



aSENSE product family
September 2001



Welcome to SenseAir

SenseAir is a world-leading manufacturer of infrared carbon dioxide sensors and controllers. One of our major markets is building automation where our sensors control individual fans, dampers, valves etc. as well as complete air handling and air conditioning units to help create a better indoor environment.

Our product range also includes "multi-sensors" that combine several different parameters, such as CO₂, CO, O₂, N₂O, temperature, relative/absolute humidity and enthalpy. Setpoint adjustment offers the possibility to manually control the climate based on your own actual and personal demand. Our sensors also offer the possibility to receive and handle data from external devices/sensors, e.g. occupancy, airflow, air pressure and external/outside temperature, humidity and enthalpy.

Using the flexibility of our products, we find unique cost-efficient building automation solutions for our customers. With one single unit we can control both ventilation, heating and cooling in sequence. The possibility to receive and handle external data optimises the performance and economy of the installation. The result is a good, stable indoor environment and major energy savings.

During the last couple of years we have further developed our products to suit new demands. Our sensors are now an important component in "intelligent buildings" due to their ability to receive and handle all necessary external data in the climate zone. In many cases we use modern communication solutions (e.g. TCP/IP and GSM) that make it possible for the user to communicate directly with the sensor in order to read/check actual status or change settings.



SenseAir Integrated Circuits



The SenseAir IR Optical Bench Assembly

Our business idea and goal

SenseAir is a research, development and production company within the gas analysing business that uses its high technical and scientific competence to find unique, cost-efficient solutions for their gas sensors and instruments.

The **business idea** is to use their unique technology to be able to offer the customers reliable and flexible products at a low cost.

The **goal** is to continue its research and development work to consolidate the position as a world-leading company within the gas analysing business.

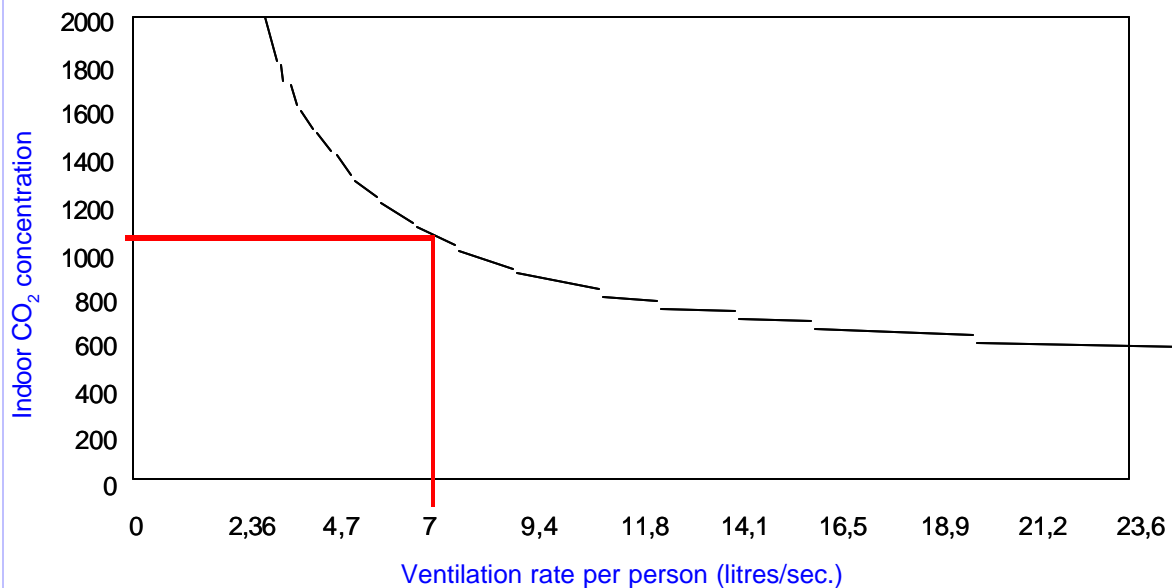
For more information:

SenseAir AB, distributed by: Global Controls, Inc.

3008-B 16th Avenue West, Seattle, WA 98119-2029 USA

Correlation between ventilation rate and CO₂ concentration

Ventilation rate based on CO₂ concentration
(assumed outdoor concentration: 350 ppm)



Regulations



According to several construction regulations world-wide, the fresh air flow should, in rooms where people stay more than occasionally, be at least 15cfm per person.

If we assume that the people in the room are adults with a light work load and the CO₂ outdoor concentration is 350 ppm, this regulated airflow answers directly to a carbon dioxide concentration of 1 040 ppm (see above).

According to different authorities around the world, the indoor carbon dioxide concentration can therefore be used as an indicator of the Indoor Air Quality (IAQ). Referring to the table above, an indoor carbon dioxide concentration below 1 000 ppm should then always be the aim. Some authorities even consider concentrations above 1 000 ppm to be a public nuisance.

