Senseair Sunlight CO_2 2% PH – 8.51

Wide operating range and easily integrated

Compliant with HVAC and building standards, we offer Senseair Sunlight CO_2 2% PH – an extremely power efficient NDIR CO_2 sensor with a wide operating range up to 20 000 ppm. Senseair Sunlight CO_2 2% PH can be used in a wide range of HVAC, fire alarm and cold storage applications as well as battery and wireless applications and other situations where you need a reliable and dependable sensor with long lifetime.

The module is designed for simple integration into products. The optical solid-state design with no moving parts makes this sensor robust and resistant to vibrations. We offer Senseair Sunlight CO_2 2% PH complete with pin headers for even easier product integration.

With our automatic baseline correction Senseair Sunlight CO_2 2% PH is maintenance-free, meaning you can mount and forget your sensor, and it will remain accurate throughout its lifetime.

Product overview

Article number	006-1-0104
Operating principle	Non-dispersive infrared (NDIR)
Measured gas	CO_2
Measurement range	0–20 000 ppm
Accuracy	±(50 ppm + 5 % of reading)
Operating conditions	-40–50 °C 0–85 %RH
Power supply	3.0–5.5 V
Peak current	< 125 mA
Average current	1–34 µA
Communication	UART, I^2C
Maintenance:	Maintenance free
Life expectancy	> 15 years
Dimensions	34 x 21 x 12 mm

Key benefits

- Wide operating range
- Ultra-low power consumption
- High precision
- Robust
- Mass production
- Self-correcting
- Easy integration

1. Sensor performance

1.1 CO_2 Sensing performance

Parameter	Conditions	Value
Target gas	-	Carbon dioxide (CO_2)
Operating principle	-	Non-dispersive infrared (NDIR)
Gas sampling method	-	Diffusion
Measurement range [1]	Standard	400–5000 ppm
	Extended	5001–20 000 ppm
Accuracy [2, 3] (Operating conditions -40 – -10 °C)	400 ppm – 5000 ppm	±(200 ppm + 3 % of reading
	5001 ppm – 20 000 ppm	±12 % of reading
Accuracy [2, 3] (Operating conditions -10 – 50 °C)	400 ppm – 5000 ppm	±(50 ppm + 5 % of reading)
	5001 ppm – 20 000 ppm	±10 % of reading
Resolution	-	1 ppm
Measurement interval	Default	16 s; Configurable from 2 s
Sampling	Default	8 samples; Configurable 2 to 1024
Warm-up time		No warm-up time (first reading is valid)
Response time	$T_{63\%}$	<30 s
Compensation [4]	Temperature	On-board sensor element
	Pressure	Pressure value must be provided by host system. Otherwise, dependency is 1.6 % reading per kPa deviation from normal pressure

1. Sensor is designed to measure in the range of 400 – 5000 ppm (extended range up to 20 000 ppm). Nevertheless, exposure to concentrations below 400 ppm may affect performance and shall be avoided with ABC turned on.
2. For more details, see chapter 1.6. Specification is referenced to uncertainty of calibration gas mixtures ±1 %.
3. Shipping, rough handling and assembly can temporarily affect the accuracy of the sensor. Accuracy can be fully restored by forced recalibration or after a maximum of 3 ABC periods after mounting the sensor.
4. CO_2 readings are temperature compensated. Optional host system can provide an ambient pressure value for pressure compensated CO_2 readings. The Sunlight does not have an integrated pressure sensor.

1.2 General performance

Parameter	Conditions	Value
Operating temperature		-40–50 °C
Operating humidity	Non-condensing	0–85 %RH
Power supply		3.05 V–5.5 V
Peak current [1]		< 125 mA
Average Current [2, 3]	Default settings	34 µA
Dimensions	(L x W x H)	34 x 21 x 12 mm
Life expectancy		> 15 years
Storage temperature		-40 – 70 °C
Weight		5 g
Communication interface		UART / I^2C
Maintenance [4]		Maintenance-free

1. At sampling start/stop there is a fast transient current. See "Customer Integration Guideline Senseair Sunrise and Sunlight CO2" (TDE7318) for details.
   To guarantee the functionality of the sensor, the voltage supply must be kept, and the maximum current must be considered.
2. The average current consumption depends on configured measurement period and number of samples per measurement, see chapter 1.7 for further information's and dependency between configuration and average current consumption.
3. Measured at 25 °C.
4. For maintenance-free operation, ABC (Automatic Baseline Correction) must be enabled .

