SIEMENS

P1 TEC

Siemens VAV with 0-10V Series-Fan Speed Output, Occupancy Sensor and 3-Stage Electric Heat

Start-up Procedures

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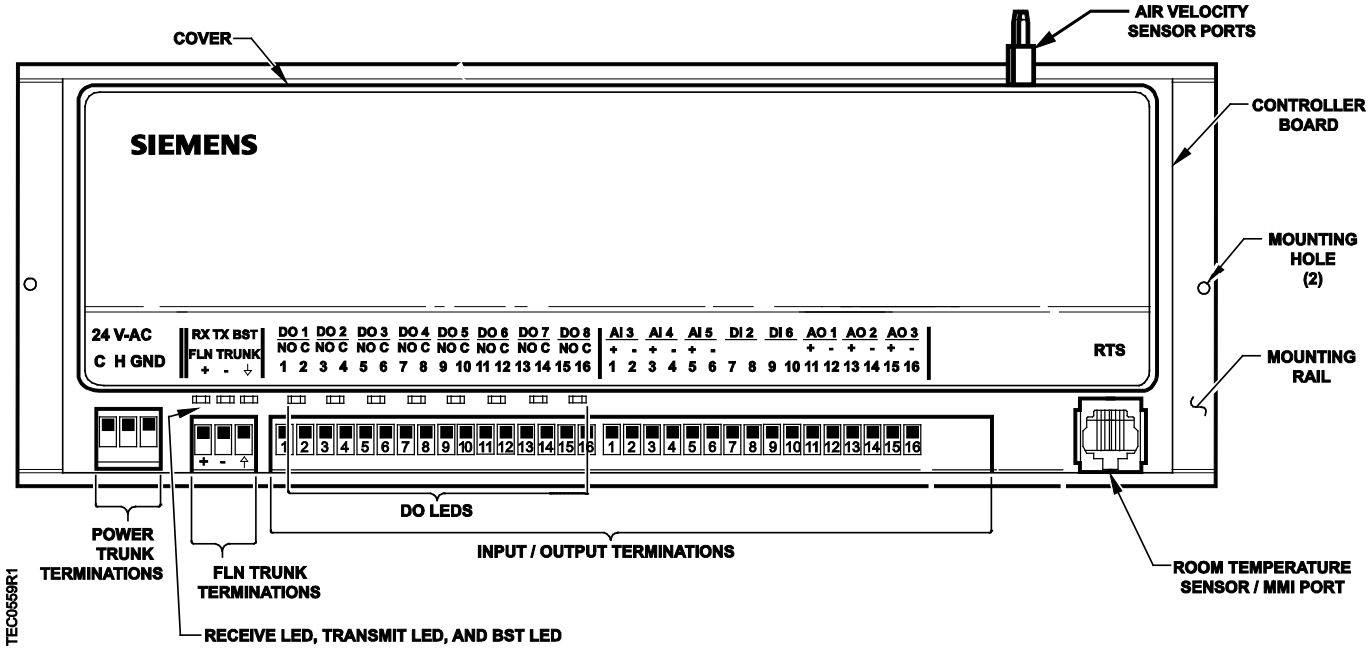
Before You Begin



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 TEC.

1. Verify that the TEC input/output (I/O) points are wired per the installation instructions.
2. Verify that the Basic Sanity Test (BST) LED on the controller flashes once per second, If BST LED does not flash on/off, see the *APOGEE Automation Service Procedures* on InfoLink for troubleshooting information.

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.

Verifying Slave Mode Application

1. Verify that APPLICATION is set to **2158**.
2. Display the STARTUP report.

Enabling Actuators

⚠ CAUTION

The controller's DOs control only 24 Vac loads.
The maximum rating is 12 VA for each DO.

The point that determines actuator run times are:

- MTR 1 TIMING
- MTR 2 TIMING
- MTR 3 TIMING

Your application may not have or use all three points.

1. Use the following table to set run time(s) for the actuator used by your application.
2. For damper rotation angles other than 90°, set ROT ANG to the appropriate value.

Damper Actuator Run Time		
Damper Actuator	**Setting (seconds)**	
	50 Hz	**60 Hz**
GDE 131.1 (flaoting control)	108	90
GLB 131.1 (floating control)	150	125
GDE 161.1 (0 to 10 V control)	108	90
GLB 161.1 (0 to 10 V control)	150	125
PTS4 electronic-to-pneumatic transducer from ACT	-	90

Valve Actuator Run Time		
Valve Actuator	**Setting (seconds)**	
	50 Hz	**60 Hz**
SSB81U, floating control fail in place	180	150
SSC81U, floating control fail in place	150	125
SSC81.5U, floating control fail-safe	125	125
SQS85.53U, floating control spring return	35	30
SSB61U, 0-10V proportional fail in place	75	75
SSC61U, 0-10V proportional fail in place	30	30
SSC61.5U, 0-10V proportional fail safe	25	25
SQS65U, 0-10V proportional fail in place	35	30

Valve Actuator Run Time		
Valve Actuator	Setting (seconds)	
	50 Hz	60 Hz
SQS65.5U, 0-10V proportional fail safe (SR)	35	30
PTS4 electronic-to-pneumatic	-	90

Specifying Motor Setup

⚠ CAUTION

If an Autozero Module is used, do not enable MTR3 (valve 2).