For more information:

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aSENSE product family - three basic models

The new SenseAir models:



aSENSE
without display



aSENSE-d
with display

aSENSE

aSENSE is an all-digital low-cost **transmitter** for installation in the climate zone or in the ventilation duct. It measures both *carbon dioxide concentration & temperature* in the ambient air, transforms the data into digital information for the microprocessor which converts this information into linear analogue outputs. The *aSENSE* is a key-component for climate control of buildings and different processes. It is also a cost-efficient alarm sensor in spaces where carbon dioxide gas is a potential danger.

aSENSE-VAV

aSENSE-VAV is a microprocessor based **controller** with built-in sensors for installation in the climate zone or in the ventilation duct. It measures both *carbon dioxide concentration & temperature* in the ambient air and transforms the data into analogue and digital output signals, used for controlling the indoor climate on demand. *aSENSE-VAV* is a key-component for energy-efficient and healthy climate control in rooms with varying occupancy, e.g. schools/nurseries, cinemas/theatres, sports centers.



The new SenseAir model:

aSENSE-VAV

The new SenseAir model:

aSENSE-Climate Controller



aSENSE-Climate Controller

aSENSE-Climate Controller is a microprocessor based **advanced controller** for advanced climate control of heating, ventilation and several stages of cooling - all in sequence. It contains a LCD and push buttons with menu functions. The unit is functionally optimized with built-in sensors together with an input for duct flow sensor (model -FC) and HVAC operating modes (model -FM). It measures both *carbon dioxide concentration & temperature* in the ambient air and optionally also the amount of supplied air. It transforms the measurements into analogue and digital control signals used for direct demand control of air supply, based on temperature, human occupancy and pre-set min. and max. levels of air supply. Extra heating or cooling stages are automatically entered, when so is required, to maintain the selected space temperature.

For more information:

SenseAir AB, distributed by: Global Controls, Inc.

aSENSE controllers with complementary sensors

aSENSE controllers with Relative Humidity

aSENSE-VAV-RH and *aSENSE-Climate Controller-RH* are microprocessor based controllers with built-in sensors for installation in the climate zone or in the ventilation duct. These two special models measure both *carbon dioxide concentration, temperature and humidity* in the ambient air, transforms the data into analogue and digital control signals used for controlling the climate on demand. As a result of the complementary humidity sensor, a calculated value of absolute humidity and/or enthalpy can also be presented through the controller outputs together with the measured values of CO₂, temperature and relative humidity. These controller models can be used to control e.g. a cooling compressor for dehumidification. *aSENSE-VAV-RH* and *aSENSE-Climate Controller-RH* are flexible key-components for energy-efficient and healthy climate control in normal indoor environments as well as in greenhouses, mushroom farms, incubators and similar environments where humidity is an important complementary control parameter.



*aSENSE-VAV-RH and
aSENSE-CC-RH*

aSENSE controllers with Oxygen



*aSENSE-VAV-O₂ and
aSENSE-CC-O₂*

aSENSE-VAV-O₂ and *aSENSE-Climate Controller-O₂* are microprocessor based controllers with built-in sensors for installation in the climate zone or in the ventilation duct. These two special models measure both *carbon dioxide concentration, temperature and oxygen* in the ambient air, transforms the data into analogue and digital control signals used for controlling the climate on demand.

Climate Control

The combination of CO₂ and O₂ in normal indoor climate control is now starting to be used in big cities and other strongly polluted areas. In e.g. offices, schools and hospitals, these products are controlling the ventilation rate based on CO₂ concentration in a normal way but, simultaneously, the complementary O₂ sensor controls an oxygen generator. When a too low O₂ concentration is detected in a room, the oxygen generator quickly stabilizes the climate to a normal, healthy O₂ concentration.

CO₂ and O₂ are both very important parameters when controlling the climate in order to stimulate or prevent growth and maturity processes for fruits, vegetables, bacteria's etc. *aSENSE-VAV-O₂* and *aSENSE-Climate Controller-O₂* are therefore installed to control the climate also in e.g. storage rooms, greenhouses, mushroom farms, incubators and similar environments.

Alarm / personal safety

In any space where CO₂ is produced, stored, generated and/or used, there is a need for an alarm system and/or protective ventilation system, to guarantee personal safety. In several cases it is also important to simultaneously measure the O₂ concentration since the presence of other gases than CO₂ (e.g. Nitrogen) can cause suffocation (from low O₂ concentration). SenseAir's multi-gas controllers are here the ultimate choice. By detecting, and warning against, both too *high* CO₂ concentrations and too *low* O₂ concentrations, *aSENSE-VAV-O₂* and *aSENSE-Climate Controller-O₂* form an important personal protection in spaces where both CO₂ and e.g. Nitrogen are present, for example in pubs, restaurants, beer/wine cellars, purifying plants, packaging industry, slaughter houses etc.

For more information:
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Technical specifications for the aSENSE product family

General Performance

Compliance with	EMC directive 89/336/EEC
Operating Temperature Range ¹	32 - 120 °F
Storage Temperature Range	-4 to +158 °F
Operating Humidity Range	0 to 95% RH (non-condensing)
Warm-up Time	≤ 1 min. (@ full specs ≤ 15 minutes)
Sensor Life Expectancy	> 15 years
Maintenance Interval	no maintenance required ^{2,3,4}
Self Diagnostics	complete function check of the sensor
Status LED Indicators ⁵	yellow = maintenance support, red = relay closed
Display ⁵	4 Digits, 7 segments LCD with ppm / °F / % indicator
Pushbuttons ⁶	offer a selection of installation support & calibration functions

