LD20 Liquid Flow Sensor Series – PROTOTYPE

Single-Use Flow Sensor for Biomedical Applications

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

Product Summary

The LD20 liquid flow sensor series enables precise and reliable measurements of dynamic liquid flow rates from a few hundred µl/h up to 1200 ml/h bi-directionally. This sensor has been designed for single-use applications in the biomedical field. The LD20 series is still being developed. Thus any specification can be subject to change in the future (performance, fittings, communication, etc.).

Electrical Interface:

Digital
- I²C-Bus

For more information on communication, please refer to section 3 of this document (preliminary).

1 Sensor 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.

3D-printed samples of the small (LD20-0600) and medium (LD20-1300) LD20 versions are available on request. Please contact Sensirion.

Parameter	LD20-0600x	LD20-1300x	LD20-2600B	Unit
H_2O Full scale flow rate	20 (0.3)	250 (4.2)	1000 (16.6)	ml/h (ml/min)
H_2O Sensor output limit[a]	25 (0.4)	300 (5)	1300 (21.67)	ml/h (ml/min)
Accuracy below full scale (whichever error is larger)	tbd tbd	tbd tbd	5 0.25	% of m.v.[b] % of full scale
Repeatability below full scale (whichever error is larger)	tbd tbd	tbd tbd	0.5 0.025	% of m.v. % of full scale
Temperature coefficient[c] (additional error / °C; whichever is larger)	tbd tbd	tbd tbd	0.2 0.01	% m.v. / °C % full scale / °C
Mounting orientation sensitivity[d]	tbd	tbd	1.0	% of full scale
Flow detection response time τ_{63}	tbd	tbd	tbd	ms

[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.

Parameter	LD20-0600x	LD20-1300x	LD20-2600B	Unit
Response time on power-up	tbd	tbd	tbd	ms
Operating temperature	+15 … +45 (+59 … +113)			°C (°F)
Operating humidity	0…95 %, non-condensing			% RH
Maximum recommended operating pressure	3 (45)			bar (psi)
Burst pressure	10 (145)			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…95 %, non-condensing			% RH
Shelf life[f]	3			years

Table 1: Performance of LD20 series (all data for medium H_2O, at 23°C)

2 Specifications Charts

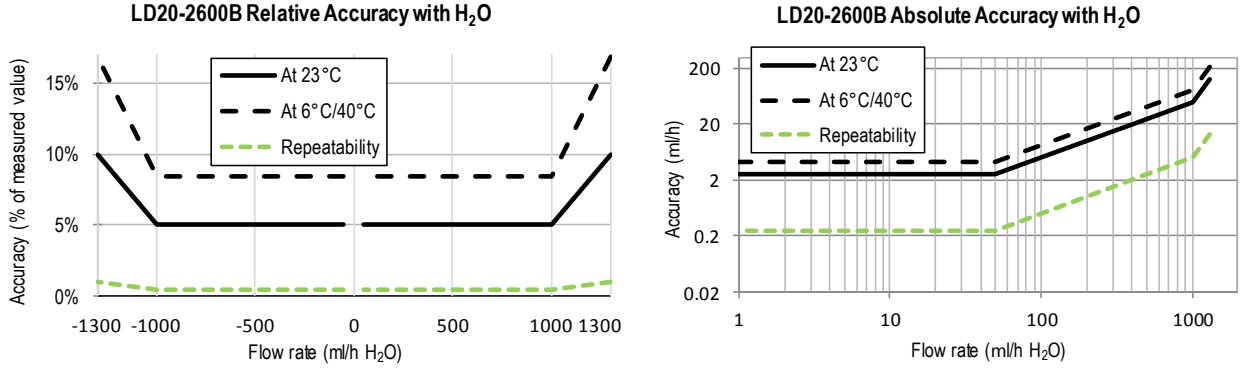


Figure 1: Liquid flow sensor accuracy and repeatability across the flow range of the LD20-2600B. Relative error in % of measured value (left) and absolute error in ml/h (right) for H_2O.

[e] Flow path empty. Short term storage refers to temporary conditions during e.g. transport.
[f] When stored at 15°C - 35°C and 20 - 80 % r.H.

3 Communication with the Sensor (Preliminary data, subject to change)

The LD20-2600B 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

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

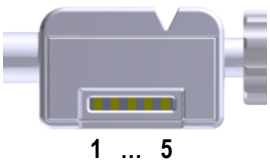
Table 2: DC characteristics

3.2 Electrical Connector and Pad Assignment

The liquid flow sensor is equipped with metal contact pads for electrical connection.[g]

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

Table 3: Electrical pad layout



1 … 5

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.

