Airflow Measurement Devices

Descriptions and Specifications

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BAC-5971ACE-AMD

BAC-9311ACE-AMD

DESCRIPTIONS

A KMC AMD (Airflow Measurement Device) measures and totalizes airflow in DOAS (Dedicated Outdoor Air Systems), fan arrays, fan walls, and ducts.

AMD models group into two series: BAC-**59x1**AC(E)-AMD and BAC-**9311**AC(E)-AMD. Models in both series communicate via either MS/TP (no E in the part number) or Ethernet ("E").

BAC-**59x1**AC(E)-AMD models measure up to 40 airflows—using input from external pressure transducers—which can be totaled in up to eight groups. BAC-59**7**1AC(E)-AMD models have a built-in touchscreen display for conveniently viewing the status of select parameters. BAC-57**0**1AC(E)-AMD models do not have a built-in display.

BAC-**9311**AC(E) models measure and total up to five airflows, using an integrated pressure sensor and input from up to four external pressure transducers.

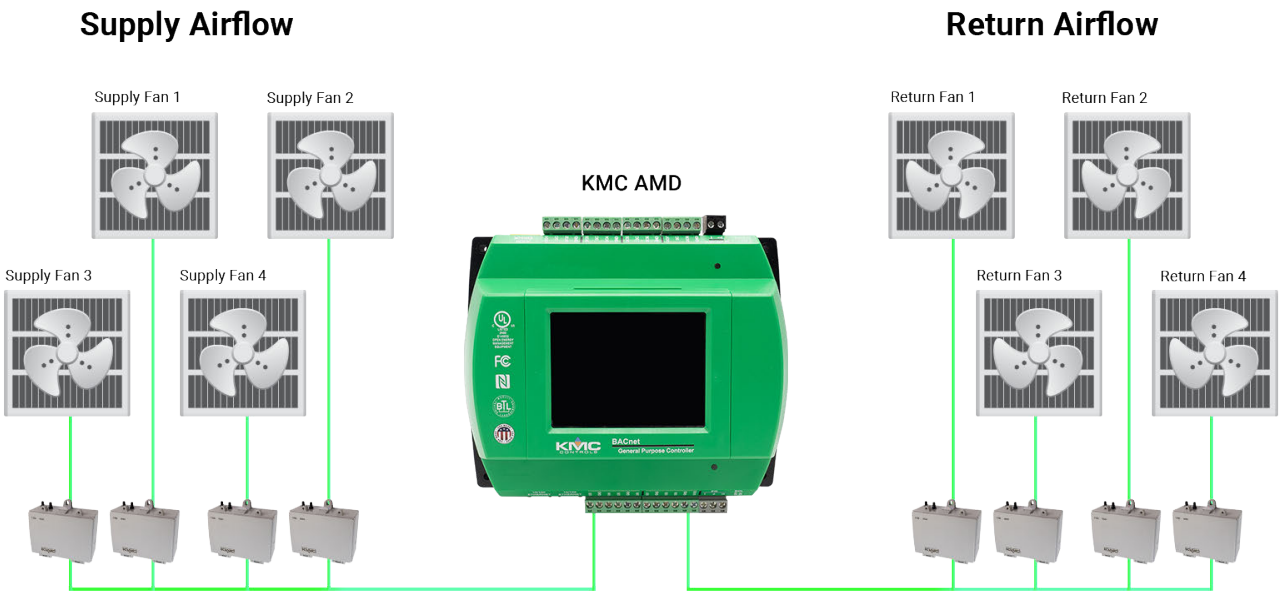
For fan applications, if piezo rings are not already provided, SSS-111x airflow pickup tubes (with mounting feet) can be mounted on the fan bell in a pitot array. For duct applications, use SSS-101x airflow pickup tubes (with mounting flanges). (See **Airflow Pickup Tubes on page 8**.)

The parallel array of SSS-1xxx airflow pickup tubes connects via poly tubing to a BAC-9311C(E)-AMD's differential air pressure ports, or to an external pressure transducer wired to any AMD model.(See **External Transducers on page 10**.)

