# KMC CONTROLS TRF-5901C(E)-AFMS TrueFit Airflow Measurement System Installation Guide



Contents



## KMC CONTROLS TRF-5901C(E)-AFMS TrueFit Airflow Measurement System

## Airflow Measurement System

| MODEL | APPLICATIONS | INPUTS | OUTPUTS | FEATURES |
|---|---|---|---|---|
| TRF5901CAFMS | 10 total: 8 universal: configurable as analog or binary | 10 total: configurable as analog, binary, or accumulator on terminals | RTU | Customizable programming, pressure sensing, real-time clock (RTC), network connectivity, airflow measurement programming |
| TRF9311CAFMS | AHU, unit ventilator | 1 air pressure sensor and 8 (total) standard: 10 total: configurable as analog, binary, or accumulator on terminals | External MS/TP Ethernet | Integrated standard airflow measurement, OAD pressure assist, and RAD pressure assist application programming |
| TRF9311CE-AFMS | AHU, unit ventilator | 4 standard: External MS/TP Ethernet | Integrated standard airflow measurement application | |

## Introduction

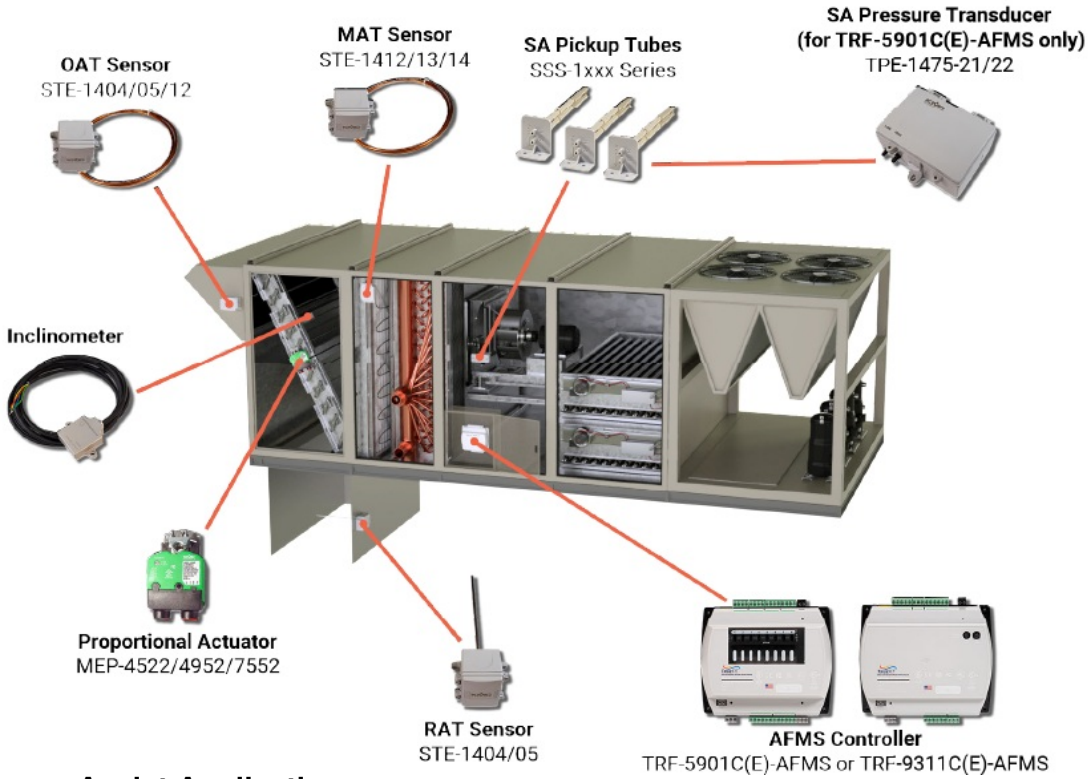
The TrueFit Airflow Measurement System (AFMS) reliably provides accurate outside, return, and supply airflow data for monitoring and control. The system delivers accurate, repeatable results on any type of equipment, without the traditionally expected mechanical limitations, performance issues, or ongoing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