Parameter	Min.	Typ.	Max.	Units
I²C 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

Table 4: I²C output characteristics

[g] Please 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 Specifications and Connections

Parameter	LD20-0600x	LD20-1300x	LD20-2600B
Wetted materials	3D-printed samples are available on request		Polyetherimide (PEI), Liquid-Crystal-Polymer (LCP), medical-grade adhesive
Fluidic connector ports (fittings)	Barbed fittings for 3D printed samples (Final fitting design to be defined)		Barbed fittings
OD of barbed fittings	1.75 mm	tbd	4.0 mm
Recommended tubing ID for barbed fittings	1.6 mm (1/16")	tbd	3.2 mm (1/8")
Pressure drop (at full scale flow rate, H_2O, 23 °C)	<1.0 mbar	tbd	< 0.2 mbar

Table 5: Fluidic specifications and connections

5 Mechanical Specifications

Parameter	LD20-0600x	LD20-1300x	LD20-2600B
Largest dimensions	~ 35.4 x 15 x 12 mm	tbd	~ 48 x 15 x 12 mm
Total mass	tbd	tbd	1.7 g
Inner diameter	~ 0.8 mm	tbd	~ 2.6 mm

Table 6: Mechanical specifications

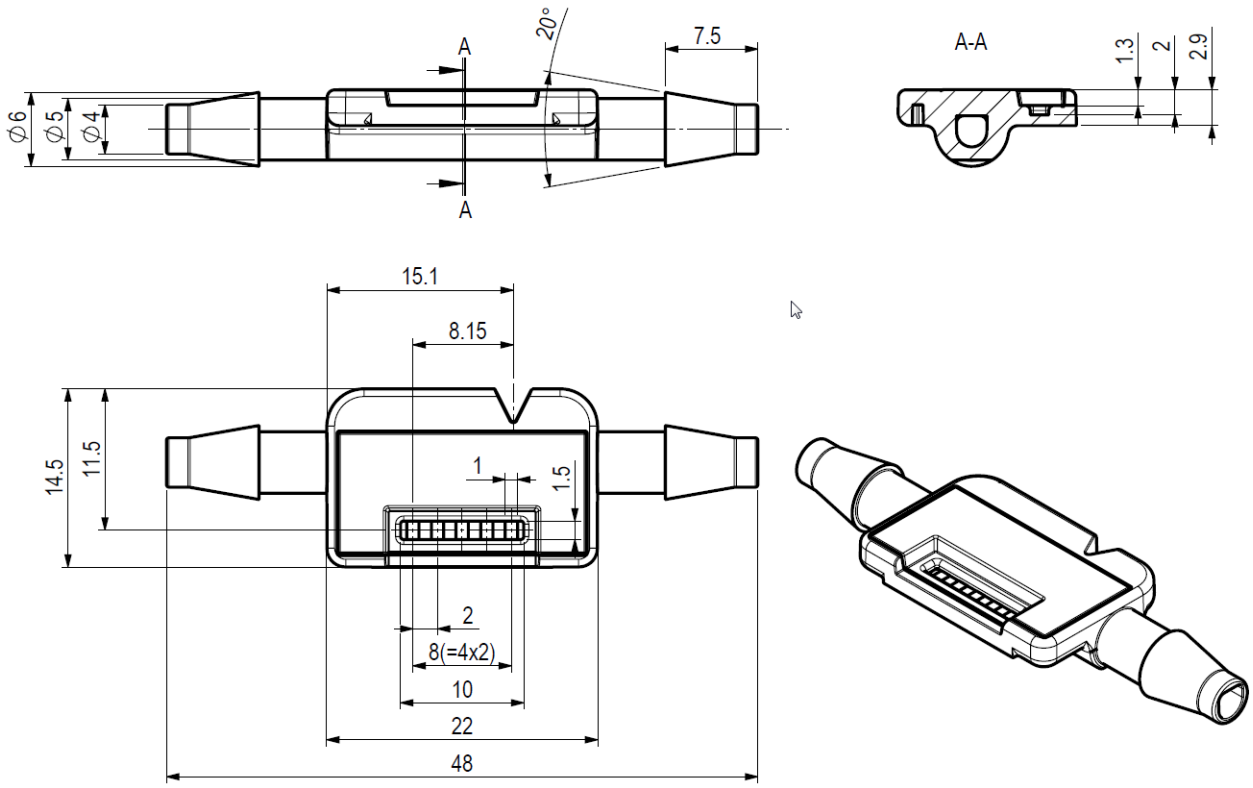


Figure 2: Dimensions of LD20-2600B (in mm)

6 Order Information

The LD20 Evaluation Kit contains:

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

Product	Article Number
LD20-2600B Liquid Flow Sensor with barbed fittings	1-101564-01
Base station for LD20 series (prototype)	1-101481-01
SCC1-USB sensor cable	1-101007-01
Evaluation Kit LD20-2600B	1-101431-02

Table 7: Order information

3D-printed samples of the small (LD20-0600x) and medium (LD20-1300x) LD20 versions are available on request also as part of an Evaluation Kit. Please contact Sensirion.

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 NO WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT. ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY EXCLUDED AND DECLINED.

SENSIRION is only liable for defects of this product arising under the conditions of operation provided for in the datasheet and proper use of the goods. SENSIRION explicitly disclaims all warranties, express or implied, for any period during which the goods are operated or stored not in accordance with the technical specifications.

SENSIRION does not assume any liability arising out of any application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. All operating parameters, including without limitation recommended parameters, must be validated for each customer's applications by customer's technical experts. Recommended parameters can and do vary in different applications.

SENSIRION reserves the right, without further notice, (i) to change the product specifications and/or the information in this document and (ii) to improve reliability, functions and design of this product.

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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