

User Manual

SenseAir[®]

Portable CO₂ and temperature monitor With Real Time Clock



SenseAir[®]



Included

General

The SenseAir portable sensor is a light-weight CO₂ instrument with a digital display designed to measure the carbon dioxide concentration in ambient air. The display shows the current carbon dioxide concentration and temperature. Built-in data logging for both CO₂ and temperature makes it perfect for worksite investigations. The gold-plated carbon dioxide sensor measures the carbon dioxide concentration in ppm. State-of-the-art non-dispersive infrared technology and automatic calibration functions have resulted in great reliability, accuracy and long-term stability of operation. The battery capacity is more than 12 hours.

Function Description

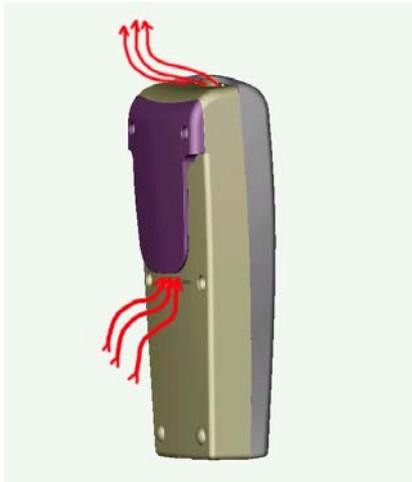


Figure 1. The flow through the unit.

The instrument is durable but can be extra secured by a safety strap on the top. The measuring sensor is inside the unit. Two openings in the housing make the air circulate through the unit. These openings must be kept open!

Please note! Whenever you go from a cold to a warm environment there is a risk of condensation (anyone with glasses has noticed it). To avoid that this influences the accuracy of the instrument it is important to allow it to adjust to the environment for a few minutes before usage.

