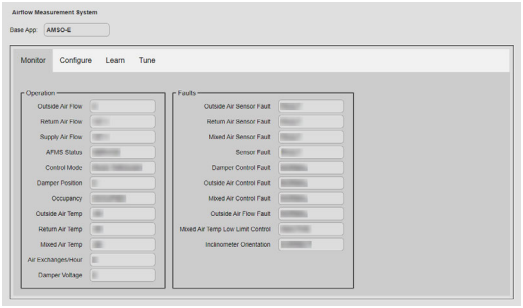
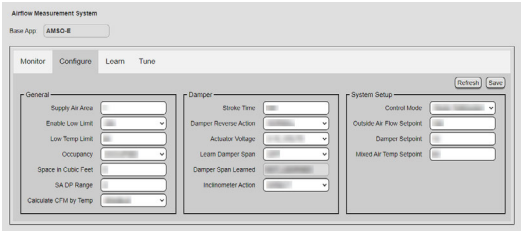
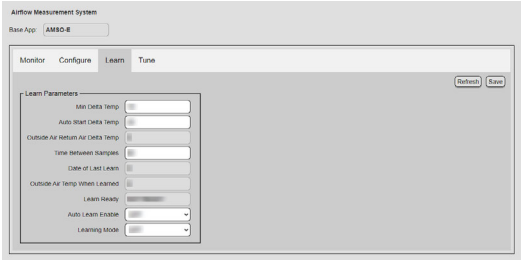
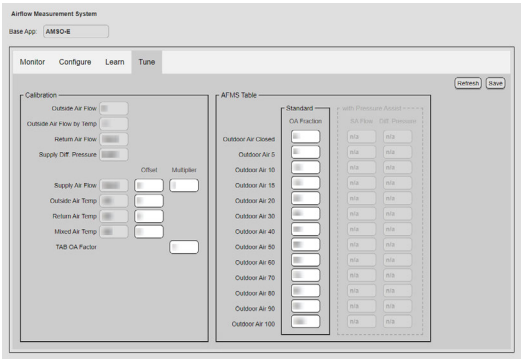
BAC-5051(A)E Pages for Configuring an AFMS

Application Guide for Checkout and Commissioning









CONTENTS

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

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 192.168.1.25**2**.

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.

3. 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.

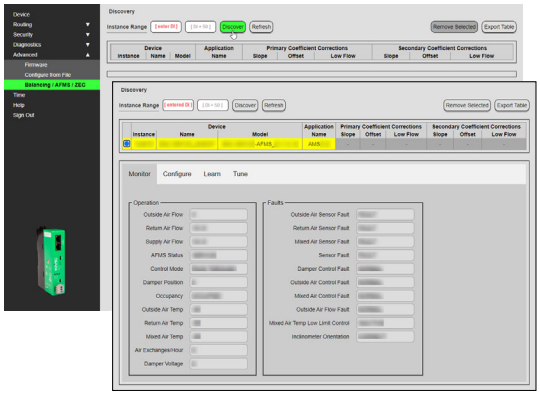
4. Configure the router and set up routing to the AFMS controller.

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

ACCESSING THE AFMS PAGES

1. Log in to the router using a web browser.

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



2. Go to **Advanced** > **Balancing / AFMS / ZEC**.

3. 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.

4. Click **Discover**.

5. 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:

1. For **Control Mode**, select **DMPR POSITION CTRL** from the drop-down menu.
2. 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.

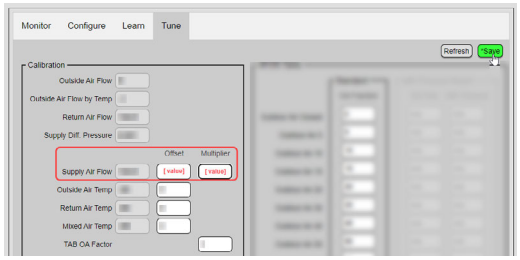
NOTE: For assistance calculating the area, use the Free Area Calculator in the *Note Sheets for AFMS Checkout and Commissioning*.

