Airflow Measurement System

AFMS Controller (Gen5), Sensors, and Actuator

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KMCAFMS
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DESCRIPTION

Building wellness and indoor air quality assurance is the current industry focus. Fresh air exchanges with conditioned outside air are a fundamental component of all major IAQ strategies. However, reliably measuring outdoor air can be challenging in many equipment types.

The KMC Airflow Measurement System (AFMS) reliably provides accurate outside, return, and supply airflow data for monitoring and control. The system delivers accurate, repeatable results on nearly any type of equipment, without the traditionally expected mechanical limitations, performance issues, or ongoing maintenance issues.

The system consists of the following components, installed on an AHU, RTU, or unit ventilator:

- One controller with airflow measurement programming
- One inclinometer (included with the controller) mounted on a horizontal outside or return air damper blade
- If only vertical damper blades, one HLO-1050 Linkage Kit
- At least two flow pickup tubes installed in the supply air duct, or on the fan inlet
- If a BAC-5901C(E)-AFMS is used, one pressure transducer
- If pressure assist measurements are needed (for units with changing pressure in mixed and/or return air sections, or for units with more than one outside air damper), one additional pressure transducer, connected to two additional flow pickup tubes that are mounted on both sides of either the outside air damper or return air damper.
- Three temperature sensors (STE-1400 Series), for outside, mixed, and return air
- One proportional actuator mounted on the damper shaft

(See the *KMC AFMS Selection Guide* for details.)

HOW IT WORKS

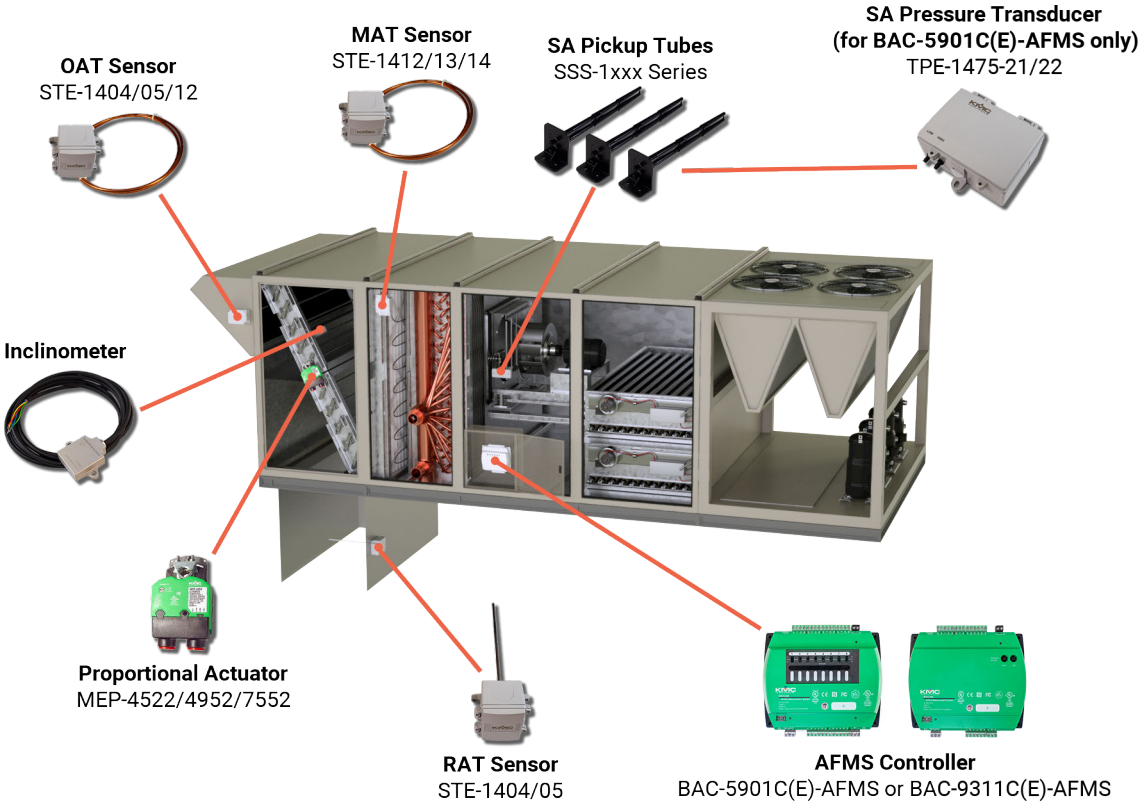
The system determines the proportion of outside versus return airflow with Characterized Airflow Performance®. The AFMS controller's programming generates a characterization curve using a Learning Mode sequence. It does this by leveraging the relationship between the inclinometer and a mixed air equation from ASHRAE Standard 111. During Learning Mode, the damper is positioned at several points (gradually increased percentages of open, as measured by the inclinometer). At each point, the airflow and temperature readings are allowed to stabilize before being sampled and averaged. The controller uses those readings and the mixed air equation to calculate the fraction of OA/RA at each point. The results are recorded in a damper characterization table. Thereafter, the sensors are no longer needed to measure the airflow, but are left in place for fault detection and later re-calibration.

