

SIEMENS



BACnet LCM-OAVS Application 6723 and 6729

**VAV Room Pressurization with
Hot Water Reheat, BTU
Compensation and Slow
Damper Actuation — One
Exhaust, One Supply**

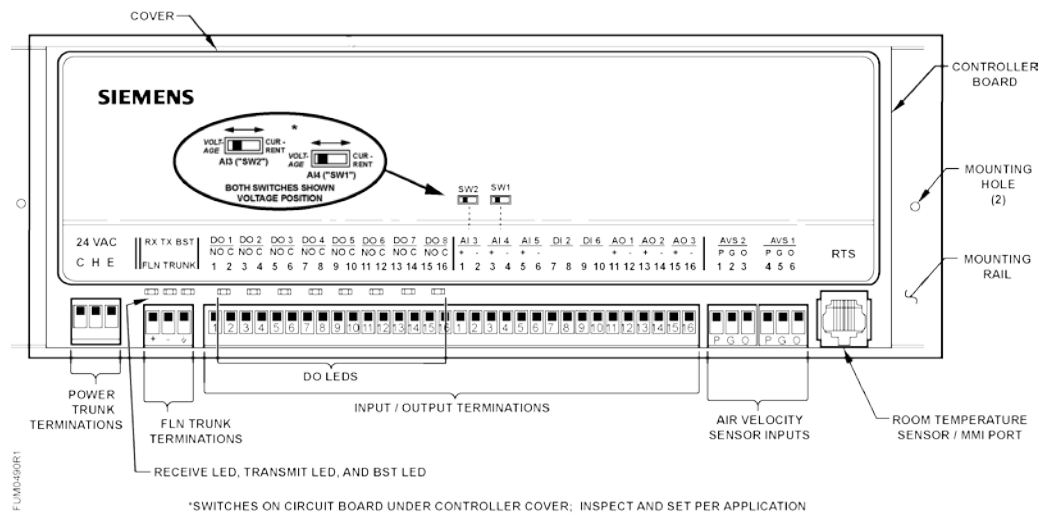
Start-up Procedures

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Before You Begin



Generic Controller I/O Layout. See *Wiring Diagram* for application specific details.

At the job site, locate the major control system and the mechanical and electrical drawings. These components include valves, motors, and any other components working in conjunction with the BACnet Laboratory Controller Module (LCM). Verify that the LCM input/output (I/O) points are wired per the installation instructions.



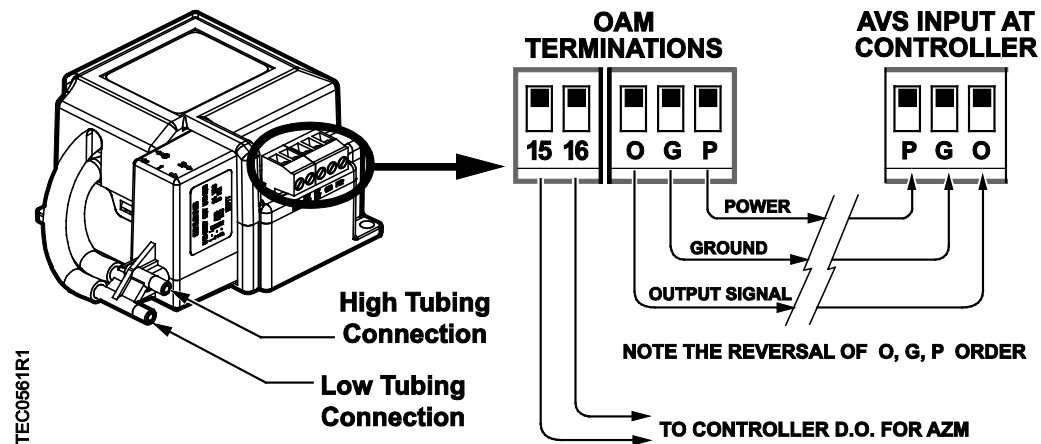
NOTE:

Update each controller at the field panel immediately after you have completed the controller start-up procedures and made all other changes to the controller's point database, including balancing, tuning, etc.



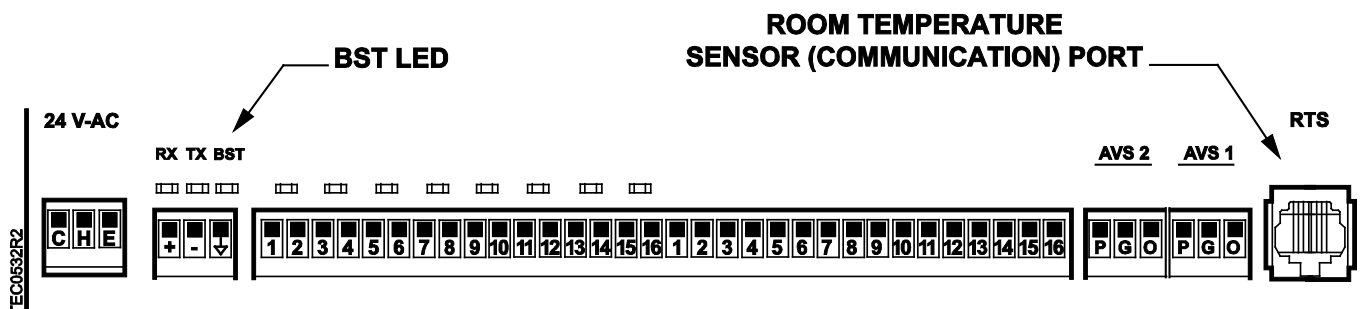
WARNING

LCM WILL BE DAMAGED/DESTROYED IF OFFBOARD AIR MODULE(S) ARE NOT WIRED CORRECTLY AND POWER IS APPLIED TO LCM.



Verifying Power

1. Verify that the controller has 24 Vac power and that the fuse has been inserted into the trunk or that power to the transformer is ON.
2. Verify that the Basic Sanity Test (BST) LED on the controller flashes once per second.



Verifying Slave Mode Application Number

1. Plug the HMI into the Room Temperature Sensor port. See the Figure LCM Showing Location of BST LED and RTS Port.
2. Verify that Application 6797 (Slave Mode) is running at the controller.

Setting the Application

1. Set APPLICATION to the desired number.
 - Application 6723: BACnet LCM-OAVS VAV Room Pressurization with HW Reheat and Damper Actuation — One Exhaust, One Supply

- Application 6729: BACnet LCM-OAVS VAV Room Pressurization with BTU Compensation, HW Reheat and Damper Actuation — One Exhaust, One Supply
- 2. Set CTLR ADDRESS to the correct value obtained from the controller schedule.
 - Each controller must have a unique address.
 - Typical values are from **00** to **127** for master and **128** to **255** for slave, 99 and 255 are reserved.

