

Product Specification

*SenseAir*<sup>®</sup> *S8-PWM*

Miniature CO2 sensor safety switch

## **SenseAir<sup>®</sup> S8** Miniature infrared CO<sub>2</sub> sensor module

**Warning! ESD  
sensitive device!**

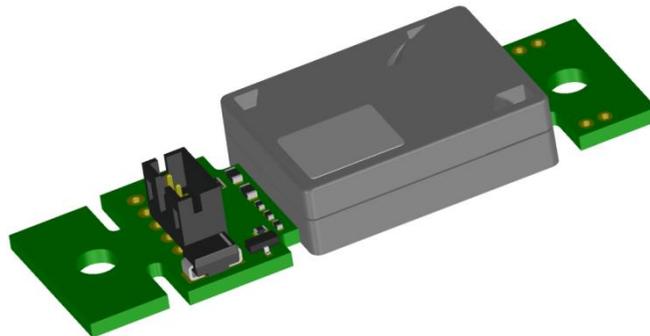


Figure 1: *SenseAir<sup>®</sup> S8* Article no. 004-0-0058

### **General**

The *SenseAir<sup>®</sup> S8-PWM* article number 004-0-0058, CO<sub>2</sub> sensor module is designed to be built-in into stationary ventilation equipment, such as window vent or duct exhaust actuators, serving as a linear transmitter of CO<sub>2</sub>. The sensor utilizes reliable and highly accurate infrared gas sensing technology.

### ***SenseAir<sup>®</sup> S8-PWM* functional description**

During normal operation, the sensor module measures ambient gas CO<sub>2</sub> concentrations at two seconds intervals. Measured CO<sub>2</sub> concentration is filtered and is transmitted to the PWM Output. The PWM Output continues to keep the last valid value in the case of measurement fault detected.

# CONFIDENTIAL, PRELIMINARY

Item	<i>SenseAir<sup>®</sup> S8-PWM</i>										
<b>Target gas</b>	CO2										
<b>Operating Principle</b>	Non-dispersive infrared (NDIR)										
<b>Measurement range</b>	0 to 5000 ppm (Note 1). Up to 10000ppm extended range (Note 2)										
<b>Measurement interval</b>	2 seconds										
<b>Accuracy</b>	±75ppm ±3% of reading (Notes 3 and 4)										
<b>Pressure dependence</b>	+ 1.6 % reading per kPa deviation from normal pressure										
<b>Gas diffusion response time</b>	2 minutes by 90%										
<b>Operating temperature</b>	5° to 30° C										
<b>Operating humidity range</b>	0 to 85% RH non condensed										
<b>Storage temperature</b>	-40° to +70°C										
<b>Storage Environment</b>	0-95% RH non condensed non corrosive gases										
<b>Dimensions (mm)</b>	61 x 20 x 8.5 mm (max dimensions)										
<b>Weight</b>	< 10 grams										
<b>Power supply</b>	4.5 to 7.0 VDC unprotected against surges and reverse connection										
<b>Power consumption</b>	300 mA peak, 30 mA average										
<b>Life expectancy</b>	5+ years in normal indoor / office environments										
<b>Compliance with</b>	Tested according Emission: EN 61000-6-3:2007, EN 61000-6-4:2007 Immunity: EN 61000-6-1:2007 RoHS directive 2011/65/EU										
<b>PWM Output, Open Drain</b>	Open drain FET; 7V/ 800mA, protected by a zener diode, 10kΩ pull-up resistor to power (+).  <table style="width: 100%; border: none;"> <tr> <td style="width: 60%;">Minimum output concentration</td> <td>0 ppm</td> </tr> <tr> <td>Output cycle period</td> <td>1004ms</td> </tr> <tr> <td>Output high level min duration</td> <td>2.0ms (@ 0 ppm)</td> </tr> <tr> <td>Output high level max duration</td> <td>1002ms (@ 5000 ppm)</td> </tr> <tr> <td>Resolution</td> <td>0.5ms (@ 2.5 ppm)</td> </tr> </table>	Minimum output concentration	0 ppm	Output cycle period	1004ms	Output high level min duration	2.0ms (@ 0 ppm)	Output high level max duration	1002ms (@ 5000 ppm)	Resolution	0.5ms (@ 2.5 ppm)
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Output high level max duration	1002ms (@ 5000 ppm)										
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<b>Maintenance</b>	Maintenance-free for normal indoor applications with SenseAir <sup>®</sup> ABC on.										
<b>Self-diagnostics</b>	Full self-diagnostics at power up and continuously running self-diagnostics at every measurement.										

