Senseair S12 CO_2

Full accuracy at quarter size

Senseair S12 CO_2 is designed for next-generation battery, wireless, and HVAC applications. It delivers the same trusted performance as Senseair Sunlight in a package of one quarter of the size. Fully compliant with ANSI/ASHRAE Standard 62.1-2022, RESET grad B, and the WELL Building Standard® (WELL v2™).

Thanks to LED technology, S12 combines ultra-low power consumption with uncompromising accuracy. Its reduced thickness and compact form make it ideal wherever space is at a premium, whether in battery systems, HVAC units, or duct installations, without sacrificing reliability.

Product overview *

Article number	012-0-0001
Operating principle	Non-dispersive infrared (NDIR)
Measured gas	CO_2
Measurement range	0–10 000 ppm
Accuracy	±(30 ppm + 3 % of reading)
Operating conditions	-10–60 °C 0–95 %RH
Power supply	3.0–5.5 V
Average current	< 34 µA
Communication	UART, I²C
Maintenance:	Maintenance free
Life expectancy	> 15 years
Dimensions	18 x 15 x 7 mm

* Preliminary specifications. May be changed without notice.

Key benefits

- SMD reflow solderable
- True NDIR CO_2 Sensing
- Ultra Compact "Micro" Format
- Versatile mounting and placement options
- Very low peak current
- Compliant with building standards:
  - o ANSI/ASHRAE Standard 62.1-2022 + Addendum d
  - o RESET grade B
  - o WELL Building Standard® (WELL v2™)
  - o Title 24, California Energy Code
- High precision

Applications

- Battery powered applications
- Indoor air quality equipment
- Building management systems
- Demand controlled ventilation systems
- Agricultural applications

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	0–5000 ppm
	Extended	5001–10 000 ppm
Accuracy [2,3,4]	ANSI/ASHRAE environments [5]	±(30 ppm + 3% of reading)
	0–5000 ppm	±(50 ppm + 3% of reading)
	5001–10 000 ppm	±(70 ppm + 3% of reading) or ±10% of reading – whichever is greater
Resolution	-	1 ppm
Measurement interval	Default	2 s; Configurable from 2 s
Sampling	Default	59 samples; Configurable
Response time	T$_{63\%}$	< 30 s
Compensation [6]	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

* Preliminary specifications. May be changed without notice.

1. Sensor is designed to measure in the range of 400–5000 ppm (extended range up to 10 000 ppm). Exposure to concentrations below 400 ppm may affect performance. For measurements of concentrations below 400 ppm, ABC shall be turned off.
2. Accuracy in the table is defined at 25 °C, 1013 mbar ambient pressure and 50% RH. The accuracy for the complete operating conditions is specified in 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. Continuous mode, filtered concentration readings.
5. S12 CO$_2$ complies with ANSI/ASHRAE Standard 62.1-2022 + addendum d, concentrations 600, 1000, and 2500 ppm measured at sea level at 25 °C.
6. CO$_2$ readings are temperature compensated. Optional host system can provide an ambient pressure value for pressure compensated CO$_2$ readings. The Sunrise does not have an integrated pressure sensor.

1.2 General performance

Parameter	Conditions	Value
Operating temperature [1]		-10–60 °C
Operating humidity	Non-condensing	0–95% RH
Power supply		3.05–5.5 V
Peak current [2]		< 20 mA
Average Current [3]	Default settings	< 34 µA
Nominal dimensions	(L x W x H)	18 x 15 x 7 mm
Life expectancy		> 15 years
Storage temperature		-40–85 °C
Weight		< 3 g
Communication interface		UART / I²C
Maintenance [4]		Maintenance-free

1. Sensor is calibrated to meet product specifications within standard range 15–35 °C, extended range -10–60 °C. Sensor can survive temperatures outside of operating range, but measurement accuracy is not guaranteed.
2. To guarantee the functionality of the sensor, the voltage supply must be kept, and the maximum current must be considered.
3. The average current consumption depends on configured measurement period and number of samples per measurement.
4. For maintenance-free operation, ABC (Automatic Baseline Correction) must be enabled.

1.3 Pin configuration and functions

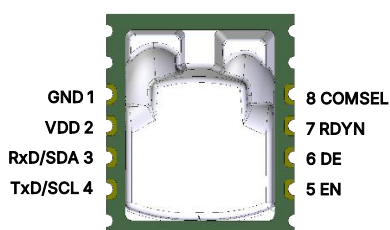| Pin #	Symbol	I/O Type	Description
1	GND	Power	Ground
2	VDD	Power	Supply voltage
3	RxD / SDA	I/O	UART receive input / I²C bidirectional serial data.
4	TxD / SCL	I/O	UART transmit output / I²C clock input.
5	EN	Input	Power down pin
6	DE	Output	UART transmit enable pin
7	RDYN	Output	Interrupt pin. Open drain output. Can be changed to push-pull output by register setting
8	COMSEL	Input	Communication select High = UART (Internal pull-up, can be left floating) Low = I²C (Connect to GND)

