mSENSE II

CO_2/CO- IAQ sensor
with built in sensor/controller

Manual for Installation

CE

SenseAir AB

EM mSENSEII Rev2/Feb-01

General

The IAQ-sensor *mSENSE II* is a multisensor designed to measure carbon dioxide, carbon monoxide, temperature and humidity simultaneously. It is also a very flexible controller, with programmable outputs for both relay- and linear control of i.e. valves and/or speed controlled fans. The unit can be hooked up directly to common VAV(Variable Air Volume) regulators available on the market or computerized systems (DDC). The controller functions are pre-programmed and can be altered from a computer and a service kit, which contains a communication cable and the user interface software *"UIP" (version 3.0)*.

NOTE! THE PLASTIC COVER STRIP OF THE CO-SENSOR MUST BE REMOVED

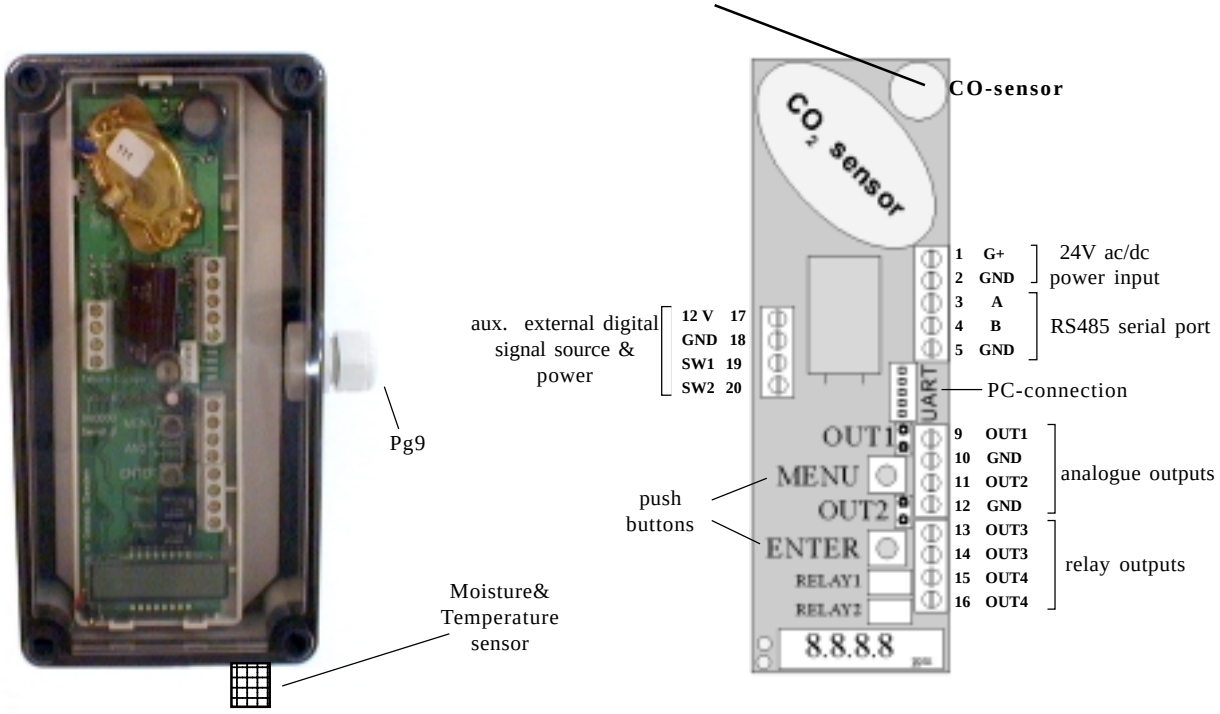


Figure 1. The connector numberings for the electrical wiring to the mSENSE II printed circuit board

The plastic cover strip of the CO-sensor must be removed before powering up the unit

The power supply shall be connected to G+ and GND . If the analogue output is to be connected *the same groundings have to be wired for the mSENSE II unit and for the signal evaluation system!* Unless different transformers are used, special precautions need to be taken.

The *mSENSE II* signal ground is not galvanically separated from the *mSENSE II* power supply! ⟸ **NOTE!!!**

Location

The IAQ-sensor has to be located in a spot representative for the area to be controlled. Locations with direct draft, as well as areas with bad air mixings, should be avoided.

Wall mounting

1) Choose an environmentally proper location, taking into account the risk for cross draft, large temperature variations, humidity build-up, etc. Make sure the connection wires are long enough to easily reach into the Pg9 cable throughput of the unit.

2) Fasten the unit to the wall with the 35 mm:s DIN bar attached. Fasten this bar in a vertical mode.