FEATURES

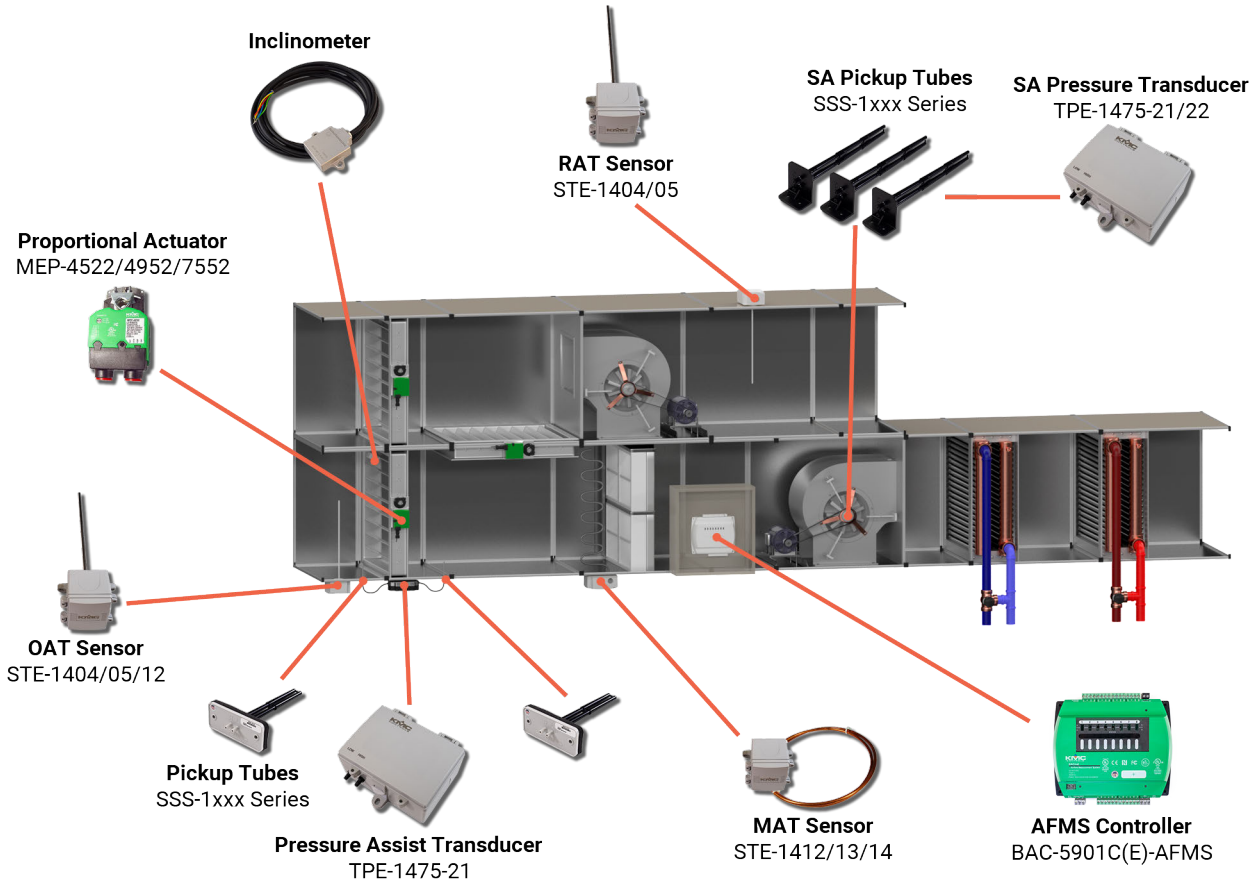
- Measurements of outside, return, and supply airflow accurate within three percent
- Sensor and system fault detection for Title 24 compliance
- Installs without restrictions of installation location
- Reduced system maintenance requirements
- AHU, RTU, and unit ventilator applications
- Applicable to both VAV and CAV systems
- Learning Mode started locally or remotely
- Four control modes: outside airflow, mixed air temperature, damper position, and pass through
- Interoperability with any BACnet open automation system