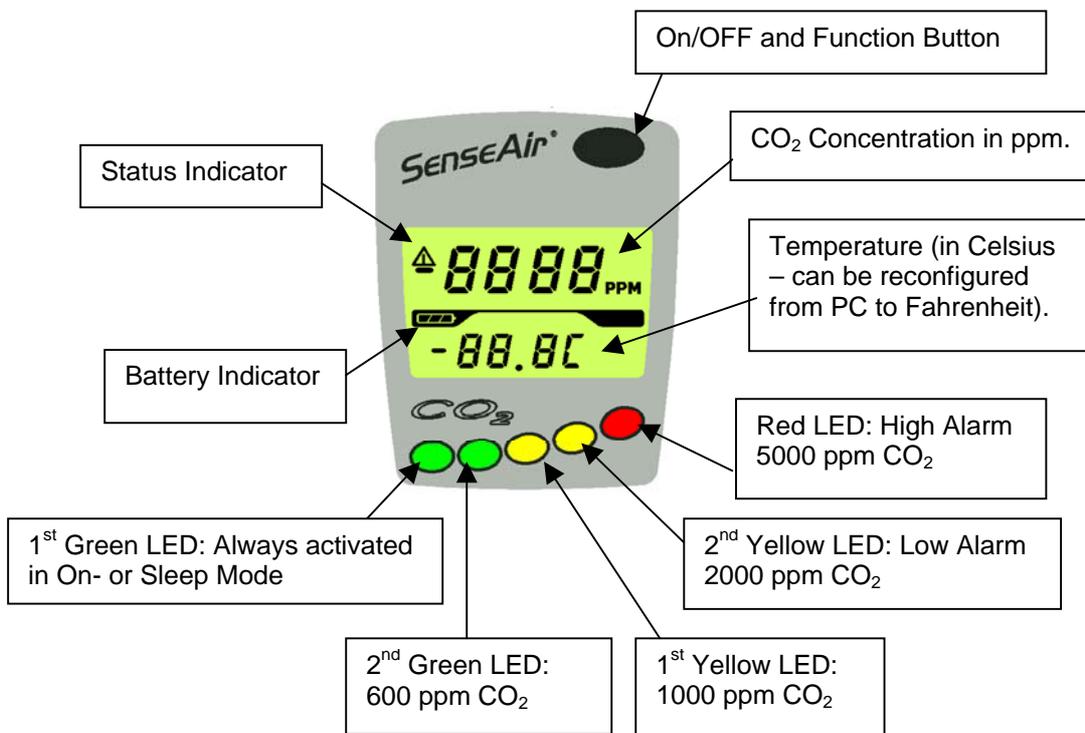


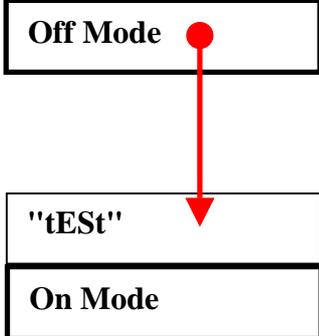
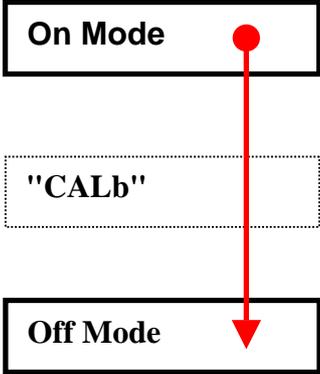
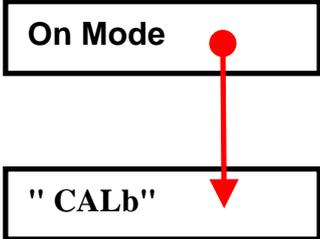
Figure 2. Front Panel

The display shows the instantaneous CO₂ value and temperature. The instantaneous CO₂ value is also easily overviewed with the front panel LEDs.



Note: If the status indicator is shown the readings are not reliable! The actions to take are then always first to charge the battery, second to recalibrate the CO₂ sensor zero point (put the unit in CALb Mode). If still the status indicator is shown after these two actions, please contact your dealer!

Default Push Button Functions

<p>On Mode</p> <ul style="list-style-type: none"> • Measuring CO₂ • Measuring Temperature • Logger active • ABC algorithm disabled 	<p>Push the button until the display shows "tESt", then release the button. The unit will then perform a full self-test sequence showing the LEDs response for the alarm set points. After the test the unit is in On Mode.</p>  <div style="border: 1px solid black; padding: 5px;"> <p>Explanation</p> <p> Push Button</p> <p> Release Button</p> </div>
<p>Power Off</p> <ul style="list-style-type: none"> • Logger resets and the sample counter will be lost. 	<p>From On Mode, push the button until all front panel LEDs are turned off. While pushing the button the unit will pass through the mode "CALb". If you accidentally release the button too early, just push the button once to reach On Mode and try again.</p> 
<p>CALb Mode</p> <ul style="list-style-type: none"> • Logger on hold • ABC algorithm enabled 	<p>From On Mode, push the button until the display shows CALb, then release the button. This will activate the Automatic Baseline Calibration ABC that requires 5 hours to complete one calibration cycle. The instrument continues to execute calibrations every four hours as long as it is left in CALb mode. Intended for overnight charging in fresh air, with minor calibration adjustment automatically performed. To get back to On Mode, just push the button once.</p> 
<p>Back light & Application Function Execution.</p>	<p>Can be turned on temporary by pushing the button. The backlight is turned off after 8-16 seconds. Application function for "standard" default setting is just backlight.</p>

Instantaneous CO₂ Concentration.

The instantaneous CO₂ concentration is shown in the upper part of the display. A rough picture of the CO₂ concentration is also given by the five LEDs found below the display.

LED indicator functions (factory settings):

Green 1: always lit when the unit is on
 Green 2: > 600 ppm
 Yellow 1: >1000 ppm
 Yellow 2: >2000 ppm
 Red 2: >5000 ppm

Temperature

Temperature is presented in degrees Celsius, but can be reconfigured from PC to be in degrees Fahrenheit. To measure an accurate reading in ambient air, the unit should be hanging in the safety strap. That orientation minimizes interference from internal heat sources. The sensor may take some half an hour to reach thermal equilibrium and accurate readings.

Note: Charging the battery will result in a temperature rise inside the unit that disturbs the temperature measurement!

Charging of the Battery

Charging of the battery can be done with the unit in Off-, CALb- or On Mode. The electronic circuitry gets activated by charging also in Off Mode, but will return to initial state when disconnected. When the DC- adapter is connected the charging of the battery is indicated by the rolling battery icon. When the battery is fully charged the battery icon lits continuously. The SenseAir unit automatically stops charging when the battery is fully charged.

The charging time for a completely discharged battery is 4±1 hours and the battery capacity is more than 12 hours.