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

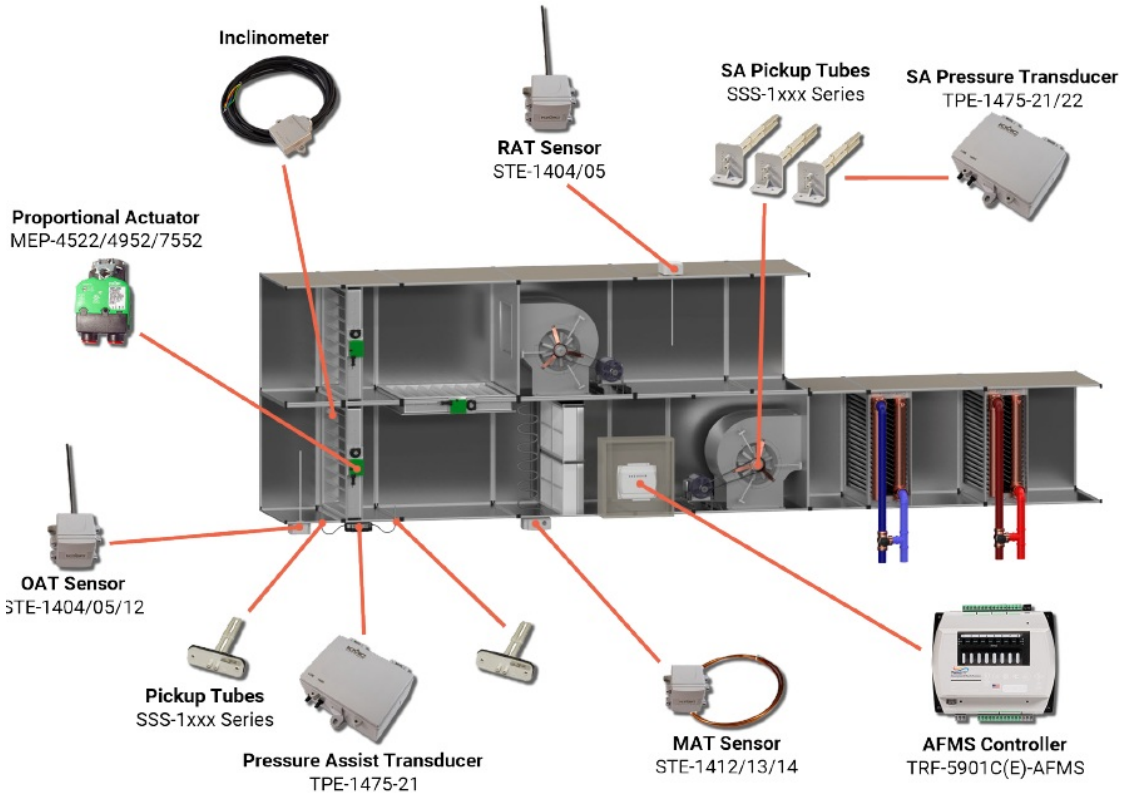

- One controller with airflow measurement programming
- One inclinometer (included with the controller) mounted on a horizontal out-side or return air damper blade
- If only vertical damper blades, one HLO-1050 Linkage Kit
- At least two flow pickup tubes installed in a pitot array in the supply air duct, or on the fan inlet
- If a TRF-5901C(E)-AFMS is used, one pressure transducer
- If pressure assist measurements are needed (see Considerations on page 4), 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

