# Airflow Measurement System

## AFMS Controller (Gen6), Sensors, and Actuator

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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 outside air can be challenging in many equipment types.

The TrueFit Airflow Measurement System (AFMS) reliably provides accurate outside, return, and supply airflow data for monitoring and control. The system delivers accurate, repeatable results on 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 TRF-5901AC(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, for outside, mixed, and return air
- One proportional actuator mounted on the damper shaft

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

## HOW IT WORKS

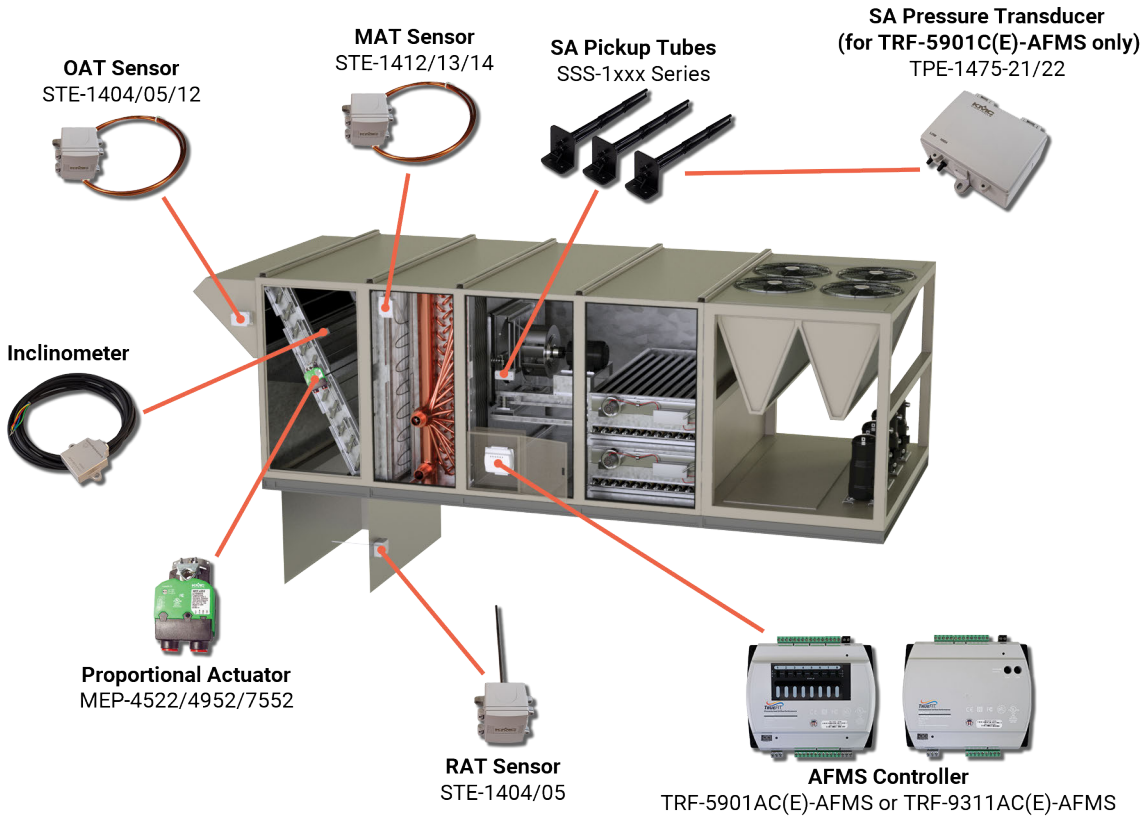
The system determines the proportion of outside versus return airflow with Characterized Airflow Performance®. The AFMS controller's programming generates a characterization curve using a Learning Mode sequence. It does this by leveraging the relationship between the inclinometer and a mixed air equation 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 position. 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

