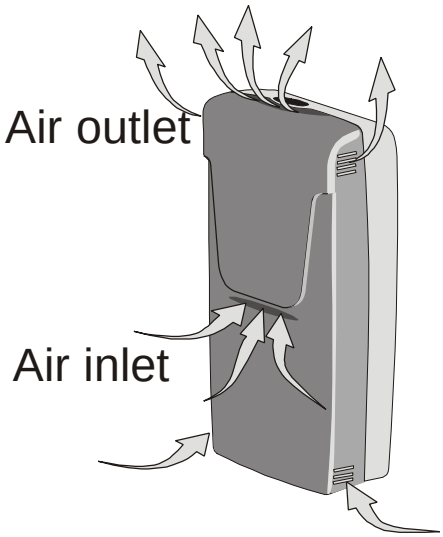
Technical Manual

C 1100

Portable carbon dioxide sensor and alarm unit
for personal safety

General

The portable C1100 is a lightweight CO_2 instrument with a digital display designed to measure the carbon dioxide concentration in ambient air. Built-in data logging and alarm functions with both audible alarm and LEDs make this portable pocket size instrument perfect for personal safety applications. The display shows the current carbon dioxide concentration and the past 8 hours TWA (Time Weighted Average) value. The gold-plated carbon dioxide sensor measures the carbon dioxide concentration in $\%_{VOL}$. 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

The instrument is durable, but for extra safety the instrument shall be secured by the safety strap on the top. The measuring sensor is inside the unit. Several 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 environment 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 1. The flow through the unit.

The display shows the instantaneous CO_2 value and the TWA-value. The instantaneous CO_2 value is also easy overviewed with the front panel LEDs. When the CO_2 concentration reaches the lowest alarm level the second yellow LED is lit and an intermitted audio alarm is triggered. If the concentration continues to rise the red LED is lit as the second alarm level is reached and a continuous audio alarm is triggered.