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



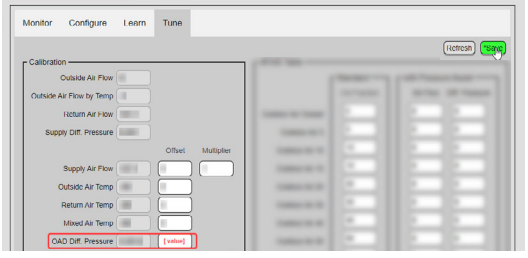
On the **Tune** page, in the **Calibration** group:

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**.

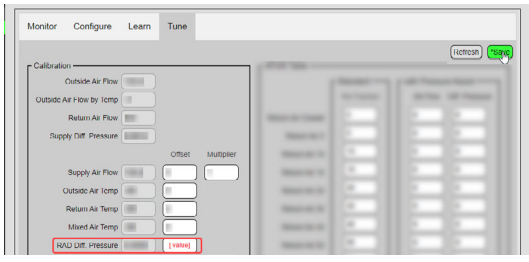
Calibrate OAD/RAD Diff. Pressure (pressure assist only)

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

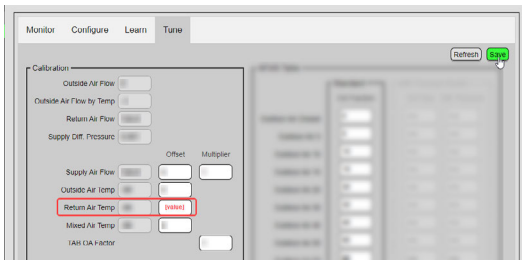


Verify and Calibrate Outside Air Temperature

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:

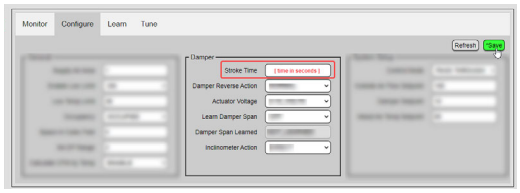
1. Locate the MAT sensor's reading, next to **Mixed Air Temp**.
2. Using a NIST-traceable instrument, measure the temperature near the MAT sensor.
3. Compare the two values.
4. Enter the **Offset** for **Mixed Air Temp**.
5. Click **Save**.

Point-point-checkout is completed. Continue to the **Damper Span Calibration Tasks on page 6.**

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.

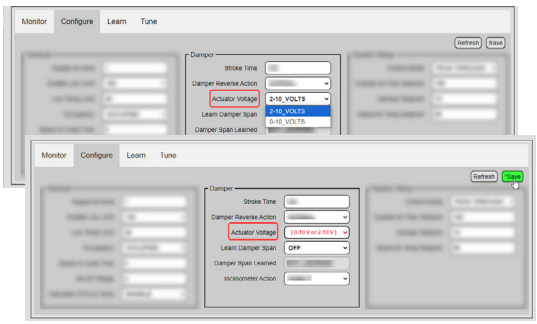
Set the Damper Stroke Time



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**.

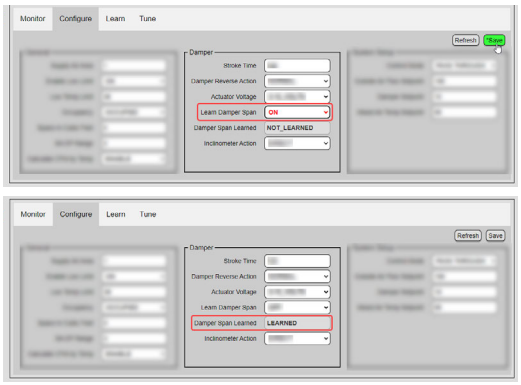
Set the Actuator Voltage Range



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**.

