Optimize Indoor Air Quality & Control to Save Energy
CO_2, Temperature, RH, Dew Point, Occupancy + Three External Sensor Inputs

Overview

The IAQEye™ is a powerful air quality measurement package designed for easy integrated into the operation of new and existing HVAC equipment and control systems (BACnet, Modbus) using an Enterprise-friendly WiFi communication. Many buildings are out-of-whack today with poor air quality and wasted energy because they cannot control what is not measured. The measurement and control of CO_2, dew point, occupancy and other elements can lead to significant improvement in air quality, energy use and comfort. The iAQEye™ can be an effective addition as a monitoring system or can be connected to existing equipment and control systems.

Key Features

- WiFi Communicating:
  - The IAQEye™ can use an existing WiFi network to relay information over the internet to the cloud or remote devices. Retrofit costs are minimized.
  - Using an existing WiFi network, all measured values can also be relayed to a local BACnet network using a Babbel Buster® Gateway. Up to 200 multi-parameter IAQEye™ devices can be supported by one gateway.
  - WiFi can also be used to send a signal directly peer-to-peer to other devices such as a rooftop air handling unit to modulate CO_2 using an economizer. AirTest offers the TR4201 Communicator that can receive the WiFi signal from the IAQEye™ and provide a 0-10V CO_2 DCV control signal to the economizer.

- The IAQEye™ can be configured to support a variety of high-security, Enterprise-level, WiFi systems including EAP-TLS and MSCHAP v2. Contact AirTest to discuss your Enterprise requirements.

- The IAQEye™ CO_2 sensor is a dual beam, non-dispersive infrared sensor that incorporates on-board pressure correction to ensure consistent readings regardless of altitude or weather. The self-calibration method is internal to the sensor and does not require indoor levels to drop to background levels to function properly.

- The IAQEye™ measures CO_2, temperature, humidity, dew point and can provide optional occupant sensing. Up to three additional external sensor inputs can also be added including two 4-20mA signals and one 10K2 or 0-5V signal. This is an easy way to add wireless communication capability to any sensing device with an analog signal.

- The IAQEye™ is available in a battery powered version (2 lithium AA) or 24 VAC powered versions.

- The display version of the IAQEye™ utilizes an ultra-low power, white, E-Ink display that is easily readable in low light conditions. Alarm level values can be red highlighted. During product setup and installation, the display parameters can be customized.

- Four front facing colored LEDs can be user programmed to provide visual indication of indoor air quality conditions. Colors are green, amber, red and green/red. An audible alert can also be activated on the presence of alarm level IAQ concentrations.

- The product is available with an optional passive infrared detector (PIR) that utilizes 17 optical lenses that provide 64 detection zones. Detection range is 10-15 meters over a 119º field of view.

- The IAQEye™ features a built-in WiFi web server to support close proximity connection with other WiFi devices including cell phones and tablets. There are two interface functions available.
  - **IAQEye™ Reporter:** By scanning the QR code on the bottom of the sensor, an Apple or Google app is available that creates a time-stamped report of current and historical IAQEye™ measurements with elevated levels highlighted.
  - **IAQEye™ Configurator:** By entering a password, service providers or installers can configure many aspects IAQEye™ communication parameters, scaling, visual and audible alarm levels, display options or configuration of auxiliary inputs.

- Up to 10 mb of on-board memory is available to store historical measurement data. Data can be read through a smartphone connection or relayed to cloud database or remote server if connected to the internet.

Display, 24VAC

Display, Battery Powered


No Display

IAQEye™ Product Selection

Model No	Power	Display	CO2,Temp, %RH, Dew Point	Occupancy
24VAC Powered				
TR8910	24VAC	Y	Y	Y
TR8911	24VAC	-	Y	Y
TR8912	24VAC	Y	Y	-
TR8913	24VAC	-	Y	-
Battery and 24VAC Powered				
TR8930	Battery/24VAC	Y	Y	Y
TR8931	Battery/24VAC	-	Y	Y
TR8932	Battery/24VAC	Y	Y	-
TR8933	Battery/24VAC	-	Y	-

All IAQEye units measure 0-2,000 ppm CO2, Ranges up to 5,000 and 10,000 ppm can be custom ordered. Contact AirTest for availability and pricing.

Why Measure and Control Carbon Dioxide (CO_2)?