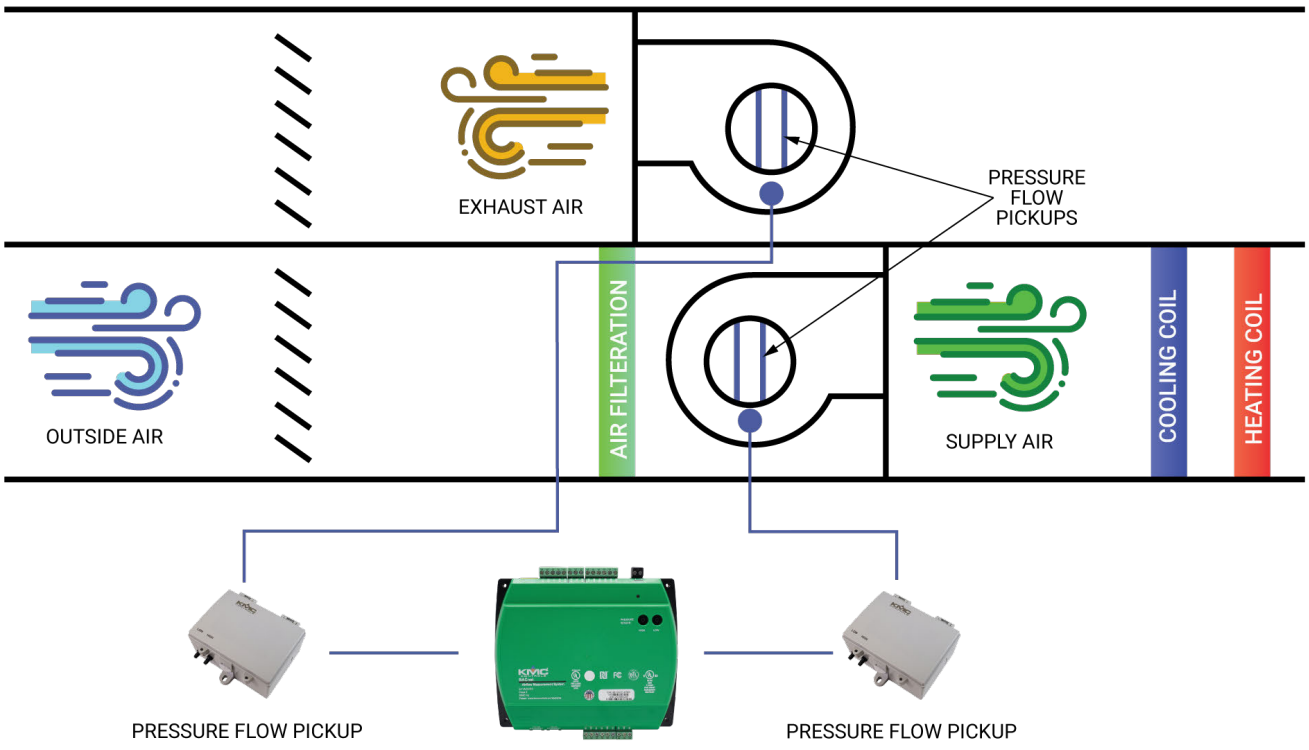
The fan totalizing of an AMD may be integrated into TrueFit AFMS (Airflow Measurement System) applications. Please contact customer support for information.

MODEL	FEATURES					
	Airflows Measured	Airflow-Groups	Touchscreen	Internal Pressure Sensor	Real-Time Clock	Communication
BAC-5901AC-AMD	40	1–8			✓	MS/TP
BAC-5901ACE-AMD	40	1–8			✓	Ethernet
BAC-5971AC-AMD	40	1–8	✓		✓	MS/TP
BAC-5971-ACE-AMD	40	1–8	✓		✓	Ethernet
BAC-9311C-AMD	5	1		✓	✓	MS/TP
BAC-9311CE-AMD	5	1		✓	✓	Ethernet

