
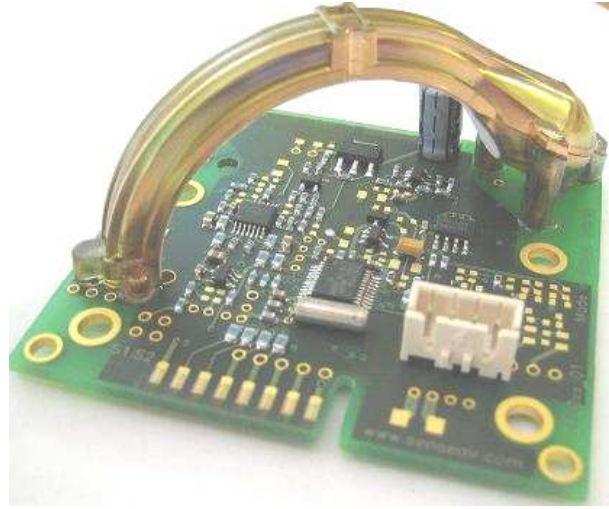


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|  | Product Specification | Page: 2 of 8 |
| Approved: Kaj Karlsson, Mgr. Q.A. | model <i>CO₂ Engine™ -LO</i> | Edition: 3 |
| Issued by: Hans Martin, Mgr. R&D | ambient air CO ₂ linear (analog) output OEM module | Valid from: 2005-12-12 |

CO₂ ENGINE model -LO is a CO₂ sensor module designed to be built-in into stationary ventilation equipment, such as window vent or duct exhaust actuators, serving as a linear transmitter of CO₂. In spite of being based on reliable infrared gas sensing technology, and being very precise, the design is very cost efficient.

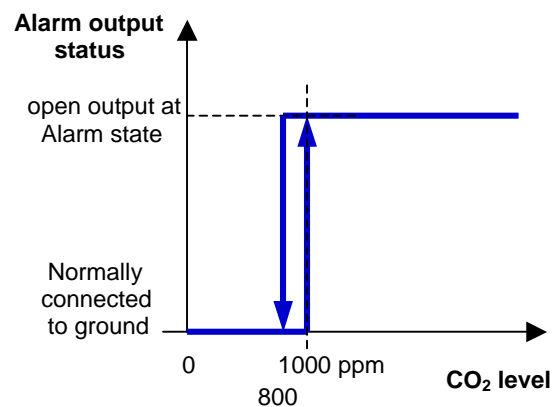
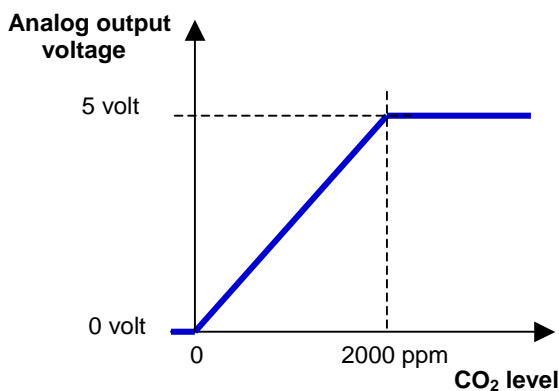



Functional Description

The unit is designed to run at 4.5 to 12 V stabilized supply voltages provided that load and line regulation of power supply is within $\pm 5\%$. The power supply voltage is measured at two seconds intervals. If the loaded input voltage gets lower than ~ 4 V the system will fail and immediately set the output alarm.

During normal operation, the sensor module measures ambient gas CO₂ concentrations at two seconds intervals. Measured CO₂ concentration is filtered and is transmitted to Analog Linear Voltage Output. At the same time it is compared with a predetermined CO₂ High Level Alarm set point. An alarm filter is configured to make the unit immune to temporal disturbances and yet matching requested response time. An internal diagnostic routine sets *Fault Alarm* in the event that any malfunction is detected. The Analog Output continues to keep the last valid value in the case of measurement fault detected.