For buildings, CO_2 is not considered a dangerous contaminant. The level of CO_2 indicates the dynamic balance between people in the space exhaling CO_2, and the amount of fresh air coming in from outside that is at a low concentration (typically 400 ppm). As a result, CO_2 concentrations indoor is a dynamic measure of the fresh outside air ventilation rate per person being delivered to a space by mechanical or passive ventilation.

Think of CO_2 as the "canary in the coal mine". When CO_2 levels are elevated people often feel lethargic and may have other physical symptoms. However, this is not due to the CO_2 but as a result of the buildup of other contaminants in the space due to inadequate ventilation. In many cases, contaminants can include COVID19 and other viruses. So, CO_2 can be used to monitor or control the right level of ventilation to ensure acceptable air quality as recommended by the ASHRAE standards organization.
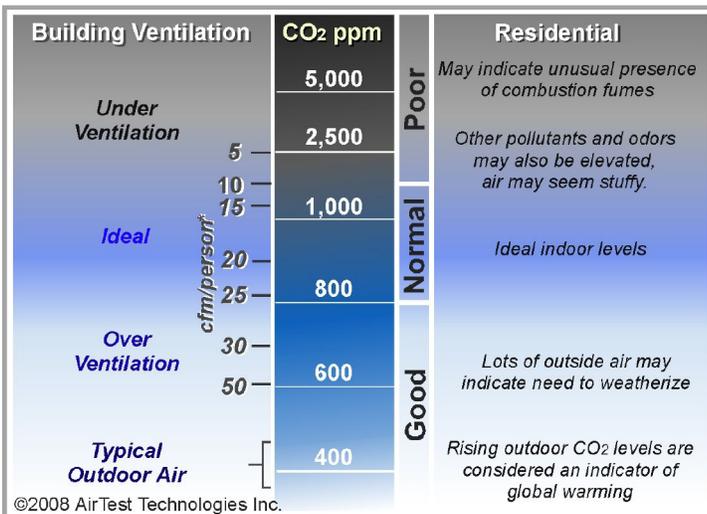
Note: Interpretation should be based on peak CO2 readings in a space.

CO_2 can also be used to sustainably create significant energy savings in buildings by using CO_2 based Demand Controlled Ventilation (DCV). A major portion of heating and cooling costs is conditioning outside air ventilation. For spaces with variable and intermittent occupancy CO_2 DCV, modulates outside air based on actual occupancy rather than ventilating for full occupancy all the time. Most electrical and some gas utilities offer rebates for the innovative approach that with the ease of wireless installation can easily provide an energy-saving payback in less than 2 years. The IAQEye™ can be used to monitor and control ventilation interfacing with most common control systems and equipment.

Specifications

Electronics Platform
- Microprocessor: 32-bit microprocessor, 200 MHz main bus clock
- Memory: 128 KB ROM, 512 KB RAM, 128 MB external Flash with 10MB dedicated data storage.

WiFi
- IEEE 802.11b/g/n, Wi-Fi compliant.
- FCC ID: TLZ-CU300.
- WPA or WPA2 encryption with ability to support Enterprise level security with EAP-TLS or PEAP-MSCHAPv2.
- Broadcast time interval is adjustable by the user.
- UDP communication packets.

Power
- 24VAC ±20%, X? Amps
- Battery, two 6.3V Lithium Batteries, with estimated life of 3-5 years depending on reporting interval. Has a 24VAC power input that will override battery power.

Display, LED and Audible Indicators
- Ultra-low power, white E-ink display, with excellent low light viewing ability. Primarily displays in black and white but red color highlights elevated values.
- Four Front cover LEDs: Green, Amber, Red, Red/Green.
- On board audible indicator can be configured to sound on alarm, or be silent, volume can also be adjusted.
- All indicator settings adjusted through a password protected WiFi interface accessible in close proximity to unit. Settings can also be set via WiFi network broadcast.

Button Interface
- Single front cover button interface with multiple selection capability.

Local WiFi Interface Capabilities
- *Report Generation:* By scanning the QR code on the bottom of the device, a report of current and recent readings will be downloaded to the connected WiFi communicating device.
- *Configuration Settings:* If the QR code is scanned and password entered it is possible to adjust many features of the IAQEye™.

Measurements
Carbon Dioxide (CO_2)
- Non-Dispersive Infrared dual beam sensor with reference channel based self-calibration. Also has on-board temperature correction and real time pressure correction to eliminate altitude and weather effects on reading.
- The dual beam, self-calibrating sensor will maintain calibration for the life of the sensor (15 years).
- For comparative calibration checks, the sensor should be compared to a recently calibrated CO2 hand held meter (using certified calibration gases) with final comparative readings correct for altitude and uncertainty of the hand-held device and calibration gases.
- Range & Accuracy: 0...2 000 ppm < ± (50 ppm +2% of the measured value), 0...5 000 ppm < ± (50 ppm +3% of the measured value). Up to 10,000 ppm available.

