OAC SERIES Manual

Fixed Setpoint/DCV Outdoor Airflow Controllers

GreenTrol® Automation Inc.

www.GreenTrol.com

Application Specific Controllers with
Integral Thermal Dispersion Airflow Measurement

Turn-key Outdoor Airflow Control

Ideal for smaller AHUs, makeup air units, and DCV systems

Your System Challenges ...

- Compensate for wind and stack effect
- Compensate for filter loading
- Compensate for fan speed variations (VAV systems, multi-speed fan systems, and DOAS)
- Compensate for damper hysteresis, deterioration, binding, and/or actuator slippage/failure
- Compensate for multizone DOAS DCV system duct pressure variations
- Maintain minimum and maximum DCV ventilation limits

Your Benefits ...

- Overcome system challenges!
- Save energy by not over-ventilating!
- Improve indoor air quality by not under-ventilating!
- Facilitate IRMM switchover
- Improve thermal comfort and humidity control!
- Improve DCV operation and satisfy the new requirements of ASHRAE 62.1-2022
- Document code compliance!
- Detect operational problems and failures!

GreenTrol Automation has been providing application specific controllers with integrated thermal dispersion airflow measurement devices since 2009. The OAC Series product line provides a turn-key outdoor airflow control solution for smaller AHUs, makeup air units, and DCV systems (single and multi-zone).

Outdoor air is required by code, paramount to acceptable indoor air quality (IAQ), and a prerequisite for thermal comfort. Improperly controlled systems often result in unacceptable indoor air quality, wasted energy, and poor temperature/humidity control.

Traditional Methods

Traditional outdoor air delivery control methods rely on damper position and/or fan speed to maintain outdoor airflow rates. These methods are ineffective in providing the outdoor air required for IAQ and pressurization and result in ventilation error in excess of 50%!

Damper position and/or reset based on fan speed cannot compensate for wind, stack, or filter loading pressure changes on the intake system. Damper hysteresis, binding, and actuator slippage/failure often goes undetected for years. The result is increased energy consumption, poor IAQ, or both.

Variable occupancy spaces often adjust the outdoor airflow rate based on the CO_2 level of the ventilation zone to save energy. CO_2 is a proxy for the outdoor air ventilation rate per person and not a direct measure of indoor air quality as many wrongly assume. CO_2-DCV ventilation rates are significantly affected by CO_2 measurement error, the CO_2 production rate of the individuals, and lag (i.e., the assumption of steady-state). As a result, traditional CO_2-DCV that maintains CO_2 levels in a ventilation zone at or below a specified level (typically 1,000 ppm), often results in underventilation at low occupancy levels and overventilation at design occupancy levels. Most CO_2-DCV systems today do not provide the ventilation rates required by ASHRAE 62.1 and building codes during operation. In addition, traditional CO_2-DCV control logic is not well suited for switchover to IRMM (Infectious Risk Management Mode) operation when conditions warrant such operation. ASHRAE 62.1-2022 recently changed its requirements for CO_2-DCV operation and no longer recommends single setpoint CO_2 ventilation control.

GreenTrol Automation's Solution

Provide constant outdoor airflow to low occupant density spaces at all times. Improve traditional CO_2-DCV or provide an advanced ASHRAE 62.1-2022 compliant DCV strategy on variable occupancy, higher density spaces.

GreenTrol Automation's OAC outdoor airflow controllers boast the following features and benefits:

- Time-tested integral thermal dispersion airflow measurement device
- Low-cost
- Easy to installation and startup
- MS/TP BACnet Interface
- Unsurpassed, field configurable, outdoor airflow control logic
  - Fixed setpoint airflow control
  - Improved single setpoint (traditional) CO_2-DCV with controlled upper and lower airflow limits
  - Supports new ASHRAE 62.1-2022 compliant DCV methods
    - Advanced CO_2-DCV resets the outdoor airflow setpoint based on the CO_2 level
    - Population-based DCV resets the outdoor airflow setpoint based on the measured population
  - Optional unoccupied airflow setpoint control operation provides pressurization during unoccupied periods

Air Handling Unit and Makeup Air Unit Solutions

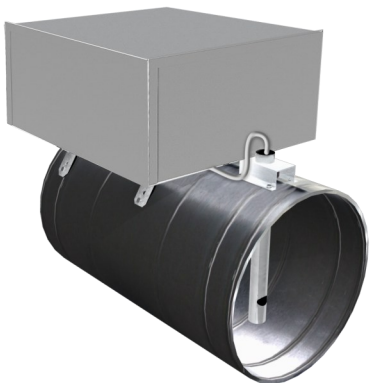
Ideal for openings up to 8 sq ft

Ideal for Systems without an Airside Economizer

- Control is triggered by a thermostat (or other binary signal), two-position actuator signal (replace two position actuator with proportional actuator), or via BACnet MS/TP
- Models available for proportional actuators or fan speed controllers
- Available with integral thermal dispersion airflow/temperature measurement probes designed to be mounted in the hood or intake duct of recirculating AHUs or in the cabinet or discharge duct of makeup air units.
- Models available that accept analog or BACnet CO_2 sensors or occupancy counters when DCV is required
- Models available with built-in schedule capability

Ducted Solutions

Ideal for 4 to 16 inch round ducts



Ideal for Ducted Intakes to AHUs, Fan Coils, and DOAS Ventilation Zones

- Control is triggered by a thermostat, binary output, or via BACnet MS/TP
- Models available for proportional or MP-bus actuators
- Available with integral thermal dispersion airflow/temperature measurement probes designed to be mounted in the hood or intake duct of recirculating AHUs or in the cabinet or discharge duct of makeup air units.
- Models available that accept analog or BACnet CO_2 sensors or occupancy counters when DCV is required
- Models available with built-in schedule capability
- Factory assembled valve/actuator option (shown) available

Integral Airflow Measurement Probe Types

DI (Duct Insertion Probe)

Typical Application: Indoor Round Ducts (4 to 16 inch diameter)

UI (Universal Insertion Probe)

Typical Application: Indoor Ducts and Equipment Cabinets

US (Universal Standoff Probe)

Typical Application: Outdoor Air Intakes and Equipment Cabinets

Outdoor Air Control Methods

Fixed Setpoint Control Methods

FLOW: Maintains a user specified outdoor airflow setpoint during occupied periods.

Demand Control Ventilation (DCV) Methods

CO2: Maintains a user specified CO_2 level between user defined upper and lower airflow limits during occupied periods. Requires an optional CO_2 sensor by GreenTrol or others.

CO2/OAF: Calculates the steady-state population of the ventilation zone based on the measured CO_2 level and airflow rate. Allows for a user specified activity level input. Requires an optional CO_2 sensor by GreenTrol or others.

COUNT: Calculates the required ventilation based on the measured population of the ventilation zone. Requires an optional occupancy counting system from GreenTrol or others.

Model Selection Chart

MODEL	SENSOR INPUTS			CONTROL FUNCTIONS				CONTROL OUTPUT			NET
Controller Model + Probe Type	Compatible Integral Airflow Measurement Probes -*{type}*	Optional CO_2 Sensor Type	Optional Occupancy Counter Type	Occupied Mode OA Control Method	UNOC Mode OA Control	Real Time Clock Scheduler	Occupied Mode "Enable" Source	Control Signal	Relay	Airflow Signal Output	RS-485 MS/TP Connection
OAC-3000-*{type}*	DI (Duct Insertion)	None	None	FLOW	Off or UNOC Airflow Setpoint Control	No	AC/DC BO or MS/TP[2]	GreenTrol MP-bus Actuator (by Belimo)	N.O. Assignable to Alarms or Mode	None	Yes[2]
		MS/TP		CO2							
	UI (Universal Insertion)			CO2/OAF							
	US (Universal Standoff)	None	MS/TP	COUNT							
OAC-3000S-{type}	DI (Duct Insertion)	None	None	FLOW	Off or UNOC Airflow Setpoint Control	Yes	AC/DC BO or MS/TP[2]	GreenTrol MP-bus Actuator (by Belimo)	N.O. Assignable to Alarms or Mode	None	Yes[2]
		MS/TP		CO2							
	UI (Universal Insertion)			CO2/OAF							
	US (Universal Standoff)	None	MS/TP	COUNT							
OAC-4000-*{type}*	DI (Duct Insertion)	None	None	FLOW	Off or UNOC Airflow Setpoint Control	No	AC/DC BO or MS/TP[2]	Analog[1]	N.O. Assignable to Alarms or Mode	None	Yes[2]
		MS/TP		CO2							
	UI (Universal Insertion)			CO2/OAF							
	US (Universal Standoff)	None	MS/TP	COUNT							
OAC-5000-*{type}*	DI (Duct Insertion)	None	None	FLOW	Off or UNOC Airflow Setpoint Control	No	AC/DC BO or MS/TP[2]	Analog[1]	N.O. Assignable to Alarms or Mode	Analog[1]	Yes[2]
		MS/TP or Analog		CO2							
	UI (Universal Insertion)			CO2/OAF							
	US (Universal Standoff)	None	MS/TP	COUNT							

Notes:

[1] 0-5, 0-10, 1-5 and 2-10 VDC output signals are provided. 1-5/2-10 VDC output signals can drive a 4-20mA input circuit.

[2] The RS-485 MS/TP connection is non-isolated. Provide a separate 24 VAC transformer for the Building Automation System (BAS).

Learn more about GreenTrol Automation's Family of Products

Visit GreenTrol.com Today!

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GreenTrol® Automation Inc.

OAC Series

Outdoor Airflow Controllers

Series Overview

Outdoor Airflow Controller Modules for Systems without an Airside Economizer

OAC controllers are perfect for rooftop air handlers or air handlers with ducted outdoor air intakes when an airside economizer is not installed. Controllers are also ideal for ducted outdoor air intakes to fan coils, DOAS and makeup air systems. OAC controllers can be configured for zone level control of DOAS systems and can be ordered a a fully assembled, turn-key, valve/actuator package. OAC controllers require an integrated IAT airflow/temperature probe or approved third-party AMD.

OAC controllers can maintain a user defined outdoor airflow setpoint or maintain airflow rates between minimum and maximum airflow limits when CO_2 or population-based DCV is enabled. Controllers can also maintain an unoccupied airflow setpoint.

OAC-3000 Outdoor Airflow Controller

The OAC-3000 modulates an MP-bus network actuator to maintain the outdoor airflow rate. The MP-bus solution is the most cost effective method for actuating small air valves and dampers on ducted systems to fan coils, makeup air to air handlers or zone level DOAS applications. DCV requires approved BACnet MS/TP CO_2 sensors or occupancy counters.

Occupied mode is typically enabled by a 24 VAC output from a thermostat on fan coil systems or via BACnet MS/TP on makeup air to air handlers or zone level DOAS systems.

OAC-3000S Outdoor Airflow Controller

The OAC-3000S is a modified version of the OAC-3000. The controller has a built-in real time clock (RTC) that allows a daily or weekend/weekday occupied unoccupied schedule to override or operate in the absence of the binary input.

OAC-4000

The OAC-4000 modulates a proportional analog actuator or fan speed controller to maintain the outdoor airflow rate. The analog actuator solution allows for larger damper sizes and is ideal for ducted systems to fan coils, makeup air to air handlers, makeup air fans or zone level DOAS applications. DCV requires approved BACnet MS/TP CO_2 sensors or occupancy counters.

Occupied mode is typically enabled by a 24 VAC output from a thermostat on fan coil systems or via BACnet MS/TP on makeup air to air handlers or zone level DOAS systems.

OAC-5000

The OAC-5000 has an additional analog input and analog output compared to the OAC-4000. As a result, the OAC-5000 can be used with analog CO_2 sensors as well as approved BACnet MS/TP CO_2 or occupancy counters. It also provides an airflow output signal, if desired.

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GreenTrol®
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OAC Series

OAC-3000 Controller

Product Data

Outdoor Airflow Controller Module with Network Control Connection for MP-Bus Actuators

- ❑ Compatible with GreenTrol IAT integrated thermal dispersion airflow/temperature sensors or approved BACnet MS/TP airflow measuring devices
- ❑ 24 VAC/DC or MS/TP BACnet binary input activates occupied mode operation
- ❑ Provide airflow setpoint control, CO_2-DCV or population based-DCV during occupied mode
- ❑ Accepts approved BACnet MS/TP CO_2 sensors or occupancy counters when DCV is required
- ❑ Clamp DCV airflow rates between minimum and maximum airflow limits
- ❑ Supports unoccupied airflow setpoint control
- ❑ Built-in notification alarms
- ❑ Contact closure relay can be assigned to notification alarms or active control mode
- ❑ MS/TP BACnet connection

- √ Compensate for damper hysteresis, filter loading, wind, stack and fan speed variations
- √ Provide continuous verification of intake flow rates
- √ Demonstrate compliance with ASHRAE Standards 62.1, 90.1 and 189.1
- √ Satisfy LEED prerequisites and document code compliance
- √ Improve indoor air quality and thermal comfort
- √ Save energy

The OAC-3000 can be provided with a single integrated IAT-DI duct probe, one or two integrated IAT-UI or IAT-US universal mount probes or an approved external BACnet MS/TP airflow measurement device.

The OAC-3000 interfaces with approved MS/TP BACnet CO_2 sensors and occupancy counters when DCV is required.

The OAC-3000 modulates a network MP-bus actuator to maintain the outdoor airflow rate when an external binary trigger is active (i.e. occupied mode). The binary trigger is typically is provided by a thermostat or other analog or MS/TP BACnet binary output. The trigger can also be provided by the 24 VAC control signal used when a two-position actuator is provided for outdoor air control (replace the two-position actuator with an MP-bus actuator).

Advanced logic and airflow measurement improves traditional CO_2-DCV when demand control ventilation is required. The OAC-3000 controller resets the outdoor airflow setpoint between user defined minimum and maximum airflow limits to maintain either a user defined fixed CO_2 level or variable airflow setpoint based on the population using a built-in CO_2/airflow counting algorithm or external occupancy counter.

The OAC-3000 controller interfaces with most MS/TP BACnet building automation systems and supports full read/write privileges as a BACnet 1/8 load master. An RS-485 signal isolator is available when an isolated MS/TP network is required.

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OAC-3000 Controller Module Technical Specifications

Functionality

Outdoor Air Control (OAC) Modes Supported

FLOW: Maintains a user defined airflow setpoint

CO2: Maintains a user defined CO_2 level by resetting the outdoor airflow setpoint (requires a CO_2 sensor)

CO2/OAF: Maintains a calculated outdoor airflow setpoint based on the estimated ventilation zone population (requires a CO_2 sensor)

COUNT: Maintains a calculated outdoor airflow setpoint based on the occupancy counter population (requires an occupancy counter)

FIXED: Maintains a fixed damper position (no control)

Unoccupied Air Control (UAC) Mode Option: Yes, maintains a user defined airflow setpoint

Notification Alarms

"Unoccupied Mode" High/Low Airflow Alarm

"Outdoor Airflow Mode" High/Low Airflow Alarm

"All Modes" CO_2 Alarm (requires a CO_2 sensor)

"All Modes" System Trouble Alarm

Note: Alarms can be assigned to the contact closure relay

User Interface

Display: 16-character alpha-numeric LCD

Navigation: 4-button interface

Integrated Sensor Capability

Type: Accepts GreenTrol IAT-DI, IAT-UI and IAT-US Thermal Dispersion Airflow and Temperature Measurement Probe (required unless an external MS/TP airflow measurement device is provided). See appropriate IAT product data sheet for probe information.

Available Configurations: IAT-DI Probes

Single Probe: 1 probe x 1 or 2 sensor nodes/probe

Available Configurations: IAT-UI and IAT-US Probes

Single Probe: 1 probe x 1 sensor node/probe

Dual Probe: 2 probes x 1 sensor node/probe

Binary Input

BI1

Type: Binary Input (BI1)

Assignment: Mode activation trigger signal

Configurable Ranges: 0-24VAC or 0-24VDC

Trigger Threshold:

VAC configuration: 6.5 VAC

VDC Configuration: 8 VDC

MP-Bus Connection

MP1

Assignment: MP-Bus proportional actuator network signal (requires MP-bus cable, sold separately)

Contact Closure Relay

R1

Type: Dry contact w/ onboard jumper to drive a remote LED

Assignment: OAC alarms or Control Mode

Status: Normally Open (N.O.)

Rating: 30 VDC or 24 VAC @ 3 amp. max.

Network Connection

N1

Type: Non-isolated MS/TP BACnet master connection (provide an RS-485 network isolator if isolation is required)

B.A.S. Object Read/Write Access: Yes

Device Load: 1/8 load

Supported Baud Rates: 9.6, 19.2, 38.4 and 76.8 kbaud

MS/TP BACnet Airflow Sensor Capability: One GreenTrol Automation or approved third-party airflow measurement device (cannot be used if an integrated airflow measurement device is connected).

MS/TP BACnet CO_2 Sensor Capability: One GreenTrol Automation or approved third-party space mounted or return air CO_2 sensor

MS/TP BACnet Occupancy Counter Capability: One to four GreenTrol Automation or approved third-party occupancy counters

Environmental Limits, Power Requirements & Dimensions

Environmental Limits

Temperature: -20 to 120 ºF [-28.9 to 48.9 ºC]

Humidity: 5 to 95%

Important: Provide a weather-proof enclosure if the controller module is mounted outdoors

Power Requirement: 24 VAC (22.8 to 26.4 under load) @8.5V-A

Dimensions:

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OAC Series

OAC-3000S Controller

Product Data

Outdoor Airflow Controller Module with Network Control Connection for MP-Bus Actuators

- ❑ Compatible with GreenTrol IAT integrated thermal dispersion airflow/temperature sensors or approved BACnet MS/TP airflow measuring devices
- ❑ 24 VAC/DC or MS/TP BACnet binary input activates occupied mode operation
- ❑ **RTC occupied/unoccupied scheduler**
- ❑ Provide airflow setpoint control, CO_2-DCV or population based-DCV during occupied mode
- ❑ Accepts approved BACnet MS/TP CO_2 sensors or occupancy counters when DCV is required
- ❑ Clamp DCV airflow rates between minimum and maximum airflow limits
- ❑ Supports unoccupied airflow setpoint control
- ❑ Built-in notification alarms
- ❑ Contact closure relay can be assigned to notification alarms or active control mode
- ❑ MS/TP BACnet connection

- √ Compensate for damper hysteresis, filter loading, wind, stack and fan speed variations
- √ Provide continuous verification of intake flow rates
- √ Demonstrate compliance with ASHRAE Standards 62.1, 90.1 and 189.1
- √ Satisfy LEED prerequisites and document code compliance
- √ Improve indoor air quality and thermal comfort
- √ Save energy

The OAC-3000S can be provided with a single integrated IAT-DI duct probe, one or two integrated IAT-UI or IAT-US universal mount probes or an approved external BACnet MS/TP airflow measurement device.