### Example Diagrams

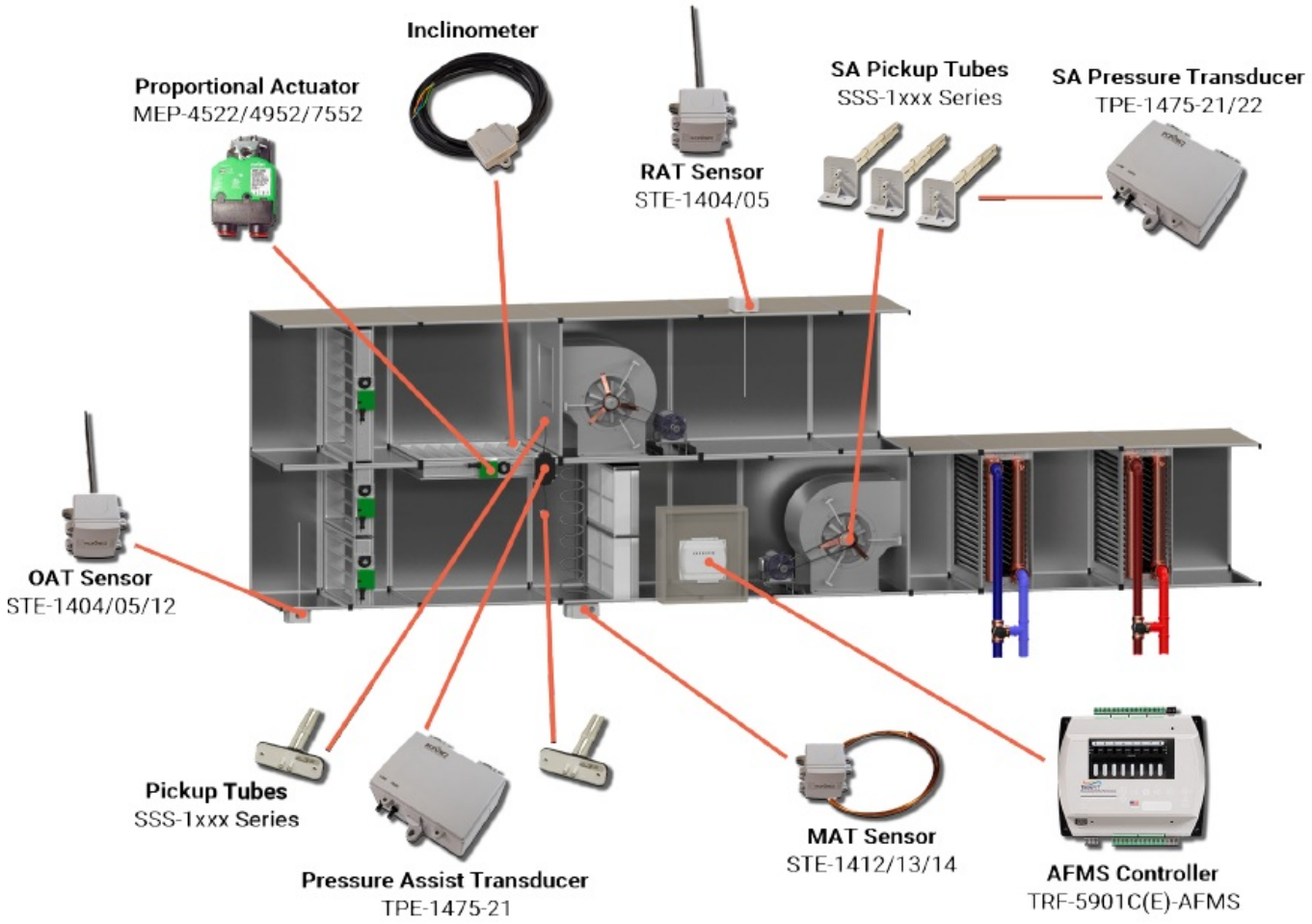
## Standard Application




## OAD Pressure Assist Application




## RAD Pressure Assist Application




## Selecting an AFMS Controller (with inclinometer)

### Considerations

Does the RTU/AHU/UV have any of these non-standard features?:

- A relief fan that is variable speed, or is operating independent of mixed air damper position
- A return fan that is not controlled by a supply fan / return fan offset
- A bypass damper for a heat recovery system
- Return VAV boxes
- Supply to return bypass (or a bypass damper used in place of a VFD)
- Outside and return air dampers that are not modulating together
- More than one outside air damper

**TRF-5901C-AFMS**
**(controller with inclinometer)**

If so, the pressure of the unit's mixed and/or return air sections may change. In that case, select a TRF-5901C(E)-AFMS for (OAD or RAD) pressure assist measurements.

**Is customizable programming needed?**
If the capability to program the controller for other functions in addition to airflow measurement is needed, select a TRF-5901C(E)-AFMS. The inputs and outputs of a TRF-9311C(E)-AFMS will be used by the components of the airflow measurement system. Therefore, it must be solely dedicated to airflow measurement.

**Where will the controller be mounted?**
If the controller will be mounted more than 20 feet from the location of the flow pickup tubes (see Selecting Flow Pickup Tubes on page 5), select a TRF-5901C(E)-AFMS. A pressure transducer can be mounted closer to the pickup tubes, then wired over a greater distance to the controller. (See Selecting Pressure Transducers on page 6.)

