

SLG64-0075

Ultra High Pressure Flow Sensor for LC Applications

- Flow Sensing up to 5 $\mu\text{l}/\text{min}$, Extended to 20 $\mu\text{l}/\text{min}$
- Operating Pressure up to 1000 bar (15000 psi)
- 30 ms Response Time



1 Introduction SLG64-0075

The SLG64-0075 Ultra High Pressure Flow Sensor enables precise, non invasive, bi-directional measurements of dynamic liquid flow rates in the microliter range.

This device has been designed for ultra high pressure applications in Liquid Chromatography Systems (UHPLC). Excellent bio-compatibility and chemical resistance is ensured by the exclusive use of fused silica, stainless steel and PEEK™ for all wetted parts. The flow path of the SLG64-0075 Liquid Flow Sensor is formed by pressure resistant fused silica capillary. This Swiss made, non invasive sensor is based on Sensirion's patented CMOSens® Technology (US Patent 6,813,944 B2).

2 Sensing Performance

The SLG64-0075 is offering two different flow sensing modes. The Precision Mode allows for precise flow sensing starting at zero flow while the Extended Mode is made for a rough estimation of the current mass flow in higher flow ranges. Please refer to related application notes for instructions how to switch between modes.

Table 1: Performance of SLG64-0075 (all data for medium H₂O, 20°C, 1 bar_{abs} unless otherwise noted)

Parameter	Precision Mode	Extended Mode	
Maximum Flow Rate	5000	20000	nl/min
Lowest Calibrated Flow (LCF)	250	2000 ^a	nl/min
Digital Resolution at LCF (16 bit)	0.5	tbd	nl/min
Accuracy ^b above LCF	10	20	% of m.v. ^c
Accuracy below LCF	0.5	n/a	% of full scale
Repeatability (3 σ)	0.6	1.2	% m.v. ^c
Signal Noise, 16 bit digital output	4.5	4.5	LSB
- at LCF	3	30	nl/min
- at Maximum Flow Rate	30	90	nl/min
Temperature Coefficient	0.5	0.5	(% m.v. ^c) / K
Mounting Orientation Sensitivity ^d	< 0.1	< 0.1	% of full scale
Flow Detection Response Time τ_{63}	40	tbd	ms
Response Time On Power-Up	120		ms
Digital Sampling Rate, 16 bit	74		ms
Digital Sampling Rate, 9 bit	1		ms
Operating Temperature	+10...+50	+10...+50	°C
Ambient storage temperature	-10...+60		°C

^a No output values lower than this limit

^c m.v. = "of the measured value"

^d Normal position: Horizontal flow channel, electrical connector on top

3 Digital Output Signals

The OEM flow sensor SLG64-0075 shows bi-directional, linear transfer characteristics. The product comes fully calibrated for water .

The SLG64-0075 provides a digital output. Digital communication between a master and the SLG64-0075 sensor runs via the standard I²C-interface. The physical interface consists of two bus lines, a data line (SDA) and a clock line (SCL). These lines can be used on 3.3V or 5.0V level with a clock frequency of 100 kHz. For the detailed specifications of this I²C communication refer to specific I²C Application Notes from Sensirion.

4 Electrical and Mechanical Specifications

4.1 Electrical Specifications

Table 2: DC Characteristics.

Parameter	Conditions	Min.	Typ.	Max.	Units
Power Supply DC, VDD		3.5	5.0	7.0	V
Operating Current	VDD = 3.5-5.5 V, no load		5.1		mA

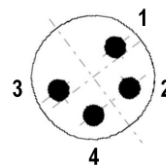
Table 3: I²C Output Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
I ² C Bus Clock Frequency			100		kHz
Output Voltage Low (SDA/SCL)	I _{sink} = 6mA		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

4.2 Electrical Connector and Pinout

The flow meter is equipped with a male connector type M8, 4-pole, threaded lock according to IEC 61076-2-101 (Ed. 1)/ IEC 60947-5-2

Pin	Function	Standardized Color Code
1	DATA	Brown
2	GND	White
3	VDD	Blue
4	CLOCK	Black



4.3 Connection Digital Communication via I²C-Bus

Digital communication between SLG64-0075 sensors and an I²C master works on both 5V or 3.3V level. The SDA and SCL lines need to be connected via pull-up resistors with the bus voltage of the system. The individual I²C address of each sensor on the I²C bus can be set with a special software tool and dedicated hardware.

4.4 RS485 Communication

The Sensirion RS485 Sensor Cable offering a robust communication link is available on request. With this, power supply and safe operation of multiple devices via one single RS485 bus is possible. A special feature of this RS485 unit is an internal ring buffer allowing to independently record flow rate data for a certain period of time.