EXAMPLE DIAGRAMS

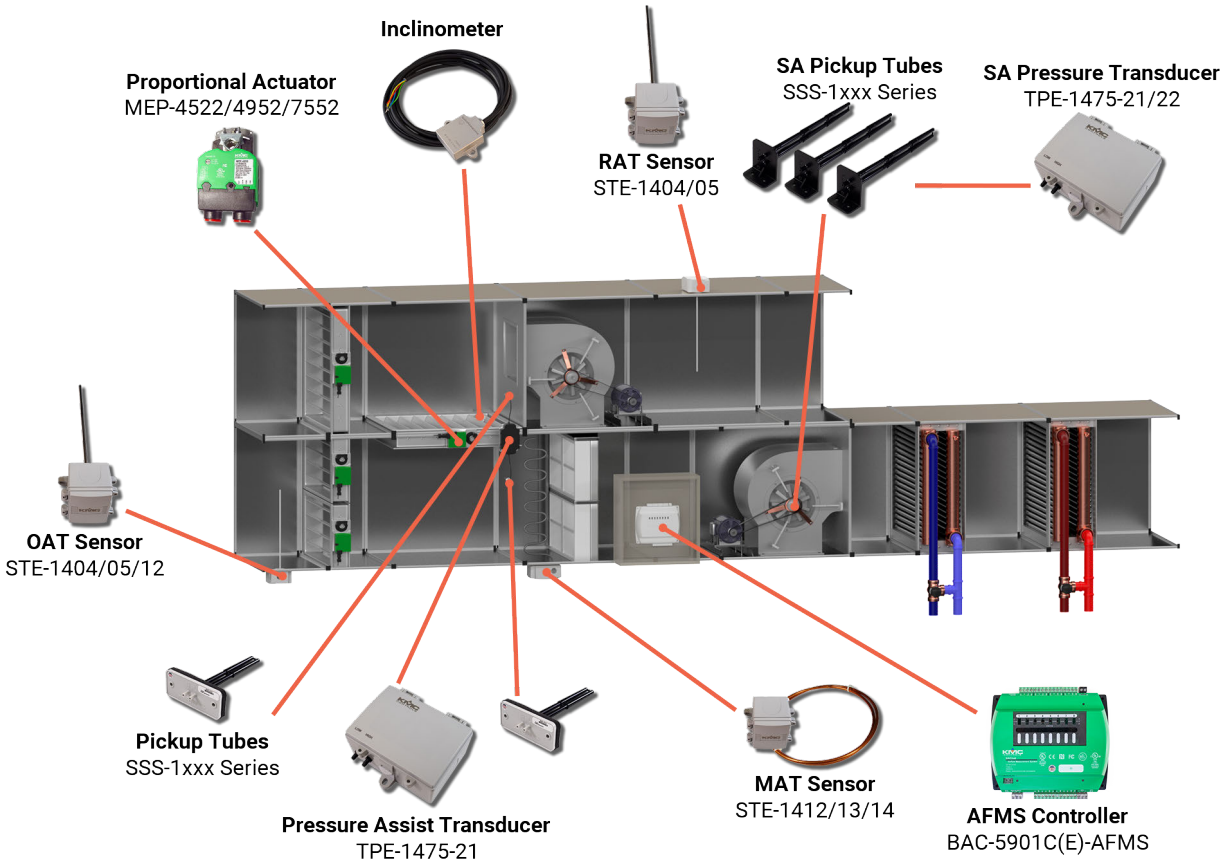
Standard Application



OAD Pressure Assist Application



RAD Pressure Assist Application



COMPONENTS

AFMS Controller with Inclinometer

BAC-5901C-AFMS	BACnet controller with real-time clock, MS/TP communication port, AFMS programming (standard and pressure assist), and inclinometer
BAC-5901CE-AFMS	BACnet controller with real-time clock, two Ethernet communication ports, AFMS programming (standard and pressure assist), and inclinometer
BAC-9311C-AFMS	BACnet controller with real-time clock, MS/TP communication port, standard AFMS programming, and inclinometer
BAC-9311CE-AFMS	BACnet controller with real-time clock, two Ethernet communication ports, standard AFMS programming, and inclinometer

Flow Pickup Tubes

Select at least two.

SSS-1x1x	Pickup tubes, 3-5/32 to 9-29/32 in. (80 to 252 mm) length, with one to six pickup points

Transducer (for BAC-5901C(E)-AFMS only)

Select at least one.

TPE-1475-21	Low Pressure Transducer, -2 to +2' wc
TPE-1475-22*	Low Pressure Transducers, –10 to +10" or 0 to 10" wc

* Requires KMC Connect and technical support to configure.

