KMC Conquest™ Controller

Application Guide

Contents

GENERAL INFORMATION

TERMINAL COLOR CODE	
Black	24 VAC/VDC Power
Gray	MS/TP and CAN Communications
Green	Inputs and Outputs

About KMC Conquest

KMC Conquest controllers are fully programmable, native BACnet controllers with integrated alarming, trending, and scheduling. This applications guide provides expanded installation information, sequences of operation, troubleshooting, and other information. For additional installation instructions, see the installation guides for the respective products.

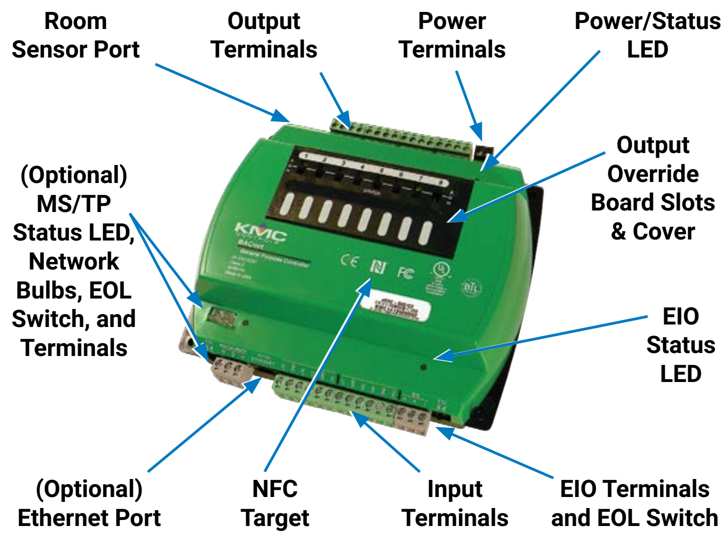


Illustration: Controller Overview (BAC-5901)

Specifications and Accessories

See the relevant KMC Conquest data sheets for:

- **BAC-5900 Series BACnet General Purpose Controllers**
- **CAN-5900 Series I/O Expansion Modules**
- **BAC-9000 Series BACnet VAV Controller-Actuators**
- **BAC-9300 Series BACnet Unitary Controllers**
- **STE-9000 Series NetSensors Digital Room Sensors**
- **TSP-8003 (Dual Duct) Tri-State Actuator with Pressure Sensor**

See also the **Conquest Selection Guide** and the **BAC-5051E BACnet Router**.

Installation Instructions

See the relevant KMC Conquest installation guides for:

- **BAC-5900 Series BACnet General Purpose Controllers**
- **CAN-5900 Series I/O Expansion Modules**
- **BAC-9000 Series BACnet VAV Controller-Actuators**
- **BAC-9300 Series BACnet Unitary Controllers**
- **STE-9000 Series NetSensors Digital Room Sensors**
- **TSP-8003 (Dual Duct) Tri-State Actuator with Pressure Sensor**

For the STE-9000 Series NetSensors, see also the **Room Sensor and Thermostat Mounting and Maintenance Application Guide**.

For 4–20 ma applications, see also the **4–20 mA Wiring for Controllers Application Guide**.

Submittal Sheets (Diagrams and Operation)

BAC-9300 series unitary controllers and BAC-9000 series VAV controllers have a collection of submittal sheets for common applications available through the KMC Connect, TotalControl, or Converge configuration wizards. The submittal sheets include wiring diagrams and sequences of operation.

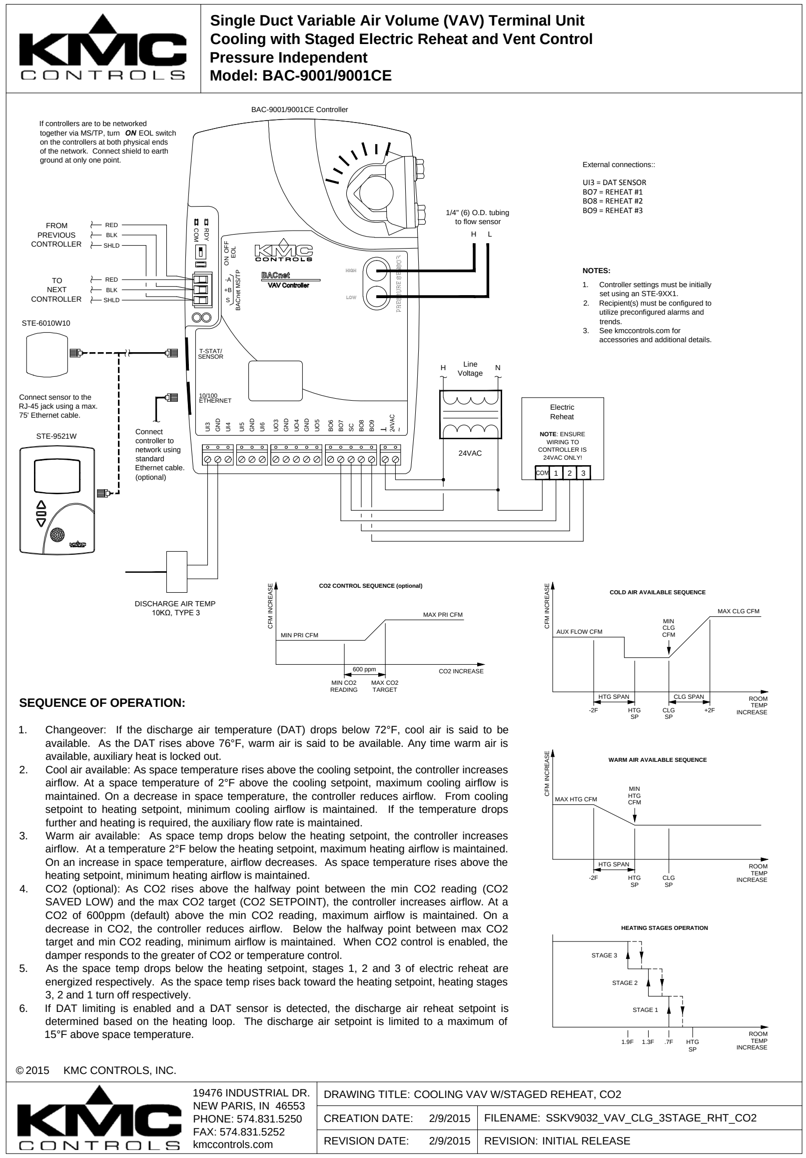


Illustration: Sample (VAV) Submittal Sheet

See the applications library in KMC Connect, TotalControl, or Converge to download the sheets.

Support

Additional resources for installation, configuration, application, operation, programming, upgrading and much more are available on the KMC Controls web site (**www.kmccontrols.com**). To see all available files, log-in to the KMC Partners site.

Important Notices

The material in this document is for information purposes only. **The contents and the product it describes are subject to change without notice.** KMC Controls, Inc. makes no representations or warranties with respect to this document. In no event shall KMC Controls, Inc. be liable for any damages, direct or incidental, arising out of or related to the use of this document.

Specifications and design are subject to change without notice.

Notes and Cautions

NOTE: In this document, a **NOTE** provides additional information that is important.

⚠ CAUTION

In this document, a CAUTION indicates potential personal injury or equipment or property damage if instructions are not followed.

Handling Precautions

For **digital and electronic** sensors, thermostats, and controllers, take reasonable precautions to prevent electrostatic discharges to the devices when installing, servicing, or operating them. Discharge accumulated static electricity by touching one's hand to a securely grounded object before working with each device.

CONNECTIONS

Input Connections (Room Sensor Port)

Dedicated Use of Room Sensor Port

⚠ CAUTION

On Conquest "E" models, do NOT plug the cable meant for Ethernet communications into the Room Sensor jack. The Room Sensor port powers a NetSensor, and the supplied voltage may damage an Ethernet card, switch, or router to which it is accidentally connected. See **Illustration: Inputs and Ethernet Port (BAC-9001CE) on page 7****.**

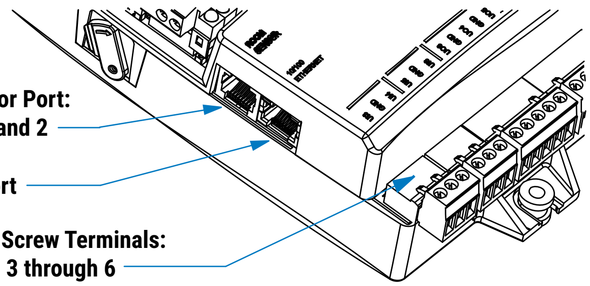


Illustration: Inputs and Ethernet Port (BAC-9001CE)

NOTE: The **input objects AI1 and AI2 are dedicated for use with analog electronic STE-6010, STE-6014, and STE-6017 sensors**, but not digital STE-9xx1 NetSensors. See **Analog STE-6000 Series Thermistor Sensors on page 7**. When a NetSensor is connected to the port, AI1 and AI2 will appear in software to be unused. The NetSensor digitally communicates with the value objects AV1, AV4, and AV5. See **Digital STE-9000 Series NetSensors on page 7**.

NOTE: For additional information on value objects, see **BACnet Objects List on page 75**.

Digital STE-9000 Series NetSensors

These KMC Conquest digital wall sensors include a room temperature sensor, optional sensors (humidity, motion, and/or CO_2), a digital display, and a push-button interface for entering setpoints and configuring the controllers. Connection is made using a standard Ethernet patch cable. If an STE-9000 series sensor is detected, the sensor's temperature is mapped to the Space Temperature Reference value object (AV1) as the temperature input value. The cooling and heating setpoints are mapped to Active Cooling Setpoint (AV4) and Active Heating Setpoint (AV5).

See also **STE-93xx/95xx CO2 Sensor and DCV on page 18**.

Analog STE-6000 Series Thermistor Sensors

Three models of the STE-6000 series sensors are compatible with the Room Sensor port on KMC Conquest VAV controllers. If an STE-6010, STE-6014, or STE-6017 is connected to the Room Sensor port (with a standard Ethernet patch cable), the sensor's **temperature** from AI1 is mapped to the Space Temperature Reference value object (AV1) as the temperature input value.

STE-6010

STE-6014

STE-6017

Illustration: STE-601x Sensors Compatible with Room Temp. Port

The STE-6014 and STE-6017 include a dial for adjusting the zone **setpoint**. If either of these two sensors is detected, the reading of the dial setting (AI2) is mapped to the Setpoint Offset (AV2).

The default range of the offset is plus or minus 1° F. This means that, **with the STE-6014/6017, users can adjust the scheduled setpoint by a maximum of one degree up or down**. To change the range, import custom table values into (Table Object) Input Table 4 using KMC Connect or TotalControl.

The STE-6017 also includes a button that will shunt the thermistor when pushed (SENSORON) to indicate an **override** of an unoccupied state. Local Override (e.g., BV4 in a BAC-9001) then becomes Active until the Local Override Timer (AV38) value is exceeded. (The controller performs the override function automatically, and no additional Control Basic programming using SENSORON is required.)

NOTE: The STE-6014/6017 override button needs to be pressed and held for at least a half a second to be reliably recognized for override mode.

Input Connections (Universal, Terminals)

NOTE: On Conquest controllers, Inputs 1 and 2 are dedicated to the Room Sensor port. Terminals on removable green blocks start with Input 3. (See **Illustration: Controller Overview (BAC-5901) on page 4** and **Illustration: Inputs and Ethernet Port (BAC-9001CE) on page 7**.) The input object AI1 is dedicated to the room temperature, and object AI2 is dedicated to room temperature setpoint. If reusing Custom Control Basic programs from older controllers, make any necessary changes to the input objects in the program.

The universal inputs on green terminal blocks can be configured as:

- Analog objects—Changing resistance (thermistor) or 0 **TO** 12 VDC
- Binary objects—Open/Close passive switch or 0 **OR** 12 VDC

For an **active** voltage input, configure the input for 0–12 VDC (in Hardware Bias drop-down selection of KMC Connect).

For **passive** input signals, such as thermistors or switch contacts, configure the input for 10K ohm (or 1K ohm for most RTDs) pull-up resistor.

For a **pulse** input signal, configure the input in the following manner:

- If the pulse input is a passive input, such as switch contacts, then configure the input for 10K ohm pull-up resistor.
- If the pulse is an active voltage up to a maximum of 12 VDC, then configure the input for 0–12 VDC.

For a **4–20 mA** current loop input, configure the input for 0–20 mA. See also the **4–20 mA Wiring for Controllers Application Guide**.

Output Connections

Connecting Universal Outputs

Connect the output device under control between the output terminal and the ground (GND) terminal on the same bank. On BAC-9300 series, Switched Common (SC) terminals are used on the BO terminals. On BAC-5900 series controllers and CAN-5900 series expansion modules, SC terminals are only used with some of the output override boards. See **Grounds Versus Switched (Relay) Commons on page 9**.

The universal outputs (on green terminal blocks) can be configured as:

- Analog objects—0 TO 12 VDC
- Binary objects—0 OR 12 VDC

For either type of output, the DC voltage signals can—within the specification of the output—connect directly to most equipment. For additional options, see **Installing Override Boards in BAC/CAN-5900 Series on page 11**.

NOTE: For 4–20 ma applications, see also the **4–20 mA Wiring for Controllers Application Guide**.

Grounds Versus Switched (Relay) Commons

Use the SC terminal in the same output bank (individual terminal block) as its output terminal. The switched common terminals are isolated from the circuit grounds used for the universal output analog circuitry in controllers. See **Illustration: Conquest SC Terminals on page 9**.

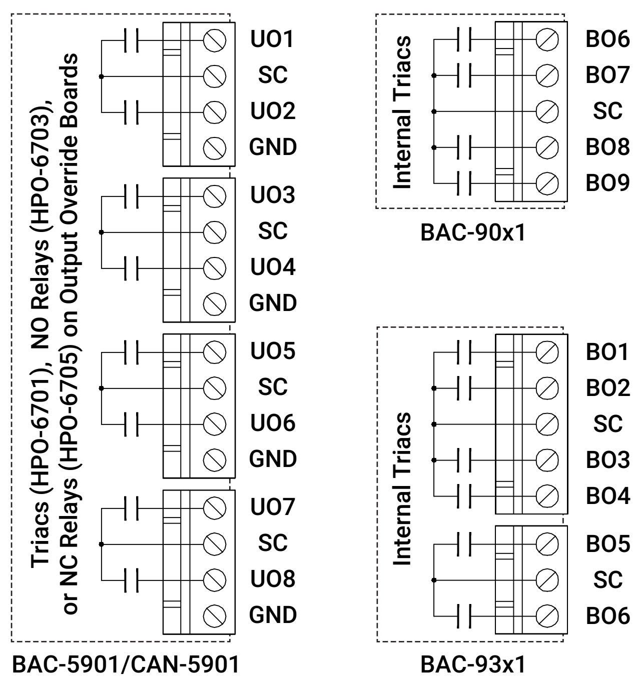


Illustration: Conquest SC Terminals

See also **SC Terminals in Initial BAC-93xx Controllers on page 10**.

Switched Common (SC) output terminals are unconnected in the BAC-5900 series controller unless the jumper is removed and an appropriate relay/triac override output board is installed. **Use only the Switched (relay) Common instead of the Ground with the HPO-6701 triac and HPO-6703/6705 relays!** See **Illustration: Output Override Boards Configuration on page 11** and **Illustration: Output Schematics on page 11**.

SC Terminals in Initial BAC-93xx Controllers

Initial shipments of BAC-93x1 controllers (**before** Date Code 1535, shipped Sept. 1, 2015, S/N KMC1509xxxxxx) had the SC (Switched Common) terminals of the two binary terminal blocks connected together on the circuit board. (See **Illustration: Initial BAC-93xx Controller SC Terminals on page 10**.)

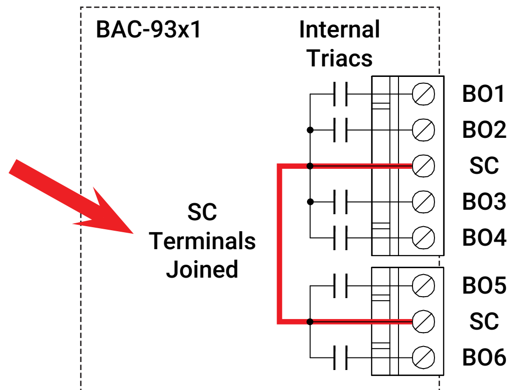


Illustration: Initial BAC-93xx Controller SC Terminals

Having SC terminals joined together is a convenience for most applications.

⚠ CAUTION

> **If SEPARATE transformers or power supplies are connected to the SC terminals of these controllers, however, equipment damage could occur.**

For example, a transformer and output device connected to the triac on BO1 and the corresponding (upper) SC terminal may conflict with another transformer and device connected to the BO5 triac and the corresponding (lower) SC terminal.

NOTE: The switched common terminals are isolated from the circuit grounds used for the universal output analog (VDC) circuitry in controllers. Triacs are for VAC only.

For these BAC-9300 series controllers:

- Connect (only) a single source of power to either SC terminal.
- If separate circuits with separate power sources are needed, connect an intermediate relay (such as an REE-3101) to an output or replace the BAC-93xx with a later unit (after Date Code 1535, shipped Sept. 1, 2015).

Later shipments of BAC-9300 series controllers have the SC terminals separate as shown in **Illustration: Conquest SC Terminals on page 9**.

Installing Override Boards in BAC/CAN-5900 Series

For enhanced output options, such as manual control or using large relays or devices that cannot be powered directly from a standard output, install output override boards (also called "cards"). See **Illustration: Output Override Boards Configuration on page 11**.

Output boards have an accessible three-position slide switch for selecting the "Hand-Off-Auto" functions:

- While in the "Hand" (H) position, the output is manually energized, and the controller receives a feedback signal to indicate the output has been overridden.
- While in the "Off" (O) position, the output is manually de-energized, and the controller receives a feedback signal to indicate the output has been overridden.
- While in the "Auto" (A) position, the output is under the command of the controller.

Each output board also has a red LED that illuminates when the output is turned On (either manually or automatically).

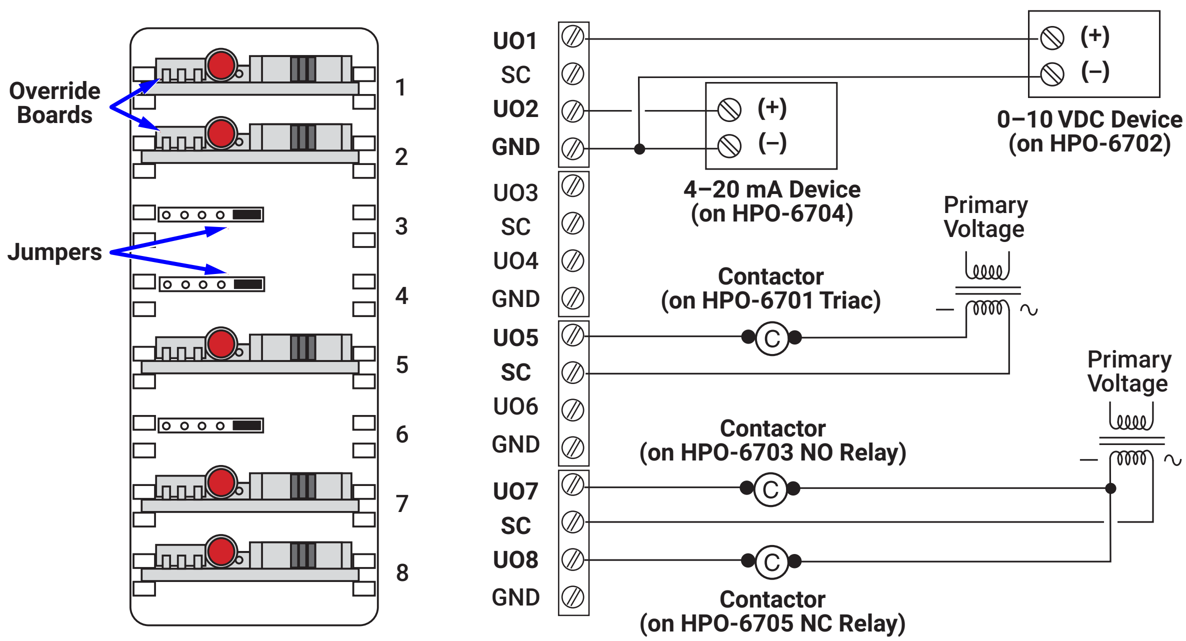
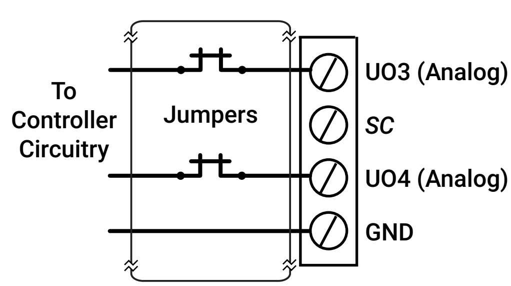
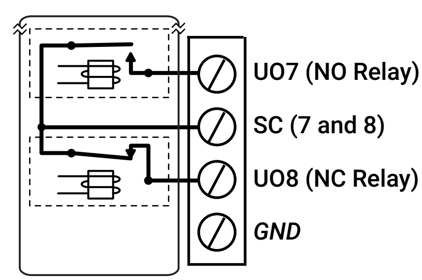


Illustration: Output Override Boards Configuration

Simplified Schematic of Standard Analog (GND) Outputs



Simplified Schematic of Override Board Relay (SC) Outputs



HPO-6703/6705 Relay Boards
(Coils Controlled by Controller Circuitry)

Illustration: Output Schematics

The following output boards are available from KMC Controls:

OUTPUT OVERRIDE BOARDS	
Model Number	**Output Type***
HPO-6701**	**Triac (AC only):** zero-cross switching, optical isolation, 12 VAC min. and 30 VAC max. voltage, 20 mA min. and 1 A max. current
HPO-6702	**0–10 VDC analog:** short protection, 100 mA max., adjustable override potentiometer
HPO-6704	**4–20 mA current loop:** short protection, adjustable override potentiometer (since the HPO-6704 supplies the power, it will not work with a 4–20 mA device that also supplies its own power)
HPO-6703*	**Normally open relay:** 30 VAC/VDC, 2 A max.
HPO-6705*	**Normally closed relay:** 30 VAC/VDC, 2 A max.
*For more information, see the **HPO-6700 Series Output Override Boards Data Sheet**. **With the **HPO-6701 triac** and **HPO-6703/6705 relays**, use the **Switched Common** terminals instead of Ground.	

NOTE: For 4–20 ma applications with the HPO6704, see also the **4–20 mA Wiring for Controllers Application Guide**.

⚠ CAUTION

Connecting 24 VAC or other signals that exceed the operation specifications of the controller before the output jumper is removed will damage the controller. Remove the jumper and install the override board before connecting AC or other voltage to the output terminals of the controller.

To install the HPO-6700 series override boards:

1. Disconnect the power to the controller.
2. Pull the top edge of the (translucent black) override board cover away from the case and open the cover.
3. Remove the jumper from the relevant mounting header pins. See **Illustration: Output Override Boards Configuration on page 11**.
4. Position the board in the relevant slot with the Hand-Off-Auto selection switch positioned toward the output connections.
5. Slide the board down the integral board tracks onto the header pins.
6. Set the selection switch on the override board to the desired position. A (Automatic) is the top position of the switch, O (Off) is the center position, and H ("Hand" or On) is on the bottom position.
7. Repeat steps 3 through 6 to install additional boards.
8. Close the override board cover.
9. Connect the output devices to the controller outputs. See **Grounds Versus Switched (Relay) Commons on page 9**.
10. Reconnect the power.

NOTE: If a board is to be moved or removed, reinstall the (HPO-0063) jumper (removed in Step 3) on the two pins closest to the outputs.

NOTE: For 4–20 ma applications, see also the **4–20 mA Wiring for Controllers Application Guide**.

Connecting a Remote Actuator to a BAC-9311

Instead of using a BAC-9000 series controller-actuator, using a BAC-9311 with a remote actuator provides additional options, such as higher torque or fail-safe. The tri-state actuator should be connected to the BO5, BO6, and SC terminals of the triac (VAC only) outputs. See **Illustration: Remote Actuator Wiring on page 13**.

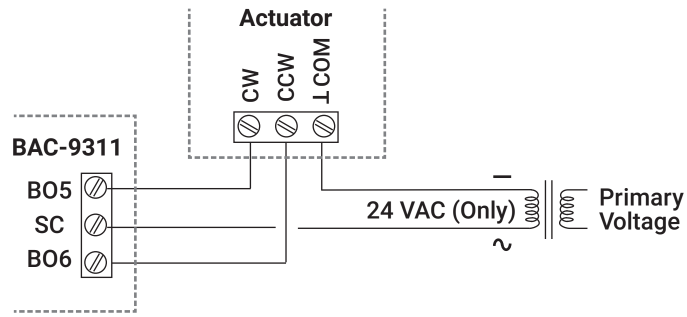


Illustration: Remote Actuator Wiring

See **Illustration: Remote Actuators for a BAC-9311 on page 13** to select an appropriate actuator. Some applications may require custom programming.

TRI-STATE MODELS*	TORQUE (IN-LB.)						
	25	40	45	80	90	180	320
NON-FAIL-SAFE							
MEP-4201	✔						
MEP-40x1/40x3		✔					
MEP-4501			✔				
MEP-48x1/48x3				✔			
MEP-4901					✔		
MEP-7501/7503						✔	
MEP-7801/7803							✔
FAIL-SAFE							
MEP-4251	✔						
MEP-4551			✔				
MEP-4951					✔		
MEP-7551/7553						✔	
MEP-7851/7853							✔
*See the relevant data sheet for options and other specifications.							

Illustration: Remote Actuators for a BAC-9311

MS/TP Network Connections

Connections and Wiring

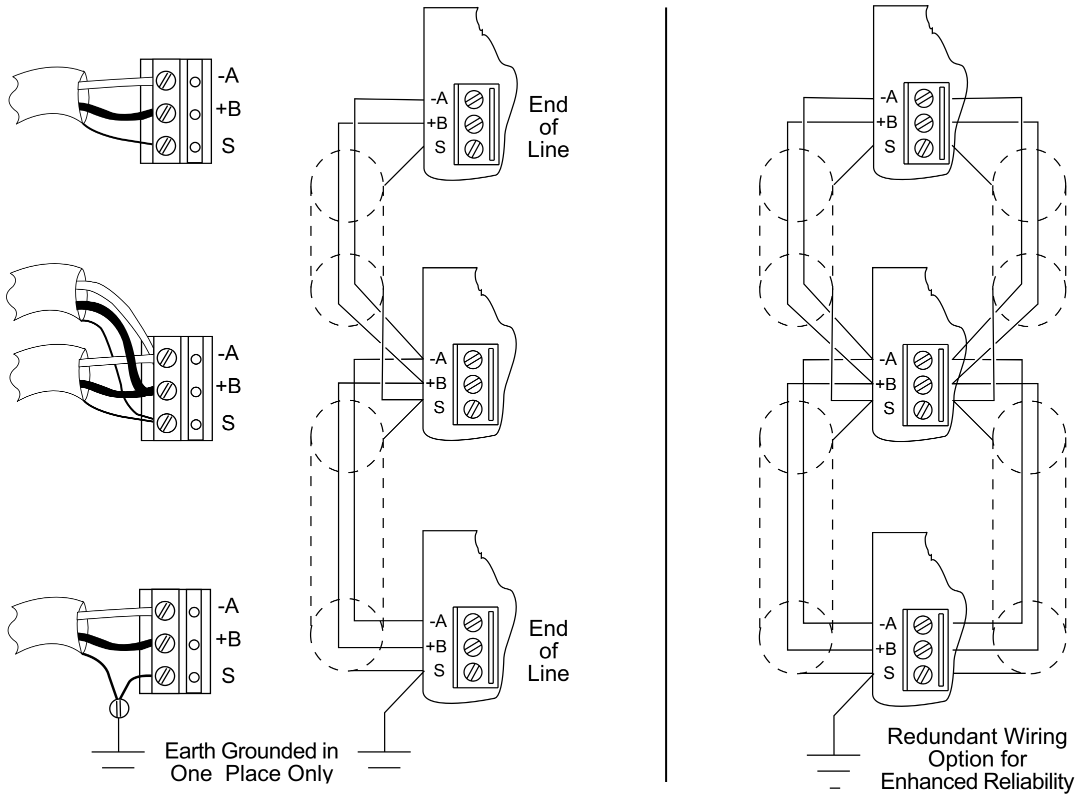


Illustration: MS/TP Network Wiring (Standard and Redundant Wiring)

Use the following principles when connecting a controller to an MS/TP network:

- Use 18 gauge, twisted-pair, shielded cable with capacitance of no more than 51 picofarads per foot (167 pf/m) for all network wiring. (Belden cable model #82760 or equivalent meets KMC requirements.)
- Connect the –A terminal in parallel with all other –A terminals and the +B terminal in parallel with all other +B terminals. See **Illustration: MS/TP Network Wiring (Standard and Redundant Wiring) on page 14**.
- Connect the shields of the cable together at each controller. For KMC BACnet controllers use the S (Shield) terminal. The S terminal is provided as a connecting point for the shield. The terminal is not connected to the circuit ground of the controller. When connecting to controllers from other manufacturers, verify the shield connection is not connected to ground.
- Connect the shield to an earth ground **at one end only**.
- To maintain communications in case of an open conductor on the network cable, use redundant wiring routed separately to enhance reliability. See **Illustration: MS/TP Network Wiring (Standard and Redundant Wiring) on page 14**.
- Connect no more than 128 addressable BACnet master devices (total) to one MS/TP network. The devices can be any mix of controllers or routers. (Up to 127 slave devices can also be connected.)
- Limiting the MS/TP network size to no more than about 60 controllers will optimize network performance.
- If the network has more than 31 MS/TP devices or if the cable length exceeds 4,000 feet (1,220 meters), use a KMD-5575 repeater (on an MS/TP-only network if the baud rate on the network is no higher than 38.4K baud) or

a faster KMC BAC-5051E router with an Ethernet network. For each network segment, connect the shields to a good earth ground at only one end of the segment; tape back the shield ground at the other end. Generally, use no more than four KMD-5575 repeaters per MS/TP network.