Configuring Supply and General Exhaust



NOTE:

On a return from power failure, the damper-command DOs (DOs 1 through 4) remain OFF for 5 seconds prior to resuming control. Because of this, it is recommended that the supply damper motor setup MTR SETUP be set to Enabled (normally closed) for rooms where negative or neutral pressurization is required and Enabled and Reversed (normally open, where the actuator is retracted) for positively pressurized rooms. Likewise, it is recommended that the general exhaust damper motor setup be set to Enabled and Reversed (via MTR SETUP) for rooms where negative or neutral pressurization is required and Enabled for positively pressurized rooms. The default for the motor direction is direct (not reversed).

1. Set MTR1 TIMING to the correct running time of the actuator. Applications 6723 and 6729 use GDE 131 actuators to control the damper. Therefore, set MTR1 TIMING to **90 seconds** for 60 Hz operation, or **108 seconds** for 50 Hz operation.
2. For a damper-actuator rotation-angle value other than 90°, set MTR1 ROT ANG to the appropriate value.
3. Enable the actuator by setting MTR SETUP to 1. Verify that the actuator completely closes the damper and that it remains closed. If it does not close, reverse the action of the actuator by setting MTR SETUP to 3.
If the damper still does not close completely, then the actuator has been installed or set up incorrectly. For more information see the actuator installation instructions, set up information, or *Automation Service Procedures* on InfoLink.
4. Set MTR2 TIMING to the correct run time of the actuator. Applications 6723 and 6729 use GDE 131 actuators to control the dampers. Therefore, set MTR2 TIMING to **90 seconds** for 60 Hz operation, or **108 seconds** for 50 Hz operation.
5. If the second actuator is a damper actuator with a rotation angle other than 90°, set MTR2 ROT ANG to the proper value.
6. Enable the second floating control actuator by referring to *Additive Values that Determine the Value of MTR SETUP* Table and changing MTR SETUP as follows:
 - If an actuator is present and enabled (MTR SETUP = 1), enable the second actuator by changing MTR SETUP to 5. Verify that the second actuator completely closes the damper and that it remains closed. If it does not close, reverse the action of the second actuator by setting MTR SETUP to 13.

- If an actuator is present, enabled, and reverse acting (MTR SETUP = 3), enable the second actuator by changing MTR SETUP to 7. Verify that the second actuator completely closes the damper and that it remains closed. If it does not close, reverse the action of the second actuator by setting MTR SETUP to 15.
- If the second floating control actuator still does not close completely, then the actuator has been installed or set up incorrectly.

The enabling and reversing, is also shown below in *Additive Values that Determine the Value of MTR SETUP* Table. Use the table to determine the value for MTR SETUP. The values are additive. For example, if you want to have Motor 1 (DOs 1 and 2) enabled, Motor 2 (DOs 3 and 4) enabled and reversed, you would set MTR SETUP equal to 13. (This is because the Motor 1 enable value is 1, the Motor 2 enabled and reversed value is 12. 1+12=13.)

Additive Values that Determine the Value of MTR SETUP.			
	Not Used	Enabled	Enabled and Reversed
Motor 1 (supply damper) (DO 1 and DO 2)	0	1	3
Motor 2 (exhaust damper) (DO 3 and DO 4)	0	4	12



NOTE:

For consistency with other applications, any value from 0-255 will be accepted, but only the values 0, 1, 3, 4, 5, 7, 12, 13 and 15 are appropriate for applications 6723 and 6729.

Setting DO DIR.REV



NOTE:

Applies only to DO points that are not used for motor points.

If the normal (de-energized) state of all of the devices controlled by DOs is direct-acting, then leave the point DO DIR.REV at its default value of 0.

Otherwise, reverse the action of the devices as follows:

1. Add the values in the *DO DIR.REV Table* for each DO you want to make reverse-acting.
2. Set DO DIR.REV to this value.

DO DIR.REV Values.	
Reverse-Acting DO	Value
DO 1	32
DO 2	16
DO 3	8

DO DIR.REV Values.	
Reverse-Acting DO	Value
DO 4	4
DO 5	2
DO 6	1
DO 7	64
DO 8	128

Setting Reheat Valve Configuration

1. Find the value of REHEAT AO1 that closes the valve by commanding REHEAT AO1 and observing the motion of the valve actuator. (Note that the presence of a discharge sensor makes it possible to detect valve operation by observing a change in discharge temperature).
⇒ Set VALVE CLOSED to this voltage value.
2. Find the value of REHEAT AO1 that opens the valve all the way.
⇒ Set VALVE OPEN to this voltage value.
3. Release **REHEAT AO1**.
4. Verify operation of the reheat valve.
⇒ Override VALVE CMD to 0 and verify that the valve closes.
⇒ Set VALVE CMD to **100%** and verify that the valve opens.
⇒ Release **VALVE CMD**.

Setting up External Airflow Variables

In this section, the external airflow variables are configured.

Setting MIN and MAX Airflow Setpoints



NOTE:

Airflow readings are most accurate when duct velocity is at least 300 fpm.

Minimum values in the Table *Min and Max Flow Limit Points* should be set up with this in mind.

1. Using values from the job specifications, enter the minimum and maximum flow limits for occupied and unoccupied conditions in each air terminal. Enter values for the points in the *Min and Max Flow Limit Points Table*.
2. If an unoccupied mode is not specified, set the UOC values equal to the OCC values.
3. If using supply or exhaust only, see the Operating without Supply or Exhaust section.

Min and Max Flow Limit Points.	
OCC SUP MAX	OCC SUP MIN
OCC GEX MAX	OCC GEX MIN
UOC GEX MAX	UOC GEX MIN
UOC SUP MAX	UOC SUP MIN

The equation relating airflow to air velocity is:

$$\text{Airflow (cfm)} = \text{Velocity (fpm)} \times \text{Duct Area (sq. ft.)} \times \text{Flow Coefficient}$$

Therefore, for best results: $\text{Airflow} \div (\text{Duct Area} \times \text{Flow Coefficient})$ should be > 300 .

