AirTest™
Sensors That Make Buildings Smart!

TR9299-WiFi
Battery Powered, Wi-Fi Communicating CO_2 & Temperature Sensor
With Webpage Accessible Data or Easy Integration With BAS Systems

Key Features

- Ideal for permanent (wall mount), temporary or walk-through monitoring.
- Battery provides 3-year operating life on 2 AA batteries. Also can use 5-24VAC/VDC line power.
- On-board data logger can log up to 3,072 points.
- Up to 200 WiFi transmitters can easily be integrated into wired BACnet™ IP, Modbus or SNMP networks using an inexpensive 3rd party gateway.
- Data easily routed to any Internet device or to an optional cloud database service (SQL database compatible) to allow data to be viewed on any computer, tablet or smartphone.
- Configurable alarm function with audible, visual, email and text alarm indication (Ideal for LEED monitoring).
- Easily configured via a USB plug-in PC interface.
- User adjustable intervals for logging and transmitting.
- Zero maintenance self-calibrating CO_2 sensor.
- "Commissioning Friendly" design supports accurate and simple in-field calibration verification or adjustment.

The TR9299-WFi is a battery operated CO_2 and Temperature sensor with a microprocessor controlled IEEE 802.11b/g radio Wi-Fi transceiver. The transmitter has an on board clock that allows it to spend most of the time in a low power quiescent state when in battery operation mode. CO_2 and temperature data is subjected to a CRC-16 error check and transmitted in a very short data packet that results in a very short transmitter on-time. This architecture combined with an ultra low power LED based CO_2 sensor, results in very low energy use that makes it ideal for long-term battery operation. The TR9299 will also communicate continuously when line powered (5-24 VDC/VAC).

Upon power up the sensor scans all available WiFi network channels (typically 1, 6, and 11) and associates with the Access Point exhibiting the strongest signal, provided the correct security and encryption setting agree. This feature can also be disabled to allow the user to operate the sensor on a fixed channel.

The TR9299 Wi-Fi CO_2 and Temperature Transmitter also has onboard memory, allowing it to function as a data logger. The sensor has programmable log rates ranging from 2 to 60 minutes. The sensor can store up to 3,072 data and/or event records.

The TR9299 is also ideal for LEED certification in that it offers an on-board audible and visual alarm, and can continuously send data to a website that records all reading for future reference. Email and text messages can be automatically generated if elevated levels occur.

AirTest also offers battery powered WiFi sensors for measuring temperature and dew point (TR7399-WiFi) for better humidity and temperature control inside coolers and also inside freezers (TR7499-WiFi) to monitor for conditions that may lead to food spoilage.

Wi-Fi Details

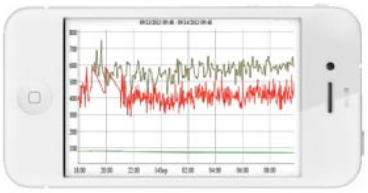
- 12dBm 2.4 GHz 802.11b/g Wi-Fi module
- Communicates with Industry Standard Access Points
- Supports WEP128, WPA-PSK (TKIP), and WPA2-PSK (AES)
- Small data packets (~75 bytes)
- Supports DHCP or Static IP
- Channel agility
- FCC, CE, and IC Class B compliant

TR9299-WiFi: One Product… Four Applications

1. LEED CO_2 Monitoring (Credit EQc1)

Green Building certification credits are available for installing CO_2 sensors that provide feedback on space ventilation performance. The battery powered TR9299-WiFI does not require wiring and can easily be installed for any retrofit application. This device can provide two ways to monitor space ventilation performance…