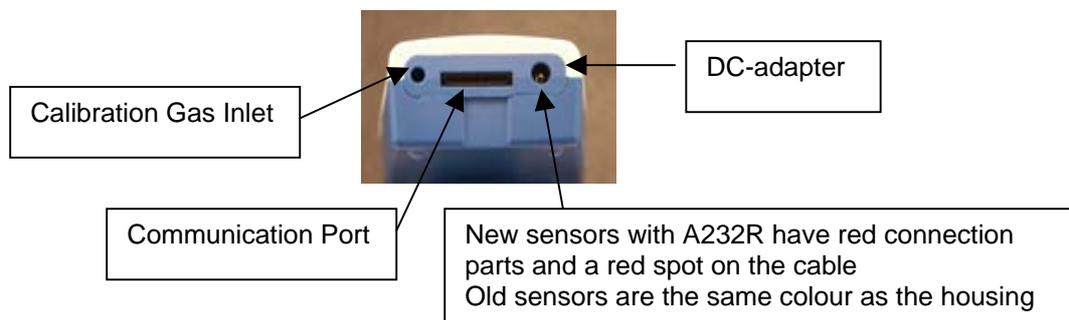


Figure 3. Connections

Self Diagnostics and Calibration

The SenseAir is basically maintenance free. The system contains complete self-diagnostics, executed automatically every time the power is turned on. The unit will then perform a full self-test sequence showing the LEDs response for the turn-on set points. SenseAir is working

with continuous self-diagnostics during operation (On Mode). If any error is detected, then the Status Indicator Segment will be lit.

The sensor has an automatic calibration function to secure long-term accuracy. It's called Automatic Baseline Calibration (ABC), implemented to eliminate any zero point drift of the infrared sensor. ABC calibration cycles are performed in 4 hours intervals. During some minutes of that time fresh air (CO₂ concentration between 380-420 ppm) has to be present. ABC function is only active in "CALb Mode" (after one hour delay) and requires 1 to 5 hours to perform one calibration adjustment. Each such adjustment is limited to a calibration tuning of about 130 ppm CO₂. Several consecutive adjustments might be performed, if required, for each additional 4 hours period stay in "CALb Mode".

The CALb Mode is intended for overnight charging in an area with good ventilation, or close to the fresh air inlet.

Background calibration can also be done by use of the software UIP-P. See Calibration with computer and UIP-P.

User Interface Program UIP-P Software Program

UIP-P is a free software that can be downloaded from the home page <http://www.senseair.com/>. The sensor can be connected to a computer with the included cable. This makes it possible to

1. Get data from sensor to the computer.
2. Reconfigure the sensor (change settings)
3. Maintain the sensor

Sensors with serial number 18602163 or higher, which have a red connection part, must be used together with a cable with red spot.

This computer communication can be done with the sensor in all modes, Off-, CALb- or On Mode, with or without the battery charger connected.

In this computer program "settings" are a set of configuration parameters that can be changed by the user.

The File menu has the submenus

Load settings from file	See Save and load files
Save settings to file	
Load backup file	
Save backup file	
Close	

The Sensor menu has the submenus

Read from sensor	Use this button to load setting and values from the sensor
Send to sensor	Sends settings to the sensor.
Calibrate	CO ₂ background CO ₂ zero point

CO₂ span
Temp (Temperature calibration)

The **Help** menu has the submenus

About
Help

Version number
Leads to Help text

UIP-P has four folders

The folder **General** shows sensor data and current reading of CO₂ and temperature.

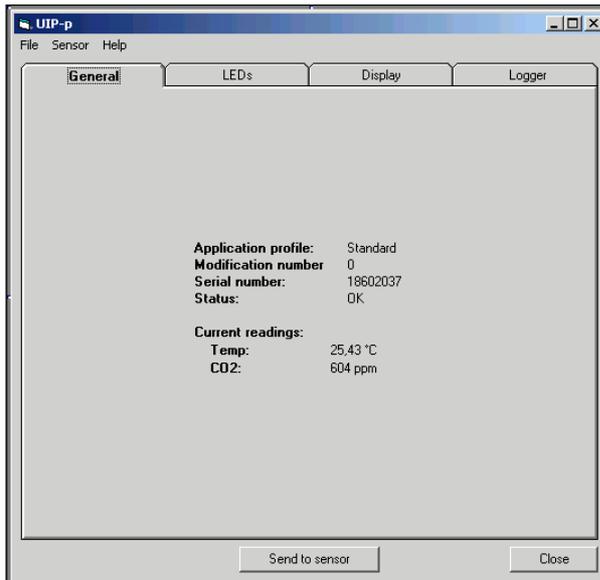


Figure 4. The folder General in the UIP-P shows sensor data and current readings

In the folder **LED** the values when the LEDs turn on are shown. The values can be changed. The changed values are sent to the sensor by pushing the **Send to sensor** button.

