Product Specification

Senseair Sunlight CO$_2$

Sensor module for battery-powered applications

Table of contents

Senseair

General

Item	Senseair Sunlight article No. 006-1-0100
Operating principle	Non-dispersive infrared (NDIR)
Measured gas	Carbon dioxide (CO_2)
Operating range	0–50 °C, 0–85% RH (non-condensing), (see figure 4)
Measurement range	0–10 000 ppm [1]
Accuracy [CO_2] (ANSI/ASHRAE Standard 62.1)	400–2500 ppm: ±75 ppm [2]
Accuracy [CO_2] (Operating conditions)	0–5000 ppm: ±(50 ppm+3% of reading) [3, 4] 5001–10 000 ppm: ±10% of reading [3, 4, 5]
Pressure dependence	1.6% reading per kPa deviation from normal pressure
RMS noise, typ. [CO_2]	Filtered: 1 ppm @ 400 ppm, 25 °C 3 ppm @ 3000 ppm, 25 °C	Unfiltered: 9 ppm @ 400 ppm, 25 °C 24 ppm @ 3000 ppm, 25 °C
Power supply	3.05–5.5 V [6]
Peak current	< 125 mA [7]
Steady state current during sampling	90 mA

| Average current, typical | Table comparing continuous measurement mode and single measurement mode.[8, 9] |

Measurement period	2 samples		8 Samples		32 Samples	
	Continuous	Single	Continuous	Single	Continuous	Single
16 s	22µA		34µA			
1 min	18µA	7µA	21µA	17µA	35µA	27µA
5 min	16µA	1µA	17µA	3µA	20µA	5µA

Item	Senseair Sunlight article No. 006-1-0100
Measurement setting	Default: Continuous measurement mode, 16 s, 8 samples (adjustable by host) [8]
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 / I²C

Table 1. General Specifications

Note 1: Sensor is designed to measure in the range 400–5000 ppm, extended range up to 10 000 ppm, which is specified in the table accuracy. Nevertheless, exposure to concentrations below 400 ppm may result in incorrect operation of ABC algorithm and shall be avoided for model with ABC ON.

Note 2: ANSI/ASHRAE Addendum ab to ANSI/ASHRAE Standard 62.1-2022 specifies sensor to be accurate within ±75 ppm at concentrations of 600, 1000, and 2500 ppm when measured at sea level at 77 °F (25 °C). See figure 4.

Note 3: 15–35 °C, 0–80% RH, after 3 ABC periods and default measurements settings.

Note 4: Specification is referenced to uncertainty of calibration gas mixtures (±1%).

Note 5: Extended range accuracy is not calibrated or guaranteed, it is extrapolated from calibrated range.

Note 6: Unprotected against surges and reverse polarity.

Note 7: At sampling start/stop there is a fast transient current. See "Customer Integration Guidelines Senseair Sunrise and Sunlight CO_2" (TDE7318) for details.

Senseair

Note 8:   See Measurement mode for detailed information
Note 9:   nRDY output pin disabled. See Figure 4 Average current.

Senseair

Description

Senseair Sunlight is a miniature sensor module for battery-powered applications. It gives full control over integration of sensor into a host system, flexibility in changing of CO_2 measurement period and power consumption.

Applications

Senseair Sunlight is designed for battery powered applications. Key Benefits

- Wide supply voltage range enables a variety of battery options
- Adjustable measurement period by host
- Adjustable ABC period by host
- Ultra-low power consumption

Installation and soldering

Refer to Senseair Sunrise and Sunlight Handling manual (ANO4947).
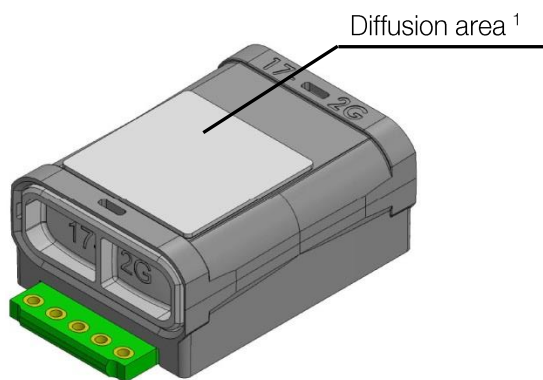
Sample gas diffusion area

Figure 1. Sample gas diffusion area

Note 1: Diffusion area must not be covered. Diminished sample gas circulation may affect response time.