For example:

$$\text{UOC SUP MIN} \div (\text{SUPDUCT AREA} \times \text{SUP FLO COEF}) > 300.$$

Fume Hood Maximum CFM

1. Set MAX HOOD VOL to the flow corresponding to 10 volts from the input signal source.
 - ⇒ If there is more than one fume hood in the room, the signals must be averaged using a Fume Hood Flow Module (FFM).
2. If using an FFM, set MAX HOOD VOL to the following: $(\text{AO2 RANGE} \times \text{Number of Hoods})$.
 - ⇒ The AO2 RANGE point in the FHC must be set to the same value in each FHC (maximum of six fume hoods per LCM).
 - ⇒ If there is more than one fume hood in the room, AO2 RANGE in each fume hood must be set to the same value that is the highest max value. For example, if one fume hood is 700 cfm and the second is 1200 cfm, each FHC AO2 RANGE should be set to 1200 cfm, while MAX HOOD VOL in the LCM would be set to 2400 cfm.

The resulting air flow is displayed in point HOOD VOL



NOTE:

If no fume hood(s) input will be connected to AI 3, make sure MAX HOOD VOL = 0 (default). This disables the alarm feature that would otherwise occur if the LCM were connected to a fume hood and the fume hood flow input dropped below 1 Vdc. When MAX HOOD VOL = 0, AI 3 is then available to use as a spare input.

Other Supply and Other Exhaust

Airflows not connected to the controller must be taken into consideration when pressurizing the room, including snorkels, canopies, and other supplies, such as offices within the lab space controlled by constant volume controllers. Since these inputs are not connected to the controller, the combination of their values must be entered into OTHER SUP and OTHER EXH so the controller can properly control the lab space.



NOTE:

If these airflow values change slowly or predictably (for example, VAV temperature control and/or occ/unoc differences), steps can be taken using PPCL to have the changes sent over the network to update OTHER EXH and OTHER SUP with the new values

- Set OTHER EXH and OTHER SUP using actual airflow values for any supply or exhaust equipment not connected to the controller that will remain constant.

Setting Volume Differential Setpoints



NOTE:

Because *volume difference* is defined as total exhaust minus supply, VOL DIF STPT is a positive value when the room is negatively pressurized, and vice versa.

VOL DIF STPT will equal UOC DIF STPT during unoccupied mode and OCC DIF STPT during occupancy.

- Set OCC DIF STPT and UOC DIF STPT to the desired value(s). The default is 400 cfm.

Setting TRACK MODE

Track mode (TRACK MODE) can be either Supply Tracks Exhaust (STE) or Exhaust Tracks Supply (ETS).

- Supply Tracks Exhaust mode is useful when trying to maintain negative pressurization.
- Exhaust Tracks Supply mode is useful when trying to maintain positive pressurization.

During Supply Tracks Exhaust, the supply air volume “tracks” or follows the exhaust air volume. If the exhaust air is “broke” (for instance is the general exhaust box damper is stuck open or stuck closed) the supply air will be adjusted so VOL DIF STPT is maintained as much as possible.

The supply air volume cannot go lower than zero and the application will not allow it to go higher than OCC SUP MAX during occupied periods or UOC SUP MAX during unoccupied periods.

During Exhaust Tracks Supply, the general exhaust air volume “tracks” or follows the supply air volume. If the supply air is “broke” (for instance is the supply box damper is stuck open or stuck closed) the general exhaust air volume will be adjusted such that VOL DIF STPT is maintained as much as possible.

The general exhaust air volume cannot go lower than zero and the application will not allow it to go higher than OCC GEX MAX during occupied periods or UOC GEX MAX during unoccupied periods.

Track mode can be different during occupied and unoccupied periods, depending on the value of TRACK MODE.

- Set TRACK MODE to the desired value, see the following table.

TRACK MODE Values.	
TRACK MODE (value)	Description
0 default	Always STE (Supply Tracks Exhaust), exhaust only.
1	STE during occupancy, ETS during the unoccupied period.
2	ETS during occupancy, STE during the unoccupied period.
3	Always ETS (Exhaust Tracks Supply), supply only.



NOTE:

If TRACK MODE is set greater than 3, it will default to 0.

Setting TRACK METHOD

The TRACK METHOD can be either FLOW or STPT. In most cases, TRACK METHOD should be set to FLOW.

When TRACK MODE is set up for **Exhaust Tracks Supply** flow tracking (ETS):

- TRACK METHOD = FLOW tracking; the general exhaust flow setpoint is calculated using the actual supply airflow being read at the controller.
- TRACK METHOD = STPT tracking; the general exhaust flow setpoint is calculated based on the setpoint for the supply terminal.

However, this module changes over to FLOW tracking mode if the supply is unable to reach setpoint.

When TRACK MODE is set up for **Supply Tracks Exhaust** flow tracking (STE):

- TRACK METHOD = FLOW tracking; the supply flow setpoint is calculated using the actual general exhaust airflow being read at the controller.
- TRACK METHOD = STPT tracking; the supply flow setpoint is calculated based on the setpoint for the general exhaust terminal.

However, this module changes over to FLOW tracking mode if the general exhaust is unable to reach setpoint.

- Set TRACK METHOD to **FLOW** or **STPT** as desired.

Setting Duct Area



NOTE:

If the LCM will be operating as Supply only, with no General Exhaust box present, or if it will be operating as General Exhaust only with no Supply box present, then follow the instructions in the *Configuring Supply and General Exhaust* section before proceeding to the next section.

If provided, enter the duct area into SUPDUCT AREA and GEXDUCT AREA. Otherwise, use the following table to determine duct area.

Area =	Round Duct	Rectangular Duct
Area in Sq. Ft. (Dimensions in inches)	$(\pi \times R^2)/144$	Length \times Height/144
Area in Sq. M (Dimensions in centimeters)	$(\pi \times R^2)/10,000$	Length \times Height/10,000



NOTE:

When entering the TEC definition for a controller at the field panel, do not enter a duct area. (Choose **N** for none when prompted for the duct shape.) This controller does not send the value of air volume to the field panel in velocity (fpm). Instead, it uses volume (cfm) so a conversion is not necessary.

Setting Flow Coefficients



CAUTION

It is extremely important that the flow readings are accurate.
Inaccurate flow readings will cause control problems.



NOTE:

The *Laboratory Room Single Duct Supply Air Terminal Technical Specification Sheet* (149-319) and *Laboratory Room Exhaust Air Terminal Technical Specification Sheet* (149-320), have a full listing of the latest coefficients for multiple setups. Those values and the coefficient values shown in the following table are initial values only. Actual values must be verified by the balancer.



NOTE:

Make sure the airflow sensors are calibrated before determining flow coefficients. This is done by setting CAL AIR to **YES** and waiting for it to switch back to NO on its own.