Electrical/Mechanical

Power Input	24 VAC/VDC±20%, 50-60 Hz (half-wave rectifier input)
Power Consumption	≤ 3 Watts average
Wiring Connections	max 16 AWG wires
Main terminal block	screw terminals
Digital/Analog inputs block	spring load terminals
UART connector	5-pin, 2.54 mm pitch, slide connector
Dimensions without housing	3.8 x 2.4 x 0.75 in (L x W x D)

Outputs

Output update interval	2 sec. (programmable from UART on request, 2 sec. to 2048 minutes ⁵)
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Analog ⁷

Protection	PTC fuse (auto reset) on signal return <i>M</i> , short-circuit safe
Output limits ⁸	MIN & MAX limits may be individually set to all outputs
Linear outputs OUT1 & OUT2	0/2-10 VDC $R_{OUT} < 100 \text{ OHM}$, $R_{load} > 5k \text{ OHM}$ (0/1-5 VDC optional) 0/4-20 mA $R_{load} < 500 \text{ OHM}$
Linear output OUT4 ⁸	0-10 VDC $R_{OUT} < 100 \text{ OHM}$, $R_{load} > 5k \text{ OHM}$
D/A Resolution	10 bits, 10 mV / 0.016 mA
D/A Conversion Accuracy	voltage mode: ± 2% of reading ± 50 mV current loop : ± 2% of reading ± 0.3 mA

ON/OFF ⁸

Relay (OUT3)	isolated N.O., 1mA/5V up to 1A/50VAC/24VDC.
Open collector OUT4	in ON/OFF mode: max 0.5A/55VDC (halfwave rectifier for AC)

UART Serial com port

Protocol	SenseAir protocol (see <i>comprot 0700xx rev 3_04.pdf</i>) ⁹
PC-interface	RS232 UART cable with sliding contact and driver (model A232 Cable)
PC User Interface Program	UIP version 4.0 (or higher) ⁹
Accessory -485	RS485 screw terminal slide-on port with network capabilities for up to 30 units

Note 1: Lower temperature operation range can be reached by adding a box heater assembly.

Note 2: In normal IAQ applications. Some industrial applications may require an annual zero gas purge, which automatically recalibrates the CO₂ sensor (implemented during autumn 2001).

Note 3: For -O₂ models, the oxygen electro-chemical cell may have to be replaced every 2-5 years.

Note 4: For -RH models, in applications with elevated temperatures and high humidity levels the relative humidity probe calibration may have to be maintained.

Note 5: Not available in all models (see in the product description sheets).

Note 6: Different menus exist for different models. Push-buttons are available only in models having a LCD.

Note 7: The specifications are valid for the output load connected to ground *G0* or common signal return *M*.

Note 8: Not available for the model aSENSE (Transmitter)

Note 9: Free download from SenseAir's homepage www.senseair.com

SenseAir AB, distributed by: Global Controls, Inc.

Technical specification for the aSENSE product family

CO₂ Measurement

Operating PrincipleNon-dispersive infrared (NDIR) with Automatic Baseline Correction (ABC) ¹⁰
Gas Sampling Modediffusion
Response Time (T_{1/e})2 min. diffusion time (20 sec. with tube connection at 0.1 litre/minute gas flow)
Accuracy ¹¹± 1% of measurement range ± 5 % of measured value
Pressure Dependence+ 1.58 % reading per kPa deviation from normal pressure, 100 kPa
Annual Zero Drift ¹¹< ±0.3 % of measurement range
Measurement ranges6 different sensor models from 0 - 3 000 ppm (standard) to 0 - 25 %_{vol}

model option code	sensor type	measurement range	+ / - accuracy	digital output range	digital resolution	factory calibration span gas (typical)
none	L	0 - 3 000 ppm	50 ppm + 5 % _{rel.}	0 - 9 999 ppm	1 ppm	1 700 ppm
- 0.6 %	L	0 - 6 000 ppm	100 ppm + 5 % _{rel.}	0 - 9 999 ppm	1 ppm	5 000 ppm
- 2 %	M	0 - 2 % _{vol.}	300 ppm + 5 % _{rel.}	0 - 10 % _{vol.}	0.001 % _{vol.}	1.5 % _{vol.}
- 4 %	H	0 - 4 % _{vol.}	500 ppm + 10 % _{rel.}	0 - 10 % _{vol.}	0.01 % _{vol.}	3 % _{vol.}
- 10 %	H	0 - 10 % _{vol.}	0.2 % _{vol.} + 5 % _{rel.}	0 - 100 % _{vol.}	0.01 % _{vol.}	8 % _{vol.}
- 25 %	H	0 - 25 % _{vol.}	0.4 % _{vol.} + 10 % _{rel.}	0 - 100 % _{vol.}	0.01 % _{vol.}	18 % _{vol.}

Temperature Measurement

Operating PrincipleThermistor
Measurement Range-4 to +140 °F
Accuracy± 0.5 °C
Digital Resolution0.1 °C (0.01 °C via UART)

Relative Humidity Measurement (model options -RH)

Operating Principlecapacitive polymer in a monolithic IC
Measurement Range ¹²0 to 100 % RH
Accuracy± 2 % RH
Digital Resolution0.1 %RH (0.01 %RH via UART)

O₂ measurement (model options -O₂)

Measurement principleelectro-chemical diffusion cell with automatic span calibration (ABC) ¹⁰
Response Time (1/e)< 2 min. diffusion time
Measurement range0 - 35 %_{vol.} O₂
Accuracy ¹³± 5 % of measured value
Sensor Life Time2-5 years ¹⁴

Note 10: The ABC function is the key for maintenance free operation. It assumes normal IAQ environments, or applications where *some* ventilation will occur (at least during *some* moment over a week period). For CO₂ sensors this function automatically corrects for any possible zero drift. For O₂ sensors this function automatically corrects for the *span* drift associated with common electro-chemical cells.

