A Cleantech/GreenTech Breakthrough In Building Control… Wireless CO_2, Temperature and Humidity Transmitter Powered By Ambient Light

Overview

AirTest Technologies has just introduced a revolutionary wireless transmitter that measures CO_2, temperature and humidity. It is powered by a small solar panel harvesting indoor ambient light. The sensor communicates using the low energy EnOcean® wireless protocol that is used by many major building control companies.

This zero energy product, makes it easy to include energy saving CO_2 demand controlled ventilation, as well as improved comfort, in almost any building in minutes, with minimal installation time and cost. According to Mike Schell, VP of Marketing for AirTest, "In retrofit applications the cost of installing wired CO_2 sensors can cost thousands of dollars per point. Because no wires are necessary, this product can be configured in 10 minutes and then attached to the wall. Most major control manufacturers offer EnOcean® wireless gateways that seamlessly integrate into their existing control systems."

Applications

CO_2 demand controlled ventilation (DCV) is an ideal energy saving approach for any conditioned space that has higher densities and variable occupancy. Building codes require that buildings bring in a specified amount of outside air into the building based on maximum occupancy. Many locations will always ventilate for this maximum occupancy, heating and cooling vast amounts of incoming outside air, even though occupancy may vary greatly. CO_2 DCV measures both the ventilation rate and the number of people breathing out CO_2 to control outside air to reflect the amount needed for actual occupancy. Savings can range form 10% to 50%. The DCV approach is recognized by ASHRAE and most building codes. Many electrical and gas utilities offer incentives and rebates for use of CO_2 DCV control. In California the use of CO_2 sensors is required as part of the Title 24 Building Code primarily because the energy savings are consistently very substantial.

While CO_2 control can be used in any building or space where human occupancy is the major purpose, the buildings that show the most significant energy saving paybacks, often well under one year with wireless installation, include:

- Retail stores.
- School classrooms, cafeterias, auditoriums and gyms.
- University lecture rooms.
- Hospitality venues.
- Meeting/waiting rooms.
- Indoor recreational facilities such as theaters, health clubs and sports facilities.
- Office meeting rooms, telemarketing and dense/flexible work spaces.

AirTest also offers a calculator tool that can be used to determine possible energy savings using CO_2 DCV on its website at: www.AirTest.com/ea.

Unique Design Features

AirTest has been an advocate, and leading supplier of CO_2 DCV equipment for over 15 years. The TR9277-EO transmitter incorporates the latest most innovative technology that integrates CO_2 measurement, temperature and humidity. The product was designed with the intent to address the increased demand for products addressing

sustainable, zero energy building programs that are targeted to minimize overall environmental impact. Considerations that are incorporated into the design of the TR9277-EO are detailed below.

Designed for Sustainable Buildings: EnOcean® represents more than a wireless protocol. AirTest is part of a group of companies called the The EnOcean Alliance which is a group of manufacturers who are dedicated to delivering building automation solutions for sustainable buildings using energy harvesting wireless technology, in order to make buildings more energy efficient, more flexible and lower in cost. The alliance offers a variety of solutions for building and lighting control including sensors, switches, receivers, gateways and control modules that are compatible. (EnOcean-alliance.com).

Inserting The Backup Battery

Minimal Environmental Impact: Many leading building certification programs like the Net Zero Energy Buildings, LEED, and the Living Building Challenge have been developed with extremely rigorous performance standards intended to minimize environmental impact. The TR9277-EO is designed to meet the needs of these types of buildings by utilizing material components and techniques that support these goals. This includes the use of lead free electronics manufacturing (RoHS compliant), and the use of materials easily recycled while eliminating the need for batteries by using a photovoltaic cell that can power the transmitter using ambient indoor light.

Ultra Low Power Design: Traditionally CO_2 sensors use a lot of power and produce a level of heat that can make co-measurement of other variables like temperature and humidity difficult. For the TR9277-EO product AirTest integrated an ultra-low-power CO_2 measurement technology that uses less than 1% of the energy requirement of a typical infrared CO_2 sensor, and as a result produces zero excess heat. The result is a sensor technology that can operate for years powered by energy harvesting or the occasional use of a battery power source.

In developing this product AirTest combined its expertise for sensors with the low energy electronics design capabilities of a company called Echoflex Solutions Inc., that has specialized in the design of EnOcean® wireless building and lighting control products that are powered by ambient light. The energy management design challenge of making a three parameter wireless communicating sensor is comparable to designing a cell phone that can last a year on one charge. The combined expertise of the two companies has resulted in a truly unique, low energy product only available from AirTest.

If it is identified that the TR9277-EO may work in low light or darkness conditions over prolonged periods, a small 3 Volt button cell battery (CR2032), can be inserted in the transmitter to provide backup power for the sensors and onboard radio. This tiny battery can operate the transmitter for up to 5 years if left in a dark environment.

Improved Accuracy & Long Term Stability: Like any gas, the measurement of CO_2 is governed by air pressure and altitude. Previous CO_2 sensors have ignored this factor in measurement, typically assuming measurement at sea level. To improve the precision of the CO_2 measurement AirTest has included an extremely sensitive pressure sensor that can discern altitude to ±3 feet and automatically correct the CO_2 reading for the actual geographic location and floor level the TR9277-EO is installed on. The transmitter is also self-calibrating which, combined with its energy harvesting capability, eliminates the need for any type of maintenance over its 10-15 year life.