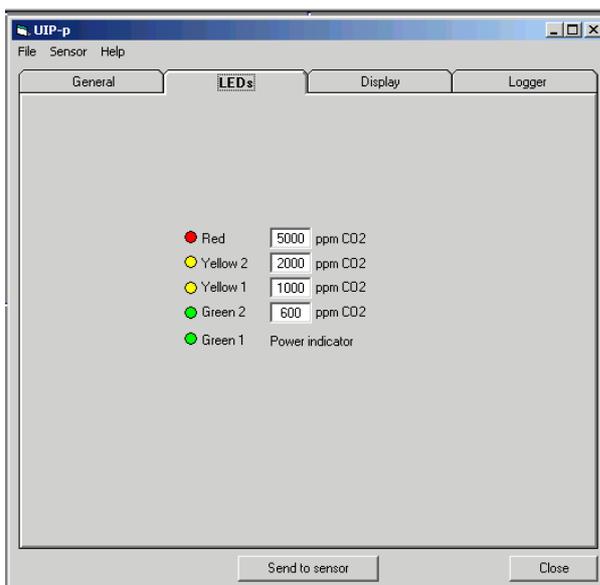


Figure 5. The folder LEDs in the UIP-P show the values when the LEDs are lit

The folder **Display** shows the upper and lower reading on the display. Default is the CO₂ concentration in ppm and temperature. If another application file has been loaded the display may show other parameters. Set the measuring unit with the buttons SI-Units and English /

US units. Temperature is shown in °C or °F. Load the new settings by pushing the button **Send to sensor**.

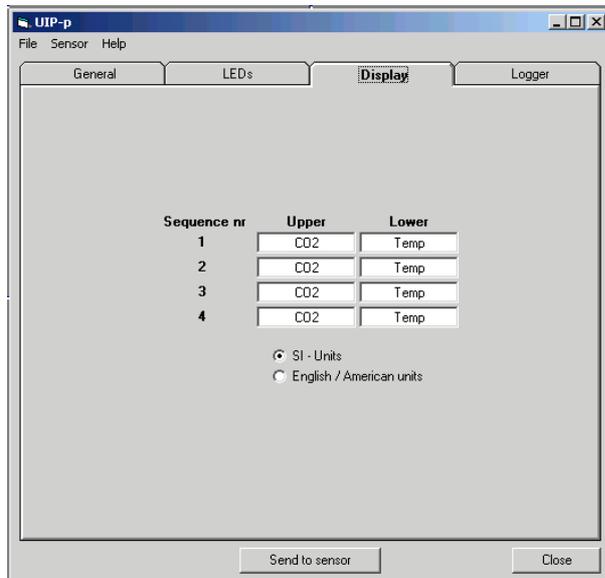


Figure 6. Folder Display in the UIP-P shows the display parameters

The folder **Logger** shows the sampled readings of CO₂ and temperature. Setting of sample interval can be done here. Push the button “Get data from logger” to get the sampled readings. A new folder is made every time the sensor starts. Check or set the clock with ”Check logger time”. Push the button ”Reset logger” to clear the logger. Readings can be transferred to a text file. See ”Logging CO₂ and temperature”.

