

Product Specification

Senseair Sunrise

Sensor module for battery-powered applications



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General

Item	Senseair Sunrise Article No. 006-0-0007
Operating principle	Non-dispersive infrared (NDIR)
Measured gas	Carbon dioxide (CO ₂)
Measurement range	0–10000ppm ¹
Accuracy [CO ₂] (ANSI/ASHRAE Standard 62.1)	600–2500ppm: ±75ppm ²
Accuracy [CO ₂] (Operating conditions)	400–5000ppm: ±(30ppm +3% of reading) ^{3, 4} 5001–10000ppm: ±(10% of reading) ^{3, 4}
Operating conditions	0–50 °C, 0–85% RH (non-condensing), (see figure 4)
Warm-up time	0s
Response time $\tau_{90\%}$	30s
Power supply	3.05–5.5V ⁵
Peak current	< 125mA ⁶
Steady state current during sampling	99mA
Average current, typical	45µA ^{7, 8}
Measurement setting	Default: Continuous measurement mode, 16s, 8 samples (adjustable by host) ⁷
Communication	UART / I ² C
Pressure dependence	1.6% reading per kPa deviation from normal pressure
RMS noise, Typ. [CO ₂]	<u>Filtered:</u> 0.6ppm @ 400ppm, 25 °C 2.5ppm @ 3000ppm, 25°C <u>Unfiltered:</u> 6ppm @ 400ppm, 25 °C 17ppm @ 3000ppm, 25 °C
Maintenance	Maintenance free
Life expectancy	> 15 years
Dimensions (LxWxH)	33.5x19.7x11.5mm
Weight	5g
Storage conditions	-40–70 °C

Table 1 General Specifications

- Note 1: Sensor is designed to measure in the range 400–5000ppm, extended range is up to 10000ppm. Nevertheless, exposure to concentrations below 400ppm may result in incorrect operation of ABC algorithm and shall be avoided for configurations with ABC ON.
- Note 2: Addendum ab to ANSI/ASHRAE Standard 62.1-2022 specifies sensor to be accurate within ±75ppm at concentrations of 600, 1000, and 2500ppm when measured at sea level at 77 °F (25 °C). See Figure 3.
- Note 3: Shipping, rough handling and assembly might temporarily affect the accuracy of the sensor. Accuracy can be fully restored by forced recalibration or after a maximum of 3 ABC periods.
- Note 4: Specification is referenced to uncertainty of calibration gas mixtures (±1%).
- Note 5: Unprotected against surges and reverse connection.
- Note 6: At sampling start/stop there is a fast transient current. See “Sunrise customer integration guidelines” (TDE7318) for details.
- Note 7: See Measurement mode for detailed information.
- Note 8: With default settings and nRDY disabled. See Figure 5 Average current.

Description

Senseair Sunrise is a miniature sensor module for battery-powered applications. It gives full control over integration of sensor into a host system, flexibility in changing of CO₂ measurement period and power consumption.

Applications

Senseair Sunrise is designed for battery powered applications.

Installation and Soldering

Refer to Senseair Sunrise and Sunlight Handling manual (ANO4947).

Sample Gas Diffusion Area

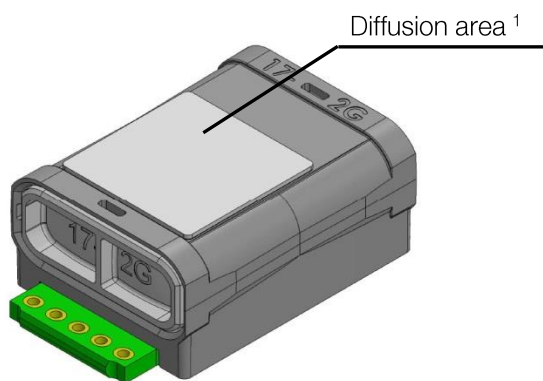


Figure 1 Sample Gas Diffusion Area

Note 1: Diffusion area must not be covered. Diminished sample gas circulation may affect response time.