The module outputs on Alarm Output the logic OR alarm if any of the three events CO₂ High / Power Low / Fault occur. The Alarm Output is an open collector transistor switch, which sinks the Alarm Output pin to zero volt in normal mode operation. The presence of the sensor module can therefore be detected by the host system using an external pull-up resistor. In alarm conditions, as well as during start-up, the Alarm Output enters an open, non-conducting state (@ + input voltage). The Alarm Output will stay in alarm mode until the results of the next measurement cycle are analyzed and filtered. The minimum alarm time is preprogrammed to 32 seconds.



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Technical Data *

General Performance:

Storage Temperature Range-30 to +70 °C
 Operating Temperature Range-5 to +60 °C
 Operating Humidity Range 0 to 95 %RH (non-condensing)
 Operating EnvironmentResidential and commercial spaces
 Conformance with standards.....RoHS directive 2002/95/EG
LNE – TEST PROTOCOL (Phase I) – JHL2003-V1

Mechanical Performance:

Dimensions6,5 x 6,0 x 3,5 cm (Length x Width x Height)
 Conformance with standards.....Mechanical shock test IEC 60068-2-27 Test Ea
Random vibration test IEC 60068-2-64 Test Fh
 Vibration immunity Test severityIEC TR 60721-4-5 table 5: IEC 60721-3-5, Class 5M3 (3,6 gRMS)
"Mechanical conditions in road vehicles in areas without well-developed road systems, light-weighted vehicles, tracked vehicles and self propelled machines, including installations in places which may be directly hit by flying stones"
 Random vibration Test severityIED TR 60721-4-2 table 7: IEC 60721-3-2, Class 2M3 (3,2 gRMS)
"Transportation in lorries, trailers and all other kinds of transportation in areas without well-developed road systems, by trains with shock reducing buffers and by ships",
IEC 60721-3-2, Class A (1,0 gRMS)
"Instrumentation and automation equipment on ships"

Electrical Data:

Power Input4,5 to 12,0 VDC maximum rating (without reverse polarity protection) stabilized to +-5% over load and line changes. Ripple voltage less than 50mV.
 Current Consumption40 mA average, < 500 mA peak current (~20 ms)
 Electrical Connections.....Power (+), Ground (G0), Alarm Output, Linear Output;
 4-pin 2,5mm pitch JST connector *B4B-XH-2*
 Serial Data CommunicationI²C bus; 2,5mm pitch footprint holes and Factory edge connector
 Warm Up time to spec precision.....30 sec

CO₂ Measurement:

Sensing Methodnon-dispersive infrared (NDIR) waveguide technology with ABC long term drift compensation
 Sampling Methoddiffusion
 Measurement interval2 seconds
 Measurement Range0 to 2 000 ppm_{vol.}
 Extended Measurement Range2000 to 10 000 ppm_{vol.} (digital readout only – accuracy not specified)
 Calibration Adjustment Switch.....close @ fresh air (~400 ppm) restores calibration if S1 short cut > 0...30 seconds
 Precision.....(+/-) 50ppm + 5% of measured value
 Pressure dependence+1,58% of reading per kPa deviation from normal pressure @ 100 kPa

Analog Linear Voltage Output:

Output range^{1,2}0 to 5V = 0 to 2 000 ppm
 Output precision (load to G0)(+/-) 40mV + 2% of output value
 Output resolution10 bit (5mV or 2ppm)
 Output internal resistance< 200 Ohm
 Minimum load (to G0).....20 kOhm

Alarm Output:

Electrical CharacteristicsOpen collector with series 120R resistor, normally closed (conducting), 10kΩ pull-up resistor to power (+)
 FunctionTransistor open at *CO₂ High OR Power Low OR at Sensor Failure*
 Response Time~ 32 seconds
 CO₂ High Alarm Level²1000 ppm
 CO₂ Alarm Reset Level² 800 ppm
 Power Low Alarm Level~4 V @ load

Note 1: Cannot exceed supply voltage. Output voltage is not defined at processor reset

Note 2: At see level altitudes and normal pressures

* PATENT PENDING: WO 2004/010116