1. Blinking LED & beep at high CO_2 levels (silence & disable capable)



2. When WiFi connected, levels are logged to an AirTest provided web page that allows for graphing and email alerts.

2. Walk Through IAQ Surveys

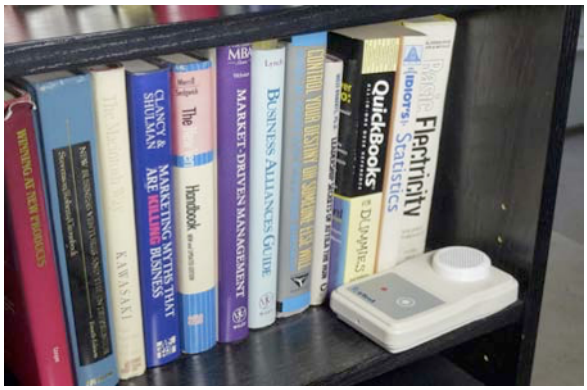
CO_2 levels are a good indication of fresh air ventilation levels. The battery powered TR9299-WiFi can be carried through the space and will store up to 3,072 time-stamped CO_2 and temperature readings.

Once the TR9299-WiFi comes within range of a known WiFi network all logged data will be uploaded to an AirTest provided webpage for viewing, graphing and download.

3. Short Term Monitoring (1-7 days)

Monitoring of CO_2 in a space over one to seven days can identify whether a space is over or under ventilated and if it is a good candidate for CO_2 demand controlled ventilation. AirTest has developed a program that allows you to determine potential CO_2 DCV savings based on measurement results.

The TR9299-WiFi can actively transfer data to a local WiFi network or a personal cellular WiFi device (e.g. myfi). If WiFi is not available, the internal data-logger will store data until it connects with its base network.



4. Integration With Building Control Systems

WiFi is the most widespread, dependable, economical and well-understood wireless communication technology available today for inside buildings.

The TR9299-Wifi can tap into any existing networks using the latest in encryption technology. Economical third party gateways are now available that can tap into a WiFi network and deliver a wired BACnet or Modbus or SNMP connection. Building controllers with internet communication capability can easily utilize the internet based data from the TR9299-WiFi.

A Commissioning Friendly CO_2 Sensor…A Different Take On Calibration

Most CO_2 sensors including the TR9299 CO_2 Transmitter incorporate a self-calibration feature that is intended to reduce maintenance and provide long-term stability in CO_2 readings.

In the case of the TR9299, the device uses a background calibration feature that periodically looks for the lowest concentration that takes place over a one or two week period and assumes that that low concentration is similar to outside levels that should be in the 400 to 450 ppm range. This would typically occur when a space is unoccupied over a weekend. Most CO_2 sensors available in today's market use this type of background calibration feature.

One problem with CO_2 sensors today is they are not really designed to allow contractors or building owners to check or perform calibrations as part of a commissioning process. Also many monitoring contractors need to be able to check calibration prior to a measurement session.

In many cases CO_2 manufacturers have felt so confident in their calibration stability they have made it almost impossible for users in the field to verify calibration. The TR9299-WiFi is designed to be "Commissioning Friendly" and offers a number of ways for a user to check or adjust calibration in a way that should be as accurate as a factory calibration.

Option One: Ambient Air Calibration

Turn on the battery powered TR9299 and place it in an outside air environment. After 10 to 15 minutes start the calibration by placing the small magnet provided with the sensor on the upper left side of the case when lying flat. Calibration assuming the outside air is 400 ppm will occur over the next 2 minutes. Job done!

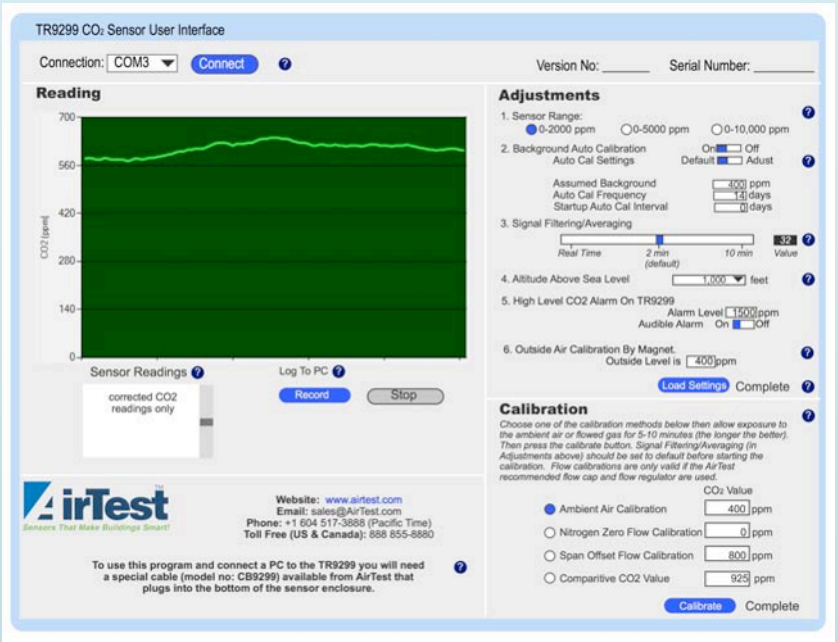
The TR9299 also keeps a date stamped record of the calibration that is included in the CO_2 sensor data stream.

