SIEMENS

Application 2359: VAV with Electric Reheat or Baseboard Radiation and Ventilation Duct — Electronic Output

Overview

In Application 2359, the controller modulates the temperature control damper of the terminal box for cooling and controls stages of electric reheat or baseboard radiation for heating. When in heating, the terminal box either maintains minimum airflow or modulates the temperature control damper. This application also has a ventilation duct controlled by a ventilation damper. The ventilation damper may either use two-position control or modulating control. In order for the terminal box to work properly, the central air handling unit must provide supply air to the temperature control duct and ventilation air must be provided to the ventilation duct. Refer to Figures 2359-1 through 2359-5.

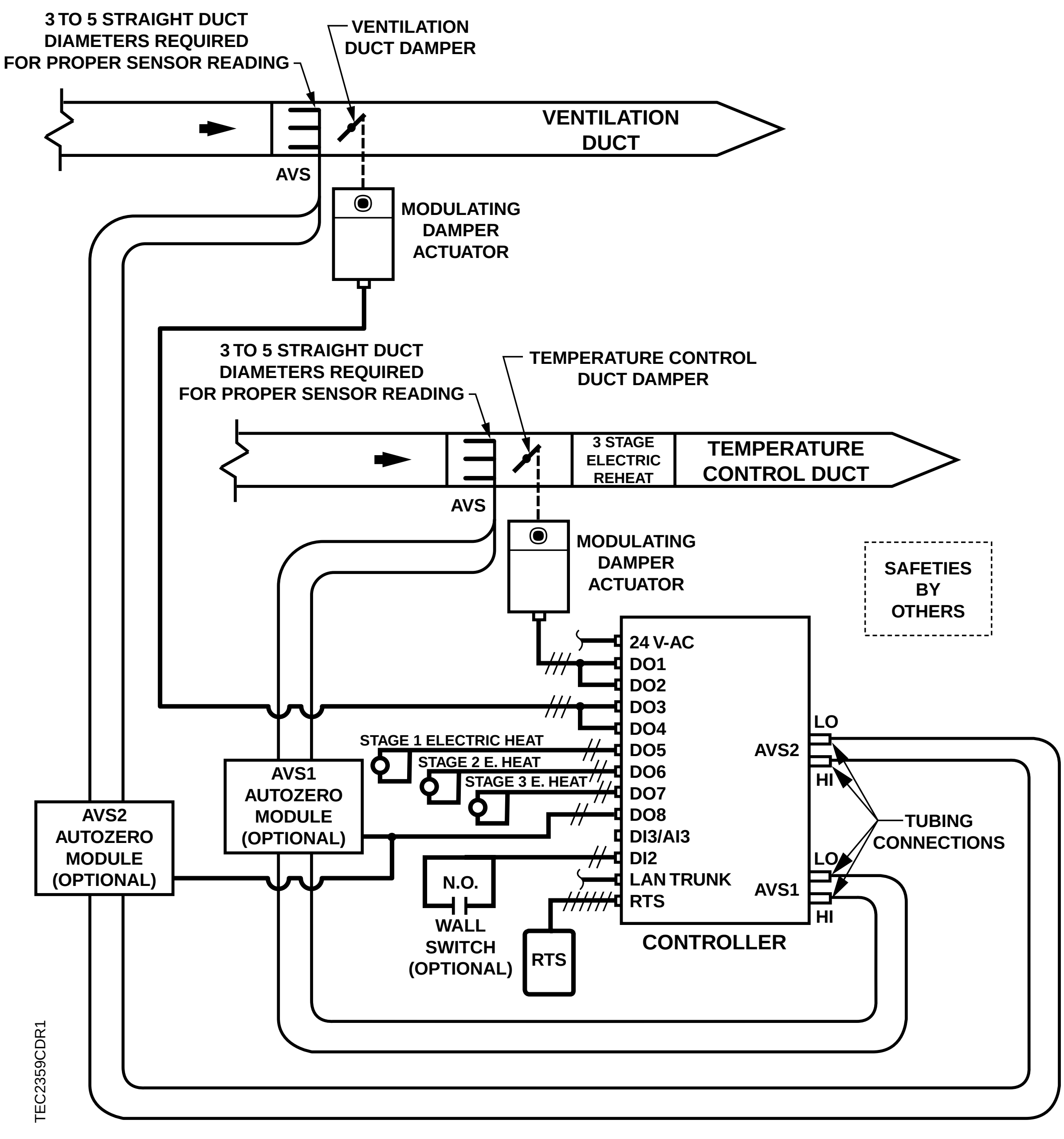
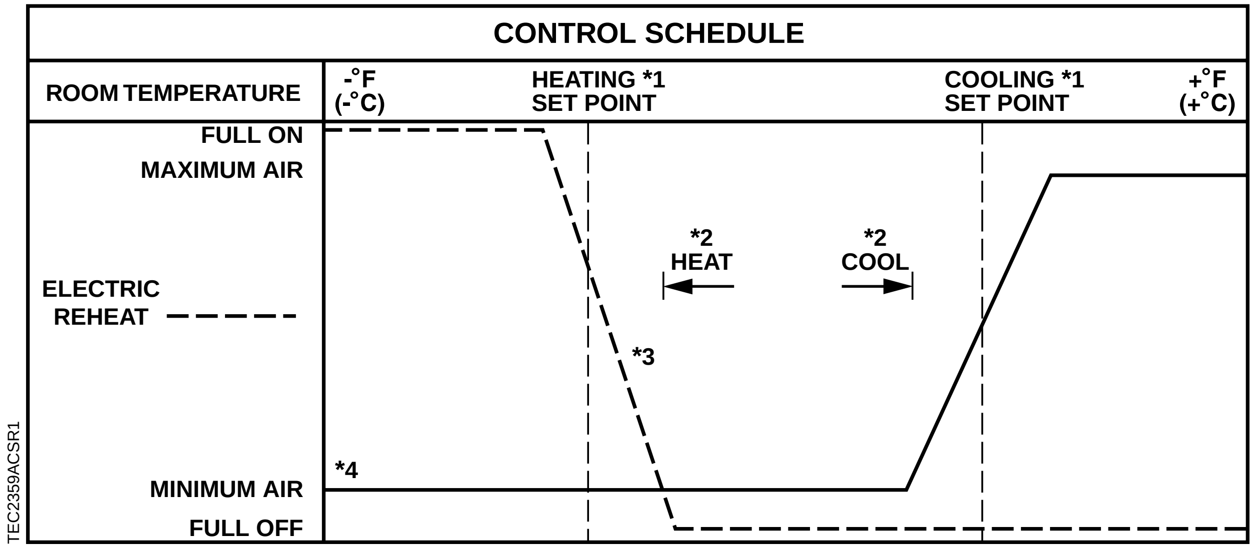
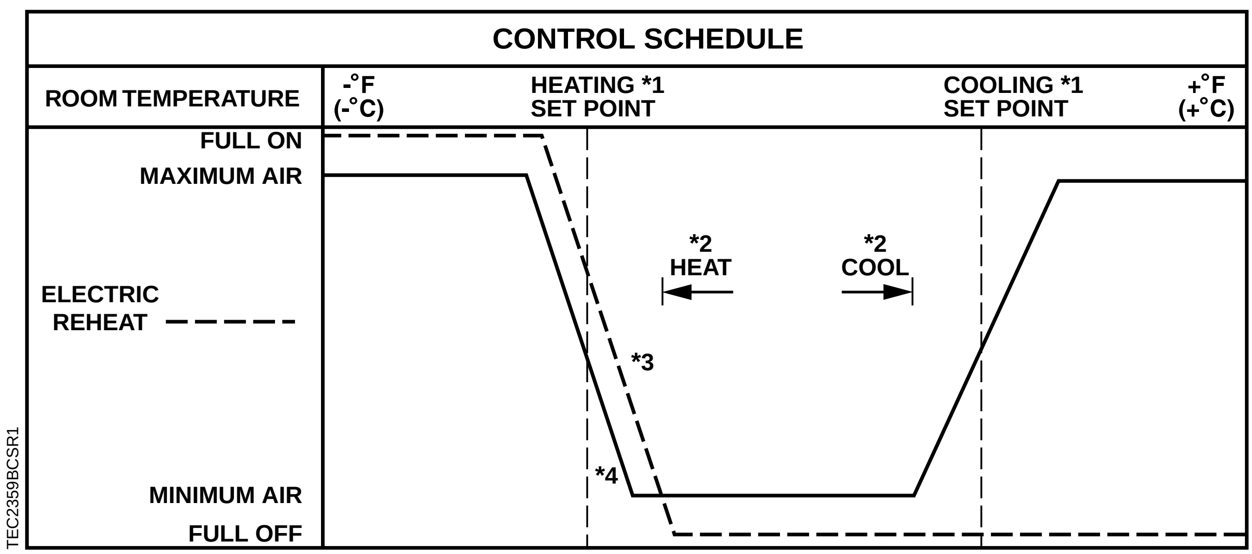