FAN ARRAY APPLICATION EXAMPLE



DOAS APPLICATION EXAMPLE



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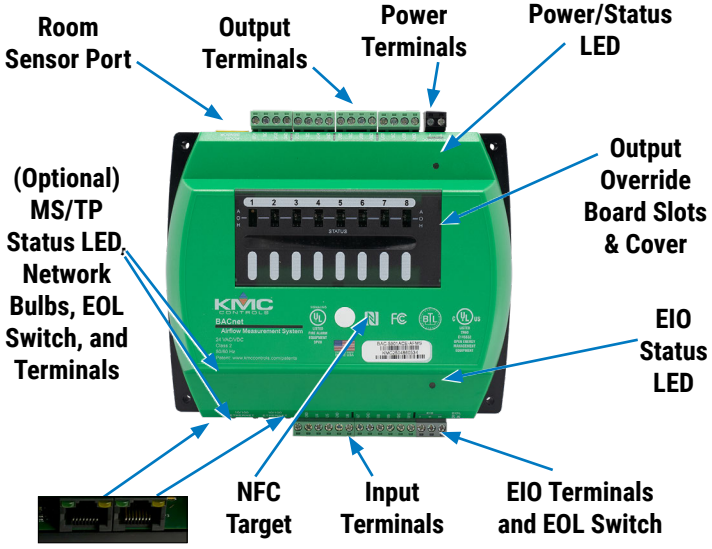
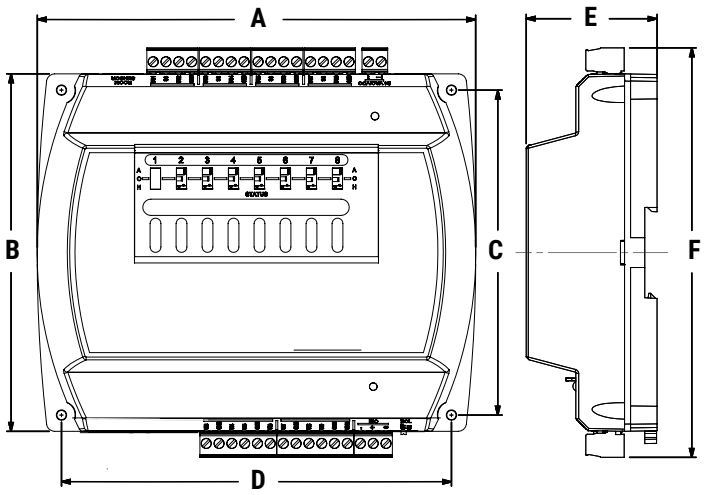
AMD SPECIFICATIONS

BAC-5901AC(E)-AMD Details & Dimensions

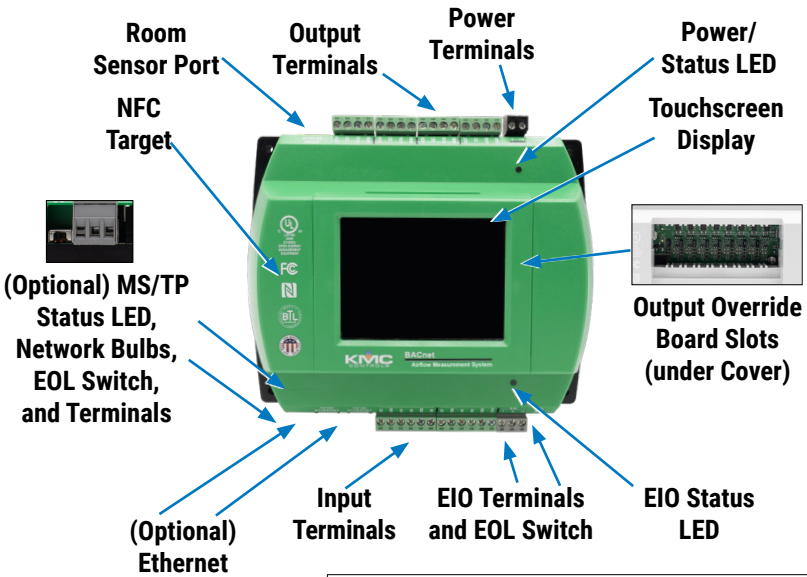


TERMINAL COLOR CODE	
Black	24 VAC/VDC Power
Gray	MS/TP and CAN Communications
Green	Inputs and Outputs



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

BAC-5971AC(E)-AMD Details & Dimensions



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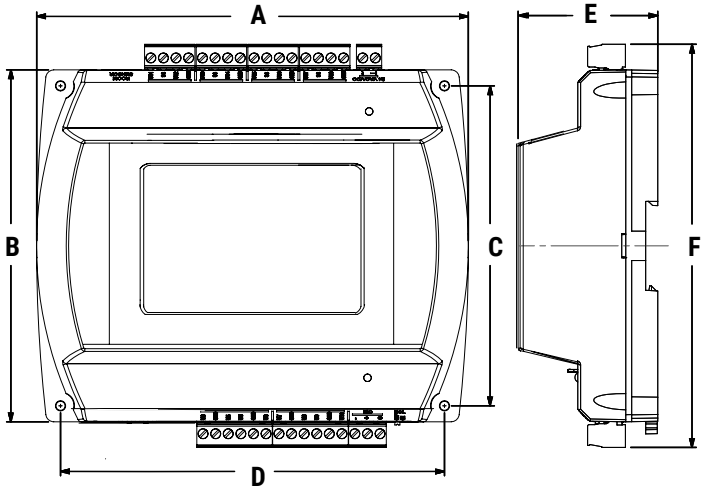