Note 11: In normal indoor air environment. Accuracy is defined at continuous operation (3 weeks minimum after installation)

Note 12: Extended exposure to > 90 % RH causes reversible shift of 3 %.

Note 13: In normal IAQ applications.

Note 14: Nominal sensor life is 1 000 000 %O₂ hours at 25°C and 50%RH, but this will be reduced by increased temperatures, as well as in dry air conditions. A 3-pin molex connector facilitates on-site sensor cell replacements.

For more information:

SenseAir AB, distributed by: Global Controls, Inc.

Model *aSENSE*

Carbon dioxide & Temperature Transmitter for wall mounting

PRODUCT DESCRIPTION

aSENSE is an all-digital low-cost transmitter for installation in the climate zone or in the ventilation duct. It measures both CO₂ and temperature in the ambient air, transforms the data into digital information for the microprocessor that converts this information into linear analog outputs. The *aSENSE* is a key component for climate control of buildings and different processes. It is also a cost-efficient gas alarm sensor for spaces where carbon dioxide gas is a potential danger.



aSENSE
(standard model)

aSENSE-d
(display model)

FEATURES

- uses state-of-the-art Non-Dispersive InfraRed (NDIR) technology to measure the carbon dioxide (CO₂) concentration
- cost-optimised for connection to DDC:s
- contributes to lower energy costs when it is applied in a *Demand Control Ventilation (DCV)* strategy
- available in 6 different carbon dioxide measurement ranges
- internal automatic self diagnostics. Maintenance interval > 5 years
- serial communication port for connection to a PC or a GSM module
- cost-efficient RS485 local network communication as an option

APPLICATIONS

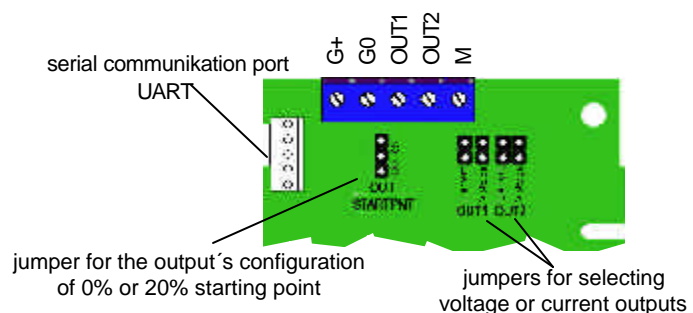
aSENSE is designed to control ventilation by transmitting the measured carbon dioxide and temperature value to the system's Master or DDC. The transmitter is flexible and suits many different ventilation strategies.

According to most building regulations, the fresh air flow should, in rooms where people stay more than occasionally, be at least 15 cfm per person. If the room occupants are adults with a light work-load and the outdoor CO₂ concentration is 350 ppm, this airflow answers directly to an indoor CO₂ concentration of 1 040 ppm. According to National Boards of Occupational Safety and Health, the CO₂ concentration can therefore be used as an indicator of the Indoor Air Quality (IAQ). A CO₂ concentration below 1 000 ppm should then always be the aim.

CONNECTIONS

Screw terminal:

1	G+	24 V AC/DC
2	G0	system ground
3	OUT1	linear output (+) CO ₂ 0...2000 ppm
4	OUT2	linear output (+) temperature 0...50 °C
5	M	signal ground (-)



Model *aSENSE-VAV*

Carbon dioxide & Temperature Controller for wall and duct mounting

PRODUCT DESCRIPTION

aSENSE-VAV is a microprocessor based controller with built-in sensors for installation in the climate zone or in a ventilation duct. It measures both CO₂ concentration and temperature in the ambient air, transforms the data into analogue and digital output signals, which are used for controlling air supply on demand. *aSENSE-VAV* is a key component for energy-effective, healthy climate control of rooms with varying numbers of people like schools/nurseries, cinemas/theatres, sports centers etc.



aSENSE-VAV-D
(wall mount IP20 with
display opening in lid)



aSENSE-VAV-IP54
(wall mount IP54)



aSENSE-VAV-K
(duct mount IP65)

FEATURES

- cost-optimised for direct linear control of dampers and speed regulated fans
- alternative/complementing regulating outputs
- contributes to lower energy costs when applied in *Demand Controlled Ventilation*
- has internal automatic self diagnostics. Maintenance interval > 5 years
- is available for different measurement ranges and with several housing options
- serial communication port for connection to PC, GSM-module or local network
- has LonWorks™ digital network communication interface for advanced building automation as an option

APPLICATIONS

A common application for *aSENSE-VAV* is controlling ventilation in rooms occupied by people. The sensor is flexible and designed to suit many different ventilation strategies.

According to European building regulations, the fresh air flow should, in rooms where people stay more than occasionally, be at least 15 cfm per and person. If the room occupants are adults with a light work-load and the outdoor CO₂ concentration is 350 ppm, this airflow answers directly to an indoor CO₂ concentration of 1 040 ppm. According to National Boards of Occupational Safety and Health, the CO₂ concentration can therefore be used as an indicator of the Indoor Air Quality (IAQ). A CO₂ concentration below 1 000 ppm should then always be the aim.