The OAC-3000S interfaces with approved MS/TP BACnet CO_2 sensors and occupancy counters when DCV is required.

The OAC-3000S modulates an MP-Bus damper actuator to maintain the outdoor airflow rate. The controller can be configured to operate solely on the schedule or use the schedule with the binary input trigger to activate occupied mode. The binary trigger is typically is provided by a thermostat or other analog or MS/TP BACnet binary output. The trigger can also be provided by the 24 VAC control signal used when a two-position actuator is provided for outdoor air control (replace the two-position actuator with an MP-bus actuator).

Advanced logic and airflow measurement improves traditional CO_2-DCV when demand control ventilation is required. The OAC-3000S controller resets the outdoor airflow setpoint between user defined minimum and maximum airflow limits to maintain either a user defined fixed CO_2 level or variable airflow setpoint based on the population using a built-in CO_2/airflow counting algorithm or external occupancy counter.

The OAC-3000S interfaces with most MS/TP BACnet building automation systems and supports full read/write privileges as a BACnet 1/8 load master. An RS-485 signal isolator is available when an isolated MS/TP network is required.

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OAC-3000S Controller Module Technical Specifications

Functionality

Outdoor Air Control (OAC) Modes Supported

- FLOW: Maintains a user defined airflow setpoint
- CO2: Maintains a user defined CO_2 level by resetting the outdoor airflow setpoint (requires a CO_2 sensor)
- CO2/OAF: Maintains a calculated outdoor airflow setpoint based on the estimated ventilation zone population (requires a CO_2 sensor)
- COUNT: Maintains a calculated outdoor airflow setpoint based on the occupancy counter population (requires an occupancy counter)
- FIXED: Maintains a fixed damper position (no control)

Unoccupied Air Control (UAC) Mode Option: Yes, maintains a user defined airflow setpoint

Notification Alarms

- "Unoccupied Mode" High/Low Airflow Alarm
- "Outdoor Airflow Mode" High/Low Airflow Alarm
- "All Modes" CO_2 Alarm (requires a CO_2 sensor)
- "All Modes" System Trouble Alarm

Note: Alarms can be assigned to the contact closure relay

Built-in RTC Scheduler Modes:

- Off: No schedule set
- Days: Allows s different occupied start time and duration for each day of the week
- Weeks: Allows a different occupied start time and duration for weekdays and weekends

User Interface

Display: 16-character alpha-numeric LCD

Navigation: 4-button interface

Integrated Sensor Capability

Type: Accepts GreenTrol IAT-DI, IAT-UI and IAT-US Thermal Dispersion Airflow and Temperature Measurement Probe (required unless an external MS/TP airflow measurement device is provided). See appropriate IAT product data sheet for probe information.

Available Configurations: IAT-DI Probes

- Single Probe: 1 probe x 1 or 2 sensor nodes/probe

Available Configurations: IAT-UI and IAT-US Probes

- Single Probe: 1 probe x 1 sensor node/probe
- Dual Probe: 2 probes x 1 sensor node/probe

Binary Input

BI1

- Type: Binary Input (BI1)
- Assignment: Mode activation trigger signal
- Configurable Ranges: 0-24VAC or 0-24VDC
- Trigger Threshold:
  - VAC configuration: 6.5 VAC
  - VDC Configuration: 8 VDC

MP-Bus Output

MP1

- Assignment: MP-Bus proportional actuator network signal (requires MP-bus cable, sold separately)

Contact Closure Relay

R1

- Type: Dry contact w/ onboard jumper to drive a remote LED
- Assignment: OAC alarms or Control Mode
- Status: Normally Open (N.O.)
- Rating: 30 VDC or 24 VAC @ 3 amp. max.

Network Connection

N1

- Type: Non-isolated MS/TP BACnet master connection (provide an RS-485 network isolator if isolation is required)
- B.A.S. Object Read/Write Access: Yes
- Device Load: 1/8 load
- Supported Baud Rates: 9.6, 19.2, 38.4 and 76.8 kbaud
- MS/TP BACnet Airflow Sensor Capability: One GreenTrol Automation or approved third-party airflow measurement device (cannot be used if an integrated airflow measurement device is connected).
- MS/TP BACnet CO_2 Sensor Capability: One GreenTrol Automation or approved third-party space mounted or return air CO_2 sensor
- MS/TP BACnet Occupancy Counter Capability: One to four GreenTrol Automation or approved third-party occupancy counters

Environmental Limits, Power Requirements & Dimensions

Environmental Limits

- Temperature: -20 to 120 ºF [-28.9 to 48.9 ºC]
- Humidity: 5 to 95%

Important: Provide a weather-proof enclosure if the controller module is mounted outdoors

Power Requirement: 24 VAC (22.8 to 26.4 under load) @8.5V-A

Dimensions: 4.34H x 6.59W x 1.83D in. [110.2 x 167.3 x 46.6 mm]

GreenTrol® Automation Inc.

OAC Series

OAC-4000 Controller

Product Data

Outdoor Airflow Controller Module with Analog Control Output Signal for Proportional Actuators and Analog Input Fan Speed Controllers

- ❑ Compatible with GreenTrol IAT integrated thermal dispersion airflow/temperature sensors or approved BACnet MS/TP airflow measuring devices
- ❑ 24 VAC/DC or MS/TP BACnet binary input activates occupied mode operation
- ❑ Provide airflow setpoint control, CO_2-DCV or population based-DCV during occupied mode
- ❑ Accepts approved BACnet MS/TP CO_2 sensors or occupancy counters when DCV is required
- ❑ Clamp DCV airflow rates between minimum and maximum airflow limits
- ❑ Supports unoccupied airflow setpoint control
- ❑ Built-in notification alarms
- ❑ Contact closure relay can be assigned to notification alarms or active control mode
- ❑ MS/TP BACnet connection

- √ Compensate for damper hysteresis, filter loading, wind, stack and fan speed variations
- √ Provide continuous verification of intake flow rates
- √ Demonstrate compliance with ASHRAE Standards 62.1, 90.1 and 189.1
- √ Satisfy LEED prerequisites and document code compliance
- √ Improve indoor air quality and thermal comfort
- √ Save energy

The OAC-4000 can be provided with a single integrated IAT-DI duct probe, one or two integrated IAT-UI or IAT-US universal mount probes or an approved external BACnet MS/TP airflow measurement device.

The OAC-4000 interfaces with approved MS/TP BACnet CO_2 sensors and occupancy counters when DCV is required.

The OAC-4000 modulates a proportional damper actuator or variable speed fan (VFD or ECM with analog speed control input) to maintain the outdoor airflow rate when an external binary trigger is active (i.e. occupied mode). The binary trigger is typically is provided by a thermostat or other analog or MS/TP BACnet binary output. The trigger can also be provided by the 24 VAC control signal used when a two-position actuator is provided for outdoor air control (replace the two-position actuator with a proportional actuator).

Advanced logic and airflow measurement improves traditional CO_2-DCV when demand control ventilation is required. The OAC-4000 controller resets the outdoor airflow setpoint between user defined minimum and maximum airflow limits to maintain either a user defined fixed CO_2 level or variable airflow setpoint based on the population using a built-in CO_2/airflow counting algorithm or external occupancy counter.

The OAC-4000 interfaces with most MS/TP BACnet building automation systems and supports full read/write privileges as a BACnet 1/8 load master. An RS-485 signal isolator is available when an isolated MS/TP network is required.

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OAC-4000 Controller Module Technical Specifications

Functionality

Outdoor Air Control (OAC) Modes Supported

FLOW: Maintains a user defined airflow setpoint

CO2: Maintains a user defined CO_2 level by resetting the outdoor airflow setpoint (requires a CO_2 sensor)

CO2/OAF: Maintains a calculated outdoor airflow setpoint based on the estimated ventilation zone population (requires a CO_2 sensor)

COUNT: Maintains a calculated outdoor airflow setpoint based on the occupancy counter population (requires an occupancy counter)

FIXED: Maintains a fixed damper position (no control)

Unoccupied Air Control (UAC) Mode Option: Yes**,** maintains a user defined airflow setpoint

Notification Alarms

"Unoccupied Mode" High/Low Airflow Alarm

"Outdoor Airflow Mode" High/Low Airflow Alarm

"All Modes" CO_2 Alarm (requires a CO_2 sensor)

"All Modes" System Trouble Alarm

Note: Alarms can be assigned to the contact closure relay

User Interface

Display: 16-character alpha-numeric LCD

Navigation: 4-button interface

Integrated Sensor Capability

Type: Accepts GreenTrol IAT-DI, IAT-UI and IAT-US Thermal Dispersion Airflow and Temperature Measurement Probe (required unless an external MS/TP airflow measurement device is provided). See appropriate IAT product data sheet for probe information.

Available Configurations: IAT-DI Probes

Single Probe: 1 probe x 1 or 2 sensor nodes/probe

Available Configurations: IAT-UI and IFT-US Probes

Single Probe: 1 probe x 1 sensor node/probe

Dual Probe: 2 probes x 1 sensor node/probe

General Purpose Input

GP1

Type: Binary Input (BI1)

Assignment: Mode activation trigger signal

Configurable Ranges: 0-24VAC or 0-24VDC

Trigger Threshold:

VAC Configuration: 7 VAC

VDC Configuration: 3 VDC

Analog Output

AO1

Assignment: Airflow control signal

Configurable Ranges: 0-5V, 0-10V, 2-10V, or 4-20mA

Maximum Number of Actuators Supported:

0-5V, 0-10V or 2-10 V: Unlimited

4-20mA: 2

Contact Closure Relay

R1

Type: Dry contact w/ onboard jumper to drive a remote LED

Assignment: OAC alarms or Control Mode

Status: Normally Open (N.O.)

Rating: 30 VDC or 24 VAC @ 3 amp. max.

Network Connection

N1

Type: Non-isolated MS/TP BACnet master connection (provide an RS-485 network isolator if isolation is required)

B.A.S. Object Read/Write Access: Yes

Device Load: 1/8 load

Supported Baud Rates: 9.6, 19.2, 38.4 and 76.8 kbaud

MS/TP BACnet Airflow Sensor Capability: One GreenTrol Automation or approved third-party airflow measurement device (cannot be used if an integrated airflow measurement device is connected).

MS/TP BACnet CO_2 Sensor Capability: One GreenTrol Automation or approved third-party space mounted or return air CO_2 sensor

MS/TP BACnet Occupancy Counter Capability: One to four GreenTrol Automation or approved third-party occupancy counters

Environmental Limits, Power Requirements & Dimensions

Environmental Limits

Temperature: -20 to 120 ^{o}F [-28.9 to 48.9 ^{o}C]

Humidity: 5 to 95%

Important: Provide a weather-proof enclosure if the controller module is mounted outdoors

Power Requirement: 24 VAC (22.8 to 26.4 under load) @8.5V-A

Dimensions: 4.34H x 6.59W x 1.83D in. [110.2 x 167.3 x 46.6 mm]

GreenTrol®
Automation Inc.

OAC Series

OAC-5000 Controller

Product Data

Outdoor Airflow Controller Module with Analog Control Output Signal for Proportional Actuators and Analog Input Fan Speed Controllers

- ❑ Compatible with GreenTrol IAT integrated thermal dispersion airflow/temperature sensors or approved BACnet MS/TP airflow measuring devices
- ❑ 24 VAC/DC or MS/TP BACnet binary input activates occupied mode operation
- ❑ Provide airflow setpoint control, CO_2-DCV or population based-DCV during occupied mode
- ❑ Accepts **analog** or approved BACnet MS/TP CO_2 sensors or occupancy counters when DCV is required
- ❑ Clamp DCV airflow rates between minimum and maximum airflow limits
- ❑ Analog airflow output signal
- ❑ Supports unoccupied airflow setpoint control
- ❑ Built-in notification alarms
- ❑ Contact closure relay can be assigned to notification alarms or active control mode
- ❑ MS/TP BACnet connection

- √ Compensate for damper hysteresis, filter loading, wind, stack and fan speed variations
- √ Provide continuous verification of intake flow rates
- √ Demonstrate compliance with ASHRAE Standards 62.1, 90.1 and 189.1
- √ Satisfy LEED prerequisites and document code compliance
- √ Improve indoor air quality and thermal comfort
- √ Save energy

The OAC-5000 can be provided with a single integrated IAT-DI duct probe, one or two integrated IAT-UI or IAT-US universal mount probes or an approved external BACnet MS/TP airflow measurement device.

The OAC-5000 interfaces with analog or approved MS/TP BACnet CO_2 sensors and occupancy counters when DCV is required. An analog airflow output signal is also provided.

The OAC-5000 modulates a proportional damper actuator or variable speed fan (VFD or ECM with analog speed control input) to maintain the outdoor airflow rate when an external binary trigger is active (i.e. occupied mode). The binary trigger is typically is provided by a thermostat or other analog or MS/TP BACnet binary output. The trigger can also be provided by the 24 VAC control signal used when a two-position actuator is provided for outdoor air control (replace the two-position actuator with a proportional actuator).

Advanced logic and airflow measurement improves traditional CO_2-DCV when demand control ventilation is required. The OAC-5000 controller resets the outdoor airflow setpoint between user defined minimum and maximum airflow limits to maintain either a user defined fixed CO_2 level or variable airflow setpoint based on the population using a built-in CO_2/airflow counting algorithm or external occupancy counter.

The OAC-5000 interfaces with most MS/TP BACnet building automation systems and supports full read/write privileges as a BACnet 1/8 load master. An RS-485 signal isolator is available when an isolated MS/TP network is required.

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OAC-5000 Controller Module Technical Specifications

Functionality

Outdoor Air Control (OAC) Modes Supported

- FLOW: Maintains a user defined airflow setpoint
- CO2: Maintains a user defined CO_2 level by resetting the outdoor airflow setpoint (requires a CO_2 sensor)
- CO2/OAF: Maintains a calculated outdoor airflow setpoint based on the estimated ventilation zone population (requires a CO_2 sensor)
- COUNT: Maintains a calculated outdoor airflow setpoint based on the occupancy counter population (requires an occupancy counter)
- FIXED: Maintains a fixed damper position (no control)

Unoccupied Air Control (UAC) Mode Option: Yes, maintains a user defined airflow setpoint

Notification Alarms

- "Unoccupied Mode" High/Low Airflow Alarm
- "Outdoor Airflow Mode" High/Low Airflow Alarm
- "All Modes" CO_2 Alarm (requires a CO_2 sensor)
- "All Modes" System Trouble Alarm

Note: Alarms can be assigned to the contact closure relay

User Interface

Display: 16-character alpha-numeric LCD

Navigation: 4-button interface

Integrated Sensor Capability

Type: Accepts GreenTrol IAT-DI, IAT-UI and IAT-US Thermal Dispersion Airflow and Temperature Measurement Probe (required unless an external MS/TP airflow measurement device is provided). See appropriate IAT product data sheet for probe information.

Available Configurations: IAT-DI Probes

- Single Probe: 1 probe x 1 or 2 sensor nodes/probe

Available Configurations: IAT-UI and IFT-US Probes

- Single Probe: 1 probe x 1 sensor node/probe
- Dual Probe: 2 probes x 1 sensor node/probe

General Purpose Inputs

GP1

- Type: Binary Input (BI1)
- Assignment: Mode activation trigger signal
- Configurable Ranges: 0-24VAC or 0-24VDC
- Trigger Threshold:
  - VAC Configuration: 7 VAC
  - VDC Configuration: 3 VDC

GP2

- Type: Analog Input (AI1)
- Assignment: Analog output CO_2 sensor
- Configurable Ranges: 0-5V, 0-10V, 2-10V, or 4-20mA

Analog Outputs

AO1

- Assignment: Airflow control signal
- Configurable Ranges: 0-5V, 0-10V, 2-10V, or 4-20mA
- Maximum Number of Actuators Supported:
  - 0-5V, 0-10V or 2-10 V: Unlimited
  - 4-20mA: 2

AO2

- Assignment: Airflow output signal
- Configurable Ranges: 0-5V, 0-10V or 2-10V

Contact Closure Relay

R1

- Type: Dry contact w/ onboard jumper to drive a remote LED
- Assignment: OAC alarms or Control Mode
- Status: Normally Open (N.O.)
- Rating: 30 VDC or 24 VAC @ 3 amp. max.

Network Connection

N1

- Type: Non-isolated MS/TP BACnet master connection (provide an RS-485 network isolator if isolation is required)
- B.A.S. Object Read/Write Access: Yes
- Device Load: 1/8 load
- Supported Baud Rates: 9.6, 19.2, 38.4 and 76.8 kbaud
- MS/TP BACnet Airflow Sensor Capability: One GreenTrol Automation or approved third-party airflow measurement device (cannot be used if an integrated airflow measurement device is connected).
- MS/TP BACnet CO_2 Sensor Capability: One GreenTrol Automation or approved third-party space mounted or return air CO_2 sensor
- MS/TP BACnet Occupancy Counter Capability: One to four GreenTrol Automation or approved third-party occupancy counters

Environmental Limits, Power Requirements & Dimensions

Environmental Limits

- Temperature: -20 to 120 ºF [-28.9 to 48.9 ºC]
- Humidity: 5 to 95%

Important: Provide a weather-proof enclosure if the controller module is mounted outdoors

Power Requirement: 24 VAC (22.8 to 26.4 under load) @8.5V-A

Dimensions: 4.72H x 7.29W x 1.36D in. [119.9 x 185.2 x 34.5 mm]

GreenTrol® Automation Inc.

