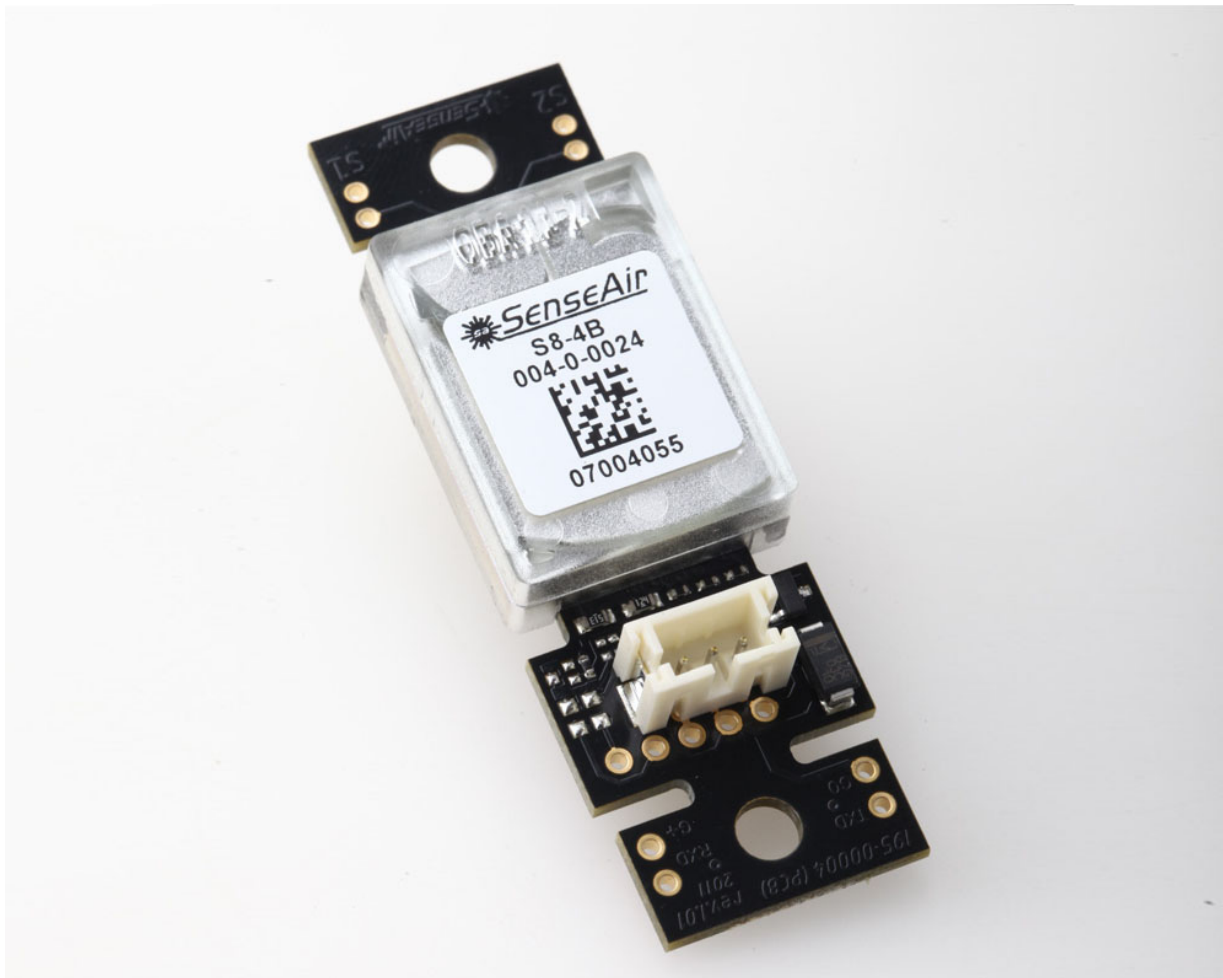


# Technical Description

*SenseAir*<sup>®</sup> *S8-4B* model  
article number 004-0-0024



**Table of contents**

- 1. General ..... 3
- 2. S8-4B functional description ..... 3
- 3. Key technical specification ..... 4
- 4. Pin assignment ..... 5
- 5. Terminal description ..... 5
- 6. Gas diffusion area ..... 6
- 7. Absolute maximum ratings ..... 6
- 8. General PCB overview ..... 7
- 9. Maintenance ..... 8

