1 Mass Flow Sensor Performance

Table 1: Overview of ASF1430 Gas Sensor Performance (All data for 20°C, 1013 mbar unless otherwise noted).

Parameter	Condition		Minimum	Typical	Maximum	Units
Flow Sensor						
Dynamic Range[1]	direct measurement		-400		400	sccm[2]
	Customer specific bypass		unlimited		unlimited	
Resolution[3]	400 sccm flow / 640 ms			0.1		sccm
	< 10 sccm flow / 640 ms			0.0143 (1/70)		sccm
Lowest Detectable Flow	< 10 sccm flow / 640 ms			0.0143 (1/70)		sccm
Pressure Drop	400 sccm, p_{abs} = 1 bar			120		Pa[4]
Repeatability				0.0025 % FS[5] 0.025 % m.v.		
Accuracy[6]	23°C	0…5 % of full scale		0.05 % FS		
		5…100 % of full scale		1 % m.v.		
Offset	23°C			< 0.005	< 0.02	% FS
Overpressure Resistance[7]				1	1.5	bar
Response Time	depends on resolution setting (see 0)		5		640	ms
Operating Temperature			0		70	°C
Ambient Temperature Coefficient	Zero			< 0.0008	< 0.002	% FS / °C
	Span			< 0.03	< 0.08	% measured value / °C
Position Sensitivity	p_{abs}=1 bar, small nitrogen flow			±0.004		% FS

Table 2: Additional Specifications of ASF1430.

Specification	Condition	Value	Unit
Temperature Sensor (measured media)			
Dynamic Range		0 – 60 / 32 – 140	°C / °F
Resolution		0.1	K
Accuracy		2	K
Material			
Wetted Materials	Si, Si_3N_4, SiOx, Gold, Viton®, Epoxy, Glob Top, PBT		
RoHS / WEEE compliance		Yes.	

[1] The calibration is valid up to +-400 sccm but the flow is displayed up to +- 440 sccm. Above 440 sccm an overflow is displayed (see section 1.1)
[2] 1 sccm = 1 cm^3/min at 0°C and 1013mbar pressure (1sccm = 0.001 norm liter).
[3] See 0
[4] 1 bar = 100 000 Pa = 0.9869 atm = 401.9 inch H_2O = 14.5 psi
[5] Error = % of full scale (FS) or % of measured value(m.v.), whichever is bigger.
[6] Better calibration available on request. Allow the Sensor to warm up for best results.
[7] Higher overpressure resistance can be realised in OEM-solutions or see Sensirion Flow Meter EM1.

Table 3: ASF1430 Mass Flow Sensor Resolution at different Flow Levels and integration time.

Flow or Differential Pressure Level	Readout Frequency 200 Hz	Readout Frequency 50 Hz	Readout Frequency 12.5 Hz	Readout Frequency 1.56 Hz
Flow Level				
400 sccm	13 sccm	3.5 sccm	0.9 sccm	0.11 sccm
100 sccm	4.0 sccm	1.0 sccm	0.3 sccm	0.03 sccm
< 10 sccm	1.0 sccm	0.25 sccm	0.06 sccm	0.0143 sccm
Mass Flow Integration Time				
	5 ms	20 ms	80 ms	640 ms

1.1 Gas Flow Characteristics

Figure 2 shows the applied gas flow vs. the digital output of the ASF1430.

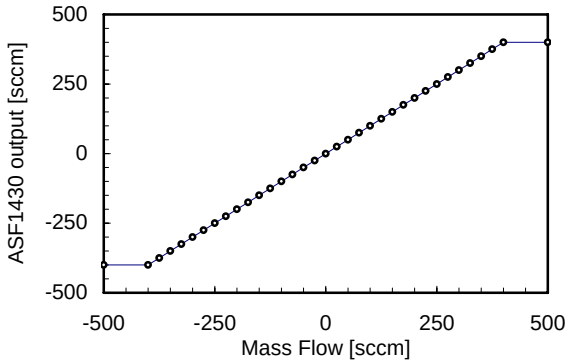

Figure 2: ASF1430 transfer characteristics.

The ASF1430 is bidirectionally calibrated up to a flow of 400 sccm. Between 400 sccm and 440 sccm flow is displayed, but with reduced accuracy. Two types of overflows are reported outside of this expanded range:

1. 'Peak Overflow' if the measured flow was only partly above 440 sccm. In this context it has to be remembered that the ASF1430 mass flow meter averages the flow over a eligible integration time. It can be that the average flow is small but that it periodically exceeds the maximum of 440 sccm and no precise measurement of the average can be guaranteed anymore. This can be checked with a sensor readout at 200 Hz.

2. 'Overflow' if the measured flow is always above the limit of 440 sccm.

1.2 Sensor Principle and Gas Types

The ASF1430 device detects mass gas flow by measuring heat transfer. A heating resistor on a thermally insulated membrane is kept above ambient temperature. In the presence of gas flow, the temperature distribution up- and downstream is disturbed. This asymmetry is then measured. Due to the minimal thermal mass of the membrane, symmetrical arrangement, and accurate temperature measurement, the revolutionary specifications of the ASF1430 devices are achieved.

The above mentioned thermal principle requires information about the gas type to be measured. The ASF1430 is available for air and nitrogen. Other gas types are available on request.

In Figure 3 the repeatability of the ASF1430 devices is compared with the repeatability of a typical Mass Flow Controller (MFC). It emphasizes the superior performance of the ASF1430 device.

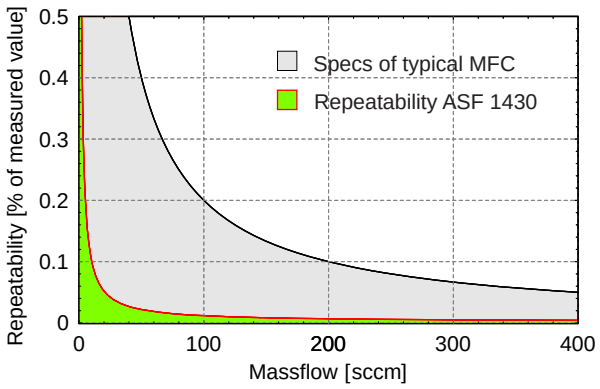

Figure 3: Comparison of the repeatability of the CMOSens® ASF1430 device compared to a typical Mass Flow Controller (MFC).