**TRF-5901C-AFMS**
**(controller with inclinometer)**

| MODEL | APPLI-CATIONS | INPUTS | OUTPUTS | FEATURES | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Customiz-able | Pressure Sensing | Real Time Clock (RTC) | Network | Airflow Measurement Programming | |
| TRF-5901C- AFMS | RTU AHU<br>unit ventilator | 10 total:<br>• 2 analog (room sensor port)<br>• 8 universal inputs (software configurable as analog, binary, or accumulator on terminals) | 8 universal:<br>• Software configurable as analog or binary<br>• Override boards give additional options | ü | External | ü | MS/TP | standard airflow measurement, OAD pressure assist, and RAD pressure assist application- ming | |
| TRF-5901CE- AFMS | | | | | | | Ethernet | | |
| TRF-9311C- AFMS | | 1 air pressure sensor<br>and 8 (total) stand- ard:<br>• 2 analog (room sensor port)<br>• 6 universal inputs (software configurable as analog, binary, or accumulator on<br>terminals) | 10 total:<br>• 6 triacs (binary)<br>• 4 universal (software configurable as analog or binary) | | Integrated | | MS/TP | standard airflow measurement application | |
| | | | | | | | Ethernet | | |
| TRF-9311CE- AFMS | | | | | | | | | |

## Selecting Flow Pickup Tubes

### Options for Installation Location

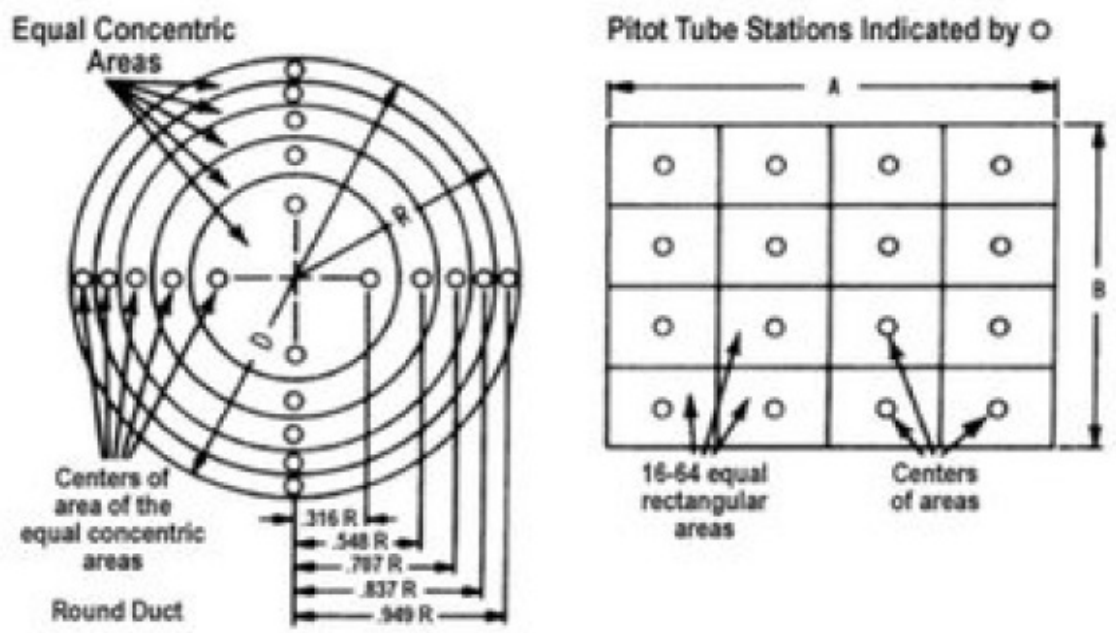
The array of supply airflow pickup tubes can be installed in one of two places:

- At least six straight duct widths down the supply air duct (the location of laminar flow)
- At the supply air fan inlet

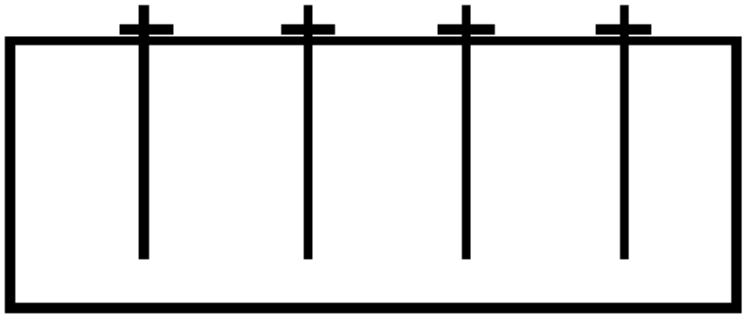
If pressure assist measurements are needed (see Considerations in the previous section) two additional flow pickup tubes must be installed, one on either side of the outside air damper.

