


KMC
CONTROLS
KMC CONTROLS
BAC-5051AE Multi
Port BACnet
Router



KMC CONTROLS BAC-5051AE Multi Port BACnet Router Instruction Manual

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KMC CONTROLS BAC-5051AE Multi Port BACnet Router



Product Information

Specifications:

- Product Name: BAC-5051(A)E Pages for Configuring an AFMS
- Manufacturer: KMC Controls
- Model Number: BAC-5051(A)E
- Function: Configuring, controlling, tuning, and monitoring an Airflow Measurement System (AFMS)
- Default IP Address: 192.168.1.252

FAQ

Q: How do I reset the default IP address of the BAC-5051(A)E router?

A: To reset the default IP address, refer to the Application and Installation Guide for the BAC-5051AE Router for detailed instructions.

BAC-5051(A)E Pages for Configuring an AFMS

Application Guide for Checkout and Commissioning



INTRODUCTION

This document guides users through checkout and commissioning of an Airflow Measurement System (AFMS). It is designed to aid in completing the tasks on the Note Sheets for AFMS Checkout and Commissioning. The BAC-5051(A)E router can be used to configure, control, tune, and monitor the operation of an AFMS. AFMS features are accessible through the Balancing / AFMS / ZEC web page and are active once a valid AFMS controller has been discovered.

NOTE: The default IP address of the BAC-5051(A)E router is 192.168.1.252.

PREREQUISITES

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

NOTE: See the AFMS installation guide found on any AFMS controller's product page.

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

NOTE: See the AFMS selection guide for a table listing the configuration tools that can be used to select the application. Select the application before configuring other settings. Changing applications after configuration will restore most parameters to their defaults.

- Set the AFMS controller's communication parameters.

NOTE: See the AFMS selection guide for a table listing the configuration tools that can be used to set the communication parameters.

- Configure the router and set up routing to the AFMS controller.

NOTE: See the Application and Installation Guide for the BAC-5051AE Router for details.

ACCESSING THE AFMS PAGES

- Log in to the router using a web browser.

NOTE: See the Application and Installation Guide for the BAC-5051AE Router for details.

- Go to Advanced > Balancing / AFMS / ZEC.

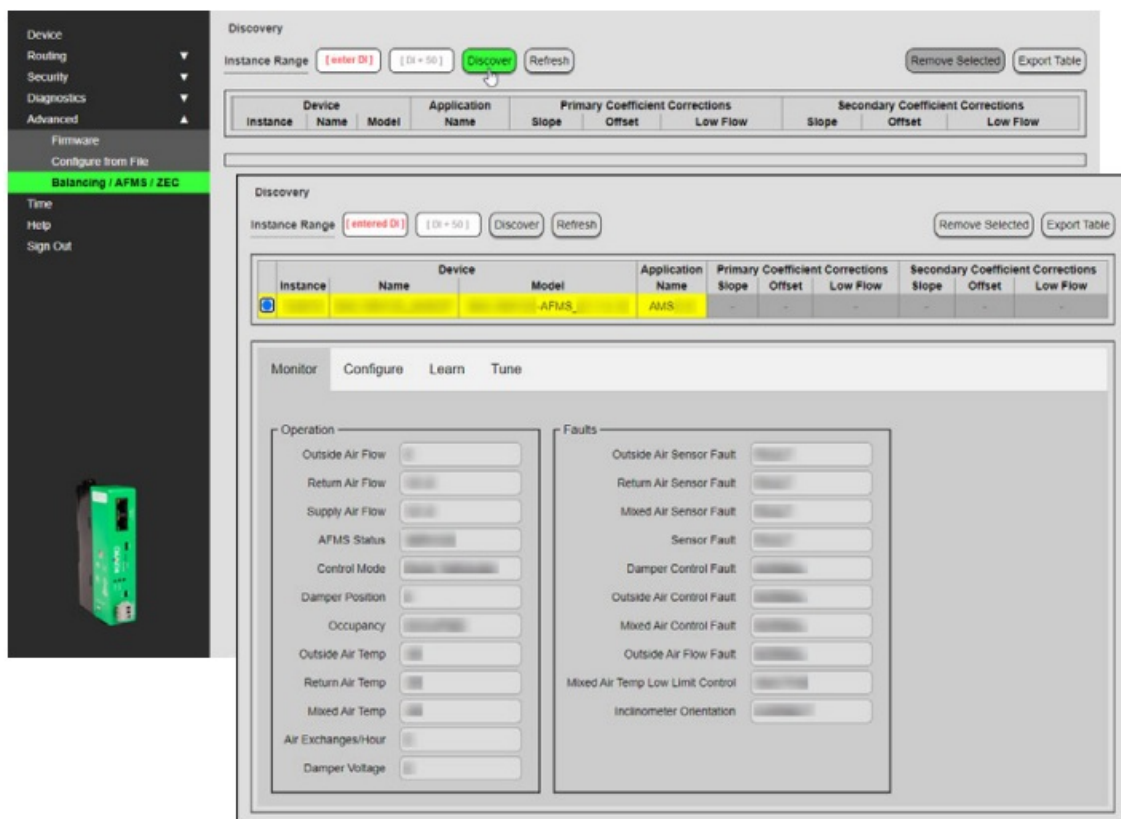
- For Instance Range, in Start, enter the device instance that was set for the AFMS controller.

