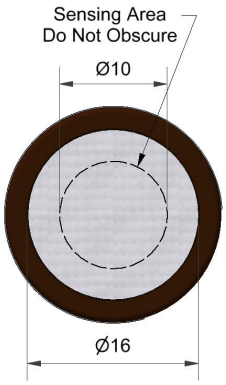
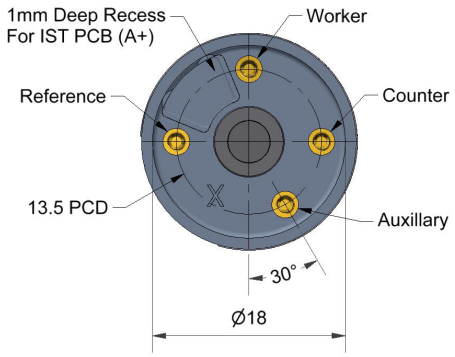
VOC-A4/VOC-A4+ Volatile Organic Compound Sensor

The VOC-A4 sensor is a PPB sensor that is designed for industrial safety and environmental air quality applications with best-in-class baseline stability. The A series is the most widely used sensor format for portable gas detection applications. This product is available in our standard format (VOC-A4) and with our patented Integrated Smart Technology (VOC-A4+) that has an IST board with a memory chip and temperature sensor integrated in the sensor. The + sensors store specific calibration, specification, and identification data on every sensor allowing plug and play operation. The on-board temperature sensor improves the accuracy and simplicity of temperature compensation algorithms.

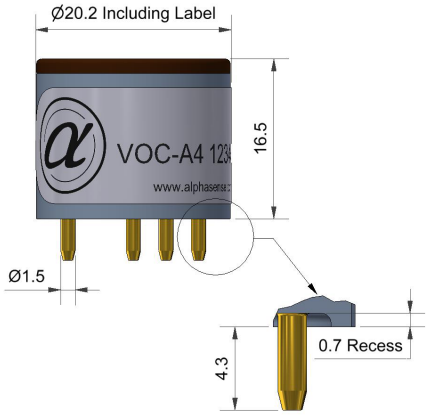
VOC-A4 Volatile Organic Compound Sensor – 4-Electrode



Top View

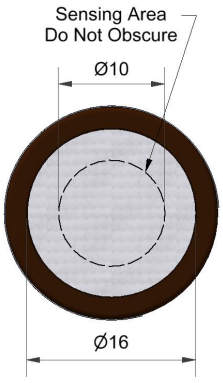


Bottom View

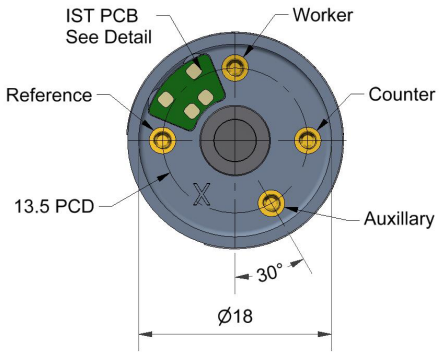


Side View

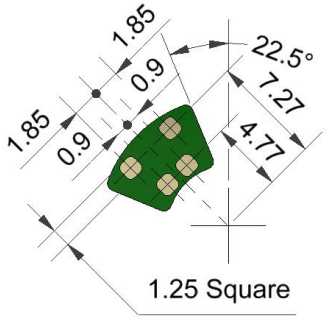
VOC-A4+ Volatile Organic Compound Sensor – 4-Electrode (with Integrated Smart Technology)



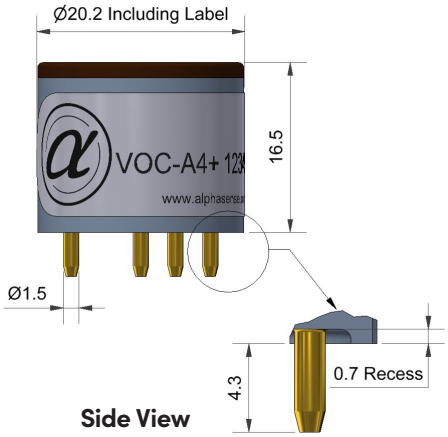
Top View



Bottom View



IST Board



Side View

Dimensions are in millimetres (± 0.15 mm).