Pin Configuration and Functions

Pin Configuration

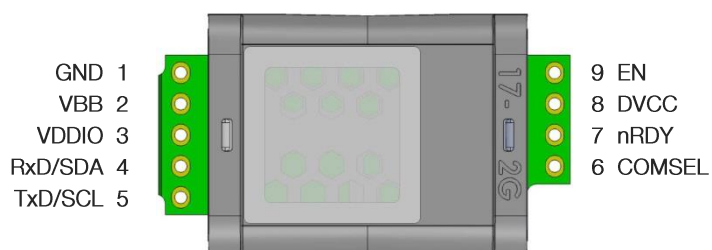


Figure 2 Pin Configuration (Top view)

Pin Functions

Pin #	Symbol	I/O Type	Description
1	GND	Power	Ground
2	VBB	Power	Sensor supply voltage
3	VDDIO	Power	I/O supply voltage for TXD/SCL and nRDY.
4	RxD/SDA	I/O	Sensor UART receive input / I ² C bidirectional serial data; True Open-Drain when operating as output.
5	TxD/SCL	I/O	Sensor UART transmit output / I ² C clock input; True Open-Drain when operating as output, 100k Ω internal Pull-Up to VDDIO.
6	COMSEL	Input	Communication select, valid at power-up: HIGH = UART (Default, internal Pull-Up, can be left floating); LOW = I ² C (Connect to GND).
7	nRDY	Output	Measurement ready output; True Open-Drain, active LOW; 1M Ω internal Pull-Up to VDDIO.
8	DVCC	Power	Internal supply voltage output. Not intended to supply external systems, leave floating if not used.
9	EN	Input	Enable (active high). Drive this pin over 1.2V to turn on the sensor. Drive this pin below 0.4V to put the sensor into shutdown mode. Do not leave floating. Connect to VBB if not used.

Table 2 Pin Functions

Specifications

Absolute Maximum Ratings

Over operating temperature range (unless otherwise noted); all voltages are with respect to GND ¹

Symbol	Description		Min	Max	Unit
Voltage					
VBB	Supply voltage		-0.3	6	V
VDDIO	I/O supply voltage				
nRDY	Ready output				
RxD/SDA	UART / I ² C				
TxD/SCL	UART / I ² C				
EN	Enable				
DVCC	Internal supply voltage output		-0.3	VBB + 0.3 or 4.3 whichever is less	V
COMSEL	Communication select	EN = HIGH EN = LOW	-0.3 -0.3	DVCC + 0.3 0.3	V
Current					
DVCC	Maximum output current		Internally limited		A
COMSEL, RxD/SDA, TxD/SCL	Instantaneous maximum current limit		25		mA

Table 3 Absolute Maximum Ratings

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Recommended Operating Conditions

Over operating temperature range (unless otherwise noted)

Symbol	Description	Min	Typ	Max	Unit	Test conditions
Voltage						
VBB	Supply voltage	3.05	3.3	5.5	V	
VDDIO	I/O supply voltage for TXD/SCL and nRDY.	0		5.5	V	
COMSEL	Communication select	0		DVCC	V	
EN	Enable	0		VBB	V	
RxD/SDA	UART / I ² C	0		VDDIO	V	
TxD/SCL	UART / I ² C	0		VDDIO	V	
Current						
I _{COMSEL} ²	DC injection current	-2		2	mA	(V _{IN} < GND, V _{IN} > DVCC)
I _{DVCC} ^{1, 2}	Internal supply voltage current	0		25	mA	

Table 4 Recommended Operating Conditions

Note 1: Leave floating if unused.

Note 2: Limited to the value specified.

