

### Description and Application

The award-winning FlexStat is a **controller and sensor** in a single, attractive package that creates a flexible solution to stand-alone control challenges or BACnet network challenges. Temperature sensing is standard with **optional humidity, motion, and CO<sub>2</sub> sensing**. Flexible input and output configurations and built-in or custom programming ensure that a variety of application needs can be met. Such applications include single- and multi-stage packaged, unitary, and split systems (including high SEER/EER variable speed packaged equipment), as well as factory-packaged and field-applied economizers, water-source and air-to-air heat pumps, fan coil units, central station air handling units, and other similar applications.

In addition, an on-board library of programs permits a single model to be rapidly configured for a wide range of HVAC control applications. Thus, a single “one size fits all” FlexStat model can replace multiple competitor models. A single BAC-120163CW, for example, can be quickly configured for any of these application options:

- ◆ Air handling unit, with proportional heating and cooling valves, and with optional economizer, dehumidification, and/or fan status
- ◆ Fan coil unit, 2-pipe or 4-pipe, proportional or 2-position valves, with optional dehumidification (w/ 4-pipe option) and/or fan status
- ◆ Heat pump unit, with up to two compressor stages, and with optional auxiliary heat, emergency heat, dehumidification, and/or fan status
- ◆ Roof top unit, with up to two H/C stages, and with optional economizer, dehumidification, and/or fan status

FlexStats also provide the capability to customize the standard library of sequences using a KMC programming tool (BACstage or TotalControl). This enables a local authorized KMC installing contractor to adapt the standard library to the unique site needs and application-specific requirements of a particular project.

BACnet over MS/TP communication is standard. **“E” versions, with an RJ-45 jack, add BACnet over Ethernet, BACnet over IP, and BACnet over IP as Foreign Device** (for communication across the Internet).



(Shown with Optional Motion and Humidity Sensors)



### Features

#### Interface and Function

- ◆ User-friendly English-language menus (no obscure numeric codes) on a 64 x 128 pixel, dot-matrix LCD display with 5 buttons for data selection and entry
- ◆ Multiple display options include selectable space temperature display precision, degrees F/C toggle, rotation values, display blanking, hospitality mode, and locked mode
- ◆ Built-in, factory-tested libraries of configurable application control sequences
- ◆ Integral energy management control with optimum start, deadband heating and cooling setpoints, and other advanced features to assure comfort while maximizing energy savings
- ◆ Schedules can easily be set uniquely by the entire week (Mon.–Sun.), weekdays (Mon.–Fri.), weekend (Sat.–Sun.), individual days, and/or holidays; six On/Off and independent heating and cooling setpoint periods are available per day
- ◆ Three levels of password-protected access (user/operator/administrator) prevent disruption of operation and configuration—plus Hospitality mode and Locked User Interface mode offer additional tamper resistance
- ◆ Integral temperature and optional humidity, motion (shown in photo above), and/or CO<sub>2</sub> sensors
- ◆ All models have 72-hour power (capacitor) backup and a real time clock for network time synchronization or full stand alone operation
- ◆ Models functionally replace most Viconics and other competitors’ products

## Features (Cont.)

### Inputs

- ◆ Six analog inputs for additional configurable remote external sensors, such as remote space temperature (with averaging, highest, and lowest options), remote CO<sub>2</sub>, OAT, MAT, DAT, water supply temperature, fan status, and other sensors
- ◆ Inputs accept industry-standard 10K ohm (Type II or III) thermistor sensors, dry contacts, or 0–12 VDC active sensors
- ◆ Input overvoltage protection (24 VAC, continuous)
- ◆ 12-bit analog-to-digital conversion on inputs

### Outputs

- ◆ Nine outputs, analog and binary (relays)
- ◆ Each short-circuit protected analog output capable of driving up to 20 mA (at 0–12 VDC)
- ◆ The NO, SPST (Form “A”) relays carry 1 A max. per relay or 1.5 A per bank of 3 relays (relays 1–3 and 4–6) @ 24 VAC/VDC
- ◆ 8-bit digital-to-analog conversion on outputs