Temperature
- Accuracy: ± 0.1°F (± 0.2°C)
- Range: 32 to 130°F (0 to 90°C)

Relative Humidity
- Accuracy ± 2% RH, 0-90%, ±3% >90%
- Range: 0-100% RH

Dew Point
- Accuracy: ± 0.3 °F Td @72°F, (± 0.6°C Td@20°C)
- Range:0-100°F Td, (0-38°C Td)

Occupancy Sensor
- Utilizes a 17 segment Passive Infrared (PIR) lens designed to provides 64 detection zones. Detection range of 10 meters (15 m in ideal conditions), and 119° field of view.

Additional Sensor Inputs:
- Two 4-20 mA inputs
- One 10K2 or 0-5V input

Why Measure Dew Point?

Relative humidity is a well-known as a measure of moisture in the air, but it is dew point that can be used as a predictive tool for the presence of condensation and conditions that lead to toxic mold growth. Dew point, expressed as °F Td or °C Td is the temperature of a surface that will cause water condensation from the air, which is related to mold and mildew formation. Recently ASHRAE standard 62-1 "Ventilation for Acceptable Indoor Air Quality" has established a maximum dew point limit of 60°F Td (15°C Td) in indoor occupied spaces to minimize conditions that lead to toxic mold and structural water related damage. Dew point is often used in food stores with coolers and freezers to manage dehumidification to prevent fogging, frosting and water condensation and water cooling. Further background on dew point is available from this AirTest Whitepaper.
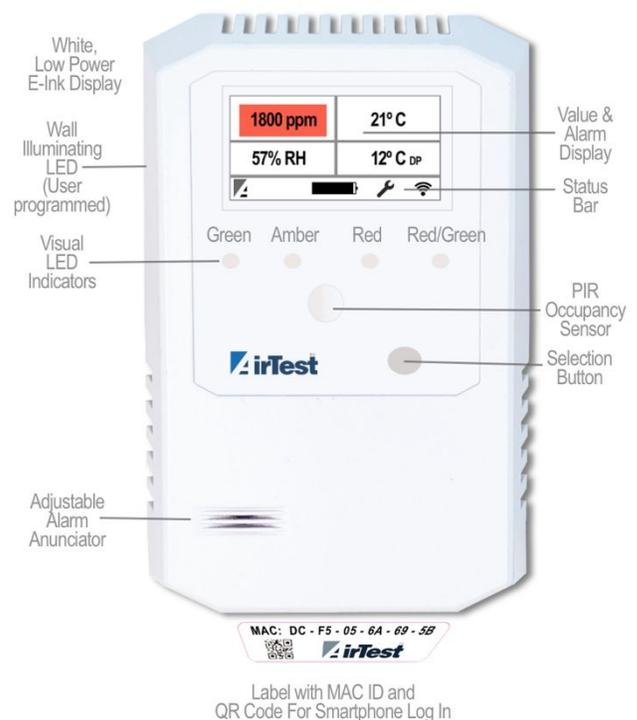
Why Measure Temperature And RH?

Temperature and % RH are typical indoor comfort parameters. Temperature is the primary method of control of heating and cooling and %RH is well known as a way to perceive general comfort related to moisture in the air. RH cannot be used to accurately control moisture in the space because RH levels actually change with temperature. Generally, an 1° F change in temp will result in a 2% change on relative humidity. In contrast, dew point is an absolute measure of moisture in the air and does not change with temperature or location within a room.

Why Measure Occupancy?

Occupancy sensors use a passive infrared sensor to detect movement of warm bodies within a space. This type of sensor can detect after hour activity in a space and temporarily activate lights and the occupied mode of the HVAC system. Energy saving up to 30% are possible.