3) Hang the sensor up together with its IP54-box and connect the wires according to table 1, next chapter. Mount the cover and by that the unit is ready for a function test.

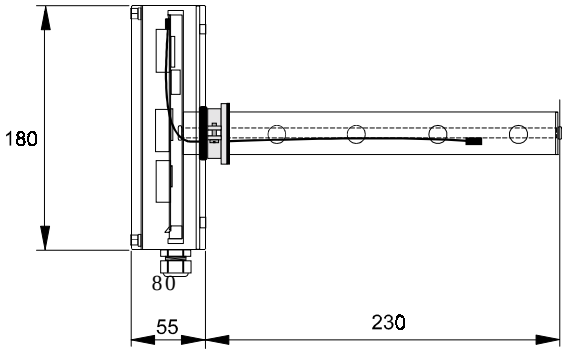


Figure 2. Sensor for duct mounting.

Duct mounting

In principle, there is no difference in the procedure of duct mounting compared to the wall mounting case. However, in duct mounting it is essential to check out that there is no leakage from the room environment into the duct mounting box. The sealings of the box cover as well as of the duct entrance have to be checked!

Choose an appropriate location in the return duct and follow the instructions that comes with the duct mounting box. Connect the cables and put the cover on. Do not forget to check also the sealing of the cable throughput!

Delivery settings

Outputs and display kan be configurated in many different ways with the help of software *UIP* (version 3). On delivery the following will be valid (unless otherwise agreed upon):

Display:	Rotating readings between the following four parameters: CO_2 (x.xxx $\%_{vol}$), temperature (xx.x C), relative humidity (xxx.x%), CO (xxx ppm)
OUT1 linear output:	0-10V = 0-100 ppm_{vol} CO
OUT2 linear output:	0-10V = 0-2000 ppm CO_2
OUT3 relay output:	Normally closed relay. It opens at CO > 35 ppm_{vol} and/or CO_2 > 1500ppm_{vol} From open mode the relay closes at CO < 30 ppm_{vol} and/or CO_2 < 1400ppm_{vol}
OUT4 relay output:	Normally closed relay. It opens at CO > 82 ppm_{vol} From open mode the relay closes at CO < 82 ppm_{vol}

Electrical Connections

Terminal number	Function	Maximum Electric Load Voltage	Current	Comments
1 G+	Power supply (+)/AC	24 VAC/DC+ (+-20%), $3W_{average}$		Internal rectifier diode (See note 1!)
2 GND	System ground (-)	Power supply AC/DC-		
3 A	Twisted pair (A)	RS485		Reserved for network (not mounted)
4 B	Twisted pair (B)			
5 GND	Cable shield			
	UART			Special RS232 connector is needed
9 OUT1	Analogue output(+)	**0-10 VDC**	R_{out} < 30 Ω R_{load} > 5 kΩ	Depending on jumper (See note 2!)
		or		
10 GND	System ground (-) via PTC fuse	**0-20 mA**	R_{load} < 500Ω	
11 OUT2	Analogue output (+)	**0-10 VDC**	R_{out} < 30 Ω R_{load} > 5 kΩ	Depending on jumper (See note 2!)
		or		
12 GND	System ground (-) via PTC fuse	**0-20 mA**	R_{load} < 500Ω	
13 OUT3	Isolated relay output	1mA/5V up to 1A/50VAC/24VDC		Normally closed
14 OUT3				
15 OUT4	Isolated relay output	1mA/5V up to 1A/50VAC/24VDC		Normally closed
16 OUT4				
17 12VDC	Power output	12VDC, max 15mA		For motion sensor
18 GND	System ground			For groundloop conn. to SW1/SW2
19 SW1	Digital input	(starts internal delay timer)		(See note 3!)
20 SW2	Digital input	(direct active only)		

Table I. Connections and terminal block numbering for the mSENSE II.

Note 1: The unit is based on a "3-wire"configuration; TB-1 & TB-2 for power supply and TB-9, TB-11 for analogue output signals. The ground terminal TB-2 is used as the negative DC power supply input or AC phase ground G0 (halfwave rectifier). The signal ground TB10/TB12 is, apart from a PTC fuse, the same as TB-2, which allows the use of only one transformer for the entire system. Situations may occur where different transformers must be used for system power and signal evaluation unit!

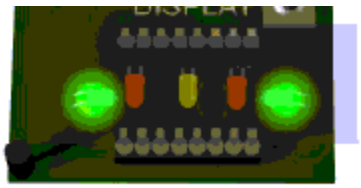
Note 2: *mSENSE II* can deliver both a 0-10V or 2-10V linear voltage, or a 0-20mA or 4-20 mA current loop for OUT1 and OUT2. To change between 0-10V and 0-20mA (or 2-10V and 4-20mA), you move the hardware jumper according to the printed circuit board marking.The choice between 0-10V (0-20mA) and 2-10V (4-20mA) is made before delivery and is changed at the factory.