DIMENSIONS		
A	6.750 inches	171 mm
B	5.500 inches	140 mm
C	5.000 inches	127 mm
D	6.000 inches	152 mm
E	2.012 inches	60 mm
F	6.300 inches	160 mm

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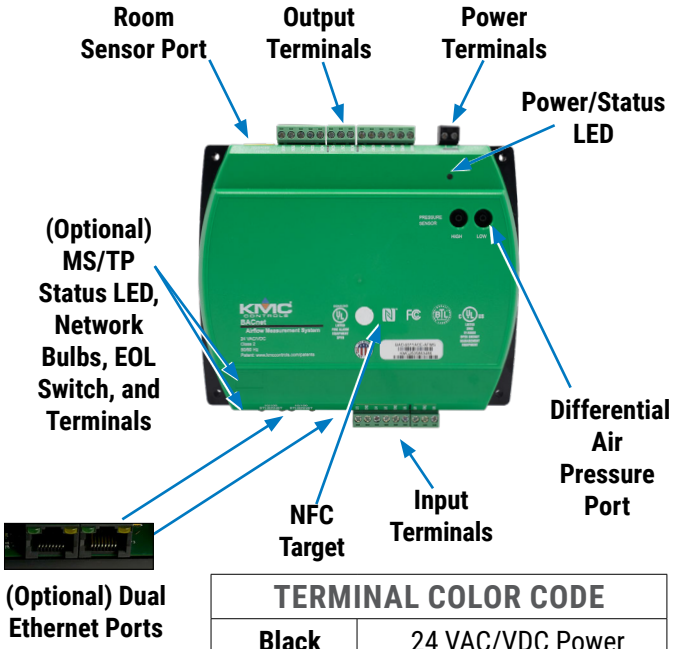
BAC-9311AC(E)-AMD Details & Dimensions



TERMINAL COLOR CODE	
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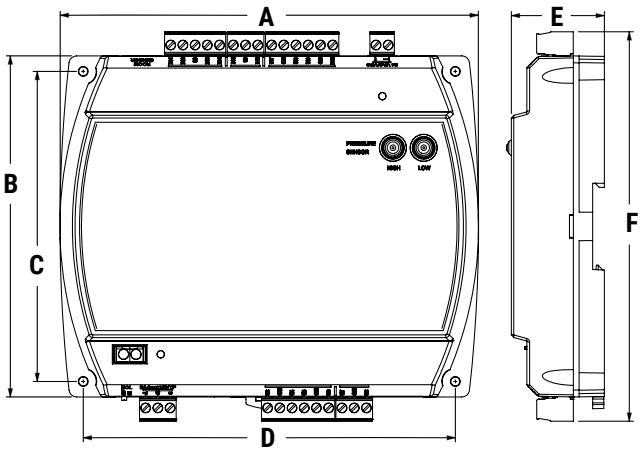
Gray	MS/TP Communications
Green	Inputs and Outputs



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

Accuracy

AMD accuracy	±3%, may be field calibrated.

Inputs, Terminal Blocks

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)

Integrated Air Pressure Sensor (Optional)

Δ 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, Terminal Blocks

Power/protection	Each short-circuit protected output capable of driving up to 100 mA (at 0–12 VDC) or 300 mA total for all outputs
Resolution	12-bit digital-to-analog conversion
Wire size	12–24 AWG, copper, in removable screw terminal blocks.

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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)	"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

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 for network time synchronization or full stand-alone operation

Display, Indicators, and Isolation

LCD display (optional)	5971 models only—Capacitive touchscreen, 2.8 x 2.2 inches (72 x 55 mm)
LED indicators	Power/status, Ethernet status
MS/TP bulbs (option.)	One network bulb assembly indicates reversed polarity and isolates circuit
Switch	EOL (end of line) for MS/TP network

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	8 VA (9311 models) / 14 VA (59x1 models), plus external loads
Wire size	12–24 AWG, copper, in a removable screw terminal block

Enclosure and Mounting

Weight	5901 models: 13.8 oz (0.39 kg); 9311 models: 14 oz (0.4 kg); 5971 models: 15.8 oz (0.45 kg)
Case material	Gray and black flame retardant plastic
Mounting	Direct mounting to panels or on DIN rails

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-BC controller type

Regulatory Approvals

UL	UL 916 Energy Management Equipment listed
BTL	*BACnet Testing Laboratory* listed as *BACnet Building Controller* (B-BC)
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.)

