# BAC-9000A Series
## BACnet VAV Controller-Actuators (B-AAC)

**(BAC-9001A with MS/TP Shown)**

## DESCRIPTION

KMC Conquest™ BAC-9000A series controller-actuators are designed to operate VAV (Variable Air Volume) terminal units. The integrated alarming, scheduling, and trending enable these BACnet Advanced Application Controllers to be powerful edge devices for the modern smart building ecosystem.

With integrated actuators, internal air pressure sensors, and other powerful features, they are ideal for new installations and upgrades of less-efficient equipment. They easily mount to terminal boxes by securing a "V" clamp on the shaft and securing a single-screw anti-rotation bracket.

The factory-supplied programming covers common VAV applications. The controllers feature simple, menu-driven setup choices using an STE-9000 series digital sensor, which can be installed permanently as the room sensor or used temporarily as a technician's service tool.

Alternately, quick configuration of controller properties can be done using NFC (Near Field Communication) from a smart phone, tablet, or computer (using KMC Connect Lite™ app) while the controller is unpowered. For demanding building automation custom requirements, these controllers are also fully programmable. Custom configuration and programming, with wizards for application programming selection/configuration, are enabled by KMC Connect™ software and the KMC Converge™ module for Niagara Workbench.

KMC Converge and TotalControl™ software additionally provide the capability of creating custom graphical web pages (hosted on a remote web server) to use as a custom user-interface for the controllers.

## APPLICATIONS

Application options include:

- Pressure independent or dependent VAV
- Cooling only and with changeover
- Staged, modulated, floating, or time-proportional reheat
- Series or parallel fan control
- Dual duct (with TSP-8003 actuators)
- CAV (Constant Air Volume)

For installations with a BACnet building automation system, these easily integrated controllers signal demands for higher static duct pressure, cooler or warmer supply air, and other diagnostics for AHU optimization.
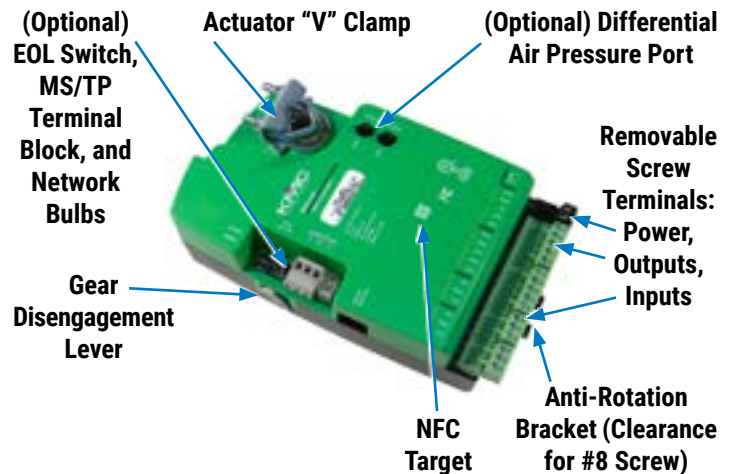
(See also **Sample Installation on page 6**.)

## MODEL

| APPLICATIONS | INPUTS | OUTPUTS | FEATURES | | | MODEL |
| --- | --- | --- | --- | --- | --- | --- |
| | | | Air Pressure Sensor | Real Time Clock | MS/TP | |
| Pressure-**independent** VAV, cooling/heating with fan and reheat; CAV | 8 total:<br>• 1 internal actuator position feedback<br>• 1 integrated air pressure sensor<br>• 2 analog (temperature sensor port)<br>• 4 software-configurable universal inputs (terminals) | 9 total:<br>• 2 internal triacs (actuator motor control)<br>• 4 external triacs (terminals)<br>• 3 universal outputs (0–12 VDC on terminals) | ✓ | | ✓ | BAC-9001A |