- Use a KMC KMD-5567 surge suppressor where a cable exits the building.

NOTE: See **Planning BACnet Networks (Application Note AN0404A)** for additional information about installing controllers.

NOTE: To temporarily disconnect the controller from the network, pull out the isolation bulb assembly or the MS/TP terminal block from its connector.

EOL (End of Line) Termination Switches

The controllers on the physical ends of the EIA-485 wiring segment must have EOL (End of Line) termination enabled for proper network operation. In the end controllers (only), turn the EOL swi tches On. See **Illustration: End-of-Line Termination on page 15**. Verify that all other controllers have EOLs turned Off (as shipped from the factory).

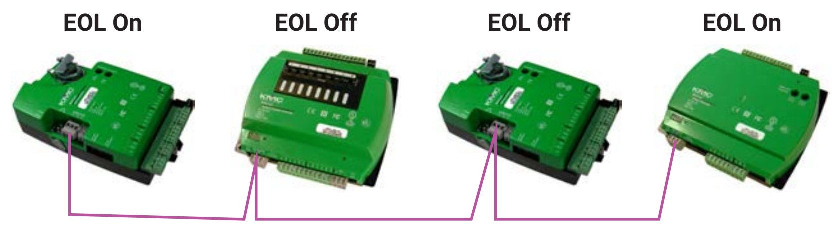


Illustration: End-of-Line Termination

Ethernet Network Connections

With updated firmware, a Conquest “E” model controller can be configured for the following types of communication:

- Ethernet 802.3 (ISO 8802-3)
- BACnet IP over Ethernet
- Foreign Device

The controller connects in the same manner as other Ethernet devices. Connect a standard T568B CAT 5 or CAT 6 Ethernet cable from the Ethernet port on the controller to a network router, switch, or hub.

⚠ CAUTION

Do NOT plug the cable meant for Ethernet communications into the Room Sensor jack. The Room Sensor port powers a NetSensor, and the supplied voltage may damage an Ethernet card, switch, or router to which it is accidentally connected. See Illustration: Inputs and Ethernet Port (BAC-9001CE) on page 7.

NOTE: These controllers are configured at the factory to communicate via BACnet Ethernet, but initial shipments cannot be reconfigured in the field to support BACnet IP. (A future firmware update will change this.) If BACnet IP connectivity is needed with currently shipping “E” models, add a BACnet router (such as a BAC-5051) to provide the IP connection. For more information, see the Conquest Ethernet Controllers and IP Support Technical Bulletin ().

NOTE: Placing the controller on an BACnet IP network without proper configuration and assigning the correct IP address could cause disruption to the Ethernet LAN network service. See relevant software documentation for more information about IP configuration.

Power (Controller) Connections

Use the following guidelines when choosing and wiring 24 VAC transformers.

- Use a KMC Controls Class-2 transformer of the appropriate size to supply power to the controllers. KMC Controls recommends powering only one controller from each transformer. Do not run 24 VAC power from within an enclosure to external controllers.
- If several controllers are mounted in the same cabinet, a transformer can be shared between them provided the transformer does not exceed 100 VA (or other regulatory requirements), the total power drawn does not exceed the transformer's rating, and the phasing is correct.

To **connect 24 VAC (–15%, +20%), 50/60 Hz, power** to the black (removable) terminal block:

- Connect the AC **phase** to the **~** (phase/R) terminal.
- Connect the **neutral** lead from the transformer to the **⊥** (common) terminal.

Power is applied to the controller when the transformer or power supply is powered and the removable terminal block is plugged into the connector.

Optional CAN-5900 series expansion modules should be powered on the same circuit as its controller. See **Connecting Power to CAN-5900 Modules on page 18**.

CAN-5900 Series Expansion Modules

Addressing CAN-5900 Modules

Multiple CAN-5900 Series expansion modules must each be addressed to uniquely identify the inputs and outputs. Between the gray EIO (Expansion Input/Output) and the green Input terminal blocks are four lever switches used for addressing. See **Illustration: Expansion Module Address Switches on page 17**.

Illustration: Expansion Module Address Switches

NOTE: Switch 4 should always be up (Off). Switches 1 through 3 should be configured for the appropriate address as shown below. See **Illustration: Expansion Module Addresses and Switch Positions on page 17**. If only one module is being used, the address (factory default of 1) does not need to be changed.

INPUTS AND OUTPUTS ADDRESSES			
Module	**Inputs**	**Outputs**	**Address**
Controller	3–10	1–8	0
EIO_1	11–18	9–16	1 (default)
EIO_2	19–26	17–24	2
EIO_3	27–34	25–32	3
EIO_4	35–42	33–40	4

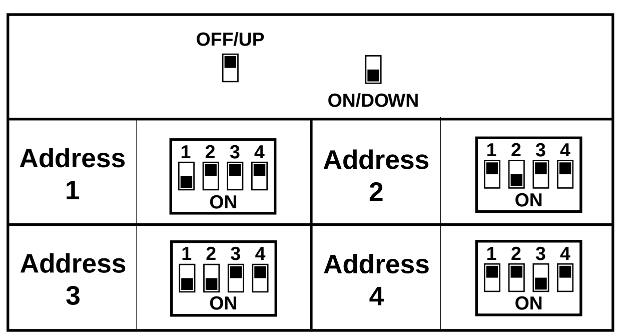


Illustration: Expansion Module Addresses and Switch Positions

NOTE: Input and output numbers must correspond with the appropriate module number set by the address switches. For example, if Inputs 19–26 and Outputs 17–24 are desired for a module, use the Address 2 switch positions.

NOTE: Addressing the EIO modules in consecutive order is recommended. If the EIO modules are not addressed in consecutive order, gaps will exist between the input and output objects. For example, Controller, EIO_1, and EIO_3 (only) would have Inputs 3–18, 27–34 and Outputs 1–16, 25–32. Controller and EIO_2 (only) would have Inputs 3–10, 19–26 and Outputs 1–8, 17–24.

Set the EOL (slide) switches (beside the gray EIO terminal block) in the same manner as MS/TP EOL switches. See **EOL (End of Line) Termination Switches on page 15**.

Connecting Power to CAN-5900 Modules

NOTE: If the a CAN-5900 series expansion module **loses communication on the CAN bus** with the BAC-5900 series controller, the expansion module **turns all of its outputs OFF** after about 30 seconds. When communication is restored, the outputs will go to whatever state the controller is commanding them to be at that time.

A CAN-5900 series expansion module is controlled by a BAC-5900 series controller. If they are on separate electrical circuits, power could possibly fail to the controller but remain on to the expansion modules. **Having the controller and all expansion modules on the same electrical circuit is recommended.**

EIO LED Indicators

EIO LED ON CAN-5900 SERIES EXPANSION MODULE		
LED Activity	**Status**	**Action**
Flashing rapidly	Communicating properly with controller	None required
Solid green	Not communicating	Check wiring
EIO LED ON BAC-5900 SERIES CONTROLLER		
LED Activity	**Status**	**Action**
Flashing	Communicating properly with expansion module	None required
Off	Not communicating	Check wiring

STE-93xx/95xx CO_2 Sensor and DCV

The space CO_2 level read by the STE-93xx/95xx sensor is mapped to AV57. Application programming that references the CO_2 value, such as for DCV (Demand Control Ventilation) or ventilation overrides, may be added to the controller either by modifying the factory application programming or by adding Control Basic logic in an unused program.

Alternately, to use an easy (menu-configurable) DCV solution for AHU, RTU, FCU, and HPU applications, see the integrated sensor-and-controller **BAC-13xxx and BAC-14xxx series of FlexStats**.

NOTE: The STE-93xx/95xx CO_2 sensor uses a self-calibration technique designed to be used in applications where CO_2 concentrations will periodically drop to outside ambient conditions (approximately 400 ppm), typically during unoccupied periods. The sensor will typically reach its operational accuracy after 25 hours of continuous operation if it was exposed to ambient reference levels of air at 400 ±10 ppm CO_2. The sensor will maintain accuracy specifications if it is exposed to the reference value at least four times in 21 days. (There is no provision for calibrating with gas.)

CONFIGURATION

Configuring, Programming, and Designing

For configuration and programming information, see the documents and Help systems for the respective tool.

SETUP PROCESS			KMC TOOL
Configuration	Programming (Control Basic)	Web Page Graphics*	
✔			Conquest NetSensor™
✔			KMC Connect Lite™ (NFC) app or software**
✔	✔		KMC Connect™ software
		✔	TotalControl™ software
		✔	KMC Converge™ module for Niagara^{AX} WorkBench
*Custom graphical user-interface web pages can be hosted on a remote web server, but not in the controller. **Near Field Communication via enabled smart phone or tablet running the KMC Connect Lite app or a PC (with an HPO-9003 NFC-Bluetooth/USB module/fob) running the KMC Connect Lite Desktop software.			

Illustration: Configuration, Programming, and Graphics Tools

For configuration using a **NetSensor**, see **Controller Configuration with STE-9xx1 Menus on page 21**. See also **Restore (RSTR) and Application/Units Selection on page 25** and **VAV Airflow Balancing with an STE-9xx1 on page 26**.

A NetSensor is only one option for configuring controllers, however. For example, a NetSensor cannot configure controllers while they are still in the box or configure IP options for Ethernet models. But those functions can be done with the **KMC Connect Lite app** on an NFC enabled smart phone. You would probably also want to use Connect Lite instead of a NetSensor if you are configuring a large number of controllers.

Use a NetSensor, on the other hand, if you want to configure MS/TP model controllers without any software or app. You would probably want to use a NetSensor if you are configuring controllers that are already installed or you only have a few controllers to configure.

NOTE: On Conquest controllers, Inputs 1 and 2 are dedicated to the Room Sensor port (for the STE-6010/6014/6017—see **Analog STE-6000 Series Thermistor Sensors on page 7**). The input object AI1 is dedicated to the room temperature (for the STE-6010/6014/6017), and object AI2 is dedicated to room temperature setpoint (for the 6014/6017). If reusing Custom Control Basic programs from older controllers, make any necessary changes to the input objects in the program.

NOTE: Input objects AI1 and AI2 are **not** used by STE-9xxx NetSensors. Those digital sensors map temperature and setpoint values directly to AV1, AV4, and AV5. (See **Digital STE-9000 Series NetSensors on page 7**.)

NOTE: Terminals on removable blocks start with Input 3. (See **Illustration: Controller Overview (BAC-5901) on page 4** and **Illustration: Inputs and Ethernet Port (BAC-9001CE) on page 7**.)

NOTE: Customized programming is the responsibility of the user. KMC Controls does not provide support for such programs.

Passwords

To protect against unauthorized tampering with the configuration parameters, Conquest controllers are factory-set with a default level 2 password when using an STE-9000 series NetSensor or the KMC Connect Lite NFC app. See the **Conquest Controllers Default Password Technical Bulletin** by logging into the **KMC Partners web site** and looking at the downloadable documents for any of the KMC Conquest controllers or STE-9000 series NetSensors.

Controller Configuration with STE-9xx1 Menus

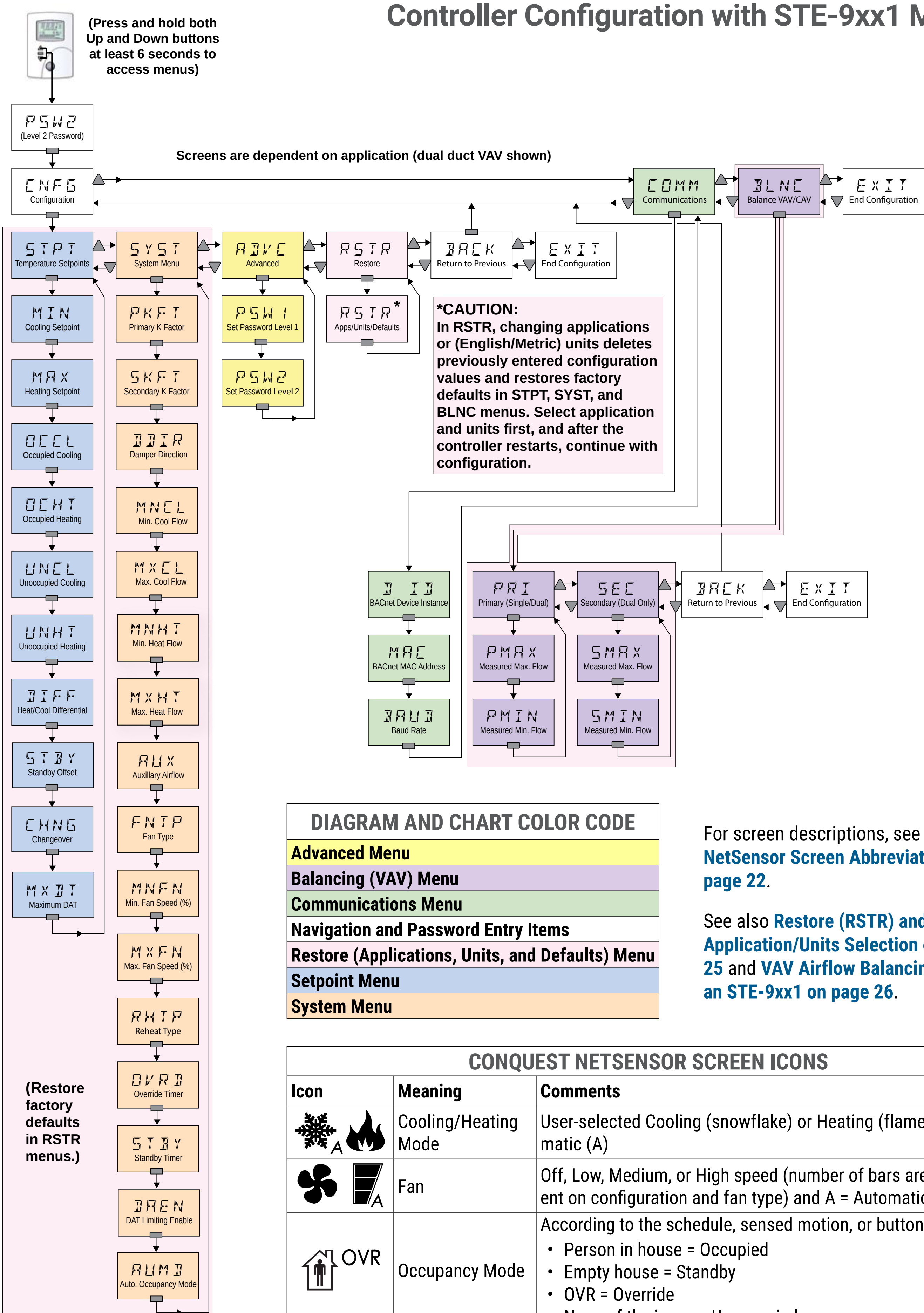


DIAGRAM AND CHART COLOR CODE
Advanced Menu
Balancing (VAV) Menu
Communications Menu
Navigation and Password Entry Items
Restore (Applications, Units, and Defaults) Menu
Setpoint Menu
System Menu

For screen descriptions, see **Conquest NetSensor Screen Abbreviations on page 22**.

See also **Restore (RSTR) and Application/Units Selection on page 25** and **VAV Airflow Balancing with an STE-9xx1 on page 26**.

CONQUEST NETSENSOR SCREEN ICONS		
Icon	**Meaning**	**Comments**
A	Cooling/Heating Mode	User-selected Cooling (snowflake) or Heating (flame) or automatic (A)
A	Fan	Off, Low, Medium, or High speed (number of bars are dependent on configuration and fan type) and A = Automatic operation
OVR	Occupancy Mode	According to the schedule, sensed motion, or button activation: • Person in house = Occupied • Empty house = Standby • OVR = Override • None of the icons = Unoccupied

CONQUEST NETSENSOR SCREEN ABBREVIATIONS		
Abbreviation	**Meaning**	**Function/Comments**
0.0	Calibration	Enter a positive number if reading is too low or negative number if reading is too high
ADVC	**Advanced Menu**	Set passwords and calibration
AUMD	Automatic Occupancy Mode	Automatic occupancy mode—enable (controller automatically enters unoccupied mode when it detects the loss of primary air supply) or disable (controller will remain in occupied mode regardless of the primary air supply)
AUX	Auxiliary Airflow (BAC-9xx1)	Set the BAC-9xx1 VAV auxiliary airflow setpoint for when reheat is active (cfm)
	Auxiliary Damper Position (BAC-9021)	Set the BAC-9021 pressure-dependent VAV auxiliary damper position (%)
	Auxiliary Heat (BAC-9301 FCU)	Enable/disable auxiliary heat for two-pipe BAC-9301 FCU applications
AUXH	Auxiliary Heat (BAC-93x1 HPU)	Select auxiliary heat options (None, 3rd Stage, Compressor Lockout) for BAC-93x1 HPU applications
AXLK	OAT Aux Heat Lockout	Set the Outside Air Temperature that locks out HPU auxiliary heat (°)
BACK	Back	Go back to previous menu
BAUD	Baud Rate	Set baud rate
BLNC	**Balance Menu**	Set airflow balancing parameters—only the PRI (primary) menu is used for single duct VAV
CHNG	SAT Changeover	Set the Supply Air Temperature setpoint (°) at which the controller will change between heating and cooling
CMLK	Compressor Lockout Temperature	Set Compressor Lockout Temperature (°)
CNFG	**Configuration Menu**	Access the configuration menus
COMM	**Communication Menu**	Set BACnet device instance, MAC address, and network baud rate
CVA	Cooling Valve Action	Select Normally Closed or Normally Open valve
DAEN	DAT Limiting Enable	Enable/disable Discharge Air Temperature Limiting
DDIR	Damper Direction	Select the rotation direction (CW or CCW) of the actuator to close the damper
DEHU	Dehumidification Setpoint	Set Dehumidification Setpoint (%)
DHDF	Dehumidification Differential	Set Dehumidification Differential (%)
D ID	BACnet Device Instance	Set BACnet Device Instance number
DIFF	Minimum Setpoint Differential	Set the minimum allowable temperature value (differential) between the cooling and heating setpoints (°)
DMIN	Dual Duct Min Airflow (BAC-9001)	Set the BAC-9001 dual duct VAV minimum airflow (cfm)

EETM	Economizer Enable Temperature	Set Economizer Enable (Outside Air) Temperature (°)
ELOC	Enable Compressor Lockout	Enable/disable compressor lockout
ENEC	Econ Enable	Enable/disable Economizer operation
ENDH	Enable Dehumidification	Enable/disable Dehumidification operation
ENST	Enable Standby Mode	Enable/disable Standby Mode
EQDY	Equipment Delay	Set Equipment Delay time (minutes)
EVAL	Start H20 Evaluation	Set Offset Temperature to Start Water Evaluation for 2-pipe FCU (°)
EXIT	Exit	End configuration
FNDY	Fan Off Delay	Set Fan Off Delay time (minutes)
FNHT	Fan Active In Heat	Select Fan Off or Auto in Heat mode
FNOC	Fan On During Occupied Mode	Enable/disable Fan On (continuously) during Occupied mode
FNTP	Fan Type	Set the fan type in VAV applications (None, Series, or Parallel)
FSPD	Fan Speeds Available	Select number of Fan Speeds Available (1, 2, or 3)
HVA	Heating Valve Action	Select Normally Closed or Normally Open valve
MAC	BACnet MAC Address	Set BACnet MAC address number
MAX	Maximum Heating Setpoint	Set the highest temperature that a user can enter as the active setpoint (°)
MIN	Minimum Cooling Setpoint	Set the lowest temperature that a user can enter as the active setpoint (°)
MNCL	Minimum Cooling Airflow	Set Minimum Cooling Airflow limit (cfm)
MNDC	Minimum DAT	Set Minimum Discharge Air Temperature (°)
MNDM	Minimum Econ Damper	Set Minimum Economizer Damper position (%)
MNFN	Min. Fan Speed	Set Minimum Fan Speed (%)
MNHT	Minimum Heating Airflow	Set Minimum Heating Airflow (cfm)
MXCL	Maximum Cooling Airflow	Set the maximum limit for cooling airflow (cfm)
MXDT	Maximum DAT	Set Maximum Discharge Air Temperature (°)
MXHT	Maximum Heating Airflow	Set Maximum Heating Airflow limit (cfm)
MXFN	Max. Fan Speed	Set Maximum Fan Speed (%)
OCCL	Occupied Cooling Setpoint	Set the cooling setpoint used as the active setpoint when the the space is occupied (°)
OCHT	Occupied Heating Setpoint	Set the heating setpoint used as the active setpoint when the the space is occupied (°)
OVRD	Override Mode	Enable/disable local unoccupied override mode
OVRT	Override Timer	Set Local Unoccupied Override Timer after override has been initiated (minutes)

PKFT	Primary K Factor	Enter the K-factor supplied by the manufacturer of the VAV terminal unit
PMAX	Primary Meas- ured Max. Airflow	Set value for either the cooling or heating maxi- mum airflow in primary duct (cfm)
PMIN	Primary Meas- ured Min. Airflow	Set value for either the cooling or heating mini- mum airflow in primary duct (cfm)
PRI	Primary	Select Primary duct to balance
PSW1	Password Level 1	Set Password 1 (entering four zeros removes the password)
PSW2	Password Level 2	Set Password 2 (entering four zeros removes the password)—see **(Unknown) Password Is Required on page 36**
RHTP	Reheat Type	Select the reheat type for none, staged, modu- lating (0–10 VDC actuator), floating (tri-state actuator), or time proportional (thermal wax actuator)
RSTR	**Restore (Menu)**	Select application, select English/Metric units, and restore STPT, SYST, and BLNC menu items to factory default settings
RVA	Reversing Valve Action	Set Reversing Valve Action (active during cooling or active during heating)—see **Reversing Valve Action (HPU) on page 55**
SEC	Secondary	Select Secondary duct to balance
SKFT	Secondary K Factor	Enter the K-factor supplied by the manufacturer of the VAV terminal unit for the second duct of a dual duct system
SMAX	Secondary Meas- ured Max. Airflow	Set value for either the cooling or heating maxi- mum airflow in secondary duct (cfm)
SMIN	Secondary Meas- ured Min. Airflow	Set value for either the cooling or heating mini- mum airflow in secondary duct (cfm)
STBT	Standby Timer	Set motion sensor inactivity time before trigger- ing Standby mode (minutes)
STDY	Stage Delay	Set Stage Delay time (minutes)
STBO	Standby Offset	Set the offset value (°) added or subtracted (de- pending on mode) from the value of the active setpoint
STPT	**Setpoint Menu**	Enter temperature setpoints and limits
SYST	**System Menu**	Configure basic HVAC application functions
UNCL	Unoccupied Cooling	Set the cooling setpoint used as the active set- point when the the space is unoccupied (°)
UNHT	Unoccupied Heating	Set the heating setpoint used as the active set- point when the the space is unoccupied (°)
VA	Valve Action	Select Normally Closed or Normally Open valve

See also **Restore (RSTR) and Application/Units Selection on page 25**.

See also **VAV Airflow Balancing with an STE-9xx1 on page 26**.

Restore (RSTR) and Application/Units Selection

The Restore (RSTR) menu performs three functions:

- Selects the application (dependent on controller model)
- Selects the units (English, Metric, or mixed)
- Restores the items in the Setpoint, System, and Balance menus to their factory defaults. (Communication settings and user-defined passwords are not affected.)

See **Controller Configuration with STE-9xx1 Menus on page 21**.

To perform one or more of these functions, follow the steps below.

NOTE: **Changing the application or the units will ALSO restore the factory defaults to the Setpoint, System, and Balance menu items!** Select the desired application and units first, let the controller restart (at least 30 seconds), and then continue configuring the applicable Setpoint, System, and Balance items.

NOTE: To restore a configured controller to the factory defaults while **keeping the existing application and units**, restore with a different application and/or units first. After the controller restarts, change the application and/or units back to the original setting. After the controller restarts again, continue with the configuration.

APPLICATIONS, UNITS, AND DEFAULTS STEPS	DISPLAY
1. Start at the temperature display.	72 °F 1251 PM
2. Press the Up and Down buttons together for at least 6 seconds and enter the level 2 password. The display changes to CNFG after Password 2 is correctly entered. See **(Unknown) Password Is Required on page 36**.	PSW2 0000
3. At the CNFG display, press the Enter button.	CNFG
4. At the STPT display, press the Up or Down button to advance to the RSTR display.	STPT
5. With RSTR flashing, press the Enter button. The application and units will start flashing. (If you do **NOT** want to restore application settings to the factory defaults, **do NOT press the Enter button while the application and units are flashing**. Let the display time out instead—about 30 seconds.)	RSTR HPU ENG
6. With the application and units flashing, use the Up and Down buttons to find the correct choice and press the Enter button. With RSTR flashing, either navigate to the Exit menu (using the Up or Down button) or let the menu time out (about 30 seconds).	EXIT

See also **VAV Airflow Balancing with an STE-9xx1 on page 26**.

VAV Airflow Balancing with an STE-9xx1

NOTE: This procedure is very similar to that of using an STE-8x01 NetSensor to balance a KMC SimplyVAV controller. See the balancing video and other information on **www.simplyvav.com/balance/**.

The airflow balancing/calibrating procedure requires the following:

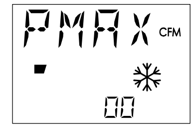
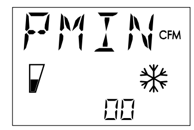
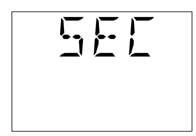
- An STE-9000 series NetSensor. If the system does not include one of these sensors, temporarily disconnect any STE-60xx sensor connected to the Room Sensor port and connect an STE-9xx1 as a service tool.
- The level 2 password.
- A flow hood or other accurate method to measure airflow.
- The engineering design specifications for the minimum and maximum airflow setpoints.
- The K factor for the box (see **Appendix: K Factors for VAV on page 101**). The **K factor value is first entered in the SYST menu** (see **Controller Configuration with STE-9xx1 Menus on page 21**).

NOTE: For a heating-only or cooling-only VAV unit, the airflow setpoints for the unused mode must be set within the range of the mode in use. Failure to set the unused setpoints correctly will result in unpredictable or erroneous air balancing settings. See **Controller Configuration with STE-9xx1 Menus on page 21**.

NOTE: Starting the balancing procedure erases all previous airflow correction factors. The airflow readings displayed by the STE-9xx1 are the actual uncorrected airflow readings as measured by the controller. Sensor calibration must be done at both Minimum and Maximum settings.

NOTE: Once the following procedure is started, all steps must be completed in order.

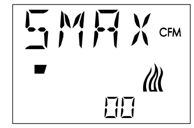
PROCEDURES AND STEPS	DISPLAY
Select balancing mode	
1. Start at the temperature display.	72 °F 12:51 PM
2. Press and hold the Up and Down buttons together for at least 6 seconds and enter the level 2 password. The display changes to CNFG after Password 2 is correctly entered. See **(Unknown) Password Is Required on page 36**.	PSW2 0000
3. From the CNFG display, press the Up or Down buttons to advance to the BLNC display.	CNFG
4. Press the Enter button to select BLNC. The display advances to PRI.	BLNC
5. Press the Enter button to select PRI.	PRI

Measure and enter maximum primary airflow	
NOTE: The display begins flashing PMAX and displays the (uncorrected) actual airflow at the bottom. The airflow will attempt to stabilize on the highest value for either the cooling or heating maximum airflow even if only one mode is operational. 6. Wait for the maximum airflow value to stabilize. 7. With a flow hood, measure the actual airflow. 8. Press the Enter button to advance to the entry display. PMAX stops flashing. 9. Press the Up or Down button to enter the measured airflow. 10. Press the Enter button to save the measured airflow. The display changes to PMIN.	
Measure and enter minimum primary airflow	
NOTE: The display begins flashing PMIN and displays the (uncorrected) actual airflow at the bottom. The airflow will attempt to stabilize on the lowest value for either the cooling or heating maximum airflow even if only one mode is operational. 11. Wait for the minimum airflow value to stabilize. 12. With a flow hood, measure the actual airflow. 13. Press the Enter button to advance to the entry display. PMIN stops flashing. 14. Press the Up or Down button to enter the measured airflow. 15. Press the Enter button to save the measured airflow. The display changes to PRI.	
Continue for dual duct or exit	
16. Press the Up or Down button to advance to one of the following choices and then press the Enter button: • BACK to choose another function. • EXIT to return to the temperature display. • SEC to balance the secondary VAV for dual duct systems. This option is available only on dual duct models. (Continue on the steps on the next page.)	