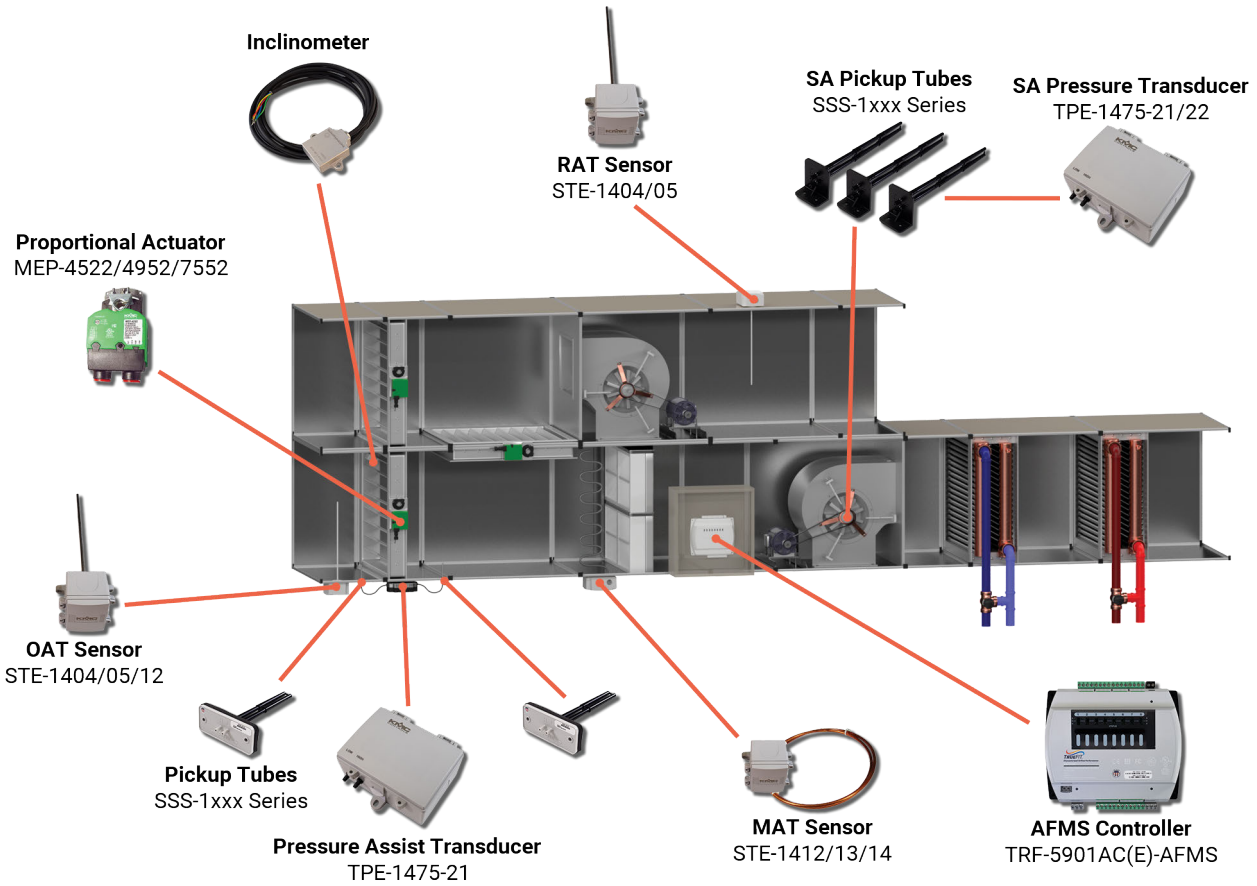
- Measurements of outside, return, and supply airflow accurate within three percent
- Sensor and system fault detection for Title 24 compliance
- Installs without restrictions of installation location
- Reduced system maintenance requirements
- AHU, RTU, and unit ventilator applications
- Applicable 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