MTR SETUP determines which actuators are controlled by the application and whether they are direct or reverse acting. Set MTR SETUP according to Table *MTR SETUP Values*.

NOTE:
When MTR SETUP is changed, all enabled actuators will calibrate. Wait until each actuator has completed its calibration before continuing.

MTR SETUP Values									
	Motor 1 Enabled			Motor 1 Enabled and Reversed			Motor 1 Not Used		
	Motor 2 Not Used	Motor 2 Enabled	Motor 2 Enabled and Reversed	Motor 2 Not Used	Motor 2 Enabled	Motor 2 Enabled and Reversed	Motor 2 Not Used	Motor 2 Enabled	Motor 2 Enabled and Reversed
Motor 3 Not Used	1	5	13	3	7	15	0	4	12
Motor 3 Enabled	17	21	29	19	23	31	16	20	28
Motor 3 Enabled and Reversed	49	53	61	51	55	63	48	52	60

Verifying Actuator Setup

1. Command all actuators closed. Verify that they close and remain closed. If not, adjust the setting for MTR SETUP according to Table *MTR SETUP Values*.
2. If any of the actuators still do not close completely, then the actuators have been installed or set up incorrectly. See the Installation Instructions, the iKnow Troubleshooting Tool, or contact Technical Support.

Setting the Application

Add the TEC to your job database and select Application 2157.

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

The air velocity sensor calibration cycle begins within three minutes of an application start-up or initialization, depending on the controller's address. After this delay, the calibration cycle takes from 2 to 5 minutes to complete. The air damper closes during calibration.

NOTE:
You can continue the startup procedure while calibration is underway. However, the controller will ignore commands to control end devices (such as the damper) until calibration of the air velocity sensor is finished.

Setting Electric Heat Stages

Check the hardware to verify the number of electric heat stages used. Set STAGE COUNT to this value.

Enabling Autozero Module

If an Autozero Module is used, enable it by setting CAL MODULE to **YES**.

⚠ CAUTION

If an Autozero Module is used, do not enable MTR3 (valve 2).

NOTE:
For a controller without an Autozero Module, the damper is commanded closed to get a zero airflow reading during calibration. For a controller with an Autozero Module, the damper is closed only for the first calibration after controller initialization or power up.

Selecting Automatic Calibration Option

1. Using the following table, set CAL SETUP to the value that best meets your job requirements.
2. If appropriate, change CAL TIMER from the default of 12 hours. This setting applies only if your choice for CAL SETUP includes Option 4.

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 a day/night mode changeover. Actual calibration is subject to a time delay of 0, 1, 2, or 3 minutes. This delay is determined by the point CTLR ADDRESS divided by 4. The remainder is the time delay in minutes. **Example:** If CTLR ADDRESS = 11, then the controller will wait 3 minutes (11 ÷ 4 = 2 R3) after it receives the day/night mode changeover command before beginning the calibration routine.
2	Calibration occurs immediately after the override switch is pressed.
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.

NOTE:
Options can be combined by summing their numbers. For example, to calibrate in Options 1 and 2, set CAL SETUP to **3**.

Setting Room Temperature Setpoints

- Day cooling: OCC CLG STPT
- Day heating: OCC HTG STPT
- Night cooling: UOC CLG STPT
- Night heating: UOC HTG STPT
- Standby Offset (STBY OFFSET), optional (default = 0.0 deg)

1. If the room temperature sensor has a setpoint dial that will be used, set STPT DIAL to **YES**. Otherwise, set STPT DIAL to **NO**.
   - Set RM STPT MIN and RM STPT MAX for the minimum and maximum allowable room temperature setpoint values, respectively. Valid values range from 55° to 95°F (13° to 35°C). Default values are 55°F (13°C) for RM STPT MIN and 90°F (32°C) for RM STPT MAX.
2. Setpoint dial configured with a heating/cooling deadband (default).
   - To allow the controller to operate with a heating/cooling deadband (functioning the same as provided when the setpoint dial is not present) the following configuration should be used.

- Set the OCC HTG STPT less than the OCC CLG STPT by the deadband (or zero energy band) that is desired. (for example, OCC HTG STPT = 70°F; OCC CLG STPT = 74°F, providing a deadband of 4 degrees). Only the difference between these values is used to determine the setpoint that will be used.
- As described below, the setpoint(s) for heating/cooling will be 1/2 of the deadband above or below the setpoint dial value.