**Arrangement in Parallel Array**

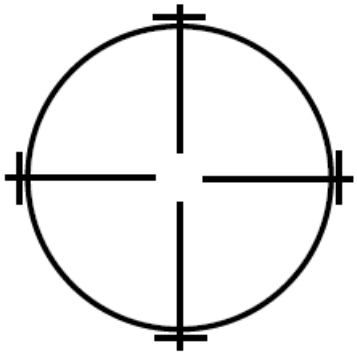
The pickup points must be arranged in a parallel array that evenly covers the area of the supply air duct or fan inlet, similar to what is show below:




**traverse on round and square duct areas**



rectangular duct array



round duct array

## Determining the Number of Pickup Points

1. Measure the duct or fan inlet:

- For a rectangular or square duct, measure the length of the longest side.
- For a circular duct or the supply fan inlet, measure the diameter.

2.Consult one of the tables below to determine the total minimum number of pickup points needed:

| **FOR A RECTANGULAR OR SQUARE DUCT** | |
|---|---|
| **If the longest side is less than or equal to:** | **Total minimum number of pickup points needed is :** |
| 4 inches | 2 |
| 15 inches | 3 |
| 24 inches | 4 |
| 35 inches | 5 |
| 48 inches | 6 |
| 63 inches | 7 |
| 80 inches | 8 |
| 99 inches | 9 |
| 100 inches or greater | 10 |

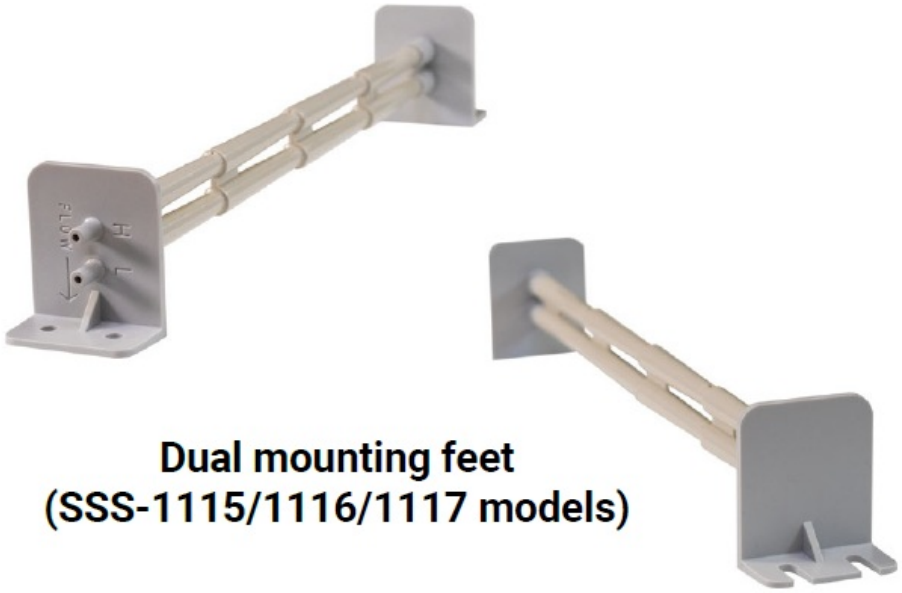
| **FOR A CIRCULAR DUCT OR THE FAN INLET** | |
|---|---|
| **Duct diameter** | **Total minimum number of pickup points needed:** |
| <10 inches | 6 |
| ≥10 inches | 10 |

**Selecting the Tubes**

Select multiple flow pickup tubes (at least two) from below that are the maximum length that will fit in the space and total to the minimum number of pickup points needed:

SSS-101x models have 3/16” connections for 1/4” OD polyethylene tubing and flat mounting flanges for installation in ducts (or on fan inlets that have struts):

- SSS-1012 One pickup point, 80 mm (about 3”) length tubes
- SSS-1013 Two pickup points, 137 mm (about 5.5”) length tubes
- SSS-1014 Three pickup points, 195 mm (about 8”) length tubes
- SSS-1015 Four pickup points, 252 mm (about 10”) length tubes



**Selecting Pressure Transducers**

**NOTE**: Select pressure transducers for a TRF-5901C(E)-AFMS only. TRF-9311C(E)-AFMS have differential air pressure ports, so a pressure transducer is not necessary to connect the flow pickup tubes.