Magnet Activated Outdoor Calibration

Option 2: Calibration Using the TR9299 User Interface

The USB/PC interface program for the TR9299 allows for a number of adjustments to the sensor. The program also supports flow through gas commissioning with the custom designed calibration cap or comparative commissioning with a handheld device.

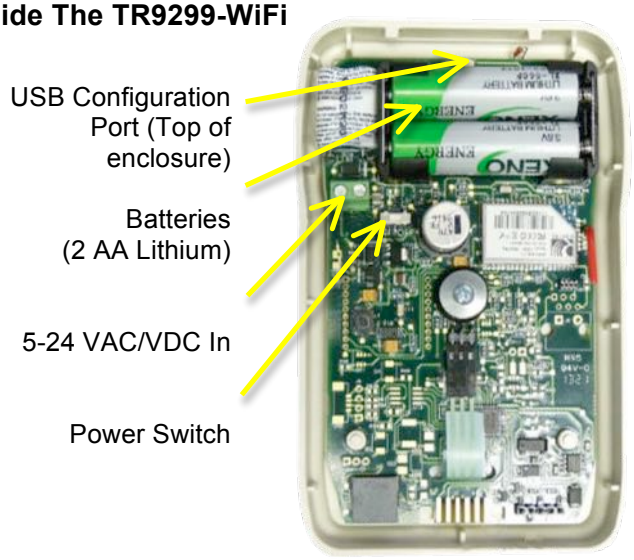
CO_2 readings can also be logged and time stamped during calibration to provide a record of the process.



Web Logging Service

AirTest also provides an option with all Wi-Fi communicating products that allows the user to automatically log sensor information to a cloud based database for a nominal monthly fee (first 6 months are free). This is ideal for applications where an ongoing, tamperproof record of readings is important. The webpage interface also allows for automatic report and alarm generation.

Inside The TR9299-WiFi



A Wide Variety Of Connection Options

The TR9299-WiFi offers a number of ways to stream the data from the sensor to a cloud database or a building control device or network.

1. For monitoring applications there is the AirTest Cloud server that can store and graph WiFi transmitter data on the web.
2. For control applications the data from the sensor can be streamed to other Internet protocol capable controllers for a building (Driver needed to translate WiFi UDP data packets).
3. To link the WiFI signal to a wired BACnet IP, Modbus or SNMP network the inexpensive Babble Buster Gateway (BB2-7010-06) from Control Solutions Inc. provides an ideal and easy-to-implement integration tool for up to 200 AirTest WiFi transmitters.

Specifications TR9299-WiFi

Sensors

CO_2 Technology: Wavelength specific LED Infrared source with self-calibration algorithm.
Calibration Interval: No calibration required when self calibration algorithm is activated. Otherwise calibration is recommended every 6 to 12 months.
CO_2 Measurement Range: 0 to 2,000 ppm, 0 to 5,000 ppm, 0 to 1%
CO_2 Operating Conditions: 0° to 50° C, 0 to 95% RH, 950 to 1050 bar
CO_2 Accuracy: +/- 50 ppm, +/- 3% of reading
CO_2 Non Linearity: < 1% of full scale
CO_2 Pressure Dependence: 0.13 % of reading per mm Hg
Temperature Accuracy: (45-120°F):± 0.9ºF
Sample Rate: Temperature 15 seconds, CO2 2 minutes (Adjustable), Continuous when line powered