⇨ When HEAT.COOL equals HEAT, then:
⇨ CTL STPT will equal RM STPT DIAL – 0.5 * (OCC CLG STPT – OCC HTG STPT) and will be limited by RM STPT MIN and RM STPT MAX.
⇨ When HEAT.COOL equals COOL, then:
⇨ CTL STPT will equal RM STPT DIAL + 0.5 * (OCC CLG STPT – OCC HTG STPT) and will be limited by RM STPT MIN and RM STPT MAX.
NOTE: A space where the deadband is used can be more energy efficient than a space where the deadband is not being used.

3. Setpoint dial configured for zero heating/cooling deadband.
   - When the job specification requires a common heating and cooling temperature setpoint, the following configuration should be used.
   - Set OCC HTG STPT equal to OCC CLG STPT. This will configure the setpoint deadband equal to zero.
   - If a setpoint deadband equals zero, then:
     CTL STPT will equal RM STPT DIAL, and will be limited by RM STPT MIN and RM STPT MAX.
     NOTE: A space where the heating/cooling deadband is zero may be more comfortable than a space where the deadband is being used, but may use more energy.
4. Set the room temperature setpoints to the desired values. Heating setpoints are not present in cooling only applications.
5. STBY OFFSET (standby offset). This optional temperature offset setpoint is used only in conjunction with an optional occupancy sensor to provide additional energy reduction during occupied modes. If an occupancy sensor is being used and no activity is detected (no one present) in the zone during occupied times, OCC STBY (occupied standby) will be set to YES. When OCC STBY = YES, the airflow is switched/reduced to the night flow setpoints, but the temperature control will remain at normal occupied setpoints unless STBY OFFSET has been configured. STBY OFFSET (default 0.0 deg) can be set to raise the cooling setpoint and lower the heating setpoint when OCC STBY = YES, providing an additional reduction in energy consumption.

Setting Room Temperature Offset (optional)

When the room has stabilized, take a precision temperature reading over a period of time at the room temperature sensor, record any difference between this reading and the value of ROOM TEMP and set this difference value (to the nearest 0.25°F (0.14°C)) into RMTMP OFFSET (or TEMP OFFSET).

Example

If the actual room temperature is 72.0°F (22.2°C), but the value of ROOM TEMP is showing 73.0°F (23.8°C), then the value to be entered into RMTMP OFFSET (or TEMP OFFSET) would be –1.0 (negative 1 degree). In this case, ROOM TEMP would read the raw value 73.0°F (23.8°C), but CTL TEMP would equal 72.0°F (22.2°C).

CTL TEMP = ROOM TEMP + RMTMP OFFSET (or TEMP OFFSET)

Setting Stat Supervision

STAT SUPV is a configurable point (values are additive). Configuration will differ depending on the type of room unit (stat) being used. (Note: If the room unit is analog, STAT SUPV is used **only** to specify thermistor inputs as 10K or 100K.Therefore for analog room units the only values possible for STAT SUPV are 0, 8, or 16. See the table below.

If the room unit is digital, STAT SUPV defines the thermistors **and also** enables the room unit temperature, humidity and/or CO_2 points to be read by the controller. For digital room units, if a temperature, humidity, or CO_2 value (see table) is not included in the configured value for STAT SUPV, then the related point cannot be read (or ever display as failed). Conversely, if you enable supervision for a feature that the room unit does not support, then the related point will always display as failed.

Example: If you are using a digital room unit and need temperature and CO_2 sensing and a 100K thermistor on AI 5, you would set STAT SUPV = 13 (1 + 4 + 8 = 13). See the table below.

STAT SUPV Additive Values	
Value	**Description**
0 (default)	10K Ω thermistor(s)
1	Temperature sensing [1]
2	Relative Humidity (RH) sensing [1]
4	CO_2 sensing [1]
8	If short board: 100K Ω thermistor on AI 3 If long board: 100K Ω thermistor on AI 5
16	Long board only: 100K Ω thermistor on AI 4 (AI 4 must be a thermistor input, not a 0-10V/4-20 mA input.)

1) Additive values 1, 2, 4 **must not** be used with analog Series 1000 / 2000 room units.

Setting Override Time

If using night/unoccupied override, set OVRD TIME to the number of whole hours that an override should last. If OVRD TIME equals 0 (default), this feature is disabled.

Setting FAN MODE

Set FAN MODE to the desired value, CONST or VARI. (VARI is the default, and means variable volume; CONST means constant volume.)

Setting Fan Flow Points (STAGE COUNT less than 3)

If STAGE COUNT equals 3, continue to the next section Setting Fan Flow Points (STAGE COUNT equals 3).