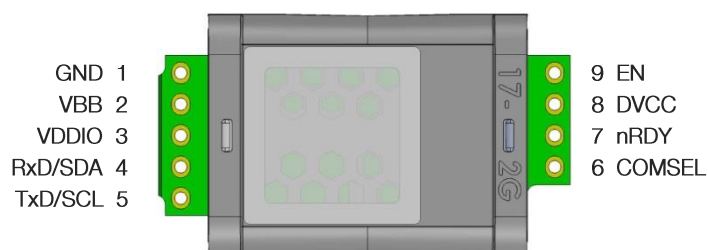## Pin configuration and functions

Pin configuration

Figure 2. Pin configuration (Top view)

Senseair

Pin functions

Pin #	Symbol	I/O Type	Description
1	GND	Power	Ground
2	VBB	Power	Sensor supply voltage
3	VDDIO	Power	I/O supply voltage for TXD/SCL and nRDY.
4	RxD/SDA	I/O	Sensor UART receive input / I²C bidirectional serial data; True open-drain when operating as output.
5	TxD/SCL	I/O	Sensor UART transmit output / I²C 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 (Default, internal Pull-Up, can be left floating); LOW = I²C (Connect to GND).
7	nRDY	Output	Measurement ready output; True open-drain, active LOW; 1MΩ internal Pull-Up to VDDIO.
8	DVCC	Power	Internal supply voltage output. Not intended to supply external systems, leave floating if not used.
9	EN	Input	Enable (active high). Drive this pin over 1.2V to turn on the sensor. Drive this pin below 0.4V to put the sensor into shutdown mode. Do not leave floating. Connect to VBB if not used.

Table 2. Pin functions

Senseair

Specifications

Absolute maximum ratings

Over operating temperature range (unless otherwise noted); all voltages are with respect to GND [1]

Symbol	Description		Min	Max	Unit
	Voltage				
VBB	Supply voltage		-0.3	6	V
EN	Enable				
VDDIO	I/O supply voltage		-0.3	6.5 [2]	V
RxD/SDA	UART / I²C				
TxD/SCL	UART / I²C				
nRDY	Ready output		-0.3	6.5	V
DVCC	Internal supply voltage output		-0.3	VBB + 0.3 or 4.3 whichever is less	V
COMSEL	Communication select	EN = HIGH	-0.3	DVCC + 0.3	V
		EN = LOW	-0.3	0.3	
	Current				
DVCC	Maximum output current			Internally limited	A
COMSEL, RxD/SDA, TxD/SCL	Instantaneous maximum current limit			15	mA

Table 3. Absolute Maximum Ratings

Note 1:   Stresses beyond those listed under Absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended operating conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Note 2:   Do not input signals or an I/O pull-up power supply while the device is not powered (EN = LOW or VBB out of recommended operating condition). The current injection that results from input of such a signal or I/O pull-up might cause malfunction and the abnormal current that passes in the device at this time might cause degradation of internal elements.

Senseair

Recommended operating conditions

Over operating temperature range (unless otherwise noted)

Symbol	Description	Min	Typ	Max	Unit	Test conditions
	Voltage					
VBB	Supply voltage	3.05	3.3	5.5	V	
VDDIO	I/O supply voltage for 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	
	Current					
I_{COMSEL} [2]	DC injection current	-2		2	mA	(V_{IN} < GND, V_{IN} > DVCC)
I_{DVCC} [1, 2]	Internal supply voltage current	0		25	mA	