## 1. General

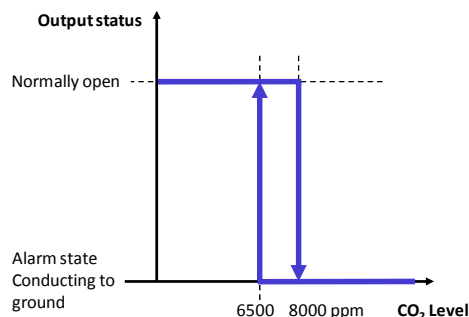
The *SenseAir*<sup>®</sup> *S8-4B* CO<sub>2</sub> sensor module is designed to serve as a CO<sub>2</sub> safety switch when built-in into kerosene heaters. The sensor utilizes reliable and highly accurate infrared gas sensing technology. The electronic circuitry is optimized for low power consumption.

The design of *SenseAir*<sup>®</sup> *S8-4B* will comply with or exceed specifications for *CO<sub>2</sub> ENGINE*<sup>™</sup> *model-4B* edition 6 dated 2005-12-12.

## 2. S8-4B functional description

During normal operation, the sensor measures ambient gas CO<sub>2</sub> concentration every 30 seconds and will set alarm output when CO<sub>2</sub> level is higher than 8000 ppm. A diagnostic routine will set *Fault Alarm* if any malfunction is detected. An alarm filter protects the sensor from issuing false alarm caused by intermittent short disturbances.

The alarm output is an open drain FET transistor switch which is in open state in normal operation and sinks the output pin to zero volts in alarm conditions. If any of the three alarm states *CO<sub>2</sub> High*, *Power Low* or *Fault* occur the unit sets the alarm. The output will stay in alarm mode until CO<sub>2</sub> level is below 6500ppm or other reason for alarm has been removed.



The unit will start operating at power supply voltages as low as 3.5V. First the micro-controller starts up in sleep mode for about 20 seconds, then power supply voltage is checked and if it is higher than 4.5 V the CO<sub>2</sub> measurement sequence is started. During the measurement of CO<sub>2</sub>, the power supply voltage is checked and must exceed 4.0 V. If power supply voltage drops below either of the thresholds the system will immediately set the output alarm and go to sleep mode for about 10 seconds. Then the system is actively discharged so that the alarm output, and the sensor itself, will reset as soon as the input voltage is totally gone. To assure an alarm reset, the power supply has to be disconnected for more than 40 seconds.

### 3. Key technical specification.

Item	<i>SenseAir<sup>®</sup> S8-4B</i>
<b>Target gas</b>	CO2
<b>Operating Principle</b>	Non-dispersive infrared (NDIR)
<b>Measurement range</b>	400 to 32000ppm (represented internally in digital format)
<b>Accuracy</b>	±1000ppm at alarm points between 7000 and 9000 ppm (Note 1)
<b>Gas diffusion response time</b>	2 minutes by 90%
<b>Operating temperature</b>	-5° to 60° C
<b>Operating humidity range</b>	0 to 95% RH non condensed
<b>Storage temperature</b>	-40° to + 70° C
<b>Storage Environment</b>	0 to 95% RH non condensed non corrosive gases, no contamination to kerosene
<b>Dimensions (mm)</b>	60 x 19.6 x 7.6
<b>Weight</b>	< 10 grams
<b>Power supply</b>	4.5 to 7.0 VDC maximum rating (without reverse polarity protection)
<b>Power consumption</b>	250 mA peak, 2 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 2002/95/EG
<b>Output Alarm, Open Drain</b>	Open drain FET; 7V/ 800mA, protected by a zener diode, normally open, 100kΩ pull-up resistor to power (+). 8000/6500 (Alarm/Release) Normal state is open. Transistor conducting at (CO2 > 8000ppm) OR (Unloaded Power voltage < 4.5V) OR (Loaded Power voltage < 4.0V) OR (Sensor Failure detected by self diagnostics)
<b>Maintenance</b>	Forced calibration (assuming 400 ppm exposure).
<b>Self diagnostics</b>	Full self diagnostics at power up and continuously running self diagnostics at every measurement.

Table I. Key technical specification for the *SenseAir<sup>®</sup> S8-4B*

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.

