

# LG216

## Pressure Resistant Milliliter Flow Sensor

- Maximum flow up to 20 ml/min
- Resolutions in the  $\mu$ l-Range
- Flow path made of glass and PEEK™ only
- Maximum pressure up to 20 bar (290 psi)



### 1 Introduction LG216

The LG216 Liquid Flow Sensor series enables fast, non invasive measurements of low liquid flow rates up to 20 ml/min with medium water<sup>a</sup>. This product line is especially suited for OEM volume applications requiring small sized components with high performance at low cost. Excellent chemical resistance and bio-compatibility are ensured: The flow path of the LG216 Liquid Flow Sensors is formed by a simple, straight glass capillary. This Swiss made, non invasive sensors are based on Sensirion's patented CMOSens® Technology (US Patent 6,813,944 B2). The fourth generation MEMS sensors combine a thermal high precision sensor element with amplification circuits and digital intelligence for linearization and temperature compensation on one single microchip – the products core element.

**Attention:** The output signal can be misunderstood below the specified minimum flow rate.

### 2 Sensing Performance

Table 1: Model specific performance of LG216 (all data for medium H<sub>2</sub>O, 20°C, 1 bar<sub>abs</sub> unless otherwise noted)

Parameter	Condition	LG216-0430	Units
Maximum Flow Rate		20	ml/min
Minimum Flow Rate		1.0	ml/min
Digital Resolution (16 bit)	Minimum Flow Rate	0.8	$\mu$ l/min
Accuracy		5.0	% of measured value
Temperature Coefficient		0.1	(% m.v.) / K
Signal Noise, 16 bit digital output		4.5	LSB
- at Minimum Flow Rate		16	$\mu$ l/min
- at Maximum Flow Rate		180	$\mu$ l/min
Signal Noise, analog output, RMS		< 2	mV
Flow Detection Response Time $\tau_{63}$		50	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	°C
Ambient storage temperature		-10...+60 (empty flow channel)	°C

#### Attention: Minimize Temperature Differences

For correct operation of the LG216 flow sensors the temperature difference between liquid medium and ambient air needs to be minimized. This temperature difference must not exceed 3°C.



<sup>a</sup> The sensors of the LG216 series are only suited for use with water or aqueous solution (solutions with high water content). For measuring other liquids please refer to Sensirion's other liquid flow sensors.

### 3 Output Signal

The LG216 can be ordered as analog output version (0...5V, LG216-xxxx-A) or as digital output version (LG216-xxxx-D). Digital communication between a master and the LG216 sensor runs via the standard I<sup>2</sup>C-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 I<sup>2</sup>C communication refer to the Sensirion "User Manual I<sup>2</sup>C-Mode SF04".

The LG216 is a uni-directional liquid flow sensor. The product comes fully calibrated for water (see Fig. 1). Below the specified minimum flow rate (with medium H<sub>2</sub>O) the flow signal is not valid and has to be actively ignored by the system as the output can be similar above the specified minimum flow rate (see Fig. 2). To determine if the flow rate is above the lower limit and the signal valid a special check via digital sensor communication is required (request application note) or an additional source of information from the surrounding system is needed.

The maximum output signal of LG216 sensors is generated at zero flow as well as above the specified maximum flow rate. At the specified minimum flow rate the output signal is zero. Between the specified minimum flow rate and the specified maximum flow rate the signal rises linearly to its maximum value.

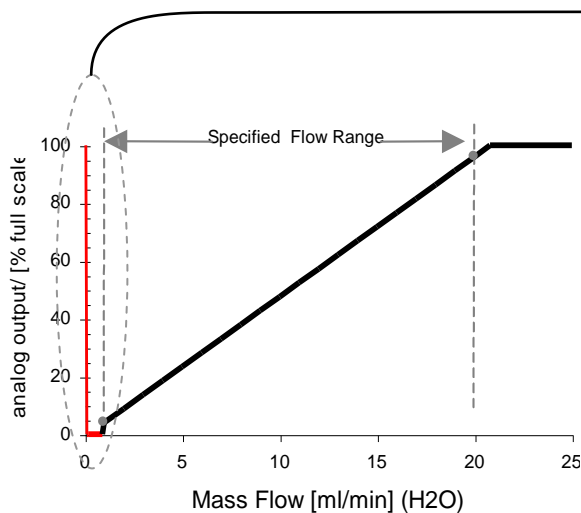


Fig. 1 : Transfer Characteristics, Full Range (example LG216-0430 with water)

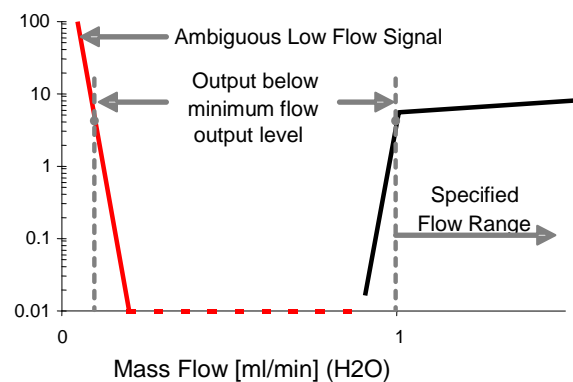


Fig. 2: Transfer Characteristics, Low Range (example LG216-0430 with water)

## 4 Electrical and Mechanical Specifications

### 4.1 Electrical Specifications

Table 2: DC Characteristics.