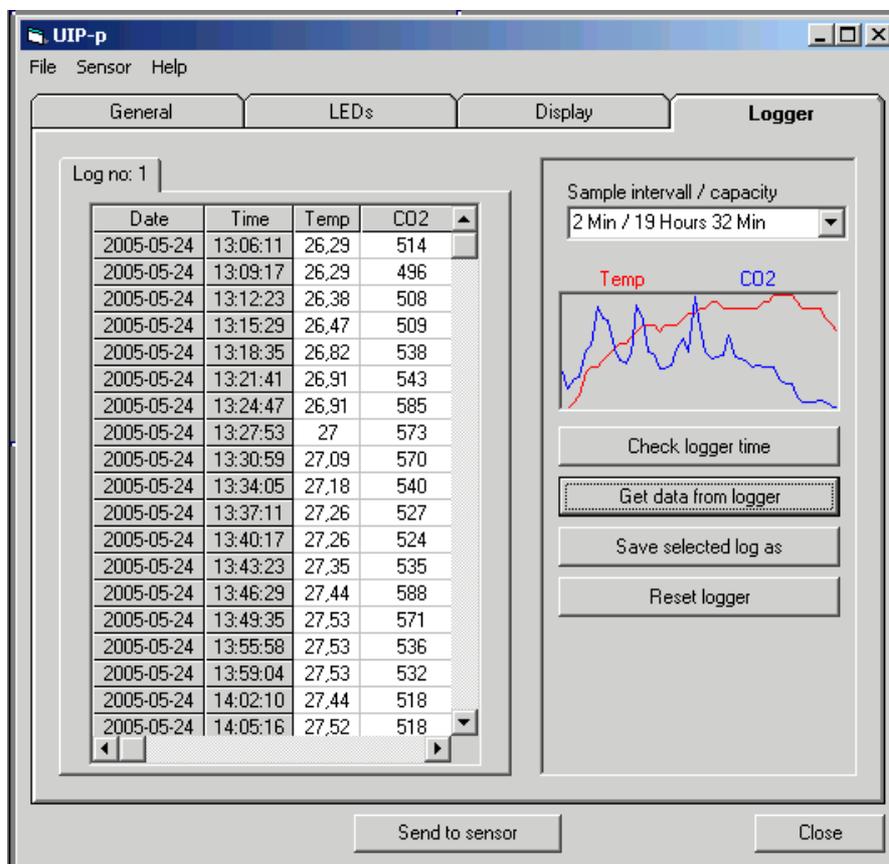


Figure 7. The folder Logger in the UIP-P shows the sampled readings The temperature is increased during battery charges

Logging CO₂ and temperature.

SenseAir continuously logs the CO₂ and temperature values. The logger is active in On mode and is reset if the sensor is turned off without the charger connected. All sampled readings can be seen in the User Interface Program UIP-P. All data from the UIP-P can be saved in a text file.

This is useful, for example, when you are investigating ventilation systems, or doing worksite investigations, over several days. Each of the two parameters can be logged up to 896 samples in a FIFO memory (“first in first out”). The default sampling interval is 10 minutes, which results in more than 6 days and nights of recording time. Longer or shorter sampling interval can be chosen. **If the sampling interval has been changed the logger must be cleared by pushing the ”Reset logger” button in the folder Logger**

If the unit is turned on for a longer period old data gets eventually over-written, keeping the records of the last recorded 896 data samples. Depending on selected sample interval you can make longer or shorter investigations over time. The logger is always active in On Mode. A new logging is started every time the sensor is turned on.

It's preferred to start a logging period with a fully loaded battery and avoid charging. Charging the battery generates extra heat inside SenseAir that will interfere with the temperature measurements. If the sensor is connected to the charger the battery is charged when the voltage is too low.

Old readings remain until they are over-written. The logger can be cleared by pushing the button ”Reset logger” in the folder **Logger**.

Tips before a measurement

- If possible do the measurement with the charger not connected.
- Start the measurement with a fully charged battery.
- Choose a suitable sampling interval so that no readings are over-written.

Transformation to Excel spreadsheet

1. Connect the sensor to the computer with the serial communication cable.
2. Open the software program UIP-P
3. The software now reads data from the sensor.
4. Choose the folder ”Logger”.
5. Choose the selected logging by selecting the folder ”Log no X”.
6. Push the button ”Save selected log as” and save the file.
7. Open the text file. Mark all. Copy all.
8. Open an empty spreadsheet and paste the copied text.

Calibration with computer and UIP-P

Background Calibration Place the sensor in fresh outdoor air. Open the program and select File-Sensor- Calibrate-CO₂ background. Push the button and see on the graph when the sensor is stable. Push ”Next” and the sensor is calibrated at 400 ppm or 0.04 %..

Zero point calibration For the most accurate zero point calibration result - proceed as follows: Put the sensor in a small plastic bag and flow zero ppm CO₂ gas (i.e. nitrogen) into the bag. Click this button and use the graph that appears to decide when the readings have stabilized, then click "Next" and the sensor will be calibrated to zero.

Span point calibration: For the most accurate span point calibration result - proceed as follows: The sensor remains in the plastic bag. Span gas with an accurately determined concentration of CO₂ is flushed through the plastic bag. The user will be asked to enter span gas concentration in % "Please enter span gas concentration in %".

