

Product Specification

eSENSE FAI eSENSE II FAI

CO₂ alarm sensor in a housing



eSENSE FAI

eSENSE II FAI

General

eSENSE FAI and eSENSE II FAI is a simple, low cost, state-of-the-art, maintenance-free carbon dioxide sensor in a housing for installation in the climate zone.

eSENSE FAI and eSENSE II FAI measures the carbon dioxide concentration in ambient air, using infrared technology. The sensor alarms with sound and light when the levels are exceeding defined levels.



Item	eSENSE FAI, eSENSE II FAI general specification
Target gas	Carbon dioxide (CO ₂)
Operating principle	Non-dispersive infrared (NDIR)
Measurement range	0 –3000 ppm _{vol}
OUT1 linear output	0 –10 V for 0 –2000 ppm ±2% of reading ±20 mV
Accuracy	±30ppm ±3% of reading ¹
Response time (T _{1/e})	<10 sec. @ 30 cc/min. flow rate, <3 min. diffusion time
Rate of measurement	0.5 Hz
Operating environment	Residential, commercial and industrial spaces ²
Operating temperature	0 –50 °C
Operating humidity	0 –95% RH non condensing
Storage temperature	-40 –70 °C (display model (Disp): -20 –50 °C) ²
Dimensions eSENSE FAI eSENSE II FAI	100 x 80 x 28 mm 130 x 85 x 30 mm
Power supply	24 V AC/DC ±20%, 50 Hz (half-wave rectifier input)
Power consumption	<1 Watt average
Warm Up time to spec. precision	1 min (@ full specs <15 min)
Life expectancy	>15 years ³
OUT 1	Linear conversion range: 0 –10 V for 0 –2000 ppm Electrical Characteristics: R _{OUT} <100 Ohm R _{LOAD} >5 kOhm D/A conversion accuracy: ±2% of reading ±20 mV D/A resolution: 10 mV (10 bit)
OUT 2	Buzzer connected
Maintenance	Maintenance-free using Senseair ABC logic Self calibration for normal indoor applications ^{3,4}

Table 1: Key technical specification of eSENSE FAI and eSENSE II FAI

Note 1: Accuracy is defined after zero calibration or after minimum three (3) ABC periods of continuous operation.

Note 2: All corrosive environments are excluded.

Note 3: In normal Indoor Air Quality (IAQ) applications @ NTP (25 °C, 101.3 kPa).

Note 4: Requires fresh air (400 ppm) at least once every week.

Terminal descriptions

The table below specifies what terminals and I/O options are available.

Functional group	Descriptions and ratings
Power supply	
G+	Power supply voltage. Positive pole of DC power supply shall be connected to G+. Sensor performs half wave rectification of supplied AC voltage. Power supply lines are protected by varistor from voltage spikes and over voltage. Serial 3R3 resistor limits start up inrush current. Nominal specification: 24 V AC/DC+ ($\pm 20\%$), 2 W Absolute maximum ratings 16.5 –40 V DC
G0	24 V AC/DC-, connected to ground of the sensor. Negative pole connection for DC power supply
Outputs	
OUT1	Buffered, linear analogue output 0 –10 V, 0 –2000 ppm Resolution 10 mV.
OUT2	Buzzer
Indicators	
Green LED	Used for gas alarm indication, or for status indication etc. Lit at heating phase, after power up, and when the CO ₂ concentration is below 800 ppm
Yellow LED	Yellow LED is dedicated to indicate status of the sensor and air quality. Lit when the CO ₂ concentration is 800 –1400 ppm
Red LED	Lit when the CO ₂ concentration is above 1400 ppm The buzzer sounds
LCD	LCD is dedicated to represent measured values and status of the sensor. List of represented values and format are defined by particular model configuration.
Button	
Push button	Silences the buzzer 30 minutes when pushed. After 30 minutes the buzzer sounds if the CO ₂ concentration is above 1400 ppm

Table 2: Functional group for eSENSE FAI and eSENSE II FAI

Error codes and action plan

Error code can be read via I²C communication channel on Factory connector JP1 (see figure 1) using SADK Interface and UIP5 software. See installation manual IMA253 for SADK Interface.