CONNECTIONS

Screw terminal:

1	G+	24 V AC/DC
2	G0	system ground
3	OUT1	control signal (+) < 10V / 20mA
4	OUT2	control signal (+) < 10V / 20mA
5	M	signal ground (-)
6,7	OUT3	ON/OFF relay
8	OUT4	control signal (+) < 10V or open collector

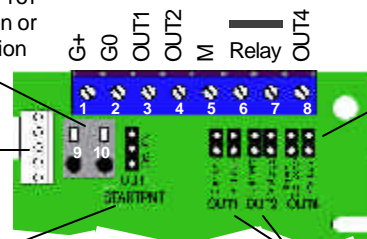
Extra terminal:

9,10	DI1	switch input to delay timer & regulators
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switch input for
forced ventilation or
regulator selection

serial
communication
port UART

configuration jumper for
alternative gain settings for
temperature regulation



jumper to choose
between open
collector or 0-10V
signal for OUT4

jumpers to choose
between voltage
and current outputs

Model aSENSE-VAV

FUNCTIONAL DESCRIPTION

aSENSE-VAV can be programmed from a PC to perform a variety of control tasks. Any change from the default is programmed from the free software *UIP* (version 4.0). In the tool box there are 6 programmable *P*-bands (linear functions) with set points, 2 additional general purpose *P*-bands, plus 1 timer function, regulator controlled by the DI1 input. In addition, the different regulator blocks may be mixed together using 3 logical multiplexers (4:1). To each of the 4 hardware outputs, the largest value of 4 regulator blocks is transformed to an output signal. The outputs can be limited within defined MIN and MAX values that can be set/updated from the push button menu.

Default settings: OUT1, OUT2 and OUT3 are, by default, pre-programmed *alternative* outputs for demand controlled ventilation. OUT4 is intended for connection to a linear heat activator, if requested.

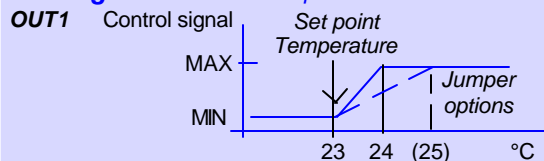
- OUT1 control signal for demand of cooling and air quality (with reduced flow by extreme cold)
- OUT2 control signal for demand of air quality alone
- OUT3 ON/OFF for demand of air quality alone
- OUT4 control signal for heat demand

Set point values of temperature (air cooling and additional heating) and air quality (CO₂), can be adjusted individually by the unit's *maintenance push buttons*. The different functions with associated outputs are seen to the right. When a set point value is changed, the control curves of that parameter are parallel displaced!

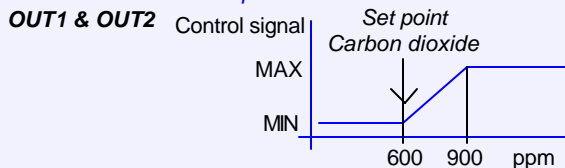
PUSH BUTTON FUNCTIONS

Two push buttons are used for service and setting of parameters. The push buttons give access to functions according to the table. In "display mode", the user cannot change the settings - only change the display presentation. The "service mode" is reached by a PIN code push button sequence.

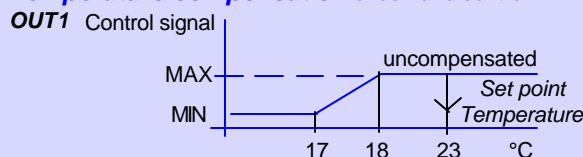
Cooling demand with set point



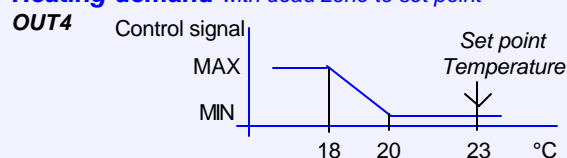
Air demand with set point



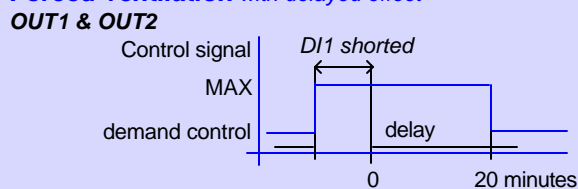
Temperature compensation of demand control



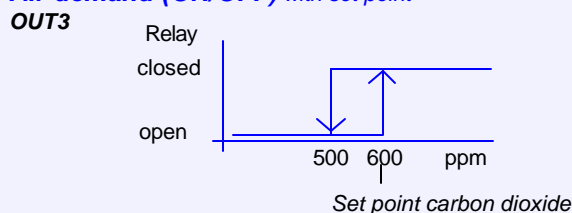
Heating demand with dead zone to set point



