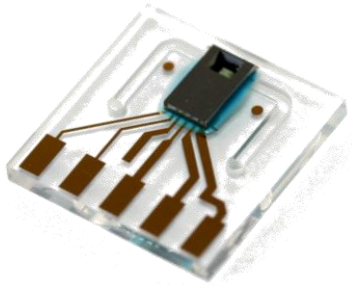
SENSIRION
THE SENSOR COMPANY

LPG10 Liquid Flow Sensor (Preliminary Datasheet)

Digital Planar Package Sensor



- Ultra small size
- Excellent repeatability
- Bio-compatible & inert materials
- Calibrated and temperature compensated digital output (I^2C)

Product Summary

Unique CMOSens® planar packaging technology allows low fabrication costs by enabling non-invasive measurement of liquid flow inside a cost-effective planar substrate (US Patent 7905140). The flow channel passes through this planar substrate and will be connected to fluidic channels in a manifold. The fluid will only be in contact with the glass channel. The digital microsensor chip provides the full signal processing functionality for a fully calibrated, temperature compensated digital output

Integrating the LPG10 sensor models

Due to the dramatically reduced size and downmount fluidic connections, the LPG10 sensor family allows an outstanding mechanical, fluidic and electronic integration. An evaluation kit with sample-manifold is available for initial testing.

1 Sensor Performance (subject to change)

Table 1: Performance of LPG10 models (all data for medium H_2O, 20°C, 1 bar_{abs} unless otherwise noted)

Parameter	LPG10-0150	LPG10-0500	LPG10-1000	Unit
Full Scale Flow Rate	10	100	1000	µl/min
Sensor Output Limit[a]	15	150	1500	µl/min
Accuracy below full scale (whichever error is larger)	5 tbd	5 0.2	5 0.25	% of measured value % of full scale
Repeatability error from zero to full scale (whichever error is larger)	1 tbd	1 0.04	1 0.05	% of measured value % of full scale
Flow Detection Response Time τ_{63}	40			ms
Response Time On Power-Up	120			ms
Operating Temperature	+10 … +50			°C
Ambient Storage Temperature[b]	-40 … +80			°C
Operating Pressure	tbd	10	3	bar (psi)
Proof Pressure[c]	tbd	20	7	bar (psi)

[a]Flow rate at which the sensor output saturates, see Section 2 for performance specifications between full scale and saturation point
[b]Non-condensing, flow path empty
[c]Pressures listed are mechanical limits of glass substrate; Proof pressure of manifold assembly depends on customer manifold seal design

2 Specifications Charts

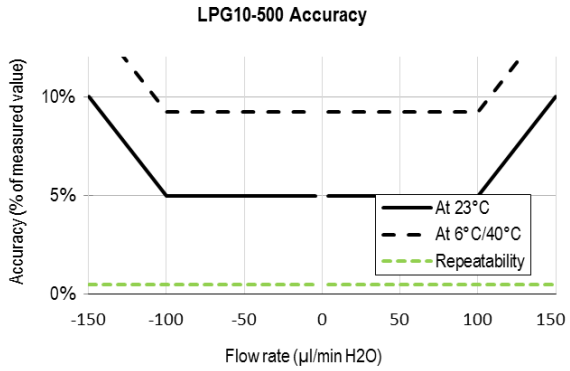


Figure 1: Sensor accuracy and repeatability (% of measured value) across the sensor's flow range

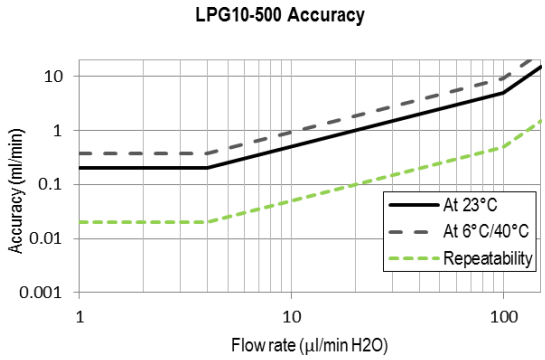


Figure 2: Sensor accuracy and repeatability (µl/min) across the sensor's flow range

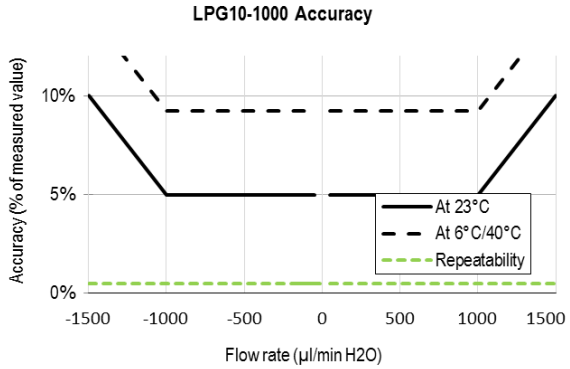


Figure 3: Sensor accuracy and repeatability (% of measured value) across the sensor's flow range

