1. Key Features

The TR9290 family of products are a value-engineered range of CO₂ transmitters targeted at ventilation control applications in buildings where the only requirement is a dependable CO₂ sensor that never needs calibration.

Key features of the TR9290 family include:

- Internal self-calibration method based on background measurement also eliminates need for outdoor CO₂ sensor.
- Choice of outputs: 0-10V, 0-5V or 4-20mA and LonWorks®.
- Built to ISO 9001 standards
- Mounting options include wall, duct and in-duct.
- Utilizes a proven infrared measurement technology with over 17 years of flawless operating history.
- Supported by a team of knowledgeable application specialists. We are just a phone call away if you have questions.
- LonMark® Certified output option.

2. Order Selection Guide

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Output</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR9290*</td>
<td>A - 0-10 V, 4-20mA</td>
<td>L - no display</td>
</tr>
<tr>
<td>TR9291*</td>
<td>B - 0-10V, 0-5V</td>
<td>L - display</td>
</tr>
<tr>
<td>TR9292</td>
<td>Lon - LonWorks®*</td>
<td></td>
</tr>
<tr>
<td>TR9293</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>TR9294</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

*LonWorks® option not available for TR9290 or TR9291

3. Transmitter Maintenance

The TR9290 family of sensors is designed to be self-calibrating and should require no maintenance over the sensor life which is typically 15 to 20 years. The reason for this remarkable stability is due to a number of design features integrated into the CO₂ transmitter.

- Extended Sample Path Length: The AirTest infrared sensor incorporates a unique, patented, oval design. All competitive sensors use a straight path of infrared energy shining through an air sample to measure CO₂. The amount of gas that can be sampled, called the “path length” is limited by the size constraints of their wall-mounted and duct-mounted cases used. The AirTest design, using a similar sized case, provides over double the path length of any other CO₂ sensor (4.8”) by bouncing the light around the small oval sensor element. Longer path length means that a larger sample of air is measured. In technical terms this results in an increased signal-to-noise ratio. This means that the AirTest sensor performs better at long-term sensor stability and accuracy than other devices. Greater dependability is the ultimate result.

Background Calibration Algorithm: Most drift of CO2 sensors occurs because the infrared light source in the sensor tends to change over time. With the extended path length described above, this change is minimized because of the high signal to noise ratio provided by the extended path length. The sensor is also designed to regularly monitor the concentrations that occur when the monitored space goes unoccupied. During these unoccupied periods, CO2 levels will typically be very similar to outside or ambient conditions. The AirTest CO2 sensor monitors these background levels and for the purpose of maintaining a consistent control strategy, the sensor calibrates this background level to 400 ppm. If the baseline level measured over many days increases or decreases, the sensor makes small adjustment in calibration. By continually checking this background level, the sensor is able to maintain an ongoing calibration. CO2 ventilation control in buildings is achieved by controlling ventilation based on the difference between inside and outside concentrations of CO2. Because the self calibration feature automatically adjusts itself to outside levels, the TR9290 family of transmitters virtually eliminates the need for a separate and expensive outside air CO2 sensor.

For commissioning purposes it is recommended that the sensor be compared to a recently calibrated handheld unit such as the PT9250 from AirTest Technologies Inc. This device can be used to verify that the sensors are properly calibrated. The chart below shows how 20 sensors that were intentionally calibrated for the self-calibration feature of the sensor to adjust for any offset in calibration that has occurred as a result of handling. The chart below shows how 20 sensors that were intentionally calibrated with an error up to 150 ppm drifted into a low error zone as the sensors calibrated themselves to the space. Many sensors will be calibrated properly out of the box, but handling may shift the units. This does not mean they are defective, but it does mean they will take time to stabilize with the self calibration feature.

For commissioning purposes it is recommended that the sensor be compared to a recently calibrated handheld unit such as the PT9250 from AirTest Technologies Inc. This device can be calibrated to outside background levels much like the AirTest Transmitter.

Control Considerations: The typical sequence of operation used for CO2 ventilation control involves modulating outside air delivery to the space as CO2 levels rise. It is recommended that some low level of ventilation be provided to the space during all occupied hours to control non-occupant related sources and to maintain building pressurization. When inside levels are a few hundred ppm over outside levels (established by the AirTest controller at 400 ppm), the outside air delivery should be increased as CO2 levels rise using a proportional or PID control strategy. The upper control point of the control strategy should be equal to the design ventilation rate of the space in terms of air volume. For 15 cfm per person in a space, the upper control point should be 1100 ppm, and similarly, for 20 cfm per person in the space, the upper control point should be 930 ppm.