# SPECIFICATIONS
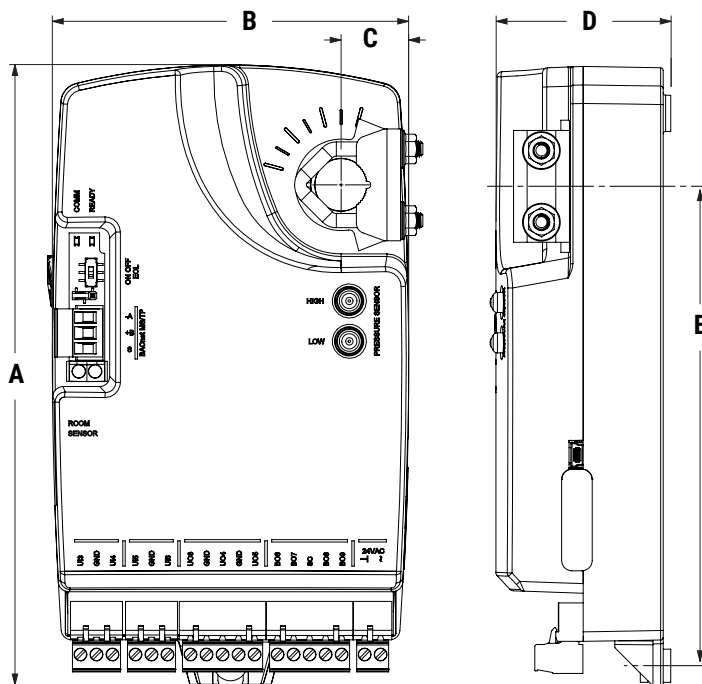


| | DIMENSIONS | |
|---|---|---|
| A | 7.605 inches | 193 mm |
| B | 4.374 inches | 111 mm |
| C | 0.830 inches | 21 mm |
| D | 2.150 inches | 55 mm |
| E | 5.891 inches | 150 mm |

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

(Optional) EOL Switch, MS/TP Terminal Block, and Network Bulbs

Actuator "V" Clamp

(Optional) Differential Air Pressure Port

Removable Screw Terminals: Power, Outputs, Inputs

Gear Disengagement Lever

NFC Target

Anti-Rotation Bracket (Clearance for #8 Screw)

## Inputs and Outputs

### Inputs, Universal (4 on Terminal Blocks)

| | |
|---|---|
| Universal inputs | Configurable as analog, binary, or accumulator objects |
| Termination | 1K and 10K ohm sensors, 0–12 VDC, or 0–20 mA (without need for an external resistor) |
| Resolution | 16-bit analog-to-digital conversion |
| Protection | Overvoltage protection (24 VAC, continuous) |
| Wire size | 12–24 AWG, copper, in removable screw terminal blocks |

### Input, Dedicated Room Sensor Port

| | |
|---|---|
| Connector | Modular connector for STE-9xx1 series digital wall sensors or STE-6010/6014/6017 analog temperature sensors |
| Cable | Uses standard Ethernet patch cable up to 150 feet (45 meters) |

### Input, Integrated Air Pressure Sensor (optional)

| | |
|---|---|
| $\triangle$ pressure range | 0 to 2" wc (0 to 500 Pa) |
| Sensor accuracy | ±4.5% of the reading or (when near zero) 0.0008" wc (0.2 Pa), whichever is greater (@ 25° C); internally linearized and temperature compensated |
| Connections | Barbed for 1/4 inch FR (Flame Retardant) tubing |

### Outputs, Universal (3 on Terminal Blocks)

| | |
|---|---|
| Universal outputs | Configurable as an analog (0 *to* 12 VDC) or binary object (0 *or* 12 VDC, on/off) |
| Power/protection | Each short-circuit protected universal output capable of driving up to 100 mA (at 0–12 VDC) or 100 mA total for all outputs |
| Resolution | 12-bit digital-to-analog conversion |
| Wire size | 12–24 AWG, copper, in removable screw terminal blocks |

## Outputs, Triac (4 Binary)

| | |
|---|---|
| Triac outputs | Optically isolated zero-crossing triac output configured as a binary object |
| Power | Maximum switching 24 VAC at 1.0 A for each output; maximum total for controller is 3.0 A |
| Wire size | 12–24 AWG, copper, in removable screw terminal blocks |