## 4. Pin assignment

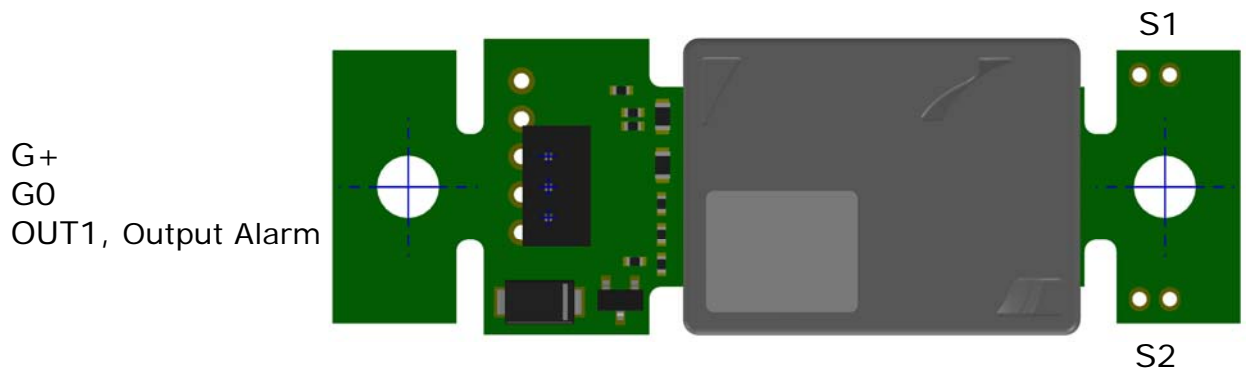


Figure 1. Pin assignment *SenseAir® S8-4B*.

## 5. Terminal description

The table below specifies terminals and I/O options of the *SenseAir® S8-4B*

Pin Function	Pin description / Parameter description	Electrical specification
<b>Power supply</b>		
G0	Power supply negative terminal. Sensor's reference (ground) terminal.	Unprotected against reverse connection!
G+	Power supply positive terminal.	Unprotected against reverse connection!
<b>Outputs</b>		
Output Alarm	Open Drain FET transistor switch output. Internal protection.	
<b>Jumpers</b>		
Calibration restore switch (S1)	Digital input forcing background calibration. Background calibration is activated when closed for minimum 30 seconds assuming 400 ppm CO2 sensor exposure. Calibration occurs every 30 seconds during switch grounding (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 II. 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 3.5 months in case of permanent S1 grounding.

## 6. Gas diffusion area

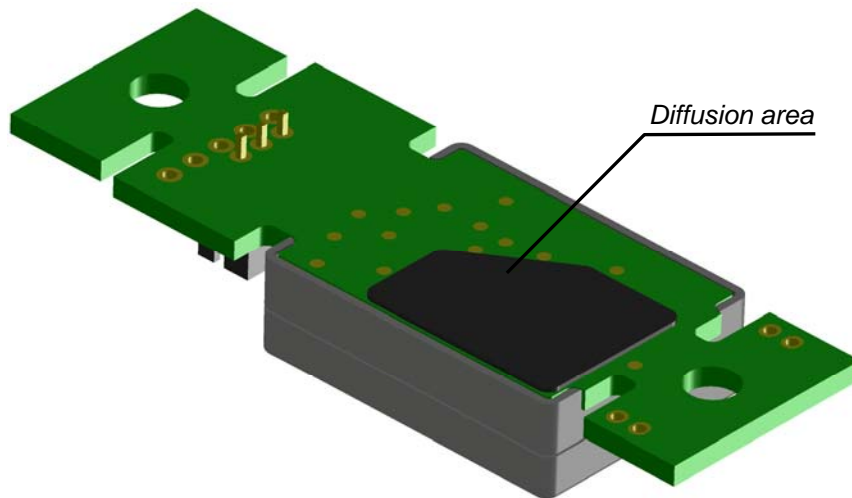


Figure 2. Gas diffusion area *SenseAir® S8-4B*.