1. Set FAN FLO CMAX to the maximum desired value that FAN FLOW should be during the occupied cooling mode. FAN FLO CMAX is also the value of FAN FLOW if FAN MODE equals CONST and the fan is ON.
2. Do one of the following:
   - If FAN MODE equals VARI, proceed with step 3 of this section.
   - If FAN MODE equals CONST, and STAGE COUNT equals 2, skip to step 4.
   - If FAN MODE equals CONST but STAGE COUNT is less than 2, skip steps 2 through 4, but READ THE NOTE at the end of this section, and then go to the *Setting FAN TIME* section.
3. Enter into FAN FLOW MIN the minimum value that you want FAN FLOW to be during the occupied heating and cooling modes.
4. Enter into FAN FLO HMAX the maximum value that you want FAN FLOW to be during the occupied heating mode.

NOTE:
If FAN MODE = CONST, it is STRONGLY recommended that FAN FLO MID be set equal to or greater than FAN FLO HMAX.

Setting Fan Flow Points (STAGE COUNT equals 3)

1. Set FAN FLO CMAX to the maximum desired value that FAN FLOW should be during the occupied cooling mode. FAN FLO CMAX is also the value of FAN FLOW if FAN MODE equals CONST and the fan is ON.
2. Do one of the following:
   - If FAN MODE equals VARI, proceed with step 3 of this section.
   - If FAN MODE equals CONST, and STAGE COUNT equals 2, skip to step 4.
   - If FAN MODE equals CONST but STAGE COUNT is less than 2, skip steps 2 through 4, but READ THE NOTE at the end of this section, and then go to the *Setting FAN TIME* section.

3. Enter into FAN FLOW MIN the minimum value that you want FAN FLOW to be during the occupied heating and cooling modes.
4. Enter into FAN FLO HMAX the maximum value that you want FAN FLOW to be during the occupied heating mode.
5. If you do not want any heating stage to modulate until the airflow out of the fan is equal to FAN FLO HMAX, then set both FAN FLOW MID and FAN FLO MORE equal to or greater than FAN FLO HMAX. Proceed to the *Setting FAN TIME* section.
6. If you want the 1st heating stage to be able to time modulate at a lower airflow than the 2nd heating stage does and if you want the 2nd heating stage to be able to time modulate at a lower airflow that than the 3rd heating stage does then set FAN FLO MORE less than FAN FLO HMAX and set FAN FLOW MID less than FAN FLO MORE.
7. When the fan flow points are set this way, the 1st stage of heat can time modulate when FAN FLOW becomes equal to or greater than FAN FLOW MID, the 2nd stage of heat can modulate when FAN FLOW becomes equal to or greater than FAN FLOW MORE and the 3rd stage of heat can time modulate when FAN FLOW becomes equal to or greater than FAN FLOW HMAX. Proceed to the *Setting FAN TIME* section.
8. If you want the 1st heating stage to time modulate at a lower airflow than the 2nd heating stage does and if you want the 2nd heating stage to time modulate at the same airflow that the 3rd heating stage does, then set FAN FLO MID less than FAN FLO HMAX and set FAN FLO MORE greater than FAN FLO HMAX.
9. When the fan flow points are set this way, then the 1st stage of heat will be allowed to time modulate when FAN FLOW becomes equal to or greater than FAN FLOW MID, while the 2nd and 3rd stages of heat cannot time modulate until FAN FLOW becomes equal to or greater than FAN FLOW HMAX. Proceed to the *Setting FAN TIME* section.
10. If you want the 1st heating stage to time modulate at the same airflow that the 2nd heating stage does and if you want the 2nd heating stage to time modulate at a lower airflow than the 3rd heating stage, then set FAN FLO MID greater than FAN FLO HMAX and set FAN FLO MORE less than FAN FLO HMAX. (Alternatively, you can get the same results by setting FAN FLOW MID less than FAN FLO HMAX and setting FAN FLO MORE less than FAN FLOW MID.)

When the fan flow points are set this way, then the 1st and 2nd stages of heat won't be allowed to time modulate until FAN FLOW becomes equal to or greater than FAN FLO MORE, while the 3rd stage of heat cannot time modulate until FAN FLOW becomes equal to or greater than FAN FLOW HMAX.

NOTE:
If FAN MODE = CONST, it is STRONGLY recommended that both FAN FLO MID and FAN FLO MORE be set equal to or greater than FAN FLO HMAX.

Setting FAN TIME

FAN TIME is used as a speed limit. It means different things under different

circumstances.

- When FAN TIME is set to be less than LOOP TIME (regardless of the value of STAGE COUNT, the application does not use FAN TIME. When this occurs, FAN FLOW can change its value as fast as the Heating PID Loop wants it to change.
- When FAN MODE equals CONST, FAN TIME is not used (regardless of the value of STAGE TIME). This is because FAN TIME is not needed for constant volume fans.

The following two bullet items describe how FAN TIME functions when FAN TIME is set equal to or greater than LOOP TIME and FAN MODE equals VARI.