Always zero calibrate before span calibration!

Temperature calibration The temperature probe may be calibrated by writing the correct value. The sensor must have been in On mode with the charger unconnected at least half an hour before. The sensor must also be placed in the same position, hanging or lying, that will be used during measurements.

Save and load files

Load settings from file. Load settings from a set file e.g. an application file. If the file is zipped it must be unzipped before loading into the sensor. New settings are not sent to the sensor until the question "Do you want to send the new settings to the sensor now" is answered with Yes or the button "Send to sensor" is pushed.

Save settings to file. Settings can be saved in a file and later loaded into the sensor.

Load backup file Loads the complete memory content, including the sensor's calibration data into the sensor. New settings are not sent to the sensor until the question "Do you want to send the new settings to the sensor now" is answered with Yes or the button "Send to sensor" is pushed. A file can only be loaded if it is created by the same sensor.

Save backup file Saves the entire memory content including the calibration data of the sensor to a file.

Application files

An application file will customize the unit for a certain professional application. Typically, the application file adds to the default unit some mathematic algorithm that will be executed by the push-button when the unit is in On Mode. Also, the display options will be enhanced and include the result of this extra function. These files are free and are included in the UIP_P software package. You are welcome to suggest new and suitable applications for this library by contacting your distributor!

To load an application file from the library into the unit, proceed as follows:

- Connect the cable and start the UIP_P software to establish the PC connection
- You might want to save the existing unit configuration for future restoration. If so, select main menu "File" / "Save settings to file" and select some appropriate file name.

- Select the main menu “File” / “Load settings from file” and select the application file of interest
- When the file has been loaded onto the PC screen you might want to edit the default display configuration and select SI or English/US units – this is the time to do it!
- When you have made your selections ***you must click on “Send to sensor”!!!***
- Exit the software when finished and turn off the sensor power (with no battery charger connected).

After power up the unit has its new operation functionality! You are free to reconfigure back and forth as much as you like, but to be sure of correct operation you must completely power down the monitor before operating with a new application configuration!

Current application file library

SenseAir Application File: “standard”

File name: 00003 SenseAir std.set

Description: The standard setting as described in this user manual. The push-button only triggers the backlight.

SenseAir Application File: “Ventilation Rate”

File name: 00256 SenseAir Vent-rate.set

Description: This application is intended for building owners, health care and energy savings consultants, providing a convenient tool for the investigation of fresh air ventilation rates in buildings occupied by humans. The extra function provided is that the SenseAir unit calculates and displays the fresh air Ventilation Rates based on the difference between indoor and outdoor CO₂ levels. The unit assumes that a steady state condition is present, with ventilation balance between CO₂, generated by the tenants inside the space, and fresh air, provided by the total ventilation system.

The unit further assumes a tenant activity level of 1,2 MET units, which equals to a CO₂ generation rate of 0,30 litres/minute (typical office labour activity). The SenseAir user is advised to first measure the outdoor CO₂ value and store this value into the unit by pressing the push-button. The text “rEAd” acknowledges the sampling of the outdoors CO₂ value.

Steady state formula used for fresh air Ventilation Rates

SI (metric) units:

Ventilation rate in litres/second/person
Ventilation rate = (5000 / (CO₂Inside - CO₂Outside))

English/US units:

Ventilation rate in CFM per person (cubic-feet-of-air per-minute per-person)
Ventilation rate = (5000 / (CO₂Inside - CO₂Outside)) x2,12

The ventilation rate can be displayed in SI units (litres/second/person) or in English/US units (CFM per person) as selected from the LCD map in the UIP-P software.

To use the Ventilation Rate function

The upper and lower parts of the display toggles between two sets of readings; the current ambient CO₂ level and temperature during one half period of time, and the outdoor CO₂ level sample and the calculated fresh air ventilation rate during the next half period. The ventilation rate displayed, however, will have no meaning until you have sampled a relevant outdoor CO₂ level and entered a building. The procedure is:

1. With the SenseAir in On Mode, first put the SenseAir in the reference media (CO₂*Outside*) and wait until the readings has stabilized. Press the button until the display acknowledges "rEAd", indicating that the sensor has now sampled the outdoor CO₂ level.
2. Place SenseAir in the space you want to study (CO₂*Inside*) and wait until the reading has stabilized before you make notes on the ventilation rate. Be aware not to contaminate the monitor readings by your own exhale!