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INPUT/OUTPUT OBJECTS/CONNECTIONS

BAC-9311AC(E)

Inputs		Analog Values		Outputs	
AI9	Diff. Pressure Sensor 1 (integrated, 0–2” wc only)	AV7	Flow 1	AO7	Flow 1 (0–10 VDC)
AI3	Differential Pressure Sensor 2 (external)	AV17	Flow 2	AO8	Flow 2 (0–10 VDC)
AI4	Differential Pressure Sensor 3 (external)	AV27	Flow 3	AO9	Flow 3 (0–10 VDC)
AI5	Differential Pressure Sensor 4 (external)	AV37	Flow 4	AO10	Flow 4 (0–10 VDC)
AI6	Differential Pressure Sensor 5 (external)	AV47	Flow 5	Flow 5 is an analog value only	

BAC-59x1AC(E)

Inputs		Analog Values		Outputs	
AI3	Differential Pressure Sensor 1	AV5	Flow 1	AO1	Fan 1 0-10 VDC Flow Output
AI4	Differential Pressure Sensor 2	AV12	Flow 2	AO2	Fan 2 0-10 VDC Flow Output
AI5	Differential Pressure Sensor 3	AV19	Flow 3	AO3	Fan 3 0-10 VDC Flow Output
AI6	Differential Pressure Sensor 4	AV26	Flow 4	AO4	Fan 4 0-10 VDC Flow Output
AI7	Differential Pressure Sensor 5	AV33	Flow 5	AO5	Fan 5 0-10 VDC Flow Output
AI8	Differential Pressure Sensor 6	AV40	Flow 6	AO6	Fan 6 0-10 VDC Flow Output
AI9	Differential Pressure Sensor 7	AV47	Flow 7	AO7	Fan 7 0-10 VDC Flow Output
AI10	Differential Pressure Sensor 8	AV55	Flow 8	AO8	Fan 8 0-10 VDC Flow Output
AI11	Differential Pressure Sensor 9	AV62	Flow 9	AO9	Fan 9 0-10 VDC Flow Output
AI12	Differential Pressure Sensor 10	AV69	Flow 10	AO10	Fan 10 0-10 VDC Flow Output
AI13	Differential Pressure Sensor 11	AV76	Flow 11	AO11	Fan 11 0-10 VDC Flow Output
AI14	Differential Pressure Sensor 12	AV83	Flow 12	AO12	Fan 12 0-10 VDC Flow Output
AI15	Differential Pressure Sensor 13	AV90	Flow 13	AO13	Fan 13 0-10 VDC Flow Output
AI16	Differential Pressure Sensor 14	AV97	Flow 14	AO14	Fan 14 0-10 VDC Flow Output
AI17	Differential Pressure Sensor 15	AV104	Flow 15	AO15	Fan 15 0-10 VDC Flow Output
AI18	Differential Pressure Sensor 16	AV111	Flow 16	AO16	Fan 16 0-10 VDC Flow Output
AI19	Differential Pressure Sensor 17	AV118	Flow 17	AO17	Fan 17 0-10 VDC Flow Output
AI20	Differential Pressure Sensor 18	AV125	Flow 18	AO18	Fan 18 0-10 VDC Flow Output

Table continues on next page.