Table 1: Key technical specification for the *SenseAir<sup>®</sup> S8-PWM*

Note 1: Accuracy is specified over operating temperature range. Specification is referenced to certified calibration mixtures. Uncertainty of calibration gas mixtures (+/-2% currently) is to be added to the specified accuracy for absolute measurements.

## Absolute maximum ratings

Stress greater than those listed in Table III may cause permanent damage to the device. These ratings are stress ratings only. Operation of the device at any condition outside those indicated in the operational section of these specifications is not implied. Exposure to absolute maximum rating for extended periods may affect device reliability.

Parameter	Minimum	Maximum	Units	Notes
Ambient temperature under bias	- 40	85	C	
Voltage on G+ pin with respect to G0 pin	- 0.3	12	V	1
Maximum voltage on Calibration restore switch(S1) and (S2) inputs	- 0.3	3.8	V	1
Maximum voltage on PWM Output	- 0.3	G+ + 0.5	V	1,2

Table 2: Absolute maximum ratings specification for the *SenseAir® S8-PWM*

Note 1: Specified parameter relies on specification of subcontractor and is not tested by SenseAir

Note 2: OUT1 (PWM Output) pin is internally pulled up to G+. External pull up to higher voltage will provide resistive divider powering sensor via high resistance.

## Gas diffusion area

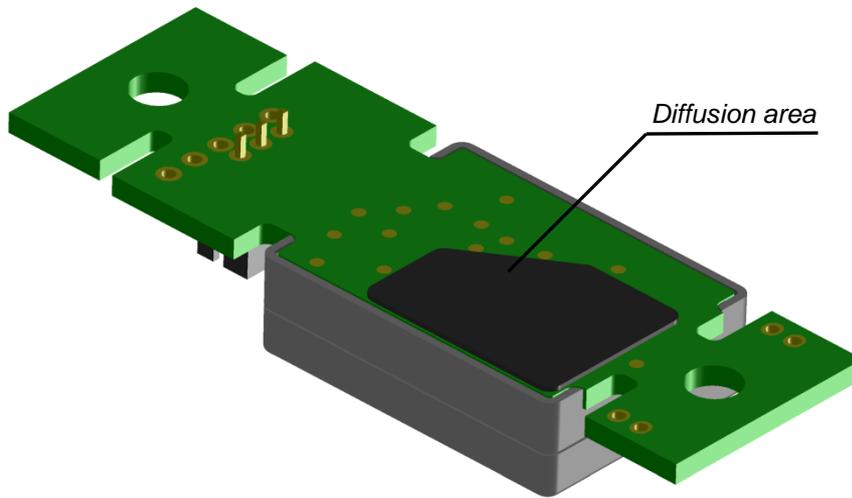


Figure 2: Gas diffusion area *SenseAir® S8-PWM*

## Pin assignment

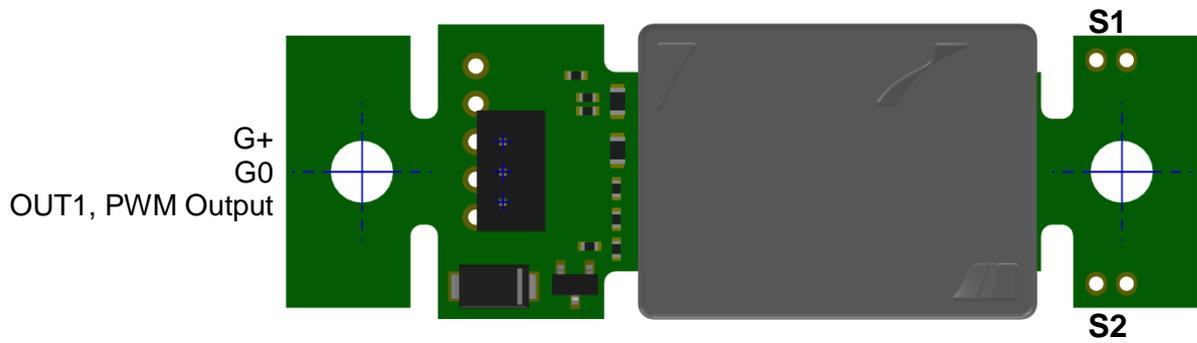


Figure 3: Pin assignment *SenseAir® S8-PWM*

## Terminals description

The table below specifies terminals and I/O options of the *SenseAir® S8-PWM*

The *SenseAir® S8-PWM* is equipped with a 3-pin connector (G+, G0, PWM Output). Part number of the connector is B3B-PH-SM4-TB, manufacturer JST (www.jst.com).

Pin Function	Pin description / Parameter description	Electrical specification
