

The LD20-2600L flow sensor shows bi-directional, linear transfer characteristics. The product comes fully calibrated for water.

Digital Sampling Time, 16 bit	74 ms
Digital Sampling Time, 9 bit	1 ms

3.1 Electrical Specifications

Table 2: DC Characteristics

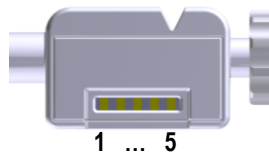
Parameter	Conditions	Min.	Typ.	Max.	Units
Power Supply DC, VDD	Sensor only	3.3	3.5	3.7	V
Operating Current	VDD = 3.5 V		5.1		mA

3.2 Electrical Connector and Pad Assignment

The liquid flow sensor is equipped with metal contact pads for electrical connection.⁹

Table 3: Electrical pad layout

Pad	
1	SDA (data)
2	SCL (clock)
3	VDDD
4	VDDA
5	GND



3.3 Digital Communication via I²C-Bus

Digital communication between a master and the LD20 sensor runs via the standard I²C-interface. 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 the 3.3 V level with a clock frequency of 100 kHz. For the detailed specifications of this I²C communication, please refer to the specific I²C Application Notes from Sensirion.

Table 4: I²C Output Characteristics

Parameter	Min.	Typ.	Max.	Units
I ² C Bus Clock Frequency	100			kHz
Output Voltage Low (SDA/SCL), I _{sink} = 6 mA		0.1	0.5	V
Low Level Output Current (SDA/SCL)			6	mA
High Level Input Voltage (SDA/SCL)	2.0			V
Low Level Input Voltage (SDA/SCL)			1.0	V

⁹Please note, that the electrical connector provided as part of the evaluation kit for testing purposes will not be commercially available. Its design is in the scope of the customer.

4 Fluidic Connection

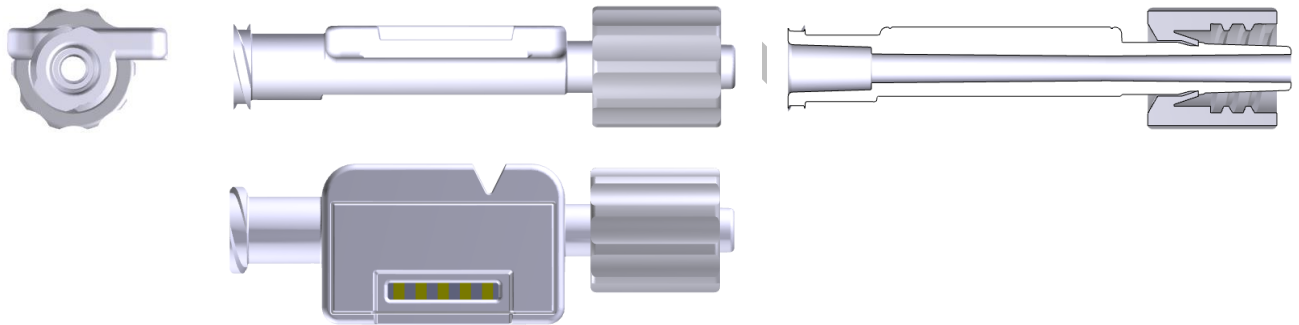
Table 5: Fluidic Specifications

Parameter	LD20-xxxxL	LD20-xxxxL	LD20-2600L
Wetted Materials	Polycarbonate (PC), Liquid-Crystal-Polymer (LCP), medical grade adhesive		
Fluidic connector ports (fittings)	Luer lock connectors (inlet: female, outlet: male)		
Pressure drop (at full scale flow rate, H ₂ O, 23 °C)	tbd	tbd	< 0.1 mbar

5 Mechanical Specifications

Table 6: Mechanical Specifications

Parameter	LD20-xxxxL	LD20-xxxxL	LD20-2600L
Largest dimensions	~ 45 x 14 x 12 mm		
Total mass	2.1 g		
Inner diameter d	tbd	tbd	2.6 mm



(Refer to 3D data for dimensions)

6 Ordering Information

The LD20 Evaluation Kit contains:

- 3 pcs disposable liquid flow sensors of type LD20-2600L
- Base station used as a reusable electrical interface connector
- PC Software (Viewer & Data Export Tool)
- SCC1-USB Sensor Cable with USB connector for plug-and-play connection to a PC.

Table 7: Ordering information

Product	Article Number
LD20-2600L	1-101433-01
Base Station for LD20	1-101481-01
Evaluation Kit LD20-2600L	1-101431-01

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.

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RoHS, REACH and WEEE Statement

The flow sensors of the LD20 series comply with requirements of the following directives and regulations:

- 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

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