## 7. 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.

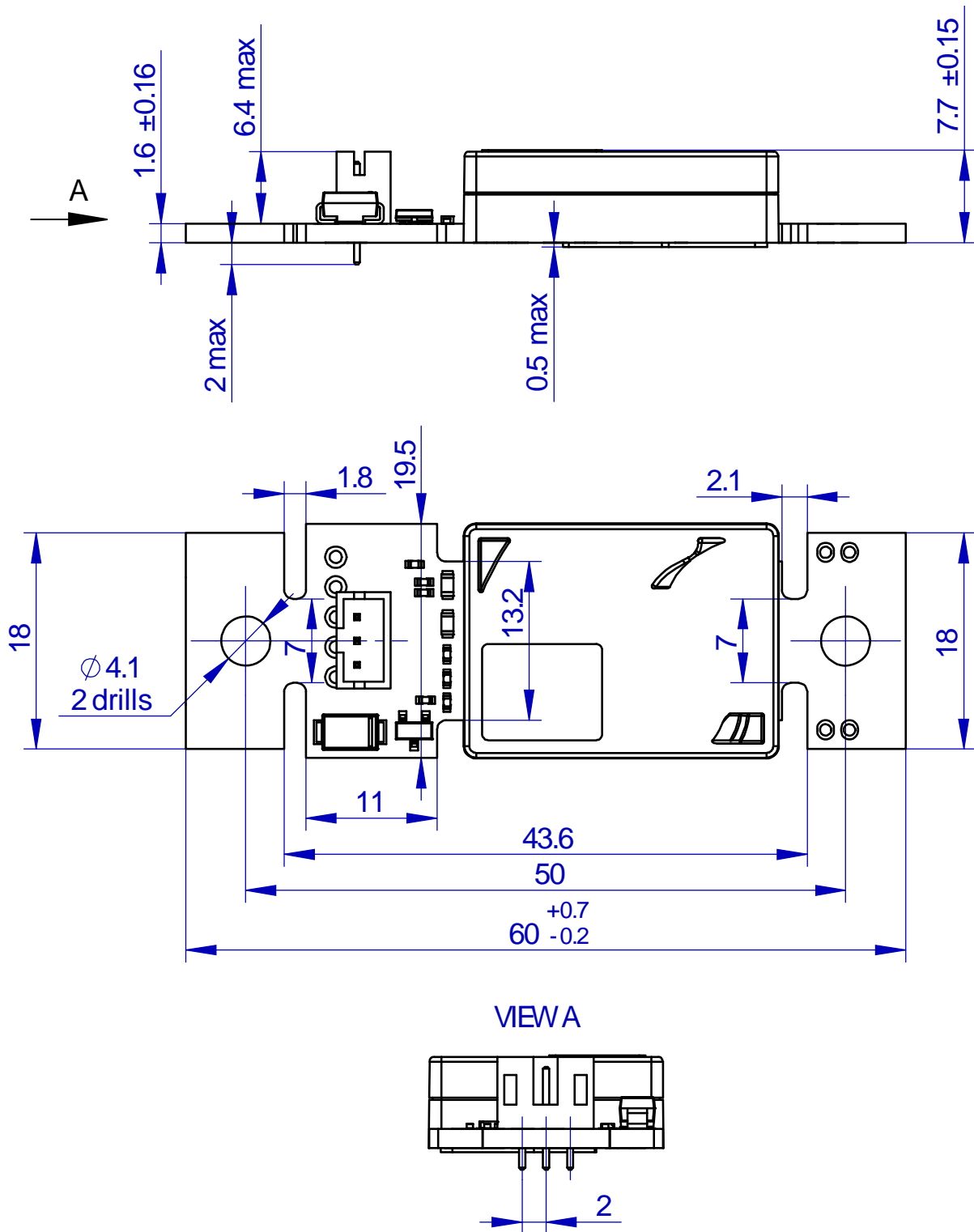
Parameter	Minimum	Maximum	Units	Notes
Ambient temperature under bias	- 40	85	C	
Voltage on G+ pin with respect to G0 pin	- 0.3	12	V	1
Maximum output current from active output pin	- 25	+ 25	mA	1
Maximum current on input	- 5	+ 5	uA	1
Maximum voltage on Calibration restore switch(S1)	- 0.3	3.8	V	1
Maximum voltage on Output Alarm	- 0.3	12	V	1,2

Table III. Absolute maximum ratings specification for the *SenseAir® S8-4B*

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

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

### 8. General PCB overview



Note: unspecified tolerances are ±0.1 mm

Figure 3a. Mechanical drawing *SenseAir® S8-4B*.