MAT, RAT, and OAT Sensors

STE-14xx or similar	10,000 ohm, Type III thermistor, temperature sensor

Proportional Actuator

similar to **MEP-4xxx**	Proportional actuator, 25 to 180 in-lb., fail-safe and non-fail-safe

Linkage Kit

Select one if the unit has vertical-axis damper blades.

HLO-1050	Accessory: Linkage Kit, AFMS

CONTROLLER SPECIFICATIONS

For more specifications, see the related data sheets for each of the system's components.

Airflow Measurement Accuracy

±3% of reading. May be field calibrated.

Communications

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" models only, two 10/100Base-seT 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-9000 series digital sensors and STE-6010/6014/6017 analog sensors
Auxiliary	One serial port with mini Type B connector (reserved for future use)

Installation

Power

Supply voltage	24 VAC (50/60 Hz) or 24 VDC; –15%, +20%; Class 2 only; non-supervised (all circuits, including supply voltage, are power limited circuits)
Required power	BAC-5901C(E)-AFMS: 14 VA, plus external loads BAC-9311C(E)-AFMS: 8 VA, plus external loads
Wire size	12–24 AWG, copper, in a removable screw terminal block

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

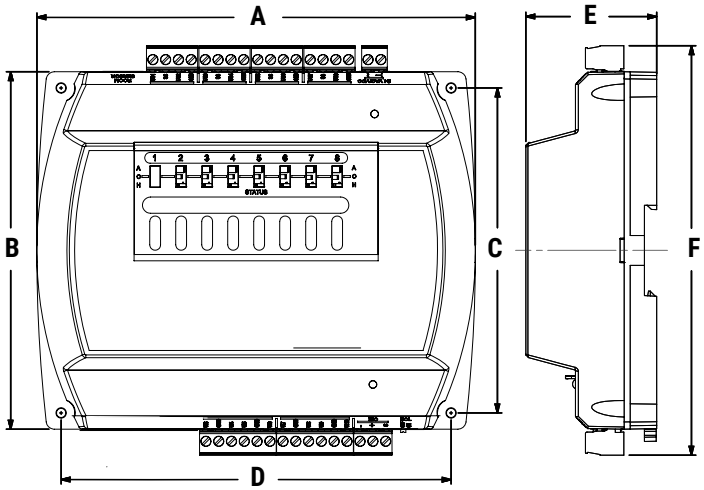
Standard	Meets or exceeds the specifications in ANSI/ASHRAE BACnet Standard 135-2010 for Advanced Application Controllers
Type	BTL-certified as a B-AAC controller type

Regulatory Approvals

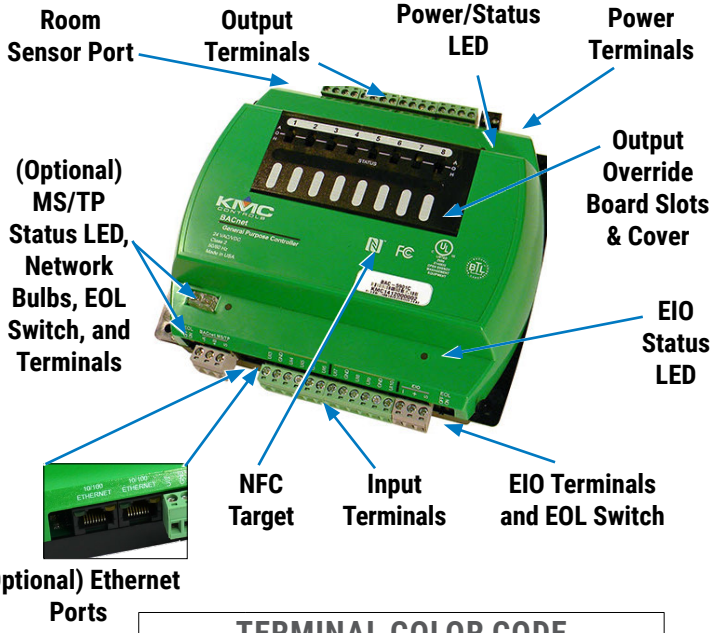
UL	UL 916 Energy Management Equipment listed UL 864 Smoke Control Equipment listed (UUKL), 10th edition—for smoke control applications, see **Smoke Control Manual for KMC Conquest Systems**, P/N 000-035-18)
BTL	BACnet Testing Laboratory listed as Advanced Application Controller (B-AAC)
CE	CE compliant
RoHS 2	RoHS 2 compliant
FCC	FCC Class A, Part 15, Subpart B and complies with Canadian ICES-003 Class A*

*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.)