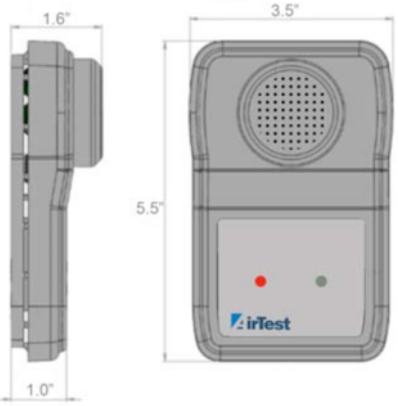
Power

Battery: 3.6 vdc Lithium Thionyl Chloride (2)
Battery Life: up to 157,680 transmissions
External Power (optional): 5-24v DC or AC. 1A peak current, 20mA average current

Wi-Fi

Transmission rate: User programmable
Log rate: User programmable
Broadcast: 12dBm 2.4 GHz 802.11b/g Wi-Fi module
Compatibility: Communicates with Industry Standard Access Points
Encryption: Supports WEP128, WPA-PSK (TKIP), and WPA2-PSK (AES)
General: Small data packets (~75 bytes), Supports DHCP or Static IP, Channel agility
Data Packet Spec Link: TR9299UDPSpec
Certification: FCC, CE, and IC Class B compliant
Weight: 5 oz
MADE IN THE USA

This device contains transmitter module
FCC ID: T9J-RN171 IC: 6514A-RN171
US Patent: 6721546
B1



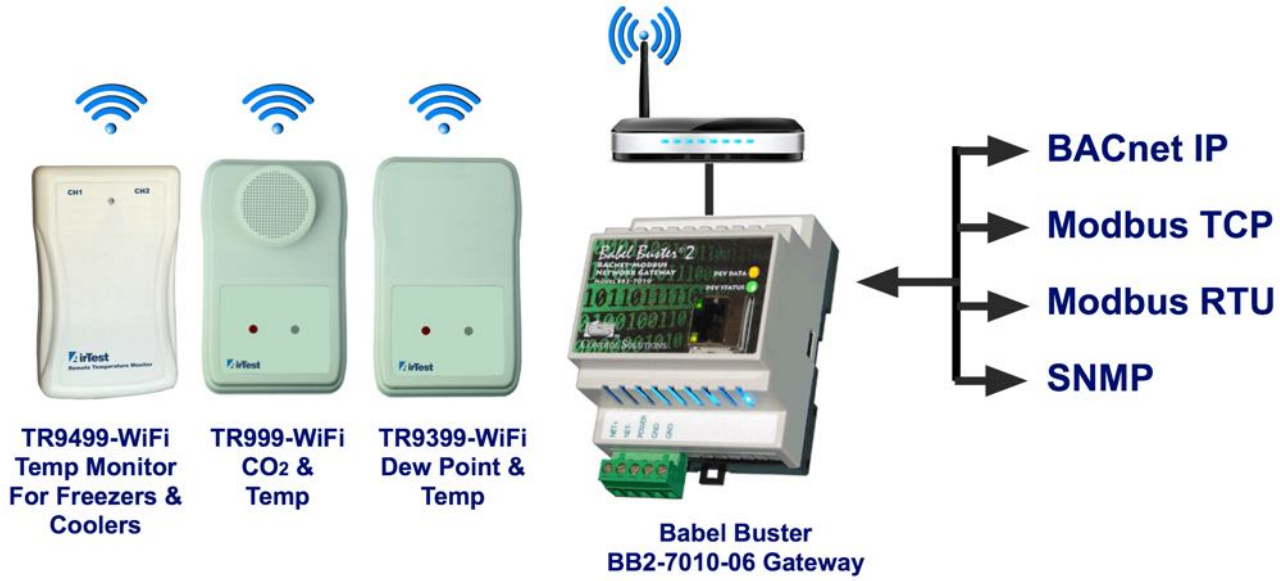
Other WiFi Products available from AirTest:
TR9399 – Temperature And Dew Point
TR9499 – Freezer/Cooler Temp Monitoring
Zigbee Versions also available (Xbee Pro)

3/12/14

AirTest™ Technologies Inc. specializes in the application of cost effective, state-of-the-art air monitoring technology to ensure the comfort, security, health and energy efficiency of buildings.