IAT Series

Airflow Measurement

Series Overview

Thermal Dispersion Airflow and Airflow/Temperature Measurement

The IAT Series use the principal of thermal dispersion to determine the airflow rate. Thermal dispersion is ideal for HVAC applications that typically require measurement of low air velocities. Each sensing node uses two thermistors to determine airflow. One thermistor is self-heated above ambient while a second thermistor determines the ambient air temperature. The power dissipated into the airstream is directly related to the airflow rate.

The IAT Series is compatible with many GreenTrol Automation transmitters and controllers.

IAT-DI Airflow/Temperature Probe

The IAT-DI probe (-DI suffix on the transmitter or controller model code) is designed for insertion into small round ducts and is available with a 3, 10, 25 or 50 foot plenum rated cable with connector plug. Available in aluminum or stainless steel. Fits 4 to 16 inch round ducts.

IAT-UI Airflow/Temperature Probe

The IAT-UI probe (-UI suffix on the transmitter or controller model code) is designed for insertion into ducts or other air paths and is available with a 10, 25 or 50 foot plenum rated cable with connector plug. Available in aluminum only. Universal, adjustable length tube, is available in 6, 8 and 16 inch probe lengths. Installed accuracy is based on the size of opening and application (typically less than or equal to 8 sq.ft.).

IAT-US Airflow/Temperature Probe

The IAT-UI probe (-UI suffix on the transmitter or controller model code) is designed for insertion into outdoor air intakes, plenums or other air paths and is available with a 10, 25 or 50 foot plenum rated cable with connector plug. Available in aluminum only. Universal, adjustable length tube can be rotated on its mounting bracket. Probes are available in 6, 8 and 16 inch lengths. Installed accuracy is based on the size of opening and application (typically less than or equal to 8 sq.ft.).

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GreenTrol® Automation Inc.

Integrated Airflow/Temperature Sensors

IAT-DI Probe

Product Data

Insertion Mount Thermal Dispersion Airflow/Temperature Measurement Probe for Round Ducts

- ❑ Compatible with GreenTrol transmitters and controllers that accept IAT integrated sensors
- ❑ Thermal dispersion technology
- ❑ Calibrated from 0 to 3,000 FPM
- ❑ Stable bead-in-glass thermistor sensors
- ❑ NIST traceable airflow and temperature measurement
- ❑ Calibrated to volumetric airflow standards
- ❑ Accurate and repeatable
- ❑ Field calibration is not required
- ❑ Fits standard 4 to 16 inch round ducts
- ❑ Easy to install insertion probe design
- ❑ Available in aluminum or stainless steel
- ❑ FEP plenum rated cable with terminal DIN connector plug provided

Typical Installations:

- Hospital, laboratory and clean room ducts
- Terminal boxes
- Outdoor air intakes to fan coils
- Makeup air ducts to air handlers

IAT (integrated airflow/temperature) sensors reduce cost by eliminating the redundancy of a separate transmitter for airflow and temperature measurement. The processing circuitry and firmware is integrated into one of GreenTrol's microprocessor-based transmitters or application specific controllers.

The IAT-DI airflow/temperature sensor is designed for duct insertion applications. Probes are available with one or two sensor nodes. Installed airflow accuracy is ±4% of reading to NIST traceable standards when installed in accordance to published placement guidelines.

The IAT-DI sensor probe uses the principal of thermal dispersion to determine the airflow rate. Thermal dispersion is ideal for HVAC applications that typically require measurement of low air velocities. Each sensing node uses two thermistors to determine airflow. One thermistor is self-heated above ambient while a second thermistor determines the ambient air temperature. The power dissipated into the airstream is directly related to the airflow rate.

Each thermistor body is a hermetically sealed bead-in-glass probe. Bead-in-glass thermistors have demonstrated extreme stability and superior performance over chip type thermistors used by other manufacturers. The bead-in-glass sensor used has been time tested for over 35 years by GreenTrol's sister company, EBTRON. Thermistors are potted in a waterproof sensor assembly and are designed for years of trouble-free operation.

Each sensing node is individually calibrated at 7 points in high-performance wind tunnels. Transmitters and controllers measure and process each individual sensor node independently. The result is the true average airflow rate and temperature when more than one sensing node is applied.

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IAT-DI Technical Specifications

Functionality

Airflow Measurement: Provides individual sensor node airflow rates to compatible GreenTrol transmitters and controllers

Temperature Measurement: Provides individual sensor node temperatures to compatible GreenTrol transmitters and controllers

Airflow/Temperature Measurement Probe

Type: -DI Duct Insertion Thermal Dispersion Airflow and Temperature Measurement Probe

Available Configurations

- **4 inch [102 mm]:** 1 probe x 1 sensor node
- **5 to 16 inch [127 to 406 mm]:** 1 probe x 2 sensor nodes

Sensing Node Sensors

- **Self-heated sensor:** Precision, hermetically sealed, bead-in-glass thermistor probe
- **Temperature sensor:** Precision, hermetically sealed, bead-in-glass thermistor probe

Probe Tube

- **Material:** Mill finish 6063 aluminum (optional: 316 SS)

Probe Mounting Brackets

- **Material:** 304 stainless steel

Probe Mounting: Insertion

Sensing Node Housing

- **Material:** Glass-filled Polypropylene
- **Sensor Potting Materials:** Waterproof marine epoxy

Sensing Node Internal Wiring

- **Material:** Kynar® coated copper

Probe to Transmitter Cables

- **Material:** FEP jacket, plenum rated CMP/CL2P, UL/cUL listed, -67 to 392 ^{0}F [-55 to 200 ^{0}C], UV tolerant
- **Standard Lengths:** 3, 10, 25 and 50 ft. [0.91, 3.1, 7.6 and 15.2 m]
- **Connecting Plug:** 0.60” [15.24 mm] nominal diameter

Airflow Measurement

- **Averaging Method:** Independent, arithmetic average
- **Installed Accuracy:** Better than ±4% of reading to NIST traceable airflow standards
- **Calibrated Range:** 0 to 3,000 fpm [0 to 15.24 m/s]
- **Calibration Points:** 7

Temperature Measurement

- **Averaging Method:** Independent, velocity weighted
- **Accuracy:** ±0.15^{0}F [0.08 ^{0}C]

Environmental Limits & Power Requirements

Environmental Limits

- **Temperature:** -20 to 160 ^{0}F [-28.9 to 71.1 ^{0}C]
  Note: Temperature limits for operation may be limited by the transmitter or controller selected
- **Humidity:** 0 to 100%

Power Requirement: Power is provided by the transmitter or controller and is included in the transmitter/controller power requirement specification

GreenTrol® Automation Inc.

Integrated Airflow/Temperature Sensors

IAT-UI Probe

Product Data

Universal Insertion Mount Thermal Dispersion Airflow/Temperature Measurement Probe for Ducts

- ❑ Compatible with GreenTrol transmitters and controllers that accept IAT integrated sensors
- ❑ Thermal dispersion technology
- ❑ Calibrated from 0 to 3,000 FPM
- ❑ Stable bead-in-glass thermistor sensors
- ❑ NIST traceable airflow and temperature measurement
- ❑ Accurate and repeatable
- ❑ Designed for openings up to 8 square feet
- ❑ Universal mounting design facilitates ordering and installation
- ❑ Three probe lengths available
- ❑ Aluminum probe construction
- ❑ FEP plenum rated cable with terminal DIN connector plug provided

Typical Installations:

- Rectangular, round and oval interior supply, return, exhaust and outdoor air intake ducts

IAT (integrated airflow/temperature) sensors reduce cost by eliminating the redundancy of a separate transmitter for airflow and temperature measurement. The processing circuitry and firmware is integrated into one of GreenTrol's microprocessor-based transmitters or application specific controllers.

The IAT-UI airflow/temperature sensor is designed for insertion mounting into interior ducts (ducts protected from rain and/or snow). One or two probes with a single sensor node are typically used. Sensor node airflow accuracy is ±3% of reading to NIST traceable standards. An installed accuracy of ±10% of reading or better can often be achieved without field adjustment. A field adjust wizard built into GreenTrol's transmitters and application specific controllers facilitate field setup when conditions warrant.

The IAT-UI sensor probe uses the principal of thermal dispersion to determine the airflow rate. Thermal dispersion is ideal for HVAC applications that typically require measurement of low air velocities. Each sensing node uses two thermistors to determine airflow. One thermistor is self-heated above ambient while a second thermistor determines the ambient air temperature. The power dissipated into the airstream is directly related to the airflow rate.

Each thermistor body is a hermetically sealed bead-in-glass probe. Bead-in-glass thermistors have demonstrated extreme stability and superior performance over chip type thermistors used by other manufacturers. The bead-in-glass sensor used has been time tested for over 35 years by GreenTrol's sister company, EBTRON. Thermistors are potted in a waterproof sensor assembly and are designed for years of trouble-free operation.

Each sensing node is individually calibrated at 7 points in high-performance wind tunnels. Transmitters and controllers measure and process each individual sensor node independently. The result is the true average airflow rate and temperature when more than one sensing node is applied.

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IAT-UI Technical Specifications

Functionality

Airflow Measurement: Provides individual sensor node airflow rates to compatible GreenTrol transmitters and controllers

Temperature Measurement: Provides individual sensor node temperatures to compatible GreenTrol transmitters and controllers

Airflow/Temperature Measurement Probe

Type: -US Universal Insertion Mount Thermal Dispersion Airflow and Temperature Measurement Probe

Available Configurations

- **Single Probe:** 1 probe x 1 sensor node/probe
- **Dual Probe:** 2 probes x 1 sensor node/probe

Sensing Node Sensors

- **Self-heated sensor:** Precision, hermetically sealed, bead-in-glass thermistor probe
- **Temperature sensor:** Precision, hermetically sealed, bead-in-glass thermistor probe

Probe Tube

- **Material:** Mill finish 6063 aluminum

Probe Mounting Brackets

- **Material:** 304 stainless steel

Probe Length: 6, 8 or 16 in. [152.4, 203.2 or406.4 mm] (adjustable)

Sensing Node Housing

- **Material:** Glass-filled Polypropylene
- **Sensor Potting Materials:** Waterproof marine epoxy

Sensing Node Internal Wiring

- **Material:** Kynar® coated copper

Probe to Transmitter Cables

- **Material:** FEP jacket, plenum rated CMP/CL2P, UL/cUL listed, -67 to 392 ^{O}F [-55 to 200 ^{O}C], UV tolerant
- **Standard Lengths:** 10, 25 and 50 ft. [3.1, 7.6 and 15.2 m]
- **Connecting Plug:** 0.60” [15.24 mm] nominal diameter

Airflow Measurement

- **Sensor Accuracy:** ±3% of reading to NIST-traceable airflow standards
- **Averaging Method:** Independent, arithmetic average
- **Installed Accuracy:** Typically better than ±10% of reading in ducts/ openings ≤ 8 sq ft [0.74 sq m]
- **Calibrated Range:** 0 to 3,000 fpm [0 to 15.24 m/s]
- **Calibration Points:** 7

Temperature Measurement

- **Averaging Method:** Independent, velocity weighted
- **Accuracy:** ±0.15^{O}F [0.08 ^{O}C]

Environmental Limits & Power Requirements

Environmental Limits

- **Temperature:** -20 to 160 ^{O}F [-28.9 to 71.1 ^{O}C]
  Note: Temperature limits for operation may be limited by the transmitter or controller selected
- **Humidity:** 0 to 100%

Power Requirement: Power is provided by the transmitter or controller and is included in the transmitter/controller power requirement specification

GreenTrol® Automation Inc.

Integrated Airflow/Temperature Sensors

IAT-US Probe

Product Data

Universal Standoff Mount Thermal Dispersion Airflow/Temperature Measurement Probe for Outdoor Intakes, Plenums and Fan Cabinets

- ❑ Compatible with GreenTrol transmitters and controllers that accept IAT integrated sensors
- ❑ Thermal dispersion technology
- ❑ Calibrated from 0 to 3,000 FPM
- ❑ Stable bead-in-glass thermistor sensors
- ❑ NIST traceable airflow and temperature measurement
- ❑ Accurate and repeatable
- ❑ Designed for openings up to 8 square feet
- ❑ Universal mounting design facilitates ordering and installation
- ❑ Three probe lengths available
- ❑ Aluminum probe construction
- ❑ FEP plenum rated cable with terminal DIN connector plug provided

Typical Installations:

- Rooftop air handler outdoor air intakes
- Fan cabinets and powered exhaust boxes
- Unit ventilator outdoor air intakes
- ERV cabinet and wheel intake/exhaust paths

IAT (integrated airflow/temperature) sensors reduce cost by eliminating the redundancy of a separate transmitter for airflow and temperature measurement. The processing circuitry and firmware is integrated into one of GreenTrol's microprocessor-based transmitters or application specific controllers.

The IAT-US airflow/temperature sensor is designed for mounting inside of plenums or other openings where airflow measurement is desired. One or two probes with a single sensor node are typically used. Sensor node airflow accuracy is ±3% of reading to NIST traceable standards. An installed accuracy of ±10% of reading or better can often be achieved without field adjustment. A field adjust wizard built into GreenTrol's transmitters and application specific controllers facilitate field setup when conditions warrant.

The IAT-US sensor probe uses the principal of thermal dispersion to determine the airflow rate. Thermal dispersion is ideal for HVAC applications that typically require measurement of low air velocities. Each sensing node uses two thermistors to determine airflow. One thermistor is self-heated above ambient while a second thermistor determines the ambient air temperature. The power dissipated into the airstream is directly related to the airflow rate.

Each thermistor body is a hermetically sealed bead-in-glass probe. Bead-in-glass thermistors have demonstrated extreme stability and superior performance over chip type thermistors used by other manufacturers. The bead-in-glass sensor used has been time tested for over 35 years by GreenTrol's sister company, EBTRON. Thermistors are potted in a waterproof sensor assembly and are designed for years of trouble-free operation.

Each sensing node is individually calibrated at 7 points in high-performance wind tunnels. Transmitters and controllers measure and process each individual sensor node independently. The result is the true average airflow rate and temperature when more than one sensing node is applied.

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IAT-US Technical Specifications

Functionality

Airflow Measurement: Provides individual sensor node airflow rates to compatible GreenTrol transmitters and controllers

Temperature Measurement: Provides individual sensor node temperatures to compatible GreenTrol transmitters and controllers

Airflow/Temperature Measurement Probe

Type: -US Universal Standoff Mount Thermal Dispersion Airflow and Temperature Measurement Probe

Available Configurations

- **Single Probe:** 1 probe x 1 sensor node/probe
- **Dual Probe:** 2 probes x 1 sensor node/probe

Sensing Node Sensors

- **Self-heated sensor:** Precision, hermetically sealed, bead-in-glass thermistor probe
- **Temperature sensor:** Precision, hermetically sealed, bead-in-glass thermistor probe

Probe Tube

- **Material:** Mill finish 6063 aluminum

Probe Mounting Brackets

- **Material:** 304 stainless steel

Probe Length: 6, 8 or 16 in. [152.4, 203.2 or 406.4 mm] (adjustable)

Sensing Node Housing

- **Material:** Glass-filled Polypropylene
- **Sensor Potting Materials:** Waterproof marine epoxy

Sensing Node Internal Wiring

- **Material:** Kynar® coated copper

Probe to Transmitter Cables

- **Material:** FEP jacket, plenum rated CMP/CL2P, UL/cUL listed, -67 to 392 ^{O}F [-55 to 200 ^{O}C], UV tolerant
- **Standard Lengths:** 10, 25 and 50 ft. [3.1, 7.6 and 15.2 m]
- **Connecting Plug:** 0.60" [15.24 mm] nominal diameter

Airflow Measurement

- **Sensor Accuracy:** ±3% of reading to NIST-traceable airflow standards
- **Averaging Method:** Independent, arithmetic average
- **Installed Accuracy:** Typically better than ±10% of reading in ducts/openings ≤ 8 sq ft [0.74 sq m]
- **Calibrated Range:** 0 to 3,000 fpm [0 to 15.24 m/s]
- **Calibration Points:** 7

Temperature Measurement

- **Averaging Method:** Independent, velocity weighted
- **Accuracy:** ±0.15^{O}F [0.08 ^{O}C]

Environmental Limits & Power Requirements

Environmental Limits

- **Temperature:** -20 to 160 ^{O}F [-28.9 to 71.1 ^{O}C]
  Note: Temperature limits for operation may be limited by the transmitter or controller selected
- **Humidity:** 0 to 100%

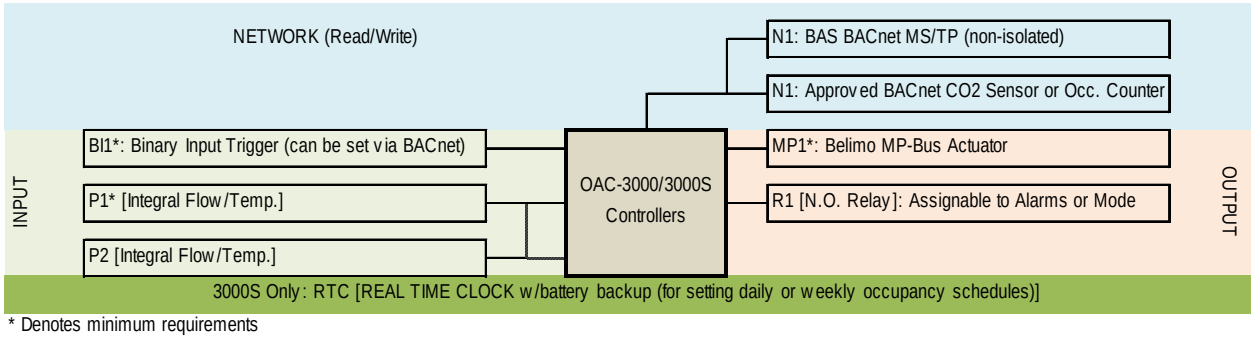
Power Requirement: Power is provided by the transmitter or controller and is included in the transmitter/controller power requirement specification

1. OAC HARDWARE ARCHITECTURE

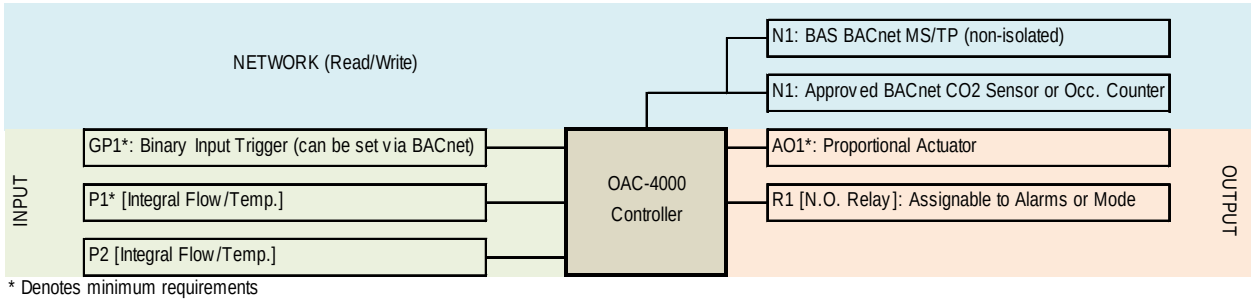
OAC Outdoor Air Controllers are based on GreenTrol Automation's 3000, 3000S, 4000 and 5000 hardware architecture. The OAC-3000 and OAC-3000S have a physical binary input (BI1). The OAC-4000 and OAC-5000 use a general-purpose input factory configured as a binary input (GP1 configured as BI1). The binary input is used to trigger occupied outdoor airflow control. The OAC-3000 and OAC-3000S modulate MP-Bus actuators provided by GreenTrol. The OAC-4000 and OAC-5000 modulate proportional analog actuators or fan speed controllers having an analog input for speed control. The OAC-3000S has a built-in real-time clock for occupancy scheduling. The OAC-5000 has an additional general purpose input factory configured as an analog input (GP2 configured as AI1) that can be configured to read an analog CO_2 sensor and an additional analog output (AO2) that is configured for airflow output.