Inputs		Analog Values		Outputs	
AI21	Differential Pressure Sensor 19	AV132	Flow 19	AO19	Fan 19 0-10 VDC Flow Output
AI22	Differential Pressure Sensor 20	AV139	Flow 20	AO20	Fan 20 0-10 VDC Flow Output
AI23	Differential Pressure Sensor 21	AV146	Flow 21	AO21	Fan 21 0-10 VDC Flow Output
AI24	Differential Pressure Sensor 22	AV153	Flow 22	AO22	Fan 22 0-10 VDC Flow Output
AI25	Differential Pressure Sensor 23	AV160	Flow 23	AO23	Fan 23 0-10 VDC Flow Output
AI26	Differential Pressure Sensor 24	AV167	Flow 24	AO24	Fan 24 0-10 VDC Flow Output
AI27	Differential Pressure Sensor 25	AV174	Flow 25	AO25	Fan 25 0-10 VDC Flow Output
AI28	Differential Pressure Sensor 26	AV181	Flow 26	AO26	Fan 26 0-10 VDC Flow Output
AI29	Differential Pressure Sensor 27	AV188	Flow 27	AO27	Fan 27 0-10 VDC Flow Output
AI30	Differential Pressure Sensor 28	AV195	Flow 28	AO28	Fan 28 0-10 VDC Flow Output
AI31	Differential Pressure Sensor 29	AV202	Flow 29	AO29	Fan 29 0-10 VDC Flow Output
AI32	Differential Pressure Sensor 30	AV209	Flow 30	AO30	Fan 30 0-10 VDC Flow Output
AI33	Differential Pressure Sensor 31	AV216	Flow 31	AO31	Fan 31 0-10 VDC Flow Output
AI34	Differential Pressure Sensor 32	AV223	Flow 32	AO32	Fan 32 0-10 VDC Flow Output
AI35	Differential Pressure Sensor 33	AV230	Flow 33	AO33	Fan 33 0-10 VDC Flow Output
AI36	Differential Pressure Sensor 34	AV237	Flow 34	AO34	Fan 34 0-10 VDC Flow Output
AI37	Differential Pressure Sensor 35	AV244	Flow 35	AO35	Fan 35 0-10 VDC Flow Output
AI38	Differential Pressure Sensor 36	AV251	Flow 36	AO36	Fan 36 0-10 VDC Flow Output
AI39	Differential Pressure Sensor 37	AV258	Flow 37	AO37	Fan 37 0-10 VDC Flow Output
AI40	Differential Pressure Sensor 38	AV265	Flow 38	AO38	Fan 38 0-10 VDC Flow Output
AI41	Differential Pressure Sensor 39	AV272	Flow 39	AO39	Fan 39 0-10 VDC Flow Output
AI42	Differential Pressure Sensor 40	AV279	Flow 40	AO40	Fan 40 0-10VDC Flow Output

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AIRFLOW PICKUP TUBES

For fan inlet applications, if piezo rings are not already provided, SSS-111x airflow pickup tubes (with mounting feet) can be mounted on the fan bell in a pitot array. For duct applications, use SSS-101x airflow pickup tubes (with mounting flanges). The parallel array of SSS-1xxx airflow pickup tubes connects via poly tubing to the BAC-9311C(E)-AMD's differential air pressure ports, or an external pressure transducer.

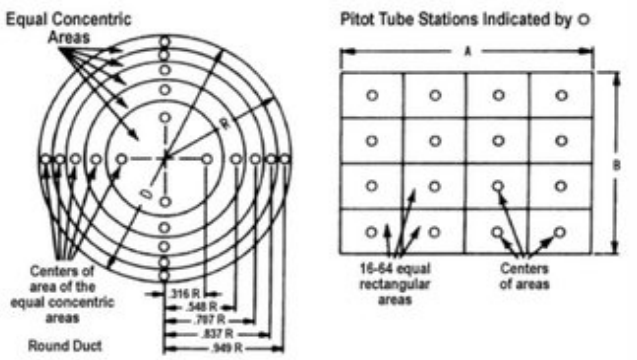
Options for Installation Location

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

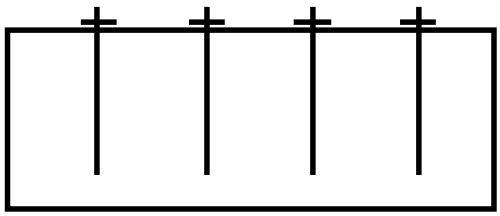
- At a fan inlet
- In a duct, at least 10 duct diameters upstream and 5 downstream of bends, elbows, or restrictions

Arrangement in Parallel Array

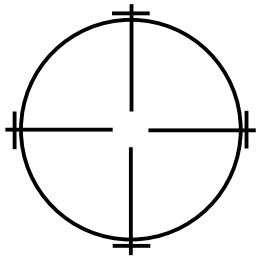
The pickup points must be arranged in a parallel array that evenly covers the area of the fan inlet or duct, similar to what is shown below:



traverse on round and square duct areas



rectangular duct array



round duct array

Determining the Number of Pickup Points

1. Measure the fan inlet or duct:
   - For a fan inlet or circular duct, measure the diameter.
   - For a rectangular or square duct, measure the length of the longest side.
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 FAN INLET OR CIRCULAR DUCT	
Duct diameter	**Total minimum number of pickup points needed:**
<10 inches	6
≥10 inches	10

Feedback? Give yours **here**.