NOTE: End automatically fills with a value, making a range of 50 device instances.

- Click Discover.

- Click the circle next to the AFMS controller's Instance.

NOTE: The selected AFMS controller highlights and the AFMS configuration page tabs appear below.



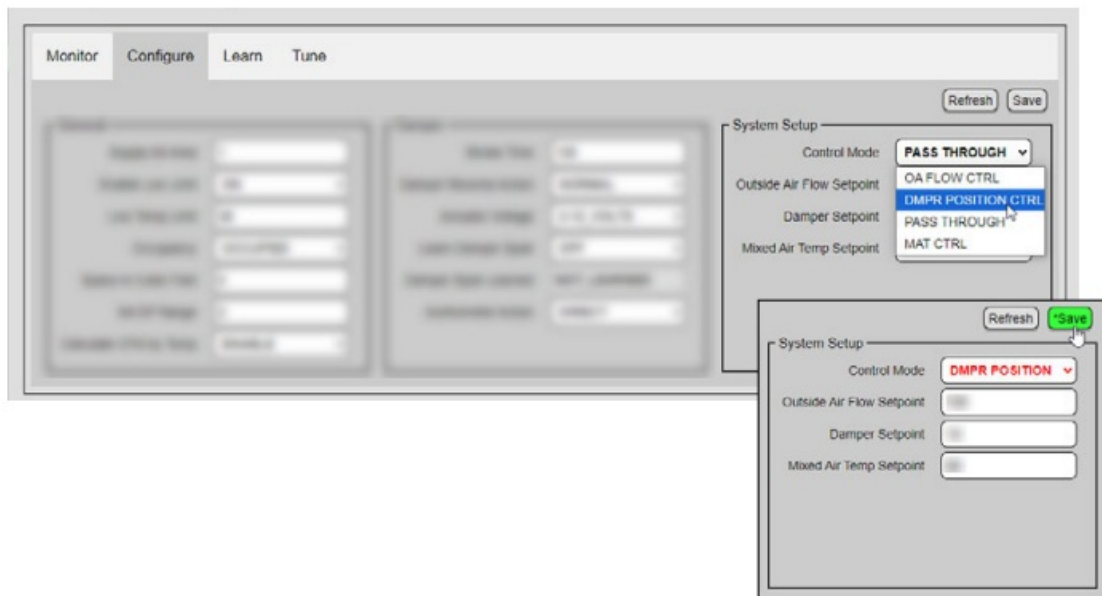
POINT-TO-POINT CHECKOUT TASKS

The steps for each point-to-point checkout task are presented in subsections below. Complete each task/subsection in the order presented.

Set Control Mode to Damper Position Control

On the Configure page, in the System Setup group:

- For Control Mode, select DMPR POSITION CTRL from the drop-down menu.
- Click Save.



Verify Pressure Transducer Settings

Do the following for all pressure transducers (supply and pressure assist) that were installed, following their manufacturer's installation instructions:

1. Verify that the signal output type is set to volts.
2. Verify that the transducer is set to unipolar mode.
3. If the transducer has several pressure range options, verify that the correct range is set (according to the pressure range of the unit).

Make Pressure Transducer Zero Adjustment

Zero out all pressure transducers (supply and pressure assist) that were installed, following their manufacturer's installation instructions.

You will need to expose the transducer high and low ports to ambient pressure by temporarily removing the tubing from the ports. After zeroing the transducer, reconnect each tube to the correct port.

Set the Supply Air Differential Pressure Range (5901- AFMS only)

On the Configure page, in the General group:

1. For SA DP Range, enter the maximum inches of water column that the supply air pressure transducer can measure.
NOTE: For example, a TPE-1475-21, can measure up to 2" wc, so enter 2. A TPE-1475-22 can measure up to 10" wc, so enter 10. (A 9311-AFMS can measure up to 2" wc.) Some AFMS installations may use other pressure transducers.
2. Click Save.

Set the Supply Air Area

On the Configure page, in the General group:

1. For Supply Air Area:

If the supply air pickup tubes were installed on the supply air fan bell, enter the square foot measurement of the fan inlet.

If the supply air pickup tubes were installed in the supply air duct, enter the square foot measurement of the duct cross-section where the tubes are located.

NOTE: For assistance calculating the area, use the Free Area Calculator in the Note Sheets for AFMS Checkout and Commissioning.