Outside CO2 Levels: As mentioned in the background calibration section, the AirTest sensor considers outside concentrations as part of its self calibration routine. As a result no outside air measurement is needed. For the control strategy to work properly, the building operator should assume for control purposes that the outside level is 400 ppm. While the actual outside level may be different from this, the purpose of CO2 control is to control based on the differential between inside and outside levels.

Continuous Commissioning & CO2: A good ongoing check of CO2 sensor accuracy is to monitor readings through the building control system and determine if relatively consistent baseline levels are occurring on nights and weekends. For the self-calibration mode AirTest CO2 sensors to work properly, CO2 levels inside should drop to outside levels at lease once per week. Some building owners will also check their CO2 readings during an intentional purge or economizer cycle where it can be assured that inside levels will be similar to outside levels. Although significant changes in baseline levels may indicate a fault with one or more CO2 sensors, it is also important to note that these changes may be an indication that an economizer or air handler may not be operating correctly.
5.1 Installation: TR9290 Wall Mount

**Dimensions**

- **Front**
  - Width: 3" (Optional)
  - Height: 3"

- **Back**
  - Width: 3.5" to 4"

- **Side**
  - Height: 1"

**Closing Enclosure**
- Hinge front cover on bottom of rear case
- Swing top cover into place until it snaps

**Opening Enclosure**
- Press tab on top of rear case
- Swing top cover open from top.

**TR9290 Wiring**

<table>
<thead>
<tr>
<th>Wire ID</th>
<th>TR9290-A</th>
<th>TR9290-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+ Positive Power</td>
<td>+ Positive Power</td>
</tr>
<tr>
<td>2</td>
<td>G Ground</td>
<td>G Ground</td>
</tr>
<tr>
<td>3</td>
<td>Out 1: 0-5V</td>
<td>Out 1: 0-10V</td>
</tr>
<tr>
<td>4</td>
<td>Out 2: 4-20mA</td>
<td>Out 2: 4-20mA</td>
</tr>
</tbody>
</table>

5.2 Installation: TR9291 In Duct Mount

**Dimensions**

- **Front**
  - Width: 2.5"
  - Height: 3.5" to 4"

- **Back**
  - Width: 2.5"

- **Side**
  - Height: 1"

**TR9291 Wiring**

- **TR9291-A**
  - + Positive Power
  - G Ground
  - 1 Out 1: 0-5V
  - 2 Out 2: 4-20mA

- **TR9291-B**
  - + Positive Power
  - G Ground
  - 1 Out 1: 0-10V
  - 2 Out 2: 4-20mA

**Wire ID**

- 1 (*): Wire color will be on unit label
- 2 (*): Wire color will be on unit label
- G (B): Wire color will be on unit label
- [R]: Wire color will be on unit label
5.3 Installation: TR9292 Aspiration Duct Mount

Dimensions

Mounting
› Drill 1/2” (25mm) Hole in duct for probe
› Attach mounting flange
› Connect flange to sensor

Important
› Once wired, tighten outside flange around wire opening. For better seal use a small amount of caulk in the flange.
› Make sure cover is firmly sealed to the box.
› To work properly box must be completely air tight so air from the duct can circulate between the sensor housing and the duct.

5.4 Installation: TR9294 Wall Mount

Dimensions

Side View
› Case hinges at bottom with clips that snap-in at the top of the case
› Case is much easier to open when on the wall

Top View
› Press two tabs down and pull off cover

TR9292 Wiring

TR9292-A
+ Positive Power
G Ground
1 Out 1: 0-5V
2 Out 2: 4-20mA

TR9292-B
+ Positive Power
G Ground
1 Out 1: 0-10V
2 Out 2: 4-20mA

TR9294 Wiring

TR9294-A
+ Positive Power
G Ground
1 Out 1: 0-5V
2 Out 2: 4-20mA

TR9294-B
+ Positive Power
G Ground
1 Out 1: 0-10V
2 Out 2: 4-20mA

TR9294-Lon
+ Positive Power
G Ground
1 Lon
2 Lon
6.1 Product Specification

**General**

**CO₂ Detection Method:** Gold Plated Non-Dispersive Infrared Optical Sensor with Automatic Baseline Correction for Self-Calibration, 4.8” optical path length, diffusion sampling.