For the standard airflow measurement application, select one pressure transducer.

For the airflow measurement application with pressure assist, select two pressure transducers.

| MODEL NUMBER | INPUT PRESSURE RANGES (SELECTABLE) |
|---|---|
| TPE-1475-21 | –2 to +2” or 0 to 2” wc (–0.5 to +0.5 kPa or 0 to 0.5 kPa) |
| TPE-1475-22* | –10 to +10″ or 0 to 10″ wc (–2.5 to +2.5 kPa or 0 to 2.5 kPa) |
| * Requires KMC Connect (see Selecting Tools for Configuration and Operation on page 9) and technical support to configure. | |


SSS-111x models have 3/16” connections for 1/4” OD polyethylene tubing and right-angled mounting feet for installation on the supply air fan bell.

Single mounting foot:

- SSS-1112 One pickup point, 80 mm (about 3”) length tubes
- SSS-1113 Two pickup points, 137 mm (about 5.5”) length tubes
- SSS-1114 Three pickup points, 195 mm (about 8”) length tubes

**Dual mounting feet:**

- SSS-1115 Four pickup points, five sections*, 315

- mm (about 13”) length tubes
- SSS-1116 Five pickup points, six sections*, 395
- mm (about 15.5”) length tubes
- SSS-1117 Six pickup points, seven sections*, 457
- mm (about 18”) length tubes

*NOTE: The extra section connects the tubes to the second mounting foot, which mounts to the other end of the fan bell (or a midway strut).

### Selecting the Mixed Air Temperature Sensor

Select a sensor that is long enough to cover the entire mixed air section of the unit. Copper sensors are recommended when the mixed air section is easily accessible. If not easily accessible, a cable sensor can be used.

| MODEL | SENSOR TYPE | PROBE TYPE | PROBE LENGTH | ENCLOSURE | CONNECTIONS* |
|---|---|---|---|---|---|
| **STE-1411** | Duct, Averaging | Copper, bend- able | 6 feet (1.8 m) | Plastic, UL94-V0, IP65 (NEMA 4X) ABS | FT-6 plenum-rated, 22 AWG wire leads |
| **STE-1412** | | | 12 feet (3.6 m) | | |
| **STE-1414** | | | 20 feet (6.1 m) | | |
| **STE-1413** | | | 24 feet (7.3 m) | | |
| **STE-1415** | | Flexible, FT-6 plenum-rated cable | 6 feet (1.8 m) | | |
| **STE-1416** | | | 12 feet (3.6 m) | | |
| **STE-1417** | | | 24 feet (7.3 m) | | |

### Selecting the Outside Air Temperature Sensor

For units with accessible outside air hoods, select an STE-1412 12-foot bendable copper averaging sensor.
For units with inaccessible outside air hoods, or for outside air ducts, select an STE-1404 duct-mounted 12-inch probe with enclosure. (For sheltered tight fits, an STE-1405 duct-mounted 4-inch probe without enclosure can be used.)

| MODEL | SENSOR TYPE | PROBE TYPE | PROBE LENGTH | ENCLOSURE | CONNECTIONS |
|---|---|---|---|---|---|
| STE-1405 | Duct, Rigid probe | 1/4-inch OD stainless-steel | 4 inches (100 mm) | None (mounting bracket only) | 10-ft. FT-6 plenum-rated, 22 AWG cable |
| STE-1404 | | | 12 inches (300 mm) | Plastic, UL94-V0, IP65 (NEMA 4X) ABS | PVC insulated, 22 AWG, wire leads |
| STE-1412 | OA Hoods, Averaging | Copper, bend- able | 12 feet (3.6 m) | | FT-6 plenum-rated, 22 AWG, wire leads |

### Selecting the Return Air Temperature Sensor

When possible, select an STE-1404 duct-mounted 12-inch probe with enclosure. For sheltered tight fits, an STE-1405 duct-mounted 4-inch probe without enclosure can be used.

| MODEL | SENSOR TYPE | PROBE TYPE | PROBE LENGTH | ENCLOSURE | CONNECTIONS |
|---|---|---|---|---|---|

### Selecting a Proportional Actuator

The unit must have a proportional actuator for the AFMS to modulate the damper as needed. If the unit does not have a proportional damper actuator already, select one.