### Installation

- ◆ Backplate mounts on a standard vertical 2 x 4-inch wall handy-box (or, with an HMO-10000 adapter, a horizontal or 4 x 4 handy-box), and the cover is secured to the backplate by two concealed hex screws
- ◆ Two-piece design provides easy wiring and installation (see the Dimensions and Connectors section)

### Connections

- ◆ Screw terminal blocks, wire size 14–22 AWG, for inputs, outputs, power, and MS/TP network
- ◆ “E” versions add an RJ-45 jack
- ◆ A four-pin EIA-485 (formerly RS-485) data port on the underside of the case enables easy temporary computer connection to the BACnet network (access with a KMD-5624 cable—requires use of KMD-5576 or third-party interface)

### BACnet Communication and Standards

- ◆ Integral peer-to-peer BACnet MS/TP LAN network communications on all models (with configurable baud rate from 9600 to 76.8K baud)
- ◆ “E” versions add BACnet over Ethernet, BACnet over IP, and BACnet over IP as Foreign Device
- ◆ Meets or exceeds BACnet AAC specifications in the ANSI/ASHRAE BACnet Standard 135-2008

## Configurability

### I/O

- ◆ Up to 10 analog input objects (IN1 is space temperature, IN2–IN4 and IN7–IN9 are 0–12 VDC inputs, IN5 is reserved for humidity, IN6 is reserved for motion detection, IN10 is reserved for CO<sub>2</sub>)
- ◆ Up to 9 analog or binary output objects

### Value

- ◆ 100 analog value objects
- ◆ 100 binary value objects
- ◆ 40 multi-state value objects (with up to 16 states each)

### Program and control

- ◆ 10 PID loop objects
- ◆ 10 program objects (contains a library of 5 built-in programs and customized Control Basic programming in the other 5 program objects can be done through BACstage or TotalControl)

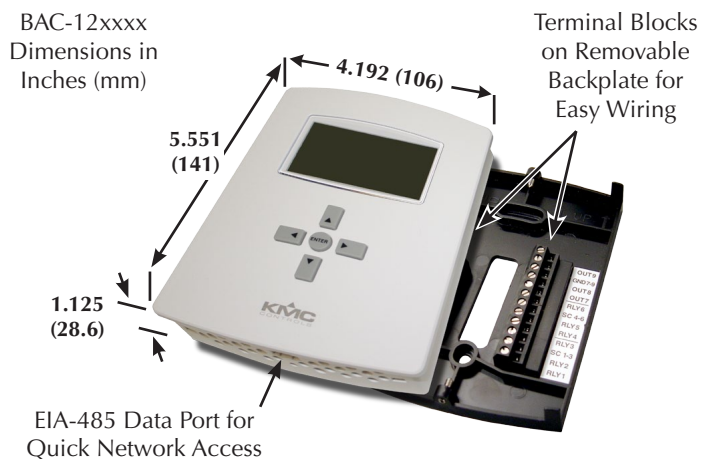
### Schedules and trends

- ◆ 2 schedule objects
- ◆ 1 calendar object
- ◆ 8 trend objects, each of which holds 256 samples

### Alarms and events

- ◆ 5 notification class (alarm/event) objects
- ◆ 10 event enrollment objects

## Dimensions and Connectors



NOTE: Two-piece design allows field rough-in and termination of field wiring to the backplate without needing the FlexStat at the site—permitting FlexStats to be bulk-configured off-site and plugged into the wired backplates at a later time if desired.

## Models

If your application is a:

- ◆ FCU (Fan Coil Unit) or Packaged Unit, AHU (Air Handling Unit), or RTU (Roof Top Unit)—see all models.
- ◆ HPU (Heat Pump Unit)—see the BAC-1xxx63CW models only.