White, Low Power E-Ink Display

Wall Illuminating LED (User programmed)

Visual LED Indicators

Green   Amber   Red   Red/Green

Value & Alarm Display

Status Bar

PIR Occupancy Sensor

Selection Button

Adjustable Alarm Anunciator

1800 ppm   21° C
57% RH   12° C DP

MAC: DC - F5 - 05 - 6A - 69 - 5B

Label with MAC ID and QR Code For Smartphone Log In

Wiring the IAQEye™

3" X 5.25"

External Analog Sensor Inputs

10K2 Thermister (NON-POLARIZING) or 0-5V Input 20K
  1 - + Input 3 (Note 1)
  3 - Reference
Current Loop or 0-10V, Input 2
  5 - + (Note 2, Note 3)
  7 - COM
Current Loop or 0-10V, Input 1
  9 - + (Note 2, Note 4)
  11 - COM

Note 1: Input Impedance = 4.99K
Note 2: If current loop is required, R60 (499 OHM Resister Must be Installed)
Note 3: If current loop is required, R1 (499 OHM Resister Must be Installed)
Note 4: Input Impediance = 20K

Outputs, Power

  2 - GND, 0-10V Output COMMON
  4 - VOUT, 0-10V Output (Note 5)
  6 - Not Used
  8 - COUT, Special Use - See Manual
Power Input
  10 - C, Common
  12 - 24VAC

Note 5: Source and Sink Current > 10mA above 2V OUT

IAQEye™ Smartphone Interface

The IAQEye™ has a built-in webserver intended for short range local communication with individual transmitters. Access to the webserver is gained by scanning the QR Code on the label on the bottom of the IAQEye™. Two functions are available.

1. IAQEye™ Reporter App: Current and historical readings are reported to the phone.
2. IAQEye Configurator: Used to commission configure or adjust the transmitter (password protected).

IAQEye™ Reporter App:

Once the QR code is scanned a report is generated and downloaded to the phone that includes:

o Graphical indication of current IAQ readings that are date and time stamped.
o List of current and historical IAQ reading (time stamped) for the past 30 days with alarm conditions highlighted. Longer time periods of data storage can be set.
o Report of max, min and Daily average over 30 days.
o Data from report can be created and emailed as a CSV formatted report.
o Read only no adjustments are possible.
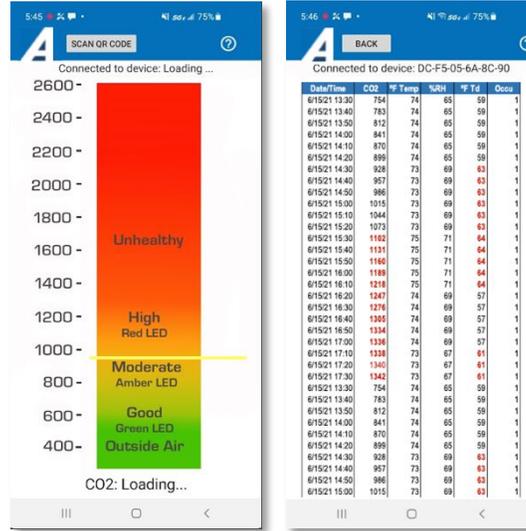
IAQEye™ Configurator

Individual IAQEye™ can log into a password protected area of each unit's embedded webserver where operating parameters can be adjusted.

Setup

- Configure IP addresses for WiFi networks, receiving gateways or other devices for peer-to-peer communication.
- Set broadcast interval.
- Set IAQ sampling rate.
- Set anticipated occupancy periods.
- Set alarm threshold values.
- Set green, yellow, Red/Alarm LED indications.
- Set measurement ranges.
- Set operating parameters for audible buzzer including volume.
- Determine what measurement parameters should be shown on the display.
- Choose metric or imperial values to display.
- Configure/scale the two 4-20 mA inputs, or thermistor input for WiFi broadcast UDP packets.
- Load standard configuration file to use on multiple units.
- Adjust functionality of button on cover.
- Generate commissioning reports.