Turn On Learn Damper Span, then Verify

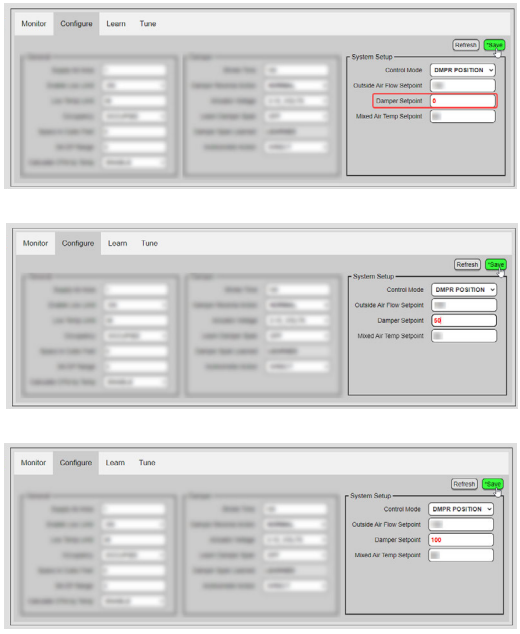


Before the AFMS can run **Learn Mode**, it must learn the minimum and maximum incline of the damper using the inclinometer. The **Learn Damper Span** sequence will take 3 to 5 minutes to complete.

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**.

Stroke Damper and Visibly Verify Positions



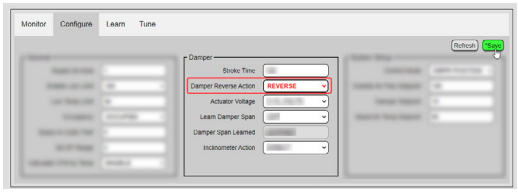
On the **Configure** page, in the **System Setup** group:

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**.

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)



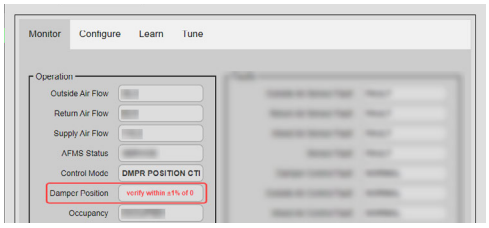
(if needed)

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**.

Stroke Damper and Verify that Reported Damper Position Follows

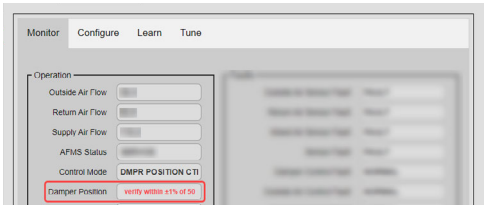
1. Go to **Configure** > the **System Setup** group:
2. Ensure that **DMPR POSITION** is set for **Control Mode**.
3. For D**amper Setpoint**, enter **0**.
4. Click **Save**.



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 ±1% of 0.

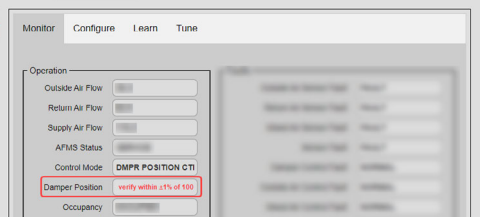
NOTE: The inclinometer can detect very small movements of the damper assembly.

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 ±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.



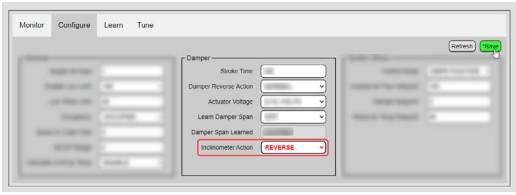
18. Go to the **Monitor** tab again.

19. Verify that **Damper Position** reports a value within ±1% of 100.

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

Set Inclinometer 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 **Inclinometer Action** to **REVERSE**.



(if needed)

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 **Inclinometer Action**, select **REVERSE** from the drop-down menu.

2. Click **Save**.

Damper span calibration is completed. Continue to the **Learning Mode Tasks on page 9**.

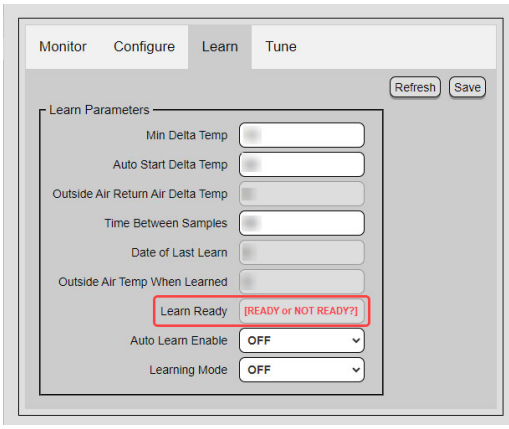
LEARNING MODE TASKS

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 Mode on page 11**.