For more details, see the **Application/Model Selection Guide on the next page.**

Model*	Outputs**	Optional Sensors***	Typical Applications
BAC-12xxx models (e.g., BAC-120036CW) are standard and do not have a CO <sub>2</sub> sensor. BAC-13xxx/14xxx models (e.g., BAC-140036CW) have CO <sub>2</sub> sensors to add Demand Control Ventilation to the applications below. <b>DCV is only available when using an AHU, RTU, or HPU application with a modulating economizer option enabled.</b> See "Specifications, CO2 Models Only" for more information.			
BAC-1x0036CW	3 Relays and 6 Analog Outputs	None	<ul style="list-style-type: none"> <li>• 1H/1C, fan, and 6 universal outputs</li> <li>• 3-speed fan, 2- or 4-pipe FCUs with modulating valves</li> <li>• Central station AHUs with modulating/1/2 Heat/Cool</li> <li>• Variable-speed fan output</li> <li>• Single-stage applications</li> </ul>
BAC-1x0136CW		Humidity****	<ul style="list-style-type: none"> <li>• Same as BAC-1x0036CW</li> <li>• Dehumidification sequence</li> <li>• Humidification sequence (AHU or 4-pipe FCU)</li> </ul>
BAC-1x1036CW		Motion/Occupancy	<ul style="list-style-type: none"> <li>• Same as BAC-1x0036CW</li> <li>• Occupancy-based operation</li> </ul>
BAC-1x1136CW		Humidity and Motion/Occupancy****	<ul style="list-style-type: none"> <li>• Same as BAC-1x0136CW</li> <li>• Occupancy-based operation</li> </ul>
BAC-1x0063CW	6 Relays and 3 Analog Outputs	None	<ul style="list-style-type: none"> <li>• 1 or 2 H and 1 or 2 C, fan</li> <li>• Multi-stage packaged or split systems</li> <li>• Multi-stage heat pumps with or without factory-packaged economizers</li> <li>• Central station AHUs with modulating Heat/Cool</li> <li>• 3-speed fan, 2- or 4-pipe FCUs with modulating or 2-position valves</li> </ul>
BAC-1x0163CW		Humidity****	<ul style="list-style-type: none"> <li>• Same as BAC-1x0063CW</li> <li>• Dehumidification sequence (AHU, 4-pipe FCU, or RTU)</li> </ul>
BAC-1x1063CW		Motion/Occupancy	<ul style="list-style-type: none"> <li>• Same as BAC-1x0063CW</li> <li>• Occupancy-based operation</li> </ul>
BAC-1x1163CW		Humidity and Motion/Occupancy****	<ul style="list-style-type: none"> <li>• Same as BAC-1x0163CW</li> <li>• Occupancy-based operation</li> </ul>
<p>*The standard color is white. To order the optional light almond color, remove the "W" at the end of the model number (e.g., BAC-121163C instead of BAC-121163CW). To order the IP version, add an E after the C (e.g., BAC-121163CEW). All models have a real-time clock.</p> <p>**Analog outputs produce 0–12 VDC @ 20 mA maximum, and relays carry 1 A max. per relay or 1.5 A per bank of 3 relays (relays 1–3, 4–6, and 7–9) @ 24 VAC/VDC.</p> <p>***All models have an internal temperature sensor and 6 analog inputs. All models have optional discharge air temperature monitoring/ trending and fan status monitoring. Optional sensors include humidity, motion, and CO<sub>2</sub>.</p> <p>****In models with CO<sub>2</sub> sensors, humidity sensors come standard.</p>			