## Output, Integrated Actuator

| | |
|---|---|
| Torque | 40 in-lb. (4.5 N•m) |
| Angular rotation | 0 to 95°; adjustable end stops at 45 and 60° rotation |
| Motor timing | 90 sec. for 90° at 60 Hz; 108 sec. for 90° at 50 Hz |
| Shaft type/size | Mounts on round or square damper shafts—see **Enclosure and Mounting on page 4** |
| Noise level | <35 db(A) @ 1 meter (3.3 feet) |

# Communication Ports

| | |
|---|---|
| MS/TP (optional) | One EIA-485 port (removable terminal block) for BACnet MS/TP, operating at 9.6, 19.2, 38.4, 57.6, 76.8, or 115.2 kilobaud; max. length of up to 4,000 feet (1,200 meters) of 18 AWG shielded twisted-pair, no more than 51 pf/ft (167 pf/m); use repeaters for longer distances |
| Ethernet (optional) | On "E" model only, two 10/100BaseT Ethernet connectors for BACnet IP, Foreign Device, and Ethernet 802.3 (ISO 8802-3); segmentation supported; up to 328 ft (100 m) between controllers (using T568B Category 5 or better cable) |
| NFC | NFC (Near Field Communication) up to 1 inch (2.54 cm) from the top of the enclosure |
| Room sensor | Modular STE connection jack for STE-9000A series digital sensors and STE-6010/6014/6017 analog sensors |
| Auxiliary | One serial port with mini Type B connector (reserved for future use) |

# Configurability

| OBJECTS* | MAXIMUM # |
|---|---|
| **Inputs and Outputs** | |
| Analog, binary, or accumulator input | 8 |
| Analog or binary output | 9 |
| **Values** | |
| Analog value | 120 |
| Binary value | 80 |
| Multi-state value | 40 |
| **Program and Control** | |
| Program (Control Basic) | 10 |
| PID loop | 10 |
| **Schedules** | |
| Schedule | 2 |
| Calendar | 1 |
| **Logs** | |
| Trend log | 20 |
| Trend log multiple (must be created) | 4 (default 0) |
| **Alarms and Events** | |
| Notification class | 5 |
| Event enrollment | 40 |

*Configuration allows creation and deletion of objects (maximum number of objects shown). The number and configuration of default objects depends on the selected application. For lists of default objects, see the **KMC Conquest Controller Application Guide**. See also the PIC statement for all supported BACnet objects.

## Configuring, Programming, and Designing

| SETUP PROCESS | | | KMC CONTROLS TOOL |
|---|---|---|---|
| **Config-uration** | **Programming (Control Basic)** | **Web Page Graphics*** | |
| ✓ | | | Conquest NetSensor |
| ✓ | | | Internal configuration web pages in Conquest Ethernet "E" models** |
| ✓ | | | KMC Connect Lite™ (NFC) app*** |
| ✓ | ✓ | | KMC Connect™ software |
| ✓ **** | ✓ **** | ✓ | TotalControl™ software |
| ✓ | ✓ | | KMC Converge™ module for Niagara WorkBench |
| | | ✓ | KMC Converge **GFX** module for Niagara WorkBench |

*Custom graphical user-interface web pages can be hosted on a remote web server, but not in the controller.

**Conquest Ethernet-enabled "E" models with the latest firmware can be configured with an HTML5-compatible web browser from pages served from within the controller. For information, see the **Conquest Ethernet Controller Configuration Web Pages Application Guide**.

***Near Field Communication via enabled smart phone or tablet running the KMC Connect Lite app.

****Full configuration and programming of KMC Conquest controllers is supported starting with TotalControl ver. 4.0.

## Hardware Features

### Processor, Memory, and Clock

| | |
|---|---|
| Processor | 32-bit ARM® Cortex-M4 |
| Memory | Programs and configuration parameters are stored in nonvolatile memory; auto restart on power failure |
| RTC | Real time clock with (capacitor) power backup for 72 hours ("C" model only) for network time synchronization or full stand-alone operation |

## Indicators and Isolation

| | |
|---|---|
| LED indicators | Power/status, MS/TP communication, and Ethernet status |
| MS/TP protection | One network bulb assembly indicates reversed polarity and isolates circuit |
| Switch | EOL (end of line) for MS/TP |