Forced ventilation with delayed effect



Air demand (ON/OFF) with set point



*** Functional description in detailed block diagram form, installation manuals etc, are available on the Internet!

function	display	description
default mode	temperature / CO ₂	present values (alternating)
status info	diagnostic code	
parameter info	present set points	information after push button press
service mode		
increase/decrease temp.	temp set point	push button +/-
increase/decrease CO ₂	CO ₂ set point	push button +/-
select output	OUT1 - OUT4	address output for temporary work
increase/decrease MIN limit	SEtL	puts selected output in MIN position
	MIN limit (%)	push button +/- gives new MIN limit
increase/decrease MAX limit	SEtH	puts selected output in MAX position
	MAX limit (%)	push button +/- gives new MAX limit
calibration of CO ₂ sensor	bCAL	calibration with fresh air
	CAL	calibration with zero gas (art.nr.F0005)

Model *aSENSE-Climate Controller*

Advanced Space Controller

with built-in carbon dioxide & temperature sensors

PRODUCT DESCRIPTION

aSENSE-Climate Controller is an advanced microprocessor based space controller with built-in sensors for installation in the climate zone or in a ventilation duct.

Models available:

- /FC** - with min/max-limits through **Flow Control**
- /ES** - with **External Set** point adjustment
- /FM** - with 3 HVAC **Function Modes**
- /TS** - with **Temperature Set** point buttons + / -
- /VS** - with CO₂ air **Volume Set** point buttons + / -
- /FV** - with extra button for **Forced Ventilation**



aSENSE-CC-D
(wall mount IP20 with
display opening in lid)



aSENSE-CC-IP54
(wall mount IP54)



aSENSE-CC-K
(duct mount IP65)

FEATURES

- a complete space controller for sequentially regulating heating/ventilation/cooling by demand
- measures room temperature and CO₂
- probes for flow, pressure, and humidity may be connected, measured, linearized and used as control parameters
- helps to reduce energy costs when applied in demand controlled ventilation strategy
- serial communication port for connection to PC, GSM-module or local network
- has LonWorks™ digital network communication interface, for advanced building automation, as an option

APPLICATIONS

aSENSE-Climate Controller is a micro-processor based controller for advanced climate control of heating, ventilation and several stages of cooling - all in sequence. It has a LCD and push buttons with menu functions. The unit is functionally optimized with built-in sensors for temperature and carbon dioxide, input for duct flow sensor (model / FC) and HVAC function modes (model / FM). *aSENSE* measures the ambient air and optionally the amount of supplied air. It transforms the measurements into analogue and digital control signals used for direct demand control of air supply, based on temperature, human occupancy and pre-set min. and max. levels of air supply. Extra heating or cooling stages are automatically entered, when so is required, to maintain the selected space temperature.

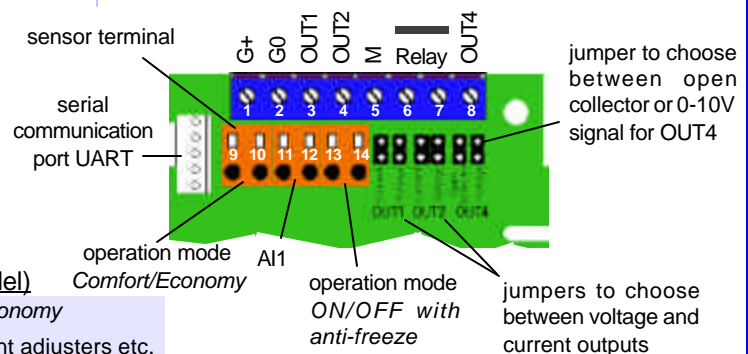
CONNECTIONS

Screw terminal:

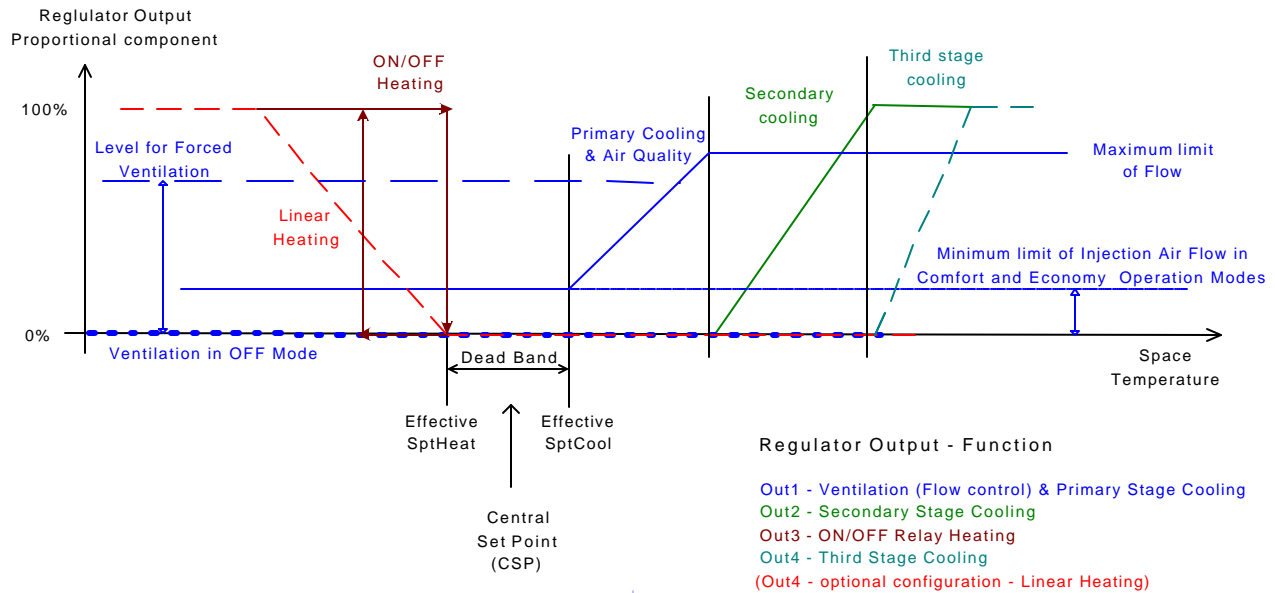
1	G+	24 V AC/DC
2	G0	system ground
3	OUT1	control signal (+) < 10V / 20mA
4	OUT2	control signal (+) < 10V / 20mA
5	M	signal ground (-)
6,7	OUT3	ON/OFF relay
8	OUT4	control signal (+) < 10V or open collector

