



TRUEFIT BAC-5051A E Airflow Measurement System Router User Guide

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Airflow Measurement System
BAC-5051(A)E Router
Application Guide



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Getting Started

Introduction

The BAC-5051E router can be used to configure, control, tune, and monitor the operation of an Airflow Measurement System (AFMS). AFMS features are accessible through the Balancing web page and are active only when a valid AFMS controller has been discovered.

Prerequisites

1. Install an AFMS (the controller and all system components).

Note: See the Airflow Measurement System Installation Guide, found on any AFMS controller's product page.

2. Select the application (on the AFMS controller) needed for the equipment.



Caution: Select the application before configuring other settings. Changing applications after configuration will restore most parameters to their defaults. See "Selecting an Application" in the AFMS Netsensor Application Guide, found on any AFMS controller's product page.

Note: Complete basic configuration using a Conquest Net Sensor, KMC Connect software, Total Control software, and/or the KMC Converge module for Niagara Work Bench.

3. Set the AFMS controller's communication parameters.

Note: See the above note on the basic configuration methods.

4. Configure the router and set up routing.

Note: See the Application and Installation Guide for the BAC-5051E Router for details.

Accessing the Router's AFMS Features

1. Use an Internet browser to log in.
2. From the Advanced group, select Balancing.
3. Enter a range of device instance values that include an AFMS controller.
4. Select Discover.

Note: Up to 50 devices will be added to the list.

5. Select an AFMS controller from the list of discovered units.

Note: The background of the selected unit changes to yellow and four tabs for the AFMS are added to the bottom of the page.

Setting Up an AFMS

To set up an AFMS using the router, complete the following processes in this order:

1. Setting AFMS Parameters on page 5
2. Calibrating the AFMS's Sensors on page 7
3. Running AFMS Learning Mode on page 8

Note: In environmental conditions where you can't run Learning Mode, see Manually Entering Damper Characterization Data on page 15.

Setting AFMS Parameters

Before Beginning

Before setting an AFMS's parameters in AFMS, ensure that the Prerequisites on page 3 have been met.



Caution: Select the appropriate application on the AFMS controller before configuring other settings. Changing applications after configuration will restore most parameters to their defaults. See "Selecting an Application" in the AFMS Net Sensor Application Guide, found on any AFMS controller's product page.

Setting the Parameters

1. Select the Configure tab.
2. For Supply Area, enter the measurement (in square feet) of the cross section where the supply airflow pickup tubes were installed.

Note: For guidance about the location of the pickup tubes, see "Mounting the Supply Airflow Pickup Tubes" in the Airflow Measurement System Installation Guide, found on any AFMS controller's product page.

3. Choose to either leave Enable Low Limit set to ON (the default), or to turn it OFF.



Warning: ON is recommended to prevent freezing of equipment. If not needed (due to your equipment's particular nature), you might choose to turn it OFF.

4. Either leave Low Temp Limit set to the default (37°F), or adjust the value.

Note: If the mixed air temperature reaches the Low Temp Limit set here (and Enable Low Limit is set to ON) the outside air damper will modulate toward closed to prevent freezing of the equipment.

5. For **Stroke Time (Seconds)**, enter the time (in seconds) that it takes for the damper to go from 100% open to 100% closed.
6. For **Damper Reverse Action**:
 - o Select **NORMAL** if the greater the output signal to the damper actuator is, the more the damper opens (if 10 volts = 100% open).
 - o Select **REVERSE** if the greater the output signal to the damper actuator is, the more the damper closes (if 10 volts = 100% closed).
7. For **Actuator Voltage**, select the voltage range of the damper actuator (2 to 10 volts or 0 to 10 volts).
8. Select ON for **Learn Damper Span**.

Note: Before the AFMS controller can run Learning Mode, it must learn the minimum and maximum incline of the damper using the inclinometer.

9. Select **Save**.

Continue to Calibrating the AFMS's Sensors on page 7.

Calibrating the AFMS's Sensors

1. Select the Tune tab.
2. Under Offset for Supply Air Flow, enter the CFM offset (determined by a TAB technician) for the supply air pressure transducer.
3. Under Multiplier for Supply Air Flow, enter the multiplier (determined by a TAB technician) for the supply air pressure transducer.
4. Under Offset for Outside Air Temp, Return Air Temp, and Mixed Air Temp, enter the °F offsets (determined by a TAB technician) for the outside, return, and mixed air temperature sensors.
5. Select Save.

