

Product Specification

aSENSE (Disp)(RL)

CO₂- / temperature sensor in a housing with relay



General

The IAQ-sensor product aSENSE (Disp) (RL) is used to measure indoor air carbon dioxide concentration and temperature in rooms. It is a flexible controller with programmable output for relay control of e.g. mixed air dampers, humidifier and fans. The measured values are shown on the display.

The unit is designed for connecting to Direct Digital Control (DDC). The linear output functions are pre-programmed as CO₂ and temperature transmitters with jumper selectable outputs 0 – 10 V / 2 – 10 V / 0 – 20 mA / 4 – 20 mA. The measuring ranges can be modified from a PC (Windows) by use of the software UIP (version 5 or higher) together with the RS232 communication cable.

Key technical specification

Item	aSENSE (Disp) (RL)
General performance	
Operating environment	Residential, commercial and industrial spaces ¹
Operating temperature range	0–50 °C
Operating humidity range	0–85% RH (non-condensing)
Storage environment	Non-condensing, non-corrosive environment
Storage temperature range	-40–70 °C (display model: -20–50°C)
Serial communication	UART, Modbus protocol
I ² C communication	I ² C
Warm up time to spec precision	< 5 min
Life expectancy	> 15 years
Self-Diagnostics	Complete function check, yellow LED and LCD error indication (display model)
Display	4 Digits, 7 segments LCD with ppm indicator (display model)
Maintenance	Maintenance-free when using Senseair ABC algorithm (<i>Automatic Baseline Correction</i>). ²

CO₂ measurement

Operating principle	Non-dispersive infrared (NDIR)
Sampling method	Diffusion
Response time (T _{1/e})	< 3 min diffusion time
Measurement period	2s
Measurement range	0–2000ppm _{vol}
Accuracy	±30ppm ±3% of measured value ^{3 4 5}

¹ SO₂ enriched environments excluded

² ABC is enabled in default configuration

³ Accuracy is specified over operating temperature range at normal pressure 101.3kPa. Specification is referenced to certified calibration mixtures. Uncertainty of calibration gas mixtures (±1% currently) is to be added to the specified accuracy for absolute measurements.

⁴ Accuracy is defined after minimum three weeks of continuous operation with ABC enabled (default configuration)

⁵ In the presence of magnetic field at a level of 3V/m (3GHz–6GHz), there is a potential impact on accuracy, with an additional deviation of up to ±150 ppm

Key technical specification

Item	aSENSE (Disp) (RL)
Repeatability	$\pm 20\text{ppm} \pm 1\%$ of measured value
Extended measurement range	2000–10000ppm _{v_{o1}}
Accuracy, extended measurement range	Typically $<(\pm 30\text{ppm} \pm 20\%$ of measured value)
Pressure dependence	+1.6% reading per kPa deviation from normal pressure

Temperature measurement

Operating principle	Negative Temperature Coefficient (NTC) resistor
Temperature measurement range	0–50 °C
Temperature measurement accuracy	± 1 °C

Electrical / Mechanical

Power supply	24VAC $\pm 20\%$, 50/60Hz
	10.5–40VDC (absolute min/max rating)
Average current consumption	$< 1\text{W}$
Electrical connections	G+ and G0
Dimensions (mm)	120x82x30mm (Length x Width x approximate Height)
OUT1	Voltage or mA current loop output, selectable by jumper Voltage output: Linear Conversion Range: 0/2–10V for 0–2000ppm mA output: Linear Conversion Range: 0/4–20mA for 0–2000ppm
OUT2	Voltage or mA current loop output, selectable by jumper Voltage output: Linear Conversion Range: 0/2–10V for 0–50 °C mA output: Linear Conversion Range: 0/4–20mA for 0–50 °C
Voltage output accuracy	D/A conversion accuracy: $\pm 2\%$ of reading $\pm 20\text{mV}$ D/A Resolution: 10mV (10 bit) Electrical Characteristics: $R_{\text{OUT}} < 100 \text{ Ohm}$ $R_{\text{LOAD}} > 5\text{kOhm}$
Current loop output accuracy	D/A conversion accuracy: $\pm 2\%$ of reading $\pm 0.3\text{mA}$ D/A Resolution: 0.02mA (10 bit) Electrical Characteristics: $R_{\text{LOAD}} < 500 \text{ Ohm}$

Table 1: Key technical specification for aSENSE (Disp) (RL)

Terminal descriptions

The table below specifies terminals and I/O options available on the aSENSE (Disp) (RL).

Functional group	Descriptions and ratings
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Power supply

G+:	<p>Power supply voltage may be AC or DC. Positive pole of DC power supply shall be connected to G+. Sensor performs half wave rectification of supplied AC voltage. Power supply lines are protected by a varistor from voltage spikes and over voltage, a 3.3Ω resistor limits start up inrush current.</p> <p>Nominal specification: 24VAC ±20% 24VDC ±20%</p> <p>Absolute maximum ratings: 10.5–40VDC</p> <p>Power consumption: < 1W</p>
G0:	<p>Connected to sensor's ground. Negative pole connection for DC power supply</p>