Sensor terminal: (mounted depending on model)

9,10	DI1	switch input operation mode <i>Comfort/Economy</i>
11	AI1-	analogue input (-) flow sensors, set point adjusters etc.
12	AI1+	analogue input (+)
13,14	DI1	switch input operation mode <i>ON/OFF (with anti-freeze)</i>



aSENSE-Climate Controller - System outputs



FUNCTIONAL DESCRIPTION

The above figure describes the mutual temperature control functions and the sequential connections to the different outputs. To these linear functions, *P-bands*, an accumulated sum $\sum k(T_{actual} - T_{set\ point})$, the *integral part*, is added. This integral part forces the outputs towards achieving the exact requested temperature. By increased heat load, the unit's *sequence handler* checks that the different cooling steps are activated in order, which means that an extended step is not started before the previous step has reached the output's MAX level defined. The reverse is true when the cooling demand is decreased.

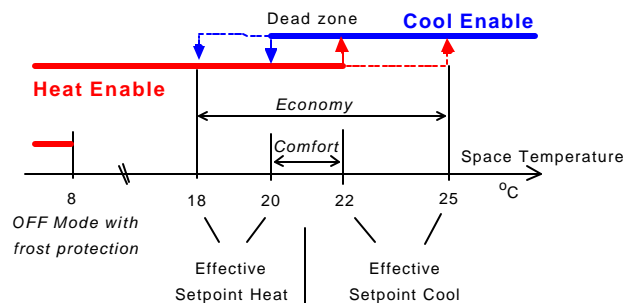
In order to handle every control situation correctly, even during fast temperature changes, the system is only allowed to be in one of the states HEAT or COOL. An automatic change-over between these two states is done by a temperature hysteresis, where a dead-zone prevents oscillation between heat and cool actuators. The size of this dead-zone depends on which *operation mode* the unit currently is working in (see figure).

The set point value of comfort mode for temperature and air quality (CO₂) can be individually adjusted from the units *maintenance push buttons*. In version /TS, the thermostat function is available to the user (software defined set point limits). In version /ES, an input 0-10 V is used for external analogue control of the set point shift. In version /VS, the set point of CO₂ is accessible to the user through the + / - push buttons.

The OUT1 and OUT2 outputs are limited by user defined MIN. and MAX. values. These values can be set/updated from the push button menu during normal operation. As shown in the figure, the start point of the outputs can be selected to 0% or 20%.

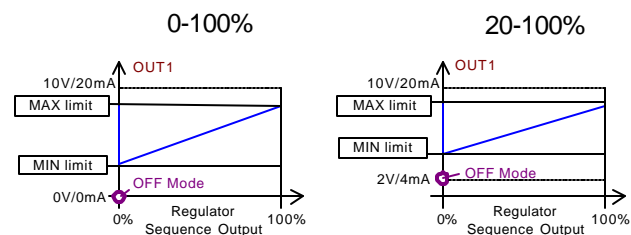
In version /FC, air flow limits MIN and MAX are defined in true numbers (litre/minute), with a feed-back from an external flow sensor.

The output values are updated every 4 seconds. This time interval can be increased, if requested, using the software. The control parameters, and partly the control strategy, can be changed from the PC.



Central Set Point = Effective Set Point \pm 1/2 Dead zone

Alternative configuration (from PC) of outputs:



Model *aSENSE-Climate Controller*

PRIORITY ORDER FOR OUTPUTS: (highest priority on top of the list)

0. Emergency Override Mode from master
1. (reserved for internal Emergency Mode)
2. Override from master or local (manually)
3. Override output levels from master(temporary)
4. Error detection - freezes latest output value
5. The units own calculated output value

EMERGENCY OVERRIDE bit pattern

00	normal operation
01	output is set to 0%
10	output is set to 100%
11	output is set to Emergency Default

NETWORK FUNCTIONS

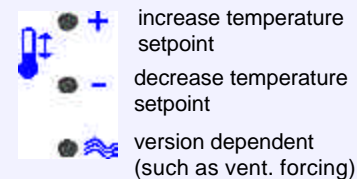
aSENSE-Climate Controller is by its structure suitable for network connections in large as well as in small systems. Several functions for network applications are in harmony with the BACNET standard. All the unit's sensor probes and actuator outputs are handled as independent OBJECTS, comprising also an object STATUS and OVERRIDE parameter. The OVERRIDE parameters are values that can be remotely assigned to different objects, instead of the values measured or calculated by the unit. The behaviour of the outputs in e.g. a fire situation can be pre-determined through the function EMERGENCY MODE. This extra operation mode is defined in the above diagram together with the system hierarchy.