Figure 2359-1. Application 2359 Control Drawing.



1. Refer to the *Control Temperature Set Points* section.
2. Refer to the *Heating/Cooling Switchover* section.
3. The electric reheat is time modulated. This allows it to be controlled proportionally rather than with deadbands.
4. The airflow is shown at minimum flow throughout the entire heating mode (default setting). The airflow can operate sequenced, parallel, or overlapping with the electric reheat (optional). Refer to the *Sequencing Logic* section.

Figure 2359-2. Application 2359 Temperature Control Duct Control Schedule for Electric Reheat.



1. Refer to the *Control Temperature Set Points* section.
2. Refer to the *Heating/Cooling Switchover* section.
3. The electric reheat is time modulated. This allows it to be controlled proportionally rather than with deadbands.
4. The airflow is shown operating parallel with the electric reheat (optional). The airflow can operate at minimum flow throughout the entire heating mode (default setting). Refer to the *Sequencing Logic* section.

Figure 2359-3. Application 2359 Temperature Control Duct Control Schedule for Electric Reheat with Modulating Damper in Heating Mode.

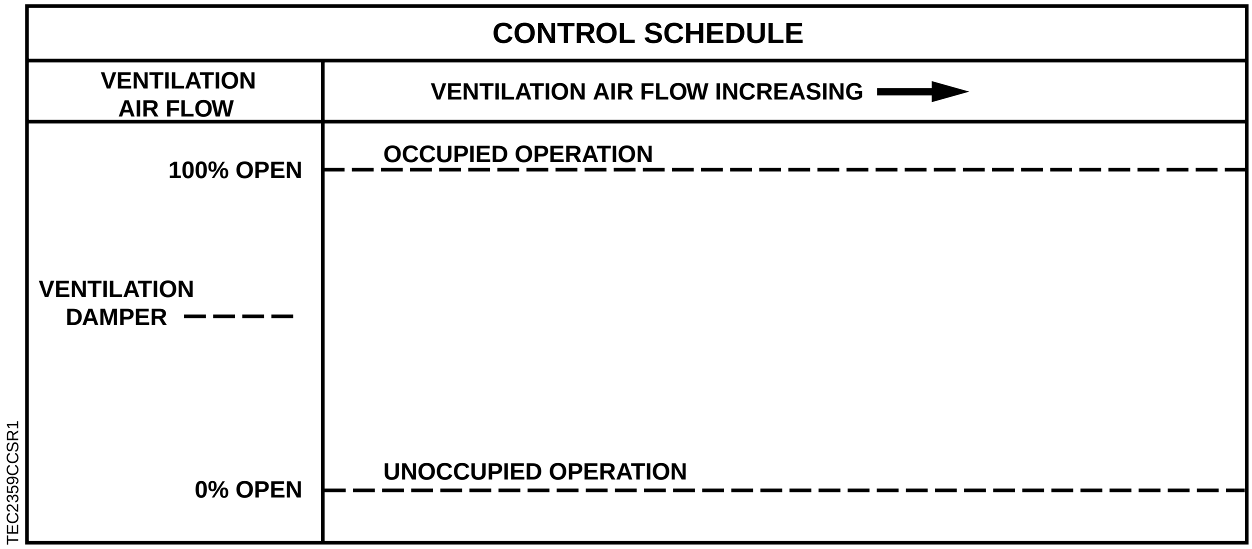


Figure 2359-4. Application 2359 Control Schedule for Ventilation Damper (Two-Position Control).