## Installation

### Power

| | |
|---|---|
| Supply voltage | 24 VAC (−15%, +20%), 50/60 Hz, Class 2 only; non-supervised (all circuits, including supply voltage, are power limited circuits) |
| Required power | 8 VA, plus external loads |
| Wire size | 12–24 AWG, copper, in a removable screw terminal block |

### Enclosure and Mounting

| | |
|---|---|
| Weight | 1.17 lb. (0.53 kg) |
| Case material | Green and black flame retardant plastic |
| Mounting | Directly mounts on 3/8 to 5/8 inch (9.5 to 16 mm) round or 3/8 to 7/16 inch (9.5 to 11 mm) square damper shafts with 2 inch (51 mm) minimum shaft length |

### Environmental Limits

| | |
|---|---|
| Operating | 32 to 120° F (0 to 49° C) |
| Shipping | −40 to 160° F (−40 to 71° C) |
| Humidity | 0 to 95% relative humidity (non-condensing) |

## Warranty, Protocol, and Approvals

### Warranty

| | |
|---|---|
| KMC Limited Warranty | 5 years (from mfg. date code) |

### BACnet Protocol

| | |
|---|---|
| Standard | Meets or exceeds the specifications in ANSI/ASHRAE BACnet Standard 135-2010 for Advanced Application Controllers |
| Type | BTL-certified as a B-AAC controller type |

| UL | UL 916 Energy Management Equipment listed |
|---|---|
| BTL | BACnet Testing Laboratory listed as Advanced Application Controller (B-AAC) |
| RoHS 2 | RoHS 2 compliant |
| FCC | FCC Class A, Part 15, Subpart B and complies with Canadian ICES-003 Class A* |

*This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. (NFC operation meets FCC compliance while the controller is in an unpowered state.)

# ACCESSORIES

NOTE: For accessory details, see the respective product data sheets and installation guides.

## DAT Sensor and Dual Duct Actuator

| STE-1405 | Discharge air temperature sensor with 10-foot plenum-rated cable |
|---|---|
| TSP-8003 | Tri-state actuator with pressure sensor for dual-duct applications |

## Differential Air Pressure Sensors

| SSS-1012 | Sensor, 3-5/32 inches (80 mm) length |
|---|---|
| SSS-1013 | Sensor, 5-13/32 in. (137 mm) length |
| SSS-1014 | Sensor, 7-21/32 in. (194 mm) length |
| SSS-1015 | Sensor, 9-29/32 in. (252 mm) length |

## Miscellaneous Hardware

| HPO-9901 | Controller replacement parts kit with terminal blocks (1 gray, 1 black, 2 green 3-terminal, 4 green 4-terminal, 2 green 5-terminal, 2 green 6-terminal) and DIN clips (2 small for router and 1 large for controllers) |
|---|---|
| SP-001 | Screwdriver (KMC branded) with a hex end (for NetSensor cover screws) and a flat blade end (for controller terminals) |

## Network Communications

| BAC-5051AE | BACnet router with single MS/TP and IP/Ethernet ports |
|---|---|
| HPO-0055 | Replacement network bulb assembly (pack of 5) |
| HPO-5551 | Router technician cable kit |
| HPO-9003 | NFC Bluetooth/USB module (fob) |
| HSO-9001 | Ethernet patch cable, 50 feet |
| HSO-9011 | Ethernet patch cable, 50 feet, plenum rated |
| HSO-9012 | Ethernet patch cable, 75 feet, plenum rated |
| KMD-5567 | Network surge suppressor |

## Room Sensors, Analog

| STE-6010W10 | Temperature sensor, white |
|---|---|
| STE-6014W10 | Sensor with rotary setpoint dial, white |
| STE-6017W10 | Sensor with rotary setpoint dial and override button, white |
| HPO-9005 | Room sensor adapter allows the use of other sensors and optional setpoint potentiometers (with wire leads or terminal blocks) to be used instead of STE-601x sensor models with modular jacks |

NOTE: Other STE-6000 series sensors are not fully compatible with the dedicated sensor port. However, various other models can be used with an HPO-9005 adapter or with the controller screw terminals. See the STE-6000 series data sheet for more information. For digital sensor information, see the STE-9000 series.