- When STAGE COUNT equals 1, OR, when STAGE COUNT equals 2 and FAN FLOW MID is equal to or greater than FAN FLO HMAX, FAN FLOW is not allowed to change from FAN FLOW MIN to FAN FLO HMAX (or vice versa) faster than the length of time set in FAN TIME.
- When STAGE COUNT equals 2 and FAN FLOW MID is less than FANFLO HMAX, FANFLOW is not allowed to change from FAN FLOW MIN to FAN FLOW MID (or vice versa) faster than the length of time set in FAN TIME. Also, under these conditions, the same length of time is required for FAN FLOW to change from FAN FLOW MID to FAN FLO HMAX (or vice versa).

The remaining bullet items in this section describe how FAN TIME functions when STAGE COUNT is 3. If you have set STAGECOUNT to be less than 3, you can skip the remainder of this section and proceed to the next section. Otherwise, enter a value for FAN TIME.

- When STAGE COUNT equals 3 and FAN FLOW MID and FAN FLO MORE are both greater than or equal to FAN FLO HMAX, FAN FLOW is not allowed to change from FAN FLOW MIN to FAN FLO HMAX (or vice versa) faster than the length of time set in FAN TIME.
- When STAGE COUNT equals 3, and FAN FLOW MID is less than FAN FLO HMAX, and FAN FLO MORE is greater than or equal to FAN FLO HMAX, FAN FLOW is not allowed to change from FAN FLOW MIN to FAN FLOW MID (or vice versa) faster than the length of time set in FAN TIME. Also, under these conditions, the same length of time is required for FAN FLOW to change from FAN FLOW MID to FAN FLO HMAX (or vice versa).
- When STAGE COUNT equals 3, and FAN FLOW MID is greater than or equal to FAN FLO HMAX, and FAN FLO MORE is less than FAN FLO HMAX, FAN FLOW is not allowed to change from FAN FLOW MIN to FAN FLO MORE (or vice versa) faster than the length of time set in FAN TIME. Also, under these conditions, the same length of time is required for FAN FLOW to change from FAN FLO MORE to FAN FLO HMAX (or vice versa).
- When STAGE COUNT equals 3, and FAN FLOW MID is less than both FAN FLO MORE and FAN FLO HMAX, and FAN FLO MORE is less than FAN FLO HMAX, FAN FLOW is not allowed to change from FAN FLOW MIN to FAN FLOW MID (or vice versa) faster than the length of time set in FAN TIME. Also, the same length of time as stored in FAN TIME is required for FAN FLOW to change from FAN FLOW MID to FAN FLO MORE (or vice versa). Furthermore, under these conditions, the

same length of time as stored in FAN TIME is required for FAN FLOW to change from FAN FLO MORE to FAN FLO HMAX (or vice versa).

Setting Stage Times

1. If STAGE COUNT equals 2 or 3, enter into STG 1 TIME the amount of time HEAT STAGE 1 must be ON before HEAT STAGE 2 may turn ON.
2. If STAGE COUNT equals 2, enter into STG 2 TIME the amount of time HEAT STAGE 2 must be OFF before HEAT STAGE 1 may turn OFF.
   If STAGE COUNT equals 3, then enter into STG 2 TIME the amount of time HEAT STAGE 2 must be OFF before HEAT STAGE 1 may turn OFF and the amount of time that HEAT STAGE 2 must be on before HEAT STAGE 3 may turn ON.
3. If STAGE COUNT equals 3, then enter into STG 3 TIME the amount of time HEAT STAGE 3 must be OFF before HEAT STAGE 2 may turn OFF.

Setting HTG DBAND

BASE DO6 cannot turn ON in the unoccupied mode unless CTL TEMP < CTL STPT − HTG DBAND.

Enter the desired value for HTG DBAND.

Setting MORN DBAND

At the beginning of the occupied mode WARMUP (Point 60) cannot turn ON unless CTL TEMP < CTL STPT − MORN DBAND.

Enter the desired value for MORN DBAND.

Setting TEMP HLIMIT and TEMP LLIMIT

The supply air damper cannot modulate in the unoccupied mode until CTL TEMP rises above TEMP HLIMIT.

1. Enter the desired value for TEMP HLIMIT.
   The electric heat will not time modulate in the unoccupied mode until CTL TEMP drops below TEMP LLIMIT.
2. Enter the desired value for TEMP LLIMIT.

Setting the Heat Sequencing Points (STAGE COUNT less than 3)

If STAGE COUNT equals 3, continue to Setting the Heat Sequencing Points (STAGE COUNT equals 3).

When FAN MODE equals CONST, the airflow out of the fan is constant at FAN FLO CMAX. In this case, the electric heat works best if FLOW END is set equal to 0.