AirTest™ Sensors That Make Buildings Smart!

WiFi-to-Wire Gateway for AirTest WiFi Transmitters (Babble Buster BB2-7010-06)



Overview

Designed to work with the transmission data packets sent from AirTest WiFi transmitters the BB2-7010-06, when connected to a generic off-the-shelf WiFi access point, will parses the data packet and places the sensor data in one or more BACnet objects. The sensor data objects may be accessed via BACnet IP, Modbus TCP, Modbus RTU, or SNMP using the BB2-7010-06. No additional software is necessary.

Key Features

- Read/Write any standard Modbus register via BACnet objects
  - Pool of 500 objects
  - Analog, Binary, Multi-State object types
  - Input, Output, Value objects
- 10/100BaseT Ethernet for BACnet IP and Modbus TCP
- BACnet slave is Modbus RTU master or vice versa
- Commandable BACnet objects implement priority array
- Bidirectional communication between BACnet and Modbus
- Modbus Features
  - Can be Modbus TCP client/server
  - Supports “coils”, input registers, holding registers
  - Single or double registers, signed, unsigned, IEEE 754
  - Modbus register mapping configured via web interface
  - Registers may be scaled (x10, x100, x0.1, x0.01, etc.)
  - Modbus (master) polling interval configurable per point
  - Hardened EIA-485 transceiver for Modbus RTU
- SNMP client and server capability

Babel Buster BB2-7010-06 Object Summary

Read/Write any standard Modbus Register as a BACnet Property Value, or vice versa!

- Analog Input, Analog Output, Analog Value
- Binary Input, Binary Output, Binary Value
- Multi-State Input, Output, Value
- Pool of 500 objects for BB2-7010-06
- Objects from pool can be assigned to any of above types
- Maximum of 250 Binary objects, includes state text
- Maximum of 1024 states for multi-state, includes state text (actual value supported varies by resource usage per object)
- Maximum of 200 dual-channel WiFi sensors supported
- Utilizes generic off-the-shelf WiFi access point router with fixed channel.

BACnet® Protocol Implementation Conformance Statement (Abbreviated)

Date: 30 December 2013
Vendor Name: Control Solutions, Inc.
Product Name: Babel Buster BB2-7010-01/02/06

Product Model Number: BB2-7010

Applications Software Version: 2.35
Firmware Revision: 2.35
BACnet Protocol Revision: 7

Product Description: Network gateway allowing Modbus RTU and TCP devices, SNMP devices, and WiFi sensors to be accessed via BACnet IP.

BACnet Standardized Device Profile (Annex L):

- ► BACnet Smart Sensor (B-SS)
- ► BACnet Smart Actuator (B-SA)

List all BACnet Interoperability Building Blocks Supported (Annex K): DS-RP-B, DS-RPM-B, DS-WP-B, DS-COV-B, DS-COVP-B, DM-DDB-B, DM-DOB-B, DM-RD-B

Segmentation Capability: Request & response, window size 8

Standard Object Types Supported: Object types: AI, AO, AV, BI, BO, BV, MSI, MSO, MSV, DEV (all static) See additional documentation for optional & proprietary properties.

Data Link Layer Options:

- ► BACnet IP (Annex J)

Device Address Binding:
Is static device binding supported?: No

Networking Options: BBMD, supports registration by foreign devices
Character Sets Supported: ANSI X3.4

If this product is a communication gateway, describe the types of non-BACnet equipment/network(s) that the gateway supports: Modbus RTU and/or Modbus TCP slaves/servers (BACnet slave device functions as Modbus RTU or TCP master), SNMP (-02), WiFi sensor data via UDP (-06)

Specifications

BB2-7010-06 WiFi-to-Wire Gateway

Description:
Designed to take WiFi data communication packets from AirTest WiFi transmitters and translate and convert into BACnet Objects. No additional software required.