1. Set SUP FLO COEF and GEX FLO COEF to initial values that match your hardware configuration. See the following table.
2. Work with a balancer to obtain the exact value(s) for SUP FLO COEF and GEX FLO COEF using the following formula to fine-tune the flow coefficient:

$$\text{New Flow Coefficient} = (\text{Actual Volume} \div \text{Controller Volume}) \times \text{Old Flow Coefficient}$$

The actual volume is the value obtained from the balancer's measurements. The controller volume is the value obtained from GEX AIR VOL and SUP AIR VOL. If the controller volume is not within 5% of the actual volume, repeat the procedure until it is. Loose or kinked flow sensor tubes, tubing connected backwards, and improper actuator and/or Damper operation can cause inaccurate readings.

Flow Coefficient Initial Values.	
SUP FLO COEF	GEX FLO COEF
0.68	0.77

Automatic Calibration Option

To set CAL SETUP, select the automatic calibration option that best meets the job's requirements from the following table. It is highly recommended that option 4, the factory default mode, be used.

At the start of the calibration cycle, the controller automatically sets CAL AIR to **YES**. When the cycle is complete, it sets CAL AIR to **NO**.



NOTE:

The air velocity sensor should be calibrated at least once every 24 hours. Make sure that the sensor has been calibrated before balancing takes place, as this will affect the balancer's results.

CAL SETUP Options.	
CAL SETUP (value)	Description
0	Calibration occurs ONLY when the point CAL AIR is set to YES .
1	Calibration occurs when the field panel commands an occupied/unoccupied or a day/night mode changeover.
4 (factory default value)	Calibration occurs on the time interval set in the point CAL TIMER. Example: If CAL TIMER = 12, then the calibration period is 12 hours. Actual calibration is subject to a time delay based on the value of CTLR ADDRESS. See the example in Option 1. This is the recommended option when using a controller with an Autozero Module.

Setting Airflow Control

These steps require that the Air Velocity Sensors have been calibrated and are operating normally (neither SUP AIR VOL nor GEX AIR VOL (Point 30) are FAILED).



NOTE:

It is very important that the minimum and maximum airflows specified can be reached.

Verifying Flow Range

1. Set SUP FLO STPT to either OCC SUP MIN or UOC SUP MIN (whichever is less) and verify that SUP AIR VOL can reach that value. Then set SUP FLO STPT to either OCC SUP MAX or UOC SUP MAX (whichever is greater) and verify that SUP AIR VOL can reach that value.

(If it is not possible to achieve minimum and maximum airflow, then the fan system must be adjusted.) When done, release SUP FLO STPT.

2. Repeat this process for the general exhaust by setting GEX FLO STPT to either OCC GEX MIN or UOC GEX MIN (whichever is less) and verify that GEX AIR VOL can reach that value. Then set GEX FLO STPT to either OCC GEX MAX or UOC GEX MAX (whichever is greater) and verify that GEX AIR VOL can reach that value.

(If it is not possible to achieve minimum and maximum airflow, then the fan system must be adjusted.) When done, release GEX FLO STPT.

Tuning the Flow Loops

1. Set VOL DIF STPT to 0.
2. Change the flow by commanding SUP FLO STPT and examine the response. If the airflow oscillates or overshoots significantly, or if the supply damper oscillates, reduce the gain (SUP P GAIN). If it takes too long to reach the setpoint, increase SUP P GAIN. Try different values—it should move accurately and with stability. When the desired performance is achieved, release SUP FLO STPT.
3. Repeat the process for GEX FLO STPT, adjusting GEX P GAIN if necessary. When the desired performance is achieved, release GEX FLO STPT.
4. Release VOL DIF STPT.

Setting Control Modes (VAV and/or CV)

Applications can operate as either a variable air volume (VAV) controller or a constant volume (CV) controller. These operational modes can vary between the occupied and unoccupied periods, if desired.

VAV means that the supply airflow can be varied to provide cooling. CV means the supply airflow is not a source of cooling. However, the supply and general exhaust can still change in CV mode to keep the volume differential setpoint constant. This is necessary if HOOD VOL is varying.

The Table *VOLUME STATE Values* shows what the application does when VOLUME STATE is at a particular value.

- Set VOLUME STATE to the desired value.

VOLUME STATE Values.	
VOLUME STATE (value)	Description
0	Always Constant Volume.
1 (default)	VAV during occupancy, Constant Volume during unoccupied period.
2	Constant Volume during occupancy, VAV during unoccupied period.
3	Always VAV.

**NOTE:**

If VOLUME STATE is set greater than 3, it will default to 0.

Setting Room Pressurization Control Mode

In this section you will configure the points that determine room pressurization during occupied and unoccupied modes while the controller is operating as VAV or CV.

OCC CV MODE

If VOLUME STATE is **0** or **2** (that is, if the controller operates in the Constant Volume Mode during the occupied period) then this procedure needs to be performed. Otherwise, this section can be skipped.

1. Set NET OCC CMD to **OCC**, if it is not there already, to ensure that the LCM is in the occupied mode.
2. Set OCC SUP MIN to be numerically equal to OCC SUP MAX. (Setting OCC SUP MIN to be numerically equal to OCC SUP MAX sets the constant volume setpoint to be as high as possible during the occupied period.)
 - ⇒ Make sure that the system operates at the VOL DIF STPT and that the room is pressurized properly when the hood is opened and when the hood is closed. (by checking the value of VOL DIFFRNC). During occupied mode VOL DIF STPT equals OCC DIF STPT.
3. Set OCC SUP MIN to its desired value for the job. (This sets the constant volume setpoint to be as low as possible during the occupied period.)
 - ⇒ Make sure that the system operates at the VOL DIF STPT and that the room is pressurized properly when the hood is opened and when the hood is closed. (by checking the value of VOL DIFFRNC). During occupied mode VOL DIF STPT equals OCC DIF STPT.
4. When all conditions have been checked, set both OCC SUP MIN and OCC SUP MAX back to their desired values for the job. If NET OCC CMD is overridden, release it.



NOTE:

Set OTHER EXH and OTHER SUP to take into account any supply or exhaust airflow values from equipment or sources not connected to the controller.

If these airflow values change slowly or predictably (for example, VAV temp control and/or occ/unoc differences), steps should be taken to have the changes sent over the network to update OTHER EXH and OTHER SUP with the new values. This can be done apart from these startup instructions

UNOCC CV MODE

If VOLUME STATE is **0** or **1** (that is, if the controller operates in the Constant Volume Mode during the unoccupied period) then this procedure needs to be performed. Otherwise, this section can be skipped.