NOTE: To order the STE-601x sensor with light almond color instead of white, drop the W on the end of the model number (e.g., STE-6010W is white and STE-6010 is light almond).
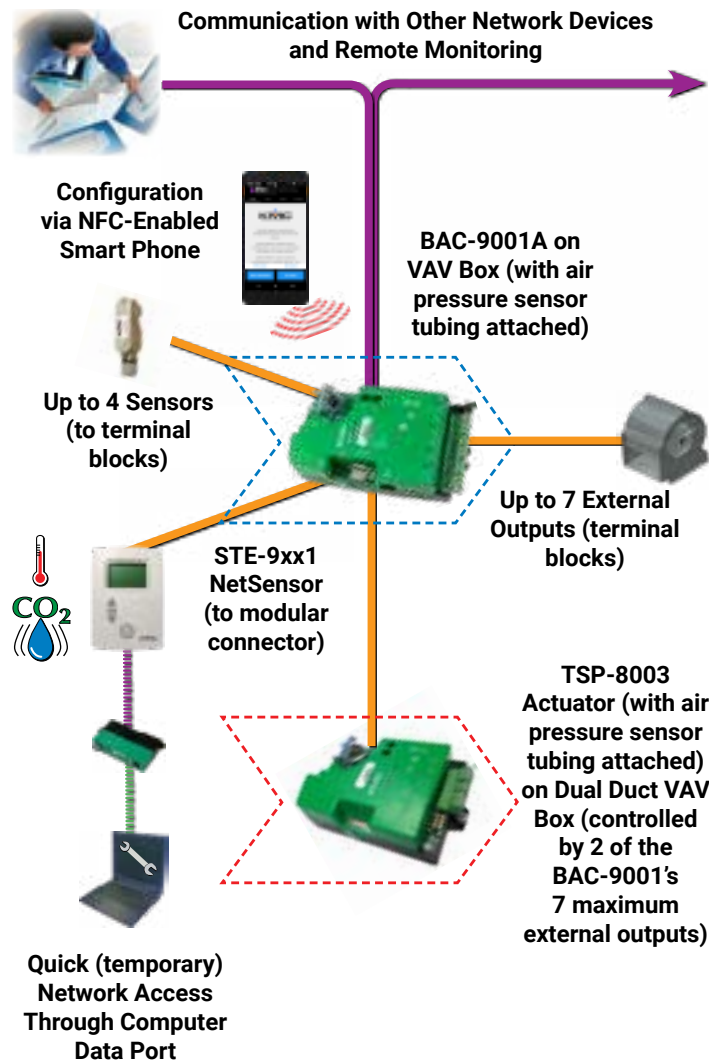
## Room Sensors, Digital (LCD Display)

| STE-9000 Series | KMC Conquest NetSensor digital room temperature sensors for viewing, configuring, and optional humidity, occupancy, and $CO_2$ sensing |
|---|---|
| HPO-9001 | NetSensor distribution module |

## Transformers, 120 to 24 VAC

| XEE-6111-050 | 50 VA, single-hub |
|---|---|
| XEE-6112-050 | 50 VA, dual-hub |

## SAMPLE INSTALLATION

**Communication with Other Network Devices and Remote Monitoring**

**Configuration via NFC-Enabled Smart Phone**

**BAC-9001A on VAV Box (with air pressure sensor tubing attached)**

**Up to 4 Sensors (to terminal blocks)**

**Up to 7 External Outputs (terminal blocks)**

**STE-9xx1 NetSensor (to modular connector)**

CO$_2$

**TSP-8003 Actuator (with air pressure sensor tubing attached) on Dual Duct VAV Box (controlled by 2 of the BAC-9001's 7 maximum external outputs)**

**Quick (temporary) Network Access Through Computer Data Port**

For more information about installation and operation, see:

* **BAC-9000 Series VAV Controller Installation Guide**
* **KMC Conquest Controller Application Guide**
* **KMC Conquest Wiring: BAC-9000 Series Controllers (Video)**

## SUPPORT

Additional resources for installation, configuration, application, operation, programming, upgrading, and much more are available on the web at **www.kmccontrols.com**. Log-in to see all available files.

**KMC CONTROLS**