All architectures support GreenTrol Automated integrated IAT, one or two sensor node, thermal dispersion airflow/temperature measuring devices (P1 and/or P2), have a contact closure relay (R1), and provide one non-isolated BACnet MS/TP connection (N1). The MS/TP connection can be configured for approved MS/TP airflow measurement devices in lieu of the integrated sensors, approved MS/TP DCV sensors and/or connection to a building automation system. All controllers support full read/write privileges as a BACnet master.

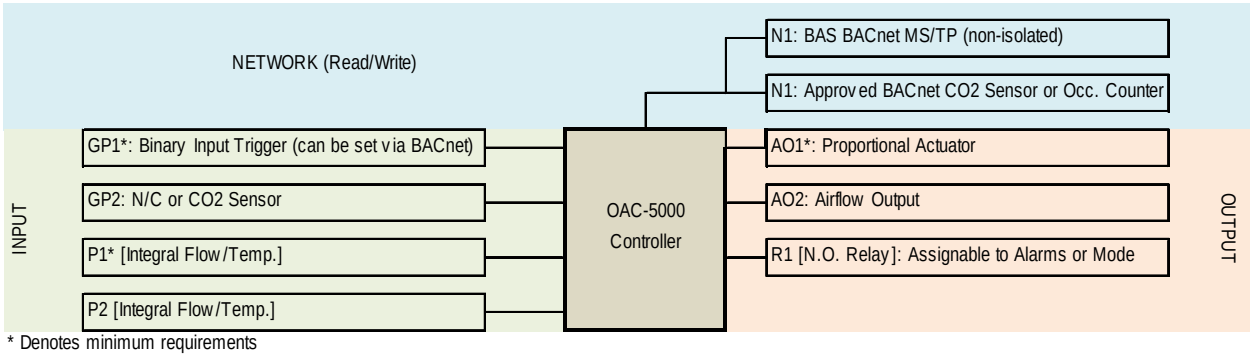
Figure 1-1 OAC Application Specific Hardware Architecture



* Denotes minimum requirements



* Denotes minimum requirements



* Denotes minimum requirements

2. OUTDOOR AIR CONTROL (OAC) METHODS

2.1. Methods Supported

OAC controllers support four modulating outdoor air control methods and one non-modulating method during occupied mode. The OAC method is selected during firmware configuration.

2.2. Modulating Control Methods

Modulating control continuously modifies the signal, MP1 or AO1, to the outdoor air actuator using one or more PID control loops and sensor inputs to maintain setpoint within a user defined deadband when occupied mode is detected. OAC controllers support fixed and variable setpoint control.

2.2.1 FIXED SETPOINT CONTROL METHODS

Fixed setpoint control maintains a user defined airflow or CO_2 setpoint. OAC controllers support the following fixed setpoint modulating control methods:

- FLOW: maintains a user defined fixed airflow setpoint
- CO2: maintains a user defined fixed CO_2 setpoint bound by optional upper and lower airflow limits

2.2.1.1. Airflow Setpoint Control [OAC=FLOW, default]

Modulates MP1 or AO1 to maintain a user defined airflow setpoint. The setpoint can be entered during firmware configuration or during normal operation by pressing either the ↑ or ↓ pushbuttons on the main circuit board.

2.2.1.2. Improved CO_2 Demand Control Ventilation (CO_2-DCV) [OAC=CO2]

Modulates MP1 or AO1 to maintain a user defined CO_2 setpoint. The setpoint can be entered during firmware configuration or during normal operation by pressing either the ↑ or ↓ pushbuttons on the main circuit board.

OAC controllers reset the outdoor airflow setpoint to maintain the desired CO_2 level. As a result, minimum and maximum ventilation airflow limits can be set by the user. Setting airflow limits significantly improves traditional CO_2-DCV that relies on fixed damper positions which are affected by damper hysteresis, fan speed changes and wind/stack pressure variations.

2.2.2 VARIABLE SETPOINT CONTROL METHODS

Variable airflow setpoint control, or population based-DCV, satisfies the ventilation requirements of ASHRAE Standard 62.1 at all population levels and is an improvement over CO_2-DCV.

The population of the ventilation zone is used to calculate the required breathing zone outdoor airflow rate. There is no user defined airflow setpoint. The breathing zone outdoor airflow rate, Vbz, is determined using the estimated population and values for the ventilation rate required per person, Rp, the ventilation rate required per floor area, Ra, and the ventilation zone floor area, Az. Values for Rp, Ra and Az should be modified for the specific space type during firmware configuration.

Vbz can be corrected for the zone ventilation effectiveness and the total outdoor air can be corrected for the worst-case expected ventilation efficiency on multi-zone systems during firmware configuration when the total population of the ventilation zone is estimated. The resulting airflow setpoint is Voz.

Variable setpoint control modulates MP1 or AO1 to maintain the calculated value for Voz. OAC controllers support the following variable setpoint modulating control methods:

- CO2/OAF: maintains a calculated airflow setpoint using the calculated population bound by optional upper and lower airflow limits
- COUNT: maintains a calculated airflow setpoint using the counted population bound by optional upper and lower airflow limits

2.2.2.1. CO2/OAF Population Estimation-DCV [OAC=CO2/OAF]

The CO2/OAF method uses a steady-state algorithm that estimates the population of the ventilation zone using indoor/outdoor CO_2 levels, metabolic activity and the measured outdoor airflow rate. The outdoor CO_2 level and metabolic activity can be modified during firmware configuration.

2.2.2.2. Direct Count-DCV [OAC=COUNT]

The COUNT method uses one to four door mounted occupancy counters to determine the occupancy of the ventilation zone.

2.3. Non-modulating Control Methods

OAC controllers support the following non-modulating method when occupied mode is detected:

- FIXED: maintains a user defined fixed damper position

3. OAC OUTPUT

3.1. Mode Detection

The active control mode is determined by the status of the binary input trigger. The trigger can be configured to be active when the input is high (above the trigger threshold) or low (below the trigger threshold).

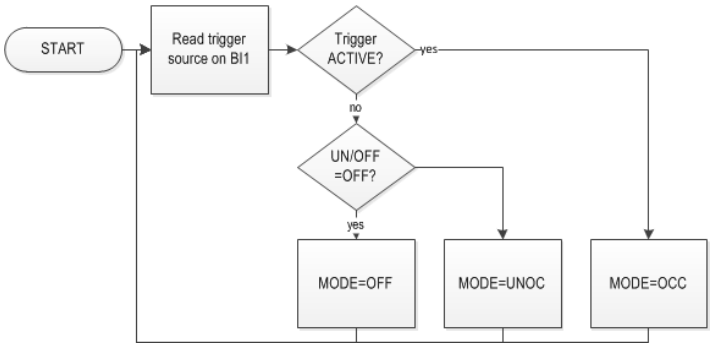
The OAC control mode trigger source can be a binary 0 to 24 VAC/VDC signal source from a thermostat or application controller. The trigger can also be the actuator control signal on packaged units using a 2-position intake damper. Replace the 2-position actuator with the appropriate analog or MP-Bus proportional actuator and use the 2-position 24 VAC control signal as the binary trigger. The binary trigger can also be provided via BACnet by the host control system.

OAC controllers detect the following modes of operation:

- Off Mode
- Unoccupied Mode
- Occupied Mode

Mode detection logic is shown in Figure 3-1.

Figure 3-1 Mode Detection Logic



3.1.1. ENHANCED MODE DETECTION (OAC-3000S)

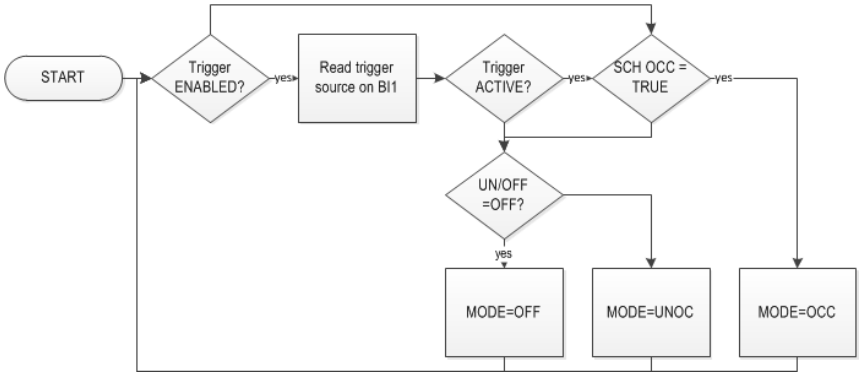
The OAC-3000S has a built-in real-time clock (RTC) to enhance operation during unoccupied modes. A schedule can be configured for individual days or weekdays/weekends and will enable occupied status (OCC = TRUE) when the time and day fall within the occupancy start time and duration specified.

The controller can be configured to operate solely on the schedule or use the schedule with the binary input trigger (logical AND) to activate occupied mode.

Press the ↓ and {ENT} buttons simultaneously during normal operation to configure schedule functions.

Enhanced mode detection logic for the OAC-3000S is shown in figure 3-2.

Figure 3-1 Enhanced Mode Detection Logic (OAC-3000S Only)



3.2. OAC Actuator and Fault Signal Outputs

The OAC actuator control output signal is provided on AO1 and is dependent on active mode, OAC method, control status and sensor status.

4. NORMAL OPERATION (NO FAULTS)

4.1. Off Mode (MODE=OFF)

The OAC controller MP1 or AO1 to 0% (damper closed)

4.2. Unoccupied Mode (MODE=UNOC)

The OAC controller modulates the output of MP1 or AO1 to maintain a user defined unoccupied airflow setpoint, UNOC SET whenever UNOC SET is greater than zero.

Note: Unoccupied airflow control is only available when a modulating minimum outdoor air control method is selected.

4.3. Outdoor Air Mode (MODE=OA)

The OAC controller sets MP1 or AO1 based on the minimum outdoor air control (OAC) method selected in SECTION 2.

5. CONTROL FAULT HANDLING

5.1. Control States

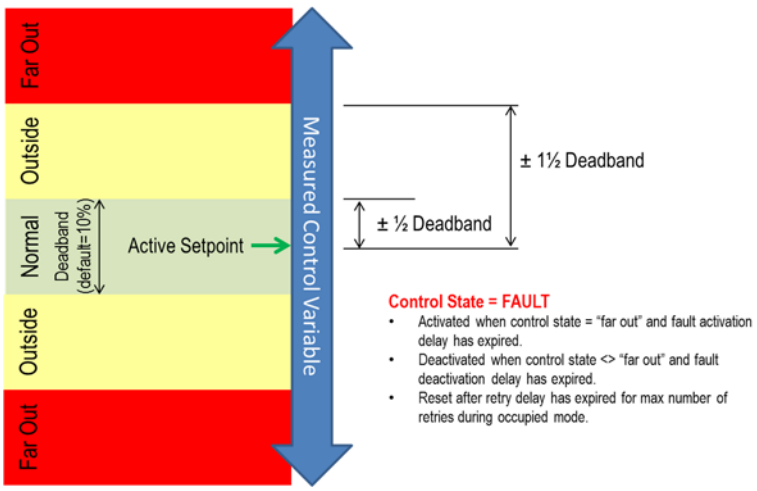
During modulating control, OAC controllers monitor the active control state (Figure 5-1). Control states are categorized as follows:

- Inactive (not in a modulating control mode)
- Normal (within/equal to active setpoint ± 0.5 deadband)
- Outside (outside active setpoint ± 0.5 deadband)
- Far Out (outside active setpoint ± 1.5 deadband)
- Control Fault (Far Out for greater than specified fault activation delay period)

Active control faults are indicated on the LCD as follows:

- Outside High, + indicated after measured output
- Outside Low, - indicated after measured output
- Far Out High, ++ indicated after measured output
- Far Out Low, -- indicated after measured output
- Control Fault High, flashing ++ after measured output
- Control Fault Low, flashing -- after measured output

Figure 5-1 Control States



5.2. Mode Dependent Control Fault Operation

5.2.1. UNOCCUPIED AIRFLOW MODE CONTROL FAULTS

5.2.1.1. Unoccupied Airflow Control Fault

An active unoccupied airflow control fault sets MP1 or AO1 to 0% (damper closed).

5.2.2. OCCUPIED OUTDOOR AIRFLOW MODE CONTROL FAULTS

5.2.2.1. Occupied Airflow Control Fault

An active occupied airflow control fault sets MP1 or AO1 to the fixed minimum position value for MIN POS established during firmware configuration (default = 10%).

5.2.2.2. CO_2 Control Fault

A CO_2 control fault only affects operation when OAC is set to CO2.

If DCVMAX is set to NONE, an active CO_2 control fault sets MP1 or AO1 to the fixed minimum position value for MIN POS established during firmware configuration (default = 10%).

If DCVMAX is not set to NONE, an active CO_2 control fault maintains DCV MAX.

If DCVMAX is not set to NONE and an active airflow control fault is active, an active CO_2 control fault sets AI1 to the fixed minimum position value for MIN POS established during firmware configuration (default = 10%). OAC modulating control is disabled.

5.3. Control Fault Recovery

Control is restored when the active fault is not present for the specified fault deactivation delay period.

Since control is disabled when an active control fault is present, it is not likely that the fault will be cleared. The OAC controller allows for a user specified number of retries after a specified retry delay.

OAC controllers log the cumulative time the controller is in each control state in non-volatile memory. Times can be viewed by navigating through the system diagnostics menus.

Press the {ESC} and ↑ buttons simultaneously during normal operation to enter the advanced setup, tools and diagnostics menus.

6. SENSOR FAULT HANDLING

6.1. Sensor Fault Detection

The OAC controller has a built-in sensor diagnostic system that detects full or partial airflow sensor, CO_2 sensor or occupancy counter failure.

6.2. Sensor Fault Operation

6.2.1. AIRFLOW SENSOR FAILURE

A partial airflow sensor failure averages functioning airflow sensor nodes and does not disrupt control operation. A complete airflow sensor sets MP1 or AO1 to the fixed minimum position value for MIN POS established during firmware configuration (default = 10%). OAC modulating control is disabled.

6.2.2. DCV SENSOR FAILURE

A DCV sensor is either a CO_2 sensor or an occupancy counter. A CO_2 sensor failure only affects operation when OAC is set to CO2 or CO2/OAF. An occupancy counter failure only affects operation when OAC is set to COUNT.

If DCVMAX is set to NONE, a DCV sensor failure sets MP1 or AO1 to the fixed minimum position value for MIN POS established during firmware configuration (default = 10%). EMOAC modulating control is disabled.

If DCVMAX is not set to NONE, a DCV sensor failure maintains DCV MAX.

If DCVMAX is not set to NONE and an active airflow control fault is active, a DCV sensor failure sets MP1 or AO1 to the fixed minimum position value for MIN POS established during firmware configuration (default = 10%). OAC modulating control is disabled.

6.3. Sensor Fault Recovery

Control is restored when the sensor fault is no longer present.

OAC controllers maintain active trouble codes and trouble history in non-volatile memory. Trouble codes and history and can be viewed by navigating through the system diagnostics menus.

Press the {ESC} and ↑ buttons simultaneously during normal operation to enter the advanced setup, tools and diagnostics menus.

7. CONTACT CLOSURE RELAY

The contact closure relay, R1, may be assigned to one or more notification alarms or the active control mode.