Parameter	Conditions	Min.	Typ.	Max.	Units
Power Supply DC, VDD	for digital out I <sup>2</sup> C operation	3.5		9 <sup>a</sup>	V
	for analog out operation	5.5		9 <sup>a</sup>	V
Operating Current	V <sub>DD</sub> = 3.5 V, no load		6.8		mA
	V <sub>DD</sub> = 12 V, no load		6.8		mA
Analog Out Voltage Range	Minimum to maximum flow rate (LG216-xxxx-A only)	0.2		4.8	V
Load at Analog Out		10		∞	kΩ

<sup>a</sup> Keep supply voltage below 9V for precision applications; if decreased accuracy is acceptable max. supply voltage is 12V; exceeding 12V will lead to permanent damage of the sensor

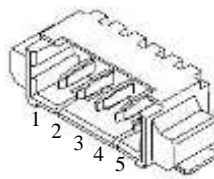
Table 3: I<sup>2</sup>C Output Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
I <sup>2</sup> C Bus Clock Frequency			100		kHz
Output Voltage Low (SDA/SCL)	I <sub>sink</sub> = 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

Connector Type: 5 pin Molex PCB Header 53261-0590 (right angle) . Assembled flat ribbon cable Molex 1.25 mm Pitch Rectacle Type 51021-0500 (PicoBlade™ 51021) included.

Pin	
1	SDA (bi-directional)
2	SCL
3	VDD
4	GND
5	Analog out



#### 4.3 Electrical Connection for Digital Communication via I<sup>2</sup>C

Digital communication between LG16-xxxx-D type sensors and an I<sup>2</sup>C 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 I<sup>2</sup>C address of each sensor on the I<sup>2</sup>C bus can be set with a special interface tool.

#### 4.4 Mechanical Specifications and Pressure Rating

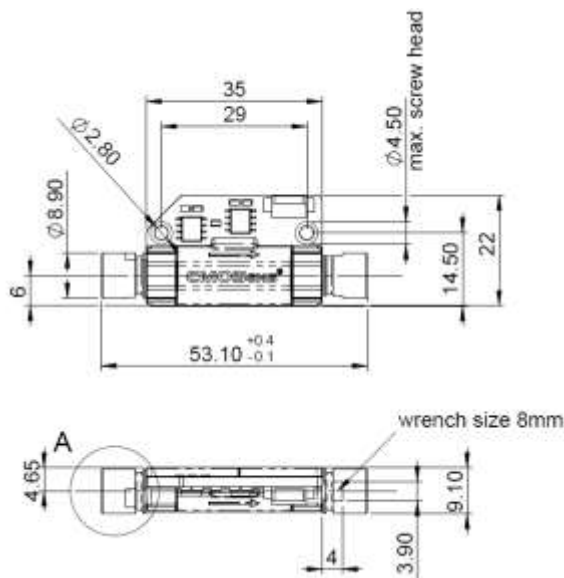
Inside the LG216 flow sensors a highly sensitive microsensor-chip is mounted on the outside of a straight glass capillary and allows to measure the flow through the wall (US Patent 6,813,944 B2) using a thermal principle.

Table 4: Mechanical Specifications and Pressure Rating

Parameter	LG216-0430
Fluid Connector Standard (Fittings)	1/4-28 for 1/16" or 1/8" OD plastic tubing
Wetted Materials:	
<ul style="list-style-type: none"> <li>Internal Sensor Capillary Material</li> </ul>	Quartz Glass (Fused Silica)
<ul style="list-style-type: none"> <li>Fitting Material</li> </ul>	100% PEEK™ (polyetheretherketone)
<ul style="list-style-type: none"> <li>Additional Sealing Material</li> </ul>	None
Overpressure Resistance	20 bar (290 psi) Burst Pressure 30 bar, Proof Pressure 15 bar
Maximum Pressure Drop (at max. flow rate)	<0.150 bar for H2O at 20°C
Internal Sensor Capillary, Inner Diameter	0.43 mm
Total Mass	6 g

Attention Fragile	
Mechanical shocks and connecting to the fittings without suitable tools leads to stress on the internal thin walled glass capillary and can cause it to break. <ul style="list-style-type: none"> <li>While tightening the fittings, fix the fluidic ports position with a wrench.</li> <li>Test for leakage after every time new connections are made.</li> </ul>	!

#### 5 Physical Dimensions



#### 6 Ordering Information

The LG216 flow sensors can be ordered with analog output (ending "-A") or with digital output ending ("-D").

Product	Article Number
LG216-0430-A	1-100854-01
LG216-0430-D	1-100855-01
LG216-0480-A	1-100431-01
LG216-0480-D	1-100432-01

## 7 Important Notices

### 7.1 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.

### 7.2 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.

See application note "ESD, Latchup and EMC" for more information.

### 7.3 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.

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### 7.4 RoHS and WEEE Statement

The LG16 product family 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.



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