Internal CO\textsubscript{2} Sensor for Automotive Applications

NDIR CO\textsubscript{2} Single Channel, Diffusion Sampling Method

The Telaire Internal Carbon Dioxide (CO\textsubscript{2}) Sensor is a nondispersive infrared (NDIR) CO\textsubscript{2} sensor that implements a single channel diffusion sampling method for automotive HVAC applications, including automatic fresh air control and safety sensing for CO\textsubscript{2} refrigerants.

Along with the patented ABC Logic™ lifetime calibration warranty, its low power consumption, compact design and simple product integration, make this an affordable gas sensing solution. All units are factory-calibrated to measure CO\textsubscript{2} concentration levels up to 5,000 ppm.

Benefits

- Safety - Measure and control in-cabin CO\textsubscript{2} levels to prevent driver drowsiness.
- Energy Savings - Reduce variations in heating and cooling in-cabin through demand control ventilation.

Applications

- Automotive HVAC - In-cabin air quality and comfort control.

Features

- ABC Logic™ - Lifetime calibration warranty
- Lin 2.0 output
- Low power consumption
- Compact design
- Versatile interface for simple product integration
- Factory-calibrated to measure CO\textsubscript{2} concentration levels up to 5,000 ppm.
- Adjustable firmware variables
- Custom packaging options
- Subject to commercial consideration, customization of firmware, connector and enclosure is possible

Amphenol

Advanced Sensors
Specifications

General Performance:

**ABC Logic**
Automatic Background Calibration – The algorithm that uses ambient air concentrations to adjust the sensor and compensate sensor long-term drift.
Adjustment cycle period is 12 – 192 hours of operation in active mode. Practical adjustment cycle depends on operating conditions.
Please see notes section for more details

**Measurement Range Configurable**
Air Quality Control:
400 – 5,000 ppm CO₂
Safety Alarm for Air Quality Control and CO₂:
400 – 40,000 ppm CO₂

**Output Range**
0 – 65,000 ppm CO₂

**Measurement Period**
Active Mode: 5 seconds
Low Power Mode: 5 minutes
Sleep Mode: 12 hours
*Timing of these modes can be configured per customer requirements.*

**Resolution and Repeatability**
Internal Sensor Resolution: 1 ppm
Repeatability: 30 ppm at 1000 ppm (Typical)

**Accuracy in Active Mode**
Range: 400 ppm to 5,000 ppm
±200 ppm or 10% of the reading, whichever is greater @ 0 to 50°C
Range: 5,000 ppm to 40,000 ppm (4%)
10% of the reading @ 0 to 50°C

**Temperature Dependence**
Additional 0.5% of reading per °C or 5 PPM/C, whichever is greater outside the range 0 to 50°C

**Pressure Dependence**
0.135% of the reading per mm Hg

**Response Time t₉₀ (90% of Step Change)**
Active Mode: <40 seconds, dependent on test regime (Typical)

**Warm-Up Time**
First measurements in:
< 5 sec after power-up
< 2 minutes maximum accuracy in Active Mode

**Total Lifetime:**
130,000 hours, limited by microcontroller flash retention specification

**Operational Lifetime:**
In Active Mode: 45,000 hours

**Relative Humidity**
0-95% non-condensing

**Mechanical:**

**Enclosure**
For ‘courtesy light’ insertion

**Filters**
Hydrophobic dust filter on the CO₂ sensor

**Conformal Coating**
Electronic components are conformal coated.

**Environmental:**

**Operating Temperature Range**
-40°C to + 90°C

**Storage Temperature Range**
-40°C to +110°C

**Electrical:**

**Power Supply Voltage**
9 16V VDC

**Current Consumption (Typical)**
Maximum Peak Current: < 100 mA
Average in Active Mode: < 10 mA
Average in Low Power Mode: < 100 uA
Average in Sleep Mode: < 25 uA
Specifications - Continued

**Cable and Connector**

**Connector**
- Bare wire

**Connection**

<table>
<thead>
<tr>
<th>Connector (T6743-E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mating Connector</td>
</tr>
<tr>
<td>Socket Configuration</td>
</tr>
<tr>
<td>1 - Ground (Common)</td>
</tr>
<tr>
<td>2 - LIN</td>
</tr>
<tr>
<td>3 - Supply +V</td>
</tr>
</tbody>
</table>

**Connection (T6743)**

<table>
<thead>
<tr>
<th>PCB Pads</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Supply +V (Square pad)</td>
</tr>
<tr>
<td>2 - LIN</td>
</tr>
<tr>
<td>3 - Ground (Common)</td>
</tr>
</tbody>
</table>

**LIN Interface**
The sensor implements a LIN interface defined by a generic LDF file.

**LIN Output Signals**

**Carbon Dioxide**
- CO₂ Concentration: 1 ppm Resolution

**Modes**
- Active Mode
- Low Power Mode
- Sleep Mode

**DebugWord**
- Unused

**Ready**
- Indicates when the sensor is ready to measure CO₂

**InternalError**
- Indicates when there is an error in sensor operation

**RespError**
- Indicates when there is an error on the LIN bus

**LIN Diagnostic Transport Layer**
- Not implemented in this release

**Notes:**

**ABC Logic™**

This method periodically adjusts the sensor to ambient CO₂ concentration levels, assuming that lowest ambient levels are 400 ppm. It allows accurate and reliable operation of the sensor through extended lifetime and even recovery from catastrophic damages.

ABC Logic algorithm has variable adjustment time cycle that depends on frequency and duration of operational cycles of the vehicle. Current implementation can adjust the sensor as soon as every 12 hours of operation, up to 192 hours of operation, depending upon how long each operation cycles takes. A rule of thumb could be number of operation cycles x 48 or 192 hours of operation, whichever comes first.

ABC Logic requires that the sensor should never be exposed to CO₂ levels lower than 380 ppm.

**Available Models**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Sampling Method</th>
<th>Range</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6743</td>
<td>Diffusion</td>
<td>0-40,000 ppm</td>
<td>PCB Only</td>
</tr>
<tr>
<td>T6743-E</td>
<td>Diffusion</td>
<td>0-40,000 ppm</td>
<td>Sensor with Enclosure</td>
</tr>
</tbody>
</table>

Note: Sensor can be customized subject to commercial consideration.