Connections:

- Hardened EIA-485 transceiver for Modbus RTU
- 10/100BaseT Ethernet for BACnet IP and Modbus TCP
- Powered by 12-24V DC/AC 50/60 Hz
- Pluggable screw terminal block for power & RTU network

Power Consumption:

- 0.1A @m24VDC

Mounting:

- DIN rail mounting, 100mm H x 70mm W x 60mm D

Operating Temperature

- -40°C to +85°C; Humidity 5% to 90%

Certifications:

- CSA/UL Listed, 3MPX, Open Energy Management Equipment
- CE
- FCC Part 15
- Made In The USA

Configuration/On-Line Manual:
Configuration of the gateway is performed using embedded web pages in the device eliminating the need for special configuration properties for each object.

A demo copy of the embedded web site contained within the Babel Buster BB2-7010 is found at the link below. Visit this link for object property summary and hardware guide, in addition to the demo copy of device configuration pages.

Link:
http://www.csimn.com/Demo-BB2-7010-06/index.html

WiFi Products available from AirTest:

B2-7010-06: WiFi-to-Wire Gateway
TR9299-WiFi: CO_2 and Temperature
TR9399-WiFi: Temperature And Dew Point
TR94990WiFi-1C: Single Channel, Remote Freezer/Cooler Temp Monitoring
TR9499-WiFi-2C: Dual Channel, Remote Freezer/Cooler Temp Monitoring
Zigbee Versions also available soon (Xbee Pro)

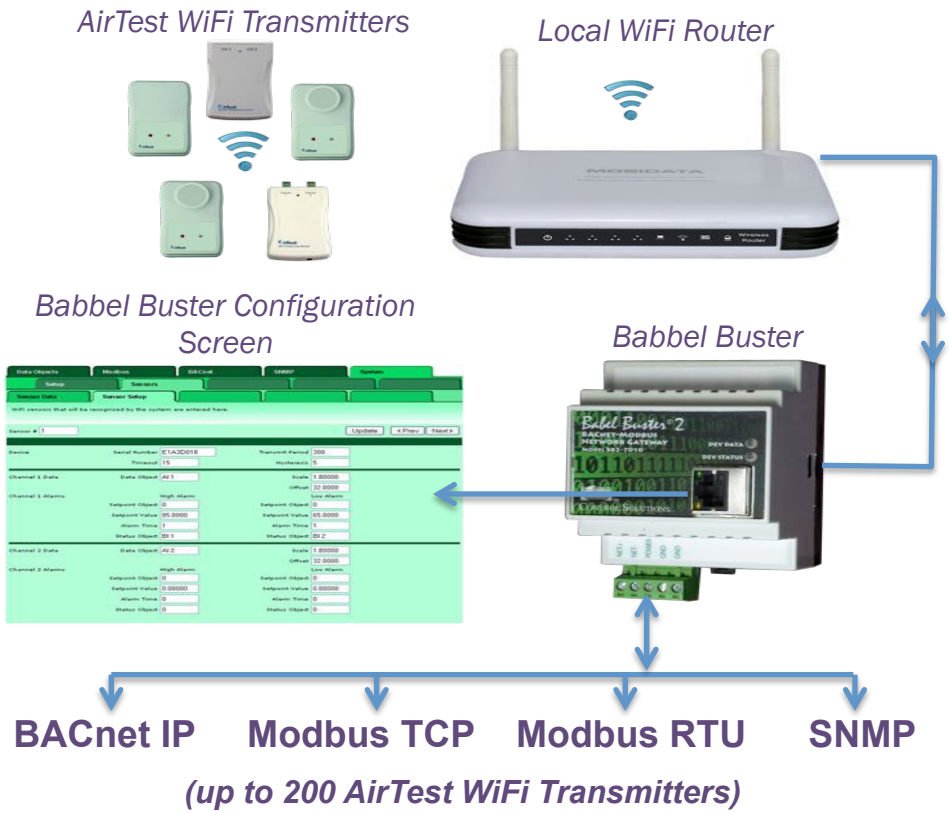
AirTest™ Technologies Inc. specializes in the application of cost effective, state-of-the-art air monitoring technology to ensure the comfort, security, health and energy efficiency of buildings.