2. Click Save.

Inspect Pressure Assist Pickup Tubes (PA only)

For pressure assist applications, ensure that the pickup tubes were installed in the correct location per the AFMS installation guide.

Calibrate the Supply Air Flow

On the Tune page, in the Calibration group:

1. Do any of the following:

In the Offset column for Supply Air Flow, enter the CFM offset (determined by a TAB technician) for the supply air pressure transducer.

In the Multiplier column for Supply Air Flow, enter the multiplier (determined by a TAB technician) for the supply air pressure transducer.

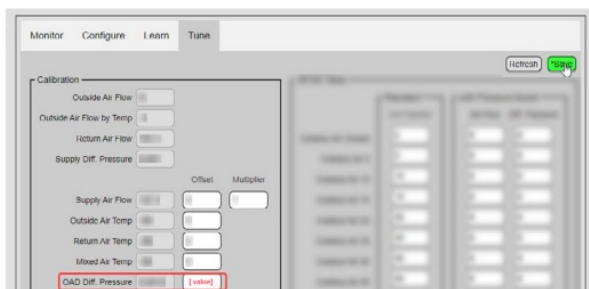
2. Click Save.



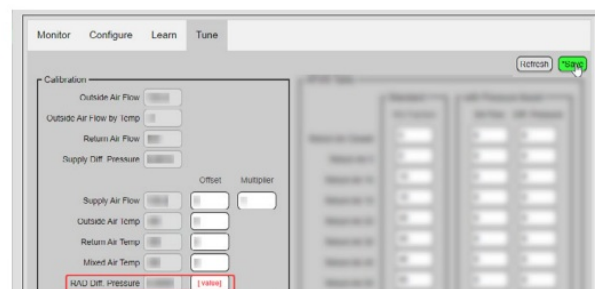
Calibrate OAD/RAD Diff. Pressure (pressure assist only)

For pressure assist applications, on the Tune page, in the Calibration group:

1. In the Offset column for OAD Diff. Pressure / RAD Diff. Pressure, enter the differential pressure offset (determined by a TAB technician) for the pressure assist pressure transducer.
2. Click Save.



or



Verify and Calibrate Outside Air Temperature

On the Tune page, in the Calibration group:

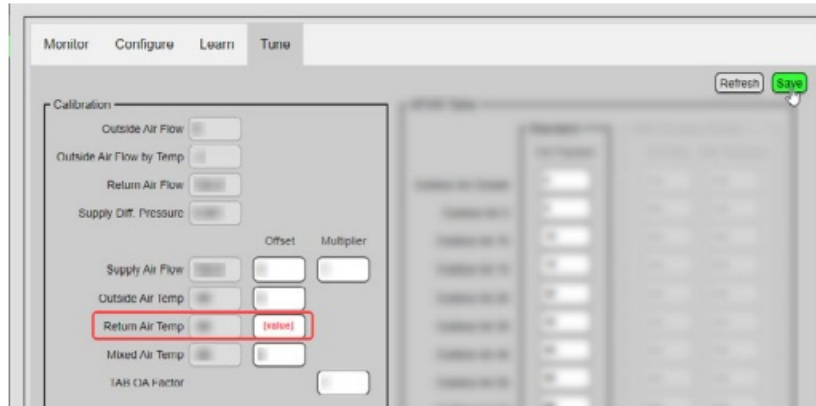
1. Locate the OAT sensor's reading, next to Outside Air Temp.
2. Using a NIST-traceable instrument, measure the temperature near the OAT sensor.
3. Compare the two values.
4. Enter the Offset for Outside Air Temp.
5. Click Save.



Verify and Calibrate Return Air Temperature

On the Tune page, in the Calibration group:

1. Locate the RAT sensor's reading, next to Return Air Temp.
2. Using a NIST-traceable instrument, measure the temperature near the RAT sensor.
3. Compare the two values.
4. Enter the Offset for Return Air Temp.
5. Click Save.

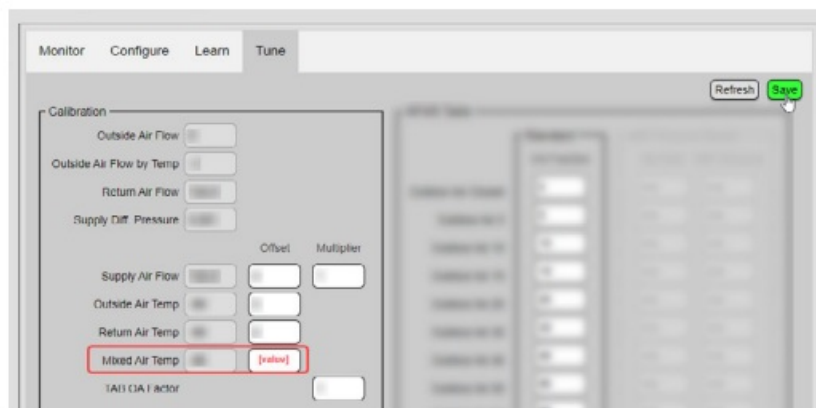


Verify and Calibrate Mixed Air Temperature

On the Tune page, in the Calibration group:

1. Locate the MAT sensor's reading, next to Mixed Air Temp.
2. Using a NIST-traceable instrument, measure the temperature near the MAT sensor.
3. Compare the two values.
4. Enter the Offset for Mixed Air Temp.
5. Click Save.