Measure and enter maximum secondary airflow

NOTE: If SEC is selected, the display begins flashing SMAX and also displays the (uncorrected) actual airflow at the bottom. The airflow will attempt to stabilize on the highest value for either the cooling or heating maximum airflow even if only one mode is operational.

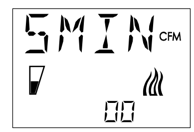
17. Wait for the maximum airflow value to stabilize.
18. With a flow hood, measure the actual airflow.
19. Press the Enter button to advance to the entry display. SMAX stops flashing.
20. Press the Up or Down buttons to enter the measured airflow.
21. Press the Enter button to save the measured airflow. The display changes to SMIN.



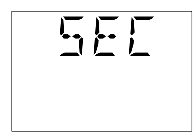
Measure and enter minimum secondary airflow

NOTE: The display begins flashing SMIN and also displays the (uncorrected) actual airflow at the bottom. The airflow will attempt to stabilize on the lowest value for either the cooling or heating maximum airflow even if only one mode is operational.

22. Wait for the minimum airflow value to stabilize.
23. With a flow hood, measure the actual airflow.
24. Press the Enter button to advance to the entry display. SMIN stops flashing.
25. Press the Up or Down buttons to enter the measured airflow.
26. Press the Enter button to save the measured airflow.



27. Press the Up or Down button to advance to one of the following (and then press the Enter button):
    - BACK to choose another function.
    - EXIT to return to the temperature display.



See also **Restore (RSTR) and Application/Units Selection on page 25**.

RESETTING AND TROUBLESHOOTING

Resetting Controllers

Types of Reset

If a controller is not operating correctly, reset the controller. Any reset interrupts normal operation, and several types of reset exist:

- A **warm start** is generally the least disruptive option (restarting normal operation the quickest).
- If problems still persist, try a **cold start**. (This should also be used after a new Control Basic program is loaded and compiled.)
- To **restore** (STPT, SYST, and BLNC) configuration values to their **factory defaults**, see **Restore (RSTR) and Application/Units Selection on page 25**.

Warm and Cold Starts

⚠ CAUTION

During a restart, the analog outputs go to zero, and triacs go to their normally open state. A restart is a process that lasts several seconds, and it may result in several changes of state for an output, turning equipment off and on abruptly. Before resetting the controller, manually override equipment as needed. If a large fan is controlled by the controller, for example, set a minimum off time.

A **WARM start** does the following in the controller:

- Zeroes out objects (during the restart process).
- Restores present values of objects to **their last values before the restart** (until they are updated by the controller's programs).
- Restarts the controller's Control Basic programs.
- Leaves configuration and programming intact.

To perform a warm start, do one of the following:

- Momentarily remove power to the controller.
- From TotalControl, Connect, or Converge, select Reinitialize Device > Warm Start.

NOTE: If the checksum test in RAM fails during a warm start, a cold start is done instead. When power is restored after an outage, the controller will attempt a warm start as long as the values in RAM are retained (up to about six hours). If the RAM checksum test fails, a cold start is done instead.

NOTE: In custom Control Basic programming, using the POWERLOSS command may be desirable to determine start-up conditions and to take appropriate actions—see the Help system in KMC Connect or TotalControl for more information.)

A **COLD start** does the following in the controller:

- Zeroes out objects (during the restart process).
- Returns all present values of objects to **their relinquished defaults** (until they are updated by the controller's programs).
- Restarts the controller's Control Basic programs.
- Leaves configuration and programming intact.

To perform a cold start, from TotalControl, Connect, or Converge, select Reinitialize Device > Cold Start.

Troubleshooting

Communication Issues

Communication Issues—CAN (Expansion Module)

- Check that EOL switches are correctly positioned on the controller and each module. See **EOL (End of Line) Termination Switches on page 15**.
- Check for correct wiring and phasing.
- Check addressing switches. See **Addressing CAN-5900 Modules on page 17**.
- See also **EIO LED Indicators on page 18** and **Power/Status LED (Green) Issues on page 31**.

NOTE: If the a CAN-5900 series expansion module **loses communication on the CAN bus** with the BAC-5900 series controller, the expansion module **turns all of its outputs OFF** after about 30 seconds. When communication is restored, the outputs will go to whatever state the controller is commanding them to be at that time.

Communication Issues—Ethernet

⚠ CAUTION

On Conquest "E" models, do NOT plug the cable meant for Ethernet communications into the Room Sensor jack. The Room Sensor port powers a NetSensor, and the supplied voltage may damage an Ethernet card, switch, or router to which it is accidentally connected. See Illustration: Inputs and Ethernet Port (BAC-9001CE) on page 7.

- Check that the Ethernet connection cable is plugged into the Ethernet port and not the Room Sensor port.
- See **Ethernet LEDs (Green and Amber) Issues on page 31**.
- Use a BAC-5051E router to check route status for network issues such as duplicate network numbers.

Communication Issues—MS/TP

- See **LED Indicators and Isolation Bulbs Issues on page 31**.
- Check that EOL switches are correctly positioned at each controller on the network. See **EOL (End of Line) Termination Switches on page 15**.
- Check for correct wiring and phasing.
- Check the Max Master setting in a configuration tool. It should be (just) higher than the highest numbered controller.
- See **Planning BACnet Networks (Application Note AN0404A)**.
- Check the baud rate setting.

NOTE: Set the baud rate the same on all controllers on the MS/TP network. Conquest controllers autobaud by default, but some other controllers do not autobaud. For example, if other controllers are set to 38400 with autobaud turned on while the one controller is set to 9600 baud, and if power to all devices is temporarily lost, the other controllers may cycle first and lock in 38400 baud before the 9600 baud controller has a chance to send any MS/TP traffic.

Communication Issues—NFC (Near Field Communication)

- Hold the NFC-enabled phone or HPO-9003 NFC-Bluetooth/USB module (fob) as close as possible over the NFC symbol on the controller or unpacked controller box.
- For other issues, see the **KMC Connect Lite User Guide**.

LED Indicators and Isolation Bulbs Issues

Power/Status LED (Green) Issues

- Within a few seconds after power is first applied, the green Power/Status LED near the power terminals will begin flashing about once a second if the device is functioning normally.
- If it is not illuminated, check the power and connections to the controller.

Ethernet LEDs (Green and Amber) Issues

The Ethernet connector has two built-in LEDs:

- The amber LED illuminates when the controller has power and is communicating at its highest speed (100BaseT). (It is off when the connection is communicating at 10BaseT.)
- The green LED will blink at a rate in accordance to Ethernet traffic.
- If neither LED is illuminated, check the power and Ethernet connection.

MS/TP LEDs (Amber) Issues

NOTE: The MS/TP network has an amber LED that flickers as it receives and passes the token during communication with the network. When the controller is powered up (but not communicating on the MS/TP port), these amber LEDs will flash slowly, about once per second. When the MS/TP port establishes communications with the network, the amber LED for that MS/TP port will flash rapidly as it receives and passes the token.

If the amber LED is not periodically flashing rapidly:

- Check the isolation bulbs. See **Network Isolation Bulbs (HPO-0055) Issues on page 31**.
- Check the network connections and configuration.
- Restart the controller.

Network Isolation Bulbs (HPO-0055) Issues

MS/TP and CAN bus networks have an assembly of two isolation bulbs located near the network terminals. Normally the bulbs are not illuminated.

- If one or both bulbs are illuminated, it indicates the network is improperly phased (the ground potential of the controller is not the same as on other controllers on the network). Disconnect the power and check the MS/TP and power connections.
- If one or both bulbs are blown, it indicates the voltage or current on the network exceeded safe levels. Correct the conditions and replace the bulbs.

Hardware Issues

Broken or Lost Terminals or DIN Clips

- Replace the item from the HPO-9901 kit.

Burned Out Network Isolation Bulbs

- See **Network Isolation Bulbs (HPO-0055) Issues on page 31**.

Input Issues

⚠ CAUTION

On Conquest "E" models, do NOT plug the cable meant for Ethernet communications into the Room Sensor jack. The Room Sensor port powers a NetSensor, and the supplied voltage may damage an Ethernet card, switch, or router to which it is accidentally connected. See Illustration: Inputs and Ethernet Port (BAC-9001CE) on page 7.

Input Values Are Outside the Expected Range

- Check that the cable to the NetSensor is plugged into the Room Sensor port and not the Ethernet port.
- After initial power-up, allow time for readings to stabilize.
- Using KMC Connect, KMC Converge, or TotalControl, check input configuration. Check that the input is not configured as Out Of Service.
- Check input wiring.

NOTE: Faulty wiring on one input can potentially cause fluctuating input values on other inputs.

- Check connected sensors (see **Illustration: Input Voltages on page 32**).

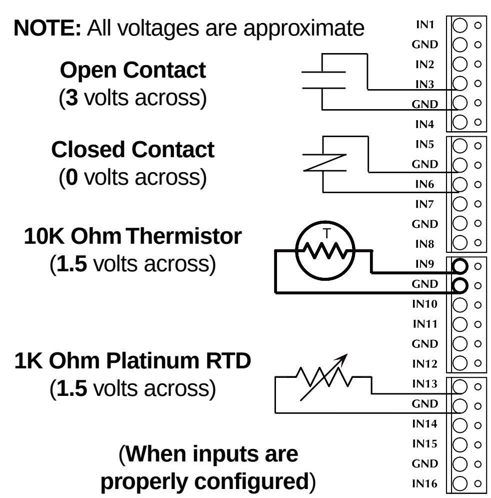


Illustration: Input Voltages

Motion/Occupancy Sensor (STE-92x1/95x1) Does Not Work

- Check that the cable to the NetSensor is plugged into the Room Sensor port and not the Ethernet port.
- After an initial power-up or restart, the motion/occupancy sensor requires about 30 seconds before it will begin responding to motion.
- In standard application programs, the motion/occupancy sensor initiates override only during "off" times in the schedule. See **Configuration/Programming Issues on page 36**.
- Check that the motion sensor is enabled and detects motion.
- See the Motion Sensing and Troubleshooting (Location) sections in the **Room Sensor and Thermostat Mounting and Maintenance Application Guide**.
- Using KMC Connect, KMC Converge, or TotalControl, check input configuration. Check that the value objects (e.g., BV6, MSV1) controlling occupancy mode are not configured as Out Of Service.

NOTE: The STE-92x1/95x1 motion sensor does not have a corresponding binary input object in the controller. The motion sensor writes to BV6.

Temperature Reading Is Incorrect

- Check that the cable to the NetSensor is plugged into the Room Sensor port and not the Ethernet port.
- After initial power-up, allow time for readings to stabilize.
- Check that the correct °F/°C temperature scale is selected. (Changing the temperature scale in the configuration, resets the controller to its factory default.)
- If the discrepancy is small, adjust the calibration offset in the configuration setup using KMC Connect, KMC Converge, or TotalControl.
- Using KMC Connect, KMC Converge, or TotalControl, check input (AI1) configuration. Check that the input is not configured as Out Of Service.
- Check that the sensor is properly mounted in a proper location. See the **Room Sensor and Thermostat Mounting and Maintenance Application Guide**.
- See also **Input Values Are Outside the Expected Range on page 32**.

Temperature Setpoint Is Not Maintained

- Check inputs and outputs. See **Input Values Are Outside the Expected Range on page 32** and **Output Issues on page 34**.
- Check schedules. See **Schedules Do Not Operate Properly on page 37**.
- Check that room temperature is being sensed correctly. See **Temperature Reading Is Incorrect on page 33**.
- Using KMC Connect, KMC Converge, or TotalControl, check output configuration. Check that the corresponding analog value object (e.g., AV3, AV4) is not configured as Out Of Service.
- In 2-pipe FCU applications, check the changeover water temperature sensor and wiring.
- If the HVAC system has trouble recovering from the unoccupied setpoint to the occupied setpoint during very cold weather, decrease the amount the setback.
- If the space temperature is overshooting the setpoint or is oscillating, try increasing the proportional band by a degree. If the problem persists, try increasing the integral value slightly (up to 20%). If the problem still persists, try setting the integral value to 0. (The optimal integral value is dependent on the characteristics of the particular space and HVAC system.)

Output Issues

Analog Output Does Not Work

⚠ CAUTION

Do not connect 24 VAC to an analog output ground. This is not the same as a relay's switched common.

NOTE: For an output on a CAN-5900 series expansion module, see also **Communication Issues—CAN (Expansion Module) on page 30**.

NOTE: Excessive loads will be clamped at the maximum. External relays may chatter or fail to latch if they need more current than the maximum allowed.

- Check for proper output object configuration.
- Using KMC Connect, KMC Converge, or TotalControl, check the outputs. Check that the output object (e.g., AO7) is not configured as Out Of Service.
- Check the Control Basic programs, loop objects, and schedules.
- Check that the output is on.
- Check the current draw of the load. Substitute an output device that draws less current.

Relay or Triac (HPO-670x Override Board) Does Not Work

⚠ CAUTION

Relays and triacs are for Class-2 voltages (24 VAC) only. Do not connect line voltage to them! Do not attach a device that draws more than the maximum current rating.

NOTE: Triacs are for AC only. See the **HPO-6700 Series Output Override Boards Data Sheet**.

NOTE: For an HPO-6701 triac output override board on a CAN-5900 series expansion module, see also **Communication Issues—CAN (Expansion Module) on page 30**.

- Check for proper output object configuration.
- Using KMC Connect, KMC Converge, or TotalControl, check the outputs. Check that the output object (e.g., BO4) is not configured as Out Of Service.
- Check the current draw of the load. Substitute an output device that draws less current.
- Check that the output is on.

NetSensor Display is Blank

CAUTION

On Conquest "E" models, do NOT plug the cable meant for Ethernet communications into the Room Sensor jack. The Room Sensor port powers a NetSensor, and the supplied voltage may damage an Ethernet card, switch, or router to which it is accidentally connected. See **Illustration: Inputs and Ethernet Port (BAC-9001CE) on page 7****.**

- Check that the cable from the NetSensor is plugged into the Room Temperature port and not the Ethernet port.
- See **Power Issues on page 35**.

Power Issues

NOTE: When the controller is powered, the green LED above the power terminals flashes slowly.

- See **Power (Controller) Connections on page 16**.
- Check for a tripped circuit breaker to the transformer.
- Check for proper supply voltage and phasing from the transformer (or power supply) and that the transformer has enough capacity (VA) for all connected devices. See the devices' respective data sheets and **Tips for Connecting 24-Volt Power Application Note (AN0604D)**.

NOTE: Wiring must be adequate to avoid excessive voltage drop on long runs! Allow plenty of "cushion." A voltage meter may be too slow to register transient dips or peaks during startup.

VAV Airflow Issues

- Hold down the gear disengagement lever and check that the damper moves freely to each end of its travel.
- Check the controller configuration.
- Check for 24 VAC at the terminals **~** (phase) and the **⊥** (common). Tolerance can be −15% to +20% (20.4 to 28.8 VAC). If using the same transformer for more than one controller, the phase and common must be the same on each device. See **Power Issues on page 35**.
- Check that the V-clamp on the actuator shaft is secure (not slipping).
- Check that the tubing to the differential pressure sensor is not kinked, pulled off, or leaking.
- Check that the flow sensor in the duct is not dirty.
- Check for adequate airflow in the duct leading to the controller.
- Review the sequence of operations in **VAV (Variable Air Volume) on page 64**.
- To properly set up a VAV controller, the correct K factor for the VAV box must be entered into the controller. If this information is unknown, see **Appendix: K Factors for VAV on page 101**.

Configuration, Programming, and Operation Issues

NOTE: Use the relevant software or app to perform the following tasks.

Control Basic Programs Do Not Work

NOTE: Standard configurations are available through the KMC application configuration wizards in KMC Connect, Converge, or TotalControl. Beyond these standard configurations, custom changes can be added to a controller using Control Basic.

NOTE: Customized programs are the responsibility of the user. KMC Controls does not provide support for such programs.

- Check that program objects are not configured as Out Of Service.
- Check that program objects are running and they have Run on Cold Start selected.
- Check the Control Basic code for errors in syntax, priority levels, and other issues. For assistance with Control Basic commands, see the Help system in KMC Connect or TotalControl.

Configuration/Programming Issues

- Check for proper connections between the controller and the app or software.
- See the help information in the documentation for the app or software. See **Configuring, Programming, and Designing on page 19**.
- To restore (STPT, SYST, and BLNC) configuration values to their factory defaults, see **Restore (RSTR) and Application/Units Selection on page 25**.

(Unknown) Password Is Required

- A **default** Level 2 password is required for initial configuration when using a STE-9000 series NetSensor or the KMC Connect Lite NFC app. See the **Conquest Controllers Default Password Technical Bulletin (TB150716)** by logging into the **KMC Partners web site** and looking at the downloadable documents for any of the KMC Conquest controllers or STE-9000 series NetSensors.

NOTE: If a Level 1 or 2 password is configured for 0000 in the Advanced menu, that password screen (for later user setpoint changes or configuration) is bypassed in an STE-9000 series NetSensor.

NOTE: To enhance security after configuration, change the Level 2 password for the controllers in the Advanced menu. **Be sure to document the new password for future reference!**

- If a **user-configured** Level 2 password has been forgotten, use KMC Connect to view the password in the NetSensor object screen. In KMC Connect, both levels of passwords can be viewed and changed as desired without having to first enter either one.

Schedules Do Not Operate Properly

- Check for proper schedule configuration.
- Check the controller’s time. See **Time and/or Date Are Not Correct on page 37**.
- Using KMC Connect, KMC Converge, or TotalControl, check the outputs. Check that the schedule object is not configured as Out Of Service.

Time and/or Date Are Not Correct

NOTE: When powered up after losing the RTC (Real Time Clock) time, the time and date will revert to the default and must be set manually or by synching to the system time.

- Set the time and date using one of the configuration tools.
- Check the DST (Daylight Saving Time) settings.
- Check the UTC Offset.

Trends Do Not Work

- Check the trend log object properties for proper configuration.
- Check that the trend log object Start Time and Stop Time are valid in the configuration.
- Check that Log Enable is selected.
- Check that the log is not full because Stop When Full is selected.
- Using KMC Connect, KMC Converge, or TotalControl, check that trend log objects are not configured as Out Of Service.

Other Issues

- Thoroughly check appropriate connections, wiring, and settings.
- Reset the controller. See **Resetting Controllers on page 29**.
- Consult with the network administrator for proper network settings.
- Contact KMC Controls technical support.

MAINTENANCE AND UPGRADES

Maintenance

For controllers, no routine maintenance is required. Each component is designed for dependable, long-term reliability and performance. Careful installation will ensure long-term reliability and performance.

For STE-9000 series NetSensors, see the **Room Sensor and Thermostat Mounting and Maintenance Application Guide**.

Controller Upgrades and Cross-References

KMC Conquest controllers are compatible with any existing BACnet networks, but some changes must be made:

- For the **MS/TP connection,** autobaud on the Conquest controller should be turned off and the **baud rate set for the lower speed of the older controllers on the network.** (Otherwise, if a power failure affects the network, the Conquest controller might be the first to restart and set the network baud rate too high for older controllers.)
- **Conquest controllers require Conquest NetSensors.** If an older KMC BACnet controller (e.g., BAC-5801) is replaced with a Conquest controller (e.g., BAC-5901), the KMD-11xx NetSensor must also be replaced with an STE-9000 series NetSensor. See **BAC-58xx/7xxx Series Controller Cross-Reference on page 39** and **KMD-11xx/12xx NetSensor Cross-Reference on page 39**. The **NetSensor cable must also be replaced with a Category 5 or better Ethernet patch cable** (such as an **HSO-9001** or **HSO-9011**) of equivalent length.

See also **Specifications and Accessories on page 4** and **Installation Instructions on page 4**.

BAC-58XX/7XXX SERIES CONTROLLER CROSS-REFERENCE			
Model Number	**Comments**	**Replacement Model Number***	**Comments**
BAC-5801	8 x 8 General Purpose	BAC-5901C	8 x 8 General Purpose w/ RTC
BAC-5802	8 x 8 General Purpose w/ RTC		
BAC-5831	16 x 12 General Purpose w/ RTC	BAC-5901C with (1) CAN-5901	16 x 16 General Purpose w/ RTC
BAC-7001/7003	VAV Controller, 18°/minute	BAC-9001	VAV controller, 60°/minute
BAC-7051/7053	VAV Controller, 60°/minute		
BAC-7301	AHU Controller	BAC-9301	Unitary Controller
BAC-7301C	AHU Controller w/ RTC	BAC-9301C	Unitary Controller w/ RTC
BAC-7302	RTU Controller	BAC-9301	Unitary Controller
BAC-7302C	RTU Controller w/ RTC	BAC-9301C	Unitary Controller w/ RTC
BAC-7303	FCU Controller	BAC-9301	Unitary Controller
BAC-7303C	FCU Controller w/ RTC	BAC-9301C	Unitary Controller w/ RTC
BAC-7401	HPU Controller	BAC-9301	Unitary Controller
BAC-7401C	HPU Controller w/ RTC	BAC-9301C	Unitary Controller w/ RTC

*NOTE: Replacement of a controller also requires replacement of any connected KMD-1xxx NetSensor with the equivalent STE-9xxx NetSensor (see below). Also the cable connecting the controller and NetSensor must be replaced with an equivalent length of Cat. 5 Ethernet patch cable.

KMD-11XX/12XX NETSENSOR CROSS-REFERENCE			
Model Number*	**Comments**	**Replacement Model Number****	**Comments**
KMD-1161	Temperature Only	STE-9001	Temperature Only
KMD-1164			
KMD-1162	Temp. Only, Hospitality***		
KMD-1181	Temp. and Humidity	STE-9021	Temp. and Humidity
KMD-1183			
KMD-1184			
KMD-1185			
KMD-1261	Temp. and Motion	STE-9201	Temp. and Motion
KMD-1281	Temp., Humidity, and Motion	STE-9221	Temp., Humidity, and Motion

*NOTE: Replacement of a KMD-1xxx NetSensor with the equivalent STE-9xxx NetSensor also requires replacement of the controller (see above). Also the cable connecting the controller and NetSensor must be replaced with an equivalent length of Cat. 5 Ethernet patch cable. The button interface on the new NetSensor will be different.

**NOTE: For color choice, the default color is Light Almond. For white, add a W to the end (e.g., STE-9001W).

***NOTE: KMD-1162 Hospitality NetSensors have slide switches for fan speed and heat/cool/off selection. An STE-9001 can perform similar functions but has a very different user interface.

SEQUENCES OF OPERATIONS

AHU (Air Handling Unit)

See **RTU (Roof Top Unit) or AHU (Air Handling Unit) on page 57**.

CAV (Constant Air Volume)

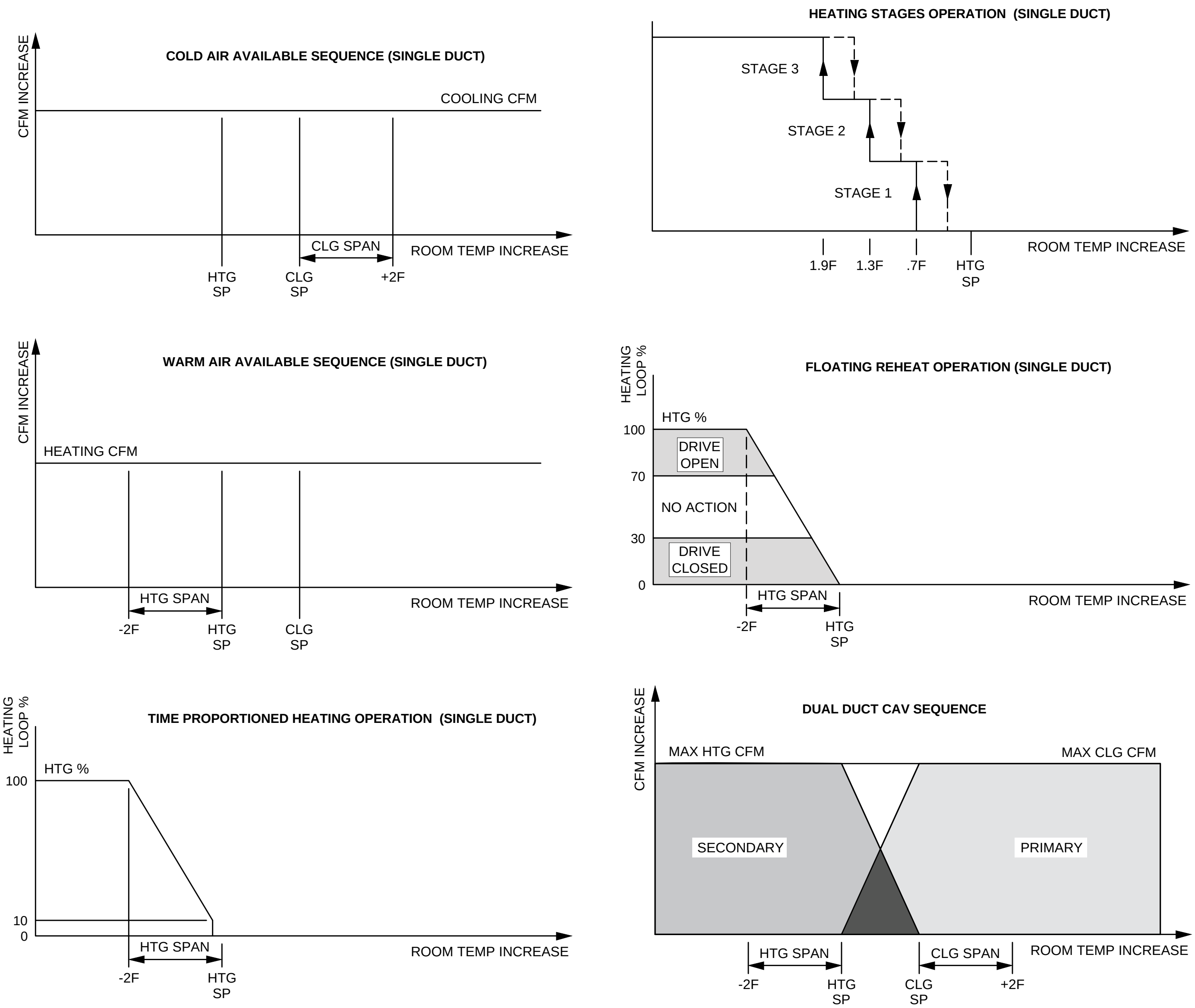


Illustration: VAV Operations

See relevant sections of **VAV (Variable Air Volume) on page 64** for additional descriptions.

FCU (Fan Coil Unit)

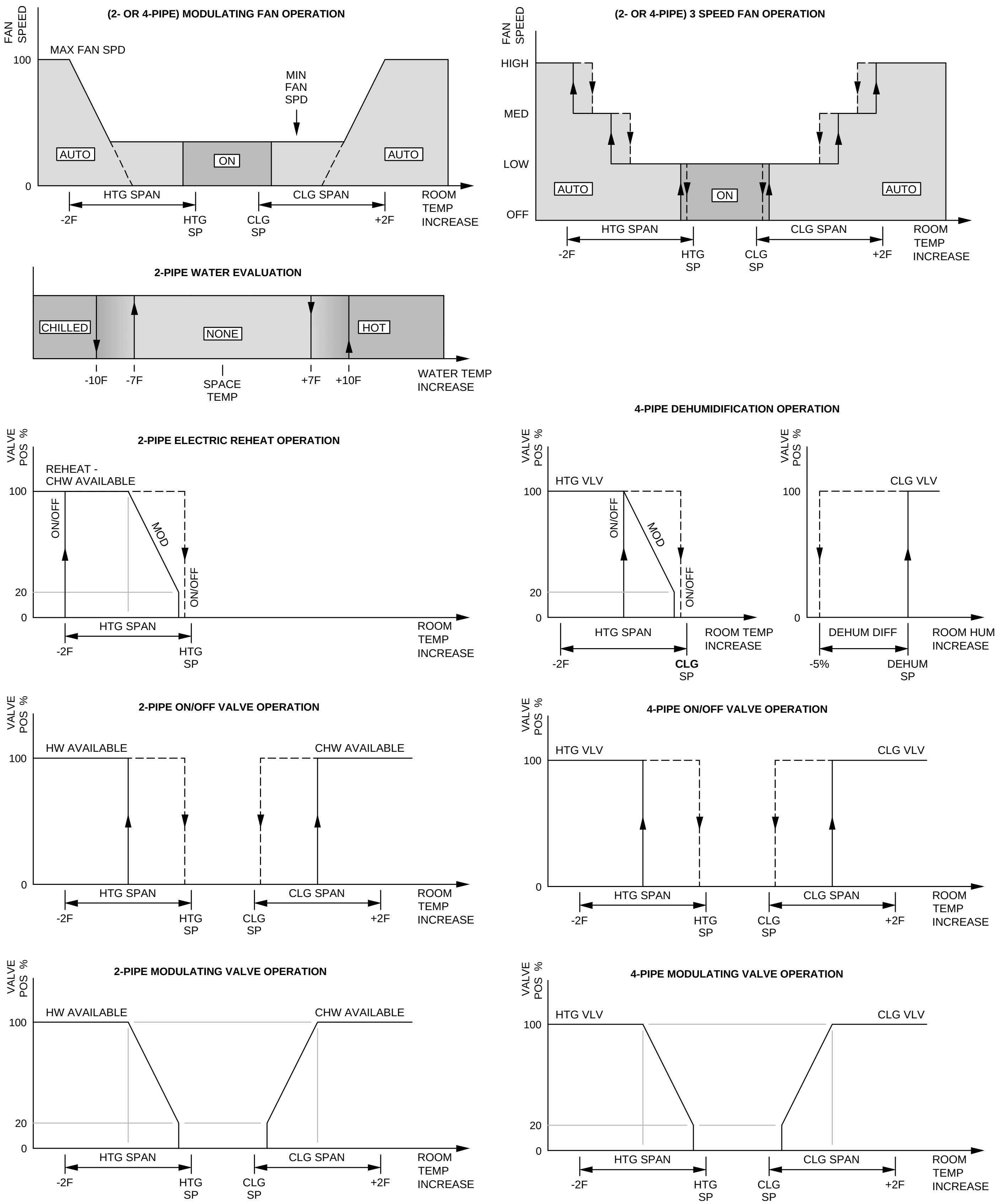


Illustration: FCU Operations

Introduction (FCU)

Topics in this section cover the FCU sequences of operation for the KMC Conquest BAC-9301 unitary controller. These are advanced topics for controls technicians and engineers.