<b>Power supply</b>		
G+	Power supply positive terminal.	Unprotected against reverse connection!
G0	Power supply negative terminal. Sensor's reference (ground) terminal.	Unprotected against reverse connection!
<b>Outputs</b>		
OUT1, PWM Output	Open Drain FET transistor switch output. Internal protection.  Absolute max voltage range(Note 1) Internal pull up to G+ resistor Max sink current (Note 1)	G0 - 0.3V to G+ + 0.5V 10k 800mA
<b>Jumpers</b>		
Calibration restore switch (S1)	Digital input forcing background calibration. Configured as digital input (when closed for minimum 4, max 8 seconds) bCAL (background calibration) assuming 400 ppm CO2 sensor exposure  Zero calibration (when closed for minimum 16 seconds) CAL (zero calibration) assuming 0 ppm CO2 sensor exposure (Note 2)  Absolute max voltage range(Note 1) Internal pull up resistor Input low level (Note 1) Input high level (Note 1)	No internal protection, Internal pull-up to 3.3V at processor reset (power up and power down)      - 0.3V to 3.8V 120K - 0.3V to 0.75V 2.3V to 3.6V

Table 3: I/O notations, description and electrical specification

Note 1: Specified parameter relies on specification of subcontractor and is not tested by SenseAir.

Note 2: Do not ground S1 input for a long time. FLASH resource will be exhausted in case of permanent S1 grounding.

## Mechanical properties

Sensor PCB may be colour green or black. Optical bench assembly (OBA) may be colour silver or black.

Please refer to mechanical drawing for detailed specification of dimensions and tolerances.

### **WARNING!**

Under no circumstances should any force be applied to the OBA, this may permanently harm the sensor and most definitely affect performance.

Sensor should be handled holding PCB only. Never touch sensor with bare hands, make sure that operators use ESD gloves.

Note! ESD sensitive device!