1. Do the following to ensure that the LCM is in the unoccupied mode:
 - a. Set NET OCC CMD to **UNOCC** if it is not there already.
 - b. Set OCC ENA to **0** if it is not there already.
2. Set UOC SUP MIN to be numerically equal to UOC SUP MAX. (Setting UOC SUP MIN to be numerically equal to UOC SUP MAX sets the constant volume setpoint to be as high as possible during the unoccupied period.)
 - ⇒ Make sure that the system operates at the VOL DIF STPT and that the room is pressurized properly when the hood is opened and when the hood is closed. (by checking the value of VOL DIFFRNC). During occupied mode VOL DIF STPT equals OCC DIF STPT.
3. Set UOC SUP MIN to its desired value for the job. (This sets the constant volume set point to be as low as possible during the unoccupied period.)
 - ⇒ Make sure that the system operates at the VOL DIF STPT and that the room is pressurized properly when the hood is opened and when the hood is closed. (by checking the value of VOL DIFFRNC). During occupied mode VOL DIF STPT equals OCC DIF STPT.
4. When all conditions have been checked, set both UOC SUP MIN and UOC SUP MAX back to their desired values for the job. If NET OCC CMD is overridden, release it.

**NOTE:**

Set OTHER EXH and OTHER SUP to take into account any supply or exhaust airflow values from equipment or sources not connected to the controller.

If these airflow values change slowly or predictably (for example, VAV temp control and/or occ/unoc differences), steps should be taken to have the changes sent over the network to update OTHER EXH and OTHER SUP with the new values. This can be done apart from these startup instructions

OCC VAV MODE

If VOLUME STATE is **1** or **3** (that is, if the controller operates in the VAV Mode during the occupied period) then this procedure needs to be performed. Otherwise, this section can be skipped.

1. Set NET OCC CMD to **OCC**, if it is not there already, to ensure that the LCM is in the occupied mode.
2. Verify pressurization in at least four airflow operating conditions. Make sure that the system operates at the VOL DIF STPT and that the room is pressurized properly. Use the following operating conditions:
 - a. Hoods open, minimum cooling
 - b. Hoods closed, minimum cooling
 - c. Hoods open, maximum cooling
 - d. Hoods closed, maximum cooling

**NOTE:**

To achieve the required conditions, set TEMP CTL VOL equal to OCC SUP MAX for maximum cooling and to OCC SUP MIN for minimum cooling.

3. When all conditions have been checked, release TEMP CTL VOL. If NET OCC CMD is overridden, release it.

**NOTE:**

Set OTHER EXH and OTHER SUP to take into account any supply or exhaust airflow values from equipment or sources not connected to the controller.

If these airflow values change slowly or predictably (for example, VAV temp control and/or occ/unoc differences), steps should be taken to have the changes sent over the network to update OTHER EXH and OTHER SUP with the new values. This can be done apart from these startup instructions

UNOCC VAV MODE

If VOLUME STATE is **2** or **3** (that is, if the controller operates in the VAV Mode during the unoccupied period) then this procedure needs to be performed. Otherwise, this section can be skipped.

1. Do the following to ensure that the LCM is in the unoccupied mode:
 - a. Set NET OCC CMD to **UNOCC** if it is not there already.
 - b. Set OCC ENA to **0** if it is not there already.
2. Verify pressurization in at least four airflow operating conditions. Make sure that the system operates at the VOL DIF STPT and that the room is pressurized properly. Use the following operating conditions:
 - a. Hoods open, minimum cooling
 - b. Hoods closed, minimum cooling
 - c. Hoods open, maximum cooling
 - d. Hoods closed, maximum cooling



NOTE:

To achieve the required conditions, set TEMP CTL VOL equal to UOC SUP MAX for maximum cooling and to UOC SUP MIN for minimum cooling.

3. When all conditions have been checked, release TEMP CTL VOL. If NET OCC CMD is overridden, release it.



NOTE:

Set OTHER EXH and OTHER SUP to take into account any supply or exhaust airflow values from equipment or sources not connected to the controller. If these airflow values change slowly or predictably (for example, VAV temp control and/or occ/unoc differences), steps should be taken to have the changes sent over the network to update OTHER EXH and OTHER SUP with the new values. This can be done apart from these startup instructions

Optional Rate Limiting of Actuators

Under specific circumstances, one actuator may consistently reach its set point faster than the other. This inequity may cause pressurization anomalies. Through the use SUP MAX RATE and GEX MAX RATE, CFM change rates can be adjusted to improve pressurization control. See the application guides for a more thorough explanation BACnet LCM-OAVS VAV Room Pressurization with HW Reheat and Damper Actuation — One Exhaust, One Supply Application 6723 and BACnet LCM-OAVS VAV Room

Pressurization with HW Reheat and Damper Actuation — One Exhaust, One Supply Application 6729 on InfoLink.

SUP MAX RATE is used to effectively limit the speed of the supply actuator. The default is 0 which means no rate limiting is being done.

GEX MAX RATE is used to effectively limit the speed of the exhaust actuator. The default is 0 which means no rate limiting is being done.

As a simple example, if an actuator flow changes 1800 cfm in 90 seconds, the current change rate is 20 cfm per second. If a lower value of 10 is entered, the full travel would now take twice as long – 180 seconds.

Since actuator flows are non-linear, the value entered is a rough approximation. Values would likely require adjustments.

SUP MAX RATE and **GEX MAX RATE** should be changed to values other than 0 only after a thorough analysis has been made of the job specific scenarios. For example, slowing down a given supply actuator to match a general exhaust actuator may actually be detrimental overall if the installation includes faster acting fume hoods.

AVS FAILMODE

AVS FAILMODE is an enumerated point that describes how the supply Damper and the general exhaust Damper will respond if one or both Air Velocity Sensors (AVS) fail. It can handle positively pressurized rooms as well as negatively pressurized rooms.

The default value of AVS FAILMODE is 0. This default causes both the supply and general exhaust to hold their current position when an AVS fails. Open Supply, Open Exhaust and Close Supply, Close Exhaust are not defined AVS FAILMODE states.

The *AVS Failure and AVS FAILMODE Values Table* shows what the application does when AVS FAILMODE is at a particular value and an air velocity sensor(s) has failed.

Set AVS FAILMODE to the desired value.

AVS failure and AVS FAILMODE values.	
	AVS FAILMODE
0 (default)	Hold Supply, Hold General Exhaust
1	Hold Supply, Open General Exhaust
2	Hold Supply, Close General Exhaust
3	Open Supply, Hold General Exhaust
4	Close Supply, Hold General Exhaust
5	Close Supply, Open General Exhaust
6	Open Supply, Close General Exhaust
7	VENTILATION
8	PRESSURE

**⚠ CAUTION**

If AVS FAILMODE is set to a value of 7 or 8, then VOL DIF MIN and VOL DIF MAX values must have the same sign. They must both be positive, or they must both be negative. Otherwise, damper(s) will respond incorrectly.