NOTE: For sequence of operations with charts and wiring diagrams, see also the FCU submittal sheets (see **Submittal Sheets (Diagrams and Operation) on page 5**).

NOTE: See also **BACnet Objects List on page 75** for more information about objects listed in the descriptions.

Room Temperature Setpoints (FCU)

Types of Setpoints

There are four temperature setpoints each for heating and cooling for a total of eight setpoints.

- Active cooling
- Occupied cooling
- Unoccupied cooling
- Standby cooling
- Active heating
- Occupied heating
- Unoccupied heating
- Standby heating

These setpoints are based on a user-entered value or the occupancy state and standby value described in **Occupancy, Motion Sensing, and Standby (FCU) on page 43**.

Active Setpoint

The active setpoint is the current setpoint being used for control. The active setpoint is determined according to the occupancy state (see **Occupancy, Motion Sensing, and Standby (FCU) on page 43**):

- When the space becomes **Occupied**, the Occupied Cooling Setpoint (AV5) is placed in the Active Cooling Setpoint (AV3), and the Occupied Heating Setpoint (AV6) is placed in the Active Heating Setpoint (AV4).
- When the space becomes **Unoccupied**, the Unoccupied Cooling Setpoint (AV7) is placed in the Active Cooling Setpoint (AV3), and the Unoccupied Heating Setpoint (AV8) is placed in the Active Heating Setpoint (AV4).
- When the space enters **Standby**, the controller calculates the active setpoint by adding or subtracting (depending on mode) the Standby Offset (AV12) from the relevant occupied (but not unoccupied) setpoint. Standby is only applied to the occupied setpoint and thus is only valid when the schedule is active.

A user with a level 1 password (if a level 1 password is configured) can enter an active setpoint from the KMC Conquest STE-9000 series NetSensor (via AI2). The local override is valid when the schedule is unoccupied or occupied. This change is for a limited time or until the next time the occupancy state changes.

For display and control loop calculations, the active setpoint value is compared to the value of the space temperature variable AV1, which is taken from the physical temperature input AI1.

Occupied Setpoint

This temperature setpoint is entered by the controls technician during controller setup and system commissioning. This is the setpoint used when the system is occupied, which is usually controlled by the schedule in the controller.

Unoccupied Setpoint

This temperature setpoint is entered by the controls technician during controller setup and system commissioning. This is the setpoint used when the system is unoccupied, which is usually controlled by the schedule in the controller.

Standby Setpoint

This setpoint is used when the controller is in the standby state. It is a calculated from the relevant occupied setpoint value and the Standby Offset value. The Standby Offset value is entered by the controls technician during controller setup and system commissioning. See **Occupancy, Motion Sensing, and Standby (FCU) on page 43**.

Setpoint Limits

Programming in the controller limits the setpoint entry so that a heating setpoint is not set higher than its corresponding cooling setpoint.

If a user adjusts a setpoint so that it falls within the range set by the value of Minimum Setpoint Differential, the corresponding setpoint is changed to maintain the differential. For example, the Minimum Setpoint Differential is 4° F and the Occupied Heating setpoint is 70° F. If the user lowers the Occupied Cooling setpoint to 71° F, the controller recalculates the Occupied Heating setpoint and changes it to 67° F.

Occupancy, Motion Sensing, and Standby (FCU)

The controller is designed to operate as a stand-alone controller and can determine occupancy based on its internal occupancy schedule and (if connected to an STE-92x1/95x1 NetSensor) motion in the space. The controller can be in any one of the following occupancy states:

- Occupied
- Unoccupied
- Standby

The controller chooses which setpoint to use based on the occupancy and standby states. See **Room Temperature Setpoints (FCU) on page 42**.

The occupancy and standby states can also be commanded by another BACnet device or an operator workstation connected to the building automation network.

Occupied

For controllers without a connected motion sensor, the controller starts in the occupied state. If an internal schedule is enabled, the state of the schedule is set to either occupied or unoccupied as the initial state. See **Scheduling Occupancy (FCU) on page 44**.

Unoccupied

The controller changes to the unoccupied state only if the internal occupancy schedule is enabled and if the schedule is inactive.

Standby

In units with a connected motion sensor, the controller starts in standby and changes to occupied after detecting motion in the space. The controller will change from occupied to standby after a lack of motion for the period specified by the variable Standby Timer (AV28).

System Mode and Cooling/Heating Changeover (FCU)

The heating/cooling mode can also be manually set by adjusting the System Mode through the user interface. The System Mode (MSV2) can be set to Off, Auto, Heat, or Cool. Setting the System Mode to Heat or Cool forces the unit into that mode. Setting the System Mode to Off turns off all heating and cooling functions but has no effect on fan control.

When set to Auto:

- If the space temperature rises above the active cooling setpoint, the mode is set to cooling.
- If the space temperature falls below the heating setpoint, the mode is set to heating.
- The changeover is immediate.

Scheduling Occupancy (FCU)

The schedule in the controller is a standard BACnet schedule object. It can be changed from a configuration tool or a BACnet operator workstation.

The internal occupancy schedule changes the controller between the Occupied (Active) and Unoccupied (Inactive) states. If the controller is connected to an STE-92x1/95x1 NetSensor with a motion sensor, the motion sensor may change the controller between occupied and standby based on motion detected in the space.

NOTE: See also **Occupancy, Motion Sensing, and Standby (FCU) on page 43**.

Dehumidification Sequence (FCU)

NOTE: See also the four-pipe section in **Illustration: FCU Operations on page 41**.

Optional dehumidification control is available only for four-pipe applications when a controller is connected to an STE-9x21 NetSensor with an internal humidity sensor. (It is not available in two-pipe applications.) The controller can run the dehumidification sequence only if the heating and cooling modes are set to automatic.

If the space humidity rises above the dehumidification setpoint, the cooling valve is opened 100%. The heating valve then follows its normal operation to maintain the cooling setpoint. Once the space humidity drops below the dehumidification setpoint minus its span, dehumidification ceases and the heating and cooling valves resume normal operation.

Temperature Sensing Inputs (FCU)

Space Temperature Sensing

The controller uses a connected STE-9000 series NetSensor digital wall sensor or an STE-6010/6014/6017 analog wall sensor. See **Digital STE-9000 Series NetSensors on page 7** and **Analog STE-6000 Series Thermistor Sensors on page 7**.

WST (Water Supply Temperature) Sensor

The WST sensor is a required sensor (e.g., STE-1455) for two-pipe fan coil units and is optional for other fan coil applications. The controller is configured for a Type III thermistor sensor to monitor water temperature. The water temperature can be monitored as an analog input, and it is also stored as an analog value object (AV19).

DAT (Discharge Air Temperature) Sensor

The DAT input is a required input for economizer applications and is an option for other applications. For DAT applications, the controller is configured for a Type III thermistor sensor (e.g., STE-1405). DAT can be monitored as an analog input (AI3), and it is also stored as an analog value object (AV20).

The DAT input is a dual function input. It is also used as the input for the fan status switch. See **Fan Status (FCU) on page 45**.

Fan Status (FCU)

Fan status is a second function of the DAT input. The function requires an NC (Normally Closed) fan status switch (e.g., CSE-1102) connected across the DAT input terminals (UI3 and GND). When the fan is started at any speed, the controller program waits 10 seconds for the Fan Status switch (FST) to open. If the status switch does not open within 10 seconds after the fan is commanded to start, all heating and cooling is commanded to stop at BACnet priority level 5. The fan output remains enabled until the fan status switch opens. The state of fan status is stored in a binary variable (BV14).

When the fan status switch is open (the fan is running), the DAT input is the temperature sensing input. When the fan status switch is closed, the value for the DAT input is greater than 260. See **DAT (Discharge Air Temperature) Sensor on page 45**.

PID (Proportional Integral Derivative) Loops (FCU)

A PID control loop calculates an error value from the difference between the measured room temperature and the active setpoint values. The error value is expressed as a percentage and is typically used in a controller to control the state of an output. When the difference between the setpoint and room temperature is large, the error is large. As the system reduces the difference between the setpoint and space temperature, the error becomes smaller. In a simple example, if the output of the PID loop that is controlling a modulating valve is 50%, the valve position is half-way open; if the output of the loop is 100%, the valve position is fully open.

The controller uses up to three PID control loops:

- The **heating** loop and **cooling** loop are implemented in all models.
- The **reheat** loop is used only for heating outputs during dehumidification.

The PID control loops in the controller are standard BACnet objects.

Valve Operation (FCU)

Four-Pipe vs. Two Pipe

Four-pipe applications have both hot and chilled water valves for heating and cooling and an option for dehumidification. Two-pipe applications have one valve, a method to determine supply water temperature, and an option for electric reheat.

On/Off Valves

On a call for cooling or heating, the valve will open once the PID loop controlling the valve reaches 50% (half the span away from setpoint). The valve will close once the loop falls to 5%. The controller programming supports both normal and reverse action valves, which are set from the user interface.

Modulating Valves

On a call for cooling or heating, a modulating valve modulates from 0 to 100% over the first half (0 to 50%) of the PID loop output controlling the valve. When the temperature drops below 50% of the span, the valve starts modulating closed.

Valve Action

The controller supports both normal and reverse valve action that is set from the user interface.

- **Normal**—The valve is fully closed when the output signal is inactive and fully open when the output is active.
- **Reverse**—The valve is fully closed when the output signal is active and fully open when the output is inactive.

Two-Pipe Water Supply Temperature Evaluation

For two-pipe fan coil units, the controller uses the WST sensor to determine if chilled or hot water is being supplied to the unit. See **WST (Water Supply Temperature) Sensor on page 45**.The water type is determined by comparing the value of the water temperature sensor input to the room temperature. The controller programming then determines that the water temperature is one of the following.

- **Hot**—the water temperature is 10° F (default) or more above room temperature.
- **Chilled**—the water temperature is over 10° F (default) or more below room temperature.
- **None**—the water temperature is within that range.

NOTE: The default of 10° F can be changed in the STE-9xx1 menu by modifying the value in EVAL. See **Conquest NetSensor Screen Abbreviations on page 22**.

If the water temperature is evaluated as None, the controller runs the water evaluation program every six hours. During a water evaluation, the controller opens the valve until a water type is determined or for five minutes, whichever is reached first. If a water evaluation is not being performed, the valve remains closed.

Electric Heating (Two-Pipe Option)

Electric heat can be added to two-pipe systems, typically through a duct or baseboard resistance heater controlled by a relay.

When the supply water type is chilled water and there is a call for heat, the controller controls the heating element through output terminal BO5. The output turns on when the heating loop is greater than 99%. The output is turned off when the loop falls to 5%. If the supply water type is hot water, only the water valve output is used to satisfy a call for heat.

Fan Operation (FCU)

Automatic Fan Control

The controller supports both modulating fans and fans with one, two, or three speeds. Fan speed is determined by the PID loop currently controlling the heating or cooling. Fan speed control is set up from the user interface by a user with a level 2 password (if a level 2 password is configured).

A user with a level 1 password (if a level 1 password is configured) can set the controller controlled fan to either run continuously or to start automatically on a call for cooling or heating.

- **On**—The fan runs continuously regardless of the heating/cooling modes or occupied/standby states.
- **Auto**—The fan begins running only when there is a call for cooling or heating. After the call for cooling or heating ends, the fan continues to run for the period set by the fan delay timer.
- **Low, Medium, High**—For systems with three-speed fans, the user has the choice of low, medium or high speed as the continuous running speed for the fan. Two-speed fans have two choices.

One, Two, and Three Speed Fans

For one, two, and three speed fans, the controller controls the fan speed with terminals BO1 (Low), BO2 (Medium), and BO3 (High) and SC.

- Single speed fans use terminal BO1 only
- Two speed fans use terminals BO1 and BO3
- Thee speed fans use terminals BO1, BO2, and BO3

The fan output terminals are energized as the cooling or heating loop varies from 0–100%. When the fan mode is set to Auto and either valve is called for, the fan starts on low speed. As the space temperature deviates further from the setpoint, the fan speed changes to medium. As the space temperature passes the active setpoint (plus/minus its span), high fan speed becomes the active speed. As the space temperature begins to return to the setpoint, the active fan speed drops to medium. As the space temperature further returns to the setpoint, the fan speed switches to low. As the active valve closes, all fan speeds are deenergized. During the occupied and standby modes, low fan speed is energized while both valves are closed if the fan mode is set to On.

Fan terminal activation is shown in the following table.

FAN SPEED	L TERMINAL (BO1)		M TERMINAL (BO2)		H TERMINAL (BO3)	
	ON	OFF	ON	OFF	ON	OFF
One (Low)	Active valve	5%	N/A	N/A	N/A	N/A
Two (Medium)	Active valve	5%	N/A	N/A	95%	80%
Three (High)	Active valve	5%	65%	50%	95%	80%

Illustration: Fan Speed and Terminal States

Modulating Fans

When the fan mode is set to Auto and either valve opens, the fan (controlled by UO7) starts at the minimum fan speed. Once the active valve is fully open, as the space temperature deviates further from the setpoint, the fan speed increases until it reaches the maximum fan speed. As the space temperature begins to return to the setpoint, the fan speed modulates toward the minimum fan speed. The fan runs at the minimum speed until the space temperature further returns to setpoint and the active valve closes. During the occupied and standby modes, the fan is energized at the minimum fan speed while both valves are closed if the fan mode is set to On.

HPU (Heat Pump Unit)

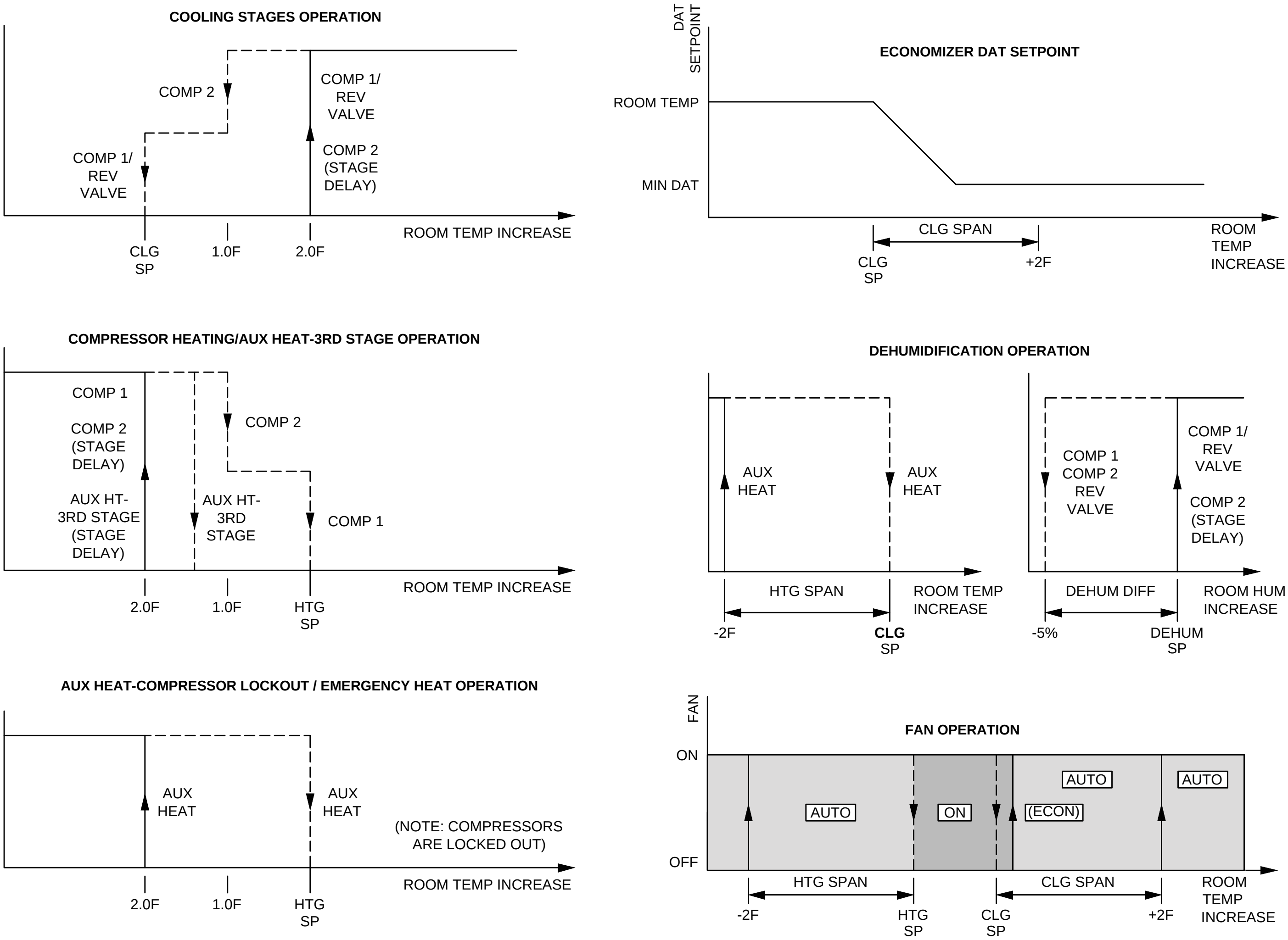


Illustration: HPU Operations

Introduction (HPU)

Topics in this section cover the sequences of operation for the HPU applications in the KMC Conquest BAC-9301 unitary controller. These are advanced topics for controls technicians and engineers.

NOTE: For sequence of operations with charts and wiring diagrams, see also the HPU submittal sheet. See **Submittal Sheets (Diagrams and Operation) on page 5**.

NOTE: See also **BACnet Objects List on page 75** for more information about objects listed in the descriptions.

Room Temperature Setpoints (HPU)

Types of Setpoints

There are four temperature setpoints each for heating and cooling for a total of eight setpoints:

- Active cooling
- Occupied cooling
- Unoccupied cooling
- Standby cooling
- Active heating
- Occupied heating
- Unoccupied heating
- Standby heating

These setpoints are based on a user-entered value or the occupancy state and standby value described in **Occupancy, Motion Sensing, and Standby (HPU) on page 51**.

Active Setpoint

The active setpoint is the current setpoint being used for control. The active setpoint is determined according to the occupancy state (see **Occupancy, Motion Sensing, and Standby (HPU) on page 51**):

- When the space becomes **Occupied**, the Occupied Cooling Setpoint (AV5) is placed in the Active Cooling Setpoint (AV3), and the Occupied Heating Setpoint (AV6) is placed in the Active Heating Setpoint (AV4).
- When the space becomes **Unoccupied**, the Unoccupied Cooling Setpoint (AV7) is placed in the Active Cooling Setpoint (AV3), and the Unoccupied Heating Setpoint (AV8) is placed in the Active Heating Setpoint (AV4).
- When the space enters **Standby**, the controller calculates the active setpoint by adding or subtracting (depending on mode) the Standby Offset (AV12) from the relevant occupied (but not unoccupied) setpoint. Standby is only applied to the occupied setpoint and thus is only valid when the schedule is active.

A user with a level 1 password (if a level 1 password is configured) can enter an active setpoint from the KMC Conquest STE-9000 series NetSensor (via AI2). The local override is valid when the schedule is unoccupied or occupied. This change is for a limited time or until the next time the occupancy state changes.

For display and control loop calculations, the active setpoint value is compared to the value of the space temperature variable AV1, which is taken from the physical temperature input AI1.

Occupied Setpoint

This temperature setpoint is entered by the controls technician during controller setup and system commissioning. This is the setpoint used when the system is occupied, which is usually controlled by the schedule in the controller.

Unoccupied Setpoint

This temperature setpoint is entered by the controls technician during controller setup and system commissioning. This is the setpoint used when the system is unoccupied, which is usually controlled by the schedule in the controller.

Standby Setpoint

This setpoint is used when the controller is in the standby state. It is calculated from the relevant occupied setpoint value and the Standby Offset value. The Standby Offset value is entered by the controls technician during controller setup and system commissioning. See **Occupancy, Motion Sensing, and Standby (HPU) on page 51**.

Setpoint Limits

Programming in the controller limits the setpoint entry so that a heating setpoint is not set higher than its corresponding cooling setpoint.

If a user adjusts a setpoint so that it falls within the range set by the value of Minimum Setpoint Differential, the corresponding setpoint is changed to maintain the differential. For example, the Minimum Setpoint Differential is 4° F and the Occupied Heating setpoint is 70° F. If the user lowers the Occupied Cooling setpoint to 71° F, the controller recalculates the Occupied Heating setpoint and changes it to 67° F.

Occupancy, Motion Sensing, and Standby (HPU)

The controller is designed to operate as a stand-alone controller and can determine occupancy based on its internal occupancy schedule and (if connected to an STE-92x1/95x1 NetSensor) motion in the space. The controller can be in any one of the following occupancy states:

- Occupied
- Unoccupied
- Standby

The controller chooses which setpoint to use based on the occupancy and standby states. See **Room Temperature Setpoints (HPU) on page 50**.

The occupancy and standby states can also be commanded by another BACnet device or an operator workstation connected to the building automation network.

Occupied

For controllers without a connected motion sensor, the controller starts in the occupied state. If an internal schedule is enabled, the state of the schedule is set to either occupied or unoccupied as the initial state. See **Scheduling Occupancy (HPU) on page 52**.

Unoccupied

The controller changes to the unoccupied state only if the internal occupancy schedule is enabled and if the schedule is inactive.

Standby

In units with a connected motion sensor, the controller starts in standby and changes to occupied after detecting motion in the space. The controller will change from occupied to standby after a lack of motion for the period specified by the variable Standby Timer (AV28).

System Mode and Cooling/Heating Changeover (HPU)

The heating/cooling mode can also be manually set by adjusting the System Mode through the user interface. The System Mode (MSV2) can be set to Off, Auto, Heat, Cool, or Emergency Heat. Setting the System Mode to Heat, Cool, or Emergency Heat forces the unit into that mode. Setting the System Mode to Off turns off all heating and cooling functions but has no effect on fan control.

When set to Auto:

- If the space temperature rises above the active cooling setpoint, the mode is set to cooling.
- If the space temperature falls below the heating setpoint, the mode is set to heating.
- The changeover does not take place until the time set by Fan Off Delay expires.

Scheduling Occupancy (HPU)

The schedule in the controller is a standard BACnet schedule object. It can be changed from a configuration tool or a BACnet operator workstation.

The internal occupancy schedule changes the controller between the Occupied (Active) and Unoccupied (Inactive) states. If the controller is connected to an STE-92x1/95x1 NetSensor with a motion sensor, the motion sensor may change the controller between occupied and standby based on detected motion.

NOTE: See also **Occupancy, Motion Sensing, and Standby (HPU) on page 51**.

Dehumidification Sequence (HPU)

NOTE: See **Illustration: HPU Operations on page 49**.

Optional dehumidification control is available only when a controller is connected to an STE-9x21 NetSensor with an internal humidity sensor.

The controller can run the dehumidification sequence only if the heating and cooling modes are set to automatic.

When dehumidification is active, cooling output is set to 100%. Heating then reheats the discharge air to maintain the space temperature to the value of the Active Cooling setpoint. The controller continuously runs the fan during dehumidification regardless of other fan settings.

If the space humidity rises above the dehumidification setpoint, compressor 1 is energized if the minimum off time has been met. If the humidity remains high for the stage delay and compressor 2’s minimum off time has been met, compressor 2 is energized. Auxiliary heat is then cycled to maintain the cooling setpoint. Once the space humidity drops below the dehumidification setpoint minus its span, dehumidification ceases and the compressors resume normal space temperature control.

Temperature Sensing Inputs (HPU)

Space Temperature Sensing

The controller uses a connected STE-9000 series NetSensor digital wall sensor or an STE-6010/6014/6017 analog wall sensor. See **Digital STE-9000 Series NetSensors on page 7** and **Analog STE-6000 Series Thermistor Sensors on page 7**.

OAT (Outside Air Temperature) Sensing

The OAT input is a required input for compressor lockout and economizer applications and is an optional input for others. The controller is configured for a Type III thermistor sensor (e.g., STE-1451) to monitor outside air temperature. The outside air temperature is also stored in an analog value object (AV19).

DAT (Discharge Air Temperature) Sensor

The DAT input is a required input for economizer applications and is an option for other applications. For DAT applications, the controller is configured for a Type III thermistor sensor (e.g., STE-1405). The DAT can be monitored as an analog input (AI3) and is also stored in an analog value object (AV20).

The DAT input is a dual function input. It is also used as the input for the fan status switch. See **Fan Status (HPU) on page 53**.

Fan Status (HPU)

NOTE: See **Illustration: HPU Operations on page 49**.

Fan status is a second function of the DAT input. See **DAT (Discharge Air Temperature) Sensor on page 53**. The function requires an NC (Normally Closed) fan status switch (e.g., CSE-1102) connected across the DAT input terminals (UI3 and GND). When the fan is started at any speed, the controller program waits 10 seconds for the Fan Status switch (FST) to open. If the status switch does not open within 10 seconds after the fan is commanded to start, all heating and cooling is commanded to stop at BACnet priority level 5. The fan output remains enabled until the fan status switch opens. The state of fan status is stored in a binary variable (BV14).

When the fan status switch is open (the fan is running), the DAT input is the temperature sensing input. When the fan status switch is closed, the value for the DAT input is greater than 260.

PID (Proportional Integral Derivative) Loops (HPU)

A PID control loop calculates an error value from the difference between the measured room temperature and the active setpoint. The error value is expressed as a percentage and is typically used in a controller to control the state of an output. When the difference between the setpoint and room temperature is large, the error is large. As the system reduces the difference between the setpoint and space temperature, the error becomes smaller. In a simple example, if the output of the PID loop that is controlling a modulating valve is 50%, the valve position is half-way open; if the output of the loop is 100%, the valve position is fully open.

The controller uses up to four PID control loops:

- The **heating** loop and **cooling** loop are implemented in all models.
- The **discharge air** loop controls the position of the economizer damper. For this loop, the setpoint is the measured temperature of the air that is discharged by a heat pump unit. See **Economizer Cooling (HPU) on page 55**.
- The **reheat** loop is used only for heating outputs during dehumidification. See also **Auxiliary and Emergency Heat Action (HPU) on page 56**.

The PID control loops in the controller are standard BACnet objects.

Staged Heating And Cooling (HPU)

Staged heating and cooling are used for applications other than chilled or hot water systems. Typically the controller controls gas heat, electric heat, or direct expansion (DX) cooling with staged heating and cooling. Staged heating or cooling can be mixed with a modulating valve for heating or cooling.

NOTE: See **Illustration: HPU Operations on page 49**.

Staged Cooling

As the demand for cooling increases, the controller starts the first stage of cooling when the cooling PID loop rises above 99% and the first stage of cooling has been turned off for at least the time set by the value of Minimum Off Time. See **PID (Proportional Integral Derivative) Loops (HPU) on page 53**.

The second stage of cooling turns on when:

- The cooling loop rises above 99%.
- And the first stage has been turned on for the period set by Stage Delay.
- And the second stage has been turned off for at least as long as the value of Minimum Off Time.

As the demand for cooling is satisfied, the second stage turns off when the cooling PID loop drops below 50%. This first stage turns off when the cooling loop drops below 1%.

Staged Heating

As the demand for heating increases, the controller starts the first stage of heating when the heating PID loop rises above 99%. The second stage of heating turns on when the heating loop rises above 99% and the first stage has already been on for the period set by the Stage Delay.