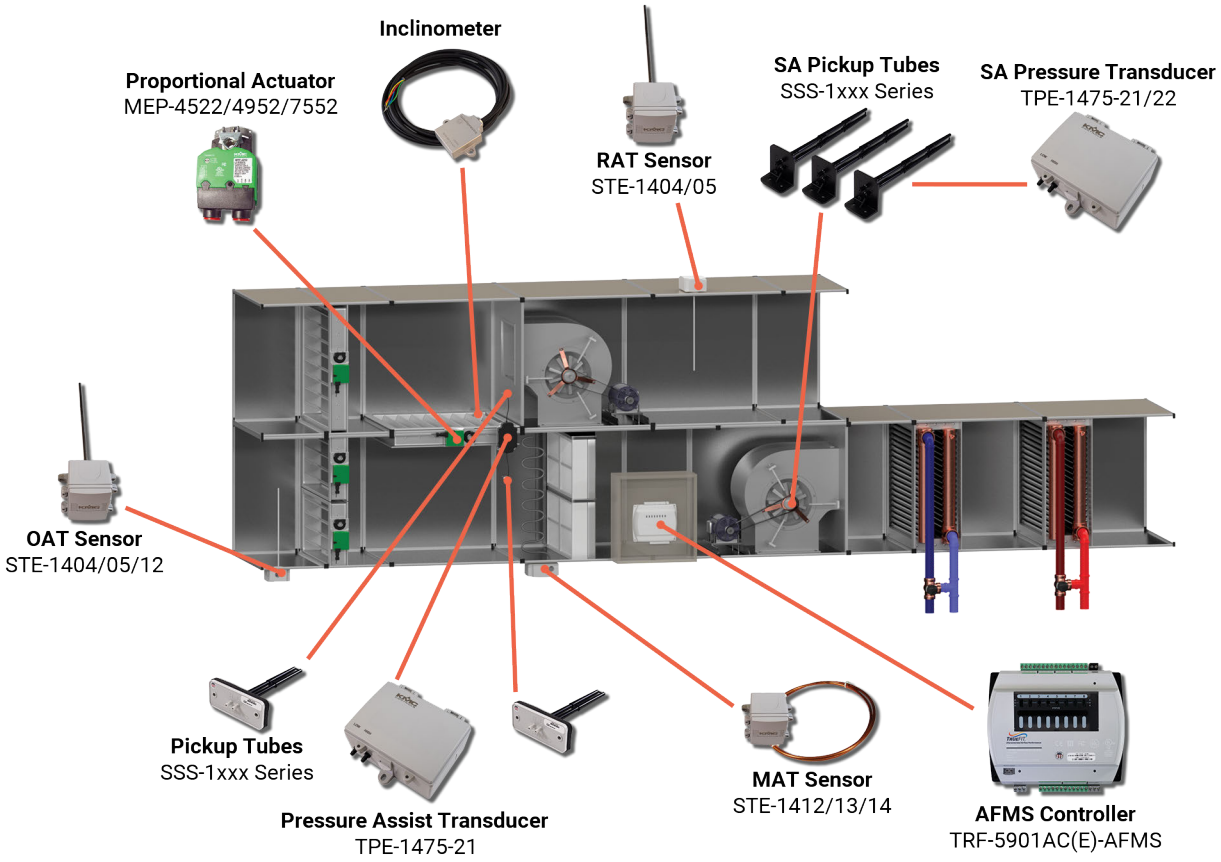
## Standard Application




## OAD Pressure Assist Application



## RAD Pressure Assist Application




# COMPONENTS

## AFMS Controller with Inclinometer

| | |
|---|---|
| **TRF-5901AC-AFMS** | BACnet controller with real-time clock, MS/TP communication port, AFMS programming (standard and pressure assist), and inclinometer |
| **TRF-5901ACE-AFMS** | BACnet controller with real-time clock, two Ethernet communication ports, AFMS programming (standard and pressure assist), and inclinometer |
| **TRF-9311AC-AFMS** | BACnet controller with real-time clock, MS/TP communication port, standard AFMS programming, and inclinometer |
| **TRF-9311ACE-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 TRF-5901AC(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 10/100BaseT 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-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 | TRF-5901AC(E)-AFMS: 14 VA, plus external loads<br>TRF-9311AC(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

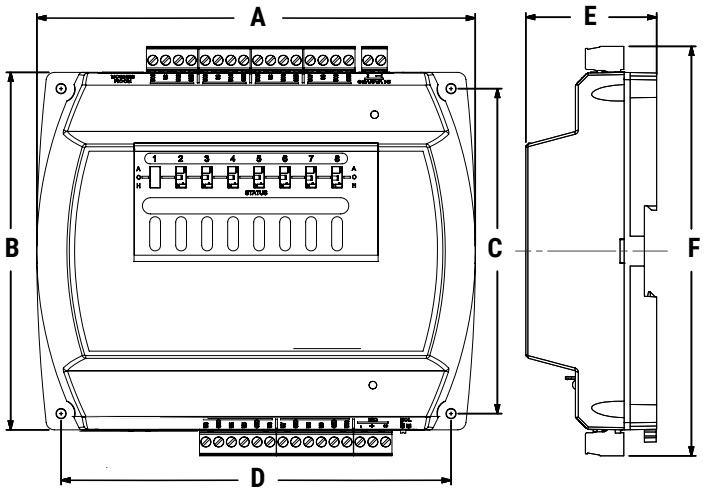
| | |
|---|---|
| Standard | Meets or exceeds the specifications in ANSI/ASHRAE BACnet Standard 135-2010 for Advanced Application Controllers |
| Type | BTL-certified as a B-AAC controller type |

### Regulatory Approvals

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

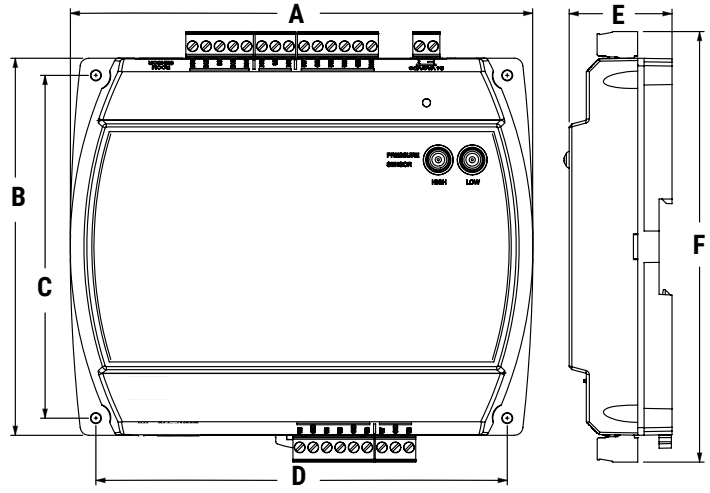
*This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. (NFC operation meets FCC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

## TRF-5901AC(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 |

## TRF-9311AC(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 |

## 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.

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 Specifications and design are subject to change without notice 