- If FAN MODE equals CONST, enter the desired value for FLOW END and skip the rest of this section. If FAN MODE equals VARI, continue with the rest of this section.

When Application 2157 is configured with only one stage of electric heat (STAGE COUNT, equals 1), FAN FLOW will be set equal to FAN FLO HMAX and the heat stage will time modulate whenever HTG LOOPOUT is equal to or greater than FLOW END.

- Enter the desired value for FLOW END and skip the rest of this section. (If you are not sure where to set FLOW END, try setting it to 33.)

If the application is configured with two stages of electric heat (STAGE COUNT equals 2), and FAN FLOW MID is set equal to or greater than FAN FLO HMAX, FAN FLOW will be set equal to FAN FLO HMAX (and both heat stages will time modulate) whenever HTG LOOPOUT is equal to or greater than FLOW END.

- Enter the desired value for FLOW END and skip the rest of this section. (If you are not sure where to set FLOW END, it is recommended that you set it to 33.)

If the application is configured with two stages of electric heat, and FAN FLOW MID is set less than FAN FLO HMAX, then the following four conditions and caution apply:

- When HTG LOOPOUT is equal to FLOW 1 END, FAN FLOW will be set equal to FAN FLOW MID.
- When HTG LOOPOUT is between FLOW 1 END and FLOW 2 START, HEAT STAGE 1 will time modulate.
- When HTG LOOPOUT goes from FLOW 2 START to FLOW END, FAN FLOW will go from FAN FLOW MID to FAN FLO HMAX.
- When HTG LOOPOUT is greater than FLOW END, HEAT STAGE 2 will time modulate.

⚠ CAUTION

Make sure that FLOW 1 END < FLOW 2 START < FLOW END.

If this is not done, the application can lock up. (For example, if FLOW 2 START is < FLOW 1 END, the fan flow and electric heat will remain frozen in place indefinitely.)

Set FLOW 1 END, FLOW 2 START, and FLOW END to the desired values. (If you are not sure what value to set these points to, it is recommended that you set FLOW 1 END to 25, FLOW 2 START to 50 and FLOW END to 75).

Setting the Heat Sequencing Points (STAGE COUNT equals 3)

When FAN MODE equals CONST, the airflow out of the fan is constant at FAN FLO CMAX. In this case, the electric heat works best if FLOW END is set equal to 0.

- If FAN MODE equals CONST, enter the desired value for FLOW END and skip the rest of this section. If FAN MODE equals VARI, continue with the rest of this section.

If the application is configured with three stages of electric heat (STAGE COUNT equals 3), and FAN FLOW MID and FAN FLO MORE are both set equal to or greater than FAN FLO HMAX, FAN FLOW will be set equal to FAN FLO HMAX (and all three

heat stages will be allowed to time modulate) whenever HTG LOOPOUT is equal to or greater than FLOW END.

- Enter the desired value for FLOW END and skip the rest of this section. (If you are not sure where to set FLOW END, it is recommended that you set it to 25.)

If the application is configured with three stages of electric heat, and FAN FLOW MID is set less than FAN FLO HMAX, and FAN FLO MORE is greater than or equal to FAN FLO HMAX, then the following four conditions and caution apply:

- When HTG LOOPOUT is equal to FLOW 1 END, FAN FLOW will be set equal to FAN FLOW MID.
- When HTG LOOPOUT is between FLOW 1 END and FLOW 2 START, HEAT STAGE 1 will time modulate.
- When HTG LOOPOUT goes from FLOW 2 START to FLOW 2 END, FAN FLOW will go from FAN FLOW MID to FAN FLO HMAX.
- When HTG LOOPOUT is greater than FLOW 2 END, HEAT STAGE 2 and HEAT STAGE 3 will time modulate.

⚠ CAUTION

Make sure that FLOW 1 END < FLOW 2 START < FLOW END.

If this is not done, the application can lock up. (For example, if FLOW 2 START is <FLOW 1 END, the fan flow and electric heat will remain frozen in place indefinitely.)

Set FLOW 1 END, FLOW 2 START, and FLOW 2 END to the desired values and skip the rest of this section. (If you are not sure what value to set these points to, it is recommended that you set FLOW 1 END to 20, FLOW 2 START to 40, and FLOW 2 END to 60.)

If the application is configured with three stages of electric heat, and FAN FLOW MID is set greater than or equal to FAN FLO HMAX, and FAN FLO MORE is less than FAN FLO HMAX, then the following four conditions and caution apply:

- When HTG LOOPOUT is equal to FLOW 1 END, FAN FLOW will be set equal to FAN FLO MORE.
- When HTG LOOPOUT is between FLOW 1 END and FLOW 3 START, HEAT STAGE 1 and HEAT STAGE 2 will time modulate.
- When HTG LOOPOUT goes from FLOW 3 START to FLOW END, FAN FLOW will go from FAN FLO MORE to FAN FLO HMAX.
- When HTG LOOPOUT is greater than FLOW END, HEAT STAGE 3 will time modulate.