Figure 1. Pin configuration of S12 CO$_2$

1.4 Drawing - Dimensions

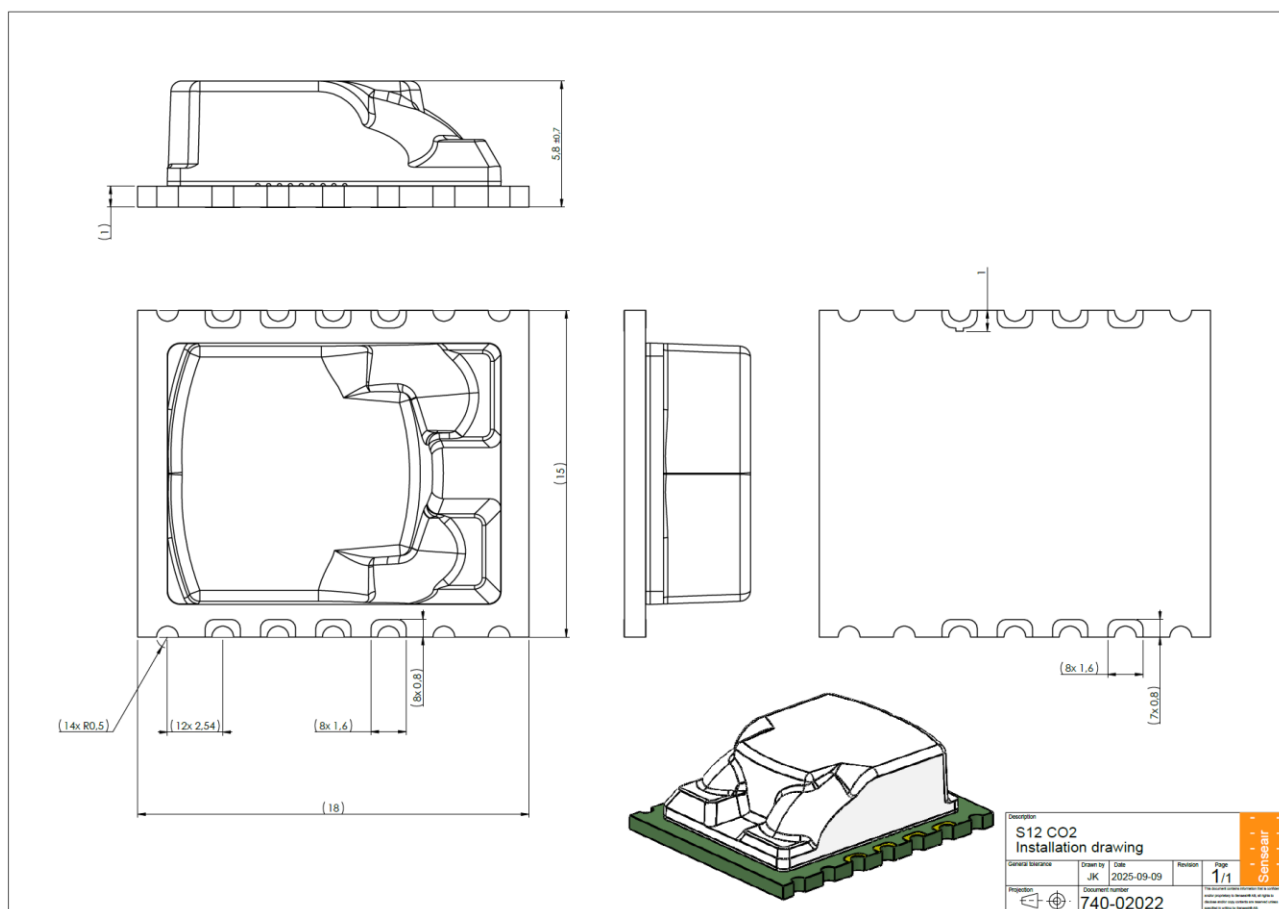Dimensional drawing of sensor with dimensions and their tolerances in millimetres.

Figure 2. Dimensions of S12 CO₂
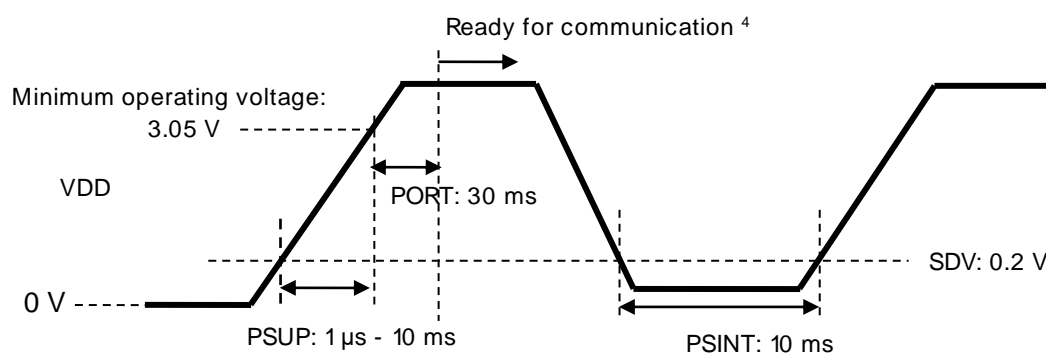
1.5 Recommended operating conditions

Over operating temperature range, unless otherwise noted.