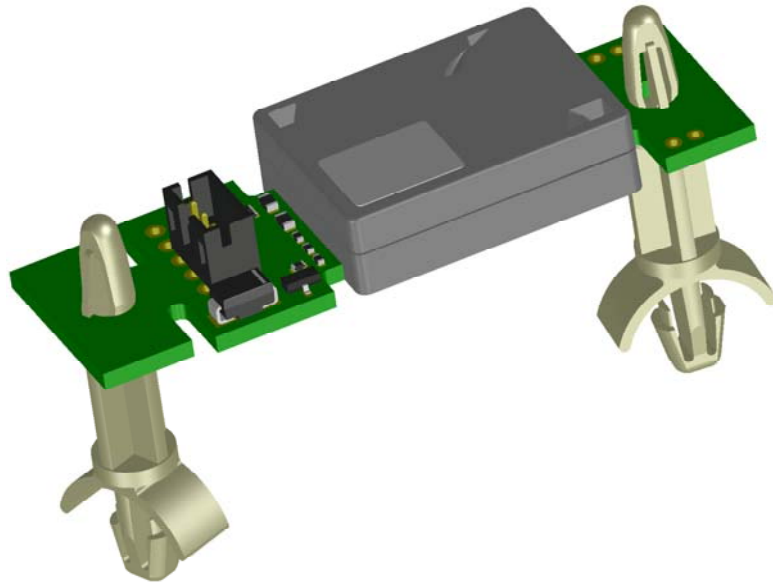


Figure 3b. Mechanical drawing *SenseAir® S8-4B*.

## 9. Maintenance

### 9.1. Calibration restore switch S1

If for some reason the sensor needs to be re-calibrated, this is possible to do by a qualified operator, provided that the sensor is exposed to fresh air during the whole process (~400 ppm CO<sub>2</sub>).

The process is actuated by creating an electrical short-cut between the two holes labeled S1. A closure here will ground one of the micro-controller I/O pins. As soon as the micro-controller detects this manually grounded switch terminal, a new zero constant sensor parameter is calculated, so as to push the current sensor reading to 400 ppm CO<sub>2</sub>. The sensor, however, is in sleep mode most of the time, implying that the delay may be up to 30 seconds between the operator closure of the switch contact S1 and the time when the sensor actually responds to the re-calibration request and replaces the old parameter.

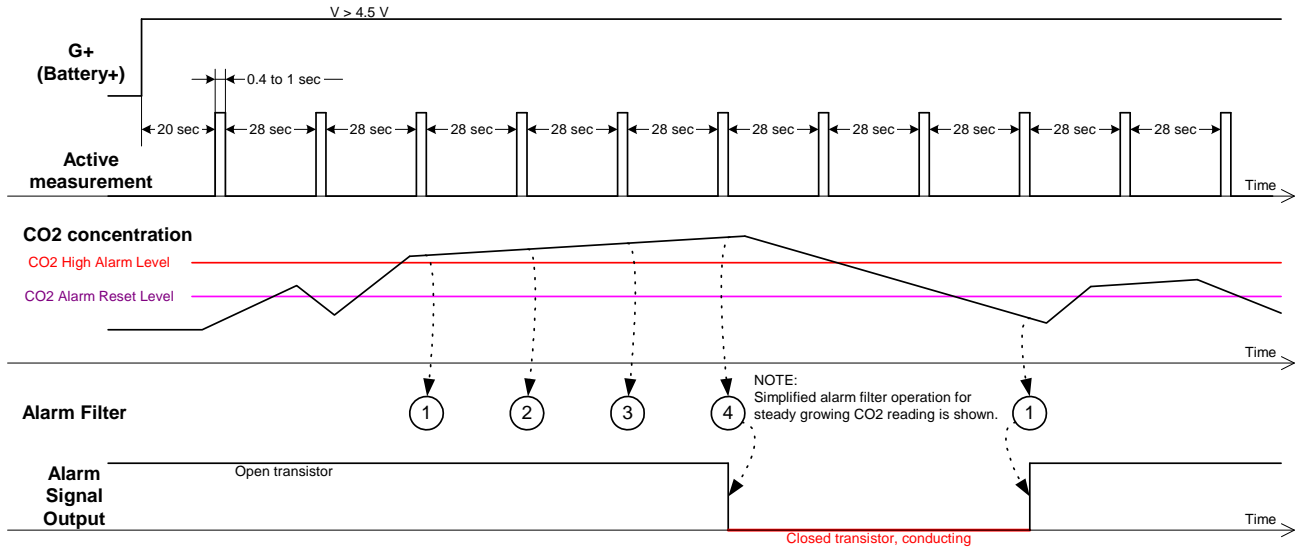
The new calibration Zero value is stored in EEPROM memory.