Table 4. Recommended operating conditions

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

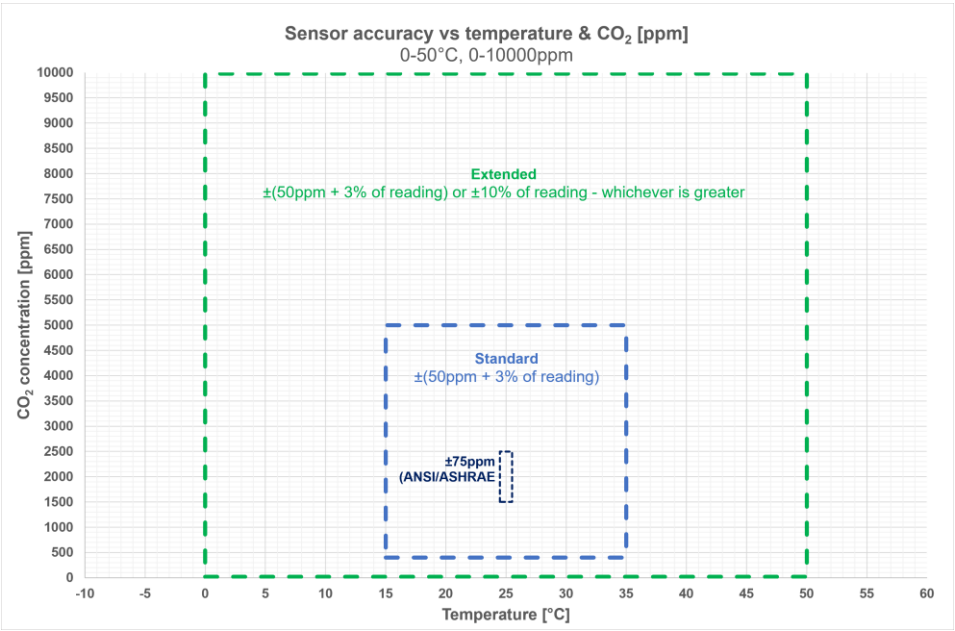**Senseair**

Accuracy over complete operating range

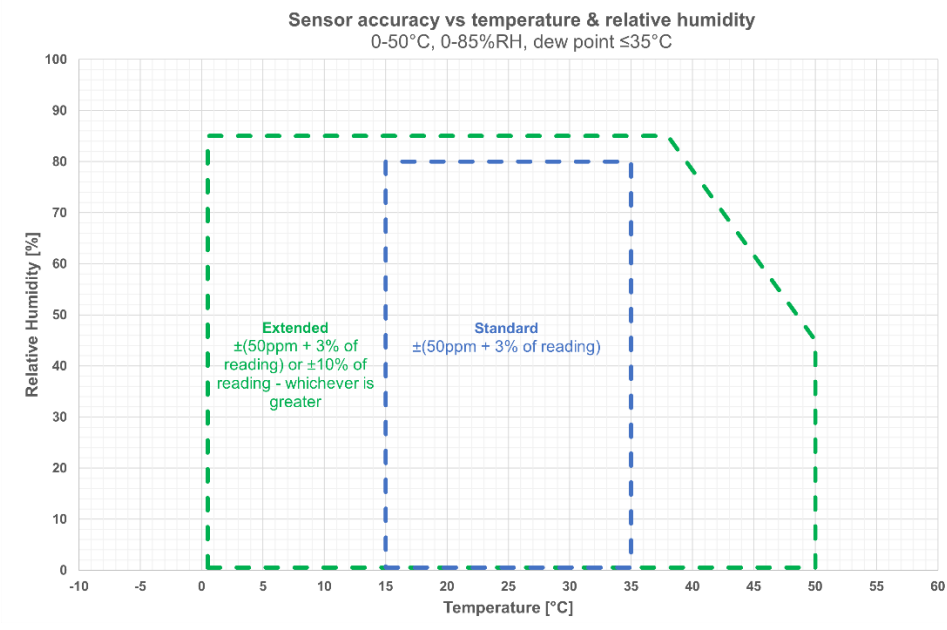Figure 3. Accuracy over complete operating range (temperature and measurement of CO_2).