⚠ CAUTION

Make sure that FLOW 1 END < FLOW 3 START < FLOW END.

If this is not done, the application can lock up. (For example, if FLOW END is <FLOW 3 START, the fan flow and electric heat will remain frozen in place indefinitely.)

Set FLOW 1 END, FLOW 3 START, and FLOW END to the desired values and skip the rest of this section. (If you are not sure what value to set these points to, it is

recommended that you set FLOW 1 END to 20, FLOW 3 START to 60, and FLOW END equal to 80.)

If the application is configured with three stages of electric heat, FAN FLOW MID is set less than both FAN FLO MORE and FAN FLO HMAX and FAN FLO MORE is less than FAN FLO HMAX, then the following six conditions and caution apply:

- When HTG LOOPOUT is equal to FLOW 1 END, FAN FLOW will be set equal to FAN FLOW MID.
- When HTG LOOPOUT is between FLOW 1 END and FLOW 2 START, HEAT STAGE 1 will time modulate.
- When HTG LOOPOUT goes from FLOW 2 START to FLOW 2 END, FAN FLOW will go from FANFLOWMID to FANFLO MORE
- When HTG LOOPOUT is between FLOW 2 END and FLOW 3 START, HEAT STAGE 2 will time modulate.
- When HTG LOOPOUT goes from FLOW 3 START to FLOW END, FAN FLOW will go from FAN FLO MORE to FAN FLO HMAX.
- When HTG LOOPOUT is greater than FLOW END, HEAT STAGE 3 will time modulate.

⚠ CAUTION

Make sure that FLOW 1 END < FLOW 2 START < FLOW 2 END < FLOW 3 START < FLOW END.

If this is not done, the application can lock up. (For example, if FLOW 3 START is < FLOW 2 END, the fan flow and electric heat will remain frozen in place indefinitely.)

Set FLOW 1 END, FLOW 2 START, FLOW 2 END, FLOW 3 START and FLOW END to the desired values. (If you are not sure what value to set these points to, it is recommended that you set FLOW 1 END to 10, FLOW 2 START to 30, FLOW 2 END equal to 45, FLOW 3 START equal to 65 and FLOW END equal to 80.)

Setting Airflow Setpoints

NOTE:
Maximum flow(s) must be set ≥ minimum flow(s).

⚠ CAUTION

For electric heating coils in the air terminal unit without a terminal fan, do not set HTG FLOW MIN to 0.

Equipment damage may occur if insufficient air flow is present with electric heat ON.

1. Set CLG FLOW MIN to the desired minimum cooling airflow setpoint. This point is used to establish the cooling flow minimum (CTL FLOW MIN) in the occupied (non-standby) modes.
2. Set CLG FLOW MAX to the desired maximum cooling airflow setpoint.
3. Set HTG FLOW MAX to the desired maximum heating airflow setpoint.
   HTG FLOW MIN: There is no heating flow minimum setpoint in this application. In the heating mode (as in the cooling mode) the occupied ventilation is maintained by VENT DMD MIN.
4. Set VENT DMD MIN to an initial minimum value that will provide the required zone ventilation.
   VENT DMD MIN can be set above, equal to, or below CLG FLOW MIN and can be controlled (reset) externally for ventilation demands. Minimum airflow will be the larger of CLG FLOW MIN and VENT DMD MIN. The control maximum flow setpoints are not affected by VENT DMD MIN.
   Optional occupancy sensor: During occupied times, when the occupancy sensor detects that no one is in the room and OCC STBY = YES, the control minimum will use the value of NGT FLOW MIN. If the occupancy sensor detects activity, OCC STBY will be set to NO and the minimum airflow will be the larger of CLG FLOW MIN and VENT DMD MIN.
5. Set NGT FLOW MIN to provide reduced (or zero) airflow during night unoccupied times (or when OCC STBY = YES during occupied times with occupancy sensor). Control will (still) modulate to the maximum flow control setpoints (heating or cooling) if the zone temperature exceeds the control temperature setpoints.

Setting Box Size

One of the functions of Application 2157 is to determine the proper airflow value for the terminal box's VAV fan. This value is stored in FAN FLOW. Once a value for FAN FLOW has been determined, a Table Statement embedded in the application's firmware uses it to determine the proper value for FAN AOV1. The application actually contains four such Table Statements, but only one will be used. Selecting the correct Table Statement depends on the value of BOX SIZE.

- BOX SIZE should be set to 3, 5, or 7 when a Nailor box is using a size of 3, 5, or 7. When this is done, the application will use 1 of 3 pre-coded Table Statements with pre-determined FAN AOV1 voltage levels that correspond to airflow values of FAN

FLOW. The voltage and flow values in these pre-coded Table Statements are fixed and cannot be changed by the user.