Bit #	Error code	Error description	Suggested action
0	1	Fatal error	Try to restart sensor by power OFF/ON. Contact local distributor.
1	2	Offset regulation error	Try to restart sensor by power OFF/ON. Contact local distributor.
2	4	Algorithm error. Indicate wrong EEPROM configuration.	Try to restart sensor by power OFF/ON. Check detailed settings and configuration with software tools. Contact local distributor.
3	8	Output error Detected errors during output signals calculation and generation.	Check connections and loads of outputs. Check detailed status of outputs with software tools.
4	16	Self-diagnostic error. May indicate the need of zero calibration (see page 5) or sensor replacement.	Check detailed self-diagnostic status with software tools. Contact local distributor.
5	32	Out of range error Accompanies most of other errors. Can also indicate overload or failures of sensor and inputs. Resets automatically after source of error disappearance.	Try sensor in fresh air. Perform CO ₂ background calibration. Check detailed status of measurements with software tools. <i>See Note 1!</i>
6	64	Memory error Error during memory operations.	Check detailed settings and configuration with software tools.
7	128	Reserved	

Table 3: Key Error code and action plan for the eSENSE FAI and eSENSE II FAI

Note 1. It occurs, for instance, during over-exposure of CO₂ sensor, in which case the error code will automatically reset when the measurement values return to normal. It could also indicate the need of zero point calibration (see page 5).

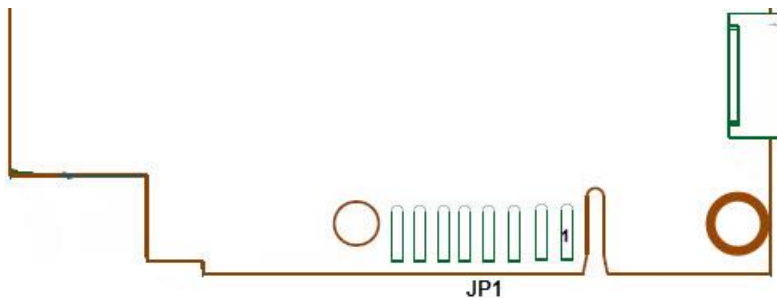


Figure 1: JP1 Factory connector

Calibration

Background- (bCAL) / Zero (zCAL) Calibration procedure

The default eSENSE FAI and eSENSE II FAI is 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 a 7.5 days interval and slowly corrects for any long-term drift detected as compared to the expected fresh air value of 400 ppm CO₂.

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 limited to about 30 ppm/week. For post calibration convenience, in the event that one cannot wait for the ABC algorithm to cure any calibration offset:

1. Connect sensor with tube and nipple (two alternative positions for nipple attachment, see Gas inlet in figure 2).
 - Soft Tube: 2x4 mm
 - Nipple: nylon tube 30x0.8x2.2 mm
2. Let gas mixture flow into the sensor through applied tube.
 - **bCal**: 400 ppm CO₂ **zCal**: 0 ppm, e.g. Nitrogen
 - Flow time: ≥3 minutes
 - Flow range: 0.3 – 1.0 litre/minute
3. Short circuit **DigIn1** (bCal)/**DigIn2** (zCal)
 - Shortcut Time: ≥8 seconds
4. Calibration executed?