As the demand for heating is satisfied, the second stage is turned off when the heating PID loop drops below 50%. This first stage is turned off when the heating loop drops below 1%.

See also **Auxiliary and Emergency Heat Action (HPU) on page 56**.

Fan Operation (HPU)

A user with a level 1 password (if a level 1 password is configured) can set the controller controlled fan to either run continuously or to start automatically on a call for cooling or heating.

- **On**—The fan runs continuously regardless of the heating/cooling modes or occupied/standby states.
- **Auto**—The fan begins running only when there is a call for cooling or heating. After the call for cooling or heating ends, the fan continues to run for the period set by the fan delay timer.

Economizer Cooling (HPU)

NOTE: See **Illustration: HPU Operations on page 49**.

NOTE: During Occupied mode, the optional economizer can be enabled only if both OAT and DAT sensors are connected to the controller. See **OAT (Outside Air Temperature) Sensing on page 53** and **DAT (Discharge Air Temperature) Sensor on page 53**.

During occupied mode, if the OAT drops below the economizer enable temperature and there is a call for cooling, the economizer mode is enabled. The economizer mode is disabled if the OAT rises 1° above the economizer enable temperature.

Once enabled, the economizer OAD (Outside Air Damper) opens to the larger value of either the minimum damper position limit (Minimum Econ Damper) or the DAT PID loop. The DAT loop modulates from 0 to 100% as the DAT rises above the DAT setpoint. The DAT setpoint resets between the sensed room temperature and the limit for minimum discharge air temperature as the cooling loop varies between 0 and 50%. If the DAT decreases below 55° F, the OAD returns to the minimum damper position.

While economizing, the OAD is open to the greater of the minimum damper position or DAT control. The OAD is shut during unoccupied mode and any time the fan is off.

Reversing Valve Action (HPU)

The controller reversing valve output BO4 to HPU terminal O/B, is energized on a call for cooling (“O” function). The action can be changed from the user interface to be active on a call for heating (“B” function). The “O” function is the default.

HPU REVERSING VALVE CONNECTIONS AND CONFIGURATION

BAC-9301 Terminal	HPU Terminal	RVA on NetSensor Display*	BV15 Object State	Reversing Valve Action*
BO4	O	ACTV CL or Disable**	Inactive	Energized for Cooling
	B	ACTV HT or Enable**	Active	Energized for Heating

*NOTE: The RVA (Reversing Valve) configuration is in the SYS menu of the STE-9xxx NetSensor. See **Controller Configuration with STE-9xx1 Menus on page 21**.

**NOTE: Displayed text is dependent on firmware version. Only initial firmware had Disable/Enable.

Illustration: HPU Reversing Valve Connections and Configuration

Auxiliary and Emergency Heat Action (HPU)

NOTE: See **Illustration: HPU Operations on page 49**.

The heat pump unit AUX/E terminal is for auxiliary or emergency heat.

Auxiliary heat operation can be configured for one of three modes:

- **Compressor lockout**—The compressors are locked out when the outside air temperature drops below the value of the Compressor OAT Low Limit, and the auxiliary heat output follows the compressor 1 heating sequence. The lockout is cleared when the outside air temperature rises 2° F above the value of Compressor OAT Low Limit. The BO5 (AUX/E) output terminal is active only on a call for heating when the compressors are locked out.
- **Third stage**—The BO5 (AUX/E) output functions as the output for a third stage of heat. When auxiliary heat is configured for third stage, the unit is in heating mode and compressor 2 has been on for the stage delay, the aux heat output is energized. As the space temperature rises above 65% of the heating span below heating setpoint, aux heat is deenergized.
- **None**—Auxiliary heat is disabled.

When the system mode is manually set to **Emergency** heat, the compressor heating outputs (BO2 and BO3) are locked out and emergency heat (BO5) is energized as the space temperature drops below the heating setpoint minus heating span. As the space temperature rises above the heating setpoint, the emergency heat output is deenergized.

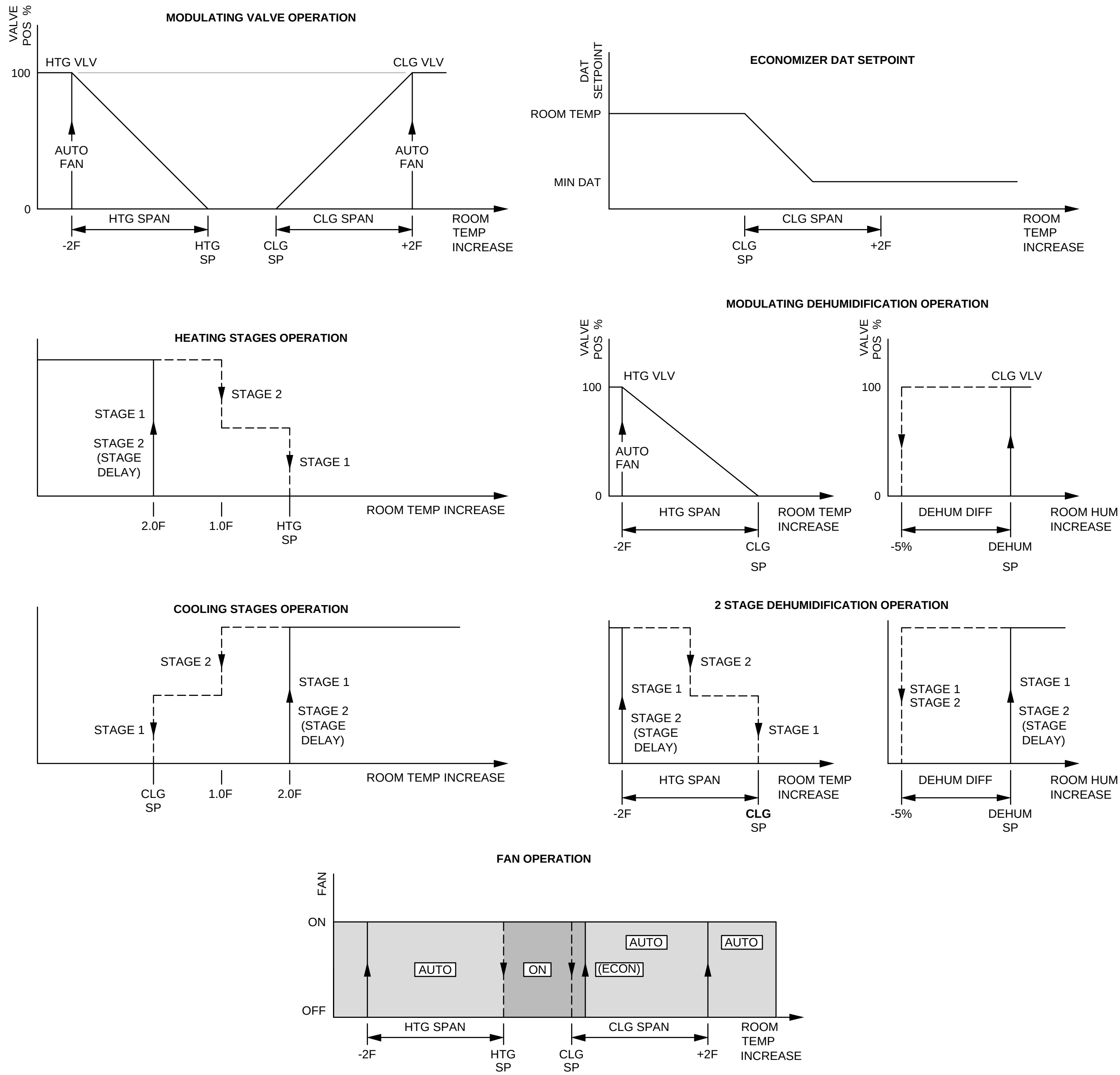


Illustration: RTU Operations

Introduction (RTU/AHU)

Topics in this section cover the RTU sequences of operation for the KMC Conquest BAC-9301 unitary controller. These are advanced topics for controls technicians and engineers.

NOTE: For sequence of operations with charts and wiring diagrams, see also the RTU submittal sheets (see **Submittal Sheets (Diagrams and Operation) on page 5**).

NOTE: See also **BACnet Objects List on page 75** for more information about objects listed in the descriptions.

Room Temperature Setpoints (RTU/AHU)

Types of Setpoints

There are four temperature setpoints each for heating and cooling for a total of eight setpoints.

- Active cooling
- Occupied cooling
- Unoccupied cooling
- Standby cooling
- Active heating
- Occupied heating
- Unoccupied heating
- Standby heating

These setpoints are based on a user-entered value or the occupancy state and standby that is described in **Occupancy, Motion Sensing, and Standby (RTU/AHU) on page 59**.

Active Setpoint

The active setpoint is the current setpoint being used for control. The active setpoint is determined according to the occupancy state (see **Occupancy, Motion Sensing, and Standby (RTU/AHU) on page 59**):

- When the space becomes **Occupied**, the Occupied Cooling Setpoint (AV5) is placed in the Active Cooling Setpoint (AV3), and the Occupied Heating Setpoint (AV6) is placed in the Active Heating Setpoint (AV4).
- When the space becomes **Unoccupied**, the Unoccupied Cooling Setpoint (AV7) is placed in the Active Cooling Setpoint (AV3), and the Unoccupied Heating Setpoint (AV8) is placed in the Active Heating Setpoint (AV4).
- When the space enters **Standby**, the controller calculates the active setpoint by adding or subtracting (depending on mode) the Standby Offset (AV12) from the relevant occupied (but not unoccupied) setpoint. Standby is only applied to the occupied setpoint and thus is only valid when the schedule is active.

A user with a level 1 password (if a level 1 password is configured) can enter an active setpoint from the KMC Conquest STE-9000 series NetSensor (via AI2). The Local override is valid when the schedule is unoccupied or occupied. This change is for a limited time or until the next time the occupancy state changes.

For display and control loop calculations, the active setpoint value is compared to the value of the space temperature variable AV1, which is taken from the physical temperature input AI1.

Occupied Setpoint

This temperature setpoint is entered by the controls technician during controller setup and system commissioning. This is the setpoint used when the system is occupied, which is usually controlled by the schedule in the controller.

Unoccupied Setpoint

This temperature setpoint is entered by the controls technician during controller setup and system commissioning. This is the setpoint used when the system is unoccupied, which is usually controlled by the schedule in the controller.

Standby Setpoint

The standby setpoint is used when the controller is in the standby state. It is calculated from the occupied setpoint and the value of Standby Offset. The Standby Offset value is entered by the controls technician during controller setup and system commissioning. See **Occupancy, Motion Sensing, and Standby (RTU/AHU) on page 59**.

Setpoint Limits

Programming in the controller limits the setpoint entry so that a heating setpoint is not set higher than its corresponding cooling setpoint.

If a user adjusts a setpoint so that it falls within the range set by the value of Minimum Setpoint Differential, the corresponding setpoint is changed to maintain the differential. For example, the Minimum Setpoint Differential is 4° F and the Occupied Heating setpoint is 70° F. If the user lowers the Occupied Cooling setpoint to 71° F, the controller recalculates the Occupied Heating setpoint and changes it to 67° F.

Occupancy, Motion Sensing, and Standby (RTU/AHU)

The controller is designed to operate as a stand-alone controller and can determine occupancy based on its internal occupancy schedule and (if connected to an STE-92x1/95x1 NetSensor) motion in the space. The controller can be in any one of the following occupancy states:

- Occupied
- Unoccupied
- Standby

The controller chooses which setpoint to use based on the occupancy and standby states. See **Room Temperature Setpoints (RTU/AHU) on page 58**.

The occupancy and standby states can also be commanded by another BACnet device or an operator workstation connected to the building automation network.

Occupied

For controllers without a connected motion sensor, the controller starts in the occupied state. If an internal schedule is enabled, the state of the schedule is set to either occupied or unoccupied as the initial state. See **Scheduling Occupancy (RTU/AHU) on page 60**.

Unoccupied

The controller changes to the unoccupied state only if the internal occupancy schedule is enabled and if the schedule is inactive.

Standby

In units with a connected motion sensor, the controller starts in standby and changes to occupied after detecting motion in the space. The controller will change from occupied to standby after a lack of motion for the period specified by the variable Standby Timer (AV28).

System Mode & Cooling/Heating Changeover (RTU/AHU)

The heating/cooling mode can also be manually set by adjusting the System Mode through the user interface. The System Mode (MSV2) can be set to Off, Auto, Heat, or Cool. Setting the System Mode to Heat or Cool forces the unit into that mode. Setting the System Mode to Off turns off all heating and cooling functions but has no effect on fan control.

When set to Auto:

- If the space temperature rises above the active cooling setpoint, the mode is set to cooling.
- If the space temperature falls below the heating setpoint, the mode is set to heating.
- The changeover does not take place until the time set by Fan Off Delay expires.

Scheduling Occupancy (RTU/AHU)

The schedule in the controller is a standard BACnet schedule object. It can be changed from a configuration tool or a BACnet operator workstation.

The internal occupancy schedule changes the controller between the Occupied (Active) and Unoccupied (Inactive) states. If the controller is connected to an STE-92x1/95x1 NetSensor with a motion sensor, the motion sensor may change the controller between occupied and standby based on motion detected in the space.

NOTE: See also **Occupancy, Motion Sensing, and Standby (RTU/AHU) on page 59**.

Dehumidification Sequence (RTU/AHU)

NOTE: See **Illustration: RTU Operations on page 57**.

Optional dehumidification control is available only when a controller is connected to an STE-9x21 NetSensor with an internal humidity sensor.

The controller can run the dehumidification sequence only if the heating and cooling modes are set to automatic.

When dehumidification is active, cooling output is activated to 100%. Heating then reheats the discharge air to maintain the space temperature to the value of the Active Cooling setpoint. The controller continuously runs the fan during dehumidification regardless of other fan settings.

Temperature Sensing Inputs (RTU/AHU)

Space Temperature Sensing

The controller uses a connected STE-9000 series NetSensor digital wall sensor or an STE-6010/6014/6017 analog wall sensor. See **Digital STE-9000 Series NetSensors on page 7** and **Analog STE-6000 Series Thermistor Sensors on page 7**.

OAT (Outside Air Temperature) Sensing

The OAT input is a required input for compressor lockout and economizer applications and is an optional input for others. The controller is configured for a Type III thermistor sensor (e.g., STE-1451) to monitor outside air temperature. The outside air temperature is also stored in an analog value object (AV19).

DAT (Discharge Air Temperature) Sensor

The DAT input is a required input for economizer applications and is an option for other applications. For DAT applications, the controller is configured for a Type III thermistor sensor (e.g., STE-1405). The DAT can be monitored as an analog input (AI3) and is also stored in an analog value object (AV20).

The DAT input is a dual function input. It is used also as the input for the fan status switch. See **Fan Status (RTU/AHU) on page 61**.

Fan Status (RTU/AHU)

NOTE: See **Illustration: RTU Operations on page 57**.

Fan status is a second function of the DAT input. See **DAT (Discharge Air Temperature) Sensor on page 61**. The function requires an NC (Normally Closed) fan status switch (e.g., CSE-1102) connected across the DAT input terminals (UI3 and GND). When the fan is started at any speed, the controller program waits 10 seconds for the Fan Status switch (FST) to open. If the status switch does not open within 10 seconds after the fan is commanded to start, all heating and cooling is commanded to stop at BACnet priority level 5. The fan output remains enabled until the fan status switch opens. The state of fan status is stored in a binary variable (BV14).

When the fan is functioning normally and the fan status switch is open the DAT input is normal temperature sensing input. When the fan status switch is closed, the value for the DAT input is greater than 260.

PID (Proportional Integral Derivative) Loops (RTU/AHU)

A PID control loop calculates an error value from the difference between the measured room temperature and the active setpoint. The error value is expressed as a percentage and is typically used in a controller to control the state of an output. When the difference between the setpoint and room temperature is large, the error is large. As the system reduces the difference between the setpoint and space temperature, the error becomes smaller. In a simple example, if the output of the PID loop that is controlling a modulating valve is 50%, the valve position is half-way open; if the output of the loop is 100%, the valve position is fully open.

The controller uses up to four PID control loops:

- The **heating** loop and **cooling** loop are implemented in all models.
- The **discharge air** loop controls the position of the economizer damper. For this loop, the setpoint is the measured temperature of the air that is discharged by the RTU. See **Economizer Cooling (RTU/AHU) on page 63**.
- The **reheat** loop is used only for heating outputs during dehumidification.

The PID control loops in the controller are standard BACnet objects.

Modulating Cooling and Heating (RTU/AHU)

Modulating cooling and heating are used in controller controlled systems with modulating valves and chilled or hot water coils. A single modulating valve can be used with staged cooling or heating.

Modulating Cooling

Modulating cooling does not start until the cooling loop exceeds 99%. Then the analog cooling output modulates over 10 VDC as the cooling loop changes from 0 to 100%. When the cooling loop drops below 1%, cooling stops until the loop again exceeds 99%.

If the economizer is enabled, cooling will not start modulating until the economizer damper is fully open.

Modulating Heating

Modulating heating does not start until the heating loop exceeds 99%. Then the analog heating output modulates over 10 VDC as the heating loop changes from 0 to 100%. When the heating loop drops below 1%, heating stops until the loop exceeds 99% again.

Valve Action

The controller supports both normal and reverse valve action that can be set from the user interface.

- **Normal**—The valve is fully closed when the output signal is 0 VDC and fully open when the output is 10 VDC.
- **Reverse**—The valve is fully closed when the output signal is 10 VDC and fully open when the output is 0 VDC.

Staged Heating And Cooling (RTU/AHU)

Staged heating and cooling are used for applications other than chilled or hot water systems. Typically the controller controls gas heat, electric heat, or direct expansion (DX) cooling with staged heating and cooling. Staged heating or cooling can be mixed with a modulating valve for heating or cooling.

NOTE: See **Illustration: RTU Operations on page 57**.

Staged Cooling

As the demand for cooling increases, the controller starts the first stage of cooling when the cooling PID loop rises above 99% and the first stage of cooling has been turned off for at least the time set by the value of Minimum Off Time. See **PID (Proportional Integral Derivative) Loops (RTU/AHU) on page 61**.

The second stage of cooling turns on when:

- The cooling loop rises above 99%.
- And the first stage has been turned on for the period set by Stage Delay.
- And the second stage has been turned off for at least as long as the value of Minimum Off Time.

As the demand for cooling is satisfied, the second stage turns off when the cooling PID loop drops below 50%. This first stage turns off when the cooling loop drops below 1%.

Staged Heating

As the demand for heating increases, the controller starts the first stage of heating when the heating PID loop rises above 99%. The second stage of heating is turned on when the heating loop rises above 99% and the first stage has been turned on for period set by the Stage Delay.

As the demand for heating is satisfied, the second stage is turned off when the heating PID loop drops below 50%. This first stage is turned off when the heating loop drops below 1%.

Fan Control (RTU/AHU)

A user with a level 1 password (if a level 1 password is configured) can set the controller controlled fan to either run continuously or to start automatically on a call for cooling or heating.

- **On**—The fan will run continuously regardless of the heat/cool modes or occupied/standby states.
- **Auto**—The fan will run only when there is a call for heating or cooling. It continues to run for the period set by the fan delay timer after the call for heating or cooling.

Economizer Cooling (RTU/AHU)

NOTE: See **Illustration: RTU Operations on page 57**.

NOTE: During Occupied mode, the optional economizer can be enabled only if both OAT and DAT sensors are connected to the controller. See **OAT (Outside Air Temperature) Sensing on page 61** and **DAT (Discharge Air Temperature) Sensor on page 61**.

During occupied mode, if the OAT drops below the economizer enable temperature and there is a call for cooling, the economizer mode is enabled. The economizer mode is disabled if the OAT rises 1° above the economizer enable temperature.

Once enabled, the economizer OAD (Outside Air Damper) opens to the larger value of either the minimum damper position limit (Minimum Econ Damper) or the DAT PID loop. The DAT loop modulates from 0 to 100% as the DAT rises above the DAT setpoint. The DAT setpoint resets between the sensed room temperature and the limit for minimum discharge air temperature as the cooling loop varies between 0 and 50%. If the DAT decreases below 55° F, the OAD returns to the minimum damper position.

While economizing, the OAD is open to the greater of the minimum damper position or DAT control. The OAD is shut during unoccupied mode and any time the fan is off.

VAV (Variable Air Volume)

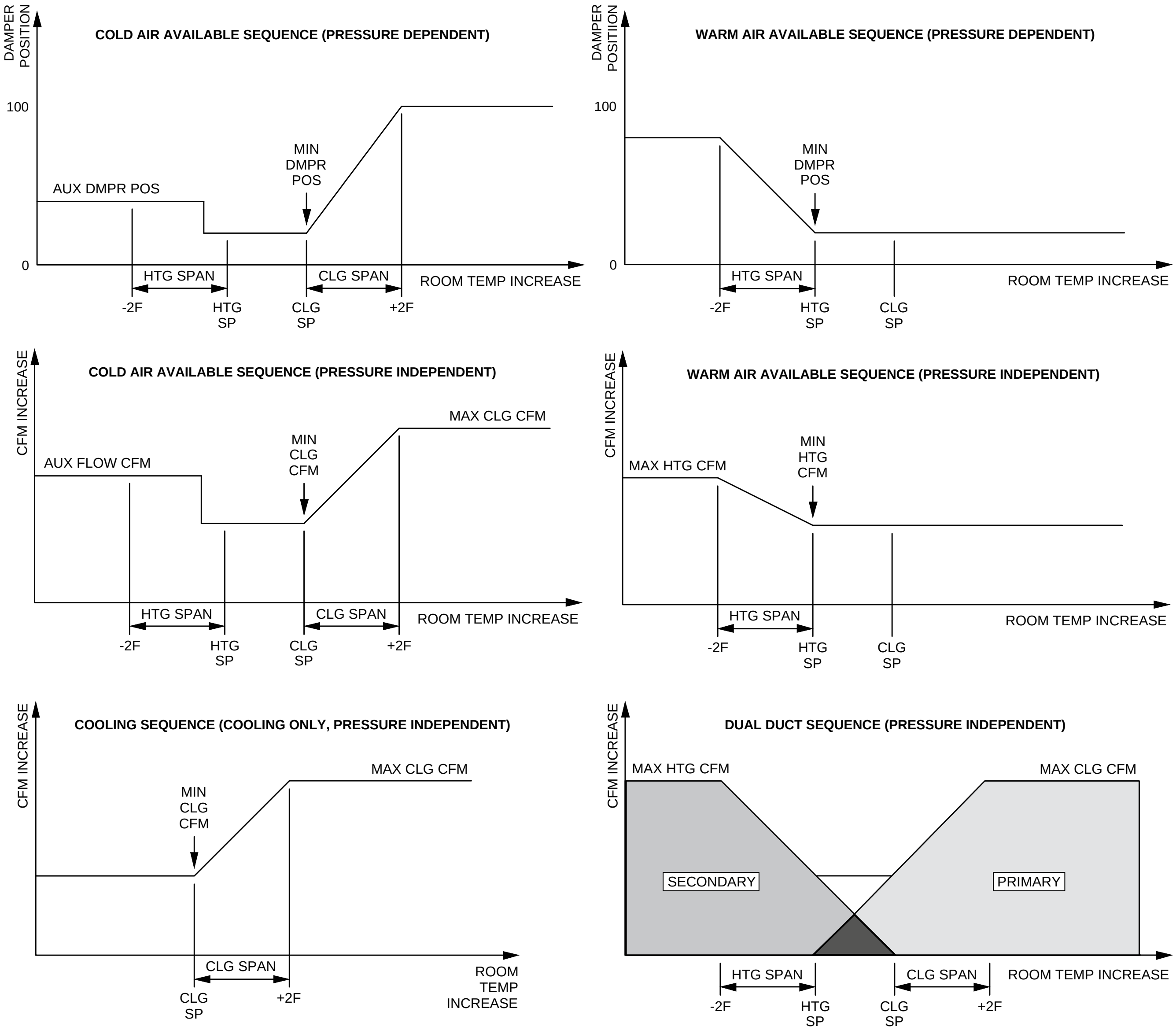


Illustration: VAV Airflow Operations

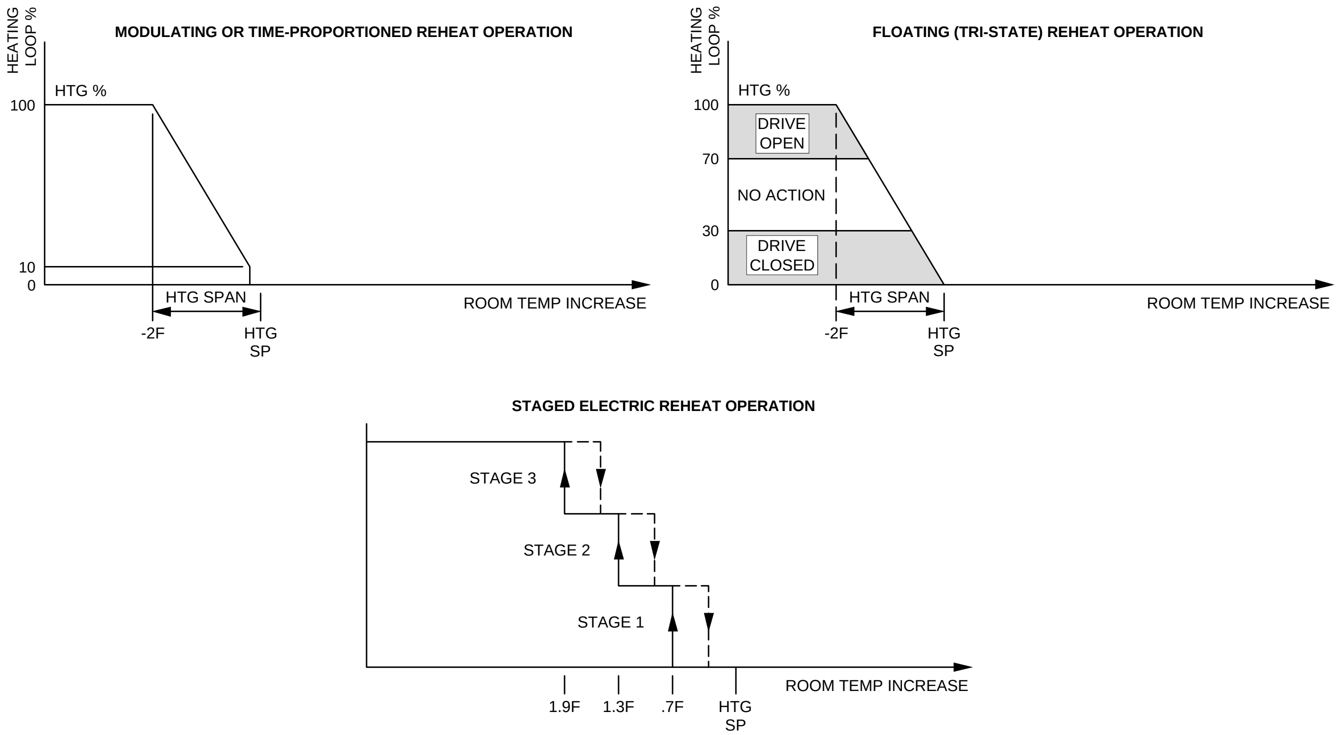


Illustration: VAV Reheat Operations

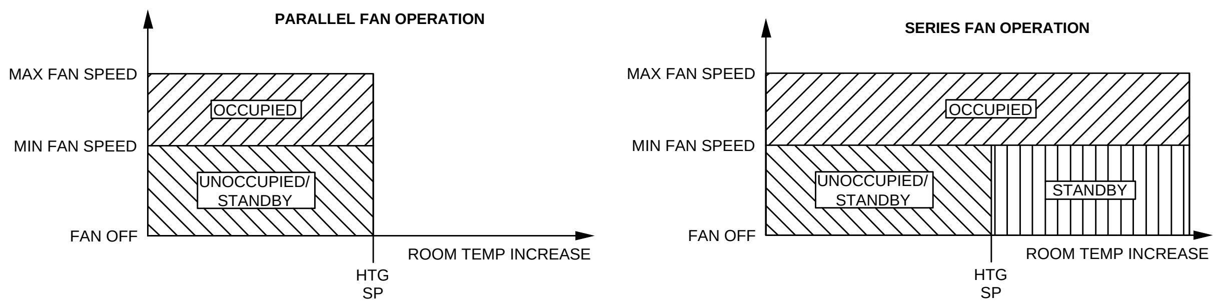


Illustration: VAV Fan Operations

Introduction (VAV)

Topics in this section cover the VAV (and CAV) sequences of operation for the KMC Conquest BAC-9000 series controller-actuators and (with use of an external actuator) the BAC-9311 unitary controller. These are advanced topics for controls technicians and engineers. Considerable differences in sequences and options exist for the various configurations of VAV (e.g., dual duct vs. single duct and type of reheat). See the sections relevant for the desired application.

NOTE: For CAV-specific diagrams, see **CAV (Constant Air Volume) on page 40**.