WARRANTY AND LIMITATION OF LIABILITY

1. SenseAir warrants that for a period of twelve (12) months following receipt by Buyer the Product supplied by SenseAir to Buyer will be, under normal use and care, free from defects in workmanship or material and to be in material conformity with SenseAir's specifications. Units returned to SenseAir for warranty repairs shall be shipped to SenseAir, at Buyer's expense, according to SenseAir's instruction. Within ninety (90) days of the receipt of product, SenseAir shall replace or repair such units and shall ship them to Buyer's designated return destination freight pre paid.

2. Warranty Limitations. This warranty does not extend to any unit that has been subject to misuse, neglect or accident; that has been damaged by causes external to the unit; that has been used in violation of SenseAir's instructions; that has been affixed to any non-standard Accessory attachment; or that has been modified, disassembled, or reassembled by anyone other than SenseAir.

3. The retailer is not responsible for any consequential loss or damages, which may occur by reason of purchase and use of this product. The warranty is, in any event, strictly limited to the replacement/repair of the product.

**This product is in accordance with the
EMC Directive 89/336/EEC and the
Low Voltage Directive 73/23/EEC
including amendments by the CE-marking
Directive 93/68/EEC
The product fulfils the following demands:
EN50081-1, EN55011(B)
EN50082-2, EN61000-4-2,-3,-4,-5, Level3**



Technical specification* for the portable monitor *SenseAir*[®]

Carbon Dioxide measurement

Operating Principle.....	Non-dispersive infrared (NDIR) with gold plated optical cell
Gas Sampling Mode.....	Diffusion
Response Time (1/e).....	2 min diffusion time & 15 sec at 0.2 litre/min gas flow
Measurement Range	0-6000 ppm
Extended Range	6000-10 000ppm (accuracy not specified)
Accuracy at NTP (+25° C).....	± 3 % of reading or ± 20 ppm , whichever is greater
Pressure Dependence	+ 1.6 % reading increase per kPa deviation from normal pressure
Automatic Background Calibration.....	Automatic Background Calibration with fresh air Can be done together with charging during the night.
LED:s.....	5 stages green-green-yellow-yellow-red LED bar graph displaying current CO ₂ concentration
Numerical Liquid Crystal Display	Simultaneous display of <ul style="list-style-type: none"> * the current CO₂ concentration (in ppm.) * temperature * battery status indication * sensor status indication * ventilation rates (user configuration)

Temperature

Operating Principle.....	Thermistor
Measurement Range	0-50 °C
Accuracy	±0.5 °C (provided that the battery charger is not connected and the unit hangs in the safety strap)

Logger and software

Digital Interface	USB connector with sensor UART-RS232 COM driver
Internal Data Logger with RTC.....	Logging of CO ₂ and temperature by 896 samples. Logger resets in Off Mode. Real Time Clock
PC software.....	Windows 95/98/NT compatible software to <ul style="list-style-type: none"> * define personal user preferences * support sensor calibrations * transfer and save logged data * view trend curves of logged data

Electrical:

Battery Charger Input.....	6VDC / 700 mAh, with NOKIA type miniature connector
Internal Battery	3,6 VDC / 1350 mAh Li-ion accumulator (> 12 h. capacity)
Battery Current Consumption.....	< 55 mA in normal mode

General Performance:

Compliance with.....	EMC Directive 89/336/EEC
Storage Temperature Range	-20° to +70° C
Operating Temperature Range	0° to +50° C
Operating Humidity Range.....	0 to 95 % RH (non Condensing)
Sensor Life Expectancy	> 15 years
Battery Life Expectancy	> 3 years
Self-diagnostics.....	complete power/sensor/ internal checks
Status Indicator	LCD triangle icon = maintenance call
Power-up Time	< 30 sec. (full specs < 15 minutes)
Housing Material.....	ABS/PC blend
Dimensions (L x W x D)	125 x 52 x 32 mm
Total Weight	135 g

Accessories:

Included in original purchase are monitor with internal battery, protective casing, and wall-plug battery charger

Optional accessories:	art.no.
PC communication cable	A232-0740
Battery charger for use in cars (12V).....	Magcom SC110
Extra wall-plug battery charger.....	R4W006070040G
Replacement battery	1PSC340848-1350
Extra protection casing	0741 BAG

* patented