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Sensor Data - CO

Specification CO Sensing

Performance	Sensitivity	nA/ppm in 2ppm CO	230 to 410
	Response time	t_{90} (s) from zero to 2ppm CO	< 30
	Zero current	nA in zero air at 20°C	±200
	Noise*	±2 standard deviations (ppb equivalent)	20
	Range	ppm limit of performance warranty	190
	Linearity	ppm CO error at full scale, linear at zero, 10ppm CO	±1.5
	Overgas limit	maximum ppm for stable response to gas pulse	1000
	***Tested with Alphasense AFE low noise circuit**		
Lifetime	Zero drift	ppb equivalent change/year in lab air	±500
	Sensitivity drift	% change/year in lab air, monthly test	< 15
	Operating life	months until 50% original signal (24-month warranted)	> 36
Environmental	Sensitivity @ -20°C	% (output @ -20°C/output @ 20°C) @ 2ppm CO	50 to 80
	Sensitivity @ 50°C	% (output @ 50°C/output @ 20°C) @ 2ppm CO	100 to 120
	Zero @ -20°C	nA change from 20°C	±20
	Zero @ 50°C	nA change from 20°C	±100
Cross Sensitivity	CO sensitivity	% measured gas @ 2ppm CO	< 110
	H_2S sensitivity	% measured gas @ 5ppm H_2S	< 400
	NO_2 sensitivity	% measured gas @ 5ppm NO_2	< -80
	Cl_2 sensitivity	% measured gas @ 5ppm Cl_2	< -40
	NO sensitivity	% measured gas @ 5ppm NO	< 40
	SO_2 sensitivity	% measured gas @ 5ppm SO_2	< 100
	H_2 sensitivity	% measured gas @ 100ppm H_2 at 20°C	< 50
	C_2H_4 sensitivity	% measured gas @ 40ppm C_2H_4	< 110
	NH_3 sensitivity	% measured gas @ 20ppm NH_3	< -0.1
	CO_2 sensitivity	% measured gas @ 5% vol CO_2	< 0.1
Key Specifications	Temperature range	°C	-30 to 50
	Pressure range	kPa	80 to 120
	Humidity range	% rh continuous	15 to 90
	Storage period	months @ 3 to 20°C (stored in sealed pot)	6
	Load resistor	Ω (AFE circuit is recommended)	33 to 100
	Weight	g	< 6

Figure 1 Linearity from 0 to 10ppm CO

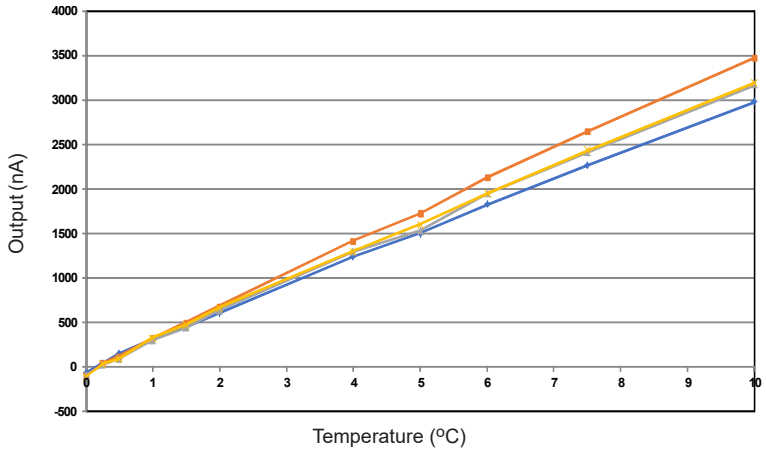

Figure 1 shows example sensor response at concentrations of up to 10ppm CO.

Figure 2 Zero Temperature Dependence

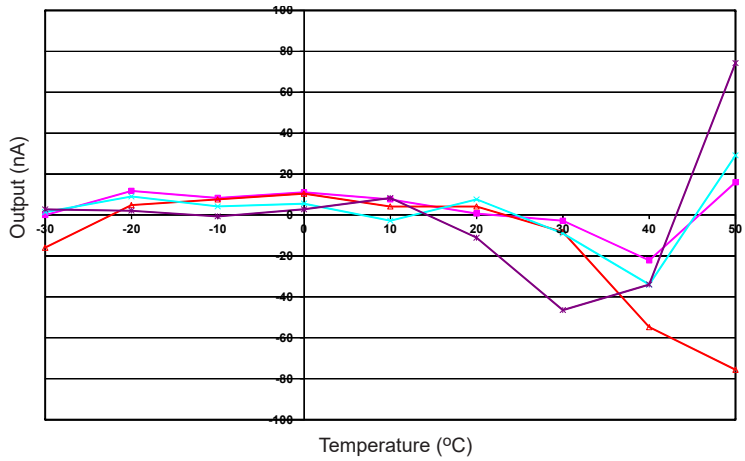

Figure 2 shows example variation in zero output of the working electrode caused by changes in temperature, expressed as nA.