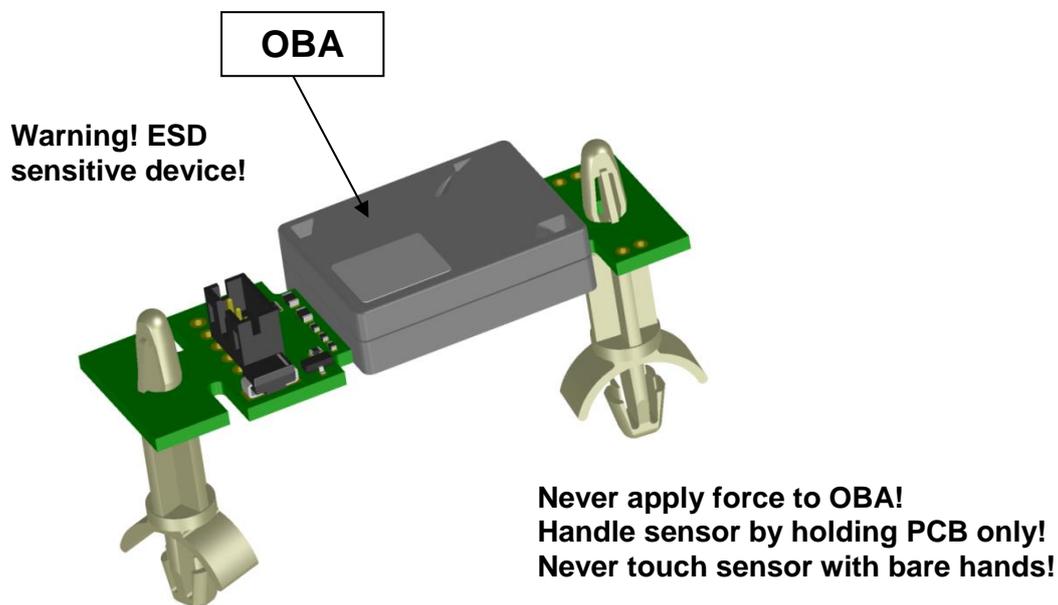


Figure 4: Mechanical properties *SenseAir® S8-PWM* Article No 004-0-0058

## Installation and soldering

During installation and assembly of sensor to PCB it is essential that compatible materials are used and that soldering process is managed. Avoid introduction of stress to the sensor's PCB or OBA. SenseAir recommends hand soldering only.

NB! Transport, handling and assembly may affect calibration. If for some reason the sensor needs to be re-calibrated, please refer to paragraph Maintenance.

Please, contact SenseAir for further information!

## Maintenance and ABC (Automatic Baseline Correction)

The models based on *SenseAir*<sup>®</sup> *S8* platform are basically maintenance free in normal environments thanks to the built-in self-correcting **ABC algorithm** (*Automatic Baseline Correction*). This algorithm constantly keeps track of the sensor's lowest reading over preconfigured time interval and slowly corrects for any long-term drift detected as compared to the expected fresh air value of 400ppm (or 0.04%<sub>vol</sub>) CO<sub>2</sub>.

Discuss your application with SenseAir in order to get advice for a proper calibration strategy.

When checking the sensor accuracy, PLEASE NOTE that the sensor accuracy is defined at continuous operation (at least 3 weeks after installation with ABC turned on)!

ABC parameter	Specification
ABC period	<b>8 days</b>

Table 4. ABC default configurations for *SenseAir*<sup>®</sup> *S8* article no. 004-0-0058

## Calibration

Rough handling and transportation might result in a reduction of sensor reading accuracy. With time, the ABC function will tune the readings back to the correct numbers. The default “tuning speed” is however limited to about 30-50 ppm/week.

For post calibration convenience, in the event that one cannot wait for the ABC algorithm to cure any calibration offset two manual calibration procedures are offered. A switch input (calibration switch ‘S1’) is defined for the operator or master system to select one of the two prepared calibration codes.

Optional calibrations are **bCAL** (*background calibration*), which requires that the sensor is exposed to fresh air (400 ppm CO<sub>2</sub>) and **CAL** (*zero calibration*), which requires the sensor measuring cell to be completely evacuated from CO<sub>2</sub> e.g. by exposing it to Nitrogen or Soda Lime CO<sub>2</sub> scrubbed air. Make sure that the sensor environment is steady and calm!

Input	Default function
bCAL_in	<b>(when closed for minimum 4, max 8 seconds)</b> <b>bCAL</b> (background calibration) assuming 400 ppm CO <sub>2</sub> sensor exposure
CAL_in	<b>(when closed for minimum 16 seconds)</b> <b>CAL</b> (zero calibration) assuming 0 ppm CO <sub>2</sub> sensor exposure

Table 5. Switch input default configurations for *SenseAir*<sup>®</sup> *S8* article no. 004-0-0058