Selecting the Tubes

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

SSS-101x models have 3/16” connections for 1/4” outer diameter 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

SSS-101x airflow pickup tubes

SSS-111x models have 3/16” connections for 1/4” outer diameter 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

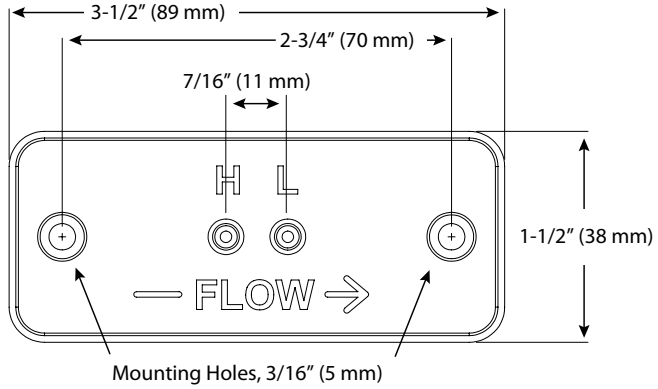
Dual mounting feet:

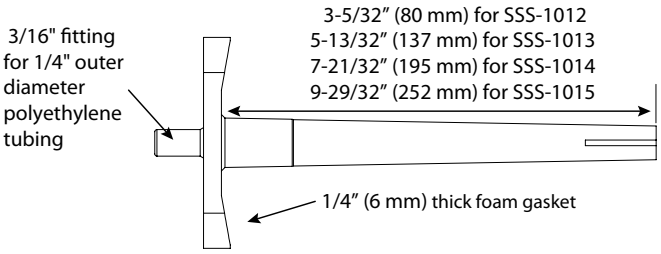
SSS-1115	Four pickup points, five sections, 315 mm (about 13”) length tubes
SSS-1116	Five pickup points, six sections, 395 mm (about 15.5”) length tubes
SSS-1117	Six pickup points, seven sections, 457 mm (about 18”) length tubes

SSS-111x airlfow pickup tubes

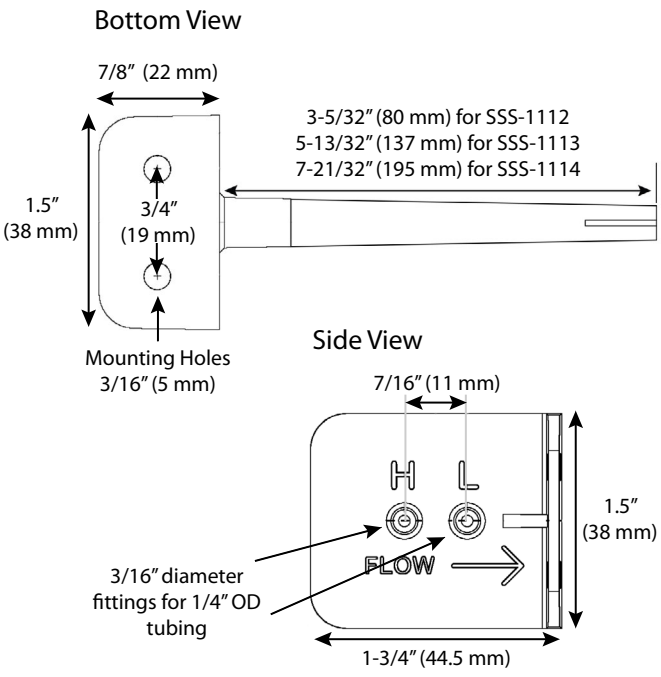
Dimensions and Details

SSS-101x Models





SSS-1112/1113/1114 Models



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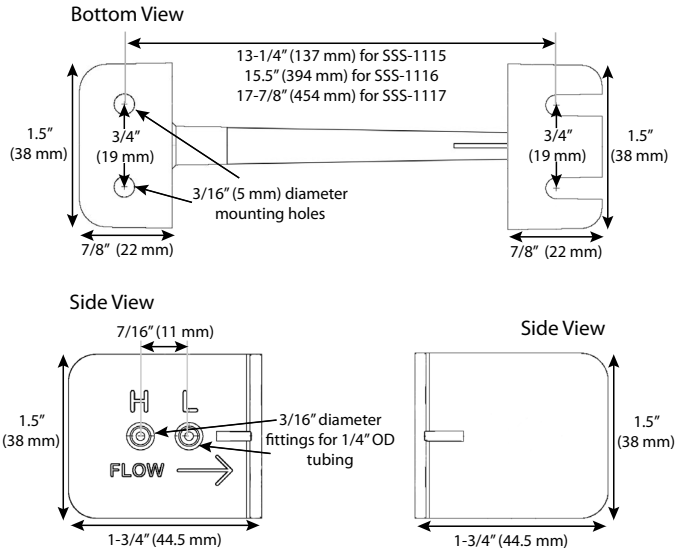
SSS-1115/1116/1117 Models



Specifications

Material	ABS/polycarbonate (UL94-5V)
Weight	1 oz. (28 grams)
Temperature Limits	
Operating	40 to 120° F (4 to 49° C)
Shipping	–40 to 140° F (–40 to 60° C)
Approvals	RoHS compliant

Maintenance

Recommend in filtered airstreams. Deployment in unfiltered airstreams will require shorter maintenance intervals.