Different communication alternatives are available, where the most cost-efficient is a connection to a RS485-"master/slave" network. This is done via the unit's serial port (UART) by connecting a small driver slide-on card (*accessory -485*). This card can be retrofit. The master must be programmed to follow the flexible and code-efficient communication protocol of SenseAir. Up to 30 *aSENSE* units can be connected to one communication line. SenseAir also offers a communication master which handles up to 3 such networks in parallel. For larger systems, the *aSENSE-Climate Controller-LON*, with a more advanced communication solution, is recommended. This model follows the open standard protocol LonWorks™.

PUSH BUTTON FUNCTIONS

Two push buttons are used for service and setting of parameters. The push buttons give access to functions according to the table. In "display mode", the user cannot change the settings (other than the set point in version /TS och /VS) - but only change the display for a short period. The "service mode" is reached by a PIN code push button sequence.

Pushbuttons for the version
aSENSE-Climate Controller/TS/FV:



function	display	description
default mode		
status info	temperature / CO ₂	present values (alternating)
parameter info	diagnostic code	
	present set points	information after push button press
service mode		
increase/decrease temp. *	temp set point	push button +/-
increase/decrease CO ₂ **	CO ₂ set point	push button +/-
select output	OUt1...OUt4	address output for temporary work
increase/decrease MIN limit	SEtL	puts selected output in MIN position
	MIN limit (%)	push button +/- gives new MIN limit
increase/decrease MAX limit	SEtH	puts selected output in MAX position
	MAX limit (%)	push button +/- gives new MAX limit
calibration of CO ₂ sensor	bCAL	calibration with fresh air
	CAL	calibration with zero gas (<i>art.nr.F0005</i>)
calibration of flow sensor	FCAL	present flow is displayed
		push button +/- gives new flow

* This function is in display mode for version /TS ** This function is in display mode for version /VS

Model *aSENSE-Climate Controller*

HOUSING OPTIONS

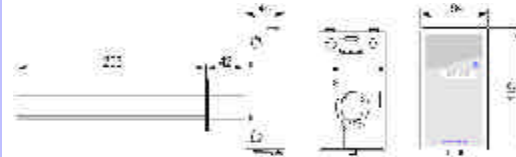
Basic model for wall mounting (IP20)
aSENSE-CC



Industrial model for wall mounting (IP54)
aSENSE-CC-IP54



Basic model for duct mounting (IP65)
aSENSE-CC-K



SENSOR ALTERNATIVES

Different applications may require different measurement ranges. For this purpose , several CO₂ sensors are available (see table). The listed accuracy is defined after at least two weeks continuous operation and by use in normal indoor environment.

model - option code	sensor type	measurement range	+ / - accuracy	digital output range	digital resolution	factory calibration span gas (typical)
none	L	0-3000 ppm	50 ppm + 5 % _{rel.}	0-9999 ppm	1 ppm	1700 ppm
-0.6 %	L	0-6000 ppm	100 ppm + 5 % _{rel.}	0-9999 ppm	1 ppm	5000 ppm
-2 %	M	0-2 % _{vol.}	300 ppm + 5 % _{rel.}	0-10 % _{vol.}	0.001 % _{vol.}	1.5 % _{vol.}
-4 %	H	0-4 % _{vol.}	500 ppm + 10 % _{rel.}	0-10 % _{vol.}	0.01 % _{vol.}	3 % _{vol.}
-10 %	H	0-10 % _{vol.}	0.2 % _{vol.} + 5 % _{rel.}	0-100 % _{vol.}	0.01 % _{vol.}	8 % _{vol.}
-25 %	H	0-25 % _{vol.}	0.4 % _{vol.} + 10 % _{rel.}	0-100 % _{vol.}	0.01 % _{vol.}	18 % _{vol.}

aSENSE-CC-RH contains a humidity probe. This product offers the extra control parameters relative humidity, absolute humidity and enthalpy.

aSENSE-CC-T2 -T3 has two or three extra temperature sensors, e.g. for discharge temperature, outdoor temperature etc. The control functions for these sensors are customized for each individual need.

PRODUCT VARIANTS

Variants listed below, adapted to different control demands, are available with model number *aSENSE-Climate Controller/X*, where *X* represents one or more

options according to the table below. Custom versions for other functional profiles are also offered (contact distributor of SenseAir products).

variant	description	remarks
/ FC	MIN/MAX limitation through Flow Control	Air flow limits MIN/MAX by external flow sensor (1-5 V signal). Calibration of the flow sensor by push button function.
/ ES	External Set point adjustment	Analogue input for temperature set point shift 0-10 V (5 V=neutral, the set point area is programmable).
/ FM	HVAC Function Mode	Switch input for Comfort-/Economy mode (e.g. from movement detector). On/Off anti freeze (e.g. from window contact).
/ TS	Temperature Set point buttons + / -	Set point buttons + / - for temperature setting available to the user
/ VS	Air Volume Set point buttons + / -	Set point buttons + / - for CO ₂ setting available to the user
/ FV	extra button for Forced Ventilation	With this function the ventilation is forced with a programmable value during a programmable delay.

SenseAir AB

Distributed by: Global Controls, Inc., 3008-B 16th Ave W.