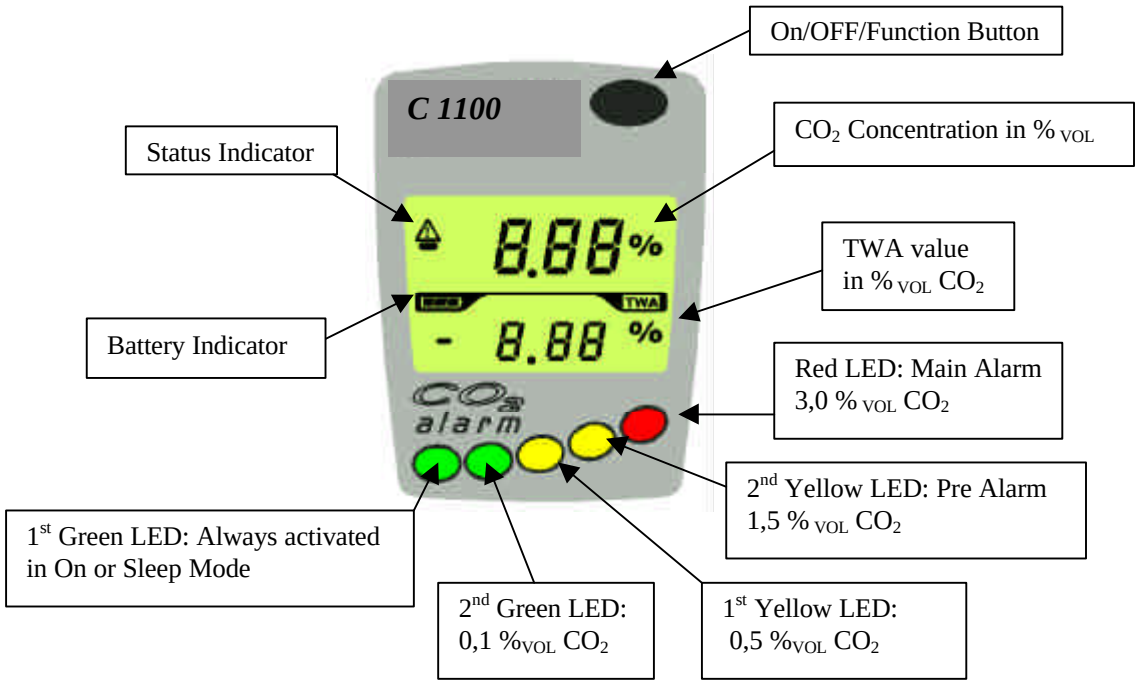


Figure 2. Front Panel

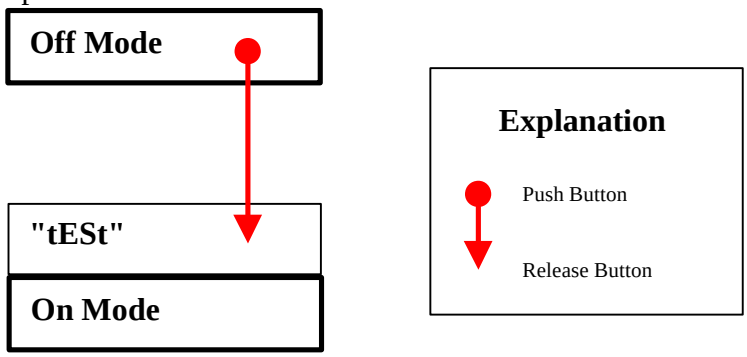
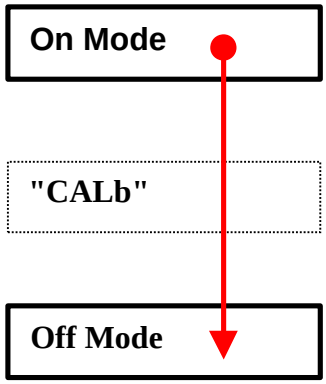
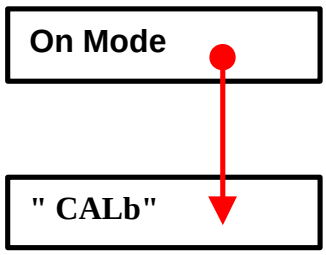
Note: If the status indicator is shown the readings are not reliable! The actions to take are then always first to charge the battery, second to recalibrate the CO_2 sensor zero point (put the unit in CALb Mode). If still the status indicator is shown after these two actions, please contact your dealer!

Accessories :

Leather casing

Charger
And
Shoulder strap

Default Push Button Functions

On Mode • Normal operation • Alarm enabled • TWA logger active • ABC algorithm disabled	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 and buzzer response for the alarm setpoints. After the test the unit is in On Mode. 
Power Off • TWA logger data will be reset.	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. 
CALb Mode • TWA logger on hold • ABC algorithm enabled	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. 
Back light & Application Function Execution.	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.
Acknowledge Alarm	In alarm and pre alarm states, pushing the button resets the sounding buzzer for 5 minutes at a time.

Instantaneous CO_2 Concentration

The instantaneous CO_2 concentration is shown in the upper part of the display and should never exceed recommended short term exposure limit values. The instantaneous CO_2 concentration is also indicated with the five LEDs below the display. Immediately leave the area if the second yellow LED is lit and the buzzer sounds!

Alarm functions (factory settings):

LED
Green 1: always lit when the unit is on
Green 2: >0,1 % $_{VOL}$ (Recommended indoor max CO_2 concentration level)
Yellow 1: >0,5 % $_{VOL}$
Yellow 2: >1,5 % $_{VOL}$, Buzzer (bip-bip-bip-…), pre alarm.
Red: >3,0 % $_{VOL}$, Buzzer (biiiiiiiiiii….), main alarm.

When the CO_2 concentration exceeds 1,5 % $_{VOL}$ the second yellow LED is lit (pre alarm) and the buzzer beeps intermittent. If the CO_2 concentration rises above 3,0 % $_{VOL}$ the red LED is lit and the buzzer sounds continuously. By pushing the button (alarm acknowledgement) the buzzer temporarily will be turned off. The backlight is automatically turned on at pre and main alarm and turned off 8-16 seconds after alarm acknowledgement. If the alarm condition remains 5 minutes from alarm acknowledgement the buzzer becomes actuated again. When the alarm condition has vanished the C 1100 returns to normal operation with the buzzer silenced (- if not acknowledged the backlight will remain on).

The TWA Value

8 hours TWA (Time Weighted Average) value represents the average carbon dioxide level exposure during a working day. In most European countries the CO_2 hygienic limit value (8 hours/day or 40 hours/week) is set to 0,5 % $_{VOL}$ (5000 ppm). It is considered unhealthy long-term to be exposed to more than this value during an 8-hour working day.

The TWA value is shown in the lower part of the display. At power on the TWA-value starts from 0,04% CO_2 and accumulates current carbon dioxide levels averaged over time. Data acquisition is done every 4th minute for the passed 4 minutes average exposure.