Sensor Data - C_2H_6O

The VOC-A4 detects both VOCs and CO gases. Using both a VOC-A4 and a CO-A4 sensor in combination allows the estimation of VOC concentration at 0V bias.

The data given in this TDS refers to the use of the VOC-A4 sensor at 0V bias. Other voltages within the range 0 to 0.3V can also be applied (see application note AAN-805).

In order to calculate the VOC concentration, it is necessary to ensure the signals from the two sensors have been corrected for electronic zero offset, sensor zero offset and temperature dependence, and sensitivity (nA/ppm) calibration and temperature dependence.

Specification Ethanol (C_2H_6O) sensing

Performance	Sensitivity to NO_2		nA/ppm in <1ppm C_2H_6O		200 to 400
	Response time		t_{90} (s) from zero to <1ppm C_2H_6O		< 30
	Zero current		nA in zero air at 20°C		±200
	Noise*		±2 standard deviations (ppb equivalent)		20
	Range		ppm limit of performance warranty		2
	Linearity		ppm error at full scale, linear at zero, <1ppm C_2H_6O		< 0.13
	Overgas limit		maximum ppm for stable response to gas pulse		5
	*Tested with Alphasense AFE low noise circuit				
Lifetime	Zero drift		ppb equivalent change/year in lab air		±500
	Sensitivity drift		% change/year in lab air, monthly test		< 15
	Operating life		months until 50% original signal (24-month warranted)		> 36
Environmental	Sensitivity @ -20°C		% (output @ -20°C/output @ 20°C)		ND
	Sensitivity @ 50°C		% (output @ 50°C/output @ 20°C)		ND
	Zero @ -20°C		nA change from 20°C		±20
	Zero @ 50°C		nA change from 20°C		±100
Cross Sensitivity	H_2S	sensitivity	% measured gas @ 5ppm	H_2S	< -100
	NO	sensitivity	% measured gas @ 5ppm	NO	< 5
	Cl_2	sensitivity	% measured gas @ 5ppm	Cl_2	< 100
	SO_2	sensitivity	% measured gas @ 5ppm	SO_2	< -3
	CO	sensitivity	% measured gas @ 5ppm	CO	< -3
	C_2H_4	sensitivity	% measured gas @ 100ppm	C_2H_4	< 0.1
	NH_3	sensitivity	% measured gas @ 20ppm	NH_3	< 0.1
	H_2	sensitivity	% measured gas @ 100ppm	H_2	< 0.1
	CO_2	sensitivity	% measured gas @ 5% volume	CO_2	0.1
	Halothane	sensitivity	% measured gas @ 100ppm	Halothane	< 0.1
Key Specifications	Temperature range		°C		-30 to 40
	Pressure range		kPa		80 to 120
	Humidity range		% rh continuous		15 to 85

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Figure 3 Linearity from 0 to 860ppb (approx) Ethanol

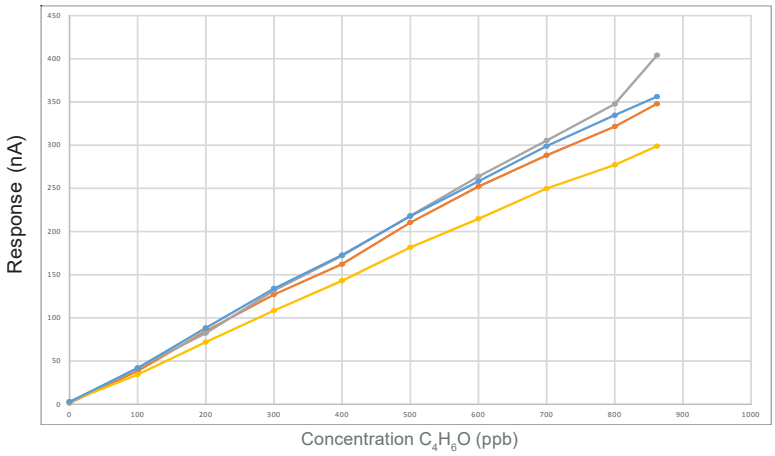

Figure 3 shows example sensor output at concentrations of up to 860ppb Ethanol.