7.1. Notification Alarm Assignment [R1 ASGN=ALRMS, default]

The contact closure relay, R1, closes when a bound notification alarm is active. To assign the contact closure relay to notification alarms, set R1 ASNG to ALRMS (default) during hardware configuration.

Note: Individual alarms must be bound to R1 during firmware configuration for an active alarm to close the relay.

7.2. Mode Assignment [R1 ASGN=MODE]

The contact closure relay, R1, closes and can enable an external device, such as a start relay for a booster fan or exhaust fan, when the specified mode is active. To assign the contact closure relay to the active control mode, set R1 ASNG to MODE during hardware configuration. Select the desired active control mode, unoccupied mode (R1 ACTMOD=UNOC), occupied mode (R1 ACTMOD=OCC) or both unoccupied and occupied modes (R1 ACTMOD=OCCUNO), that enables the contact closure relay.

8. NOTIFICATION ALARMS

OAC controllers have built-in notification alarms. Notification alarms are automatically displayed at position 11 on the LCD and can be individually bound to the contact closure relay, R1, when R1 ASGN is set to ALRMS. Notification alarms are also available via BACnet.

8.1. System Status Alarms

8.1.1. SYSTEM TROUBLE ALARM [TRBL ALARM]

The alarm can become active during any mode. The system trouble alarm is active when any malfunction of the controller module, airflow measuring device or installed DCV sensor is detected. The alarm is enabled by default and configured for automatic reset. Active trouble codes and trouble code history are viewed using built-in diagnostic tools.

8.2. Mode Dependent Setpoint Alarms

The following mode dependent setpoint alarms are available:

- Unoccupied Airflow Alarm
- Outside Airflow Alarm (Occupied airflow alarm)
- CO_2 Alarm

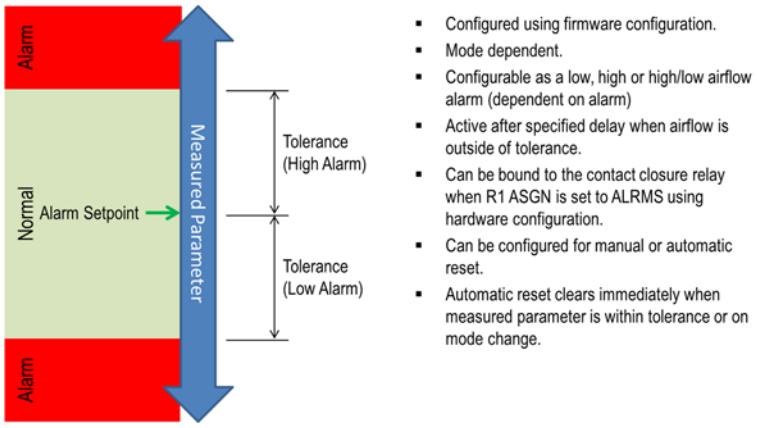
Notification alarms are disabled by default and must be enabled during firmware configuration to become active.

Notification alarms can be configured to reset automatically when the mode changes and/or alarm status is no longer active, or require manual reset. Active, manually reset, notification alarms are cleared by pressing the {ESC} button or via BACnet.

Each notification alarm has unique type (high, low or high/low), tolerance and delay parameters. Alarm history is maintained in non-volatile memory.

Notification alarm parameters can be modified during firmware configuration.

Figure 8-1 Setpoint Notification Alarms



8.2.1. UNOCCUPIED AIRFLOW ALARM [UNOC ALARM]

The alarm can only become active during unoccupied mode when the unoccupied airflow setpoint (UNOC SET) is greater than zero. The alarm uses the unoccupied airflow setpoint as the default alarm setpoint. The alarm can be set as a high, low or high/low airflow alarm.

8.2.2. OUTDOOR AIRFLOW ALARM [OA ALARM]

The alarm can only become active during occupied mode and any OAC method except when the OAC method is set to CO2. The alarm uses the active OA airflow setpoint (OA SET) when the OAC method is set to FLOW, CO2/OAF or COUNT. The alarm uses a user defined airflow setpoint when the OAC method is set to FIXED. The alarm can be set as a high, low or high/low airflow alarm.

8.2.3 CO_2 ALARM [CO2 ALARM]

The alarm can become active during any mode and with any OAC method. A CO_2 sensor must be installed and configured for the alarm to be available. The alarm uses the CO_2 setpoint (CO2 SET) when the OAC method is set to CO_2 or a user defined CO_2 setpoint for all other methods. The alarm is only available as a high CO_2 alarm.

OAC-3000 Wiring Diagram

Outdoor Airflow Control for Thermostat-based Systems

Optional DCV Configuration: RS-485 BACnet MS/TP CO_2 Sensor or Occupancy Counter

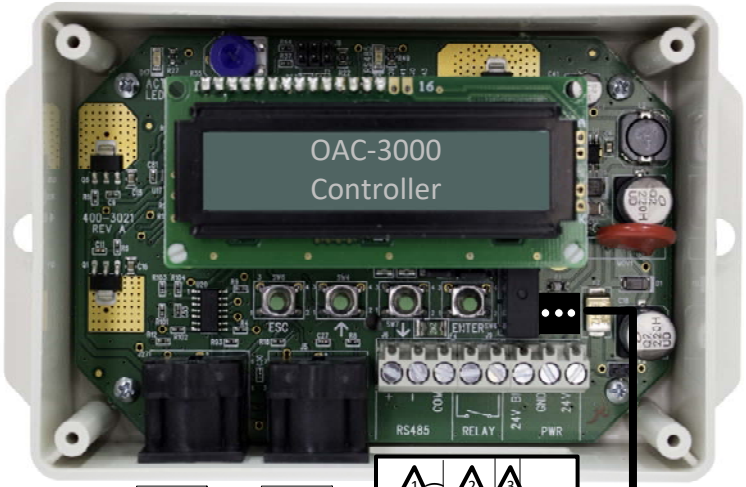
IAT THERMAL DISPERSION OUTDOOR AIRFLOW PROBE(S)

Probe #1 - 1 or 2 sensors
(required)

or

Probe #2 - 1 sensor
(optional if probe 1 is one sensor)

PROPORTIONAL ACTUATOR
Belimo MP-bus



BLACK (1-)
RED (2+)
WHITE (5MP)

MP-bus Cable Provided
2 ft., 5 ft. or 10 ft.

P1
P2

FEP Plenum Rated
Cable w/DIN Plug
Included
10ft., 25ft. or 50 ft.

1 NET + (N1+)
NET – (N1-)
NETCOM (N1C)

2 RELAY R1
RELAY R1

3 BI1 + (24V BI)
COM - (GND)
HOT+ (24 V)

Occupied Control Enable Trigger:
(select one)
1. Fan On
2. Stage 1 Compr. On*
3. Occupied Mode

* Heat pumps only

OPTIONAL BACnet MS/TP CO_2 SENSOR or COUNTER
NET+
NET-
NETCOM
L1 (+)
L2 (-)

R (+)
24 VAC
C (-)

O/B
OCC
Y1
Y2
W1
W2
G

THERMOSTAT CONTROL CIRCUIT
(by others)

1. RS-485 may be "daisy-chained" to a remote B.A.S. BACnet objects are read-write. OAC controllers are a ⅛ load BACnet Master device. Set termination jumper (J3) on the OAC controller if it is located at the end of the RS-485 line. OAC controller RS-485 connections are non-isolated. Install a GreenTrol network isolator if an isolated RS-485 connection is required.

2. N.O. contact closure relay. 30 VDC or 24 VAC @ 3A max. On-board jumper (J2) allows relay to drive an external LED (by others).

3. BI1 is configured as a binary 0/24 VAC input for thermostat applications. Occupied mode can be triggered by 0 VAC or 24 VAC via firmware parameter BI TRIG (default is 24 VAC).

OAC-3000_WiringDiagram_Thermostat_BACnetDCV_r1a.vsd

OAC-3000S Wiring Diagram

Outdoor Airflow Control for Thermostat-based Systems

Optional DCV Configuration: RS-485 BACnet MS/TP CO_2 Sensor or Occupancy Counter

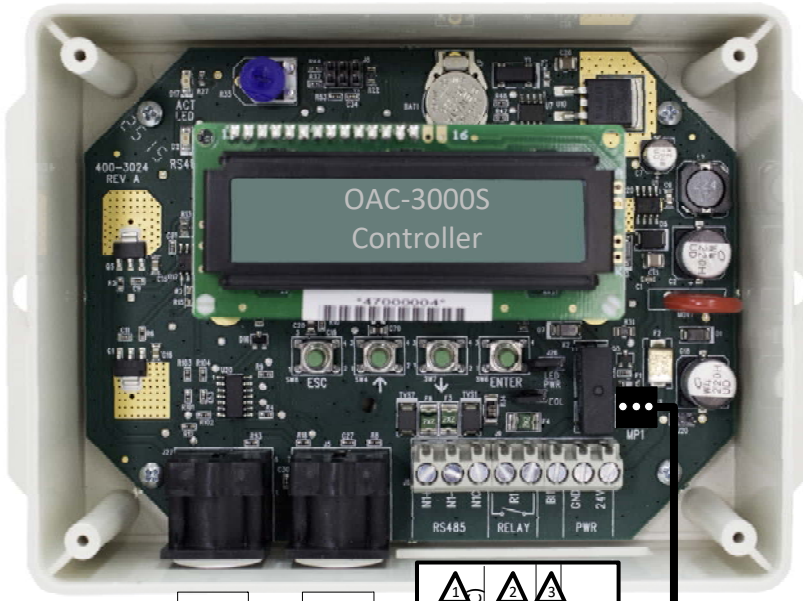
IAT THERMAL DISPERSION OUTDOOR AIRFLOW PROBE(S)

Probe #1 - 1 or 2 sensors
(required)

or

Probe #2 - 1 sensor
(optional if probe 1 is one sensor)

PROPORTIONAL ACTUATOR
Belimo MP-bus



OAC-3000S

Built-in Real Time Clock (RTC)

- Daily Schedule
- Weekday/Weekend

Active control setpoints will be maintained when the RTC occupancy status = "occupied" AND the thermostat trigger state = "true"

Inactive control setpoints will be maintained when the RTC occupancy status = "unoccupied" AND the thermostat trigger state = "False"

Note: The thermostat trigger configuration "NC" defaults the thermostat trigger state to "True" at all times. This results in active and inactive control setpoint conditions being solely determined by the RTC and schedule.

BLACK (1-)
RED (2+)
WHITE (5MP)

MP-bus Cable Provided
2 ft., 5 ft. or 10 ft.

P1
P2

FEP Plenum Rated Cable w/DIN Plug Included
10ft., 25ft. or 50 ft.

1 NET + (N1+)
NET – (N1-)
NETCOM (N1C)

2 RELAY R1
RELAY R1

3 BI1 + (BI1)
COM - (GND)
HOT+ (24 V)

Occupied Control Enable Trigger:
(select one)

1. Fan On
2. Stage 1 Compr. On*
3. Occupied Mode

* Heat pumps only

OPTIONAL BACnet MS/TP CO_2 SENSOR or COUNTER

NET+
NET-
NETCOM
L1 (+)
L2 (-)

R (+)
24 VAC
C (-)

O/B
OCC
Y1
Y2
W1
W2
G

THERMOSTAT CONTROL CIRCUIT
(by others)

1. RS-485 may be "daisy-chained" to a remote B.A.S. BACnet objects are read-write. OAC controllers are a ⅛ load BACnet Master device. Set termination jumper (J3) on the OAC controller if it is located at the end of the RS-485 line. OAC controller RS-485 connections are non-isolated. Install a GreenTrol network isolator if an isolated RS-485 connection is required.

2. N.O. contact closure relay. 30 VDC or 24 VAC @ 3A max. On-board jumper (J2) allows relay to drive an external LED (by others).

3. BI1 is configured as a binary 0/24 VAC input for thermostat applications. Occupied mode can be triggered by 0 VAC or 24 VAC via firmware parameter BI TRIG (default is 24 VAC).

OAC-3000S_WiringDiagram_Thermostat_BACnetDCV_r1a.vsd

OAC-4000 Wiring Diagram

Outdoor Airflow Control for Thermostat-based Systems

Optional DCV Configuration: RS-485 BACnet MS/TP CO_2 Sensor or Occupancy Counter

IAT THERMAL DISPERSION OUTDOOR AIRFLOW PROBE(S)

Probe #1 - 1 or 2 sensors
(required)

or

Probe #2 - 1 sensor
(optional if probe 1 is one sensor)

P1

P2

FEP Plenum Rated Cable w/DIN Plug Included
10ft., 25ft. or 50 ft.

1 NET + (N1+)
NET – (N1-)
NETCOM (N1C)

2 AO1 + (AO1)
AO – (GND)

3 RELAY R1
RELAY R1

4 GP1 + (GP1)

COM - (GND)
HOT+ (24 V)

PROPORTIONAL ACTUATOR
2-10 VDC
0-5/0-10 VDC
4-20 mA
(by others)

Feedback (+)
Control (+)
Common (-)
24 VAC POWER (Hot +)

Occupied Control Enable Trigger:
(select one)
1. Fan On
2. Stage 1 Compr. On*
3. Occupied Mode

* Heat pumps only

OPTIONAL BACnet MS/TP CO_2 SENSOR or COUNTER
NET+
NET-
NETCOM
L1 (+)
L2 (-)

R (+)
24 VAC
C (-)

THERMOSTAT CONTROL CIRCUIT
(by others)
O/B
OCC
Y1
Y2
W1
W2
G

1. RS-485 may be "daisy-chained" to a remote B.A.S. BACnet objects are read-write. OAC controllers are a ⅛ load BACnet Master device. Set termination jumper (J3) on the OAC controller if it is located at the end of the RS-485 line. OAC controller RS-485 connections are non-isolated. Install a GreenTrol network isolator if an isolated RS-485 connection is required.

2. Actuator signal common is not required when a single transformer is provided to devices without isolated outputs.

3. N.O. contact closure relay. 30 VDC or 24 VAC @ 3A max. On-board jumper (J26) allows relay to drive an external LED (by others).

4. GP1 is configured as a binary 0/24 VAC input for thermostat applications. Occupied mode can be triggered by 0 VAC or 24 VAC via firmware parameter BI TRIG (default is 24 VAC).

OAC-4000_WiringDiagram_Thermostat_BACnetDCV_r1a.vsd

OAC-4000 Wiring Diagram

2-Position OA Damper Conversion to Modulating Damper

Optional DCV Configuration: RS-485 BACnet MS/TP CO_2 Sensor or Occupancy Counter

IAT THERMAL DISPERSION OUTDOOR AIRFLOW PROBE(S)

Probe #1 - 1 or 2 sensors
(required)

or

Probe #2 - 1 sensor
(optional if probe 1 is one sensor)

OAC-4000
2-Position OA Damper Conversion to Modulating Control

Replace the 2-position outdoor air actuator with a modulating, proportional, actuator (spring return, failsafe closed advised) of sufficient torque for the outdoor air damper provided.

Use the 24 VAC, 2-position, actuator signal as the binary trigger signal for active control.

PROPORTIONAL ACTUATOR
2-10 VDC
0-5/0-10 VDC
4-20 mA
(by others)

Feedback (+)
Control (+)
Common (-)
24 VAC POWER (Hot +)

P1
P2

FEP Plenum Rated Cable w/DIN Plug Included
10ft., 25ft. or 50 ft.

1 NET + (N1+)
NET – (N1-)
NETCOM (N1C)

2 AO1 + (AO1)
AO – (GND)

3 RELAY R1
RELAY R1

4 GP1 + (GP1)

COM - (GND)
HOT+ (24 V)

OPTIONAL BACnet MS/TP CO_2 SENSOR or COUNTER
NET+
NET-
NETCOM
L1 (+)
L2 (-)

R (+)
24 VAC
C (-)

2-Position OA Damper RTU Controller

2-POS ACT 24 VAC
2-POS ACT COM

1. RS-485 may be "daisy-chained" to a remote B.A.S. BACnet objects are read-write. OAC controllers are a ⅛ load BACnet Master device. Set termination jumper (J3) on the OAC controller if it is located at the end of the RS-485 line. OAC controller RS-485 connections are non-isolated. Install a GreenTrol network isolator if an isolated RS-485 connection is required.

2. Actuator signal common is not required when a single transformer is provided to devices without isolated outputs.

3. N.O. contact closure relay. 30 VDC or 24 VAC @ 3A max. On-board jumper (J26) allows relay to drive an external LED (by others).

4. GP1 is configured as a binary 0/24 VAC input for this application. Occupied mode is triggered by the 24 VAC signal that would normally open the 2-position actuator.

OAC-4000_WiringDiagram_2PosConversion_BACnetDCV_r1a.vsd

OAC-5000 Wiring Diagram

Outdoor Airflow Control for Thermostat-based Systems

Optional DCV Configuration: RS-485 BACnet MS/TP CO_2 Sensor or Occupancy Counter

IAT THERMAL DISPERSION OUTDOOR AIRFLOW PROBE(S)

Probe #1 - 1 or 2 sensors
(required)

or

Probe #2 - 1 sensor
(optional if probe 1 is one sensor)

PROPORTIONAL ACTUATOR
2-10 VDC
0-5/0-10 VDC
4-20 mA
(by others)

Feedback (+)
Control (+)
Common (-)
24 VAC POWER (Hot +)

P1
P2

FEP Plenum Rated Cable w/DIN Plug Included
10ft., 25ft. or 50 ft.