Note 3: It is recommended that any connected peripheral unit, i.e IR motion sensors or manual pushbuttons, should normally be in closed "*Absence*" state connected to the ground, with the relay (or manual pushbutton) opened in the "*Presence*" state, in which latter case a pull-up resistor in *mSENSE II* will guarantee a HIGH logic level for SW1 and SW2. A delay timer is connected to SW1 and will be restarted every measurement cycle as long as a HIGH level (opened state) is detected on the digital input TB-19.

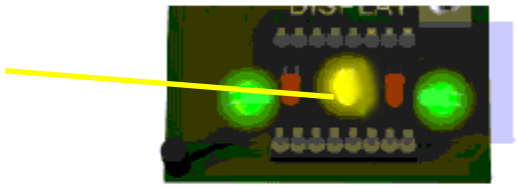
FUNCTION CONTROL for climate sensor model *mSENSE II*

Visual control and function test, according to the text below, can easily be carried out by the installation engineer.
This model has 5 different LEDs -*2 x green, yellow, 2 x red* . They are located behind the semi transparent display. The purpose of these LEDs is to present status information.
The LEDs indicates as following:

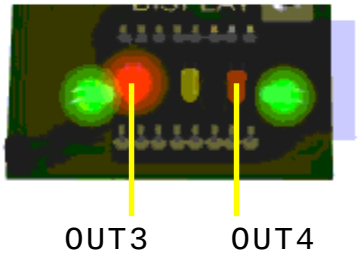
Green- *Powered LED* - emits constantly when power is on.



Yellow- *Maintenance LED* - emits constantly when the error information flag is set.
Acknowledges push button pressing and flashes rapidly in service mode when serial communication is disabled.



Red- *High Level Alarm LED* - emits constantly in cases when each of the two relay outputs are activated .



There are no errors found when the yellow LED is out!
For additional system information, please read the following chapter.

Push Buttons

There are two push buttons on the main PCB for manual interface, denoted *MENU* and *ENTER*. Via the LCD they inform about sensor readings and outputs in the system. Furthermore, assistance of system installation, service and maintenance is being offered.

The yellow LED flashes when a push button is pressed. To ”unlock” the push button functions you consecutively press *MENU* - *ENTER* - *MENU*. The display indicates (by each press) COOL - CALL - tESt. The last string signifies ”test” - the first line in the function menu. Step through the menu lines by pressing the button *MENU*, and confirm your choice with *ENTER*. The different alternatives are described in the diagram at the following page.

After going through the menu the display returns to showing momentary readings.
Even if you remain in menu mode the display automatically returns after approximately 20 minutes, except for some service modes where you can remain for an unlimited time. After a power down the unit always starts in a normal reading display mode.

Some push button functions disables the serial communication connections during the execution. The unit indicates this with a rapid intermittentflash of the yellow LED. After having performed the function the sensor returns to normal mode.

Push Button Functions

Menu lines	*text*	*time-limit*	*Function description*
1	t ES t	Yes	Performs a self diagnostic check procedure which includes a 50 msec long output adjust and read back of every analogue output. If any error is found the yellow LED will emit and an error code is indicated on the LCD together with a wrenge symbol.
2	CHAn	No	Gives access to a submenu where you by pressing the *MENU* button XX = 0...12, and confirming with *ENTER* are able to read the internal register CHXX: *channel* *name* *register* CH00 OUT1 analogue output #1, TB-9 CH01 OUT2 analogue output #2, TB-11 CH02 T 0.0 (internal data) CH03 IN 0.0 temperature sensor CH04 T 0.1 (not in use) CH05 IN 0.1 calculated absolute humidity CH06 IN 1 (not in use) CH07 IN 2 relative humidity sensor CH08 T 1 (internal detector temperature) CH09 OUT3 relay output #1, TB-13/14 CH10 OUT4 CO result (relay switch TB-15/16 at50%FS) CH11 IR 1 CO_2 sensor CH12 IR 2 CO sensor (not compensated)
3	AOUt	No	For adjustment of peripheral equipment. Gives access to a submenu where you by pressing the *MENU* button XX = 1...4, are able to lock the chosen output AnXX (= OUT1-4) in two consecutive positions: AnXX LO chosen output fixed at 0 % full scale HI chosen output fixed at 100 % full scale
4	CALb	Yes	CO_2- and CO sensor background calibration against fresh air. An easy way to take care of potential zero point errors of the sensors - provided being exposed to fresh air (400 ppm CO_2 and 0 ppm CO).
5	CAL	Yes	Zero point calibration of the CO_2- and COsensors. This requires an exposure of normally humidified zero CO_2 gas. See special calibration instruction!
6	I d XX	No	Functional for RS485 network only. Displays the network number of the unit. ENTER gradually enumerates in the interval of XX= 0...29