Applications and Options	FlexStat Models and Outputs							
	6 Relays and 3 Analog				3 Relays and 6 Analog			
	BAC-1x0063CW	BAC-1x0163CW (+ Humidity)	BAC-1x1063CW (+ Motion)	BAC-1x1163CW (+ Humidity/Motion)	BAC-1x0036CW	BAC-1x0136CW (+ Humidity)	BAC-1x1036CW (+ Motion)	BAC-1x1136CW (+ Humidity/Motion)
<b>Packaged Unit (Air Handling Unit and Roof Top Unit)</b>								
1 Heat and 1 Cool					X	X	X	X
1 or 2 Heat and 1 or 2 Cool (in RTU Menu Only)	RTU	RTU	RTU	RTU				
1 or 2 Heat and Modulating Cool					X	X	X	X
Modulating Heat and 1 or 2 Cool					X	X	X	X
Modulating Heat and Modulating Cool (in AHU Menu Only)	AHU	AHU	AHU	AHU	X	X	X	X
Opt. Outside Air Damper, Modulating	X	X	X	X	X	X	X	X
Opt. Outside Air Damper, 2 Position (in RTU Menu Only)	RTU	RTU	RTU	RTU	X	X	X	X
Opt. Mechanical Cooling								
Opt. Fan Speed Control					X	X	X	X
Opt. Dehumidification		X		X		X		X
Opt. Humidifier						X		X
Opt. Motion/Occupancy Sensor			X	X			X	X
<b>FCU (Fan Coil Unit)</b>	<i>With 3-speed fan</i>				<i>With 3-speed fan</i>			
2 Pipe, Modulating	X	X	X	X	X	X	X	X
2 Pipe, 2 Position	X	X	X	X				
4 Pipe, Modulating	X	X	X	X	X	X	X	X
4 Pipe, 2 Position	X	X	X	X				
Opt. Dehumidification (4 pipe only)		X		X		X		X
Opt. Humidifier (4 pipe only)						X		X
Opt. Motion/Occupancy Sensor			X	X			X	X
<b>HPU (Heat Pump Unit)</b>	<i>1 or 2 compressors with auxiliary and emergency heat</i>							
Opt. Outside Air Damper, Modulating	X	X	X	X	N/A			
Opt. Dehumidification		X		X				
Opt. Motion/Occupancy Sensor			X	X				
All models have a real-time clock and also have optional discharge air temperature monitoring/trending and fan status monitoring.								
<b>Model "Code" for BAC-1xmhra CEW:</b> BAC = BACnet Device 1 = Model Series x = CO2 Sensor Type (3 or 4) or None (2) m = Motion Sensor (1) or None (0) h = Humidity Sensor (1) or None (0) r = Number of Relay Outputs (3/6) a = Number of Analog Outputs (3/6) C = Real-Time Clock E = IP Option (no E = MS/TP only) W = White Color (no W = light almond)								

**NOTE:** On models with a CO<sub>2</sub> sensor, the humidity sensor is standard and Demand Control Ventilation is only available when using an AHU, RTU, or HPU application with a modulating economizer option enabled.

For more details, see the Models section on the previous page. For details about the CO<sub>2</sub> model options, see the Specifications, CO<sub>2</sub> Models Only section.

## Specifications, General

<b>Supply Voltage</b>	24 VAC (+20%/–10%), Class 2
<b>Supply Power</b>	13 VA (not including relays)
<b>Outputs (3/6 or 6/3)</b>	Binary outputs (NO, SPST, Form “A” relays) carry <b>1 A</b> max. per relay <b>or</b> a total of <b>1.5 A per bank</b> of 3 relays (relays 1–3 and 4–6) @ 24 VAC/VDC  Analog outputs produce 0–12 VDC, <b>20 mA</b> maximum
<b>External Inputs (6)</b>	Analog 0–12 VDC (active/passive contacts, 10K thermistors)
<b>Connections</b>	Wire clamp type terminal blocks; 14–22 AWG, copper Four-pin EIA-485 (Opt.) eight-pin Ethernet jack
<b>Display</b>	64 x 128 pixel dot matrix LCD
<b>Case Material</b>	White (standard) or light almond flame-retardant plastic
<b>Dimensions*</b>	5.551 x 4.192 x 1.125 inches (141 x 106 x 28.6 mm)
<b>Weight*</b>	0.48 lbs. (0.22 kg)
<b>Approvals*</b>	UL 916 Energy Management Equipment; FCC Class B, Part 15, Subpart B and complies with Canadian ICES-003 Class B; BTL listing pending

### Humidity Sensor (optional internal)

<b>Sensor Type</b>	CMOS
<b>Range</b>	0 to 100% RH
<b>Accuracy @ 25°C</b>	±2% RH (10 to 90% RH)
<b>Response Time</b>	Less than or equal to 4 seconds

### Temperature Sensor (without humidity sensor)

<b>Sensor Type</b>	Thermistor, Type II
<b>Accuracy</b>	±0.36° F (±0.2° C)
<b>Resistance</b>	10,000 ohms at 77° F (25° C)
<b>Operating Range</b>	48 to 96° F (8.8 to 35.5° C)