<p><u>Yes</u> Sensor shows 400 ppm (bCal)/0 ppm (zCal) CO₂</p>	<p><u>No</u> sensor detected unstable gas concentration</p> <ol style="list-style-type: none">1. Remove shortcut2. Wait 10 seconds3. Repeat step 3 to 4
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5. Remove shortcut

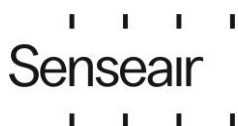
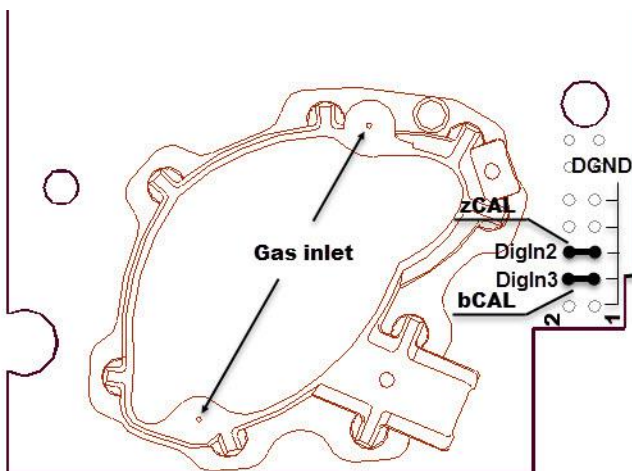


Figure 2: Shortcuts to execute zero- and background calibration

Self-diagnostics

The system contains complete self-diagnostic procedures. A full system test is executed automatically every time the power is turned on. In addition, constantly during operation, the sensor probes are checked against failure by checking the valid dynamic measurement ranges. All EEPROM updates, initiated by the sensor itself, as well as by external connections, are checked by subsequent memory read back and data comparisons. These different system checks return error bytes to the system RAM. If this byte is not zero, the LED **Status** will be put into Low level state. *Offset regulation error* and *Out of Range* are the only bits that are reset automatically after return to normal state. All other error bits have to be reset after return to normal by power OFF/ON.

Maintenance

The eSENSE FAI and eSENSE II FAI is basically maintenance free in normal environments thanks to the built-in self-correcting *ABC* algorithm. Discuss your application with Senseair in order to get advice for a proper calibration strategy.

When checking the sensor accuracy, **NOTE** that the sensor accuracy is defined at continuous operation (at least three (3) *ABC* periods after installation)!

Installation

The modules are factory calibrated and ready for use directly after power up. To connect the eSENSE FAI or eSENSE II FAI to a host system (see installation manual IMA0202 for eSENSE FAI or IMA0123 for eSENSE II FAI):

Main terminal: available signals are power supply (G+ and G0) and the buffered analogue output (OUT1), (a buzzer is connected to OUT2).

Note: The terminal is not protected against reverse voltages and current spikes! Proper ESD protection is required during handling, as well as by the host interface design.

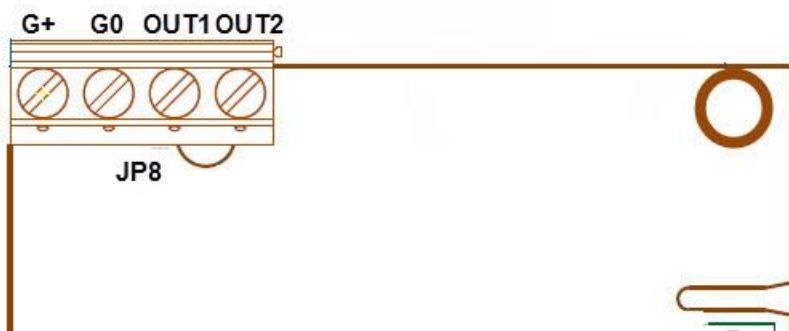


Figure 3: JP8 Main terminal

Default functions / configurations

Outputs

The basic eSENSE FAI and eSENSE II FAI configuration is a simple analogue output sensor transmitter signal directed to OUT1. Via the SADK adapter and UIP5 software the CO₂ readings are available to an even higher precision, together with additional system information such as sensor status, analogue outputs, and other variables.

The user can modify the output ranges at any time using SADK Interface, including UIP5 software and a special serial communication cable.

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