1 NET + (N1+)
NET – (N1-)
NETCOM (N1C)

2 AO1 + (AO1)
AO – (GND)
AO2 + (AO2)

3 RELAY R1
RELAY R1

4 GP1 + (GP1)
GP – (GND)
GP2 + (GP2)

COM - (GND)
HOT + (24 V)

Airflow Output 5

Occupied Control Enable Trigger:
(select one)
1. Fan On
2. Stage 1 Compr. On*
3. Occupied Mode

* Heat pumps only

OPTIONAL BACnet MS/TP CO_2 SENSOR or COUNTER
NET+
NET-
NETCOM
L1 (+)
L2 (-)

R (+)
24 VAC
C (-)

THERMOSTAT CONTROL CIRCUIT
(by others)
O/B
OCC
Y1
Y2
W1
W2
G

1. RS-485 may be "daisy-chained" to a remote B.A.S. BACnet objects are read-write. OAC controllers are a ⅛ load BACnet Master device. Set termination jumper (J3) on the OAC controller if it is located at the end of the RS-485 line. OAC controller RS-485 connections are non-isolated. Install a GreenTrol network isolator if an isolated RS-485 connection is required.

2. Actuator signal common is not required when a single transformer is provided to devices without isolated outputs.

3. N.O. contact closure relay. 30 VDC or 24 VAC @ 3A max. On-board jumper (J26) allows relay to drive an external LED (by others).

4. GP1 is configured as a binary 0/24 VAC input for thermostat applications. Occupied mode can be triggered by 0 VAC or 24 VAC via firmware parameter BI TRIG (default is 24 VAC).

5. Do not connect the secondary of the 24 VAC transformer to earth ground if the airflow output on AO2 is connected to a B.A.S. requiring a floating output signal.

OAC-5000_WiringDiagram_Thermostat_BACnetDCV_r1a.vsd

OAC-5000 Wiring Diagram

2-Position OA Damper Conversion to Modulating Damper

Optional: RS-485 BACnet MS/TP CO_2 Sensor or Occupancy Counter

IAT THERMAL DISPERSION OUTDOOR AIRFLOW PROBE(S)

Probe #1 - 1 or 2 sensors
(required)

or

Probe #2 - 1 sensor
(optional if probe 1 is one sensor)

OAC-5000
2-Position OA Damper Conversion to Modulating Control

Replace the 2-position outdoor air actuator with a modulating, proportional, actuator (spring return, failsafe closed advised) of sufficient torque for the outdoor air damper provided.

Use the 24 VAC, 2-position, actuator signal as the binary trigger signal for active control.

PROPORTIONAL ACTUATOR
2-10 VDC
0-5/0-10 VDC
4-20 mA
(by others)

Feedback (+)
Control (+)
Common (-)
24 VAC POWER (Hot +)

P1
P2

FEP Plenum Rated Cable w/DIN Plug Included
10ft., 25ft. or 50 ft.

1 NET + (N1+)
NET – (N1-)
NETCOM (N1C)

2 AO1 + (AO1)
AO – (GND)
AO2 + (AO2)

3 RELAY R1
RELAY R1

4 GP1 + (GP1)
GP – (GND)
GP2 + (GP2)

COM - (GND)
HOT + (24 V)

Airflow Output 5

OPTIONAL BACnet MS/TP CO_2 SENSOR or COUNTER
NET+
NET-
NETCOM
L1 (+)
L2 (-)

R (+)
24 VAC
C (-)

2-Position OA Damper RTU Controller
2-POS ACT 24 VAC
2-POS ACT COM

1 RS-485 may be "daisy-chained" to a remote B.A.S. BACnet objects are read-write. EMOAC controllers are ⅛ load BACnet Master device. Set termination jumper (J3) on the EMOAC-5000 controller if it is located at the end of the RS-485 line. The EMOAC-5000 controller RS-485 is non-isolated. Install a GreenTrol network isolator if an isolated RS-485 connection is required.

2 Actuator signal common is not required when a single transformer is provided to devices without isolated outputs.

3 N.O. contact closure relay. 30 VDC or 24 VAC @ 3A max. On-board jumper (J26) allows relay to drive an external LED (by others).

4 GP1 is configured as a binary 0/24 VAC input for this application. Occupied mode is triggered by the 24 VAC signal that would normally open the 2-position actuator.

5 Do not connect the secondary of the 24 VAC transformer to earth ground if the airflow output on AO2 is connected to a B.A.S. requiring a floating output signal.

OAC-5000_WiringDiagram_2PosConversion_BACnetDCV_r1a.vsd

OAC-5000 Wiring Diagram

Outdoor Airflow Control for Thermostat-based Systems

Optional DCV Configuration: Analog CO_2 Sensor

IAT THERMAL DISPERSION OUTDOOR AIRFLOW PROBE(S)

Probe #1 - 1 or 2 sensors
(required)

or

Probe #2 - 1 sensor
(optional if probe 1 is one sensor)

PROPORTIONAL ACTUATOR
2-10 VDC
0-5/0-10 VDC
4-20 mA
(by others)

Feedback (+)
Control (+)
Common (-)
24 VAC POWER (Hot +)

P1
P2

FEP Plenum Rated Cable w/DIN Plug Included
10ft., 25ft. or 50 ft.

1 NET + (N1+)
NET – (N1-)
NETCOM (N1C)

2 AO1 + (AO1)
AO – (GND)
AO2 + (AO2)

3 RELAY R1
RELAY R1

4 GP1 + (GP1)
GP – (GND)
GP2 + (GP2)

COM - (GND)
HOT + (24 V)

Airflow Output 5

Occupied Control Enable Trigger:
(select one)
1. Fan On
2. Stage 1 Compr. On*
3. Occupied Mode

* Heat pumps only

OPTIONAL ANALOG CO_2 SENSOR
AO+
AO -
L1 (+)
L2 (-)

2

R (+)
24 VAC
C (-)

THERMOSTAT CONTROL CIRCUIT
(by others)
O/B
OCC
Y1
Y2
W1
W2
G

1. RS-485 may be "daisy-chained" to a remote B.A.S. BACnet objects are read-write. OAC controllers are a ⅛ load BACnet Master device. Set termination jumper (J3) on the OAC controller if it is located at the end of the RS-485 line. OAC controller RS-485 connections are non-isolated. Install a GreenTrol network isolator if an isolated RS-485 connection is required.

2. Actuator and/or CO_2 sensor signal common are not required when a single transformer is provided to devices without isolated outputs.

3. N.O. contact closure relay. 30 VDC or 24 VAC @ 3A max. On-board jumper (J26) allows relay to drive an external LED (by others).

4. GP1 is configured as a binary 0/24 VAC input for thermostat applications. Occupied mode can be triggered by 0 VAC or 24 VAC via firmware parameter BI TRIG (default is 24 VAC). Install jumper (J2) if a 4-20 mA CO_2 sensor is connected to GP2.

5. Do not connect the secondary of the 24 VAC transformer to earth ground if the airflow output on AO2 is connected to a B.A.S. requiring a floating output signal.

OAC-5000_WiringDiagram_Thermostat_AnalogDCV_r1a.vsd

OAC-5000 Wiring Diagram

2-Position OA Damper Conversion to Modulating Damper

Optional DCV Configuration: Analog CO_2 Sensor

OAC-5000

2-Position OA Damper Conversion to Modulating Control

Replace the 2-position outdoor air actuator with a modulating, proportional, actuator (spring return, failsafe closed advised) of sufficient torque for the outdoor air damper provided.

Use the 24 VAC, 2-position, actuator signal as the binary trigger signal for active control.

IAT THERMAL DISPERSION OUTDOOR AIRFLOW PROBE(S)

Probe #1 - 1 or 2 sensors
(required)

or

Probe #2 - 1 sensor
(optional if probe 1 is one sensor)

PROPORTIONAL ACTUATOR
2-10 VDC
0-5/0-10 VDC
4-20 mA
(by others)

Feedback (+)
Control (+)
Common (-)
24 VAC POWER (Hot +)

P1

P2

FEP Plenum Rated Cable w/DIN Plug Included
10ft., 25ft. or 50 ft.

1	2	3	4	
NET + (N1+) NET – (N1-) NETCOM (N1C)	AO1 + (AO1) AO – (GND) AO2 + (AO2)	RELAY R1 RELAY R1	GP1 + (GP1) GP – (GND) GP2 + (GP2)	COM - (GND) HOT + (24 V)

Airflow Output 5

OPTIONAL ANALOG CO_2 SENSOR
AO+
AO -
L1 (+)
L2 (-)

2

R (+)
24 VAC
C (-)

2-Position OA Damper RTU Controller

2-POS ACT 24 VAC
2-POS ACT COM

1. RS-485 may be "daisy-chained" to a remote B.A.S. BACnet objects are read-write. OAC controllers are a ⅛ load BACnet Master device. Set termination jumper (J3) on the OAC controller if it is located at the end of the RS-485 line. OAC controller RS-485 connections are non-isolated. Install a GreenTrol network isolator if an isolated RS-485 connection is required.

2. Actuator and/or CO_2 sensor signal common are not required when a single transformer is provided to devices without isolated outputs.

3. N.O. contact closure relay. 30 VDC or 24 VAC @ 3A max. On-board jumper (J26) allows relay to drive an external LED (by others).

4. GP1 is configured as a binary 0/24 VAC input for this application. Occupied mode is triggered by the 24 VAC signal that would normally open the 2-position actuator.

5. Do not connect the secondary of the 24 VAC transformer to earth ground if the airflow output on AO2 is connected to a B.A.S. requiring a floating output signal.

OAC-5000_WiringDiagram_2PosConversion_AnalogDCV_r1a.vsd

OAC HARDWARE CONFIGURATION

FACTORY DEFAULT HARDWARE CONFIGURATION

N1 BACnet MS/TP Network	NONE. No MS/TP sensors or building automation system connected.
Actuator Type	2-10 VDC proportional actuator (Belimo MP-bus with 3000 and 3000S models)
Outdoor Airflow Sensor	Integral, -U or -T, thermal dispersion airflow/termperature probe(s) - Auto detected
Outdoor Air Intake Sensor Area	Null. MUST BE ENTERED FOR OPERATION.
CO2 Sensor	NONE
Occupancy Counter	NONE
Alarm/Mode Relay Assignement	ALRMS (assigned to active alarms bound to N.O. relay, R1)

CUSTOM HARDWARE CONFIGURATION

Open by simultaneously pressing {ESC} {ENT} during normal operation

Use ↑↓ buttons to navigate up/down menu. Press {ENT} to modify (parameter will flash). Use ↑↓ buttons to modify, {ENT} to accept, {ESC} to keep previous.

Fixed parameters (parameters that cannot be changed) will indicate "PARAMETER FIXED"

If LOCK SECURITY<>NONE using the SETUP MENU pressing enter will indicate "CONFIG LOCKED" and only parameter viewing is allowed.

Navigate entire menu to step 28 to save settings. Press {ESC} twice at any time to exit without saving changes.

ITEM #	PARAMETER	VALUE	DESCRIPTION	SKIP TO
1	N1 DEVICES	NONE	No BACnet MS/TP devices connected to network N1.	
		SENS	Approved MS/TP CO2 and/or Occupancy Counters connected to network N1. *Note: Approved sensors have network parameters factory preset and autodetected by the EMOAC controller. No configuration is required. If custom configuration of network parameters is desired (baud rate, device MAC address or device/sensor device instance numbers) select BAS rather than SENS.*	
		BAS	BAS MS/TP network connected to network N1 *Note: MS/TP network parameters should be configured by the network integrator. Choose this setting without a BAS is it is desired to modify network settings (i.e. baud rate , device MAC address, or device instance numbers of device/network sensors).*	
2	ITEMS 2 and 3 are only visible on the OAC-4000 and 5000 controllers.			
3	ACTR SGNL	0-5V	0-5 VDC actuator control signal, 0% to 100% of full span.	
		0-10V	0-10 VDC actuator control signal, 0% to 100% of full span.	
		2-10V	2-10 VDC (can drive a 4-20 mA input) actuator control signal, 0% to 100% of full span.	
4	BI1 SGNL	AC	0-24 VAC binary input.	
		DC	0-24 VDC binary input.	
			Note: GP1 is factory configured as a binary input.	
5	BI1 TRIG	HI	Occupied mode is active above the binary threshold.	
		LO	Occupied mode is active below the binary threshold.	
			Note: The binary threshold is 7VAC/VDC with 3000 and 3000A models and 7VAC/3VDC with 4000 and 5000 models.	
5	OAF AREA	{}	Outdoor airflow measuring device free area, in sq ft [sq m]. ***Important: Area is required for operation. Leave null field (default) if area is not known during configuration. The device will prompt for area prior to operation.***	
6	CO2 TYP	NONE	No CO2 sensor connected.	9
		ANLG	Analog CO2 sensor connected (EMOAC-5000 only). *Note: An analog CO2 input is not available when ECO FAULT = ON*	
		MS/TP	Approved MS/TP CO2 sensor connected (N1 DEVICES = SENS or BAS).	9

OAC HARDWARE CONFIGURATION

7	CO2 SGNL	0-5V	0-5 VDC output CO2 sensor installed.	
		0-10V	0-10 VDC output CO2 sensor installed.	
		2-10V	2-10 VDC output CO2 sensor installed.	
		4-20mA	4-20mA (4-wire) output CO2 sensor installed. Jumper required on EMOAC PCB.	
			Note: Factory default output scaling is set to 0-2,000 ppm. The full scale reading of the CO2 sensor can be modified using advanced setup.	
8	CO2 FS	2000	CO2 sensor full scale reading, 1,000 to 10,000 ppm.	
9	CNTR TYP	NONE	No occupancy counter connected.	11
		MS/TP	Approved MS/TP occupancy counter connected (N1 DEVICES = SENS or BAS).	
10	NUM CNTRS	1	Number of counters, 1 to 4. *Note: If more than one counter is used, the device instance number additional counters must be modified in each counter. If N1 DEV=SENS, set counter 2 DI=32, counter 3 DI=33 and counter 4 DI=34.*	
11	R1 ASGN	NONE	Relay R1 not assigned.	13
		ALRMS	R1 assigned to EMOAC notification alarms bound to R1.	13
		MODE	R1 assigned to the active control mode.	
12	R1 ACTMOD	OCCUNO	R1 active during occupied and unoccupied modes.	
		OCC	R1 active during occupied mode.	
		UNOC	R1 active during unoccupied mode.	
13	ITEMS 14 to 27 are only visible if N1 DEVICES is equal to BAS.			
14	N1 BAUD	76800	N1 newtork baud rate of 76,800 bps.	
		38400	N1 newtork baud rate of 38,400 bps.	
		19200	N1 newtork baud rate of 19,200 bps.	
		9600	N1 newtork baud rate of 9,600 bps.	
15	N1 MAX MAST	7	N1 network max master, 0 to 127. *Note: Limiting MAX MAST to the actual number of devices on the network and sequentially addressing each device will limit network overhead and improve network efficiency. The default value for N1 MAX MAST assumes no building automation system is connected to the N1 MS/TP network.*	
16	N1 DEV MAC	1	The MAC address of this device on the N1 network, 0 to 127.	
17	DEV DI	1	The device instance number of this device on the N1 network, 0 to 4,194,302.	
18	ITEM 19 is only visible if CO2 TYP is equal to MS/TP.			
19	CO2 DI	21	The device instance number of the CO2 sensor on the N1 network, 0 to 4,194,302	
20	ITEM 21 is only visible if CNTR TYP is equal to MS/TP and NUM CNTRS is greater than or equal to 1.			
21	CNTR1 DI	31	The device instance number of counter 1 on the N1 network, 0 to 4,194,302.	
22	ITEM 23 is only visible if CNTR TYP is equal to MS/TP and NUM CNTRS is greater than or equal to 2.			
23	CNTR2 DI	32	The device instance number of counter 2 on the N1 network, 0 to 4,194,302.	
24	ITEM 25 is only visible if CNTR TYP is equal to MS/TP and NUM CNTRS is greater than or equal to 3.			
25	CNTR3 DI	33	The device instance number of counter 3 on the N1 network, 0 to 4,194,302.	
26	ITEM 27 is only visible if CNTR TYP is equal to MS/TP and NUM CNTRS is equal to 4.			
27	CNTR4 DI	34	The device instance number of counter 4 on the N1 network, 0 to 4,194,302.	
28	DONE	SAVE	Save changes and return to normal operation.	
		CANCEL	Do not save changes and return to normal operation.	
		RESET	Reset to factory default configuration and return to normal operation.	

OAC FIRMWARE CONFIGURATION

FACTORY DEFAULT FIRMWARE CONFIGURATION

Outdoor Air Control (OAC)	FLOW (modulating airflow setpoint outdoor airflow control during occupied mode)
Occupied Airflow Setpoint	0 cfm [lps] (simultaneously press ↑ or ↓ buttons during normal operation to modify)
Unoccupied Airflow Setpoint	0 cfm [lps]
Off-mode Operation (UN/OFF)	OFF (actuator output 0% when unoccupied mode is active)

CUSTOM FIRMWARE CONFIGURATION

Open by simultaneously pressing ↑↓ during normal operation

Use ↑↓ buttons to navigate up/down menu. Press {ENT} to modify (parameter will flash). Use ↑↓ buttons to modify, {ENT} to accept, {ESC} to keep previous.

Fixed parameters (parameters that cannot be changed) will indicate "PARAMETER FIXED"

If LOCK SECURITY<>NONE using the SETUP MENU pressing enter will indicate "CONFIG LOCKED" and only parameter viewing is allowed.

Navigate entire menu to step 39 to save settings. Press {ESC} twice at any time to exit without saving changes.