Point-point-checkout is completed. Continue to the Damper Span Calibration Tasks



DAMPER SPAN CALIBRATION TASKS

After completing the Point-to-Point Checkout Tasks on page 3, calibrate the damper span. The steps for each damper span calibration task are presented in subsections below. Complete each task/subsection in the order presented.

Set the Damper Stroke Time

On the Configure page, in the Damper group:

1. For Stroke Time, enter the time (in seconds) that it takes for the actuator to move the damper from fully closed to fully open.
2. Click Save.

The screenshot shows the 'Configure' tab of a software interface. In the 'Damper' section, the 'Stroke Time' field is highlighted with a red box. The field is labeled 'Stroke Time' and has a placeholder text '(time in seconds)'. To the right of the 'Stroke Time' field, there are 'Refresh' and 'Save' buttons. The 'Save' button is green and has a mouse cursor hovering over it.

Set the Actuator Voltage Range

On the Configure page, in the Damper group:

1. For Actuator Voltage, select the voltage range of the damper actuator from the drop-down menu (2 to 10 volts or 0 to 10 volts).
2. Click Save.

The first screenshot shows the 'Configure' tab with the 'Actuator Voltage' drop-down menu highlighted by a red box. The menu is open, showing three options: '2-10_VOLTS', '2-10_VOLTS', and '0-10_VOLTS'. The second screenshot shows the same interface, but the 'Actuator Voltage' field now displays '[0-10 V or 2-10 V]' and the 'Save' button is highlighted with a green box and a mouse cursor hovering over it.

Turn On Learn Damper Span, then Verify

Before the AFMS can run Learn Mode, it must learn the minimum and maximum incline of the damper using the inclinometer. The Learn Damper Span sequence will take 3 to 5 minutes to complete.

On the Configure page, in the Damper group:

1. For Learn Damper Span, select ON from the drop-down menu.
2. Click Save.
3. After 3 to 5 minutes, verify that Damper Span Learned reports LEARNED.

The image displays two screenshots of a web-based configuration interface for a damper system. The interface has four tabs: Monitor, Configure, Learn, and Tune. The 'Configure' tab is active in both screenshots.

Top Screenshot: The 'Damper' section shows the following settings: Stroke Time (0.00), Damper Reverse Action (000000), Actuator Voltage (0.00), **Learn Damper Span (ON)**, Damper Span Learned (NOT_LEARNED), and Inclinator Action (000000). A red box highlights the 'Learn Damper Span' dropdown menu.

Bottom Screenshot: The 'Damper' section shows the following settings: Stroke Time (0.00), Damper Reverse Action (000000), Actuator Voltage (0.00), **Learn Damper Span (OFF)**, **Damper Span Learned (LEARNED)**, and Inclinator Action (000000). Red boxes highlight the 'Learn Damper Span' dropdown menu and the 'Damper Span Learned' status.

Stroke Damper and Visibly Verify Positions

On the Configure page, in the System Setup group:

1. Ensure that DMPR POSITION is set for Control Mode.
2. For Damper Setpoint, enter 0.
3. Click Save.
4. Once the actuator stops moving, visibly verify that the damper is fully closed.
5. For Damper Setpoint, enter 50.
6. Click Save.
7. Once the actuator stops moving, visibly verify that the damper is 50% open/closed.
8. For Damper Setpoint, enter 100.
9. Click Save.

Monitor Configure Learn Tune

System Setup

Control Mode: DMPR POSITION

Outside Air Flow Setpoint: 0

Damper Setpoint: 0

Mixed Air Temp Setpoint: 0

Refresh Save

Monitor Configure Learn Tune

System Setup

Control Mode: DMPR POSITION

Outside Air Flow Setpoint: 0

Damper Setpoint: 50

Mixed Air Temp Setpoint: 0

Refresh Save

Monitor Configure Learn Tune

System Setup

Control Mode: DMPR POSITION

Outside Air Flow Setpoint: 0

Damper Setpoint: 100

Mixed Air Temp Setpoint: 0

Refresh Save

10. Once the actuator stops moving, visibly verify that the damper is fully open.

If the actuator is moving the damper in reverse (i.e. 10 volts = closed), see the next section, “Set Damper Reverse Action”.