Accuracy over complete operating range

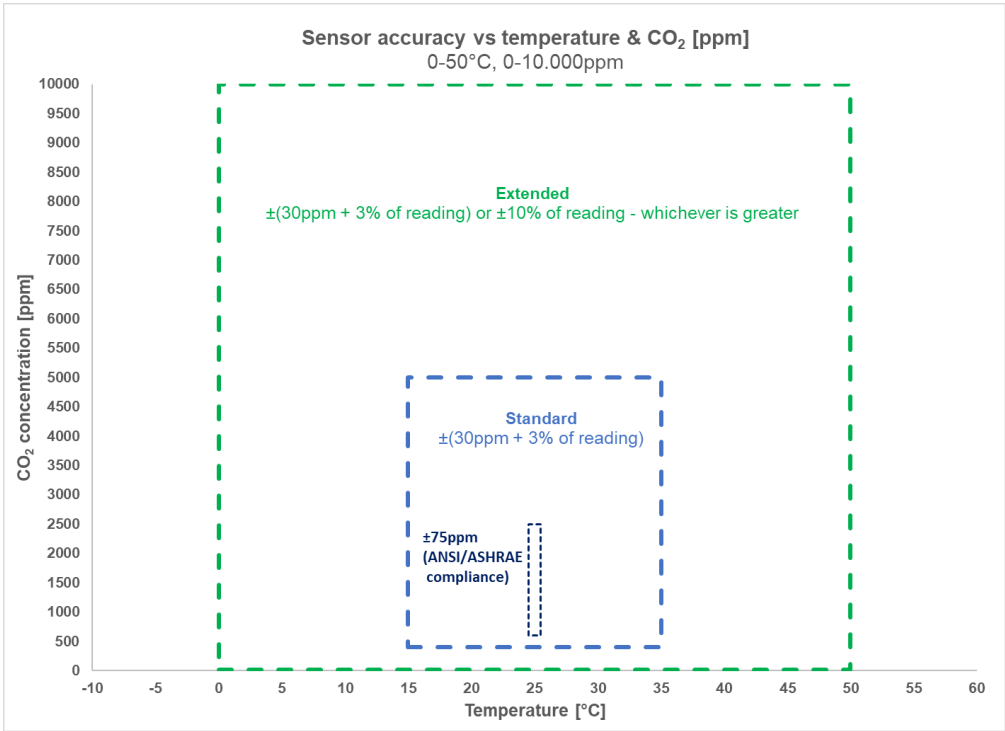


Figure 3 Accuracy over complete operating range (temperature and measurement range of CO₂)

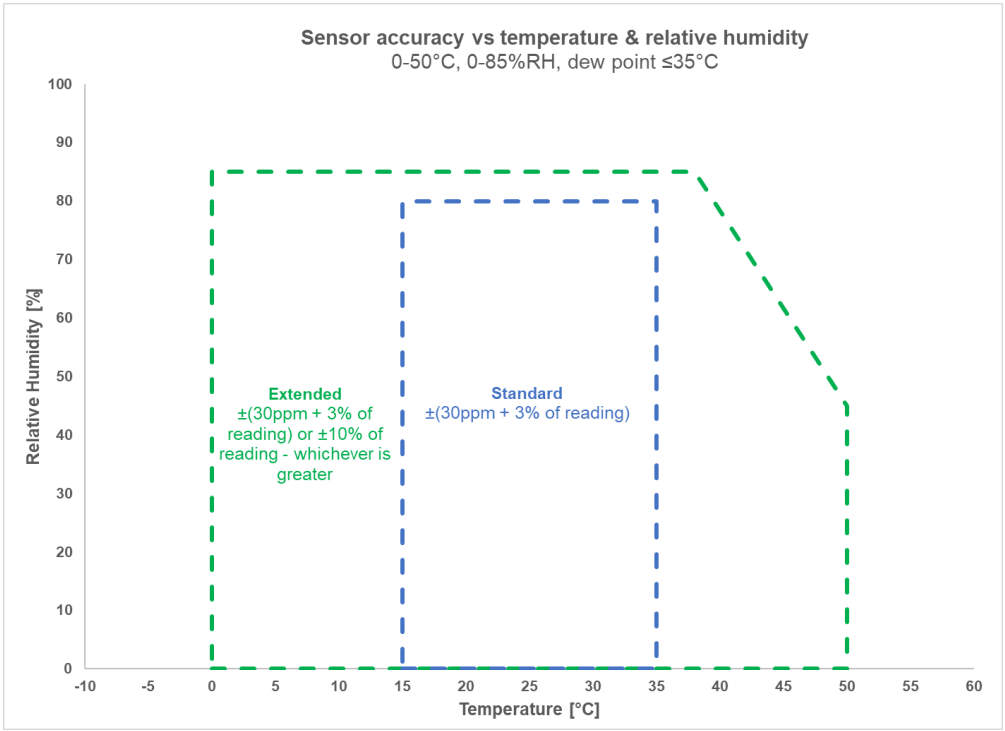


Figure 4 Accuracy over full operating range (temperature and relative humidity)

Electrical Characteristics

Over operating temperature range, $V_{EN} = V_{BB} = 3.3V$ and default settings:
Continuous mode, 16s measurement period, 8 samples, unless otherwise noted.