NOTE: For sequence of operations with charts and wiring diagrams, see also the VAV submittal sheets (see **Submittal Sheets (Diagrams and Operation) on page 5**).

NOTE: See also **BACnet Objects List on page 75** for more information about objects listed in the descriptions.

NOTE: Starting the balancing procedure clears the previously calculated balancing correction factors. See **Balancing Airflow (VAV) on page 73**.

NOTE: If Auto Occupancy is enabled (disabled by default) and the measured airflow is 75% or less of the requested airflow for at least five minutes during Occupied mode, the mode will change to Unoccupied. See **Occupancy, Motion Sensing, and Standby (VAV) on page 68**.

NOTE: Auxiliary Flow is the airflow setpoint used during reheat operation. If the measured airflow is 25% or less of the Auxiliary Flow setting, reheat is disabled.

NOTE: If the supply air is warmer than the changeover setpoint (74° default) plus 2° F, the controller modulates between minimum and maximum heating airflows and reheat is locked out. See **Cooling/Heating Changeover (VAV) on page 70**.

NOTE: To properly set up a VAV controller, the correct K factor for the VAV box must be entered into the controller. If this information is unknown, see **Appendix: K Factors for VAV on page 101**.

Sensors (VAV)

Space Temperature Sensor

The controller uses a connected STE-9000 series NetSensor digital wall sensor or an STE-6010/6014/6017 analog wall sensor. See **Digital STE-9000 Series NetSensors on page 7** and **Analog STE-6000 Series Thermistor Sensors on page 7**.

DAT (Discharge Air Temperature) Sensor

The DAT sensor is an optional Type III, 10K ohm thermistor (e.g., STE-1400 series) and is required for VAV heating applications. If the controller detects that this sensor is connected, the controller uses discharge air temperature to determine when to change between heating and cooling. The DAT sensor input is also used to control reheat. See **Reheat (VAV) on page 71** and **Cooling/Heating Changeover (VAV) on page 70**.

NOTE: DAT can be monitored as an analog input (AI3).

Airflow Sensors and Pickups

VAV airflow is calculated by measuring the high and low duct pressures with the built-in airflow sensor connected to airflow pickup tubes (e.g., SSS-101x). The high and low pressure measurements along with the K-factor of the VAV terminal unit are used to calculate the airflow through the VAV unit. (See **Appendix: K Factors for VAV on page 101**.)

Room Temperature Setpoints (VAV)

Types of Setpoints

There are four temperature setpoints each for heating and cooling for a total of eight setpoints.

- Active cooling
- Occupied cooling
- Unoccupied cooling
- Standby cooling
- Active heating
- Occupied heating
- Unoccupied heating
- Standby heating

These setpoints are based on a user-entered value or the occupancy state and standby value described in **Occupancy, Motion Sensing, and Standby (VAV) on page 68**.

Active Setpoint

The active setpoint is the current setpoint being used for control. The active setpoint is determined according to the occupancy state (see **Occupancy, Motion Sensing, and Standby (VAV) on page 68**):

- When the space becomes **Occupied**, the Occupied Cooling Setpoint (AV5) is placed in the Active Cooling Setpoint (AV3), and the Occupied Heating Setpoint (AV6) is placed in the Active Heating Setpoint (AV4).
- When the space becomes **Unoccupied**, the Unoccupied Cooling Setpoint (AV7) is placed in the Active Cooling Setpoint (AV3), and the Unoccupied Heating Setpoint (AV8) is placed in the Active Heating Setpoint (AV4).
- When the space enters **Standby**, the controller calculates the active setpoint by adding or subtracting (depending on mode) the Standby Offset (AV12) from the relevant occupied (but not unoccupied) setpoint. Standby is only applied to the occupied setpoint and thus is only valid when the schedule is active.

A user with a level 1 password (if a level 1 password is configured) can enter an active setpoint from the KMC Conquest STE-9000 series NetSensor (via AI2). The local override is valid when the schedule is unoccupied or occupied. This change is for a limited time or until the next time the occupancy state changes.

For display and control loop calculations, the active setpoint value is compared to the value of the space temperature variable AV1, which is taken from the physical temperature input AI1.

Occupied Setpoint

This temperature setpoint is entered by the controls technician during controller setup and system commissioning. This is the setpoint used when the system is occupied, which is usually controlled by the schedule in the controller.

Unoccupied Setpoint

This temperature setpoint is entered by the controls technician during controller setup and system commissioning. This is the setpoint used when the system is unoccupied, which is usually controlled by the schedule in the controller.

Standby Setpoint

This setpoint is used when the controller is in the standby state. It is calculated from the relevant occupied setpoint value and the Standby Offset value. The Standby Offset value is entered by the controls technician during controller setup and system commissioning. See **Occupancy, Motion Sensing, and Standby (VAV) on page 68**.

Setpoint Limits

Programming in the controller limits the setpoint entry so that a heating setpoint is not set higher than its corresponding cooling setpoint.

If a user adjusts a setpoint so that it falls within the range set by the value of Minimum Setpoint Differential, the corresponding setpoint is changed to maintain the differential. For example, the Minimum Setpoint Differential is 4° F and the Occupied Heating setpoint is 70° F. If the user lowers the Occupied Cooling setpoint to 71° F, the controller recalculates the Occupied Heating setpoint and changes it to 67° F.

Occupancy, Motion Sensing, and Standby (VAV)

Occupancy Options

The controller can operate as a stand-alone controller and can determine occupancy based on its internal occupancy schedule and (if connected to an STE-92x1/95x1 NetSensor) motion in the space. The controller can be in any one of the following occupancy states:

- Occupied
- Unoccupied
- Standby

The controller chooses which setpoint to use based on the occupancy and standby states. See **Room Temperature Setpoints (VAV) on page 67**.

The occupancy and standby states can also be commanded by another BACnet device or an operator workstation connected to the building automation network.

Automatic Occupancy

If Automatic Occupancy is enabled, the controller automatically toggles between Unoccupied, Occupied, and Standby based on the presence of primary airflow and motion in the zone. The default for Automatic Occupancy is Disabled.

Occupied

For controllers without a connected motion sensor, the controller changes to Occupied upon the detection of primary airflow.

Controllers **with** a connected motion sensor change to Occupied upon the detection of primary airflow **and** motion in the space. The unit remains in the Occupied state as long as periodic motion is detected and primary airflow continues. If motion stops, the controller changes to Standby.

If an internal schedule is enabled, the occupancy state is set according to the schedule. See **Scheduling Occupancy (VAV) on page 69**.

Unoccupied

Occupancy mode changes to Unoccupied when the controller detects a loss of primary airflow. While in the Unoccupied state, the controller will fully open the damper in an attempt to reach the maximum airflow setpoint.

Loss of primary airflow is defined as detection of less than 25% of the requested flow for at least 5 minutes. The occupancy mode changes to Occupied or Standby once the actual airflow is at least 30% of the requested flow.

The Occupied state changes to the Unoccupied state if the internal occupancy schedule is enabled and if the schedule for that time is inactive.

Standby

In units with a connected motion sensor, the controller starts in Standby and changes to Occupied after detecting motion in the space. Motion in the space is defined as two movements detected within 5 minutes. The controller will change back to Standby after a lack of motion for the period specified by the variable Standby Timer (AV39).

Standby mode is not available for controllers without a motion sensor, unless commanded by a building management system.

Scheduling Occupancy (VAV)

The schedule in the controller is a standard BACnet schedule object. It can be changed from a configuration tool or a BACnet operator workstation.

The internal occupancy schedule changes the controller between the Occupied (Active) and Unoccupied (Inactive) states. If the controller is connected to an STE-92x1/95x1 NetSensor with a motion sensor, the motion sensor may change the controller between occupied and standby based on motion detected in the space.

See also **Occupancy, Motion Sensing, and Standby (VAV) on page 68**.

PID (Proportional Integral Derivative) Loops (VAV)

A PID control loop calculates an error value from the difference between the measured room temperature and the active setpoint. The error value is expressed as a percentage and is typically used in a controller to control the state of an output. When the difference between the setpoint and room temperature is large, the error is large. As the system reduces the difference between the setpoint and space temperature, the error becomes smaller. In a simple example, if the output of the PID loop that is controlling the damper is 50%, the damper position is half-way open; if the output of the loop is 100%, the damper position is fully open.

The controller uses up to four PID control loops:

- The output of either the **heating** loop or the **cooling** loop is used to control the position of the damper.
- The **discharge air** loop and the DAT input (if present) control the reheat loop.
- The **reheat** loop is used to control the temperature of the discharge air.

The PID control loops in the controller are standard BACnet objects.

Airflow Setpoints Sequence (VAV)

NOTE: See **Illustration: VAV Airflow Operations on page 64**. See also **Reheat (VAV) on page 71**.

If no room sensor is connected to the controller, the controller uses the Minimum Cooling Airflow setpoint to maintain airflow.

Cool Air Sequence: As the Cooling loop increases from 0% to 100%, the Primary Airflow Setpoint is proportionally calculated between the Minimum Cooling Airflow and the Maximum Cooling Airflow. If there is a call for reheat to maintain room temperature, the primary airflow is set to the value of Auxiliary Flow.

Warm Air Available: In the heating mode, as the Heating Loop increases from 0% to 100%, the Primary Airflow Setpoint is proportionally calculated between the Minimum Heating Airflow and the Maximum Heating Airflow.

Cooling/Heating Changeover (VAV)

NOTE: The **SAT (Supply Air Temperature)** is the temperature of the air in the duct supplied by the AHU or RTU and entering into the VAV box before any reheat is applied. The **DAT (Discharge Air Temperature)** is the temperature of the air leaving from the VAV box and entering the room. Sometimes SAT and DAT are used interchangeably, but they are only equivalent if reheat is inactive.

NOTE: See also **Reheat (VAV) on page 71**.

The DAT input is used by the controller to determine the type of air being supplied by the AHU or RTU. The DAT sensor is required for applications that require automatic changeover between cooling and heating.

The changeover function is disabled while Heating (reheat) is active. Changeover is enabled again 3 minutes after Heating ends. (This is because the same sensor is used for DAT and changeover.)

When Heating inactive, the DAT input is compared to the SAT Changeover Temperature (AV37). If the DAT is below the SAT Changeover Temperature minus 2°, the SAT Changeover Mode is set to Cooling. If the DAT is above the SAT Changeover Temperature plus 2° F, the SAT Changeover Mode is set to Heating. The default changeover temperature is 74° F.

Discharge Air Temperature (DAT) Limiting (VAV)

If a DAT sensor is detected and DAT Limiting is enabled, the VAV terminal will be controlled by the DAT loop. When there is a call for heat and the primary air is cool air, the reheat outputs are directly controlled by the DAT Loop and the DAT Setpoint reset based on the output of the Heating loop. As the Heating loop increases from 0% to 50%, the DAT Setpoint is proportionally calculated between the Space Temperature Reference and the Space Temperature Reference +15° F up to a maximum of 90° F. This allows the reheat to be controlled by the DAT loop over the first 50% of a call for heat.

If DAT Limiting is enabled, and a DAT sensor is not connected, the controller will lock out reheat control only in the cooling mode. The unit will operate this way until a DAT sensor is detected or DAT limiting is disabled.

If DAT Limiting is disabled, the unit's reheat is controlled by the Heating loop instead of the DAT loop. ***See also* Reheat (VAV) on page 71.**

Reheat (VAV)

Types and Control of Reheat

The controllers can control four types of reheat installations:

- Modulating
- Time-proportioned
- Floating
- Staged

NOTE: See **Illustration: VAV Reheat Operations on page 65**.

All reheat is controlled by either the Heating loop or the Discharge Air Temp Limiting (DAT) PID loop. See **PID (Proportional Integral Derivative) Loops (VAV) on page 69**.

- If Discharge Air Temp Limiting is enabled, reheat is controlled by the DAT PID loop.
- If DAT control is not enabled, reheat is controlled by the Heating loop.

In the following descriptions, the PID loop controlling reheat is referred to as the Reheat loop.

Modulating Reheat

If the controller is configured for modulating reheat, it controls an analog reheat unit with 0–10 VDC at the analog reheat output. On a call for reheat, the reheat output is modulated over the span of the Reheat loop. If the Reheat loop is less than 10%, the reheat output remains at zero. The reheat is set to zero if the Cooling loop is active.

Time Proportioned Reheat

For controllers configured for time proportional reheat, the duty cycle of a binary triac output varies over a 10 second period. For example, if the Reheat loop is at 50%, the reheat output is On for 5 seconds and Off for 5 seconds. If the Reheat loop is less than 10%, the reheat output remains at zero.

Floating Reheat

If the controller is configured for floating reheat, it controls two binary triac outputs to drive the inputs of a tri-state actuator connected to a valve. If the Reheat loop is less than 30%, the valve is driven closed. If the loop is greater than 70%, the valve is driven open. If the loop is in between 30% and 70%, no valve action is taken.

Staged Reheat

If the controller is configured for staged reheat, it can control up to three stages of reheat through binary triac outputs. The reheat outputs are commanded On when the Reheat loop rises above the On threshold and Off when the loop drops below the Off threshold. Thresholds and stage activation are shown in the following table.

HEATING STAGES	OUTPUT STATE	
	ON THRESHOLD	OFF THRESHOLD
Stage 1	35%	15%
Stage 2	65%	45%
Stage 3	95%	75%

Illustration: Staged Reheat Thresholds

Damper Operation (VAV)

Damper movement is determined by comparing the actual airflow reading to the airflow setpoints. If the actual airflow is within 5% of the setpoint, no damper action is initiated. Once within the 5% deadband, the actual airflow must be outside a 7% deadband before damper position changes.

Fan Operation (VAV)

The controllers support both series and parallel fan powered VAV units. See **Illustration: VAV Fan Operations on page 65**. For either type of fan operation, the fan is controlled through the following terminals:

- A binary output triac controls a 24-volt fan starting circuit.
- A 0–10 VDC analog output controls the speed of the fan. The output controls fan speed at either Min Fan Speed or Max Fan Speed. See the topic Set the airflow setpoints on page 34 for the procedure to set the fan speeds.

If the VAV unit is not configured for a fan, the two outputs are not used and remain inactive regardless of the occupancy state.

Series Fan

If the controller is configured for a series fan, any time the Occupancy mode of the controller is set to either Occupied or Standby, the fan runs continuously. The fan speed is set to Maximum Fan Speed when the state is Occupied and set to Minimum Fan Speed when the state is Standby.

When the Occupancy state is Unoccupied, the fan starts and runs at minimum speed only on a call for heating. The fan starts when the Heating loop is greater than 5% and stops when the Heating loop is less than 1%.

Parallel Fan

If the controller is configured for a parallel fan, any time the Occupancy mode of the controller is set to either Occupied or Standby and there is a call for heat, the fan runs continuously. The fan starts when the Heating loop is greater than 5% and stops when the Heating loop is less than 1%.

When the unit Occupancy state is Unoccupied, the fan starts and runs at minimum speed only on a call for heating. The fan starts when the Heating loop is greater than 5% and stops when the Heating loop is less than 1%.

Dual Duct (VAV)

A dual duct installation consists of separate primary heating and cooling ducts, both with control dampers and airflow monitoring. For this type of installation a BAC-9001 controller-actuator controls the cooling air (primary) damper and a TSP-8003 actuator controls the heating air (secondary) damper.

- As the space temperature rises above the cooling setpoint, the primary airflow is modulated from the Cooling Minimum flow to the Cooling Maximum Flow.
- As the space temperature falls below the heating setpoint, the secondary airflow is modulated from the Heating Minimum flow to the Heating Maximum Flow.
- Between the heating and cooling setpoints, both the primary airflow and secondary airflow are modulated to maintain the Dual Duct Minimum airflow.

Balancing Airflow (VAV)

Balancing airflow is the process of calibrating the internal airflow sensor to a known standard. In the field, airflow is measured with an airflow hood or other measuring instrument and then compared to the airflow measurements from the sensor in the controller. The balancing process uses a KMC Conquest STE-9000 series NetSensor as the technician setup tool for initiating the balancing sequence and entering actual flow measurements.

When the balancing sequence starts, all other functions of the controller are locked out.

At the start of the sequence, the controller drives the damper open until the airflow reaches the highest value of either the cooling or heating maximum airflow setpoints. An airflow measurement is made with an airflow hood and the actual airflow value is entered into the controller. Once the actual airflow is entered, the controller drives the damper closed to the lower value of either the cooling or heating minimum airflow. Another measurement is made with the flow hood and that measurement is entered into the controller.

After the minimum airflow measurement is entered, the programming in the controller calculates the airflow correction factors, which are used to adjust the measurements from the internal airflow sensor. Balancing is complete and the controller is returned to normal operation.

NOTE: For the procedure to balance the airflow with a Conquest NetSensor, see **VAV Airflow Balancing with an STE-9xx1 on page 26**.

System Diagnostics (VAV)

Object Types Monitored

The controller programming includes four system diagnostic indicators in the form of BACnet value objects.

- Need AHU start
- Need for cooler supply air
- Need for warmer supply air
- Need for higher static pressure

These diagnostic indicators or flags are monitored by other BACnet devices connected to the same building automation system as the controller. (See the documentation for the relevant equipment.)

Need AHU Start (BV1)

The Need AHU Start value object is set to Active for any of the following conditions:

- The system mode is Unoccupied and the Cooling loop or the Heating loop reaches 100%.
- The system mode is Occupied.
- The system mode is Standby.

The Need AHU Start object changes to Inactive when both loops drop below 5%.

Need for Cooler Supply Air (BV2)

The Need Cooler Supply value object is set to Active when the damper is fully open and the Cooling loop is greater than 95% for 30 minutes. The indicator changes to Inactive when the Cooling loop falls below 90%.

Need For Warmer Supply Air (BV7)

The Need Warmer Supply value object is set to Active when the damper is fully open and the Heating loop is greater than 95% for 30 minutes. The indicator changes to Inactive when the Heating loop falls below 90%.

Need for Higher Static Pressure (BV3)

The Need Higher Static value object is set to Active when the damper is fully open and airflow cannot reach the required setpoint value.

SYSTEM INTEGRATION AND NETWORKING

Networking

See **MS/TP Network Connections on page 14** and **Ethernet Network Connections on page 15**.

BACnet Objects List

General Notes

NOTE: Objects are dependent on controller model and application. Use KMC Connect, KMC Converge, or TotalControl to check relevant objects in a controller.

NOTE: AI1 and AI2 are dedicated for use with the analog electronic STE-6010/6014/6017 sensors but not the digital STE-9xx1 NetSensors or any other sensors. Room temperature and setpoints are mapped to value objects. See **Digital STE-9000 Series NetSensors on page 7** and **Analog STE-6000 Series Thermistor Sensors on page 7**.

On the following pages, see:

- **BAC-5900 Series (General Purpose Controller) Objects on page 76**
- **BAC-9000 Series (VAV Controller) Objects on page 77**
- **BAC-9300 Series (Unitary Controller) Objects on page 86**

BAC-5901 GENERAL PURPOSE OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
Inputs				
AI1	SPACE SENSOR	Space Sensor	KMC Type II Deg F	
AI2	SPACE SETPOINT	Space Setpoint	TABLE_4	
Values				
AV1	SPACE_TEMP	Space Temperature	Degrees F	0
AV2	AV_02	Analog Value #2	No Units	0
AV3	ACT_COOL_STPT	Active Cooling Setpoint	Degrees F	74
AV4	ACT_HEAT_STPT	Active Heating Setpoint	Degrees F	72
AV5	OCC_CL_STPT	Occupied Cooling Setpoint	Degrees F	76
AV6	OCC_HT_SPT	Occupied Heating Setpoint	Degrees F	72
AV7	UNOCC_CL_STPT	Unoccupied Cooling Setpoint	Degrees F	80
AV8	UNOCC_HT_STPT	Unoccupied Heating Setpoint	Degrees F	65
AV9	MIN_CL_STPT	Minimum Cooling Setpoint	Degrees F	68
AV10	MAX_HT_STPT	Maximum Heating Setpoint	Degrees F	76
AV11	MIN_STPT_DIFF	Minimum Setpoint Differential	Degrees F	2
AV12	STBY_OFFSET	Standby Offset	Degrees F	3
AV21	REL_HUMIDITY	Relative Humidity	Relative Humidity	0
AV38	OVRD_TIME	Local Override Timer	Minutes	60
AV57	ROOM CO2	Room CO2 Level	Parts per Million	0
BV28	LOCAL_OVRD	Local Override Mode		Inactive
BV40	ICO_FAN	Fan Icon		Inactive
BV41	ICO_FAN_LOW	Icon Fan Low Speed		Inactive
BV42	ICO_FAN_MEDIUM	Icon Fan Medium Speed		Inactive
BV43	ICO_FAN_HIGH	Icon Fan Auto		Inactive
BV44	ICO_FAN_AUTO	Icon Fan Auto		Inactive
BV45	ICO_OCCUPIED	Icon Occupied		Inactive
BV46	ICO_STANDBY	Icon Standby		Inactive
BV47	ICO_COOLING	Icon Cooling		Inactive
BV48	ICO_HEATING	Icon Heating		Inactive
BV49	ICO_AUTO_MODE	Icon Auto Mode		Inactive
BV50	ICO_OVERRIDE	Icon Override		Inactive
MSV2	SYSTEM_MODE	Control Mode	OFF	2
			AUTO	
			COOL	
			HEAT	

BAC-9000 Series (VAV Controller) Objects

BAC-9001 PRESSURE INDEPENDENT VAV, SINGLE DUCT OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
Inputs				
AI1	SPACE SENSOR	Space Sensor	KMC Type II Deg F	
AI2	SPACE SETPOINT	Space Setpoint	TABLE_4	
AI3	DISCHARGE AIR	Discharge Air Temperature	KMC10K_Type_III	
AI7	PRIMARY DUCT	Primary Duct Pressure	NONE	
AI8	PRIMARY POSITION	Primary Damper Position		
Outputs				
AO3	ANALOG HEAT	Analog Heat	0_100%	0
AO4	FAN SPEED	Fan Speed	0_100%	0
BO1	PRI DAMPER CW	Primary Damper Clockwise	Unknown	Inactive
BO2	PRI DAMPER CCW	Primary Damper Counter Clockwise	Unknown	Inactive
BO6	FAN	Fan	Unknown	Inactive
BO7	HT STAGE 1	Heating Stage 1	Unknown	Inactive
BO8	HT STAGE 2	Heating Stage 2	Unknown	Inactive
BO9	HT STAGE 3	Heating Stage3	Unknown	Inactive
Values				
AV1	SPACE TEMP	Space Temperature	Degrees F	0
AV2	STPT REFERENCE	Setpoint Reference	Degrees F	72
AV3	ACT COOL STPT	Active Cooling Setpoint	Degrees F	74
AV4	ACT HEAT STPT	Active Heating Setpoint	Degrees F	70
AV5	OCC CL STPT	Occupied Cooling Setpoint	Degrees F	74
AV6	OCC HT SPT	Occupied Heating Setpoint	Degrees F	70
AV7	UNOCC CL STPT	Unoccupied Cooling Setpoint	Degrees F	80
AV8	UNOCC HT STPT	Unoccupied Heating Setpoint	Degrees F	64
AV9	MIN CL STPT	Minimum Cooling Setpoint	Degrees F	68
AV10	MAX HT STPT	Maximum Heating Setpoint	Degrees F	76
AV11	MIN STPT DIFF	Minimum Setpoint Differential	Degrees F	4
AV12	STBY_OFFSET	Standby Offset	Degrees F	3
AV13	MIN COOL FLOW	Minimum Cooling Flow	Cubic Feet per Minute	100
AV14	MAX COOL FLOW	Maximum Cooling Flow	Cubic Feet per Minute	400
AV15	MIN HEAT FLOW	Minimum Heating Flow	Cubic Feet per Minute	100
AV16	MAX HEAT FLOW	Maximum Heating Flow	Cubic Feet per Minute	400
AV17	AUXILLARY FLOW	Auxillary Flow	Cubic Feet per Minute	200
AV18	PRI K FACT	Primary K Factor	No Units	904
AV19	PRI CORR SLOPE	Primary Correction Slope	No Units	1
AV20	PRI CORR OFFST	Primary Correction Offset	Cubic Feet per Minute	0
AV21	PRI LO FLOW CORR	Primary Low Flow Correction	No Units	1
AV22	PRI FLOW STPT	Primary Flow Setpoint	Cubic Feet per Minute	0
AV23	PRI RAW FLOW	Primary Raw Flow	Cubic Feet per Minute	0
AV24	PRI ACTUAL FLOW	Primary Actual Flow	Cubic Feet per Minute	0
AV25	AV_25	Analog Value #25	No Units	0
AV32	MIN FAN SPEED	Minimum Fan Speed	Percent	25
AV33	MAX FAN SPEED	Maximum Fan Speed	Percent	100
AV34	AV_34	Analog Value #34	No Units	0
AV36	DAT RESET	Discharge Air Temp Setpoint	Degrees F	90

BAC-9001 PRESSURE INDEPENDENT VAV, SINGLE DUCT OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
AV37	SAT CHANGEOVER	SAT Changeover Temperature	Degrees F	72
AV38	LOCAL OVRD TIME	Local Override Timer	Minutes	60
AV39	STANDBY TIMER	Standby Timer (motion)	Minutes	15
AV40	OCCUPANCY TRIGGE	Occupancy Trigger	Minutes	5
AV41	REL_HUMIDITY	Relative Humidity	Relative Humidity	0
AV43	MEASURED MAX	Measured Maximum	Cubic Feet per Minute	0
AV44	MEASURED MIN	Measured Minimum	Cubic Feet per Minute	0
AV45	PRI SAVE MIN FLO	Primary Saved Minimum Airflow	Cubic Feet per Minute	0
AV46	AV_46	Analog Value #46	No Units	0
AV47	DAT MAXIMUM	Maximum DAT Setpoint	Degrees F	90
AV48	CCW DMP POS	CCW Damper Position	Volts	0
AV49	CW DMP POS	CW Damper Position	Volts	0.01
AV50	DAMPER POSITION	Damper Position	Percent	0
AV51	APP_ID	Application Identification	No Units	0
AV54	MOTOR PAUSE	Delays Motor Close to Setpoint	Seconds	0
AV55	CHNG OVER DELAY	Heating Change Over Delay	Minutes	3
AV56	LOW AUTO OCC	Low Limit for Auto Occupy	Cubic Feet per Minute	50
AV57	ROOM CO2	Room CO2 Level	Parts per Million	0
BV1	NEED AHU	Needl For AHU		Inactive
BV2	NEED COLDER SPLY	Need For Colder Air Supply		Inactive
BV3	NEED MORE STATIC	Need For More Static Pressure		Inactive
BV4	LOCAL OVRD	Local Override Mode		Inactive
BV5	MOTION OVRD	Motion Override Mode		Inactive
BV6	MOTION SENSOR	Motion Sensor (Wall Stat)		Inactive
BV7	NEED HOTTER SPLY	Need For Hotter Air Supply		Inactive
BV8	SUPPLY AIR TYPE	Supply Air Type		Active
BV9	DAT LIMITING	Discharge Air Temp Limiting		Inactive
BV10	DIR TO CLOSE	Direction to Close		Inactive
BV11	AUTO OCCUPANCY	Auto Occupancy Detection		Inactive
BV12	BALANCE MODE	Balance Mode		Inactive
BV13	DAT SENSOR	DAT Sensor Present		Inactive
BV14	PRI BAL TRIGGER	Primary Balance Trigger		Inactive
BV15	BV_15	Binary Value #15		Inactive
BV40	ICO_FAN	Fan Icon		Inactive
BV41	ICO_FAN_LOW	Icon Fan Low Speed		Inactive
BV42	ICO_FAN_MEDIUM	Icon Fan Medium Speed		Inactive
BV43	ICO_FAN_HIGH	Icon Fan Auto		Inactive
BV44	ICO_FAN_AUTO	Icon Fan Auto		Inactive
BV45	ICO_OCCUPIED	Icon Occupied		Inactive
BV46	ICO_STANDBY	Icon Standby		Inactive
BV47	ICO_COOLING	Icon Cooling		Inactive
BV48	ICO_HEATING	Icon Heating		Inactive
BV49	ICO_AUTO_MODE	Icon Auto Mode		Inactive
BV50	ICO_OVERRIDE	Icon Override		Inactive

BAC-9001 PRESSURE INDEPENDENT VAV, SINGLE DUCT OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
MSV1	OCCUPIED MODE	Occupied Mode	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
			MOTION OVERRIDE	
MSV2	FAN CONFIG	Fantype Configuration	NONE	1
			SERIES	
			PARALLEL	
MSV3	REHEAT	Reheat Type	NONE	1
			STAGED	
			MODULATING	
			FLOATING	
			TIME PROP	
MSV4	STPT_MODE	User Setpoint Mode	Heat	1
			Cool	
			Unocc Heat	
			Unocc Cool	
MSV8	OCCUPIED STATE	Occupied State	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
MSV10	WALL SENSOR	Wall Sensor Type	STE-9001 TEMP	1
			STE-9021 HUMIDITY	
			STE-9201 MOTION	
			STE-9221 HUMIDITY/ MOTION	
			STE-9301 CO2	
			STE-9321 HUMIDITY/CO2	
			STE-9501 MOTION/CO2	
			STE-9521 HUMIDITY/MO-TION/CO2	
			STE-6014/7	
			STE-6010	
			NONE	