1.3 Pin configuration and functions

Pin #	Symbol	I/O Type	Description
1	GND	Power	Ground
2	VBB	Power	Supply voltage
3	VDDIO	Power	I/O supply voltage for TxD/SCL and nRDY
4	RxD / SDA	I/O	UART receive input / I^2C bidirectional serial data. True open drain when operating as output.
5	TxD / SCL	I/O	UART transmit output / I^2C clock input. True open drain when operating as output. 100kΩ internal pull-up to VDDIO
6	COMSEL	Input	Communication select – Valid at power-up. High = UART (Internal pull-up, can be left floating) Low = I^2C (Connect to GND)
7	nRDY	Output	Measurement ready output. True open drain, active low, 1 MΩ internal pull-up to VDDIO
8	DVCC	Power	Internal supply voltage output. Not intended to supply external system. Leave floating if not used.
9	EN	Input	Enable sensor (active high). Drive this pin >1.2 V to turn on the sensor. Drive this pin <0.4 V to shut down the sensor. Do not leave floating. Connect to VBB if not used.

Figure 1. Pin configuration of Senseair Sunlight CO_2 2% PH – 8.51

1.4 Drawing - Dimensions – Handling

Dimensional drawing of sensor with dimensions and their tolerances in millimetres. Note that the black particle filter on top of the sensor must not be removed or modified to ensure specified sensor performance over its lifetime.

Additional information about the integration and handling can be found in the *"Handling guideline ANO4947"* at our webpage.

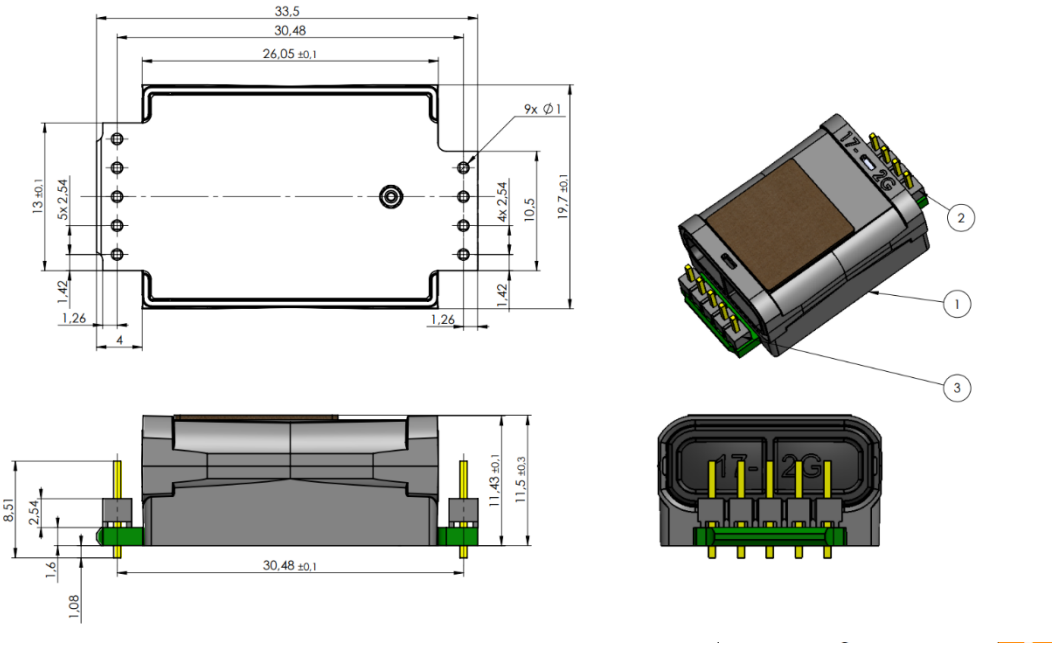

Figure 2. Dimensions of Senseair Sunlight CO_2 2% PH – 8.51

1.5 Recommended operating conditions

Over operating temperature range, unless otherwise noted.