Figure 4. Accuracy over complete operating range (temperature and relative humidity)

Electrical characteristics

Over operating temperature range, $V_{EN} = V_{BB} = 3.3V$ and default settings:
Continuous mode, 16s measurement period, 8 samples, unless otherwise noted.

Symbol	Description		Min	Typ	Max	Unit
	Voltage					
V_{DVCC} [1]	Supply voltage output		2.70		2.91	V
V_{IH}	Input high voltage [2]	COMSEL RxD (UART)	2.32			V
		SDA (I²C) SCL (I²C)	2.0			
		ENABLE	1.2			
V_{IL}	Input low voltage [2]	COMSEL RxD (UART)			0.54	V
		SDA (I²C) SCL (I²C)			0.81	
		ENABLE			0.4	
V_{HYS}	Input hysteresis	COMSEL, RxD/SDA, TxD/SCL	270			mV
	Current					
I_{VBB}	Operating peak current Operating average current	$V_{EN} \geq 1.2V$; $3.05 \leq V_{BB} \leq 5.5V$		34 [3]	125	mA µA
I_{VBB}	Supply quiescent current	$V_{EN} \leq 0.3V$; $3.05 \leq V_{BB} \leq 5.5V$		0.2	1	µA
I_{EN}	Enable pin leakage current	$V_{EN} = V_{BB} = 5.5V$		5.5		µA
I_{VDDIO}	I/O supply leakage current	$V_{DDIO} = 3.3V$		0.2	1.1	µA
I_{IN}	Input leakage current	$V_{DDIO} = 3.3V$; RxD/SDA, TxD/SCL		0.1	5	µA

Table 5. Electrical characteristics, Typical values at $T_A = 25\ °C$.

Note 1: Output is not intended to supply external systems, leave floating if unused.
Note 2: Different voltage levels on pins RxD/SDA and TxD/SCL depending on if UART or I²C is used.
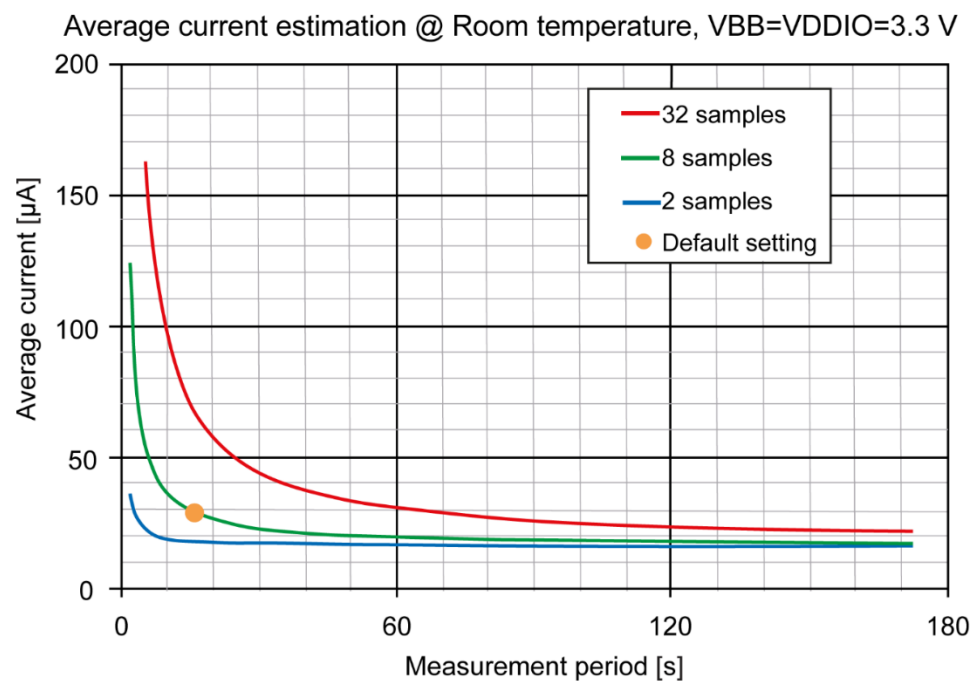Note 3: nRDY output pin disabled.