EXTERNAL TRANSDUCERS

BAC-9311C(E)-AMD have an integrated pressure sensor with a differential pressure range of 0 to 2" wc (0 to 500 Pa). The AMD can also receive input from up to four external pressure transducers. Select the number and type needed from the table below (or select similar differential 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)

Specifications

Pressure Ranges	See table above.
Accuracy	±1% FSO (Full Scale Output)
Measurement Type	Differential (two port) or static
Response Time	250 ms
Stability	< ±1% FSO per year
Thermal Effects	< ±3% over compensated range
Compensated Range	32 to 122° F (0 to 50° C)
Proof Pressure	40" wc (10 kPa)
Burst Pressure	120" wc (30 kPa)
Operating Conditions	32 to 122° F (0 to 50° C), 10 to 90% RH non-condensing
Media Compatibility	Non-corrosive, non-ionic clean dry air or inert gases
Power Supply (at transmitter)	20 to 28 VAC/VDC (non-isolated half-wave rectified)
Supply Current	< 4 mA in voltage mode or 20 mA max. in current mode
Input Voltage Effect	Negligible over specified operating range
Protection Circuitry	Reverse voltage protected and output limited

Output Signal Options	
	4–20 mA (2-wire)
	0–10 VDC (3-wire)
Output Drive Capability	
	400 ohm maximum @ 24 VDC for current mode or 10K ohms minimum for voltage mode
Zero Adjustment	Push-button auto-zero
Wiring Connections	Screw terminal block (14 to 22 AWG)
Pressure Connections	
	Barbed ports for 0.170” (5 mm) ID flexible tubing (two for TPE-1475 or one port and one probe for TPE-1477)
Conduit Connection	Access hole for 1/2” NPT conduit or cable gland
Enclosure Material	Polycarbonate UL94-V0, IP65 (NEMA 4X)
Weight	6 oz. (170 grams)
Manufacturing	ISO 9001 registered quality system
Approvals	CE and RoHS Compliant

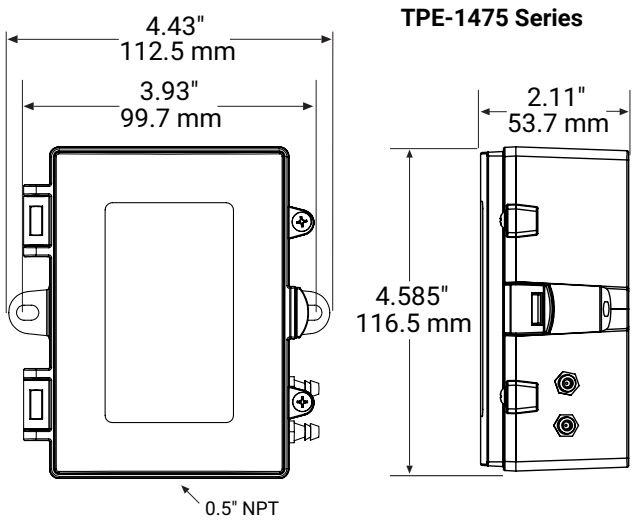
⚠ CAUTION

Ensure that the maximum individual port pressure does not exceed the maximum pressure range of the unit.

Use electrostatic discharge precautions during installation and do not exceed the device ratings.

Do not use in an explosive or hazardous environment, with combustible or flammable gases, as safety or emergency stop devices, or in any other application where failure of the product could result in personal injury.

Dimensions and Mounting



Avoid locations with severe vibrations or excessive moisture. Mount the transmitter on a vertical surface using #10 screws (not supplied) through the two integrated mounting holes. The enclosure has a opening for a standard 1/2-inch conduit fitting. Ensure there is enough space around the unit to make the tubing (without kinking) and electrical connections. For added security, two (provided) screws may be installed in the integrated screw tabs of the hinged cover.

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