1.1.1. Operating conditions for voltage

Symbol	Description	Min	Typ	Max	Unit
VBB	Supply voltage	3.05	3.3	5.5	V
VDDIO	I/O supply voltage TxD/SCL and nRDY	0	-	5.5	V
COMSEL	Communication select	0	-	DVCC	V
EN	Enable	0	-	VBB	V
RxD/SDA	UART / I²C	0	-	VDDIO	V
TxD/SCL	UART / I²C	0	-	VDDIO	V

1.1.2. Operating conditions for current

Symbol	Description	Min	Typ	Max	Unit	Test conditions
I_{COMSEL} [1]	DC injection current	-2	-	2	mA	(V_{IN}<GND, V_{IN}>DVCC)
I_{DVCC} [1,2]	Internal supply current	0	-	25	mA	

1. Limited to the value specified.
2. Leave floating if unused.

1.6 Sensor accuracy over the nominal operating range

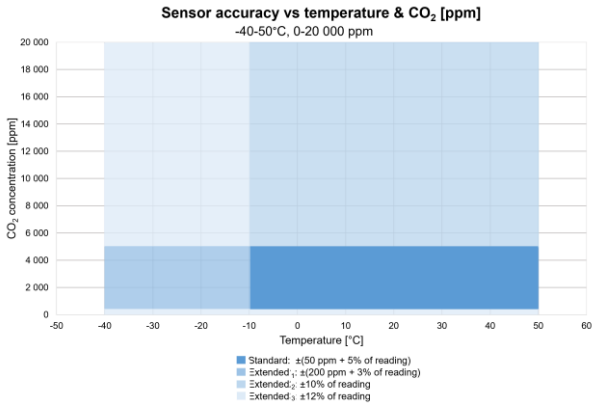

Figure 3. Accuracy over temperature and CO_2

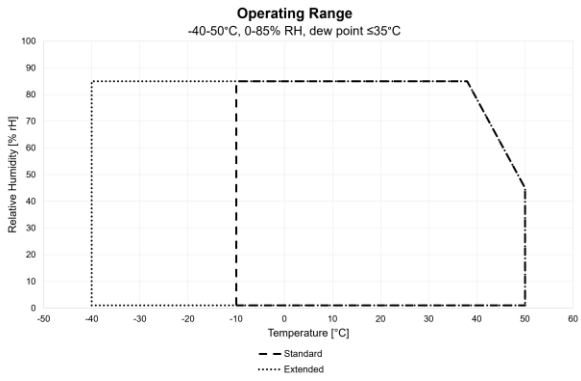

Figure 4. Operating range

1.7 Average current consumption depending on sensor configuration

Average current consumption at different measurement intervals, measured at 25 °C:

Measurement period [s]	2 samples		8 samples		32 samples	
	Continuous	Single	Continuous	Single	Continuous	Single
16	22 µA	-	34 µA[1]	-	-	-
60	18 µA	7 µA	21 µA	17 µA	35 µA	27 µA
300	16 µA	1 µA	17 µA	3 µA	20 µA	5 µA

1. Default setting.

2. Sensor documentation

2.1 Measurement mode

The Senseair Sunlight CO_2 2% PH – 8.51 supports two modes of operation:

1. Continuous measurement mode
2. Single measurement mode

The **default** operation mode for Senseair Sunlight CO_2 2% PH – 8.51 is **Continuous measurement mode**.

1) In Continuous measurement mode, the sensor measures at regular intervals (measurement period, default setting 16 s). 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. By using this function, the current consumption can be further optimized and gives more flexibility how often the sensor should start a measurement without changing basic settings of the sensor.

See *"Customer Integration Guidelines Senseair Sunrise and Sunlight CO_2" (TDE7318)* for details.

2.2 Communication

See *"Modbus on Senseair Sunrise and Sunlight" (TDE5514)* and *"I2C on Senseair Sunrise and Sunlight" (TDE5531)*. Follow the *"Customer Integration Guidelines Senseair Sunrise and Sunlight CO_2" (TDE7318)* for additional instructions.

2.3 Maintenance

Senseair Sunlight CO_2 2% PH – 8.51 has a built-in self-correcting ABC algorithm**.** ABC period is adjustable by host and per default enabled. Discuss your application with Senseair in order to get advice for a proper calibration strategy.

The sensor also allows for performing a Zero calibration, Background calibration, or Target calibration. For more information, see *"Customer Integration Guidelines Senseair Sunrise and Sunlight CO_2" (TDE7318)*.

2.4 User- and integration-guide

Further and detailed information for the use and integration of the sensor are described in the *"Customer Integration Guidelines Senseair Sunrise and Sunlight CO_2" (TDE7318)* and can be download from the Senseair webpage.

2.5 Handling

See "*Senseair Sunrise and Sunlight Handling manual*" *(ANO4947)*

2.6 Revision History

Date	Version	Page(s)	Changes
November 2025	1	All	Initial release of document.
January 2026	2	All	Update of layout and formatting according to new template TED15352.

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