Understand CO_2 Levels

Easy to Install: The TR9277-EO includes built in tools that makes it easy to evaluate a particular mounting location for optimum light levels and radio signal strength. The transmitter comes with a sub-base that is easily mounted on the wall and that provides a tamper resistant mechanism to prevent unauthorized removal.

Determine CO_2 Readings at Any Time: Given the low energy nature of this product, an on-board display of transmitter readings was not possible. However by pressing a small button on the side of the unit, three LEDs mounted to the right

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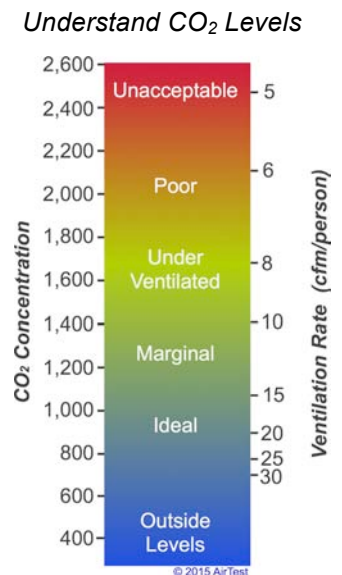
of the solar panel will flash in sequence to indicate the actual CO_2 reading (green=500 ppm, amber=100 ppm, red=25 ppm). The LEDs will also flash every 15 seconds to confirm that the sensor is operating and indicate the general level of CO_2 in the space (green flash = under 1,100 ppm, amber flash = 1,000 to 1500 ppm, red flash = >1,500 ppm). Refer to the chart to see the general meaning of various CO_2 levels.

Building Commissioning Friendly: Increasingly, building owners are insisting on a formal building commissioning process for all building components, including sensors and controls both at building start-up and periodically over the life of the building.   As part of this process the TR9277-EO can easily be compared to a recently calibrated hand held device for CO_2, temp and RH. For CO_2 it is also possible to very quickly calibrate the sensor to outside ambient air (typically 400 ppm) that can be completed in a 10-15 minute period.

Integration With Building Control Systems

As previously mentioned, members of the EnOcean Alliance make a variety of products that are compatible with the TR9277-EO. For integration into building control systems, installers will want to use a component called a "gateway" that can receive the signal broadcasted by EnOcean compatible wireless devices, and translate and pass through the reading so they can be read by the building control system. There are typically two types of EnOcean® compatible gateways available:
1. Gateways that communicate using the BACnet communication protocol, common in building control.
2. Gateways that communicate using TCP/IP a common internet based communication protocol.

Vendors of both types of products can be found on the EnOcean Alliance website at the following link:
https://www.enocean-alliance.org/en/products/

Future Developments

AirTest will also be introducing at least two additional version of this product in the near future. One version will provide a dew point output that will allow for better and more precise control of humidity/moisture in the space. A second product will provide readings related to the on-board absolute pressure sensor used to correct CO_2 readings. AirTest believes this could become a useful tool to provide real time monitoring & control of building pressurization.

Other Wireless Products From AirTest

AirTest also makes a line of battery powered, WiFi communicating sensors that allow the cost effective retrofit of buildings utilizing sensor technologies with minimal labor requirement. Sensors available include:
- CO_2 & Temperature (TR9299-wifi)
- Dew Point & Temperature (TR9399-wifi)
- RH & Temperature (TR9389-wifi)
- Remote temperature monitoring (e.g. coolers and freezers) (TR9499-wifi)
- 4-20 mA to wifi transducer for monitoring other devices (TR9699-wifi)

For buildings with existing control systems AirTest wifi communicating sensors capable of using existing wifi networks or overlay networks that can communicate to a common network gateway. The network gateway will

translate the readings of up to 200 sensors into BACnet objects that can easily be read on control platforms that use BACnet, Modbus TCP, Modbus RTU or SNMP protocols.

AirTest also offers a web-based monitoring service that can store sensor readings, monitor for user set alarm levels, and send out text and/or email messages upon alarm detection.   The on-line interface can even track current status of an alarm response.   This service is often used with our remote temperature sensors to measure coolers, freezers, compressors and motors for abnormal temperatures.

AirTest has also just introduced its RTUiLink™ family of products that offer a number of fast to install, wifi based sensor solutions for existing, stand alone rooftop air handling units. This offering includes a number of wireless modules that can be added to an RTU to quickly and inexpensively add the following upgrades that will not compromise existing warranties.
- CO_2 Demand controlled ventilation,
- Dew point economizer control,
- Wifi communicating thermostats with remote adjustment and lockout capability,
- Monitoring of RTU compressor and fan power,
- Real time RTU fault detection.

All information is available on a web interface that can be viewed on any smart device. Email and text alerts can also be programmed for certain alarm levels or RTU faults detected.

More information on AirTest's wifi products can be found at www.AirTest.com/wifi

About AirTest Technologies

AirTest specializes in the application of cost effective, state-of-the-art monitoring technology to ensure the comfort, security and energy efficiency of all buildings.

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