Outputs

OUT1	<p>Buffered linear output 0–10V or 2–10V alternatively 0–20mA or 4–20mA, or any other voltage/current span within 0–10V / 0–20mA range, depending on sensor configuration. Resolution: 10mV / 0.02mA</p> <p>Choice of Voltage/Current output is provided by “Configuration jumpers” JP11 (V)/JP12 (mA).</p> <p>This output can be used as transmitter output, linear output for regulation or digital ON/OFF output. CO₂ and temperature as well as combinations of CO₂ and temperature can be used as source for the output.</p>
OUT2	<p>Buffered linear output 0–10V or 2–10V alternatively 0–20mA or 4–20mA, or any other voltage/current span within 0..10V / 0..20mA range, depending on sensor configuration. Resolution: 10mV / 0.02mA</p> <p>Choice of Voltage/Current output is provided by “Configuration jumpers” JP16 (V)/JP17 (mA) or by JP22.</p> <p>This output can be used as transmitter output, linear output for regulation or digital ON/OFF output. CO₂ and temperature as well as combinations of CO₂ and temperature can be used as source for the output.</p>
OUT3	<p>Digital relay (optional) output, output also control LED3. LED is on when relay is in active state.</p> <p>Relay: Rated load: 0.5A at 125VAC; 1A at 24VDC Max switching voltage: 125VAC, 60VDC Max switching current: 1A</p>

Serial Communication

UART (TxD, RxD)	<p>JP3, CMOS physical layer, ModBus communication protocol. Logical levels corresponds 5.0V powered logics. UART_RxD line is configured as digital input. Input high level is 2.1V min Input low level is 0.8V max UART_TxD line is configured as digital output. Output high level is 2.3V (assuming 5.0VDVCC) min Output low level is 0.75V max UART_RxD input is pulled up to DVCC = 5.0V by 56kOhm UART_TxD output is pulled up to DVCC = 5.0V by 56kOhm ABSOLUTE MAX RATING G0-0.5V DVCC + 0.5V</p>
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I²C extension

I ² C (SDA, SCL)	<p>Pull-up of SDA and SCL lines to 5.0V. (refer to “I²C comm guide 2_15.pdf” or later version for details) ABSOLUTE MAX RATING G0-0.5V DVCC + 0.5V</p>
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Table 2: I/O notations for aSENSE (Disp) (RL)

Maintenance

The aSENSE Disp RL is basically maintenance free. An internal self -adjusting calibration function takes care of normal long term drift associated to the CO₂ sensor. To secure the highest accuracy, a time interval of five years is recommended between CO₂ calibrations, unless some special situations have occurred.

Input Switch Terminal <i>(normally open)</i>	Default function <i>(when closed for minimum 10 seconds)</i>
Menu/+/-	bCal (background calibration) assuming 400ppm CO ₂ sensor exposure
Esc/-/-	zCal (zero calibration) assuming 0 ppm CO ₂ sensor exposure

Table 3: Calibration options for the aSENSE (Disp) (RL)

If the calibration was successful the yellow LED (Status) will flash five (5) times (200msec ON / 200 msec OFF). If unsuccessful, please release the input and wait at least 10 seconds before repeating the procedure. Make sure that the environment is steady and calm during calibration!

Self-diagnostics

The system contains complete self-diagnostic procedures. A full system test is executed automatically every time the power is turned on. In addition, constantly during operation, the sensor probes are checked against failure by checking the valid dynamic measurement ranges. All EEPROM updates, initiated by the sensor itself, as well as by external connections, are checked by subsequent memory read back and data comparisons. These different system checks return error bytes to the system RAM. The error codes are available by connecting a PC with a special RS232 cable connected to the UART port slide connector. The error codes are shown in the software UIP (version 5 or higher). Warm up and Out of Range are the only bits that are reset automatically after return to normal state. All other error bits have to be reset manually after return to normal by power off/on.

Yellow LED do not lit: OK.

Yellow LED flashes: an error has been detected.

Yellow LED is lit: a fatal error has been detected.



Error codes and action plan

Bit #	Error code	Error description	Suggested action
0	1	Fatal error	Try to restart sensor by power OFF/ON. Contact local distributor.
1	2	Offset regulation error Resets automatically after source of error disappearance.	Try to restart sensor by power OFF/ON. Contact local distributor.
2	4	Algorithm error. Indicate wrong EEPROM configuration.	Try to restart sensor by power OFF/ON. Check detailed settings and configuration with software tools. Contact local distributor.
3	8	Output error Detected errors during output signals calculation and generation.	Check connections and loads of outputs. Check detailed status of outputs with software tools.
4	16	Self-diagnostic error. May indicate the need of zero calibration or sensor replacement.	Check detailed self-diagnostic status with software tools. Contact local distributor.
5	32	Out of range error Accompanies most of other errors. Can also indicate overload or failures of sensors and inputs. Resets automatically after source of error disappearance.	Check connections of temperature and relative humidity probe (if mounted). Try sensor in fresh air. Perform CO ₂ background calibration. Check detailed status of measurements with software tools. <i>See Note!</i>
6	64	Memory error Error during memory operations.	Try to restart sensor by power OFF/ON. Contact local distributor.
7	128	Warm-up state Is always set after power up or power failure. Resets after restart sequence.	If it doesn't disappear in 30 s, check power stability.

Table 4: Error codes and action plan

Note. If any probe is out of range, it occurs, for instance, during over-exposure of CO₂ sensor, in which case the error code will automatically reset when the measurement values return to normal. It can also indicate the need of zero point calibration. If the CO₂ readings are normal, and the error code remains, any other sensor probe mounted (if any) can be defective, or the connection to this probe is broken.

Remark: If several errors are detected at the same time the different error code numbers will be added together into one single error code!

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