### Temperature Sensor (with humidity sensor)

<b>Sensor Type</b>	CMOS
<b>Accuracy</b>	±0.9° F offset (±0.5° C) from 40 to 104° F (4.4 to 40° C)
<b>Operating Range</b>	36 to 120° F (2.2 to 48.8° C)

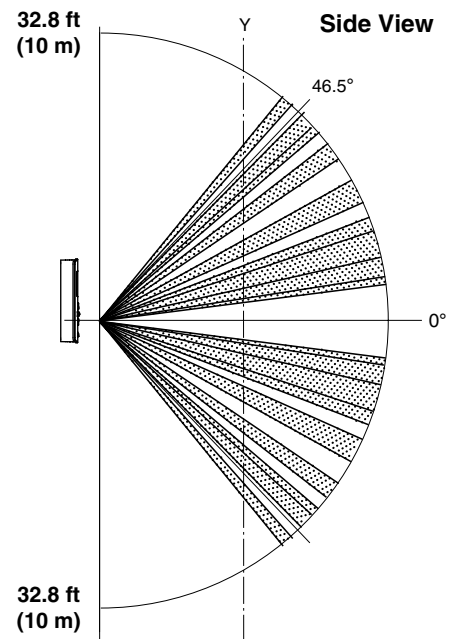
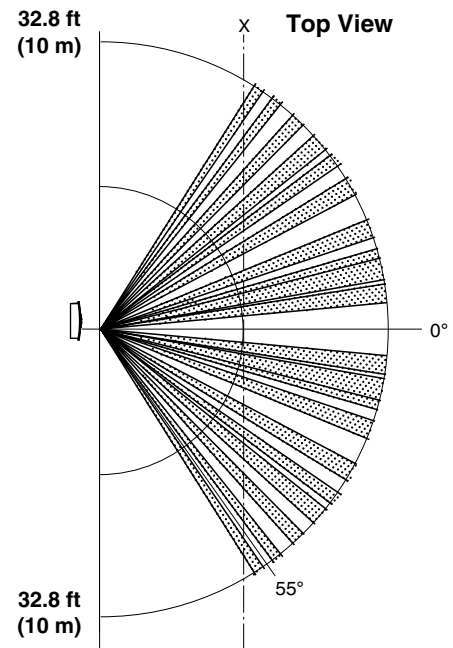
### Environmental Limits\*

<b>Operating</b>	34 to 125° F (1.1 to 51.6° C)
<b>Shipping</b>	–22 to 140° F (–30 to 60° C)
<b>Humidity</b>	0 to 95% RH (non-condensing)

## Specifications, Motion Sensor

**Motion Sensor (Opt.)** Passive infrared with approx. 10 meter (32.8 feet) range

### Motion/Occupancy Sensor Detection Performance

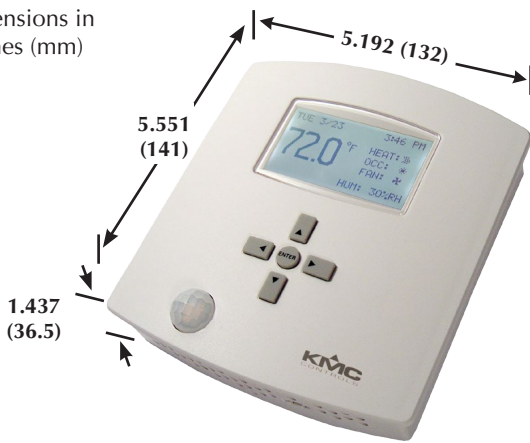


For more details about operation of the motion sensor, see the FlexStat Application Guide.

\*NOTE: Except for CO<sub>2</sub> sensor models—see the next page for those specifications.

## Specifications, CO<sub>2</sub> Models Only

Dimensions in  
Inches (mm)



### Dimensions

5.551 x 5.192 x 1.437 inches  
(141 x 132 x 36.5 mm)

### Weight

0.5 lbs. (0.28 kg)

### Environmental Limits

#### Operating

34 to 122° F (1.1 to 50° C)

#### Shipping

-22 to 140° F (-30 to 60° C)

#### Humidity

0 to 95% RH (non-condensing)

### Approvals

UL 916 Energy Management Equipment; FCC Class A, Part 15, Subpart B and complies with Canadian ICES-003 Class A; BTL listing pending

NOTE: See the previous page for specifications in common with other models.