Figure 4 Response to 860ppb (approx) Ethanol

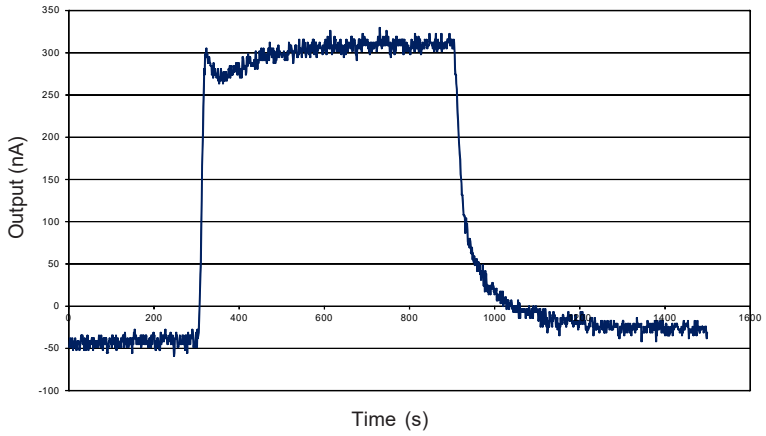

Figure 4 shows example sensor output in reponse to 860ppb Ethanol.

Figure 5 Response to 2ppm C_4H_8 with voltage bias

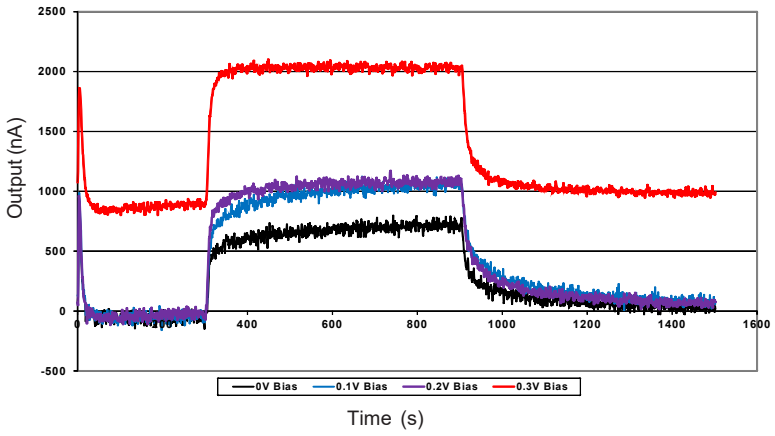

Figure 5 shows example output at different bias voltages in reponse to 2ppm C_4H_8.

IST Board Data

Interface	Communication Bus	Compatible with the 400 kHz I²C protocol
	Max. Bus Speed	Up to 1 MHz
	Input Logic Levels	High (Recessive) < 2.3 V | Low (Dominant) < 0.2 V
	Absolute Max. Input Signal	3.6 V
Electrical	Supply Voltage Range	1.7 V to 3.6 V
	Supply current – Stand-By	< 5 µA
	Supply current – Operating	< 0.15 mA (temperature reading only) < 2.15 mA (temperature reading + memory reading/writing)
	Power Supply Conditioning	Built-In 100 nF decoupling capacitor
	ESD Protection	4 kV (human body model) - Enhanced ESD / Latch-Up protection
	Bus Pins Input Capacitance	15 pF max.
Performance	Operational Temperature	–40 °C to +85 °C
	Temperature Sensor Accuracy	±1°C (-0°C to +70°C)
	Memory Data Retention	> 200 years
	Memory Write Cycles	> 4,000,000
Data & Communication	Memory IC & I2C Address	M24128X-FCU | Device Address: R - 0xA0 / W – 0xA1
	Temperature IC & I2C Address	MAX31875R0TZS+T | Device Address: R - 0x90 / W – 0x91
	Product Data Start Address	0x0900
	Calibration Data Start Address	0x0B00
	User Data Area	0x0D00 – 0x18FF (3,072 Bytes)
	CRC Polynomial	0x 01 04C1 1DB7
	Digital Signature Algorithm	SHA-256

Factory-populated data

Product Data
- Data Format Version
- Customer (OEM) ID
- Product ID
- Type of Sensor / Target Gas
- Sensor Serial Number
- End of Storage Period Date
- Sensor Replacement Date
- Product Data Checksum
- Alphasense Digital Signature
- Customer Digital Signature

Calibration
- Calibration Data Units
- Zero (clean dry air) Output
- Calibration Span
- Calibration Output
- Sensitivity
- Calibration Date
- Calibration Data Checksum
- Calibration Data Signature

Sensor Specification
- Over-gas limit
- Concentration Range
- Temperature Range Low
- Temperature Range High
- Humidity Range Low
- Humidity Range High
- Pressure Range Low
- Pressure Range High
- Specification Checksum

15,000+ locations

Customer Specific
- Custom Parameters
- Re-Calibration Due Date
- Operational Limits:
- Low | High | STEL | TWA
- Next Bump Test Due Date
- User Data Area

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For further information on the performance of this sensor, on other sensors in the range or any other subject, please contact Alphasense Ltd. or visit our website at "www.alphasense.com".