Senseair

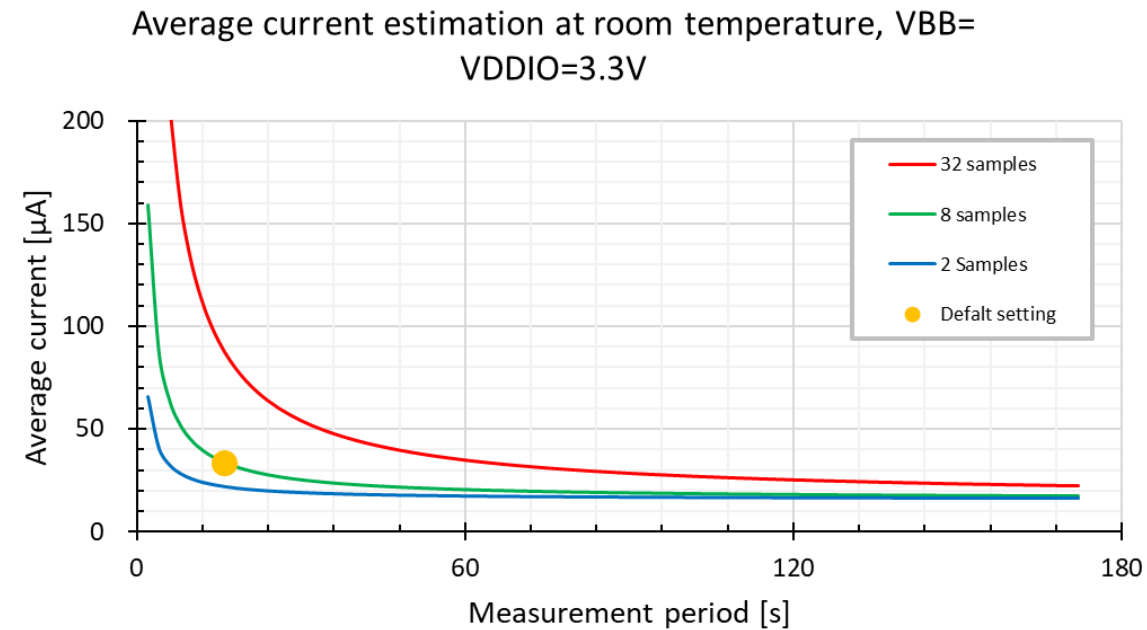## Average current

Average current estimation at room temperature, VBB=VDDIO=3.3V

Average current estimation @ Room temperature, VBB=VDDIO=3.3 V
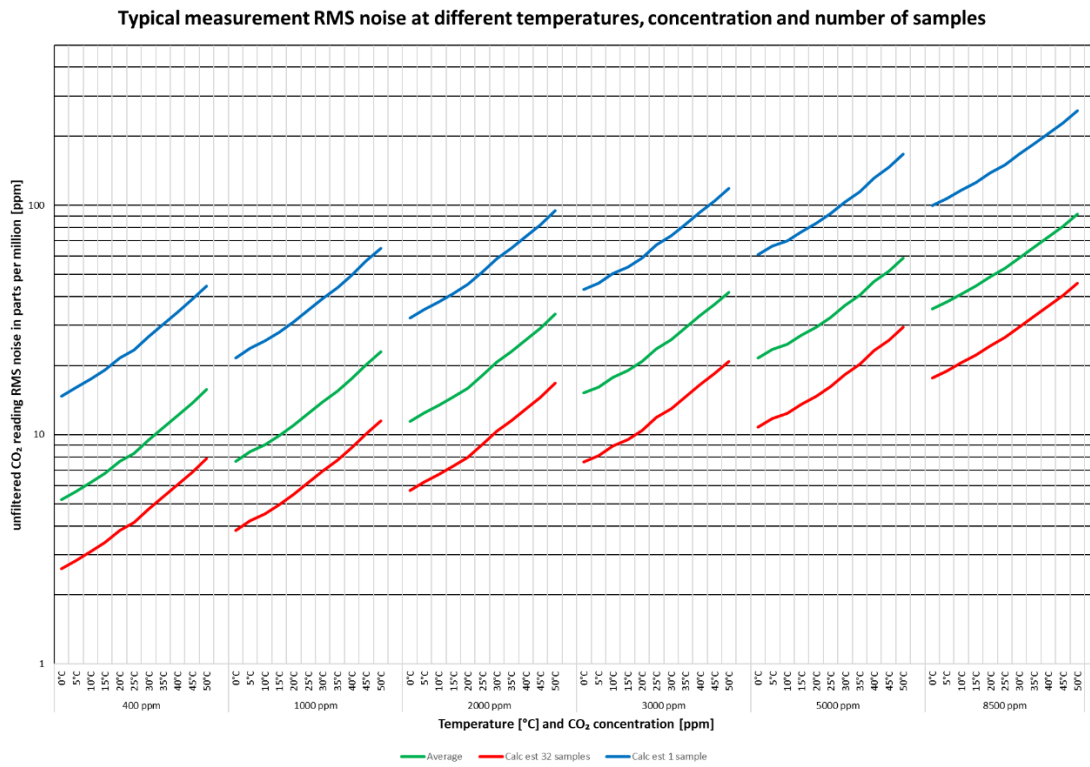