Management

- Check battery levels
- Perform offset and comparative calibrations.
- Generate commissioning reports.
- Check operating status.
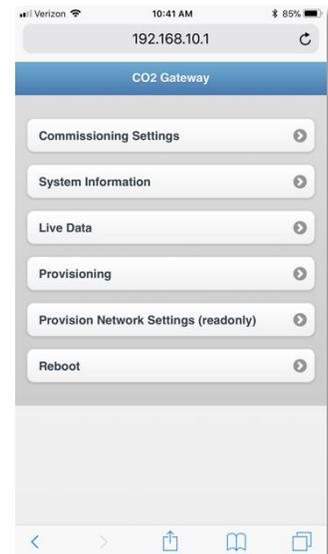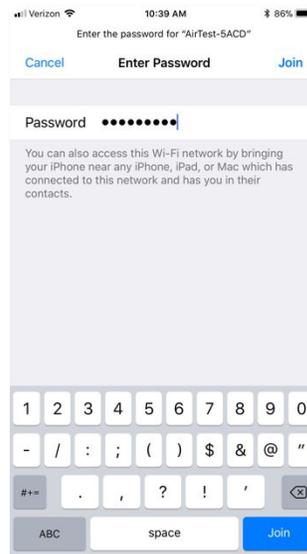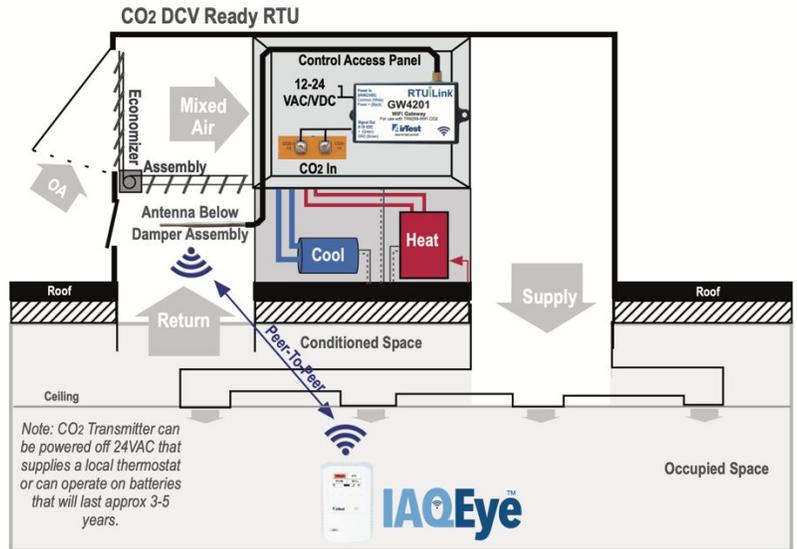
WiFi Communication Protocol

The IAQEye™ utilizes a widely used internet communication methodology called User Datagram Protocol (UDP). The UDP format is a string of data that is broadcast from the IAQEye™ that contains the sensor ID, all measurement data and operating data such as battery level. It is very easy for controllers and servers connected to the internet and local WiFi network to receive and translate this information. A copy of the UDP protocol is available from AirTest to assist in integrating the output of the IAQEye™ into other systems and devices. AirTest also offers devices that have built in translation capability as described below.

RTU Wireless CO2 DCV Retrofit

Most Rooftop heating and cooling units built in the last 15 to 20 years have an unused CO_2 DCV input. CO_2 DCV is a unique control approach that can save energy by modulating fresh air delivery to a space based on actual occupancy rather than assuming maximum occupancy all the time. CO_2 control also ensures that enough outside ventilation air is provided for acceptable indoor air quality to dilute airborne viruses.

AirTest uses WiFi to directly connect the IAQEye™ to a RTUiLink™ gateway (GW4201) to receive and input a 0-10V control signal to the RTU. No local WiFi network is required, as the system components communicate peer-to-peer.

Installation involves minor wiring and minimal labor. Operation can be verified at any time using the WiFi on any smartphone or cell phone. AirTest also offers the TR8999 retrofit kit that includes everything required to complete an installation. This is ideal for RTUs that are operated directly by a thermostat.

Note: CO2 Transmitter can be powered off 24VAC that supplies a local thermostat or can operate on batteries that will last approx 3-5 years.

Wifi Range is approximately 10,000 to 15,000 square feet coverage below the RTU. Tools are available to test this onsite.

Integration With BACnet® Control Systems

The IAQEye™ is designed to be easily integrated into an existing BACnet control system using a WiFI gateway called the Babbel Buster® that translates the UDP measurement data relayed via WiFi from the transmitter into BACnet® objects used by a control system. Up to 200 IAQEye™ units can be used with one Babbel Buster® (BB3-7302).

The Babel Buster BB3-7301 BACnet Router routes BACnet messages between BACnet IP and BACnet MS/TP networks. The BB3-7301 BACnet Router can be a learning router or configured router, and includes BBMD and Slave Proxy support.

The Babel Buster BB3-7301 BACnet Router can also operate as a BACnet gateway, reading and writing other BACnet devices and retaining a copy of object values in its own set of BACnet objects. The BB3-7301 provides a Modbus TCP client and server for operation as a gateway. The BB3-7301 can be used as a Modbus TCP to BACnet MS/TP gateway without routing.

Note: This unit is customized to utilize the AirTest UDP.