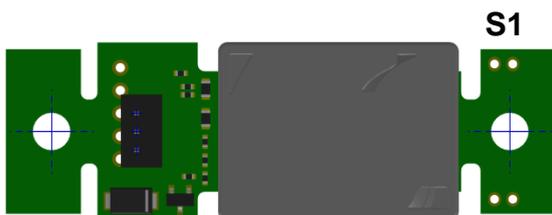
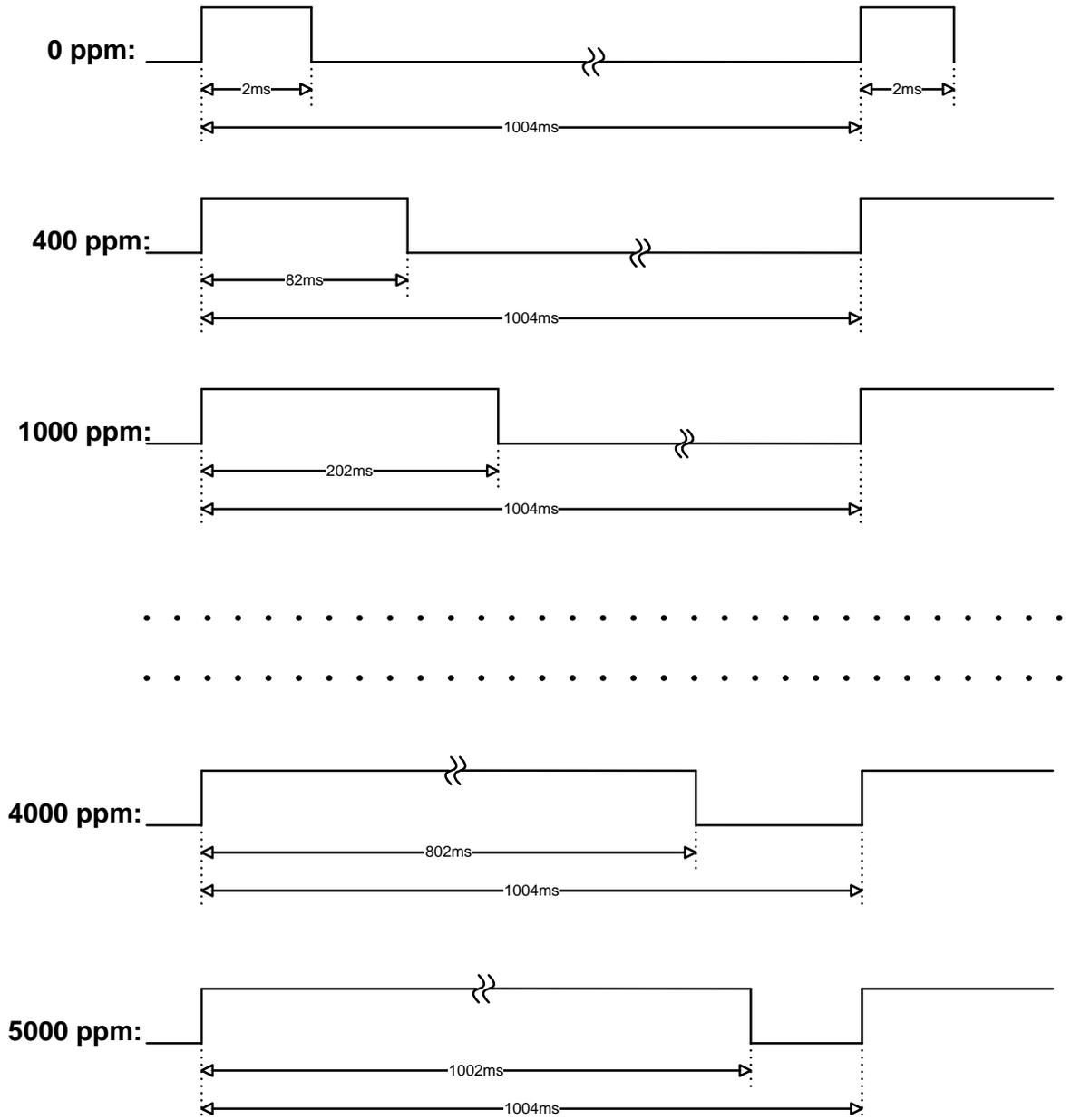


Figure 5: Position of calibration switch S1

**Sensor PWM output timing diagram**



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