Set Damper Reverse Action (if needed)

If visual inspection (see the previous section) revealed that the damper actuator moves in reverse action (i.e. 10 volts = closed), on the Configure page, in the Damper group:

1. For Damper Reverse Action, select REVERSE from the drop-down menu.
2. Click Save.

Monitor Configure Learn Tune

Stroke Time: 0

Damper Reverse Action: REVERSE

Actuator Voltage: 0

Learn Damper Span: 0

Damper Span Learned: 0

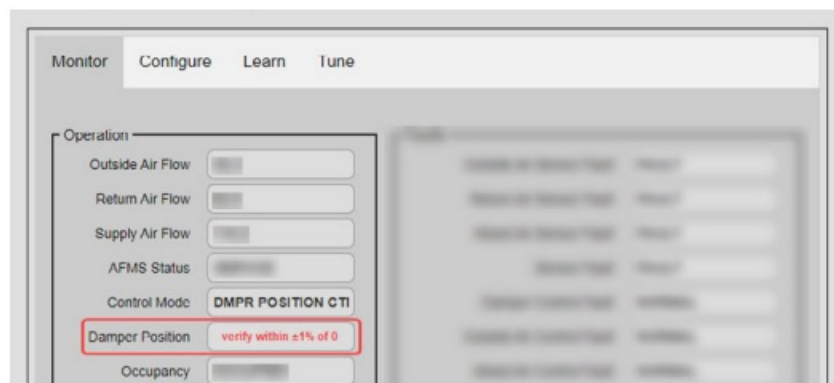
Inclinometer Action: 0

Refresh Save

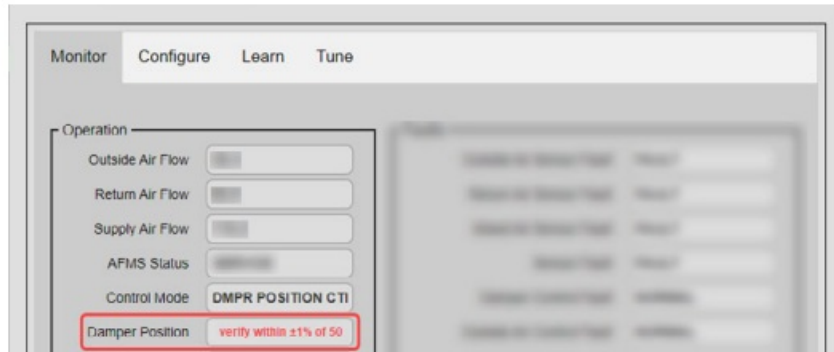
(if needed)

Stroke Damper and Verify that Reported Damper Position Follows

1. Go to Configure > the System Setup group:
 2. Ensure that DMPR POSITION is set for Control Mode.
 3. For Damper Setpoint, enter 0.
 4. Click Save.
 5. Once the actuator stops moving, visibly verify that the damper is fully closed.
 6. Go to the Monitor tab.
 7. Verify that Damper Position (in the Operation group) reports a value within $\pm 1\%$ of 0.
- NOTE: The inclinometer can detect very small movements of the damper assembly.

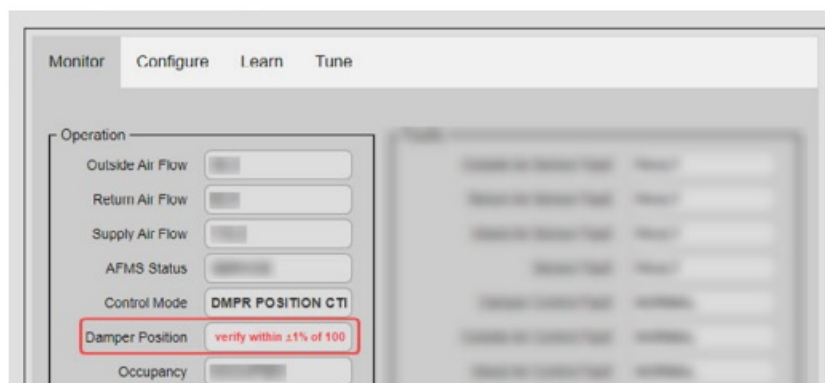


8. Go to the Configure tab again.
9. For Damper Setpoint, enter 50.
10. Click Save.
11. Once the actuator stops moving, visibly verify that the damper is 50% open/closed.
12. Go to the Monitor tab again.
13. Verify that Damper Position reports a value within $\pm 1\%$ of 50.
14. Go to the Configure tab again.
15. For Damper Setpoint, enter 100.
16. Click Save.
17. Once the actuator stops moving, visibly verify that the damper is now fully open.



18. Go to the Monitor tab again.

19. Verify that Damper Position reports a value within $\pm 1\%$ of 100.



If Damper Position reports values that are the opposite of the entered Damper Setpoint, see the next section, “Set Inclinator Action to Reverse”.