If the operator leaves the sensor with S1 closed for some period of time, the sensor will continue to recalibrate for the 400 ppm target value every 30 seconds, until the switch closure is released.

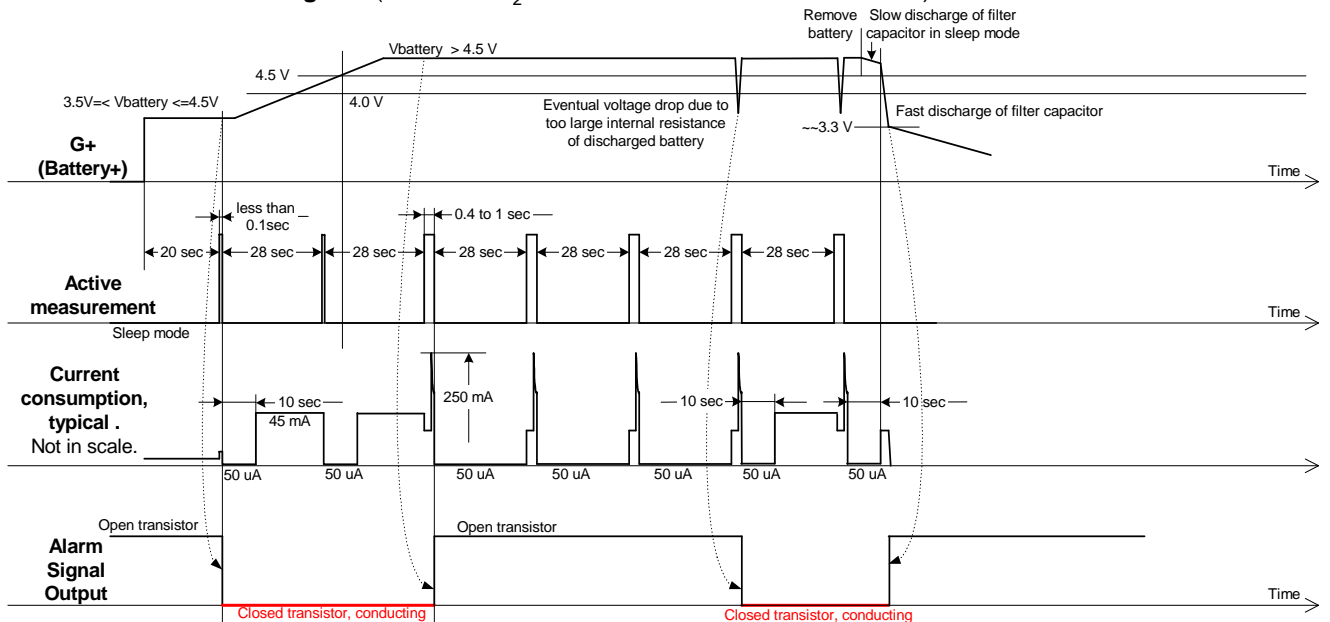


## 14.2. Alarm output filter and time diagram

### 1. High CO<sub>2</sub> alarm time diagram. (Assume power good).



### 2. Power Low time diagram. (Assume CO<sub>2</sub> concentration to be under alarm level).



**SenseAir® AB**

Box 96  
Stationsgatan 12  
SE- 82060 Delsbo  
Sweden

Phone: +46(0)653 – 71 77 70  
Fax: +46(0)653 – 71 77 89  
E-mail: [info@senseair.com](mailto:info@senseair.com)  
Web page: [www.senseair.com](http://www.senseair.com)

**BeiJing DiHui Technology  
Co.Ltd**

Room 1706.Building1.  
BiXing Garden  
Luozhuangxili,Zhichun Road  
Haidian district,Beijing  
China

Phone: +86-(0)10-517 366 16  
Fax:+86-(0)10-517 366 16-805  
E-mail: [dihuitech@126.com](mailto:dihuitech@126.com)  
Webpage:[www.dihuitech.net](http://www.dihuitech.net)

**SenseAir® Chengdu Gas Sensors  
Ltd.**

First floor 8th of Xingke Road  
Hi-Tech Industry Park  
Jinniu district, Chengdu  
Sichuan province  
China

Phone: +86-028 - 875 928 85  
Fax: +86-028 – 875 928 85  
E-mail: [info@senseair.asia](mailto:info@senseair.asia)  
Web page: [www.cnsenseair.com](http://www.cnsenseair.com)