NOTE: The CO<sub>2</sub> models are not approved for residential applications.

CO <sub>2</sub> Sensor	BAC-13xxxx	BAC-14xxxx
Applications	For zones with <b>occupied/unoccupied</b> times*	For zones with <b>continuous occupancy</b> *
Method	Non Dispersive Infrared (NDIR), with ABC Logic*	Non Dispersive Infrared (NDIR), dual channel*
Calibration	Self-calibrates over several weeks*	Self-calibrates approximately once every 24 hours*
Typical Life of Sensor	15 years	10 years
Measurement Range	400 to 2000 ppm	0 to 2000 ppm
Accuracy (at nominal operating temperature)	±35 ppm @ 500 ppm, ±60 ppm @ 800 ppm, ±75 ppm @ 1000 ppm, ±90 ppm @ 1200 ppm	±75 ppm or 10% of reading (whichever is greater)
Altitude Correction	Configurable from 0 to 32,000 feet	
Pressure Dependence	0.135 of reading per mm Hg	
Temperature Dependence	0.2% FS (full scale) per °C	
Stability	< 2% of FS over life of sensor	< 5% of FS or < 10% reading annual over life of sensor
Response Time	< 2 minutes for 90% step change typical	
Warm Up Time	< 2 minutes (operational) and 10 minutes (maximum accuracy)	
*See explanations below.		

The BAC-13xxxx series uses Automatic Background Logic, or ABC Logic, a patented self-calibration technique designed to be used in applications where concentrations will drop to outside ambient conditions (approximately 400 ppm) at least three times in a 14 day period, typically during unoccupied periods. With ABC Logic enabled, 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<sub>2</sub>. The sensor will maintain accuracy specifications with ABC Logic enabled, given that it is at least four times in 21 days exposed to the reference value and this reference value is the lowest concentration to which the sensor is exposed. ABC Logic requires continuous operation of the sensor for periods of at least 24 hours.

NOTE: The BAC-13xxxx series, with ABC Logic, has been certified to comply with CA Title 24, Section 121(c), as well as sub-paragraph 4.F that specifies accuracy will be maintained within tolerance for a minimum of 5 years without recalibration and that a detected sensor failure will cause the controller to take appropriate corrective action.

NOTE: See also the Demand Control Ventilation section on the next page.

The BAC-14xxxx series, for zones with continuous occupancy, has a dual channel sensor. A CO<sub>2</sub> channel measures gas concentration, and a reference channel measures the sensor signal intensity. Self-calibrations are performed approximately every 24 hours using the reference channel. During the self-calibration the sensor ppm reading is frozen and will not react to changing CO<sub>2</sub>.

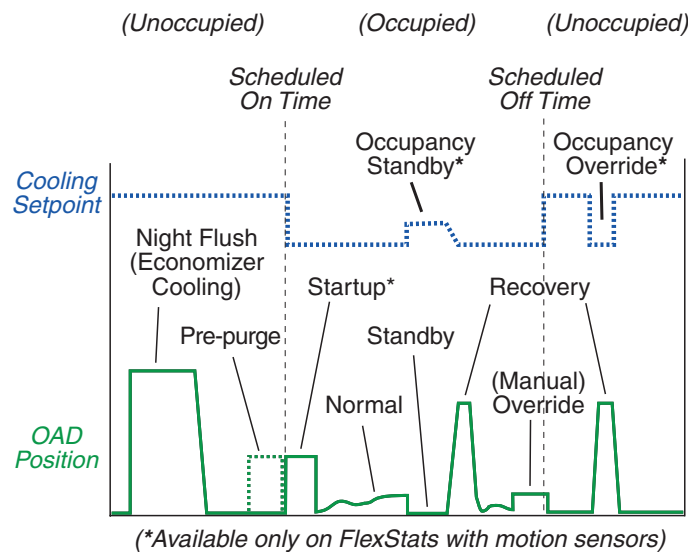
## Demand Control Ventilation

When using applications with a modulating economizer option, the three types of Demand Control Ventilation (DCV) configurations available are:

- ◆ Basic—provides basic DCV, modulating the outside air damper in direct response to the current CO<sub>2</sub> level with respect to its setpoint.
- ◆ Standard—When the BAC-13xxxx settings are properly configured, complies with **CA Title 24, Section 121(c)**.
- ◆ Advanced—When the settings are properly configured, complies with **ASHRAE Standard 62.1-2010** and follows guidelines by **Portland Energy Conservation, Inc. (PECI)**.