Alarms

ALARM ENA is an analog point whose value determines whether or not a particular alarm activates ALARM DO7.

For ALARM ENA, the terms enabled and not enabled do not mean that a particular alarm is enabled or not. It means whether or not a particular alarm will or will not activate ALARM DO7. For example, if ALARM ENA is set to 1 (Vent Alarm Enabled) and a ventilation alarm occurs, then both VENT ALM and ALARM DO7 will turn on. However, if ALARM ENA is not Vent Alarm Enabled and a ventilation alarm occurs, VENT ALM will turn on, but ALARM DO7 will not.

- Using the job specification, determine which alarms are required and set them up accordingly.

ALARM ENA Values.	
	ALARM ENA
0 default	No alarms are enabled.
1	Vent Alarm is enabled.
2	Alarm Switch is enabled.
4	Dif Alarm is enabled.
5	Vent Alarm and Dif Alarm are enabled
6	Alarm Switch and Dif Alarm are enabled
7	Vent Alarm, Alarm Switch, and Dif Alarm are all enabled

**NOTE:**

If ALARM ENA is set greater than 7, it will default to 0.

ALM ENA is additive. For example, if ALM ENA equals 5, then either a ventilation or a pressurization alarm would activate ALARM DO7, but the alarm switch would not.

Pressurization Alarm

1. To set the pressurization alarm, set DIF ALM DBD to the alarm level specified. If no value is specified, use the default value, provided that the warning that follows is satisfied.



⚠ WARNING

To ensure that VOL DIF ALM turns on before the pressure in the room changes sign, DIF ALM DBD must be less than the absolute value of VOL DIF STPT.

For example, if negative pressure is desired and VOL DIF STPT equals 70 cfm and DIF ALM DBD is 200 cfm, then the room could go positive by almost 130 cfm without the pressure alarm turning on. In this case, if you want the alarm to turn on before the room changes sign, then you must set DIF ALM DBD to be less than 70 cfm.

2. For delay time, set DIF ALM DEL to the value specified. If no value is specified, start with the default value of 30 seconds. Adjust as required to eliminate nuisance alarms.
3. Set ALARM ENA to a value that enables the pressure alarm (4, 5, 6, or 7) if the specification requires annunciation of the pressurization alarm through a local alarm device connected to ALARM DO7.



NOTE:

VOL DIF ALM is the output point that indicates an alarm condition.

Hardware Switch

The hardware alarm switch is ALM SWIT DI6. If the specification requires that the controller pass alarms from other equipment (connected to ALM SWIT DI6) to a local alarm device using ALARM DO7, then set ALARM ENA to a value that enables the Alarm Switch (2, 3, 6, or 7).

Ventilation Alarm

1. Set OC V ALM LVL to the specified alarm level for the occupied mode. It may be specified in air changes per hour. If so, convert it to cfm (lps).
If no ventilation alarm is required, set OC V ALM LVL to 0 (zero).
2. Set UC V ALM LVL to the specified value for the unoccupied mode. If no unoccupied mode is specified, use the same value as OC V ALM LVL.
(If ventilation alarms are not required during unoccupied mode, set UC V ALM LVL to 0 (zero).



NOTE:

Setting the alarm level to zero means the ventilation alarm will not turn on just because of a low value for TOTL SUPPLY. However, even if the alarm level is set to zero, the ventilation alarm will still turn on if:

- SUP AIR VOL stays below the currently active supply minimum for a time at least equal to VENT ALM DEL.

and/or

- GEX AIR VOL stays below the currently active general exhaust box minimum for a time at least equal to VENT ALM DEL.

- In the previous note, the currently active supply flow minimum is OCC SUP MIN during occupancy and UOC SUP MIN during the unoccupied period. Likewise, the currently active general exhaust box minimum is OCC GEX MIN during occupancy and UOC GEX MIN during the unoccupied period.

3. For the alarm delay, set VENT ALM DEL to the value specified. If no value is specified, use the default value.
4. Set ALARM ENA to a value that enables the ventilation alarm (1, 3, 5, or 7) if the job specification requires annunciation of the ventilation alarm through a local alarm device connected to ALARM DO7.



NOTE:

VENT ALM is the output point that indicates an alarm condition.

Network Alarms

If there are other alarms to be indicated in the local ALARM DO7, they may be programmed in the field panel to work through NET ALM CMD. No setup is required at the controller to enable this function.

Setting Occupancy Control

OCC ENA is an analog point whose value determines whether or not OCC BUTTON, or OCC SWIT DI2, is enabled.

The Table *OCC ENA Values* shows what is enabled when OCC ENA is at a particular value.

OCC ENA Values	
OCC ENA (value)	Description
0 (default)	Both OCC BUTTON and OCC SWIT DI2 are disabled.
1	Only OCC BUTTON is enabled.
2	Only OCC SWIT DI2 is enabled.

**NOTE:**

OCC ENA does not allow both OCC BUTTON and OCC SWIT DI2 to be enabled at the same time. This is because the switch point is a maintained input, while the button point is a momentary input. By setting OCC ENA to 1 or 2, the controller can be configured to be on the lookout for one or the other input type. It cannot be on the lookout for both types of input at the same time.

If OCC ENA is set greater than 2, it will display a 0 and act like it was set to 0.

**NOTE:**

There is no timeout for the push button input on lab controllers.

1. To set up occupancy control, determine the occupancy triggers required by the job specification.
 - If the controller must set occupancy according to the state of a switch connected to OCC SWIT DI2 set OCC ENA to 2.
 - If the controller must set occupancy according to the push button on the room thermostat, set OCC ENA to 1.
 - ⇒ If there are other occupancy criteria, they may be programmed at the field panel to work through NET OCC CMD. The controller does not require any setup for this.
 - ⇒ If network commands are not required and occupancy will be set by sources in the room, set NET OCC CMD to **UNOCC**. (If NET OCC CMD = OCC, the controller stays in occupied mode.)
2. If there is no unoccupied mode specified, do the following:
 - Set OCC ENA to 0 (default).
 - Set NET OCC CMD to **OCC** (default).

Setting Discharge Temperature Control

If the discharge temperature limits are called out in the specification, set DISCH MIN and DISCH MAX according to the specification. If they are not called out, then set the limits according to the desired HVAC system operation. For example, from 55°F to 80°F.