1.1.1. Operating conditions for voltage

Symbol	Description	Min	Typ	Max	Unit
VDD	Supply voltage	3.05	3.3	5.5	V
COMSEL	Communication select	-0.3	-	VDD+0.3	V
EN	Enable	-0.3	-	VDD+0.3	V
RxD/SDA	UART / I²C	-0.3	-	VDD+0.3	V
TxD/SCL	UART / I²C	-0.3	-	VDD+0.3	V

Parameter	Description	Symbol	Min	Typ	Max	Unit
Power supply rise time [1,2]	Time until VDD is set to the operating voltage from 0.2 V.	PSUP	1 μ		10 m	s
Power-on reset time [1,2]	Time until ready for communication after PSUP.	PORT			30	ms
Shutdown voltage [2,3]	Shutdown voltage for POR re-starting.	SDV			0.2	V
Power supply interval time [1,2,3]	Voltage retention time below SDV for POR re-starting.	PSINT	10			ms

1. Values of these parameters are not guaranteed and not tested in production. Therefore, for applications that require high reliability, please do not use Power-On Reset (POR) and do reset using the PDN pin.
2. POR circuit detects rising edge of AVDD, resets the internal circuit, and initializes the registers. The host system must take into account PSUP and PORT times to communicate with the AK9726ADS.
3. Unless this condition is satisfied, reset may not be correctly performed.

4. In single measurement mode, the "External capacitor charge time" setting should also be considered.
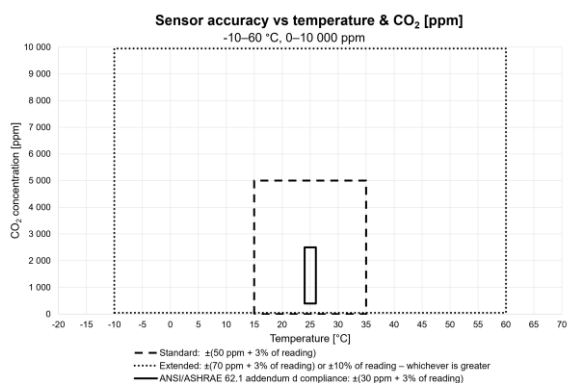

1.6 Sensor accuracy over operating range

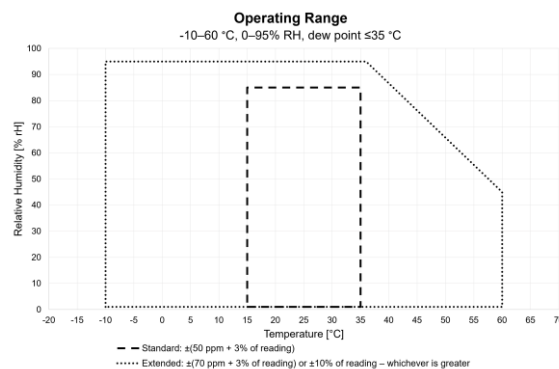Figure 3: Accuracy over temperature and CO_2

Figure 4: Operating Range

1.7 EEPROM Characteristics

Parameter	Min	Typ	Max	Unit
Retention	15			years
Endurance [1]			100 000	cycles
Writing time [2]			180	ms

1. Values of these parameters are not guaranteed and not tested in production.
2. When the values of the following registers in the EEPROM register are rewritten at a time.
   - Measurement Mode
   - Measurement Period
   - Number of samples
   - ABC period
   - ABC Target
   - Static IIR filter parameter
   - Meter control
   - MB / I^2C address

2. Sensor documentation

2.1 Measurement mode

The S12 CO$_2$ supports two modes of operation:

1. Continuous measurement mode
2. Single measurement mode

The **default** operation mode for S12 CO$_2$ is **Continuous measurement mode**.

1) In Continuous measurement mode, the sensor measures at regular intervals (measurement period, default setting 2 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.

2.2 Communication

See "Modbus on S12 CO$_2$" (TDE15927) and "I^{2}C on S12 CO$_2$" (TDE15933).

2.3 Maintenance

Senseair S12 CO$_2$ 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.

2.4 Revision History

Date	Revision	Page(s)	Changes
September 2025	1	All	Initial release of document
January 2026	2	All	Removal of "Micro" from sensor name. Update of operating range from 0–85% RH to 0–95% RH. Update of standard measurement range from 400–5000 ppm to 0–5000 ppm. Addition of "±(70 ppm + 3% of reading)" to extended range accuracy. Update of default sampling settings, from 64 to 59 samples. Update of weight from <5 g to <3 g. Addition of "standard range 15–35 °C, extended range -10–60 °C" to Note 1 in 1.2 General performance. Update of Figure 3: Accuracy over temperature and CO2 Figure 4: Operating Range. Removal of fields that were missing information.

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