Note: For more information on the AFMS's sensors, see the Airflow Measurement System Selection Guide, found on any AFMS controller's product page.

Continue to Running AFMS Learning Mode on page 8.

Running AFMS Learning Mode

Before Starting Learning Mode

For valid results, first ensure that:

- The parameters are set correctly. (See Setting AFMS Parameters on page 5.)
- The sensors are calibrated. (See Calibrating the AFMS's Sensors on page 7.)
- The supply air fan is running at a normal, steady rate (without hunting or sporadic spikes).
- If the unit has a heat recovery wheel, it is turned off.
- If any heating or cooling sources are located upstream of the MAT sensor, they are turned off.
- If the unit has a bypass damper, it is set to 100% open.

Checking Learn Ready Status

1. Select the Learn tab.
2. Take note whether Learn Ready reports READY or NOT READY.

Interpreting Learn Ready Status

If READY is reported, you may manually start Learning Mode. (Continue to Manually Starting Learning Mode on page 9.)

If NOT READY is reported:

- Check Sensor Fault. If FAULT is reported, fix any faults found.
Note: Go to Monitor to find more detailed information on faults. (See Monitoring with an AFMS on page 13.)
- Ensure that Learn Damper Span has completed.
Note: (Under Configure,) Learn Damper Span must currently be OFF, and Damper Span Learned must report LEARNED.
- Mixed Air Temp Low Limit Control may be ACTIVE. If that is the case, continue to Enabling Learning Mode to Auto Start on page 9.
Note: Go to Monitor to find Mixed Air Temp Low Limit Control. Go to Configure to find Enable Low Limit and Low Temp Limit. (See Setting AFMS Parameters on page 5 for important guidance on Low Limit.)

- Check Min Delta Temp. If the current ΔT (the absolute difference between the outside and return air temperatures) is less than the minimum difference allowed, then continue to Enabling Learning Mode to Auto Start on page 9.

Note: Go to Monitor to find Outside Air Temp and Return Air Temp. Calculate the absolute difference, then compare to Min Delta Temp.

Manually Starting Learning Mode

If Learn Ready reports READY (see Checking Learn Ready Status on page 8), you may start Learning Mode manually.

1. Leave Min Delta Temp set to the default, or adjust it if needed.

Note: If the ΔT becomes less than the Min Delta Temp, the AFMS controller will abort Learning Mode. This is to insure that the controller does not receive unusable learning samples. Setting the Min Delta Temp at a 10°F or larger difference is recommended.

2. Leave Time Between Samples (Seconds) set to the default, or adjust it if needed.

Note: Most often, Time Between Samples (Seconds) can be left on the default (60 seconds). You might increase the value if the damper Stroke Time (see Setting AFMS Parameters on page 5) is longer than that of a typical unit, or if the damper actuator requires extra time to respond. You might decrease it if a large ΔT is present and time at the site is limited. However, too little time between samples could result in inaccurate measurements.

3. For Learning Mode, select ON.

4. Select Save.

5. Wait for Learning Mode to complete.

Note: To calculate the total time (in minutes) that Learning Mode should take to complete, multiply Time Between Samples (Seconds) by 91, then divide by 60.

Note: Learn Timer shows the elapsed time since Learning Mode started.

Enabling Learning Mode to Auto Start

If Learn Ready reports NOT READY because of currently unfavorable temperatures (see Interpreting Learn Ready Status on page 8) you may enable the AFMS controller to automatically start Learning Mode when it detects favorable temperatures at a later time.

1. Leave Min Delta Temp set to the default, or adjust it if needed.

Note: If the ΔT becomes less than the Min Delta Temp, the AFMS controller will abort Learning Mode. This is to insure that the controller does not receive unusable learning samples. 10°F or more Min Delta Temp is recommended.

2. Leave Auto Start Delta Temp set to the default, or adjust it if needed.

Note: When the ΔT reaches the Auto Start Delta Temp, Learning Mode will start. Learning Mode will complete if the ΔT remains greater than the Min Delta Temp for the entire duration. An Auto Start Delta Temp that is at least 10°F more than Min Delta Temp is recommended.

3. Leave Time Between Samples (Seconds) set to the default, or adjust it if needed.

Note: Most often, Time Between Samples (Seconds) can be left on the default (60 seconds). You might increase the value if the damper Stroke Time (Seconds) (found under Configure > Damper) is longer than that of a typical unit, or if the damper actuator requires extra time to respond.

4. For Auto Learn Enable, select ON.

5. Select Save.

Note: See the Date of Last Learn and the OAT When Learned once Learning Mode has run automatically.