AirTest™ Sensors That Make Buildings Smart!

1. AirTest Hosted Web-Logging & Alarm

2. WiFi-To-Wire Gateway

- Easy way of integrating AirTest WiFi sensors into a existing wired control system.
- Uses the Babbel Buster to communicate to a wired BACnet or Modbus control systems.
- Supports up to 200 AirTest WiFi transmitters.



3. Connection To Any Internet Device

AirTest WiFi Transmitters

WiFi Router

Translation App To Unwrap UDP (User Datagram Packet)

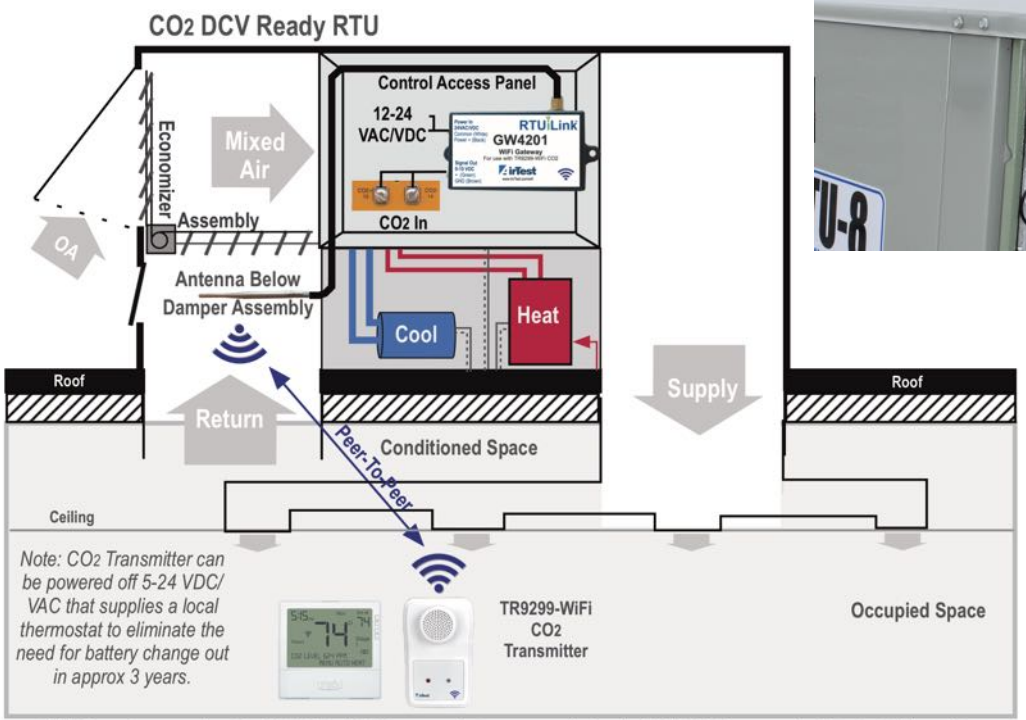
IP Based Controller: *(Tridium Jace, EasyIO, Can2Go)*

Online Database/ *Web Monitoring Service*

Typical CN9099 Kit Installation

TR9099 Kit

- Designed for single story buildings
- Intended to be integrated with CO_2 DCV ready RTUs
- Must have working Economizer control.
- Assumes metal roof will block WiFi signal so necessary to locate Gateway WiFi Antenna so signal can easily enter the space.
- Antenna is installed so that the wifi signal is channeled down the return air into the space.
- Assumes 1 CO_2 sensor per RTU.
- Designed to be installed with minimal labor time.
- Other methods of configuration and installation possible.



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