BAC-9001 PRESSURE INDEPENDENT VAV, DUAL DUCT OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
Inputs				
AI1	SPACE SENSOR	Space Sensor	KMC10K_Type_II	
AI2	SPACE SETPOINT	Space Setpoint	TABLE_4	
AI3	DISCHARGE AIR	Discharge Air Temperature	KMC10K_Type_III	
AI4	AI_04	Analog Input #4	no sensor	
AI5	SECONDARY DUCT	Secondary Duct Pressure	NONE	
AI6	SECONDARY POS	Secondary Damper Position	Volts_0_to_5	
AI7	PRIMARY DUCT	Primary Duct Pressure	NONE	
AI8	PRIMARY POSITION	Primary Damper Position	Volts_0_to_5	
Outputs				
AO3	AO_03	Analog Output #3	no sensor	0
AO4	AO_04	Analog Output #4	no sensor	0
AO5	AO_05	Analog Output #5	no sensor	0
BO1	PRI DAMPER CW	Primary Damper Clockwise	Unknown	Inactive
BO2	PRI DAMPER CCW	Primary Damper Counter Clockwise	Unknown	Inactive
BO6	BO_06	Binary Output #6	no sensor	Inactive
BO7	SEC DAMPER CW	Secondary Damper Clockwise	Unknown	Inactive
BO8	SEC DAMPER CCW	Secondary Damper CounterCW	Unknown	Inactive
BO9	BO_09	Binary Output #9	no sensor	Inactive
Values				
AV1	SPACE TEMP	Space Temperature	Degrees F	0
AV2	STPT REFERENCE	Setpoint Reference	Degrees F	72
AV3	ACT COOL STPT	Active Cooling Setpoint	Degrees F	68
AV4	ACT HEAT STPT	Active Heating Setpoint	Degrees F	64
AV5	OCC CL STPT	Occupied Cooling Setpoint	Degrees F	68
AV6	OCC HT SPT	Occupied Heating Setpoint	Degrees F	64
AV7	UNOCC CL STPT	Unoccupied Cooling Setpoint	Degrees F	80
AV8	UNOCC HT STPT	Unoccupied Heating Setpoint	Degrees F	64
AV9	MIN CL STPT	Minimum Cooling Setpoint	Degrees F	68
AV10	MAX HT STPT	Maximum Heating Setpoint	Degrees F	76
AV11	MIN STPT DIFF	Minimum Setpoint Differential	Degrees F	4
AV12	STBY_OFFSET	Standby Offset	Degrees F	3
AV13	MIN COOL FLOW	Minimum Cooling Flow	Cubic Feet per Minute	100
AV14	MAX COOL FLOW	Maximum Cooling Flow	Cubic Feet per Minute	400
AV15	MIN HEAT FLOW	Minimum Heating Flow	Cubic Feet per Minute	100
AV16	MAX HEAT FLOW	Maximum Heating Flow	Cubic Feet per Minute	400
AV17	DUAL MINIMUM	Dual Minimum	Cubic Feet per Minute	400
AV18	PRI K FACT	Primary K Factor	No Units	904
AV19	PRI CORR SLOPE	Primary Correction Slope	No Units	1
AV20	PRI CORR OFFST	Primary Correction Offset	Cubic Feet per Minute	0
AV21	PRI LO FLOW CORR	Primary Low Flow Correction	No Units	1
AV22	PRI FLOW STPT	Primary Flow Setpoint	Cubic Feet per Minute	0
AV23	PRI RAW FLOW	Primary Raw Flow	Cubic Feet per Minute	0
AV24	PRI ACTUAL FLOW	Primary Actual Flow	Cubic Feet per Minute	0

BAC-9001 PRESSURE INDEPENDENT VAV, DUAL DUCT OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
AV25	SEC K FACT	Secondary K Factor	No Units	904
AV26	SEC CORR SLOPE	Secondary Correction Slope	No Units	1
AV27	SEC CORR OFFST	Secondary Correction Offset	Cubic Feet per Minute	0
AV28	SEC LO FLOW CORR	Secondary Low Flow Correction	No Units	1
AV29	SEC FLOW STPT	Secondary Flow Setpoint	Cubic Feet per Minute	0
AV30	SEC RAW FLOW	Secondary Raw Flow	Cubic Feet per Minute	0
AV31	SEC ACTUAL FLOW	Secondary Actual Flow	Cubic Feet per Minute	0
AV32	AV_32	Analog Value #32	No Units	0
AV38	LOCAL OVRD TIME	Local Override Timer	Minutes	60
AV39	STANDBY TIMER	Standby Timer (motion)	Minutes	15
AV40	OCCUPANCY TRIGGE	Occupancy Trigger	Minutes	5
AV41	REL_HUMIDITY	Relative Humidity	Relative Humidity	0
AV42	AV_42	Analog Value #42	No Units	0
AV43	MEASURED MAX	Measured Maximum	Cubic Feet per Minute	0.3
AV44	MEASURED MIN	Measured Minimum	Cubic Feet per Minute	0.3
AV45	PRI SAVE MIN FLO	Primary Saved Minimum Airflow	Cubic Feet per Minute	0.3
AV46	SEC SAVE MIN FLO	Secondary Save Min Flow	Cubic Feet per Minute	0.3
AV47	AV_47	Analog Value #47	No Units	0
AV48	CCW DMP POS	CCW Damper Position	Volts	3
AV49	CW DMP POS	CW Damper Position	Volts	2.999725
AV50	DAMPER POSITION	Damper Position	Percent	0
AV51	APP_ID	Application Identification	No Units	0
AV52	SEC CCW DMP POS	CCW Damper Position	Volts	0.5
AV53	SEC CW DMP POS	CW Damper Position	Volts	2.9
AV54	MOTOR PAUSE	Delays Motor Close to Setpoint	Seconds	0
AV55	AV_55	Analog Value #55	No Units	0
AV56	LOW AUTO OCC	Low Limit for Auto Occupy	Cubic Feet per Minute	50
AV57	ROOM CO2	Room CO2 Level	Parts per Million	0
AV58	AV_58	Analog Value #58	No Units	
AV60	SEC DAMPER POSITION	Damper Position	Percent	0
BV1	NEED AHU	Needl For AHU		Inactive
BV2	NEED COLDER SPLY	Need For Colder Air Supply		Inactive
BV3	NEED MORE STATIC	Need For More Static Pressure		Inactive
BV4	LOCAL OVRD	Local Override Mode		Inactive
BV5	MOTION OVRD	Motion Override Mode		Inactive
BV6	MOTION SENSOR	Motion Sensor (Wall Stat)		Inactive
BV7	NEED HOTTER SPLY	Need For Hotter Air Supply		Inactive
BV8	SUPPLY AIR TYPE	Supply Air Type		Active
BV9	NEED SEC STATIC	Need More Secondary Static		Inactive
BV10	DIR TO CLOSE	Direction to Close		Inactive
BV11	AUTO OCCUPANCY	Auto Occupancy Detection		Inactive
BV12	PRI BALANCE MODE	Primary Balance Mode		Inactive
BV13	SEC BALANCE MODE	Secondary Balance Mode		Inactive
BV14	PRI BAL TRIGGER	Primary Balance Trigger		Inactive
BV15	SEC BAL TRIGGER	Secondary Balance Trigger		Inactive
BV16	BV_16	Binary Value #16		Inactive
BV40	ICO_FAN	Fan Icon		Inactive
BV41	ICO_FAN_LOW	Icon Fan Low Speed		Inactive
BV42	ICO_FAN_MEDIUM	Icon Fan Medium Speed		Inactive
BV43	ICO_FAN_HIGH	Icon Fan Auto		Inactive

BAC-9001 PRESSURE INDEPENDENT VAV, DUAL DUCT OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
BV44	ICO_FAN_AUTO	Icon Fan Auto		Inactive
BV45	ICO_OCCUPIED	Icon Occupied		Inactive
BV46	ICO_STANDBY	Icon Standby		Inactive
BV47	ICO_COOLING	Icon Cooling		Inactive
BV48	ICO_HEATING	Icon Heating		Inactive
BV49	ICO_AUTO_MODE	Icon Auto Mode		Inactive
BV50	ICO_OVERRIDE	Icon Override		Inactive
MSV1	OCCUPIED MODE	Occupied Mode	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
			MOTION OVERRIDE	
MSV2	MSV_02	Multistate Variable #2		
MSV3	MSV_03	Multistate Variable #3		
MSV4	STPT_MODE	User Setpoint Mode	Heat	1
			Cool	
			Unocc Heat	
			Unocc Cool	
MSV8	OCCUPIED STATE	Occupied State	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
MSV10	WALL SENSOR	Wall Sensor Type	STE-9001 TEMP	1
			STE-9021 HUMIDITY	
			STE-9201 MOTION	
			STE-9221 HUMIDITY/ MOTION	
			STE-9301 CO2	
			STE-9321 HUMIDITY/CO2	
			STE-9501 MOTION/CO2	
			STE-9521 HUMIDITY/MO-TION/CO2	
			STE-6014/7	
			STE-6010	
			NONE	

BAC-9021 PRESSURE DEPENDENT VAV, SINGLE DUCT OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
Inputs				
AI1	SPACE SENSOR	Space Sensor	KMC Type II Deg F	
AI2	SPACE SETPOINT	Space Setpoint	TABLE_4	
AI3	DISCHARGE AIR	Discharge Air Temperature	KMC10K_Type_III	
AI8	PRIMARY POSITION	Primary Damper Position		
Outputs				
AO3	ANALOG HEAT	Analog Heat	0_100%	0
AO4	AO_04	Analog Output #5	0_100%	0
BO1	PRI DAMPER CW	Primary Damper Clockwise	Unknown	Inactive
BO2	PRI DAMPER CCW	Primary Damper Counter Clockwise	Unknown	Inactive
BO6	BO_06	Binary Output #6	Unknown	Inactive
BO7	HT STAGE 1	Heating Stage 1	Unknown	Inactive
BO8	HT STAGE 2	Heating Stage 2	Unknown	Inactive
BO9	HT STAGE 3	Heating Stage3	Unknown	Inactive
Values				
AV1	SPACE TEMP	Space Temperature	Degrees F	0
AV2	STPT REFERENCE	Setpoint Reference	Degrees F	72
AV3	ACT COOL STPT	Active Cooling Setpoint	Degrees F	77
AV4	ACT HEAT STPT	Active Heating Setpoint	Degrees F	67
AV5	OCC CL STPT	Occupied Cooling Setpoint	Degrees F	74
AV6	OCC HT SPT	Occupied Heating Setpoint	Degrees F	70
AV7	UNOCC CL STPT	Unoccupied Cooling Setpoint	Degrees F	80
AV8	UNOCC HT STPT	Unoccupied Heating Setpoint	Degrees F	64
AV9	MIN CL STPT	Minimum Cooling Setpoint	Degrees F	68
AV10	MAX HT STPT	Maximum Heating Setpoint	Degrees F	76
AV11	MIN STPT DIFF	Minimum Setpoint Differential	Degrees F	4
AV12	STBY_OFFSET	Standby Offset	Degrees F	3
AV13	AV_13	Analog Value #13	No Units	0
AV36	DAT STPT	Discharge Air Temp Setpoint	Degrees F	90
AV37	SAT CHANGEOVER	SAT Changeover Temperature	Degrees F	72
AV38	LOCAL OVRD TIME	Local Override Timer	Minutes	60
AV39	STANDBY TIMER	Standby Timer (motion)	Minutes	15
AV40	OCCUPANCY TRIGGE	Occupancy Trigger	Minutes	5
AV41	REL_HUMIDITY	Relative Humidity	Relative Humidity	0
AV47	DAT MAXIMUM	Maximum DAT Setpoint	Degrees F	90
AV48	CCW DMP POS	CCW Damper Position	Volts	0
AV49	CW DMP POS	CW Damper Position	Volts	0.01
AV50	DAMPER POSITION	Damper Position	Percent	0
AV51	APP_ID	Application Identification	No Units	0
AV55	CHNG_OVER_DELAY	Cooling Change Over Delay	Minutes	3
AV56	LOW AUTO OCC	Low Limit for Auto Occupy	Cubic Feet per Minute	50
AV57	AV_57	Analog Value #57	No Units	0

BAC-9021 PRESSURE DEPENDENT VAV, SINGLE DUCT OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
AV64	DAMPER STPT	Damper Setpoint	Percent	0
AV65	MIN COOL DMPR	Minimum Cooling Damper Position	Percent	10
AV66	MAX COOL DMPR	Maximum Cooling Damper Position	Percent	100
AV67	MIN HEAT DMPR	Minimum Heating Damper Position	Percent	10
AV68	MAX HEAT DMPR	Maximum Heating Damper Position	Percent	100
AV69	AUXILLARY DMPR	Auxiliary Damper Position	Percent	50
BV1	NEED AHU	Need For AHU		Inactive
BV2	NEED COLDER SPLY	Need For Colder Air Supply		Inactive
BV3	NEED MORE STATIC	Need For More Static Pressure		Inactive
BV4	LOCAL OVRD	Local Override Mode		Inactive
BV5	MOTION OVRD	Motion Override Mode		Inactive
BV6	MOTION SENSOR	Motion Sensor (Wall Stat)		Inactive
BV7	NEED HOTTER SPLY	Need For Hotter Air Supply		Inactive
BV8	SUPPLY AIR TYPE	Supply Air Type		Active
BV9	DAT LIMITING	Discharge Air Temp Limiting		Inactive
BV10	DIR TO CLOSE	Direction to Close		Inactive
BV11	BV_11	Binary Value #11		Inactive
BV12	CALIBRATE DMPR	Start Damper Calibration		Inactive
BV13	DAT SENSOR	DAT Sensor Present		Inactive
BV14	BV_14	Binary Value #14		Inactive
BV40	ICO_FAN	Fan Icon		Inactive
BV41	ICO_FAN_LOW	Icon Fan Low Speed		Inactive
BV42	ICO_FAN_MEDIUM	Icon Fan Medium Speed		Inactive
BV43	ICO_FAN_HIGH	Icon Fan Auto		Inactive
BV44	ICO_FAN_AUTO	Icon Fan Auto		Inactive
BV45	ICO_OCCUPIED	Icon Occupied		Inactive
BV46	ICO_STANDBY	Icon Standby		Inactive
BV47	ICO_COOLING	Icon Cooling		Inactive
BV48	ICO_HEATING	Icon Heating		Inactive
BV49	ICO_AUTO_MODE	Icon Auto Mode		Inactive
BV50	ICO_OVERRIDE	Icon Override		Inactive
MSV1	OCCUPIED MODE	Occupied Mode	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
			MOTION OVERRIDE	
MSV2	MSV_02	Multistate Variable #2		
MSV3	REHEAT	Reheat Type	NONE	1
			STAGED	
			MODULATING	
			FLOATING	
			TIME PROP	

BAC-9021 PRESSURE DEPENDENT VAV, SINGLE DUCT OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
MSV4	STPT_MODE	User Setpoint Mode	Heat	1
			Cool	
			Unocc Heat	
			Unocc Cool	
MSV8	OCCUPIED STATE	Occupied State	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
MSV10	WALL SENSOR	Wall Sensor Type	STE-9001 TEMP	1
			STE-9021 HUMIDITY	
			STE-9201 MOTION	
			STE-9221 HUMIDITY/ MOTION	
			STE-9301 CO2	
			STE-9321 HUMIDITY/CO2	
			STE-9501 MOTION/CO2	
			STE-9521 HUMIDITY/MO-TION/CO2	
			STE-6014/7	
			STE-6010	
			NONE	

BAC-9300 Series (Unitary Controller) Objects

BAC-9301 2-PIPE FCU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
Inputs				
AI1	SPACE SENSOR	Space Sensor	KMC Type II Deg F (10K)	
AI2	SPACE SETPOINT	Space Setpoint	TABLE_4	
AI3	DISCHARGE AIR	Discharge Air Temperature	KMC Type III Deg F (10K)	
AI4	OUTDOOR AIR	Outdoor Air Temp	KMC10K_Type_III	
AI5	HUMIDITY	Space Humidity	Humidity (0-100 % 0-5 v)	
AI6	WATER_TEMP	Supply Water Temperature	KMC Type III Deg F (10K)	
AI7	AI_07	Analog Input #7	no sensor	
AI8	AI_08	Analog Input #8	no sensor	
AI9*	AI_09	Analog Input #9	no sensor	
Outputs				
AO7	ANALOG VALVE	Analog Valve Output	0-100% (0-10 V)	0
AO8	ANALOG AUX HEAT	Auxiliary Heat	0-100% (0-10V)	0
AO9	AO_09	Analog Output #9	NONE	0
AO10	ANALOG_FAN	Fan Speed Control	0-100% (0-10V)	0
BO1	LOW	Fan Low Speed	Unknown	Inactive
BO2	MEDIUM	Fan Medium Speed	Unknown	Inactive
BO3	HIGH	Fan High Speed	Unknown	Inactive
BO4	DIGITAL VALVE	Digital Valve	Unknown	Inactive
BO5	DIGITAL AUX HEAT	Auxiliary Heat	Unknown	Inactive
BO6	BO_06	Binary Output #6	Unknown	Inactive
Values				
AV1	SPACE_TEMP	Space Temperature	Degrees F	0
AV2	STPT REFERENCE	Setpoint Reference	Degrees F	72
AV3	ACT_COOL_STPT	Active Cooling Setpoint	Degrees F	80
AV4	ACT_HEAT_STPT	Active Heating Setpoint	Degrees F	64
AV5	OCC_CL_STPT	Occupied Cooling Setpoint	Degrees F	74
AV6	OCC_HT_SPT	Occupied Heating Setpoint	Degrees F	70
AV7	UNOCC_CL_STPT	Unoccupied Cooling Setpoint	Degrees F	80
AV8	UNOCC_HT_STPT	Unoccupied Heating Setpoint	Degrees F	64
AV9	MIN_CL_STPT	Minimum Cooling Setpoint	Degrees F	68
AV10	MAX_HT_STPT	Maximum Heating Setpoint	Degrees F	76
AV11	MIN_STPT_DIFF	Minimum Setpoint Differential	Degrees F	2
AV12	STBY_OFFSET	Standby Offset	Degrees F	3
AV13	AV_13	Analog Value #13	No Units	0
AV19	WATER _TEMP	Water Temperature	Degrees F	0
AV20	DISCHARGE_TEMP	Discharge Air Temp	Degrees F	0
AV21	REL_HUMIDITY	Relative Humidity	Relative Humidity	0
AV22	AV_22	Analog Value #22	No Units	0
AV25	FAN_OFF_DELAY	Fan Off Delay	Minutes	2
AV26	AV_26	Analog Value #26	No Units	0
AV28	STANDBY_TIMER	Inactivity Timer	Minutes	20
AV29	OCCUPANCY TRIGGE	Occupancy Trigger	Minutes	5

BAC-9301 2-PIPE FCU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
AV30	AV_30	Analog Value #30	No Units	0
AV34	FAN_SPEED	Fan Speed	Percent	0
AV35	FAN_MAXIMUM	Fan Maximum Speed	Percent	100
AV36	FAN_MINIMUM	Fan Minimum Speed	Percent	35
AV37	AV_37	Analog Value #37	No Units	0
AV38	OVRD_TIME	Local Override Timer	Minutes	60
AV39	AV_39	Analog Value #39	No Units	0
AV51	APP_ID	Application Identification	No Units	0
AV52	COOL PROP	Cooling Proportional Band	Degrees F	2
AV53	HEAT PROP	Heating Proportional Band	Degrees F	2
AV54	COOL INTG	Cool Integral	Per Hour	0
AV55	HEAT INTG	Heat Integral	Per Hour	0
AV56	START_H2O_EVAL	Offset Temp to Start H2O Evaluat	Degrees F	10
AV57	ROOM CO2	Room CO2 Level	Parts per Million	0
BV1	BV_1	Binary Value #1		Inactive
BV2	BV_2	Binary Value #2		Inactive
BV3	BV_3	Binary Value #3		Inactive
BV4	COND_OVERFLO	Condensate Overflow		Inactive
BV5	OCC_SCHEDULE	Occupy Schedule		Inactive
BV6	MOTION	Motion Detected		Active
BV7	DAT_SENSOR	DAT Sensor Present		Inactive
BV8	MODE	Heat or Cool Mode		Active
BV9	FAN_NEED	Call for Fan		Inactive
BV10	COOL_HEAT_NEED	Cooling or Heating Needed?		Active
BV11	SPEED_UP	Speed Up Timers X 15		Inactive
BV12	BV_12	Binary Value #12		Inactive
BV13	OCCUPIED_FAN	Fan On During Occupied Mode		Inactive
BV14	FAN_STATUS	Fan Proof		Inactive
BV15	BV_15	Binary Value #15		Inactive
BV19	VLV_ACTION	Normal Close/Normal Open		Inactive
BV20	COOL_STG_1	Cooling Stage 1		Inactive
BV21	BV_21	Binary Value #21		Inactive
BV22	HEAT_STG_1	Heating Stage 1		Inactive
BV23	BV_23	Binary Value #23		Inactive
BV28	LOCAL_OVRD	Local Override Mode		Inactive
BV29	BV_29	Binary Value #29		Inactive
BV33	STANDBY_ENABLE	Enable Standby Mode		Active
BV34	AUXILIARY HEAT	Auxiliary Heat		Inactive
BV35	WATER_EVAL	Water Ealuation Mode		Inactive
BV36	STPT_HOLD	Hold Temperature Setpoint		Inactive
BV37	BV_37	Binary Value #37		Inactive
BV40	ICO_FAN	Fan Icon		Inactive
BV41	ICO_FAN_LOW	Icon Fan Low Speed		Inactive
BV42	ICO_FAN_MEDIUM	Icon Fan Medium Speed		Inactive
BV43	ICO_FAN_HIGH	Icon Fan Auto		Inactive
BV44	ICO_FAN_AUTO	Icon Fan Auto		Inactive
BV45	ICO_OCCUPIED	Icon Occupied		Inactive
BV46	ICO_STANDBY	Icon Standby		Inactive
BV47	ICO_COOLING	Icon Cooling		Inactive
BV48	ICO_HEATING	Icon Heating		Inactive
BV49	ICO_AUTO_MODE	Icon Auto Mode		Inactive
BV50	ICO_OVERRIDE	Icon Override		Inactive

BAC-9301 2-PIPE FCU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
MSV1	OCCUPIED MODE	Occupied Mode	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
MSV2	SYSTEM_MODE	Control Mode	OFF	2
			AUTO	
			COOL	
			HEAT	
MSV3	FAN_MODE	Fan Auto-Manual Mode	AUTO	1
			LOW	
			MED	
			HIGH	
MSV4	AVAILABLE_SPEEDS	Number of Fan Speeds Available	SINGLE SPEED	1
			TWO SPEED	
			THREE SPEED	
MSV9	WATER_TYPE	Water Supplied to FCU	CHILLED WATER	1
			HOT WATER	
			UNCONDITIONED	
MSV8	OCCUPIED STATE	Occupied State	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
MSV10	WALL SENSOR	Wall Sensor Type	STE-9001 Temp	1
			STE-9021 Humidity	
			STE-9201 Motion	
			STE-9221 Humidity/Motion	
			STE-9301 CO2	
			STE-9321 Humidity/CO2	
			STE-9501 Motion/CO2	
			STE-9521 Humidity/Motion/CO2	
			STE-6014/7	
			STE-6010	
			None	

***NOTE:** **AI9** is for the **optional** air pressure sensor (in the BAC-9311). All models of the BAC-9300 series have **8 standard** inputs—2 analog for the temp. sensor port and 6 universal inputs (software configurable as analog, binary, or accumulator on terminals).

BAC-9301 4-PIPE FCU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
Inputs				
AI1	SPACE SENSOR	Space Sensor	KMC Type II Deg F (10K)	
AI2	SPACE SETPOINT	Space Setpoint	TABLE_4	
AI3	DISCHARGE AIR	Discharge Air Temperature	KMC Type III Deg F (10K)	
AI4	OUTDOOR AIR	Outdoor Air Temp	KMC10K_Type_III	
AI5	HUMIDITY	Space Humidity	Humidity (0-100 % 0-5 v)	
AI6	AI_06	Analog Input #6	no sensor	
AI7	AI_07	Analog Input #7	no sensor	
AI8	AI_08	Analog Input #8	no sensor	
AI9*	AI_09	Analog Input #9	no sensor	
Outputs				
AO7	ANALOG_COOLING	Analog Cooling Output	0-100% (0-10 V)	0
AO8	ANALOG_HEATING	Analog Heating Output	0-100% (0-10 V)	0
AO9	AO_09	Analog Output #9	NONE	0
AO10	ANALOG_FAN	Fan Speed Control	0-100% (0-10V)	0
BO1	LOW	Fan Low Speed	Unknown	Inactive
BO2	MEDIUM	Fan Medium Speed	Unknown	Inactive
BO3	HIGH	Fan High Speed	Unknown	Inactive
BO4	DIGITAL_COOLING	Cooling Valve	Unknown	Inactive
BO5	DIGITAL_HEATING	Heating Valve	Unknown	Inactive
BO6	BO_06	Binary Output #6	Unknown	Inactive
Values				
AV1	SPACE_TEMP	Space Temperature	Degrees F	0
AV2	STPT REFERENCE	Setpoint Reference	Degrees F	72
AV3	ACT_COOL_STPT	Active Cooling Setpoint	Degrees F	80
AV4	ACT_HEAT_STPT	Active Heating Setpoint	Degrees F	64
AV5	OCC_CL_STPT	Occupied Cooling Setpoint	Degrees F	74
AV6	OCC_HT_SPT	Occupied Heating Setpoint	Degrees F	70
AV7	UNOCC_CL_STPT	Unoccupied Cooling Setpoint	Degrees F	80
AV8	UNOCC_HT_STPT	Unoccupied Heating Setpoint	Degrees F	64
AV9	MIN_CL_STPT	Minimum Cooling Setpoint	Degrees F	68
AV10	MAX_HT_STPT	Maximum Heating Setpoint	Degrees F	76
AV11	MIN_STPT_DIFF	Minimum Setpoint Differential	Degrees F	2
AV12	STBY_OFFSET	Standby Offset	Degrees F	3
AV13	AV_13	Analog Value #13	No Units	0
AV19	OUTDOOR_TEMP	Outdoor Temperature	Degrees F	0
AV20	DISCHARGE_TEMP	Discharge Air Temp	Degrees F	0
AV21	REL_HUMIDITY	Relative Humidity	Relative Humidity	0
AV22	DEHUM_STPT	Dehumidification Setpoint	Percent	60
AV23	AV_23	Analog Value #23	No Units	0
AV24	DEHUM_DIFF	Dehumidification Differential	Percent	5
AV25	FAN_OFF_DELAY	Fan Off Delay	Minutes	2
AV26	AV_26	Analog Value #26	No Units	0

BAC-9301 4-PIPE FCU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
AV28	STANDBY_TIMER	Inactivity Timer	Minutes	20
AV29	OCCUPANCY TRIGGE	Occupancy Trigger	Minutes	5
AV30	AV_30	Analog Value #30	No Units	0
AV34	FAN_SPEED	Fan Speed	Percent	0
AV35	FAN_MAXIMUM	Fan Maximum Speed	Percent	100
AV36	FAN_MINIMUM	Fan Minimum Speed	Percent	35
AV37	AV_37	Analog Value #37	No Units	0
AV38	OVRD_TIME	Local Override Timer	Minutes	60
AV39	AV_39	Analog Value #39	No Units	0
AV51	APP_ID	Application Identification	No Units	0
AV52	COOL PROP	Cooling Proportional Band	Degrees F	2
AV53	HEAT PROP	Heating Proportional Band	Degrees F	2
AV54	COOL INTG	Cool Integral	Per Hour	0
AV55	HEAT INTG	Heat Integral	Per Hour	0
AV56	AV_56	Analog Value #56	No Units	0
AV57	ROOM CO2	Room CO2 Level	Parts per Million	0
BV1	BV_1	Binary Value #1		Inactive
BV2	BV_2	Binary Value #2		Inactive
BV3	BV_3	Binary Value #3		Inactive
BV4	COND_OVERFLO	Condensate Overflow		Inactive
BV5	OCC_SCHEDULE	Occupy Schedule		Inactive
BV6	MOTION	Motion Detected		Active
BV7	DAT_SENSOR	DAT Sensor Present		Inactive
BV8	MODE	Heat or Cool Mode		Active
BV9	FAN_NEED	Call for Fan		Inactive
BV10	COOL_HEAT_NEED	Cooling or Heating Needed?		Active
BV11	SPEED_UP	Speed Up Timers X 15		Inactive
BV12	BV_12	Binary Value #12		Inactive
BV13	OCCUPIED_FAN	Fan On During Occupied Mode		Inactive
BV14	FAN_STATUS	Fan Proof		Inactive
BV15	BV_15	Binary Value #15		Inactive
BV18	CL_VLV_ACTION	Normal Close/Normal Open		Inactive
BV19	HT_VLV_ACTION	Normal Close/Normal Open		Inactive
BV20	COOL_STG_1	Cooling Stage 1		Inactive
BV21	BV_21	Binary Value #21		Inactive
BV22	HEAT_STG_1	Heating Stage 1		Inactive
BV23	BV_23	Binary Value #23		Inactive
BV27	OAT_SENSOR	Outdoor Sensor Present?		Inactive
BV28	LOCAL_OVRD	Local Override Mode		Inactive
BV29	BV_29	Binary Value #29		Inactive
BV31	DEHUM_ENABLE	Enable Dehumidification		Inactive
BV32	DEHUM_MODE	Dehumidification Mode		Inactive
BV33	STANDBY_ENABLE	Enable Standby Mode		Active
BV34	BV_34	Binary Value #34		Inactive

BAC-9301 4-PIPE FCU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
BV36	STPT_HOLD	Hold Temperature Setpoint		Inactive
BV37	BV_37	Binary Value #37		Inactive
BV40	ICO_FAN	Fan Icon		Inactive
BV41	ICO_FAN_LOW	Icon Fan Low Speed		Inactive
BV42	ICO_FAN_MEDIUM	Icon Fan Medium Speed		Inactive
BV43	ICO_FAN_HIGH	Icon Fan Auto		Inactive
BV44	ICO_FAN_AUTO	Icon Fan Auto		Inactive
BV45	ICO_OCCUPIED	Icon Occupied		Inactive
BV46	ICO_STANDBY	Icon Standby		Inactive
BV47	ICO_COOLING	Icon Cooling		Inactive
BV48	ICO_HEATING	Icon Heating		Inactive
BV49	ICO_AUTO_MODE	Icon Auto Mode		Inactive
BV50	ICO_OVERRIDE	Icon Override		Inactive
MSV1	OCCUPIED MODE	Occupied Mode	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
MSV2	SYSTEM_MODE	Control Mode	OFF	2
			AUTO	
			COOL	
			HEAT	
MSV3	FAN_MODE	Fan Auto-Manual Mode	AUTO	1
			LOW	
			MED	
			HIGH	
MSV4	AVAILABLE_SPEEDS	Number of Fan Speeds Available	SINGLE SPEED	1
			TWO SPEED	
			THREE SPEED	
MSV8	OCCUPIED STATE	Occupied State	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
MSV10	WALL SENSOR	Wall Sensor Type	STE-9001 Temp	1
			STE-9021 Humidity	
			STE-9201 Motion	
			STE-9221 Humidity/Motion	
			STE-9301 CO2	
			STE-9321 Humidity/CO2	
			STE-9501 Motion/CO2	
			STE-9521 Humidity/Mo-tion/CO2	
			STE-6014/7	
			STE-6010	
			None	

***NOTE:** **AI9** is for the **optional** air pressure sensor (in the BAC-9311). All models of the BAC-9300 series have **8 standard** inputs—2 analog for the temp. sensor port and 6 universal inputs (software configurable as analog, binary, or accumulator on terminals).