ITEM #	PARAMETER	VALUE	DESCRIPTION	SKIP TO
1	OAC	FLOW	Modulate to maintain a fixed, user defined, minimum airflow rate.	9
		CO2	Modulate to maintain a fixed, user defined, CO2 level.	10
		CO2/OAF	Modulate to maintain a calculated minimum airflow rate based on estimated population.	
		COUNT	Modulate to maintain a calculated minimum airflow rate based on measured population.	4
		FIXED	Maintain the fixed minimum position specified by MIN POS.	15
			Note: CO2 and CO2/OAF will only be visible if a CO2 sensor was configured during hardware config. COUNT will only be visible if an occupancy counter was configured during hardware config.	
2	OA CO2	400	Outdoor air CO2 level, 300 to 700 ppm. *Note: Outdoor air CO2 is typically assumed since CO2 sensor technology typically is not accurate in outdoor air applications. OA CO2 can be modified via BACnet if actual CO2 levels are monitored.*	
3	MET	1.2	Expected occupant metabolic equivalent based on activity, 0.7 to 10 MET. *Note: Sedentary adults have a average MET output of 1.2. Metabolic activity can range between 0.7 (very low activity such as sleeping) to over 10 (very high activity such as jumping rope) and varies with age and diet. Occupant activity significantly affects the relationship between ventilation and indoor CO2 levels.*	
4	RP	18 [3.4]	Ventilation zone required airflow rate, 0 to 50 cfm/person [0 to 10 lps/person]. *Note: Rp is generally determined using ASHRAE Standard 62.1. The default value is based on the equivalent ventilation rate for 1,000 ppm of sedentary adults and does not meet the requirements of the Standard.*	
5	RA	0	Ventilation zone required airflow rate, 0 to 1 cfm/sq ft [0 to 5 lps/sq m]. *Note: Ra is generally determined using ASHRAE Standard 62.1. The default value does not meet the requirements of the Standard.*	
6	AZ	0	Ventilation zone floor area, 0 to 99,999 sq ft [0 to 9,999 sq m]. *Note: Az must be entered if Ra is greater than 0.*	
7	EZ	1	Ventilation effectiveness, 0.1 to 1.5. *Note: Ez is generally determined using ASHRAE Standard 62.1. It should be used when occupancy counters are used or CO2 sensors are installed in the return air stream.*	
8	EVZ	1	Ventilation efficiency, 0.1 to 1. *Note: Using an estimated value for Evz can improve DCV peformance on multi-zone systems.*	11

OAC FIRMWARE CONFIGURATION

9	OA SET	0	Occupied outdoor airflow setpoint, 0 to 9,999 cfm [0 to 5,000 lps]. *Note:The minimum outdoor airflow setpoint can be modified at any time during normal operation by pressing the ↑ or ↓buttons.*	13
10	CO2 SET	1000	CO2 setpoint, 500 to 2,000 ppm. *Note:The CO2 setpoint can be modified at any time during normal operation by pressing the ↑ or ↓buttons.*	
11	DCV MIN	0	Lower ventilation rate limit during DCV, 0 to DCV MAX cfm [lps] *Note: DCV MIN limits the minimmum ventilation rate setpoint rather than fixed damper position. Set to equal the minimum required ventilation rate or local exhaust rate, whichever is greater.*	
12	DCV MAX	NONE 9999	Upper ventilation rate limit during DCV, NONE or DCV MIN to 9,999 cfm [5,000 lps] *Note: DCV MAX limits the maximum ventilation rate setpoint rather than fixed damper position. Set to equal the ventilation required for the maximum expected population. This limit may result in higher than expected CO2 levels and activate the CO2 alarm if the CO2-DCV method uncertaintly would result in over-ventilation at high occupancy levels. Setting DCV MAX to NONE will not limit ventilation and maintain the CO2 level specified.*	
13	UNOC SET	0	Unoccupied mode airflow setpoint, 0 to 9,999 cfm [0 to 5,000 lps]. *Note: The unoccupied airflow setpoint will be maintained whenever UN/OFF is set to UNOC in step 14 or via BACnet.*	
14	UN/OFF	OFF	Off Mode: The actuator output signal will be set to 0% when occupied mode is inactive.	
		UNOC	Unoccupied Mode: Modulate to maintain UNOC SET when occupied mode is inactive.	
15	MIN POS	10%	Minimum fixed damper position, 0% to 100% of full stroke. *Note: MIN POS is used as the default damper position during active fault conditions when UNOC or OA modes are active.*	
16	ITEMS 17 to 21 are only visible if OAC is set to FLOW, CO2, CO2/OAF or COUNT.			
17	UNOC ALARM	OFF	UNOC mode airflow notification alarm disabled.	23
		MAN	UNOC mode airflow notification alarm enabled. Manual reset required.	
		AUTO	UNOC mode airflow notification alarm enabled. Automatic reset with return to in tolerance.	
18	R1 BIND	NO	Do not bind active alarm to relay, R1.	
		YES	Bind active alarm to relay, R1 (requires R1 ASGN=ALRMS during hardware config.).	
19	TYPE	LO	Low airflow alarm. Active below SETPNT - TOL after specified DELAY.	
		HI	High airflow alarm. Active above SETPNT + TOL after specified DELAY.	
		HI/LO	High/Low airflow alarm. Active above/below SETPNT ± TOL after specified DELAY.	
20	SETPNT	{}	Alarm setpoint, in cfm [lps]. *Note:The default {} value for SETPNT is UNOC SET.*	
21	TOL	20%	Alarm tolerance, ½ OAF PID deadband tolerance to 50%	
22	DELAY	1	Delay, 0 to 30 minutes, after alarm is "outside" of tolerance before alarm is active.	
23	ITEMS 24 to 29 are NOT visible if MOAC is set to CO2 (MOA airflow alarm is not available when MOAC is set to CO2).			
24	OA ALARM	OFF	Occupied mode airflow notification alarm disabled.	30
		MAN	Occupied mode airflow notification alarm enabled. Manual reset required.	
		AUTO	Occupied mode airflow notification alarm enabled. Automatic reset with return to in tolerance.	
25	R1 BIND	NO	Do not bind active alarm to relay, R1.	
		YES	Bind active alarm to relay, R1 (requires R1 ASGN=ALRMS during hardware config.).	
26	TYPE	LO	Low airflow alarm. Active below SETPNT - TOL after specified DELAY.	
		HI	High airflow alarm. Active above SETPNT + TOL after specified DELAY.	
		HI/LO	High/Low airflow alarm. Active above/below SETPNT ± TOL after specified DELAY.	
27	SETPNT	{}	Alarm setpoint, in cfm [lps]. *Note:The default {} value for SETPNT is OA SET when OAC is set to FLOW, the calculated active airflow setpoint when OAC is set to OAF/CO2 or COUNT, or 0 when OAC is set to FIXED or PASS.*	
28	TOL	15%	Alarm tolerance, ½ OAF PID deadband tolerance to 50%	
29	DELAY	1	Delay, 0 to 30 minutes, after alarm is "outside" of tolerance before alarm is active.	
30	ITEM 31 to 36 are only visible if CO2 TYP is equal to ANLG or MS/TP (i.e. a CO2 sensor is installed).			
31	CO2 ALARM	OFF	All mode CO2 notification alarm disabled.	36
		MAN	All mode CO2 notification alarm enabled. Manual reset required.	
		AUTO	All mode CO2 notification alarm enabled. Automatic reset with return to in tolerance.	

OAC FIRMWARE CONFIGURATION

32	R1 BIND	NO	Do not bind active alarm to relay, R1.	
		YES	Bind active alarm to relay, R1 (requires R1 ASGN=ALRMS during hardware config.).	
33	TYPE	HI	High CO2 alarm. Active below SETPNT - TOL after specified DELAY.	
34	SETPNT	{}	Alarm setpoint, in ppm. *Note:The default {} value for SETPNT is CO2 SET when OAC is set to CO2, or 1,000 when OAC is set to FLOW, CO2/OAF, COUNT, FIXED or PASS.* ***Important: 1,000 ppm may be exceeded whenever 18 cfm [3.4 lps] or less is provided to sedentary adults even though the ventilation rate provided may meet the requirement of ASHRAE standard 62.1.***	
35	TOL	15%	Alarm tolerance, ½ CO2 PID deadband tolerance to 50%	
36	DELAY	10	Delay, 0 to 30 minutes, after alarm is "outside" of tolerance before alarm is active.	
37	TRBL ALARM	OFF	System status notification alarm disabled.	39
		MAN	System status notification alarm enabled. Manual reset required.	
		AUTO	System status notification alarm enabled. Automatic reset with return to in tolerance.	
38	R1 BIND	NO	Do not bind active alarm to relay, R1.	
		YES	Bind active alarm to relay, R1 (requires R1 ASGN=ALRMS during hardware config.).	
39	DONE	SAVE	Save changes and return to normal operation.	
		CANCEL	Do not save changes and return to normal operation.	
		RESET	Reset to factory default configuration and return to normal operation.	

OAC SCHEDULE CONFIGURATION

SCHEDULE CONFIGURATION

Open by simultaneously pressing ↑{EN} during normal operation

Use ↑↓ buttons to navigate up/down menu. Press {ENT} to modify (parameter will flash). Use ↑↓ buttons to modify, {ENT} to accept, {ESC} to keep previous.

Fixed parameters (parameters that cannot be changed) will indicate "PARAMETER FIXED"

If LOCK SECURITY<>NONE using the SETUP MENU pressing enter will indicate "CONFIG LOCKED" and only parameter viewing is allowed.

Navigate entire menu to step 25 to save settings. Press {ESC} twice at any time to exit without saving changes.

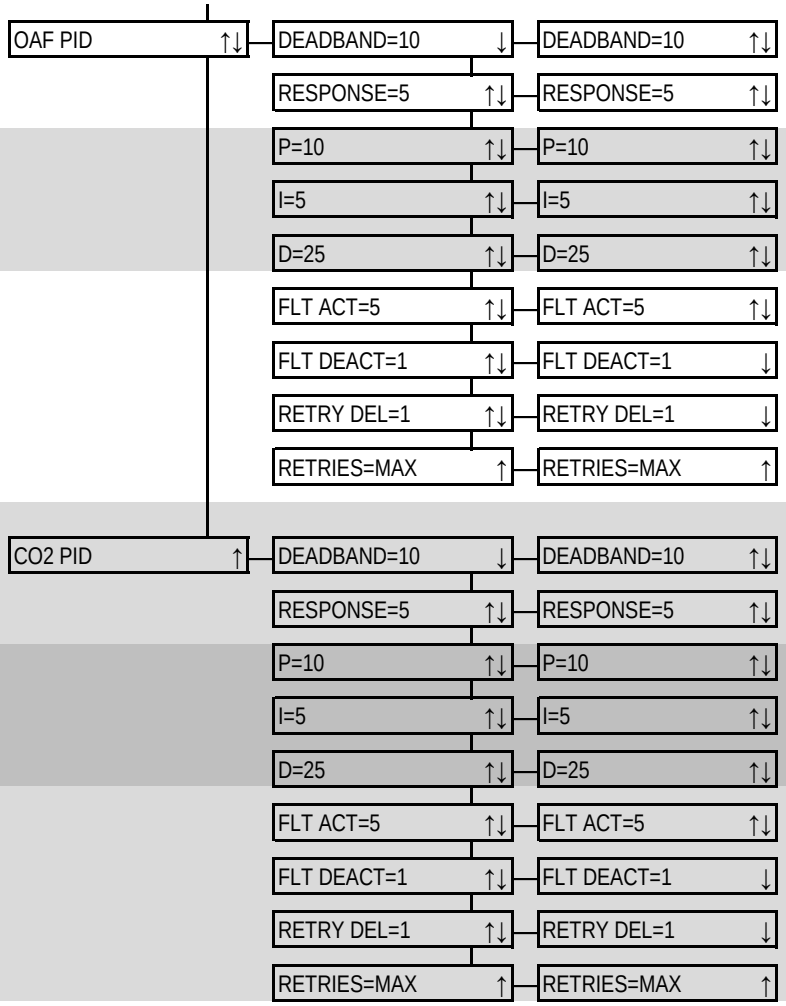
ITEM #	PARAMETER	VALUE	DESCRIPTION	SKIP TO
1	TIME	12:00 AM	Time of day.	
2	MONTH	1	Month.	
3	DAY	1	Day of month.	
4	YEAR	2017	Year.	
5	TRIG ENABLE	YES	The binary trigger must be enabled for OCC or UNOC modes to be active.	
		NO	OCC and UNOC modes are determined only by the schedule.	
6	SCHED	OFF	No schedule set.	25
		DAYS	Allows a different occupied start time and duration to be entered for each day of the week.	11
		WEEKS	Allows a different occupied start time and duration to be entered for weekdays and weekends.	
7	M-F OCC	OFF	Set the occupied start time for Monday to Friday, OFF or time of day.	
		12:00 AM		
8	OCC HRS	0.0	Set the occupied duration, in hours, for Monday to Friday.	
9	S-S OCC	OFF	Set the occupied start time for Saturday and Sunday, OFF or time of day.	
		12:00 AM		
10	OCC HRS	0.0	Set the occupied duration, in hours, for Saturday and Sunday.	25
11	MON OCC	OFF	Set the occupied start time for Monday, OFF or time of day.	
		12:00 AM		
12	OCC HRS	0.0	Set the occupied duration, in hours, for Monday.	
13	TUE OCC	OFF	Set the occupied start time for Tuesday, OFF or time of day.	
		12:00 AM		
14	OCC HRS	0.0	Set the occupied duration, in hours, for Tuesday.	
15	WED OCC	OFF	Set the occupied start time for Wednesday, OFF or time of day.	
		12:00 AM		
16	OCC HRS	0.0	Set the occupied duration, in hours, for Wednesday.	
17	THU OCC	OFF	Set the occupied start time for Thursday, OFF or time of day.	
		12:00 AM		
18	OCC HRS	0.0	Set the occupied duration, in hours, for Thursday.	
19	FRI OCC	OFF	Set the occupied start time for Friday, OFF or time of day.	
		12:00 AM		
20	OCC HRS	0.0	Set the occupied duration, in hours, for Friday.	
21	SAT OCC	OFF	Set the occupied start time for Saturday, OFF or time of day.	
		12:00 AM		
22	OCC HRS	0.0	Set the occupied duration, in hours, for Saturday.	
23	SUN OCC	OFF	Set the occupied start time for Sunday, OFF or time of day.	
		12:00 AM		
24	OCC HRS	0.0	Set the occupied duration, in hours, for Sunday.	
25	DONE	SAVE	Save changes and return to normal operation.	
		CANCEL	Do not save changes and return to normal operation.	
		RESET	Reset to factory default configuration and return to normal operation.	

OAC CONTROLLER - ADVANCED SETUP

Open by simultaneously pressing {ESC} ↑ during normal operation. Follow navigation rules below.

↑ or↓ Move up/dwn {ENT} Move right {ESC} Exit menu	↑ or↓ Move up/dwn {ENT} Move right {ESC} Move left	↑ or↓ Move up/dwn {ENT} Move right {ESC} Move left	↑ or↓ Modify (Parameter Flashes) {ENT} Accept, move left {ESC} Cancel, move left	Range/Units (if applicable) IP Min/Max	 SI Min/Max	Notes/Comments
ADVANCED ↓	SYSTEM ↓	U/M=IP ↓	U/M=IP ↓			Imperial/US customary units (ft, fpm, cfm, °F)
			U/M=SI ↑			International system of units (m, m/s, lps, °C)
		AF METH=ACT ↑↓	AF METH=ACT ↓			Actual air velocity or volumetric flow
			AF METH=STD ↑			Standard (mass) air velocity or volumetric flow
		ALT=0 ↑	ALT=0 ↑↓	-200/20000 ft	-60/6000 m	Altitude
	DAMPER ↑↓	STROKE=100 ↑	STROKE=100 ↓	25/100 %		Damper stroke at full open position
	OAF SENSOR ↑↓	LCD INT=300 ↓	LCD INT=300 ↑↓	1/3000		Integration buffer size for airflow on LCD
OAC-5000 Only		OAF SGNL=0-10V ↑↓	OAF SGNL=0-10V ↓			Linear analog output for airflow (AO2)
			OAF SGNL=2-10V ↑↓			
			OAF SGNL=0-5V ↑↓			
			OAF SGNL=1-5V ↑			
		OAF UNITS=FPM ↑↓	OAF UNITS=FPM ↓			Velocity, FPM [MPS]
			OAF UNITS=CFM ↑			Volumetric Flow, CFM [LPS]
		OAF FS=2000 ↑↓	OAF FS=2000 ↑↓	100/9999 Units	50/5000 Units	Full scale airflow
		OAF INT=30 ↑↓	OAF INT=30 ↑↓	1/1000		Integration buffer size for airflow analog output
		GAIN=1 ↑↓	GAIN=1 ↑↓			Gain adjustment for OAF flow
		OFFSET=0 ↑↓	OFFSET=0 ↑↓	±20000 cfm	±10000lps	Offset adjustment for OAF flow
		ADJUST=OFF ↑↓	ADJUST=OFF ↓			Disable offset/gain adjustments
			ADJUST=ON ↑			Enable offset/gain adjustments
		EXT CAB=0 ↑↓	EXT CAB=0 ↑	0/40 ft	0/12.2 m	Extension cable added to original flow probes
		RESET PROBES ↑	RESET=N ↓			Do not clear probe cal data
			RESET=Y ↑			Clear probe cal data and read/re-write one wire memory data

OAC CONTROLLER - ADVANCED SETUP



	10/50%	Deadband (centered)	
	1/10 or CUS	PID response time (recommended)	
RESPONSE=CUS	1 to 100%	Proportional term	
	1 to 100%	Integral term	
	1 to 100%	Derivative term	
	1/30 minutes	Delay before "far out" goes to active "fault"	
	1/30 minutes	Delay after return to "outside" or "normal" to deactivate "fault"	
	1/30 minutes	Delay before clearing "fault" to "normal" for control retry	
	0/999 or MAX (no limit)	Number of retries allowed for control retry	
CO2 TYPE<>NONE			
	10/50%	Deadband (centered)	
	1/10 or CUS	PID response time (recommended)	
RESPONSE=CUS	1 to 100%	Proportional term	
	1 to 100%	Integral term	
	1 to 100%	Derivative term	
	1/30 minutes	Delay before "far out" goes to active "fault"	
	1/30 minutes	Delay after return to "outside" or "normal" to deactivate "fault"	
	1/30 minutes	Delay before clearing "fault" to "normal" for control retry	
	0/999 or MAX (no limit)	Number of retries allowed for control retry	

OAC CONTROLLER - TOOLS

Open by simultaneously pressing {ESC} ↑ during normal operation. Follow navigation rules below.