Alternative to Running Learning Mode

While not ideal, the damper characterization data can be calculated and entered manually. This should only be done if — in the allotted time for setting up the AFMS — the ΔT is unlikely to remain greater than the Min Delta Temp for the duration of Learning Mode. See Manually Entering Damper Characterization Data on page 15 for guidance.

Controlling Airflow with an AFMS

About

After Setting Up an AFMS on page 4, you can control outside air flow, or control mixed air temperature. Also, for setup or maintenance purposes, you can command a damper position.

Alternatively, you can pass through control of the damper actuator to an external controller, using the AFMS for measurement and monitoring only. (See Monitoring with an AFMS on page 13.)

Controlling Outside Air Flow

1. Select the Configure tab.
2. From the Control Mode dropdown menu, select OA FLOW CTRL.
3. Enter an Outside Air Flow Setpoint (as CFM).
4. Select Save.

Note: The outside air damper will modulate to maintain the Outside Air Flow Setpoint. If Enable Low Limit is ON and the mixed air temperature reaches the Low Temp Limit, the damper will modulate toward closed to prevent freezing of the equipment. If an occupancy sensor is used, this Control Mode will only be active when the served space is occupied.

Controlling Mixed Air Temperature

1. From the tabs that appear, select Configure.
2. From the Control Mode dropdown menu, select MAT CTRL.
3. Enter a Mixed Air Temp Setpoint.
4. Select Save.

Note: The outside air damper will modulate to maintain the Mixed Air Temp Setpoint. If Enable Low Limit is ON and the mixed air temperature reaches the Low Temp Limit, the damper will modulate toward closed to prevent freezing of the equipment. If an occupancy sensor is used, this Control Mode will only be active when the served space is occupied.

Commanding a Damper Position

1. From the tabs that appear, select Configure.
2. From the Control Mode drop-down menu, select DMPR POSITION CTRL.
3. Enter an Outside Air Damper Setpoint (0–100% open).
4. Select Save.

Note: The AFMS controller will command the damper to the Outside Air Damper Setpoint. If Enable Low Limit is

ON and the mixed air temperature reaches the Low Temp Limit, the damper will modulate toward closed to prevent freezing of the equipment. If an occupancy sensor is used, this Control Mode will only be active when the served space is occupied.

Enabling Pass Through

1. From the tabs that appear, select Configure.
2. From the Control Mode drop-down menu, select PASS THROUGH.
3. Select Save.

Note: The external controller (if the AFMS controller is wired to one) will be allowed to control the damper actuator. (For wiring details, see the Airflow Measurement System Installation Guide, found on any AFMS controller's product page.) This Control Mode will only be active when Learn Damper Span and Learning Mode (under the Learn tab) are OFF.



Warning: The Enable Low Limit and Low Temp Limit do not apply when in PASS THROUGH. Ensure the external controller has its own low limit and other safeties configured to prevent equipment damage.

Monitoring with an AFMS

Accessing Monitoring

Select the **Monitor** tab.

Monitoring Operation

Label	Description
Outside Air Flow	The AFMS controller's current outside air CFM calculation displays here.
AFMS Status	NORMAL = No faults are detected. LEARN MODE = Learning Mode is ON . (See Running AFMS Learning Mode on page 8.) SPAN MODE = Learn Damper Span is ON . (See Setting AFMS Parameters on page 5.) SERVICE = One or more faults are detected. (See Monitoring Faults on page 13.)
Control Mode	The saved Control Mode (OA FLOW CTRL , MAT CTRL , DMPR POSITION CTRL or PASS THROUGH) displays here. (See Controlling Airflow with an AFMS on page 11.)
Damper Position	The damper's percentage open displays here.
Occupancy	The default is OCCUPIED . If an occupancy sensor is used and the served space is vacant, UNOCCUPIED will display.
Outside Air Temp	The outside air temperature sensor's measurement displays here.
Return Air Temp	The return air temperature sensor's measurement displays here.
Mixed Air Temp	The mixed air temperature sensor's measurement displays here.