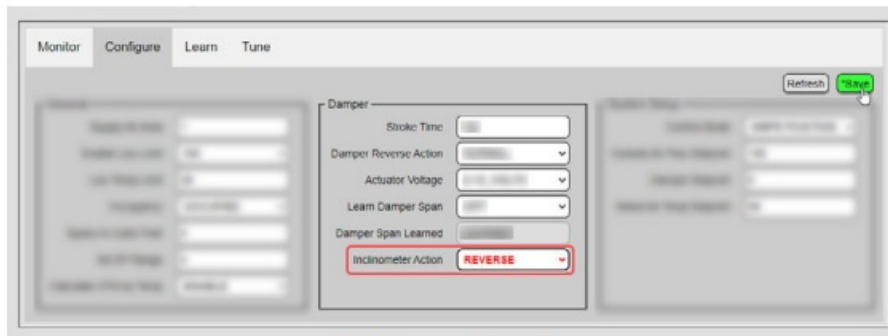
Set Inclinator Action to Reverse (if needed)

For the standard (AMSO) application or OAD Pressure Assist (AMSOP) application, if the inclinometer was mounted on a horizontal return air damper blade because the outside air damper blades are vertical, then you need to set Inclinator Action to REVERSE.

If testing revealed that Damper Position reports values that are the opposite of the Damper Setpoint (see the

previous section), on the Configure page, in the Damper group:

1. For Inclinator Action, select REVERSE from the drop-down menu.
2. Click Save.



(if needed)

Damper span calibration is completed. Continue to the Learning Mode Tasks on.

LEARNING MODE TASKS

The steps for each learning mode task are presented in subsections below. Complete each task/subsection in the sequence presented.

Prerequisite Tasks

Before starting Learning Mode, for valid results, ensure that:

- The sensors are calibrated (Point-to-Point Checkout Tasks on page 3).
- AFMS is configured properly (Damper Span Calibration Tasks on page 6).
- 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.

Starting Learning Mode

1. Go to the Learn tab.
2. Note whether Learn Ready reports READY or NOT READY.

If READY is displayed, Learning Mode can be started manually. Otherwise, see Enabling Learning Mode to Auto Start on page 10.

NOTE: In special cases, you may consider the Alternative to Running Learning.

Manually Starting Learning Mode

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

NOTE: If the ΔT becomes less than Min Delta Temp, the AFMS controller will abort Learning Mode. This is to ensure that the controller does not receive unusable learning samples. Setting Min Delta Temp at a 15°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 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 ACTIVE.
4. Click 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.

Skip to Verify that AFMS Status is in Learning Mode

Enabling Learning Mode to Auto Start

If Learn Ready reports NOT READY because of currently unfavorable temperatures, you may enable the AFMS to automatically start Learning Mode when it detects favorable temperatures later (overnight is likely).

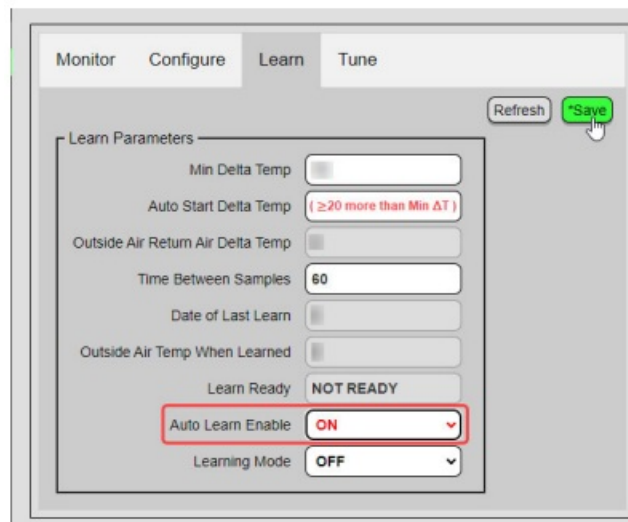
1. Leave Min Delta Temp set to the default or adjust it if needed.

NOTE: If the ΔT becomes less than Min Delta Temp, the AFMS controller will abort Learning Mode. This is to ensure that the controller does not receive unusable learning samples. Setting Min Delta Temp at a 15°F or larger difference 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 20°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 is longer than that of a typical unit, or if the damper actuator requires extra time to respond.



The screenshot shows the 'Learn' tab of the AFMS configuration interface. The 'Learn Parameters' section contains several input fields: 'Min Delta Temp' (with a slider), 'Auto Start Delta Temp' (with a red warning note '(≥20 more than Min ΔT)'), 'Outside Air Return Air Delta Temp' (with a slider), 'Time Between Samples' (set to 60), 'Date of Last Learn', and 'Outside Air Temp When Learned'. Below these, the 'Learn Ready' status is 'NOT READY'. The 'Auto Learn Enable' dropdown is set to 'ON' and is highlighted with a red box. The 'Learning Mode' dropdown is set to 'OFF'. At the top right of the 'Learn' tab, there are 'Refresh' and 'Save' buttons, with a mouse cursor clicking on the 'Save' button.