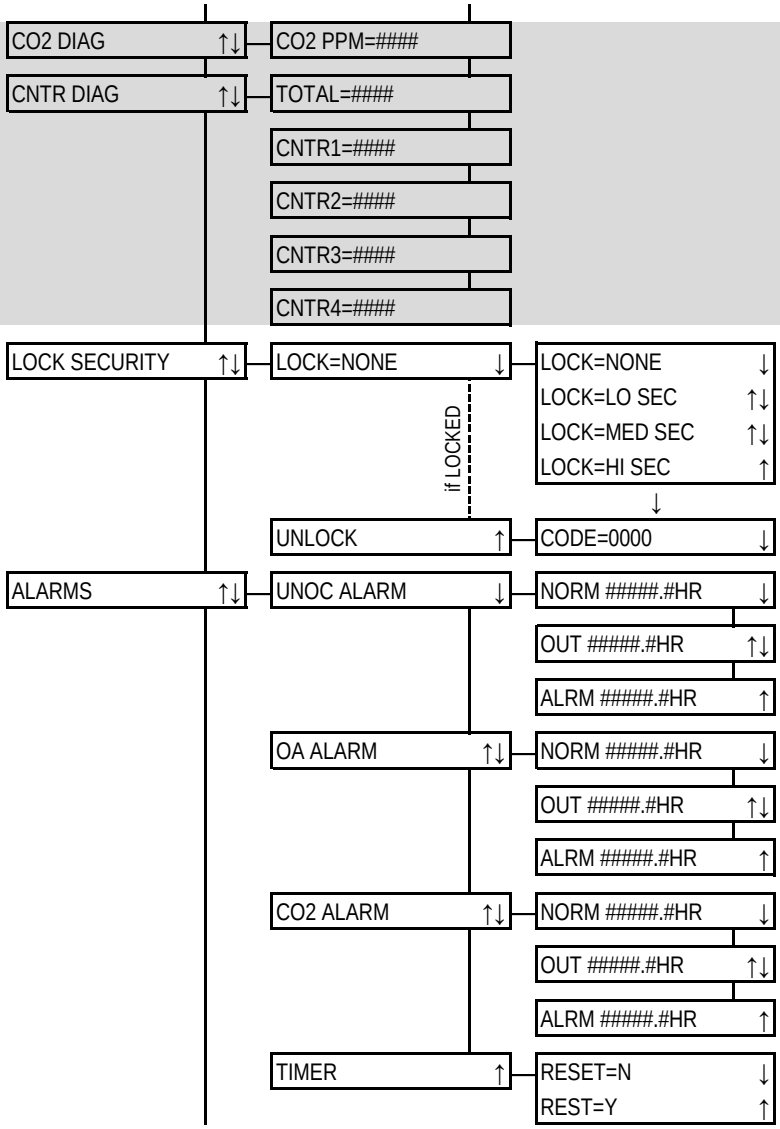
↑ or↓ Move up/dwn {ENT} Move right {ESC} Exit menu	↑ or↓ Move up/dwn {ENT} Move right {ESC} Move left	↑ or↓ Move up/dwn {ENT} Run tool {ESC} Cancel, move left	Notes/Comments
ADVANCED ↓			
TOOLS ↑↓	TEST DMPR ↓	{RUN TOOL}	Set damper between 0 and 100% open and display airflow
	FIND MIN POS ↑↓	{RUN TOOL}	Enter desired minimum nominal airflow rate to find MIN POS. Write MIN POS to memory.
	ADJUST OAF ↑	{RUN TOOL}	Run outdoor air field adjust wizard and write GAIN and OFFSET to memory.

OAC CONTROLLER - DIAGNOSTICS

Open by simultaneously pressing {ESC} ↑ during normal operation. Follow navigation rules below.

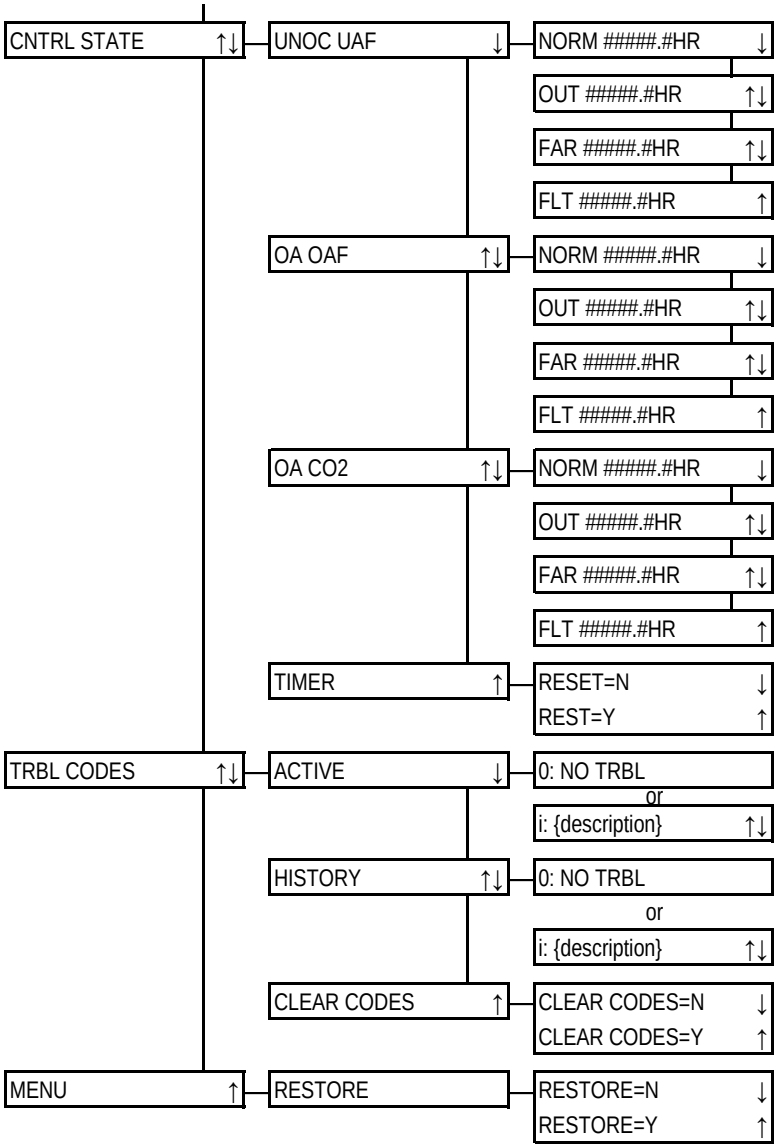
↑ or↓ Move up/dwn {ENT} Move right {ESC} Exit menu	↑ or↓ Move up/dwn {ENT} Move right {ESC} Move left	↑ or↓ Move up/dwn {ENT} Move right {ESC} Move left	↑ or↓ Modify/Scroll, Parameter Flashes {ENT} Accept/Hold Last {ESC} Cancel, move left	Range/Units (if applicable) IP Min/Max	 SI Min/Max	Notes/Comments
ADVANCED ↓						
TOOLS ↑↓						
DIAGNOSTICS ↑	DEV DIAG ↓	DEV# ##### ↓				
		PCB# ######## ↑↓				
		FW VER #.## ↑↓				
		READ AI1 ↑↓	AI1=##.###		%	Input percentage of AI1
		READ AI2 ↑↓	AI2=##.###		%	Input percentage of AI2
		READ AO1 ↓	AI1=##.###		%	Output percentage of AO1
		READ AO2 ↑↓	AI2=##.###		%	Output percentage of AO2
		READ R1 ↑↓	R1={}		OFF or ON	Relay status
		SET AO1 ↑↓	AO1=0% ↑↓		%	Set output percentage of AO1. Reverts to operation on exit.
		SET AO2 ↑↓	AO2=0% ↑↓		%	Set output percentage of AO2. Reverts to operation on exit.
		SET R1 ↑	R1 STAT=OFF ↓			Disable relay R1. Reverts to operation on exit.
			R1 STAT=ON ↑			Enable relay R1. Reverts to operation on exit.
	OAF DIAG ↑↓	PROBE SN ↓	P1=##### ↓			Serial number of probe(s)
		AVG VEL ↑↓	VEL=####	fpm	m/s	Average velocity of integral airflow probe(s)
		AVG TEMP ↑↓	TEMP=###.#	F	C	Average temperature of integral airflow probes(s)
		SENS VEL ↑↓	S1=#### ↓	fpm	m/s	Individual sensor node velocities
		SENS TEMP ↑↓	T1=##.# ↓	F	C	Individual sensor node temperatures
		HS VOLTS ↑↓	HS1=##.## ↓		volts	Self-heated thermistor voltage
		TS VOLTS ↑	TS1=##.## ↓		volts	Temperature sensor voltage

OAC CONTROLLER - DIAGNOSTICS



IF INSTALLED			
	CO2 PPM=####	ppm	Analog or MS/TP CO2 sensor reading
	TOTAL=####	people	MS/TP occupancy counter total reading
	CNTR1=####	people	MS/TP occupancy counter 1 reading
	CNTR2=####	people	MS/TP occupancy counter 2 reading
	CNTR3=####	people	MS/TP occupancy counter 3 reading
	CNTR4=####	people	MS/TP occupancy counter 4 reading
	LOCK=NONE		No lock security code required to change configuration/settings
	LOCK=LO SEC		Low lock security
	LOCK=MED SEC		Medium lock security
	LOCK=HI SEC		High lock security
	CODE=0000		Lock/unlock code
	NORM #####.#HR		Hours normal
	OUT #####.#HR		Hours outside (not normal)
	ALRM #####.#HR		Hours active fault
	NORM #####.#HR		Hours normal
	OUT #####.#HR		Hours outside (not normal)
	ALRM #####.#HR		Hours active fault
	NORM #####.#HR		Hours normal
	OUT #####.#HR		Hours outside (not normal)
	ALRM #####.#HR		Hours active fault
	RESET=N		Do not clear
	REST=Y		Reset timer for alarms

OAC CONTROLLER - DIAGNOSTICS



Normal control

Outside control but not far out

Far out but not fault

Fault

Normal control

Outside control but not far out

Far out but not fault

Fault

Normal control

Outside control but not far out

Far out but not fault

Fault

Do not clear

Reset timer for modes

No trouble codes active

Active trouble codes and description

No trouble history

Trouble history in chronoligical order (active and intactive)

Do not clear

Clear active trouble codes and history

Do not restore menu

Reset menu settings to factory default

DISPLAY FUNCTION

STARTUP DISPLAY (after power up)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	O	A	C	-	5	0	0	0									Display Series and Board Model
	F	I	R	M	W	R	E		#	#	.	#	#				Display Firmware Version
	M	M	-	D	D	-	Y	Y		T	T	:	T	T	?	M	Date and Time (3000S only)
	O	A	F		P	1								#	#	#	P1 Presence: YES, NO
	O	A	F		P	2								#	#	#	P1 Presence: YES, NO
	C	O	2		T	Y	P	E				#	#	#	#	#	CO2 Type: NONE, ANLG, MS/TP
	N	1		D	E	V	I	C	E	S			#	#	#	#	N1 DEVICES (N1 DEV): NONE, SENS, BAS
Visible if N1 DEV <> NONE	C	O	2		M	S	/	T	P				#	#	#	#	NONE, ERR or Last 4 digits of DI*
	C	N	T	R	1		M	S	/	T	P		#	#	#	#	NONE, ERR or Last 4 digits of DI*
	C	N	T	R	2		M	S	/	T	P		#	#	#	#	NONE, ERR or Last 4 digits of DI*
	C	N	T	R	3		M	S	/	T	P		#	#	#	#	NONE, ERR or Last 4 digits of DI*
	C	N	T	R	4		M	S	/	T	P		#	#	#	#	NONE, ERR or Last 4 digits of DI*
	R	1		A	S	G	N					#	#	#	#	#	R1 Assignment: ALRMS or MODE

* Notes:

NONE - Sensor not conigured

ERR - Configured sensor not found when N1 DEVICES=BAS (Operate in PASS MODE if OAC = CO2 or OAF/CO2)

ERR - Configured sensor not found after discovery delay when N1 DEVICES=SENS (Operate in PASS MODE if OAC = CO2 or OAF/CO2)

Last 4 digits of DI - Configured sensor found

DISPLAY FUNCTION

SETPOINT DISPLAY (OAC=FLOW)

Press ↑ or ↓ arrow to enter setpoint display mode. Use ↑ or ↓ to change setpoint. Return to normal operating display after 15 seconds.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
S	E	T	P	N	T		#	#	#	#	C	F	M	↑	↓	Display Active Setpoint

NORMAL OPERATING DISPLAY (OAC=FLOW, CO2/OAF or COUNT)

↑ or ↓ arrows changes setpoint.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
#	#	#	#	C	F	M						X	X	X	X	Display Airflow (Control state=Normal) and Mode
#	#	#	#	C	F	M	+					X	X	X	X	Display Airflow + (Control state=Outside High) and Mode
#	#	#	#	C	F	M	–					X	X	X	X	Display Airflow - (Control state=Outside Low) and Mode
#	#	#	#	C	F	M	+	+				X	X	X	X	Display Airflow ++ (Control state=Far Out High) and Mode
#	#	#	#	C	F	M	–	–				X	X	X	X	Display Airflow -- (Control state=Far Out Low) and Mode
#	#	#	#	C	F	M	+	+				X	X	X	X	Display Airflow ++ flashes (Control state=Active Control Fault High) and Mode
#	#	#	#	C	F	M	–	–				X	X	X	X	Display Airflow -- flashes (Control state=Active Control Fault Low) and Mode
#	#	#	#	C	F	M	?	?		T		X	X	X	X	Display Airflow, {?? = control state}, TRBL Alarm Active and Mode
#	#	#	#	C	F	M	?	?		U		X	X	X	X	Display Airflow, {?? = control state}, UNOC Alarm Active and Mode
#	#	#	#	C	F	M	?	?		M		X	X	X	X	Display Airflow, {?? = control state}, MOA Alarm Active and Mode
#	#	#	#	C	F	M	?	?		C		X	X	X	X	Display Airflow, {?? = control state}, CO2 Alarm Active and Mode

Note: Multiple active alarms will cycle on display. Escape clears manual active alarms.

DISPLAY FUNCTION

SETPOINT DISPLAY (OAC=CO2)

Press ↑ or ↓ arrow to enter setpoint display mode. Use ↑ or ↓ to change setpoint. Return to normal operating display after 15 seconds.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
S	E	T	P	N	T		#	#	#	#	P	P	M	↑	↓	Display Active Setpoint

NORMAL OPERATING DISPLAY (OAC=CO2)

↑ or ↓ arrows changes setpoint.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
#	#	#	#	P	P	M						X	X	X	X	Display CO2 (Control state=Normal) and Mode
#	#	#	#	P	P	M	+					X	X	X	X	Display CO2 + (Control state=Outside High) and Mode
#	#	#	#	P	P	M	–					X	X	X	X	Display CO2 - (Control state=Outside Low) and Mode
#	#	#	#	P	P	M	+	+				X	X	X	X	Display CO2 ++ (Control state=Far Out High) and Mode
#	#	#	#	P	P	M	–	–				X	X	X	X	Display CO2 -- (Control state=Far Out Low) and Mode
#	#	#	#	P	P	M	+	+				X	X	X	X	Display CO2 ++ flashes (Control state=Active Control Fault High) and Mode
#	#	#	#	P	P	M	–	–				X	X	X	X	Display CO2 -- flashes (Control state=Active Control Fault Low) and Mode
#	#	#	#	P	P	M	?	?		T		X	X	X	X	Display CO2, {?? = control state}, TRBL Alarm Active and Mode
#	#	#	#	P	P	M	?	?		U		X	X	X	X	Display CO2, {?? = control state}, UNOC Alarm Active and Mode
#	#	#	#	P	P	M	?	?		C		X	X	X	X	Display CO2, {?? = control state}, CO2 Alarm Active and Mode

Note: Multiple active alarms will cycle on display. Escape clears manual active alarms.

DISPLAY FUNCTION

NORMAL OPERATING DISPLAY (OAC=FIXED)

OAC=FIXED: Setpoint changed in SETUP CONFIG (MIN POS).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
#	#	#	#	C	F	M						X	X	X	X	Display airflow and Mode
#	#	#	#	C	F	M				T		X	X	X	X	Display Airflow, TRBL Alarm Active and Mode
#	#	#	#	C	F	M				M		X	X	X	X	Display Airflow, MOA Alarm Active and Mode
#	#	#	#	C	F	M				C		X	X	X	X	Display Airflow, CO2 Alarm Active and Mode

Note: Multiple active alarms will cycle on display. Escape clears manual active alarms.

DISPLAY FUNCTION

DETAIL DISPLAY

Press {ENT} to show itemized, {ESC} from itemized returns to normal or after 60 second timeout.
Display will step through the following items. Some items are MOAC dependent.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
M	O	D	E									X	X	X	X	Active Mode, OFF, UNOC, OCC
O	A	C							X	X	X	X	X	X	X	OAC method
M	M	–	D	D	–	Y	Y		T	T	:	T	T	?	M	Date and Time (3000S only)
D	M	P	R									#	#	#	%	Current Damper Position
S	E	T	P	N	T						#	#	#	#	%	Setpoint if OAC=FIXED
S	E	T	P	N	T				#	#	#	#	C	F	M	Setpoint if OAC=FLOW, CO2/OAF, or COUNT
O	A	F							#	#	#	#	C	F	M	Measured airflow
S	E	T	P	N	T				#	#	#	#	P	P	M	Setpoint if OAC=CO2
C	O	2							#	#	#	#	P	P	M	Display measured CO2 level (if CO installed)
P	O	P		E	S	T						#	#	#	#	Display calculated occupancy using CO2/OAF (if CO2 installed)
C	O	U	N	T	E	R						#	#	#	#	Display counter occupancy (if counter installed)