During continous operation the TWA value displayed by the C 1100 unit is an average value of the latest 8 hours data recorded. To reset TWA, just switch the unit into Off Mode and back on (without any battery charger connected). Senseair then starts up with the default value 0,04 % $_{VOL}$ CO_2.

In CALb, the current TWA-value is kept on hold. This is useful when you want to take a pause in measuring, for example, if you are doing a worksite investigation and have to leave the area for some time. When the unit is switched back into On Mode it will resume the started TWA recording period.

Switching the unit into OFF Mode, with the battery charger connected until switched back into ON Mode again, will also pause and resume the TWA calculations.

For the records, it is possible to download to a PC all logged data for the last 8 hours TWA period. A special communication cable is required (accessory), plus the free software UIP-P. This connection can be done in OFF Mode during battery charging, as well as during normal operation in ON or CALb Modes, with or without any battery charger connected.

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 off 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 is lit 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 of operation.

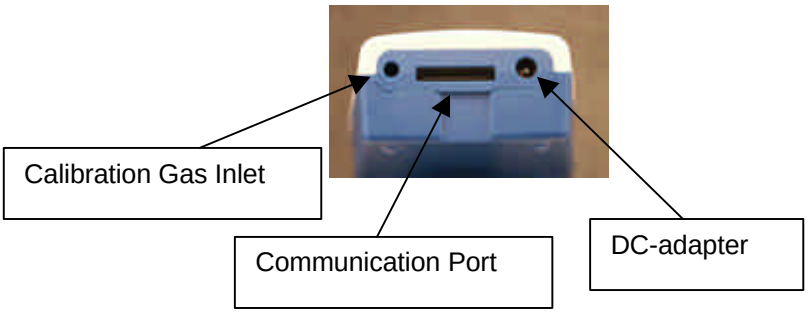


Figure 3. Connections

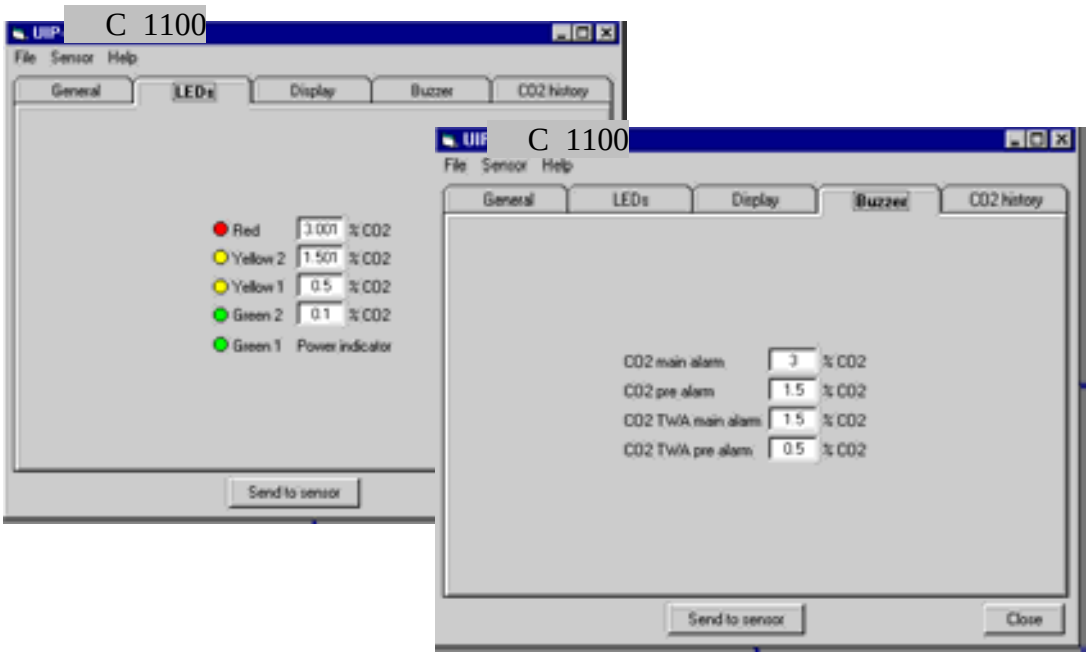
Self Diagnostics and Calibration

The C 1100 is basically maintenance free. The system contains a complete self-diagnostic routine, which is executed automatically every time the power is turned on. The unit will then perform a full self-test sequence showing the LEDs and buzzer response for the alarm setpoints. C 1100 is working with continuous self-diagnostics during operation (On Mode). If any error is detected 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 (CO_2 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 fine-tuning of 0,01% CO_2. 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.