Monitoring Faults

Label	Description
Outside Air Sensor Fault	FAULT = The outside air temperature sensor is missing or shorted.
Return Air Sensor Fault	FAULT = The return air temperature sensor is missing or shorted.
Mixed Air Sensor Fault	FAULT = The mixed air temperature sensor is missing or shorted.
Sensor Fault	FAULT = One or more of the three temperature sensors is missing or shorted.
Damper Control Fault	If the saved Control Mode is DMPR POSITION CTRL (see Commanding a Damper Position on page 11), FAULT will display if the damper position is more than 15% off from the Outside Air Damper Setpoint for longer than the Stroke Time (Seconds) (found under Configure > Damper). This indicates that the damper is not moving properly.
Outside Air Control Fault	If the saved Control Mode is OA FLOW CTRL (see Controlling Outside Air Flow on page 11), FAULT will display if Outside Air Flow is more than 15% off from the Outside Air Flow Setpoint for longer than the Stroke Time (Seconds) (found under Configure > Damper). This indicates that the damper is not moving properly.

Label	Description
Mixed Air Flow Fault	If the saved Control Mode is MAT CTRL (see Controlling Mixed Air Temperature on page 11), FAULT will display if Mixed Air Temp is more than 15°F off from the Mixed Air Temp Setpoint for longer than the Stroke Time (Seconds) (found under Configure > Damper). This indicates that the damper is not moving properly.
Outside Air Flow Fault	FAULT = The calculation of the airflow based on the damper characterization data (see Accessing the Damper Characterization Table on page 15) has differed from the calculation using the current temperatures by more than the tolerance (20% difference default) for longer than 10 minutes. Ensure that the equipment is in the same physical condition as it was when Learning Mode was run. Learning Mode may need to be run again and/or sensors re-calibrated.
Mixed Air Temp Low Limit Control	ACTIVE = The damper is modulating toward closed to prevent freezing of the equipment because the Mixed Air Temp is lower than the Low Temp Limit (found under Configure > General). INACTIVE = Either the Mixed Air Temp is higher than the Low Temp Limit , or Enable Low Limit is set to OFF . See the related low limit information in Setting AFMS Parameters on page 5.

Accessing the Damper Characterization Table

Manually Entering Damper Characterization Data

While not ideal, the damper characterization data can be calculated and entered manually in the AFMS Table. This should only be done if — in the allotted time for Setting Up an AFMS on page 4 — the ΔT is unlikely to be greater than the Min Delta Temp for the duration of Learning Mode. In that case, for reliability, running Learning Mode at a later available time is still recommended.

Accessing the AFMS Table

Select the Tune tab.

Interpreting the AFMS Table

Label	Description
Flow	Percentage (expressed as a decimal) of the supply airflow that is outside airflow at the given outside air damper position
Diff Pressure (pressure assist application only)	The pressure differential (in inches of water column) at the given outside air damper position See the AFMS documentation for pressure assist information .
Outside Air Closed	Outside air damper at closed position
Outside Air 5	Outside air damper at 0–5% open
Outside Air 10	Outside air damper at 5–10% open
Outside Air 15	Outside air damper at 10–15% open
Outside Air 20	Outside air damper at 10–20% open
Outside Air 30	Outside air damper at 20–30% open
Outside Air 40	Outside air damper at 30–40% open
Outside Air 50	Outside air damper at 40–50% open
Outside Air 60	Outside air damper at 50–60% open
Outside Air 70	Outside air damper at 60–70% open
Outside Air 80	Outside air damper at 70–80% open
Outside Air 90	Outside air damper at 80–90% open
Outside Air 100	Outside air damper at 90–100% open

Calculating the damper characterization data

Use the %OA equation found in ASHRAE Standard 111, section 7.6.3.3: “Flow Rate Approximation by Temperature Ratio”.

Note: Find ASHRAE Standard 111 on this page of read-only versions of ASHRAE standards.

Note: See Controlling Airflow with an AFMS on page 11 for how to set the outside air damper to the required positions for the measurements.

Note: See Monitoring with an AFMS on page 13 for where to find the sensor readings.

Continue to Getting Started on page 3.

Verifying the Damper Characterization Data

Should the damper characterization data require verification, measurements should only be made using Nontraceable instruments and the method described in ASHRAE Standard 111. (See the details in Manually Entering Damper Characterization Data on page 15.)

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KMC Controls, 19476 Industrial Drive, New Paris,
IN 46553 / 877-444-5622 / Fax: 574-831-5252 /

www.kmccontrols.com

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Documents / Resources

	<p>TRUEFIT BAC-5051A E Airflow Measurement System Router [pdf] User Guide BAC-5051A E Airflow Measurement System Router, BAC-5051A, E Airflow Measurement System Router, Measurement System Router, System Router, Router</p>
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References

-  [Read-Only Versions of ASHRAE Standards](#)
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