BAC-93X1 RTU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
Inputs				
AI1	SPACE SENSOR	Space Sensor	KMC Type II Deg F (10K)	
AI2	SPACE SETPOINT	Space Setpoint	TABLE_4	
AI3	DISCHARGE AIR	Discharge Air Temperature	KMC Type III Deg F (10K)	
AI4	OUTDOOR AIR	Outdoor Air Temp	KMC10K_Type_III	
AI5	HUMIDITY	Space Humidity	Humidity (0-100 % 0-5 v)	
AI6	AI_06	Analog Input #6	no sensor	
AI7	AI_07	Analog Input #7	no sensor	
AI8	AI_08	Analog Input #8	no sensor	
AI9*	AI_09	Analog Input #9	no sensor	
Outputs				
AO7	COOLING_OUTPUT	Analog Cooling Output	0-100% (0-10 V)	0
AO8	HEATING_OUTPUT	Analog Heating Output	0-100% (0-10 V)	0
AO9	ECON_DAMPER	Economizer Output	0-100% (0-10 V)	0
AO10	AO_10	Analog Output #10	no sensor	0
BO1	FAN	Fan Start - Stop	Unknown	Inactive
BO2	CL STAGE 1	Cool Stage 1	Unknown	Inactive
BO3	CL STAGE 2	Cool Stage 2	Unknown	Inactive
BO4	BO_04	Binary Output #04	Unknown	Inactive
BO5	HT STAGE 1	Heating Stage 1	Unknown	Inactive
BO6	HT STAGE 2	Heating Stage 2	Unknown	Inactive
Values				
AV1	SPACE_TEMP	Space Temperature	Degrees F	0
AV2	STPT REFERENCE	Setpoint Reference	Degrees F	72
AV3	ACT_COOL_STPT	Active Cooling Setpoint	Degrees F	74
AV4	ACT_HEAT_STPT	Active Heating Setpoint	Degrees F	70
AV5	OCC_CL_STPT	Occupied Cooling Setpoint	Degrees F	74
AV6	OCC_HT_SPT	Occupied Heating Setpoint	Degrees F	70
AV7	UNOCC_CL_STPT	Unoccupied Cooling Setpoint	Degrees F	80
AV8	UNOCC_HT_STPT	Unoccupied Heating Setpoint	Degrees F	64
AV9	MIN_CL_STPT	Minimum Cooling Setpoint	Degrees F	68
AV10	MAX_HT_STPT	Maximum Heating Setpoint	Degrees F	76
AV11	MIN_STPT_DIFF	Minimum Setpoint Differential	Degrees F	2
AV12	STBY_OFFSET	Standby Offset	Degrees F	3
AV13	DAT RESET	Discharge Air Temperature Setpoi	Degrees F	0
AV14	MIN DAT	Min Dishcharge Air Temp	Degrees F	55
AV15	MIN_ECON_DAMPER	Minimum Econ Damper	Percent	10
AV16	ECON_ENABLE_TEMP	Econimizer Enable Temperature	Degrees F	60
AV17	AV_17	Analog Value #17	No Units	0
AV19	OUTDOOR_TEMP	Outdoor Air Temperature	Degrees F	0
AV20	DISCHARGE_TEMP	Discharge Air Temp	Degrees F	0
AV21	REL_HUMIDITY	Relative Humidity	Percent	0
AV22	DEHUM_STPT	Dehumidification Setpoint	Percent	60
AV23	AV_23	Analog Value #23	No Units	0
AV24	DEHUM_DIFF	Dehumidification Differential	Percent	5
AV25	FAN_OFF_DELAY	Fan Off Delay	Minutes	2
AV26	MIN_ OFF_TIME	Equipment Delay	Minutes	5
AV27	STAGE_DELAY	Stage Delay	Minutes	10
AV28	STANDBY_TIMER	Inactivity Timer	Minutes	20
AV29	OCCUPANCY TRIGGE	Occupancy Trigger	Minutes	5
AV30	AV_30	Analog Value #30	No Units	0
AV38	OVRD_TIME	Local Override Timer	Minutes	60

BAC-93X1 RTU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
AV39	AV_39	Analog Value #39	No Units	0
AV51	APP_ID	Application Identification	No Units	0
AV52	COOL PROP	Cooling Proportional Band	Degrees F	2
AV53	HEAT PROP	Heating Proportional Band	Degrees F	2
AV54	COOL INTG	Cool Intergral	Per Hour	0
AV55	HEAT INTG	Heat Intergral	Per Hour	0
AV56	AV_56	Analog Value #56	No Units	0
AV57	ROOM CO2	Room CO2 Level	Parts per Million	0
BV1	BV_1	Binary Value #1		Inactive
BV2	BV_2	Binary Value #2		Inactive
BV3	BV_3	Binary Value #3		Inactive
BV4	BV_4	Binary Value #4		Inactive
BV5	OCC_SCHEDULE	Occupy Schedule		Inactive
BV6	MOTION	Motion Detected		Active
BV7	DAT_SENSOR	DAT Sensor Present		Inactive
BV8	MODE	Heat or Cool Mode		Active
BV9	FAN_NEED	Call for Fan		Inactive
BV10	COOL_HEAT_NEED	Cooling or Heating Needed?		Active
BV11	SPEED_UP	Speed Up Timers X 15		Inactive
BV12	HEATING_FAN	Fan Acitve In Heat		Active
BV13	OCCUPIED_FAN	Fan On During Occupied Mode		Inactive
BV14	FAN_STATUS	Fan Proof		Inactive
BV15	BV_15	Binary Value#15		Inactive
BV16	ECON_ENABLE	Econimizer		Inactive
BV17	ECON_MODE	Start Stop Econimizer		Inactive
BV18	CL_VLV_ACTION	Normal Close/Normal Open		Inactive
BV19	HT_VLV_ACTION	Normal Close/Normal Open		Inactive
BV20	COOL_STG_1	Cooling Stage 1		Inactive
BV21	COOL_STG_2	Cooling Stage 2		Inactive
BV22	HEAT_STG_1	Heating Stage 1		Inactive
BV23	HEAT_STG_2	Heating Stage 2		Inactive
BV24	BV_24	Binary Value #24		Inactive
BV27	OAT_SENSOR	Outdoor Sensor Present?		Inactive
BV28	LOCAL_OVRD	Local Override Mode		Inactive
BV29	BV_29	Binary Value #29		Inactive
BV31	DEHUM_ENABLE	Enable Dehumidification		Inactive
BV32	DEHUM_MODE	Dehumidification Mode		Inactive
BV33	STANDBY_ENABLE	Enable Standby Mode		Active
BV34	BV_34	Binary Value #34		Inactive
BV36	STPT_HOLD	Hold Temperature Setpoint		Inactive
BV37	BV_37	Binary Value #37		Inactive
BV40	ICO_FAN	Fan Icon		Inactive
BV41	ICO_FAN_LOW	Icon Fan Low Speed		Inactive
BV42	ICO_FAN_MEDIUM	Icon Fan Medium Speed		Inactive
BV43	ICO_FAN_HIGH	Icon Fan Auto		Inactive
BV44	ICO_FAN_AUTO	Icon Fan Auto		Inactive
BV45	ICO_OCCUPIED	Icon Occupied		Inactive
BV46	ICO_STANDBY	Icon Standby		Inactive
BV47	ICO_COOLING	Icon Cooling		Inactive
BV48	ICO_HEATING	Icon Heating		Inactive
BV49	ICO_AUTO_MODE	Icon Auto Mode		Inactive
BV50	ICO_OVERRIDE	Icon Override		Inactive

BAC-93X1 RTU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
MSV1	OCCUPIED MODE	Occupied Mode	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
MSV2	SYSTEM_MODE	Control Mode	OFF	2
			AUTO	
			COOL	
			HEAT	
MSV3	FAN_MODE	Fan Auto-Manual Mode	AUTO	1
			ON	
MSV8	OCCUPIED STATE	Occupied State	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
MSV10	WALL SENSOR	Wall Sensor Type	STE-9001 Temp	1
			STE-9021 Humidity	
			STE-9201 Motion	
			STE-9221 Humidity/Motion	
			STE-9301 CO2	
			STE-9321 Humidity/CO2	
			STE-9501 Motion/CO2	
			STE-9521 Humidity/Motion/CO2	
			STE-6014/7	
			STE-6010	
			None	

***NOTE:** **AI9** is for the **optional** air pressure sensor (in the BAC-9311). All models of the BAC-9300 series have **8 standard** inputs—2 analog for the temp. sensor port and 6 universal inputs (software configurable as analog, binary, or accumulator on terminals).

BAC-93X1 HPU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
Inputs				
AI1	SPACE SENSOR	Space Sensor	KMC Type II Deg F (10K)	
AI2	SPACE SETPOINT	Space Setpoint	TABLE_4	
AI3	DISCHARGE AIR	Discharge Air Temperature	KMC Type III Deg F (10K)	
AI4	OUTDOOR AIR	Outdoor Air Temp	KMC10K_Type_III	
AI5	HUMIDITY	Space Humidity	Humidity (0-100 % 0-5 v)	
AI6	AI_06	Analog Input #6	no sensor	
AI7	AI_07	Analog Input #7	no sensor	
AI8	AI_08	Analog Input #8	no sensor	
AI9*	AI_09	Analog Input #9	no sensor	
Outputs				
AO7	AO_07	Analog Output #7	no sensor	0
AO8	AO_08	Analog Output #8	no sensor	0
AO9	ECON_DAMPER	Economizer Output	0-100% (0-10 V)	0
AO10	AO_10	Analog Output #10	no sensor	0
BO1	FAN	Fan Start - Stop	Unknown	Inactive
BO2	COMPRESSOR_1	Stage 1 Compressor	Unknown	Inactive
BO3	COMPRESSOR_2	Stage 2 Compressor	Unknown	Inactive
BO4	REVERSING _VALVE	Reversing Valve	Unknown	Inactive
BO5	AUXILIARY_HEAT	Auxiliary Heat	Unknown	Inactive
BO6	BO_06	Binary Output #6	no sensor	Inactive
Values				
AV1	SPACE_TEMP	Space Temperature	Degrees F	0
AV2	STPT REFERENCE	Setpoint Reference	Degrees F	72
AV3	ACT_COOL_STPT	Active Cooling Setpoint	Degrees F	80
AV4	ACT_HEAT_STPT	Active Heating Setpoint	Degrees F	64
AV5	OCC_CL_STPT	Occupied Cooling Setpoint	Degrees F	74
AV6	OCC_HT_SPT	Occupied Heating Setpoint	Degrees F	70
AV7	UNOCC_CL_STPT	Unoccupied Cooling Setpoint	Degrees F	80
AV8	UNOCC_HT_STPT	Unoccupied Heating Setpoint	Degrees F	64
AV9	MIN_CL_STPT	Minimum Cooling Setpoint	Degrees F	68
AV10	MAX_HT_STPT	Maximum Heating Setpoint	Degrees F	76
AV11	MIN_STPT_DIFF	Minimum Setpoint Differential	Degrees F	2
AV12	STBY_OFFSET	Standby Offset	Degrees F	3
AV13	DAT_RESET	Discharge Air Reset STPT	Degrees F	0
AV14	MIN DAT	Min Discharge Air Temp	Degrees F	55
AV15	MIN_ECON_DAMPER	Minimum Econ Damper	Percent	10
AV16	ECON_ENABLE_TEMP	Economizer Enable Temperature	Degrees F	60
AV17	CMP_LOCKOUT	Compressor Lockout Temperature	Degrees F	25
AV18	AUX_HT_LOCKOUT	OAT AUX Heat Lockout	Degrees F	60
AV19	OUTDOOR_TEMP	Outdoor Air Temperature	Degrees F	0
AV20	DISCHARGE_TEMP	Discharge Air Temp	Degrees F	0
AV21	REL_HUMIDITY	Relative Humidity	Relative Humidity	0
AV22	DEHUM_STPT	Dehumidification Setpoint	Percent	60
AV23	AV_23	Analog Value #23	No Units	5
AV24	DEHUM_DIFF	Dehumidification Differential	Percent	5
AV25	FAN_OFF_DELAY	Fan Off Delay	Minutes	2
AV26	MIN_ OFF_TIME	Equipment Delay	Minutes	5

BAC-93X1 HPU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
AV27	STAGE_DELAY	Stage Delay	Minutes	10
AV28	STANDBY_TIMER	Inactivity Timer	Minutes	20
AV29	OCCUPANCY TRIGGE	Occupancy Trigger	Minutes	5
AV30	AV_30	Analog Value #30	No Units	0
AV38	OVRD_TIME	Local Override Timer	Minutes	60
AV39	AV_39	Analog Value #39	No Units	0
AV51	APP_ID	Application Identification	No Units	0
AV52	COOL PROP	Cooling Proportional Band	Degrees F	2
AV53	HEAT PROP	Heating Proportional Band	Degrees F	2
AV54	COOL INTG	Cool Intergral	Per Hour	0
AV55	HEAT INTG	Heat Intergral	Per Hour	0
AV56	AV_56	Analog Value #56	No Units	0
AV57	ROOM CO2	Room CO2 Level	Parts per Million	0
BV1	BV_1	Binary Value #1		Inactive
BV2	BV_2	Binary Value #2		Inactive
BV3	BV_3	Binary Value #3		Inactive
BV4	BV_4	Binary Value #4		Inactive
BV5	OCC_SCHEDULE	Occupy Schedule		Inactive
BV6	MOTION	Motion Detected		Active
BV7	DAT_SENSOR	DAT Sensor Present		Inactive
BV8	MODE	Heat or Cool Mode		Active
BV9	FAN_NEED	Call for Fan		Inactive
BV10	COOL_HEAT_NEED	Cooling or Heating Needed?		Active
BV11	SPEED_UP	Speed Up Timers X 15		Inactive
BV12	BV_12	Binary Value #12		Inactive
BV13	OCCUPIED_FAN	Fan On During Occupied Mode		Inactive
BV14	FAN_STATUS	Fan Proof		Inactive
BV15	REV_VLV_POLARITY	Reversing Valve Action		Inactive
BV16	ECON_ENABLE	Economizer		Inactive
BV17	ECON_MODE	Start Stop Economizer		Inactive
BV18	BV_18	Binary Value #18		Inactive
BV20	COOL_STG_1	Cooling Stage 1		Inactive
BV21	COOL_STG_2	Cooling Stage 2		Inactive
BV22	HEAT_STG_1	Heating Stage 1		Inactive
BV23	HEAT_STG_2	Heating Stage 2		Inactive
BV24	AUX_HEAT_STG	Auxiliary Heat Stage		Inactive
BV25	AUX_LOCKOUT	Aux Heat Lockout		Inactive
BV26	COMP_LOCKOUT	Compressor Lockout		Inactive
BV27	OAT_SENSOR	Outdoor Sensor Present?		Inactive
BV28	LOCAL_OVRD	Local Override Mode		Inactive
BV29	BV_29	Binary Value #29		Inactive
BV31	DEHUM_ENABLE	Enable Dehumidification		Inactive
BV32	DEHUM_MODE	Dehumidification Mode		Inactive
BV33	STANDBY_ENABLE	Enable Standby Mode		Active

BAC-93X1 HPU OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
BV34	BV_34	Binary Value #34		Inactive
BV36	STPT_HOLD	Hold Temperature Setpoint		Inactive
BV37	ENBL_CMP_LOCKOUT	Enable Compressor Lockout		Active
BV40	ICO_FAN	Fan Icon		Inactive
BV41	ICO_FAN_LOW	Icon Fan Low Speed		Inactive
BV42	ICO_FAN_MEDIUM	Icon Fan Medium Speed		Inactive
BV43	ICO_FAN_HIGH	Icon Fan Auto		Inactive
BV44	ICO_FAN_AUTO	Icon Fan Auto		Inactive
BV45	ICO_OCCUPIED	Icon Occupied		Inactive
BV46	ICO_STANDBY	Icon Standby		Inactive
BV47	ICO_COOLING	Icon Cooling		Inactive
BV48	ICO_HEATING	Icon Heating		Inactive
BV49	ICO_AUTO_MODE	Icon Auto Mode		Inactive
BV50	ICO_OVERRIDE	Icon Override		Inactive
MSV1	OCCUPIED MODE	Occupied Mode	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
MSV2	SYSTEM_MODE	Control Mode	OFF	2
			AUTO	
			COOL	
			HEAT	
			EMERGENCY_HEAT	
MSV3	FAN_MODE	Fan Auto-Manual Mode	AUTO	1
			ON	
MSV5	AUX_HEAT	Auxiliary Heat	None	1
			3rd Stage	
			Comp Lockout	
MSV8	OCCUPIED STATE	Occupied Mode	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
MSV10	WALL SENSOR	Wall Sensor Type	STE-9001 Temp	1
			STE-9021 Humidity	
			STE-9201 Motion	
			STE-9221 Humidity/Motion	
			STE-9301 CO2	
			STE-9321 Humidity/CO2	
			STE-9501 Motion/CO2	
			STE-9521 Humidity/Motion/CO2	
			STE-6014/7	
			STE-6010	
			None	

***NOTE:** **AI9** is for the **optional** air pressure sensor (in the BAC-9311). All models of the BAC-9300 series have **8 standard** inputs—2 analog for the temp. sensor port and 6 universal inputs (software configurable as analog, binary, or accumulator on terminals).

BAC-9311 VAV WITH REMOTE ACTUATOR OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
Inputs				
AI1	SPACE SENSOR	Space Sensor	KMC Type II Deg F	
AI2	SPACE SETPOINT	Space Setpoint	Table 4	
AI3	DISCHARGE AIR	Discharge Air Temperature	KMC Type III Deg F	
AI8	PRIMARY POSITION	Primary Damper Position	0-12 Volts	
AI9*	PRIMARY DUCT	Primary Duct Pressure	NONE	
Outputs				
AO7	ANALOG HEAT	Analog Heat	0-100 % (0-10 V)	0
AO8	FAN SPEED	Fan Speed	0_100%	0
AO9	AO_09	Analog Output #9	NONE	0
BO1	FAN	Fan	Unknown	Inactive
BO2	HT STAGE 1	Heating Stage 1	Unknown	Inactive
BO3	HT STAGE 2	Heating Stage 2	Unknown	Inactive
BO4	HT STAGE 3	Heating Stage3	Unknown	Inactive
BO5	PRI DAMPER CW	Primary Damper Clockwise	Unknown	Inactive
BO6	PRI DAMPER CCW	Primary Damper Counter Clockwise	Unknown	Inactive
Values				
AV1	SPACE TEMP	Space Temperature	Degrees F	0
AV2	STPT REFERENCE	Setpoint Reference	Degrees F	72
AV3	ACT COOL STPT	Active Cooling Setpoint	Degrees F	74
AV4	ACT HEAT STPT	Active Heating Setpoint	Degrees F	70
AV5	OCC CL STPT	Occupied Cooling Setpoint	Degrees F	74
AV6	OCC HT SPT	Occupied Heating Setpoint	Degrees F	70
AV7	UNOCC CL STPT	Unoccupied Cooling Setpoint	Degrees F	80
AV8	UNOCC HT STPT	Unoccupied Heating Setpoint	Degrees F	64
AV9	MIN CL STPT	Minimum Cooling Setpoint	Degrees F	68
AV10	MAX HT STPT	Maximum Heating Setpoint	Degrees F	76
AV11	MIN STPT DIFF	Minimum Setpoint Differential	Degrees F	4
AV12	STBY_OFFSET	Standby Offset	Degrees F	3
AV13	MIN COOL FLOW	Minimum Cooling Flow	Cubic Feet per Minute	100
AV14	MAX COOL FLOW	Maximum Cooling Flow	Cubic Feet per Minute	400
AV15	MIN HEAT FLOW	Minimum Heating Flow	Cubic Feet per Minute	100
AV16	MAX HEAT FLOW	Maximum Heating Flow	Cubic Feet per Minute	400
AV17	AUXILLARY FLOW	Auxillary Flow	Cubic Feet per Minute	200
AV18	PRI K FACT	Primary K Factor	No Units	904
AV19	PRI CORR SLOPE	Primary Correction Slope	No Units	1
AV20	PRI CORR OFFST	Primary Correction Offset	Cubic Feet per Minute	0
AV21	PRI LO FLOW CORR	Primary Low Flow Correction	No Units	1
AV22	PRI FLOW STPT	Primary Flow Setpoint	Cubic Feet per Minute	0
AV23	PRI RAW FLOW	Primary Raw Flow	Cubic Feet per Minute	0
AV24	PRI ACTUAL FLOW	Primary Actual Flow	Cubic Feet per Minute	0
AV25	AV_25	Analog Value #25	No Units	0
AV32	MIN FAN SPEED	Minimum Fan Speed	Percent	25
AV33	MAX FAN SPEED	Maximum Fan Speed	Percent	100

BAC-9311 VAV WITH REMOTE ACTUATOR OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
AV34	AV_34	Analog Value #34	No Units	0
AV36	DAT STPT	Discharge Air Temp Setpoint	Degrees F	90
AV37	SAT CHANGEOVER	SAT Changeover Temperature	Degrees F	72
AV38	LOCAL OVRD TIME	Local Override Timer	Minutes	60
AV39	STANDBY TIMER	Standby Timer (motion)	Minutes	15
AV40	OCCUPANCY TRIGGE	Occupancy Trigger	Minutes	5
AV41	REL_HUMIDITY	Relative Humidity	Relative Humidity	0
AV43	MEASURED MAX	Measured Maximum	Cubic Feet per Minute	0
AV44	MEASURED MIN	Measured Minimum	Cubic Feet per Minute	0
AV45	PRI SAVE MIN FLO	Primary Saved Minimum Airflow	Cubic Feet per Minute	0
AV46	AV_46	Analog Value #46	No Units	0
AV47	DAT MAXIMUM	Maximum DAT Setpoint	Degrees F	90
AV48	CCW DMP POS	CCW Damper Position	Volts	0
AV49	CW DMP POS	CW Damper Position	Volts	0.01
AV50	DAMPER POSITION	Damper Position	Percent	0
AV51	APP_ID	Application Identification	No Units	0
AV55	CHNG OVER DELAY	Heating Change Over Delay	Minutes	3
AV56	LOW AUTO OCC	Low Limit for Auto Occupy	Cubic Feet per Minute	50
AV57	ROOM CO2	Room CO2 Level	Parts per Million	0
BV1	NEED AHU	Needl For AHU		Inactive
BV2	NEED COLDER SPLY	Need For Colder Air Supply		Inactive
BV3	NEED MORE STATIC	Need For More Static Pressure		Inactive
BV4	LOCAL OVRD	Local Override Mode		Inactive
BV5	MOTION OVRD	Motion Override Mode		Inactive
BV6	MOTION SENSOR	Motion Sensor (Wall Stat)		Inactive
BV7	NEED HOTTER SPLY	Need For Hotter Air Supply		Inactive
BV8	SUPPLY AIR TYPE	Supply Air Type		Active
BV9	DAT LIMITING	Discharge Air Temp Limiting		Inactive
BV10	DIRECTION-CLOSE	Clockwise Close		Inactive
BV11	AUTO OCCUPANCY	Auto Occupancy Detection		Inactive
BV12	BALANCE MODE	Balance Mode		Inactive
BV13	DAT SENSOR	DAT Sensor Present		Inactive
BV14	PRI BAL TRIGGER	Primary Balance Trigger		Inactive
BV15	BV_15	Binary Value #15		Inactive
BV40	ICO_FAN	Fan Icon		Inactive
BV41	ICO_FAN_LOW	Icon Fan Low Speed		Inactive
BV42	ICO_FAN_MEDIUM	Icon Fan Medium Speed		Inactive
BV43	ICO_FAN_HIGH	Icon Fan Auto		Inactive
BV44	ICO_FAN_AUTO	Icon Fan Auto		Inactive
BV45	ICO_OCCUPIED	Icon Occupied		Inactive
BV46	ICO_STANDBY	Icon Standby		Inactive
BV47	ICO_COOLING	Icon Cooling		Inactive
BV48	ICO_HEATING	Icon Heating		Inactive
BV49	ICO_AUTO_MODE	Icon Auto Mode		Inactive
BV50	ICO_OVERRIDE	Icon Override		Inactive

BAC-9311 VAV WITH REMOTE ACTUATOR OBJECTS				
OBJECT	**NAME**	**DESCRIPTION**	**UNITS or STATE**	**DEFAULT**
MSV1	OCCUPIED MODE	Occupied Mode	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
			MOTION OVERRIDE	
MSV2	FAN CONFIG	Fantype Configuration	NONE	1
			SERIES	
			PARALLEL	
MSV3	REHEAT	Reheat Type	NONE	1
			STAGED	
			MODULATING	
			FLOATING	
			TIME PROP	
MSV8	OCCUPIED STATE	Occupied State	OCCUPIED	1
			STANDBY	
			UNOCCUPIED	
			LOCAL OVERRIDE	
MSV6	WALL SENSOR	Wall Sensor Type	STE-9001 Temp	1
			STE-9021 Humidity	
			STE-9201 Motion	
			STE-9221 Humidity/Motion	
			STE-9301 CO2	
			STE-9321 Humidity/CO2	
			STE-9501 Motion/CO2	
			STE-9521 Humidity/Motion/CO2	
			STE-6014/7	
			STE-6010	
			None	

***NOTE:** **AI9** is for the **optional** air pressure sensor (in the BAC-9311). All models of the BAC-9300 series have **8 standard** inputs—2 analog for the temp. sensor port and 6 universal inputs (software configurable as analog, binary, or accumulator on terminals).

APPENDIX: K FACTORS FOR VAV

To properly set up a VAV controller, the correct K factor for the VAV box must be entered into the controller. Typically, this is part of the airflow chart that the manufacturer places on the VAV unit. If this information is missing and not available from the manufacturer, use a generic K factor from the following chart as an approximate value.

DUCT SIZE (INCHES)	K FACTOR
4 (Round)	265
5	357
6	460
7	652
8	890
9	1145
10	1143
12	1972
14	2771
16	3741
20	2106
22	2106
26	2498
40	7176
24 x 16 (Rectangular)	6980

INDEX

N

O

P

R

S

T

U

V

W