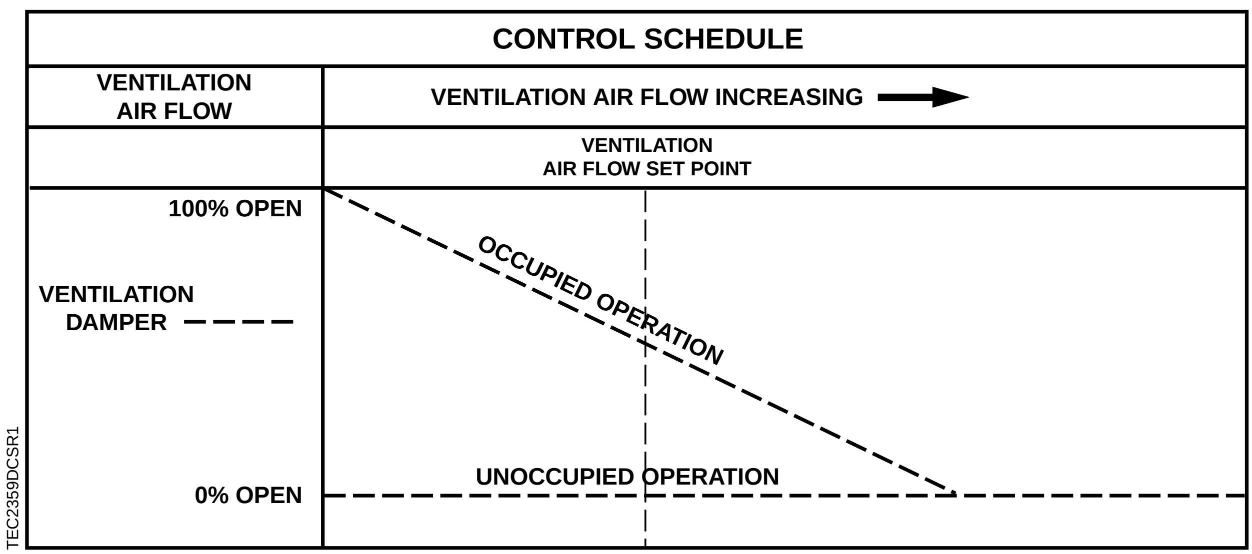


Figure 2359-5. Application 2359 Control Schedule for Ventilation Damper (Modulating Control).

Hardware Inputs

Analog

- Air velocity sensor
- Room temperature sensor
- Room temperature set point dial (optional)

Digital

- Night mode override (optional)
- Wall switch (optional)

Hardware Outputs

Analog

- None

Digital

- Autozero Module (optional)
- Damper actuator (2 required)
- Stage 1 electric reheat; or, 2-position heating valve
- Stage 2 electric reheat (optional)
- Stage 3 electric reheat (optional)

Ordering Notes

Order Custom Solution number 242.

Part Number 540-873.

Point Database

Table 2359-1 presents the point database information for Application 2359.

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2359, “VAV with Electric Reheat or Baseboard Radiation and Ventilation Duct — Electronic Output.”

Control Temperature Set Points

Depending on the controller’s current operational mode (day or night), the control temperature set point, CTL STPT (Point 92) holds the value of one of the following set points:

Day Mode – In day mode, CTL STPT holds the value of DAY CLG STPT (Point 6) or DAY HTG STPT (Point 7). If the room temperature sensor has a set point dial and STPT DIAL (Point 14) is set to YES, then CTL STPT holds the value of RM STPT DIAL (Point 13).

If the set point dial is used and the value of RM STPT DIAL is less than the value of RM STPT MIN (Point 11), then CTL STPT holds the value of RM STPT MIN. If the value of RM STPT DIAL is greater than the value of RM STPT MAX (Point 12), then CTL STPT holds the value of RM STPT MAX.

Night Mode – In night mode, CTL STPT holds the value of NGT CLG STPT (Point 8) or NGT HTG STPT (Point 9).

NOTE: The value of CTL TEMP (Point 78) is the same as the value of ROOM TEMP (Point 4), unless CTL TEMP is overridden.

Day and Night Modes

The day/night status of the space is determined by the status of DAY.NGT (Point 29). The control of this point differs depending on whether the controller is monitoring the status of a wall switch or if the controller is connected to a field panel.