User Interface Program UIP-P



C 1100 Customizations & User Preferences

UIP-P is a PC software tool that gives access to a number of different maintenance and configuration options. It provides a number of functions to customize the user application:

- Configure the trigger levels for the five LEDs.
- Configure the alarm levels for the buzzer.
- Customize display. Which parameters shall be visible for the user?
- Save and load application and customized files.
- Make CO_2 sensor calibrations.

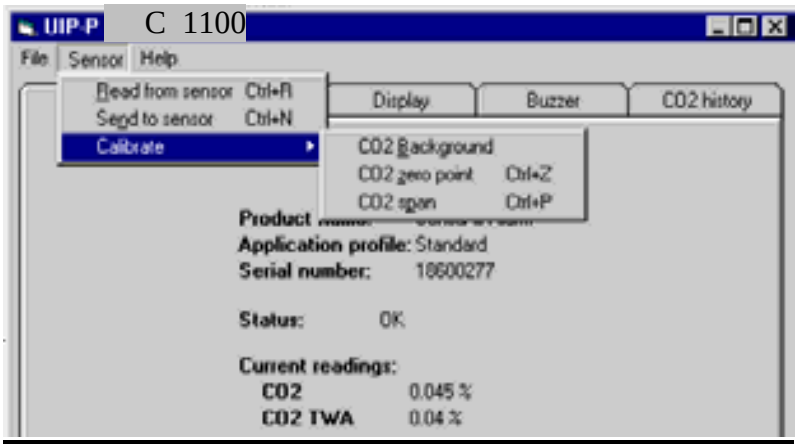


Figure 4. Calibration options provided by UIP-P

C 1100 Alarm internal data logger

The display shows the TWA value that is an average value of the latest 8 hours of recorded CO_2 levels. The logging is active in On Mode and resets in Off Mode (resets only if battery charger is not connected). All samples taken during the eight hours (120 samples) can be viewed with the User Interface Program UIP-P. From UIP-P it is also possible to save all data in a PC text file for storage or further data processing.

Figure 5. Example of a 8 hours working day recording extracted from the SenseAir Alarm unit using UIP-P

Selecting "Update" in the UIP-P "CO2 history" map will only display data up to the time position of the sample counter. Setting C 1100 in Off Mode will reset to zero the sample counter from the previous session of recorded data. The old data still remains, however, until new recordings eventually overwrite it. After a power up such "lost" data may be recovered by selecting "Update" with the *right* mouse button.

Figure 6. "Recovery" (memory dump) of yesterday's recording using "Update" with right mouse click.

Technical specification for the portable C 1100

CO_2 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	0-3 % vol.
Extended Range	3-10 % vol. (accuracy not specified)
Accuracy at NTP (+25° C)	± 3 % of reading or ± 0.02 % vol., whichever is greater
Pressure Dependence	+ 1.6% reading increase per kPa deviation from normal pressure
Temperature Dependence	≤ 0.005 % vol. / °C at zero gas level ≤ 0.015 % vol. / °C at 3 % vol. CO_2
Time Weighted Average (TWA) calculation	8 h time span (most recent) with 4 min sample period Reset can be selected during unit turn-on sequence
Automatic Background Calibration	Automatic Background Calibration with fresh air Can be done together with charging during the night.

Alarm / Measurement Interface:

LEDs	5 step "bar graph" green-green-yellow-yellow-red LEDs with trip points defined by the present CO_2 concentration and preset comparator levels.
Numerical Liquid Crystal Display	Simultaneous display of * the current CO_2 concentration (in % vol.) * the 8 h CO_2 TWA value (in % vol.) * battery status indication * sensor status indication
Audible horn	Transducer with 2kHz resonance frequency, sounding during alarm status until push-button acknowledgement is pressed
Push-button	A single multi-purpose push-button
Internal Data Logger	The latest 8 h accumulated turn-on time of recorded CO_2 concentration data is shown on display (TWA). Logged samples can be downloaded together with communication cable (Art.no. A232-0740) and free software UIP-P.
Digital Interface	USB connector with sensor UART-RS232 com driver
PC software	Windows 95/98/NT compatible software to * transfer logger and events data * configure Alarm Status and LED trip point levels * define user preferences * support sensor calibration

Electrical:

Battery Charger Input	6 VDC / 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
	< 100 mA in alarm 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 ikon = 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	135g

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

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

CE