**Certification:** CE, EMCS/336/EEC, CA Energy Commission, NYSERDA, LonMark® Certified (V3.4).

**Transmitter Rated Life:** 15 years

**Operating Conditions:** 32 to 122º F (0 to 50ºC), 0 to 95% RH

**Storage Conditions:** -40 to 158º F (-40 to 70º C)

**Performance**

**CO₂ Measurement Range:** 0-2000 ppm (factory adjustable to 10,000 ppm upon request),

**CO₂ Accuracy:** +/- 1% of measurement range

**Calibration:** Self Calibrating, Calibration Not Required

**Response Time:** T90 = <2 minutes (diffusion), <15 seconds for flow through.

**Power**

**Input:** 24 VAC/VDC ±20%, 50-60 Hz (half-wave rectified)

**Average Power Consumption:** < 1 Watt average

**Ground:** Analog output transmitters must share common ground with control system.

**Outputs**

**Linear Analog Output:** Two simultaneous dual output options available: A) 0-5V & 4-20mA, B) 0-10V & 4-20mA

**LonWorks®:** CO₂ ppm & % SNVT

6.2 LonWorks®/LonMark® Specifications

**AirTest Models:** TR9294-L-Lon, TR9294-Lon

**Category:** Sensor

**Measurement Range:** 0-2000 ppm (factory adjustable to 10,000 ppm)

**Standard Program ID:** 80:00:E5:05:46:06:04:01

**LonMark® Version:** 3.4

**Manufacturer ID:** 229

**Device Class:** CO₂ Sensor (10.70)

**Usage:** 06 – Residential/Commercial

**XIF/DRF Download:**

www.airtest.ca/support/sw/AirTestLon.zip

**Transceiver:** 04-TPFT-10

**Model:** 2

**XIF Available:** True

**DRF available:** True

**LonMark Objects:** 0000 Node object (1), 1070 CO₂ Sensor (1)

**Clock Rate:** 10 MHz

Power Requirement: 18-30VAC/VDC (1/2 wave rectified) < 1 W average

Object Details: See diagram

7. Product Warranty And Limitations Of Liability

AirTest Technologies Inc. (hereinafter referred to as AIRTEST) warrants that the Product shall conform to and perform in accordance with published technical specifications and the accompanying written materials, and shall be free of defects in material and workmanship for a period of one year, such Warranty period commencing on receipt of the product by the Customer.

This Warranty is limited to the repair and or replacement, at AIRTEST’s sole discretion, of defective or non-conforming Product, and AIRTEST shall not be responsible for failure of the Product to perform specific functions, or any other non-conformance caused by or attributable to:

a) any misapplication or misuse of the Product;

b) failure of the Customer to adhere to any of AIRTEST’s specifications or instructions;

c) neglect of, abuse of, modification to, or accident to, the Product; or

d) any associated or complimentary equipment or software not furnished by AIRTEST.

If this unit should malfunction, it must be returned to the factory for evaluation. Contact AIRTEST to determine if a product problem is a Warranty or repair issue (1-888-855-8880 or 604-517-3888).

Prior to sending any Product back to AIRTEST the Customer must contact AIRTEST to receive a Return Materials Authorization Number (RMA #). This number must be marked clearly on the outside of the package you are sending. Packages without RMA #’s may be returned to sender unopened. Customer agrees to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to AIRTEST, and to use the original shipping container or equivalent. Upon examination by AIRTEST, if the unit is found to be defective and therefore qualifies for Warranty, it will be repaired or replaced at no charge to the Customer. If the product is found not to qualify for Warranty, the Customer will be offered the opportunity to pay for repair of the damaged unit, and the Customer will be responsible for all shipping charges.

**Limitations Of Liability**

EXCEPT AS EXPRESSLY PROVIDED HEREIN, AIRTEST MAKES NO WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, WITH RESPECT TO ANY EQUIPMENT, PARTS OR SERVICES PROVIDED PURSUANT TO THIS AGREEMENT, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NEITHER AIRTEST NOR ITS RESELLER SHALL BE LIABLE FOR ANY OTHER DAMAGES, INCLUDING BUT NOT LIMITED TO, DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, WHETHER IN AN ACTION IN CONTRACT OR TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY), SUCH AS, BUT NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS OR BENEFITS RESULTING FROM OR ARISING OUT OF, OR IN CONNECTION WITH, THE USE OF FURNISHING OF EQUIPMENT, PARTS OR SERVICES HEREUNDER OR THE PERFORMANCE, USE OR INABILITY TO USE THE SAME, EVEN IF AIRTEST OR ITS RESELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT WILL AIRTEST OR ITS RESELLERS TOTAL LIABILITY EXCEED THE PRICE PAID FOR THE PRODUCT.
Looking For A Good CO₂ Diagnostic/ Commissioning Tool?

Try the TR9250 Hand Held CO₂

- Measures CO₂ & Temperature
- On Board Data-logging
- PC Based Interface
- Calculates Ventilation Rate Based on Inside/Outside CO₂ Differential
- Easily Calibrated To Outside Air
- 8 Hour Battery Life
- Comes with Charger, Case and Belt Clip

Datasheet

Website

Store