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.

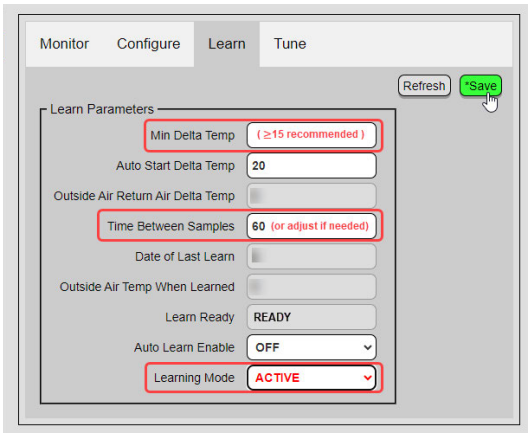
2. Leave **Time Between Samples** (Seconds) set to the default or adjust it if needed.

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 on page 10**.



Enabling Learning Mode to Auto Start

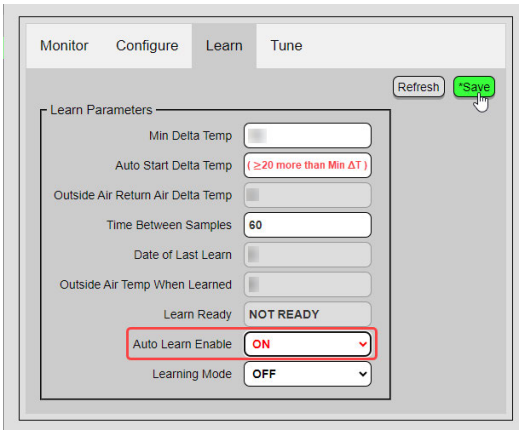
If **Learn Ready** reports **NOT READY** because of currently unfavorable temperatures, you may enable the AFMS to automatically start Learning Mode when it detects favorable temperatures later (overnight is likely).

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.

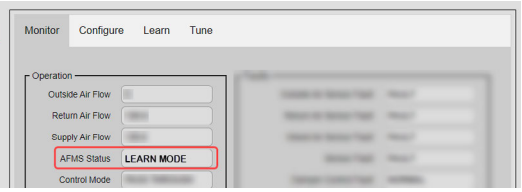
NOTE: Most often, **Time Between Samples** (Seconds) can be left on the default (60 seconds). You might increase the value if the damper **Stroke Time** is longer than that of a typical unit, or if the damper actuator requires extra time to respond.

4. For **Auto Learn Enable**, select **ON**.

5. Click **Save**.

6. Wait for Learning Mode to complete during favorable temperatures (overnight is likely).

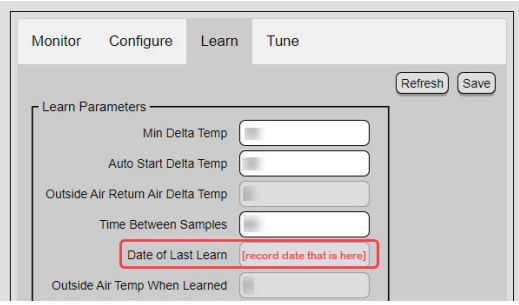
Skip to **Verify Learning Mode Completed and Record Date on page 10**.



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 on page 11.**

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**.

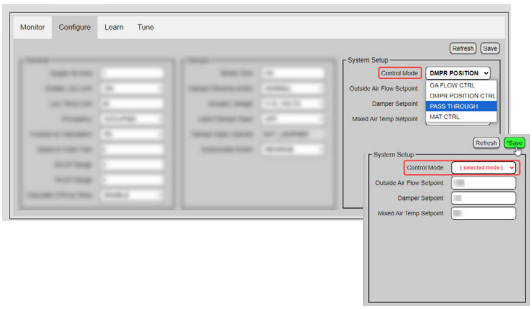
Repeat those steps for the remaining 12 damper positions listed on the **AFMS Table**.

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 pressure assist applications)
   - The **RA Fraction** column (for return air damper pressure assist applications 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.

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.

IMPORTANT NOTICES

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The KMC Connect Lite™ app for NFC configuration is protected under United States Patent Number 10,006,654.

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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.