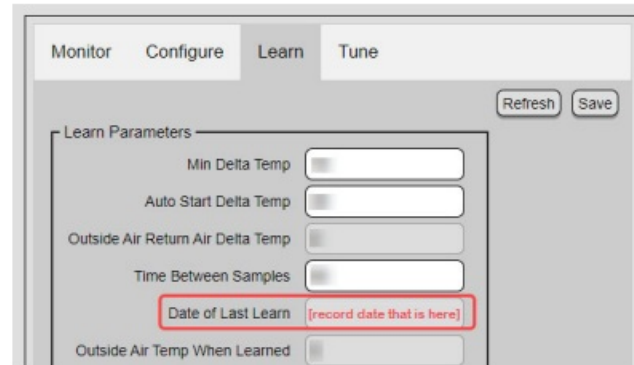
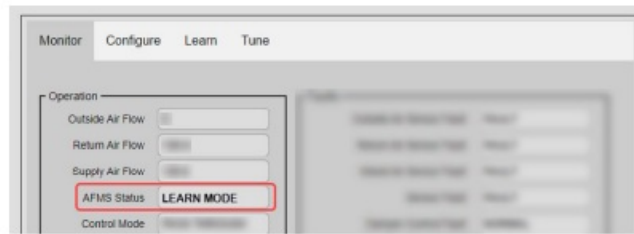
4. For Auto Learn Enable, select ON.
5. Click Save.
6. Wait for Learning Mode to complete during favorable temperatures (overnight is likely).

Verify that AFMS Status is in Learning Mode

On the Monitor page, in the Operation group, verify whether AFMS Status reports LEARN MODE.

Verify Learning Mode Completed and Record Date

After the AFMS completes Learning Mode (approximately 2 hours), on the Learn page:



1. Locate the Date of Last Learn (YYMMDD).
 2. Enter the date into the Note Sheets for AFMS Checkout and Commissioning.
- Skip to Access the AFMS Table and Record Data

Alternative to Running Learning Mode

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 the AFMS—the ΔT is unlikely to remain greater than the Min Delta Temp for the duration of Learning Mode.

To make the calculations, use the %OA/%RA equations found in ASHRAE Standard 111, section 7.6.3.3, “Flow Rate Approximation by Temperature Ratio”.

1. Go to the Configure tab.
2. For Damper Setpoint, enter the first damper position (Closed, i.e. 0) found in the AFMS Table (on the Tune tab).
NOTE: Note: Each subsequent time through this process, enter the next damper position from the table: 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100.
3. Click Save.
4. Go to the Monitor tab.
5. Allow the Outside Air Temp, Return Air Temp, and Mixed Air Temp to stabilize.
6. Depending on the application, calculate either the OA Fraction or RA Fraction, using the temperature readings and either the %OA or %RA equation from the standard.
7. Go to the Tune tab.
8. Enter the result into the OA Fraction column/ RA Fraction column (depending on the application).
NOTE: For Pressure Assist applications, also enter the Supply Air Flow reading into the SA Flow column and the OAD Diff. Pressure / RAD Diff. Pressure reading into the Diff. Pressure column.
9. Select Save.

Repeat those steps for the remaining 12 damper positions listed on the AFMS Table.

Access the AFMS Table and Record Data

On the Tune page, in the AFMS Table group:

1. Locate the Characterized Airflow Performance® data, found in:
 - The OA Fraction column (for both standard and outside air damper pres-sure assist applications)
 - The RA Fraction column (for return air damper pressure assist applica-tions only)
 - The SA Flow column (for both types of pressure assist applications only)
 - The Diff. Pressure column (for both types of pressure assist applications only)
2. Record the data into the Note Sheets for AFMS Checkout and Commissioning:
 - For standard applications, use the AFMS Post Table.
 - For pressure assist applications, use the AFMS PA Post Table.