1. Set DISCH MIN to match the temperature supplied by the air handler. It should be set a few degrees lower than the air handler temperature. This will prevent undesired heating if there is some discrepancy between the sensor in the air handler and the one in the supply terminal.
2. Set DISCH MAX according to the heating function required.
 - ⇒ Many lab rooms do not need “heat,” meaning they never need supply air to come in above the room temperature setpoint. The reheat equipment only serves to reduce the cooling effect of the supply airflow. In this case, set DISCH MAX a few degrees higher than the room temperature setpoint.
 - ⇒ Rooms with significant exposure to cold outside conditions may call for discharge temperatures significantly above the room temperature. In these

rooms, DISCH MAX should be set to the warmest discharge temperature desired for the heating function—for example, 90 degrees.

3. Check the operation of the discharge temperature loop by overriding DISCH STPT and observing the response of DISCH TEMP. Tune the discharge temperature loop if necessary.
 - ⇒ The discharge temperature loop is more sensitive at low airflow than at high airflow. Check tuning at a low flow (such as minimum) by overriding the setpoint and observing the response of the discharge temperature.
 - ⇒ Overshoot is acceptable as a suggested response (even 5 to 10 degrees), but it should dampen out within 1 or 2 cycles. Small sustained oscillations may be acceptable if they do not overwork the valve. If acceptable performance is achieved at low flow, then the system should be stable, but not too slow at high flow.
4. Release DISCH STPT.

To set room temperature control, enter the room temperature setpoint (ROOM STPT) or set the thermostat dial. The room temperature should settle at the setpoint with very little oscillation within an hour. If it does not settle out or reach the setpoint, adjust the room temperature loop gains.



NOTE:

Advanced PID algorithms have been implemented at and near the setpoint to minimize actuator repositioning.

Room Temperature Setpoint Limits

If the room temperature sensor has a setpoint dial that will be used, set RM STPT MIN and RM STPT MAX for the minimum and maximum allowable room temperature set point values, respectively. Common values for these points are 65°F (18°C) for RM STPT MIN and 80°F (27°C) for RM STPT MAX.



NOTE:

If CTL STPT is going to be controlled from a field panel, this section can be skipped. When CTL STPT is overridden or controlled by a field panel, RM STPT MIN/MAX are ignored.

Setting Room Temperature Control

To set room temperature control, enter the room temperature setpoint (ROOM STPT) or set the thermostat dial. The room temperature should settle at the setpoint with very little oscillation within an hour. If it does not settle out or reach the setpoint, adjust the room temperature loop gains.



NOTE:

Advanced PID algorithms have been implemented at and near the setpoint to minimize actuator repositioning.



NOTE:

When using a Series 2000 Room Thermostat:

During **unoccupied mode**, you cannot change the Room Setpoint using a Siemens Industry Series 2000 thermostat. Any attempt to change Room Setpoints during unoccupied mode using a Series 2000 stat will be ignored.

During **occupied mode**, the Room Setpoint can be changed using a Series 2000 stat, but if it is, then the controller initial values should be uploaded to the field panel. Otherwise the controller will not keep the adjusted Room Setpoint value upon return from a power failure.

See the *APOGEE Automation Service Procedures* on InfoLink for additional information on room temperature control problems.

Room Temperature Offset (Optional)

TEMP OFFSET is a user-adjustable offset that will compensate for deviations between the value of ROOM TEMP and the actual room temperature. This corrected value is displayed in CTL TEMP.

$$\text{CTL TEMP} = \text{ROOM TEMP} + \text{TEMP OFFSET}$$

Example

If the actual room temperature is 72.0°F, and the value of ROOM TEMP is 73.0°F, then the value entered into TEMP OFFSET is -1.0. In this case, the value of ROOM TEMP would read 73.0°F, but the value of CTL TEMP would read 72.0°F.



NOTE:

Update each controller at the field panel immediately after you have completed the controller start-up procedures and made all other changes to the controller's point database, including balancing, tuning, etc.

MODHTG FLO

As a safety feature for jobs where reheat is an electric element, these applications include MODHTG FLO to ensure that adequate airflow is present before reheat is energized. The value is in feet-per-minute (differing from cfm) and is defaulted to 300 fpm, which means that the airflow must be at least 300 fpm before heating output is enabled. (Using fpm (feet per minute) rather than cfm (cubic feet per minute) makes the feature not dependent on duct size.)

A value of 300 fpm equates to the following cfm:

In a 12 inch diameter duct and a typical flow coefficient of 0.7, 300 fpm equates to 158 cfm.

$$12 \text{ inch diameter} = 0.75 \text{ sq ft}$$

$$0.75 \text{ sq ft} * 300 \text{ fpm} * 0.7 = 158 \text{ cfm}$$

In an 8 inch diameter duct and a typical flow coefficient of 0.7, 300 fpm equates to 74 cfm.

8 inch diameter = 0.35 sq ft

0.35 sq ft * 300 fpm * 0.7 = 74 cfm

The default value of 300 fpm can be raised or lowered as required based on manufacturers minimum flow recommendation for a given electric reheat element. As the fpm changes by a certain percentage, the associated minimum cfm for a given duct size will also change by that same percentage.

If the application uses hot water heat rather than electric heat, then MODHTG FLO may be set lower than the default value of 300. This would allow reheating to occur even if for some reason the box is operating well below its designated minimum flow setting.

Setting RH Calculation

Inputs



NOTE:

The AI 3/AI 4 current voltage switch is used to properly set an input of 0-10v or 4-20mA. (This is the switch on the controller, not an actual point.)

AI 3 / AI 4 - Ranges from 0-10 V or 4-20mA depending on the value of the voltage / current switch for AI 3 (or AI 4).

RH CONFIG - This is an enumerated value used for selecting the physical RH input as well as enabling and disabling the RH control.

Outputs

RM RH - The value, in percentage, of RH (humidification control) at the RM sensor.

The point RM RH is assigned using the percentage value from AI 3 (or AI 4) or it may be overridden by a digital room stat.

RH CONFIG is an enumerated analog point that has the following four mode values:

- 0 - RH control is totally disabled.
- 1 - RH control is enabled. AI 3 and AI 4 are both spare. The value of RM RH is used for RH control and in this mode the value of RM RH is set via PPCL from a field panel or by a digital room stat.
- 3 - RH control is enabled. AI 3 is the input used for calculating RM RH. AI 4 is spare.
- 4 - RH control is enabled. AI4 is the input used for calculating RM RH. AI 3 is spare.