Symbol	Description		Min	Typ	Max	Unit
	Operating voltage					
V _{DVCC} ¹	Supply voltage output		2.74		2.91	V
V _{IH}	Input high voltage	COMSEL, RxD/SDA, TxD/SCL	2.0			V
		ENABLE	1.2			V
V _{IL}	Input low voltage	COMSEL, RxD/SDA, TxD/SCL			0.82	V
		ENABLE			0.4	V
V _{HYS}	Input hysteresis	COMSEL, RxD/SDA, TxD/SCL	164			mV
	Operating current					
I _{VBB}	Operating peak current	V _{EN} ≥ 1.2V; 3.05 ≤ V _{BB} ≤ 5.5V			125	mA
	Operating average current			45 ²	μA	
	Shutdown current					
I _{VBB}	Supply quiescent current	V _{EN} ≤ 0.3V; 3.05 ≤ V _{BB} ≤ 5.5V		0.2	1	μA
I _{EN}	Enable pin leakage current	V _{EN} = V _{BB} = 5.5V		5.5		μA
I _{VDDIO}	I/O supply leakage current	V _{VDDIO} = 3.3V		0.2	1.1	μA
I _{IN}	Input leakage current	V _{VDDIO} = 3.3V; RxD/SDA, TxD/SCL		0.1	1	μA

Table 5 Electrical Characteristics, Typical values at $T_A = 25\text{ }^{\circ}C$.

Note 1: Output is not intended to supply external systems, leave floating if unused.
Note 2: nRDY disabled.