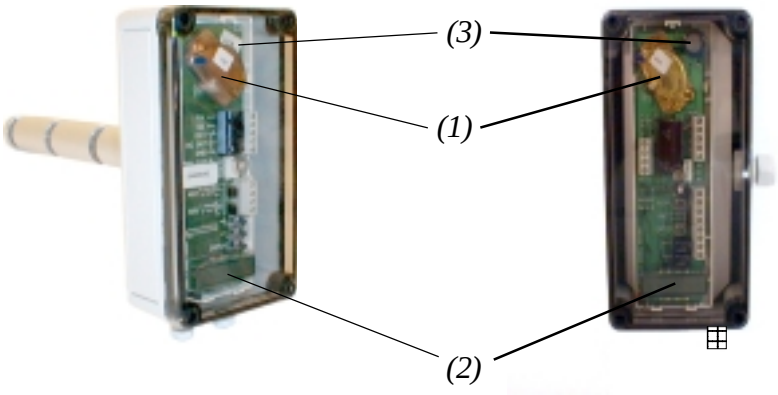
Function test

Remove the cover in order to increase air supply. Take a breath of air and blow it right into the CO_2 sensor (*1*) from a couple of decimetres distance. The controller will register a sharp increase of the carbon dioxide level, which is indicated on the display (*2*). If the controller is connected to a valve in a ventilation system the controller will signal by increasing the air flow.

If cigarette smoke is blown into the sensor there is also a registration of increased CO level. The CO sensor (*3*), however, reacts somewhat slower (several minutes), and it is therefore recommended to close the cover and, if necessary, refill with some more cigarette smoke after a couple of minutes.

To recieve a quantitative reading test result you have to close the cover and expose the unit to a known gas concentration, i. e by letting the gas flow (using a tube) through the air holes of the sensor back.
NOTE! Accuracy is defined at continous operation (3 weeks minimum after installation).

CO/CO_2-IAQ sensor mSENSE II



Duct mount *Wall mount*

Check the sensor readings and outputs in the system on the display (*2*). This information is available by using the push button functions, see page 5.

Maintenance

For a thorough check, or alteration of the system, you are referred to the maintenance kit, art. no. UIP, version 3.
Recommended time interval for zero check is five years, unless some extreme situation has occured. When checking the sensor, a pc is to be connected to the unit via a special RS232 cable which is included in the maintenance kit. This may be done on spot without interfering with the normal operation of the ventilation system.

Self diagnostics

The system performs at every measurement cycle (every two seconds) an internal check up of different voltage and calculated readings for every sensor . In the event of errors the yellow LED will emit and the display will show a wrench symbol. When the error has been corrected the error status is reset.
The system also features an even more *full self diagnostic check procedure*, which also includes a hardware check of the system outputs OUT1...OUT4. This is performed automatically after each power up, but can also be initiated on command using the push button operation "tESt". During this check procedure every analogue output will, in 50 milliseconds, be adjusted and read back. Should anything be incorrect this function returns an *error code* indicated on the display. This error code is a *byte* (a number<256) built up by an amount of binary flags, one for each test. This means that should more than one error occur at the same time, the error codes will add up and form the indicated error code (below).

Checks performed and error byte bit declaration

ERRORSTATUS= 0 , no bit set (= 00) , means there are no errors detected

bit	***error code***	***suggested measure***
#0, #1	-	(not in use)
#2	4	Check power supply.
#3	8	Overload or short circuit of analogue output OUT1. To check the function - remove the cables connected to the output. Run the push button operation "tESt" or restart. During the start up procedure the analogue outputs will be automatically checked.
#4	16	Output OUT2 error . **See error code 8.**
#5	32	Sensor out of range. Frequently recurring at start up.Indicates an exposure outside the specified sensor range. Should the error code appear **on other occasions** are any of the CO_2 or CO sensor in need of a zero calibration. **To correct this, please perform the push button operation CALb or CAL**. Information is available with the push button function CHAn.
#6	64	Relay output OUT3 error. **See error code 8.**
#7	128	Relay output OUT4 error. **See error code 8.**

LIMITED GUARANTEE

This product has been accurately tested and examined for proper operation. Please operate this product only in accordance with the instructions.

SenseAir AB warrants this product against defects in workmanship and material for a period of one year from date of purchase by the original owner. If the product should become defective within this warranty period, SenseAir AB will repair or exchange it. Please contact your retailer for further information.

The retailer is not responsible for any consequential loss or damages that may occur by reason of purchase and use of this product. The responsibility of SenseAir AB, in any event, is 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

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