Figure 5. Average current

Senseair

Figure 6. Measurement RMS noise

Senseair

Measurement mode

The Senseair Sunlight supports two modes of operation for measurement of CO_2 concentration: Continuous measurement mode and Single measurement mode. The default operation mode for Senseair Sunlight is Continuous measurement mode.

1) In Continuous measurement mode, the sensor measures at regular intervals (measurement period, default setting 16s). 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.

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

Communication

Refer to "Modbus on Senseair Sunrise and Sunlight" (TDE5514) and "I2C on Senseair Sunrise and Sunlight" (TDE5531). See "Customer Integration Guidelines Senseair Sunrise and Sunlight CO_2" (TDE7318) for details.

Dimensions

Refer to drawing 740-00600. (Senseair Sunlight Customer Drawing)

Maintenance

Senseair Sunlight has a built-in self-correcting ABC algorithm. ABC period is adjustable by host. Discuss your application with Senseair in order to get advice for a proper calibration strategy.

Handling

Refer to Handling Manual (ANO4947)

Senseair

IMPORTANT NOTICE

1. Senseair reserves the right to make changes to the information contained in this document without notice. When you consider any use or application of Senseair product stipulated in this document ("Product"), please make inquiries the sales office of Senseair or authorised distributors as to current status of the Products.
2. All information included in this document are provided only to illustrate the operation and application examples of Senseair Products. Senseair neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Senseair or any third party with respect to the information in this document. You are fully responsible for use of such information contained in this document in your product design or applications. Senseair ASSUMES NO LIABILITY FOR ANY LOSSES INCURRED BY YOU OR THIRD PARTIES ARISING FROM THE USE OF SUCH INFORMATION IN YOUR PRODUCT DESIGN OR APPLICATIONS.
3. The Product is neither intended nor warranted for use in equipment or systems that require extraordinarily high levels of quality and/or reliability and/or a malfunction or failure of which may cause loss of human life, bodily injury, serious property damage or serious public impact, including but not limited to, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signalling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. Do not use Product for the above use unless specifically agreed by Senseair in writing.
4. Though Senseair works continually to improve the Product's quality and reliability, you are responsible for complying with safety standards and for providing adequate designs and safeguards for your hardware, software and systems which minimise risk and avoid situations in which a malfunction or failure of the Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption.
5. Do not use or otherwise make available the Product or related technology or any information contained in this document for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). When exporting the Products or related technology or any information contained in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. The Products and related technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Please contact Senseair sales representative for details as to environmental matters such as the RoHS compatibility of the Product. Please use the Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Senseair assumes no liability for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
7. Resale of the Product with provisions different from the statement and/or technical features set forth in this document shall immediately void any warranty granted by Senseair for the Product and shall not create or extend in any manner whatsoever, any liability of Senseair.
8. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Senseair.

www.senseair.com

Senseair