When a wall switch is physically connected to the termination strip on the controller at DI 2 (Figures 2359-1 and 2359-6), and WALL SWITCH (Point 18) equals YES, the controller monitors the status of DI 2. When the status of DI 2 (Point 24) is ON (the switch is closed), then DAY.NGT will be set to DAY indicating that the controller is in day mode. When the status of DI 2 is OFF (the switch is open), then DAY.NGT will be set to NIGHT indicating that the controller is in night mode.

When WALL SWITCH equals NO, the controller does not monitor the status of the wall switch, even if one is connected to it. In this case, and if the controller is operating stand-alone, then the controller stays in day mode all the time. If the controller is operating with centralized control (connected to a field panel), then the field panel can send an operator or PPCL command to override the status of DAY.NGT. Refer to *Powers Process Control Language (PPCL) User’s Manual* (125-1896) and *Field Panel User’s Manual* (125-1895) for more information.

Night Mode Override Switch

If an override switch is present on the room temperature sensor and a value (in hours) other than zero has been entered into OVRD TIME (Point 20), then by pressing the override switch a room occupant can reset the controller to day operational mode for the amount of time that is set in OVRD TIME. The status of NGT OVRD (Point 21) changes to DAY and remains there until the override time elapses, at which time the controller returns to night mode and the status of NGT OVRD changes back to NIGHT.

It is only when the controller is in night mode that the override switch on the room sensor will have any effect on the controller.

Heating/Cooling Switchover

The heating/cooling switchover determines whether the controller is in heating or cooling mode by monitoring the room temperature and the demand for heating and cooling (as determined by the temperature control loops).

If all of the following conditions are met for the length of time set in SWITCH TIME (Point 86), then the controller switches from heating to cooling mode by setting HEAT.COOL (Point 5) to COOL:

- HTG LOOPOUT (Point 80) is less than SWITCH LIMIT (Point 85).
- CTL TEMP (Point 78) is above CTL STPT (Point 92) by at least the value set in SWITCH DBAND (Point 90).
- CTL TEMP is greater than the appropriate cooling set point minus SWITCH DBAND.

If all of the following conditions are met for the length of time set in SWITCH TIME, then the controller switches from cooling to heating mode by setting HEAT.COOL to HEAT:

- CLG LOOPOUT (Point 79) is less than SWITCH LIMIT.
- CTL TEMP is below CTL STPT by at least the value set SWITCH DBAND.
- CTL TEMP is less than the appropriate heating set point plus SWITCH DBAND.

CAUTION:

This heating/cooling switchover mechanism is not affected by the air temperature in the temperature control or ventilation ducts.

To change the value of HEAT.COOL (Point 5) based on the supply air temperature, you must command HEAT.COOL through PPCL. This is required when the temperature control duct flow loop will be used as a source of cooling in cooling mode and a source of heat in heating mode. (Refer to Examples 1-3 in the *Sequencing Logic* section.) If the temperature control duct flow loop is used in heating mode just to meet minimum air requirements, then the heating/cooling switchover mechanism operates as described in this section to control HEAT.COOL. (Refer to Example 4 in *Sequencing Logic*.)

Control Loops

The terminal box is controlled by three Proportional, Integral, and Derivative (PID) control loops (two temperature loops and a flow loop).

Temperature Loops – The two temperature loops are a cooling loop and a heating loop. The active temperature loop maintains room temperature at the value in CTL STPT (Point 92). Refer to the *Control Temperature Set Points* section.

The cooling temperature loop generates cooling loopout which is then used to generate FLOW STPT (Point 93). FLOW STPT is the flow set point for the temperature control duct. FLOW STPT is the result of scaling the cooling loopout to the appropriate range of values determined by the points CLG FLOW MIN (Point 31) and CLG FLOW MAX (Point 32). In order to scale it, the loopout is multiplied by the range (MAX – MIN) and then added to the minimum set point.

When CLG FLOW MIN does not equal 0 CFM, FLOW STPT does not equal CLG LOOPOUT (Point 79). The minimum flow set point is (CLG FLOW MIN ÷ CLG FLOW MAX) × 100% flow. And FLOW STPT is [CLG LOOPOUT × (100% – minimum set point)] + minimum set point.