Although BAC-12xxxx FlexStats do not have a built-in CO<sub>2</sub> sensor, they still have DCV control sequences available. When DCV is enabled in these models, IN9 is assumed to be connected to an external KMC SAE-10xx CO<sub>2</sub> sensor. BAC-13xxxx/14xxxx FlexStats also have the external sensor option, and if used, the highest of the two readings (internal vs. external) will be used to control DCV sequences. The CO<sub>2</sub> ppm display (when enabled) also shows the highest of the two levels.

**NOTE: DCV is only available when using an AHU, RTU, or HPU application with a modulating economizer option enabled.** Without that configuration, DCV will not appear in menus, but the CO<sub>2</sub> ppm readings will (unless turned off in the User Interface menu) still show on the lower right of the display.



Example Schedule, DCV, and Motion Sensor Applications

## Accessories



HMO-10000 Horizontal or 4 x 4 handy box wall mounting plate for BAC-12xxxx models only, light almond (shown)

HMO-10000W HMO-10000 in white



HPO-0044 Replacement cover hex screw



HTO-1103 FlexStat firmware flash upgrade kit (formerly KMD-5699)



KMD-5567 Network surge suppressor



KMD-5575 Network repeater/isolator



KMD-5576 EIA-485 to USB Communicator

KMD-5624 PC data port (EIA-485) cable (FlexStat to USB Communicator)—included with the KMD-5576 (buy for third-party EIA-232 interfaces)



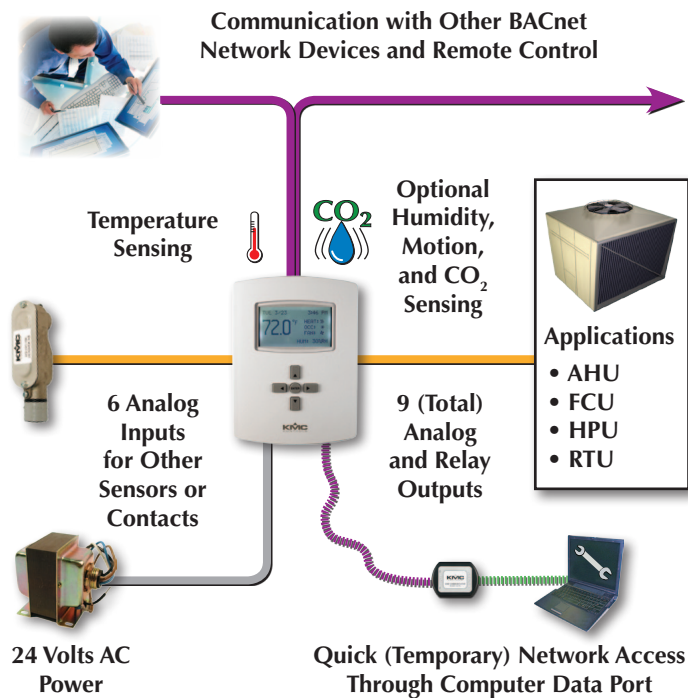
SP-001 Flat blade and hex end screwdriver (with KMC logo) for cover hex screws



XEE-6111-040 Transformer, 120-to-24 VAC, 40 VA, single-hub

XEE-6112-040 Transformer, 40 VA, dual-hub

## Sample Installation



NOTE: For specifications on the older BAC-10000 series FlexStats (with only three external inputs and no Ethernet or CO<sub>2</sub> options), see the data sheet (913-035-01) for that series.

## Support

FlexStats come with a printed Installation Guide. Additional award-winning resources for configuration, application, operation, programming, upgrading and much more is available on the KMC Controls web site ([www.kmcccontrols.com](http://www.kmcccontrols.com)). To see all available files, you will need to log-in to the Partners site.



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