Average current

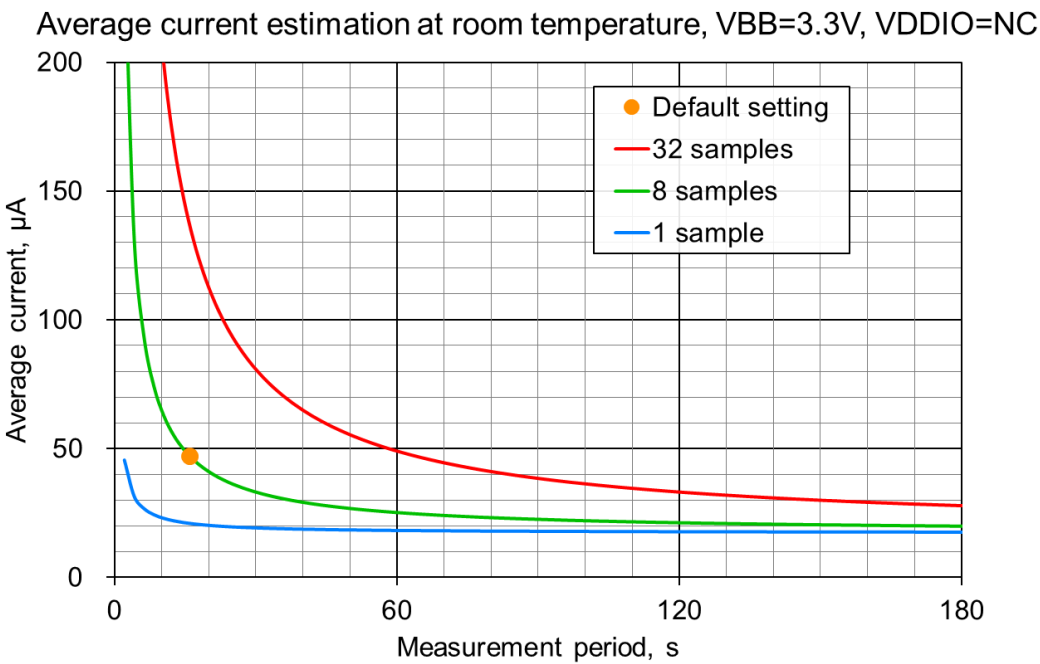


Figure 5 Average current

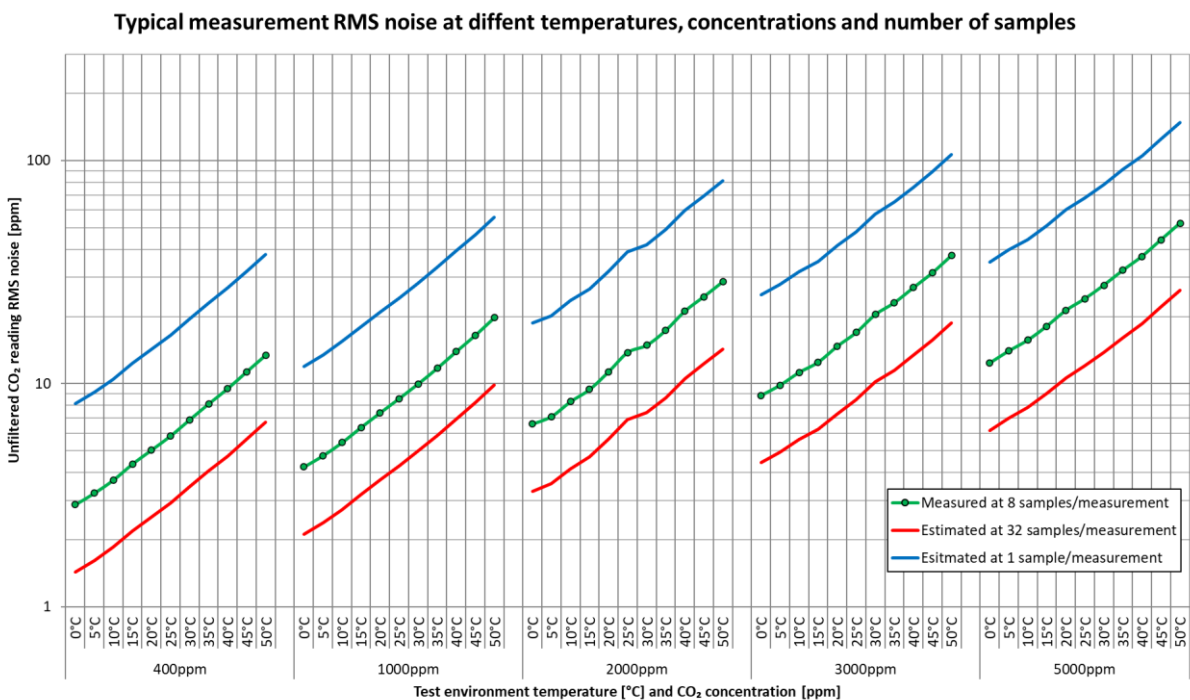


Figure 6 Measurement RMS noise

Measurement Mode

The Senseair Sunrise supports two modes of operation for measurement of CO₂ concentration: Continuous measurement mode and Single measurement mode. The default operation mode for Senseair Sunrise is Continuous measurement mode.

- 1) In Continuous measurement mode, the sensor measures at regular intervals (measurement period, default setting 16s). The host can read measurement data after each measurement and does not need to send any command to trigger measurements.
- 2) In Single measurement mode, the sensor waits for the hosts command to measure. The host needs to send a command sequence to trigger each measurement.

See "Sunrise customer integration guidelines" (TDE7318) for details.

Communication

Refer to "Modbus on Senseair Sunrise and Sunlight" (TDE5514) and "I²C on Senseair Sunrise and Sunlight" (TDE5531). See "Sunrise customer integration guidelines" (TDE7318) for details.

Dimensions

Refer to drawing 740-00993.

Maintenance

Senseair Sunrise has a built-in self-correcting ABC algorithm. ABC period is adjustable by host. Discuss your application with Senseair in order to get advice for a proper calibration strategy.

Handling

Refer to "Sunrise and Sunlight Handling Manual" (ANO4947)

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