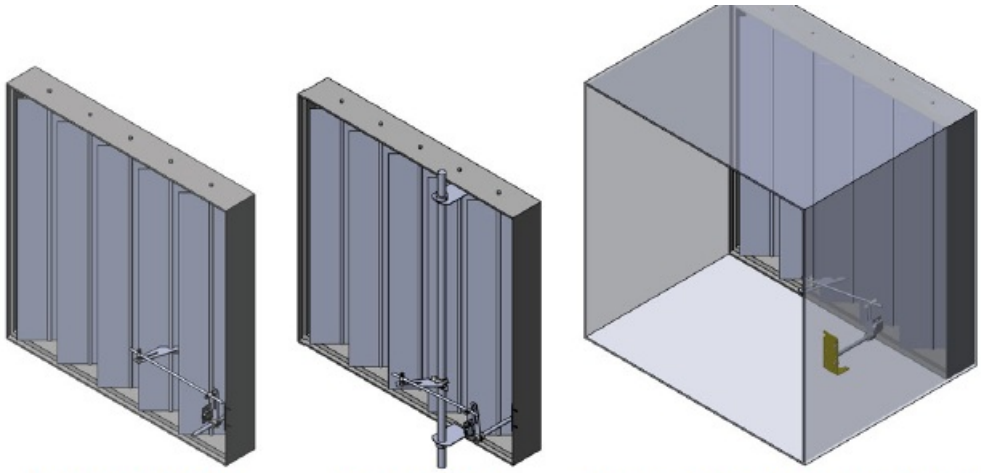
| MODEL | TORQUE*<br>in-lb.<br>(N•m) | PROPORTIONAL CONTROL | FEEDBACK | FAILSAFE |
|---|---|---|---|---|
| MEP-4552 | 45<br>(5) | 0-10 or 2-10 | | |
| MEP-4952 | 90<br>(10) | VDC | 0/1-5 or 0/2-10 VDC | ü |
| MEP-7552 | 180<br>(20) | 0-10 VDC, 2-10 VDC,<br>or 4-20 mA | | |
| *Use the online Actuator Calculator to assist with torque requirements. | | | | |

### Selecting an HLO-1050 Linkage Kit

The AFMS controller's inclinometer must be mounted on a horizontal-axis damper blade. For units with vertical-axis damper blades, select an HLO-1050 Linkage Kit. The linkages transfer the damper motion to a surface with a horizontal axis (the kit's inclinometer crankarm), on which inclinometer can then be mounted.

The kit's damper blade crankarm can be mounted to a damper blade or on a jackshaft using its included jackshaft coupler and V-bolt.
If the kit's axle mount shaft cannot be mounted on a unit's damper frame (such as when mounting in a duct),

select a VTD-0903 right-angle bracket in addition to the kit.



damper blade mounting

jackshaft mounting

damper blade mounting in a duct with VTD-0903

### Selecting Tools for Configuration and Operation

The rows in the table below list the sequence of processes to set up and operate an AFMS. The columns give the KMC Controls tools that can be used to complete the processes. Consult the table to determine which tools can complete each process and for which AFMS applications.
The user interface and setup requirements of each tool varies. For more information, see each tool’s product pages and documents.

| PROCESSES | CONFIGURATION TOOLS | | | | | | |
|---|---|---|---|---|---|---|---|
| | BAC-5051(A)E router | Ethernet controller served web pages | Conquest™ NetSensor | KMC Connect™ or TotalControl™ | KMC Converge™ for Niagara Workbench | KMC Commander®2 | KMC Connect Lite™ (NFC) app3 |
| Selecting the application | | P | P | P | | | |
| Configuring communication | | P | P | P | P | | P |
| Setting AFMS parameters | P | P | P | P | P | P | |
| Calibrating sensors | P | P | P | P | P | P | |
| Starting Learning Mode | P | P | P | P | P | P | |
| Controlling airflow | P | P | P | P | P | P | |
| Monitoring operation & faults | P | P | P | P | P | P | |

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.

## Support

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

Specifications and design subject t9 o change without notice

## Documents / Resources


**KMC CONTROLS TRF-5901C(E)-AFMS TrueFit Airflow Measurement System** [pdf] Installation Guide

TRF-5901C E -AFMS, TRF9311C E -AFMS, HLO-1050, TRF-5901C E -AFMS TrueFit Airflow Measurement System, TrueFit Airflow Measurement System, Airflow Measurement System, Measurement System, System