For example:

If CLG FLOW MIN = 200 CFM and CLG FLOW MAX = 1000 CFM

then, the minimum flow set point is
(200 CFM ÷ 1000 CFM) × 100% flow = 20%

When CLG LOOPOUT is 0%, FLOW STPT equals 20% flow.
[0% × (100% – 20%)] + 20% = 20%
(This ensures that the airflow out of the terminal box is no less than CLG FLOW MIN.)

When CLG LOOPOUT is 50%, FLOW STPT equals 60% flow.
[50% × (100% – 20%)] + 20% = 60%

When CLG LOOPOUT is 100%, FLOW STPT equals 100% flow.
[100% × (100% – 20%)] + 20% = 100%

If the controller is in heating mode, then the operation of the temperature control duct flow loop is flexible. It can be set up to do one of the following:

- Constantly maintain an airflow out of the terminal box equal to HTG FLOW MIN (Point 33).
- Operate in sequence with the electric reheat.
- Operate parallel with the electric reheat.
- Have its operation overlap with the operation of the electric reheat. Refer to the *Sequencing Logic* section for more information.

If the first option described above is chosen, then HTG LOOPOUT (Point 80) will control the electric reheat in order to maintain the room temperature. If any one of the last three options is chosen, then HTG LOOPOUT will control both the temperature control flow loop set point (FLOW STPT) and the electric reheat in order to maintain the room temperature. Refer to the *Sequencing Logic* section for more information.

HTG LOOPOUT will adjust the value of FLOW STPT differently depending on which flow loop setup is chosen. However, the following rule applies no matter what setup is chosen:

In heating mode, FLOW STPT will never be set below
(HTG FLOW MIN / HTG FLOW MAX) × 100% flow
or above 100% flow.

Temperature Control Duct Flow Loop – The temperature control flow loop maintains different minimum airflow and maximum airflow values depending on the season.

When the controller is in cooling mode, the airflow in the temperature control duct stays between CLG FLOW MIN and CLG FLOW MAX.

When the controller is in heating mode, the airflow in the temperature control duct stays between HTG FLOW MIN and HTG FLOW MAX.

In Application 2359, you can set CLG FLOW MIN equal to, but not greater than CLG FLOW MAX, and you can set HTG FLOW MIN equal to, but not greater than HTG FLOW MAX. If the minimum and maximum values are set equal, then the flow loop becomes a constant volume loop and its ability to control temperature is lost.

The temperature control duct flow loop maintains FLOW STPT by modulating the supply air damper point, DMPR COMD (Point 48).

FLOW (Point 75) is the input value for the temperature control duct flow loop. When HEAT.COOL equals COOL, it is calculated as a percentage based on where AIR VOLUME 1 (Point 35) is between 0 CFM and CLG FLOW MAX. When HEAT.COOL equals HEAT, FLOW is calculated as a percentage based on where AIR VOLUME (Point 35) is between 0 CFM and HTG FLOW MAX. In the following text, this percentage will be referred to as % flow. It will also be assumed that HEAT.COOL = COOL.

- If AIR VOLUME 1 equals 0 CFM, then FLOW is 0% flow.
- If AIR VOLUME 1 equals CLG FLOW MAX, then FLOW is 100% flow.

The low limit of FLOW STPT will be the percentage that corresponds to the volume given in CLG FLOW MIN. This percentage can be calculated as: (CLG FLOW MIN ÷ CLG FLOW MAX) × 100% flow. The flow loop ensures that the supply air will not be less than CLG FLOW MIN.

For example:

If CLG FLOW MIN equals 250 CFM, and if CLG FLOW MAX equals 1000 CFM

then,

the low limit of FLOW STPT = (250 CFM ÷ 1000 CFM) × 100% flow.
= 0.25 × 100% flow
= 25% flow

Since 25% of 1000 CFM equals 250 CFM, the minimum airflow out of the terminal box will be 250 CFM.

Electric Reheat

CAUTION:

Verify that the equipment is supplied with safeties by others to ensure that there is airflow across the heating coils when they are to be energized.

The heating loop controls up to three stages of electric reheat to warm up the room. The electric reheat is time modulated using a duty cycle as shown in the following example. When the controller is in cooling mode, the electric heat is OFF at all times.