If RM RH is overridden while in modes 1, 3, or 4, the overridden value is used for RH control purposes.

If RM RH is overridden while in mode 0, there is to be no RH control even if RM RH is overridden to some high value that normally would result in RH control.

Entering a value other than one of these four valid values will return 0; no RH control.



NOTE:

Mode 2 is intentionally skipped so that modes 3 and 4 can be used for inputs 3 and 4 respectively.

Setting STAT SUPV

The point STAT SUPV is used when a digital room unit is used with the all controllers. The value set, allows the temperature, humidity, and CO₂ subpoints to read failed when the room unit is not functioning or is disconnected. It also defines the thermistor input being used.

If a value is not selected, the points will not fail. If you enable supervision for a feature that is not being used, such as humidity or CO₂, that value always displays as failed.

- If the digital room unit (Series 2200 or 3200) is being used, STAT SUPV must be set to a value greater than 0 (zero), to define temperature sensing and thermistor inputs.

Configure STAT SUPV using the following values, these values are additive.

For example, If using a Series 2200 or 3200 room unit and you want temperature and CO₂ sensing and a 100K thermistor on AI 5, the value set in STAT SUPV would be 13 (1 + 4 + 8 = 13).

Value	Description
1	Temperature sensing only
2	Relative Humidity (RH) sensing
4	CO ₂ sensing
8	To select a 10K (default) or 100K Ω software selectable thermistor on AI 5 (for long board), AI 3 (for short board)
16	To select a 10K (default) or 100K Ω software selectable thermistor

Flashing Controller Firmware

FLT Procedure

Use Commissioning Tool Firmware Loading Tool (FLT) for this procedure.

1. Connect to RTS port of PTEC.
2. Set Communications to **1200 baud** and **ID**.
3. Click the **Identify** button in FLT.
4. Browse for new firmware.
5. Select **Load**.

WCIS Procedure

1. Connect to device.
2. From the **Device** menu, select, **Load TEC Firmware**
3. Click the **Browse** button in **Load TEC Firmware** dialog box.
4. Select the firmware.
5. Select **Load**.

Start-up Notes

This section includes notes on operating the LRC with only a supply or general exhaust box.

Configuring Supply Only

Do the following if Application 6723 is run without a general exhaust box:

1. Set TRACK METHOD to **FLOW**.
2. Set the following points to **0**:
 - TRACK MODE
A value of 0 = STE (supply tracks exhaust) Flow Tracking, which should be used for both the occupied and unoccupied modes.
 - GEX FLO COEF
When GEX FLO COEF equals 0, GEX AIR VOL will always read 0, but will never show as Failed.
 - OCC GEX MIN and UOC GEX MIN
If these two points are not set to 0, GEX AIR VOL—which will read 0 since GEX FLO COEF was set to 0—will be less than the general exhaust box minimum, resulting in a false ventilation alarm.
3. In this setup, the application varies the supply airflow as the fume hood flow changes in order to maintain the proper room pressurization. The supply airflow is not varied as a source of cooling; all temperature control is done by the reheat valve. Because of this, START should be set to **100** to allow the reheat valve to be controlled by the full range of TEMP LOOPOUT and to prevent the room temperature PID Loop from winding up.

Configuring Supply Only with BTU Compensation

Do the following if Application 6729 is run without a general exhaust box:

1. Set TRACK METHOD to **FLOW**.
2. Set the following points to **0**:
 - TRACK MODE
A value of 0 = STE (supply tracks exhaust) Flow Tracking, which should be used for both the occupied and unoccupied modes.
 - GEX FLO COEF
When GEX FLO COEF equals 0, GEX AIR VOL will always read 0, but will never show as Failed.
 - OCC GEX MIN and UOC GEX MIN
If these two points are not set to 0, GEX AIR VOL—which will read 0 since GEX FLO COEF was set to 0—will be less than the general exhaust box minimum, resulting in a false ventilation alarm.
 - VOLUME STATE
When a general exhaust box is not present, the application will vary the supply airflow as the fume hood flow changes, in order to maintain the proper room

pressurization. In this setup, the supply airflow is not varied for cooling purposes; all temperature control is done by the reheat valve. Because of this, VOLUME STATE should be set to 0 to prevent the BTU Compensator from trying to use the supply airflow for cooling.

Configuring Exhaust Only

Do the following if Application 6723 is run without a supply box:

1. Set TRACK METHOD to **FLOW**.
2. Set TRACK MODE to **3** (a value of 3 = ETS Flow Tracking, which should be used for both the occupied and unoccupied modes).
3. Set the following points to **0**:
 - SUP FLO COEF
When SUP FLO COEF equals 0, SUP AIR VOL will always read 0, but will never show as Failed.
 - OCC SUP MIN and UOC SUP MIN
If these two points are not set to 0, SUP AIR VOL—which will read 0 since SUP FLO COEF was set to 0—will be less than the supply box minimum, resulting in a false ventilation alarm.
4. This setup is useful when the room has a constant source of supply air from other equipment or sources not connected to the LCM.
 - If you enter this constant supply air volume value into OTHER SUP, the application will vary the general exhaust airflow as the fume hood flow changes in order to maintain the proper room pressurization.
 - Since all temperature control will be done by the reheat valve, START should be set to **100** to allow the reheat valve to be controlled by the full range of TEMP LOOPOUT and to prevent the room temperature PID Loop from winding up.

Configuring Exhaust Only with BTU Compensation

Do the following if Application 6729 is run without a supply box:

1. Set TRACK METHOD to **FLOW**.
2. Set TRACK MODE to **3** (a value of 3 = ETS Flow Tracking, which should be used for both the occupied and unoccupied modes).
3. Set the following points to **0**:
 - SUP FLO COEF
When SUP FLO COEF equals 0, SUP AIR VOL will always read 0, but will never show as Failed.
 - OCC SUP MIN and UOC SUP MIN
If these two points are not set to 0, SUP AIR VOL—which will read 0 since SUP FLO COEF was set to 0—will be less than the supply box minimum, resulting in a false ventilation alarm.
4. This setup is useful when the room has a constant source of supply air from other equipment or sources not connected to the LRC. If you enter this constant supply

air volume value into OTHER SUP, the application will vary the general exhaust airflow as the fume hood flow changes, in order to maintain the proper room pressurization.

- Since all temperature control will be done by the reheat valve, VOLUME STATE should be set to **0**.
- Both OCC SUP MAX and UOC SUP MAX should be set equal to **OTHER SUP**. This will prevent the BTU Compensator from trying to use the supply airflow as a source of cooling.

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