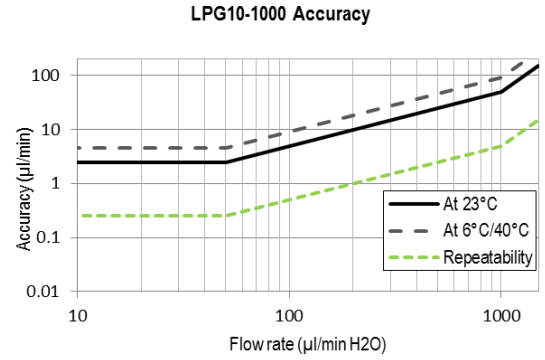


Figure 4: Sensor accuracy and repeatability (µl/min) across the sensor's flow range

3 Communication with the Sensor

The OEM flow sensor models LPG10 show 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

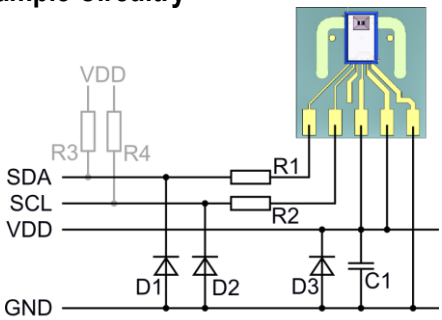
3.1 Electrical Specifications

Table 2: DC Characteristics

Parameter	LPG10 Series
Operating voltage	3.3– 3.6 V_{DC} (Recommended: 3.4-3.5 V)
Current drain	< 6 mA typical in operation

For electrical connection to the LPG10 flow sensor family please follow the schematic shown in 3.2. The required electrical connection can be realized in different ways, e.g. using spring contacts.

3.2 Sample Circuitry



D1, D2, D3: ESD5Z5.0T1G
R1, R2: 47R
C1: 1uF, 25V, X7R, place as close as possible to the sensor pads

Pad assignment from left to right:

1 SDA, Data
2 SCL, Clock
3 VDDA, Analog Supply Voltage
4 VDDD, Digital Supply Voltage
5 GND, Ground

3.3 Digital Communication via I²C-Bus

Digital communication between a master and the LPG10 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.

These lines can be used on a 3.3V level with a 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

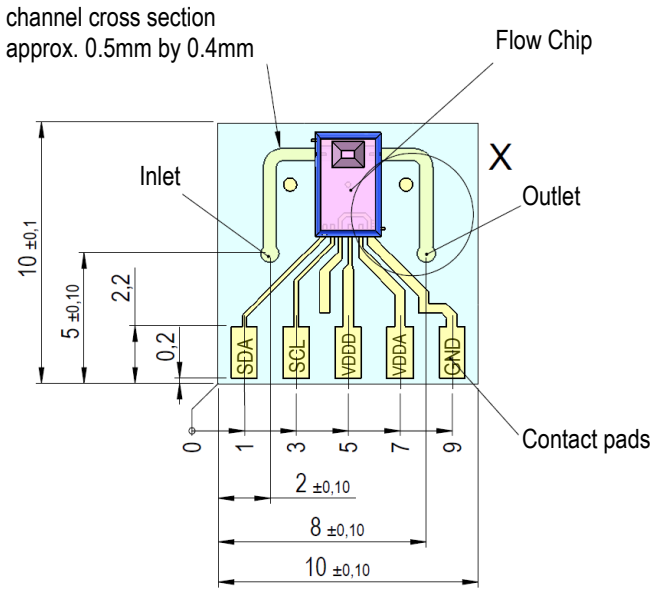
Table 3: Fluidic Specifications and Pressure Rating

Parameter	LPG10-0150	LPG10-0500	LPG10-1000
Wetted Materials:	REACH, RoHS and WEEE compliant		
• Internal Substrate Flow Channel Material	Borosilicate glass		
Fluid Connector Ports (Fittings)	Down mount		
Pressure Drop (at full scale flow rate, H_2O, 23°C)	tbd	0.2 mbar	0.1 mbar
Total Internal Volume	tbd	~3.2 µl	~11.7 µl

5 Mechanical Specifications

Table 4: Mechanical Specifications

Parameter	LPG10-0150	LPG10-0500	LPG10-1000
Largest dimensions (approximately)	tbd	10 x 10 x 1.65 mm	10 x 10 x 2.2 mm
Total Mass	tbd	0.23 g	0.32 g
Cross Section Sensor Tube (approximately)	tbd	0.5 mm x 0.4 mm	0.9 mm x 0.9 mm



All dimensions in mm

Note: Example of LPG10-0500. For other versions, layout will be exactly identical, but size of channel and fluidic ports will be slightly different.

6 Ordering Information

For OEM applications, the LPG10 flow meters can be purchased in larger quantities without any additional parts (100 pcs. minimum order quantity).

For initial testing and technology evaluation, the LPG10 evaluation kit can be ordered.
This evaluation package contains:

- Liquid Flow Meter LPG10-xxxx
- Manifold body for selected type of sensor
- Connector cap with 4-pin molex connector
- Screws and O-rings required for assembly
- SCC1-USB Sensor Cable with USB connector for plug-and-play connection to a PC
- Adapter cable for 4-pin molex to SCC1 Sensor Cables
- 4-pin molex ribbon cable

Product	Article No
LPG10-0500	1-101119-01
LPG10-1000	1-101126-01
Evaluation Kit LPG10-0500	1-101318-01
Evaluation Kit LPG10-1000	1-101319-01

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 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.

REACH, RoHS and WEEE Statement

The sensors of the LPG10 series comply with requirements of the following directives:

- 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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