BAC-5901C(E)-AFMS Dimensions

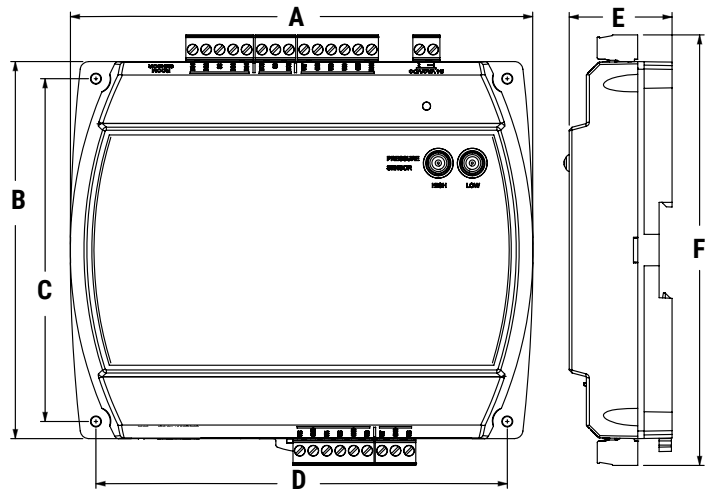


DIMENSIONS		
A	6.750 inches	171 mm
B	5.500 inches	140 mm
C	5.000 inches	127 mm
D	6.000 inches	152 mm
E	2.012 inches	51 mm
F	6.300 inches	160 mm

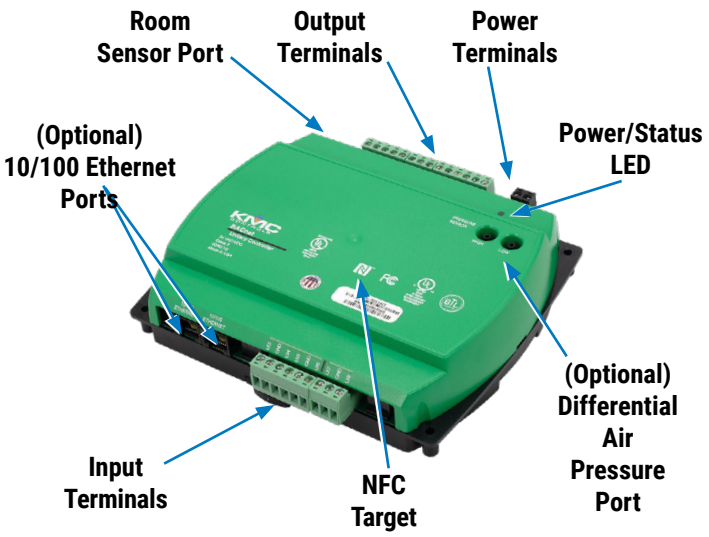


TERMINAL COLOR CODE	
Black	24 VAC/VDC Power
Gray	MS/TP and CAN Communications
Green	Inputs and Outputs

BAC-9311C(E)-AFMS Dimensions



DIMENSIONS		
A	6.744 inches	171 mm
B	5.500 inches	140 mm
C	5.000 inches	127 mm
D	6.000 inches	152 mm
E	1.500 inches	38 mm
F	6.279 inches	159 mm



TERMINAL COLOR CODE	
Black	24 VAC/VDC Power
Gray	MS/TP Communication (optional; not shown)
Green	Inputs and Outputs

Configuring and Operating

PROCESSES	CONFIGURATION TOOLS						
	BAC-5051AE router	Ethernet controller[1] served web pages	Conquest™ NetSensor	KMC Connect™ or TotalControl™	KMC Converge™ for Niagara Workbench	KMC Commander®[2]	KMC Connect Lite™ (NFC) app[3]
Selecting the application		✓	✓	✓			
Configuring communication		✓	✓	✓	✓		✓
Setting AFMS parameters	✓	✓	✓	✓	✓	✓	
Calibrating sensors	✓	✓	✓	✓	✓	✓	
Starting Learning Mode	✓	✓	✓	✓	✓	✓	
Controlling airflow	✓	✓	✓	✓	✓	✓	
Monitoring operation & faults	✓	✓	✓	✓	✓	✓	

[1] Ethernet (E) models with the latest firmware can be configured with a web browser from pages served within the controller.
[2] KMC Commander's AFMS module currently supports the standard AFMS application only.
[3] Near Field Communication via enabled smart phone or tablet running the KMC Connect Lite app.

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SUPPORT

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

 Specifications and design are subject to change without notice 925-035-05F