Separate documentation is available on request for

- Sensirion RS485 Sensor Cable
- Communication Protocol according to Sensirion HDLC Standard for RS485
- Communication possible via Sensirion Driver DLL for Windows

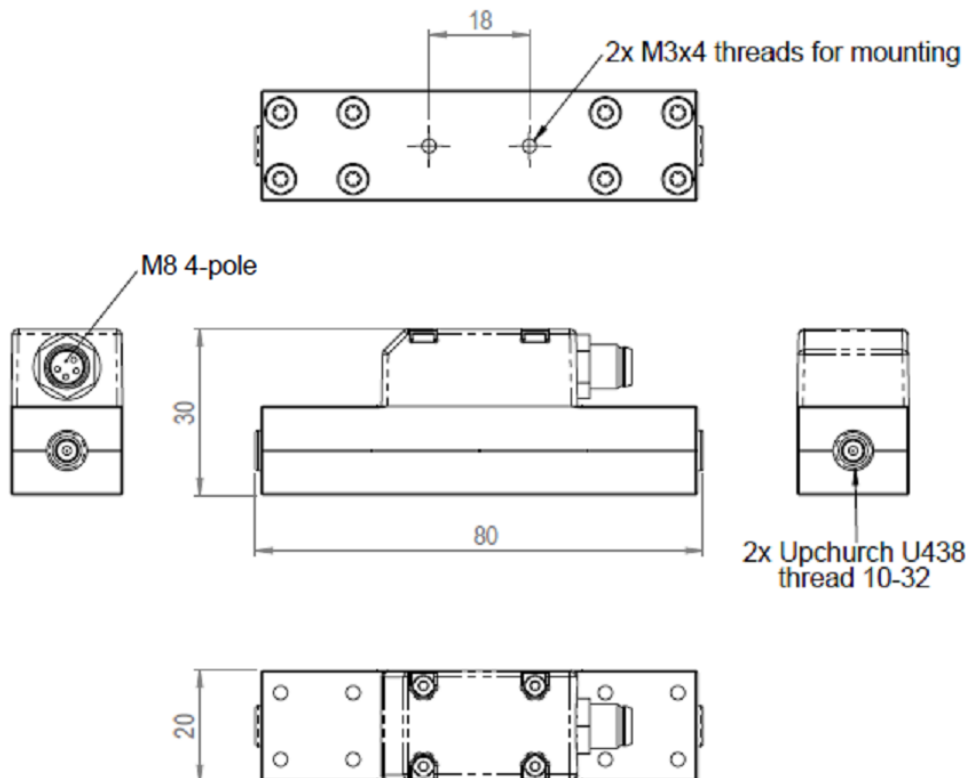
4.5 Mechanical Specifications and Pressure Rating

Inside the SLG64-0075 flow sensors a highly sensitive microsensor-chip is mounted on the outside of a high pressure resistant fused silica capillary and allows to measure the flow with high sensitivity through the wall (US Patent 6,813,944 B2) using a thermal principle.

Table 4: Mechanical Specifications and Pressure Rating

Parameter	SLG64-0075
Fluid Connector Ports (Fittings)	1/16" UHP fittings, stainless steel IDEX U438 standard
Wetted Materials:	
<ul style="list-style-type: none"> Internal Sensor Capillary Material 	fused silica
<ul style="list-style-type: none"> Fitting Material 	Stainless steel
<ul style="list-style-type: none"> Additional Sealing Material 	100% PEEK™ sleeves
Overpressure Resistance	1000 bar (15000 psi)
Maximum Pressure Drop (at max. flow rate)	100 mbar
Internal Sensor Capillary, Inner Diameter	75 µm
Total Internal Volume	tbd
Total Mass	150 g

5 Physical Dimensions



6 Important Notices

6.1 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. 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 data sheet 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.

6.2 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.

6.3 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 data sheet 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.

Copyright© 2001-2009, SENSIRION.

CMOSens® is a trademark of Sensirion

All rights reserved.

PEEK™ is a trademark of Victrex PLC

Teflon® and Tefzel® are registered trademarks of DuPont Corporation

Duran® is a trademark of the SCHOTT-Group

6.4 RoHS and WEEE Statement

The SLG64-0075 product complies with requirements of the following directives:

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 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (**RoHS**), OJ 13.02.2003; esp. its Article 4.



Headquarter and Sales Office

SENSIRION AG
Laubisruetistr. 50
CH-8712 Staefa ZH
Switzerland

Phone: +41 44 306 40 00
Fax: +41 44 306 40 30
info@sensirion.com
<http://www.sensirion.com>

SENSIRION Inc.
Westlake Pl. Ctr. I, suite 204
2801 Townsgate Road
Westlake Village, CA 91361
USA

Phone: +1 805 409 4900
Fax: +1 805 435 0467
michael.karst@sensirion.com
<http://www.sensirion.com>

SENSIRION Japan
Sensirion Japan Co. Ltd.
Shinagawa Station Bldg. 7F
4-23-5 Takanawa
Minato-ku, Tokyo, Japan

Phone: +81 3-3444-4940
Fax: +81 3-3444-4939
info@sensirion.co.jp
<http://www.sensirion.co.jp>

SENSIRION Korea Co. Ltd.
#1414, Anyang Construction Tower B/D,
1112-1, Bisan-dong, Anyang-city,
Gyeonggi-Province, South Korea

Phone: +82-31-440-9925~27
Fax: +82-31-440-9927
info@sensirion.co.kr
<http://www.sensirion.co.kr>

SENSIRION China Co. Ltd.
Room 2411, Main Tower
Jin Zhong Huan Business Building,
Futian District, Shenzhen, PR China
Postal Code 518048

Phone: +86 755 8252 1501
Fax: +86 755 8252 1580
info@sensirion.com.cn
<http://www.sensirion.com.cn>

Find your local representative at: <http://www.sensirion.com/reps>