- BOX SIZE should be set to 0 when a box other than a Nailor box is being used, or when a Nailor Box is using a size other than 3, 5 or 7. When this is done, the application uses an embedded, general purpose Table Statement to adjust the value of FAN AOV1 based on the value of FAN FLOW. The flow and voltage values of this table statement are not pre-coded and must be entered into the controller.

Enter the desired value for BOX SIZE.

If BOX SIZE is set to a value other than 0, READ THE NOTE at the end of this section, then proceed with Setting Controller Address.

If BOX SIZE is set to 0, the controller needs to have the following fan AOV Table Statement parameters entered into it:

- FLO LO – This is the lowest flow the fan can produce. (FLO LO must be equal to or less than FAN FLOW MIN.)

⚠ CAUTION

Make sure that FLO LO is high enough that the fan can actually maintain it.

If FLO LO is set too low, the fan could shut off without the application being aware of it. If this happens, there is a possibility that the electric heat could turn on while the fan is off. Consult with the fan manufacturer to find out what the lowest airflow is that the fan can maintain.

- FLO LO VOLTS – This is the voltage value that FAN AOV1 must have in order to get the fan to produce the amount of airflow that is stored in FLO LO.
- FLO HI – This is the highest flow that the fan can produce. FLO HI must be set greater than or equal to both FAN FLO HMAX and FAN FLO CMAX.
- FLO HI VOLTS – This is the voltage value that FAN AOV1 must have in order to get the fan to produce the amount of airflow that is stored in FLO HI.

Enter the desired values for FLO LO, FLO HI, FLO LO VOLTS and FLO HI VOLTS.

When properly set up, the Table Statement works as follows:

- When FAN FLOW is equal to or less than FLO LO, FAN AOV1 will be set to FAN LO VOLTS.
- When FAN FLOW is equal to or greater than FAN HI, FAN AOV1 will be set to FAN HI VOLTS.
- When FAN FLOW is in between FLO LO and FLO HI, the Table Statement will use linear interpolation to set the value of FAN AOV1 to a value that is between FAN LO VOLTS and FAN HI VOLTS.

NOTE:
Once FAN AOV1 is set to a particular voltage, this signal is sent to an intelligent motor controller that controls the fan and which is provided by others. This controller must be configured to know what airflow corresponds to a given voltage of FAN AOV1. Consult the operating instructions provided by the manufacturer of the intelligent motor controller for proper set-up information.

Setting Duct Area

If provided, enter the duct area (sq ft or sq m) into DUCT AREA and continue to Setting Flow Coefficient.

If you do not know the duct area, use the following table:

Area =	Round Duct	Rectangular Duct
Area in Sq. Ft.	$(\pi \times R^2)/144$ (where π = 3.14 and R = radius of duct in inches)	Width x Height/144 (in centimeters)
Area in Sq. M	$(\pi \times R^2)/10{,}000$ (where π = 3.14 and R = radius of duct in centimeters)	Width x Height/10,000 (in centimeters)

Setting Flow Coefficient

1. Set FLO COEFF to the appropriate value found in Table *Box Manufacturer Flow Coefficients*. This value is a starting point for the air balancer.
2. To fine tune the flow coefficient, use the following formula:

   ⇨ **New Flow Coefficient = (Actual Volume ÷ Controller Volume) × Old Flow Coefficient**
   The actual volume is the value obtained from the balancer's measurements.
   The controller volume is the value obtained from AIR VOLUME.
3. If the controller volume is not within 5% of the actual volume, repeat this procedure until it is within 5%.

Box Manufacturer Flow Coefficients		
Manufacturer	**Sensor Type**	**Value**
Anemostat	2-pipe without orifice 2-pipe with orifice Spider without orifice Spider with orifice	0.79 0.59 0.73 0.39
Carnes	2-pipe Flow cross	0.66 0.59
Carrier		0.59
E.H. Price/Siemens Industry Terminal Boxes		0.78
Environmental Technologies		0.79
Krueger		0.68
Metal Aire		0.72
Nailor Industries		0.69
Titus		0.60
Trane		0.66

Enabling Wall Switch

If a wall switch is used for day/night (occupied/unoccupied) control, enable it by setting WALL SWITCH to **YES**.

Otherwise, leave WALL SWITCH at its default value of **NO**.

Enabling Occupancy Sensor

If an optional occupancy sensor will be used, set WALL SWITCH = NO and OCC SENSOR = YES. (See the application documentation for a description of how control is affected during Day modes.)

Setting Controller Address

NOTE:
If you are going to enter an LCTLR point at the field panel, keep track of the controller address and override time you enter at the WCIS. You will be required to enter these values again at the field panel.

Set the controller address by setting CTLR ADDRESS to the appropriate number. (Addresses 00 to 98 are valid; 00 to 31 are typically used.)

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

The start-up is complete.

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