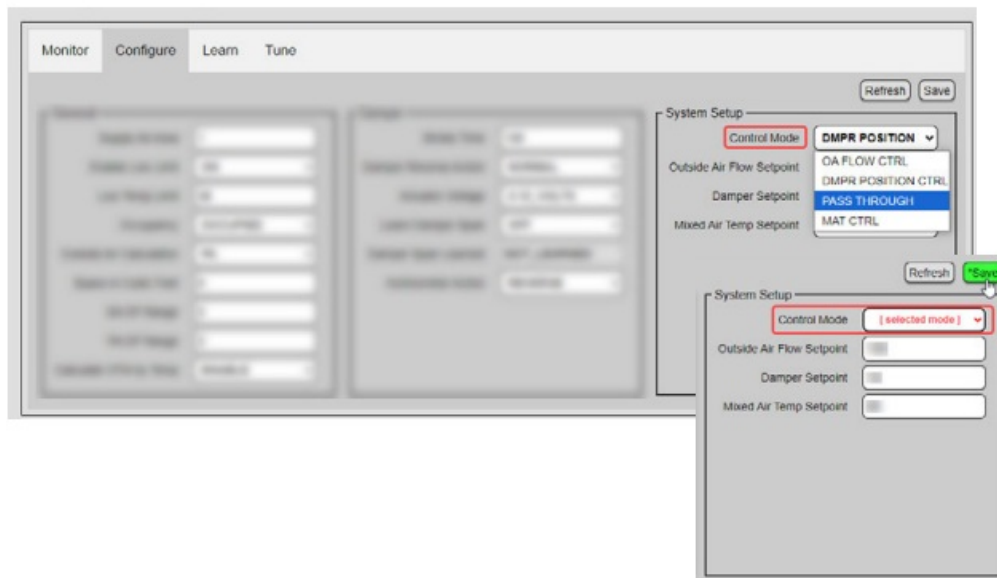
The image displays two screenshots of the AFMS configuration interface. The top screenshot shows the 'Standard' mode, and the bottom screenshot shows the 'with Pressure Assist' mode. Both screenshots feature a table of data for Outdoor Air Flow (CFM) ranging from 5 to 100. The table columns are OA Fraction, SA Flow, and Diff. Pressure. The 'Standard' mode has a red box around the OA Fraction column, while the 'with Pressure Assist' mode has a red box around the SA Flow and Diff. Pressure columns.

Outdoor Air Flow (CFM)	OA Fraction	SA Flow	Diff. Pressure
Outdoor Air Closed	[button]	[button]	[button]
Outdoor Air 5	[button]	[button]	[button]
Outdoor Air 10	[button]	[button]	[button]
Outdoor Air 15	[button]	[button]	[button]
Outdoor Air 20	[button]	[button]	[button]
Outdoor Air 30	[button]	[button]	[button]
Outdoor Air 40	[button]	[button]	[button]
Outdoor Air 50	[button]	[button]	[button]
Outdoor Air 60	[button]	[button]	[button]
Outdoor Air 70	[button]	[button]	[button]
Outdoor Air 80	[button]	[button]	[button]
Outdoor Air 90	[button]	[button]	[button]
Outdoor Air 100	[button]	[button]	[button]

Set Control Mode

On the Configure page, in the System Setup group:

1. For Control Mode, select from the drop-down menu the option that will be the AFMS's normal mode for this installation:
 - OA FLOW CTRL: The AFMS modulates the damper actuator to maintain the Outside Air Flow Setpoint (CFM).
 - PASS THROUGH: The AFMS passes control of the damper actuator to another controller. (The AFMS measures and monitors only.)
 - MAT CTRL: The AFMS modulates the damper actuator to maintain the Mixed Air Temp Setpoint (°F/°C).
2. Click Save.



ABOUT TESTING AND BALANCING AFMS

If everything was installed and configured correctly prior to running Learning Mode, the AFMS Table data is very reliable. The AFMS uses the same method from ASHRAE Standard 111 (Section 7.6.3.3, “Flow Rate Approximation by Temperature Ratio”) that a good tester and balancer should use. Furthermore, as the AFMS performs the method, it takes the OAT, RAT, and MAT measurements simultaneously and several times for reliable averages, increasing the reliability of the data.

However, should verification be required, the following guidelines should be observed:

- Make measurements using NIST-traceable instruments.
- Use the method from ASHRAE Standard 111, Section 7.6.3.3, “Flow Rate Approximation by Temperature Ratio” to calculate the table data.
- Should an adjustment be needed, adjust single data items from the AFMS Table rather than making a linear adjustment.

NOTE: TAB OA Factor (found in the Calibration group under Tune) should be at 1 and not adjusted.

If large adjustments need to be made to the AFMS Table data, one or more of the sensors may have been installed incorrectly and/or a setting was misconfigured prior to running Learning Mode. The problem should be corrected by fixing the installation and/or configuration, then running Learning Mode again.

HANDLING PRECAUTIONS

For digital and electronic sensors, thermostats, and controllers, take reasonable precautions to prevent electrostatic discharges to the devices when installing, servicing, or operating them. Discharge accumulated static electricity by touching one’s hand to a securely grounded object before working with each device.



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- The KMC Connect Lite™ app for NFC configuration is protected under United States Patent Number 10,006,654.
- Pat. <https://www.kmccontrols.com/patents/>


SUPPORT

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



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Documents / Resources

	KMC CONTROLS BAC-5051AE Multi Port BACnet Router [pdf] Instruction Manual BAC-5051AE Multi Port BACnet Router, BAC-5051AE, Multi Port BACnet Router, BACnet Router, Router
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References

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