Example: If the duty cycle is 10 minutes (STAGE TIME (Point 89) = 10 minutes) and the heating loop is calling for 60% of heating (HTG LOOPOUT (Point 80) = 60%), then for every 10 minute period, the stages of electric auxiliary heat cycle as follows:

	Stage 1: minutes		Stage 2: minutes		Stage 3: minutes	
	ON	OFF	ON	OFF	ON	OFF
With 1 stage of electric heat:	6	4	--	--	--	--
With 2 stages of electric heat:	10	0	2	8	--	--
With 3 stages of electric heat:	10	0	8	2	0	10

Baseboard Radiation

The baseboard radiation can be either a two-position valve or electrical resistance heating.

If the controller is in cooling mode, then the heating valve is closed.

When in heating mode, the controller will operate the heating valve to maintain the heating set point as if it were a single stage of reheat.

Sequencing Logic

NOTE: The default setups for the points FLOW START (Point 16) and FLOW END (Point 17) are 0. This will provide minimum airflow during heating mode through the temperature control duct.

In heating mode, this application includes logic that allows the temperature control duct flow loop to operate either in sequence, parallel, or overlapping with the electric reheat. Portions of the output of the heating loop, HTG LOOPOUT (Point 80), will drive both the flow loop and the electric reheat from 0 to 100%. Refer to the following three examples. For simplicity, assume that in these examples HTG FLOW MIN (Point 33) equals 0 CFM, there is one stage of electric heat (STAGE COUNT (Point 88) equals 1), and the cycle time of the electric heat is 10 minutes (STAGE TIME (Point 89) equals 10). (When this is done, FLOW STPT (Point 93) will equal 0 when HTG LOOPOUT equals 0). The ladder diagrams in Figure 2359-6 shows sequenced, parallel and overlapping temperature control duct flow loop operations with electric reheat. The vertical bars show the output of heating loopout from 0 to 100%. The horizontal bars (reheat start, flow start, etc.) show the action that occurs when the loop output rises above the horizontal bar. The relative positions shown on the graphs are for illustration purposes only and may differ from the examples.

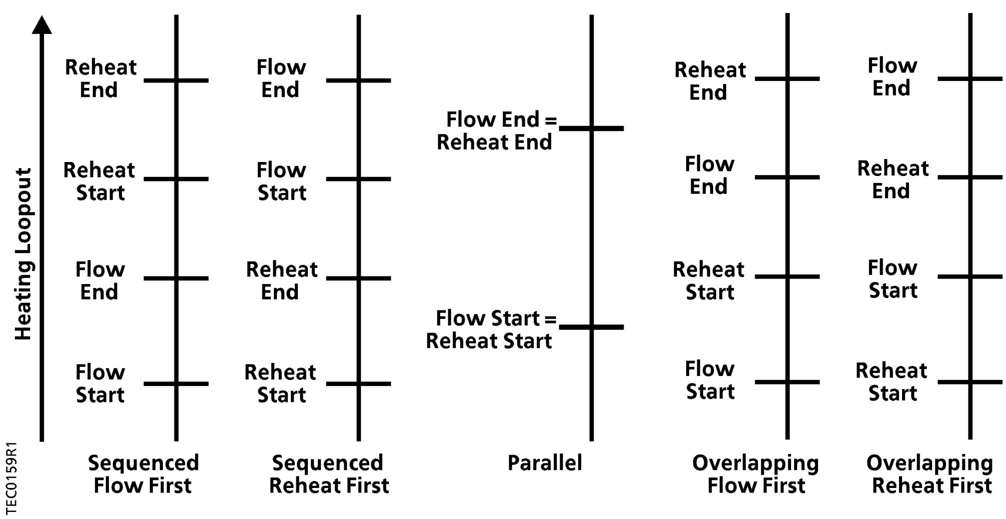


Figure 2359-6. Sequenced, Parallel, and Overlapping Temperature Control Duct Flow Loop Operations with Electric Reheat.

Example 1: Assume your system has electric heat operating in *sequence* with the temperature control duct flow loop. If,

- FLOW START (Point 16) equals 0%
- FLOW END (Point 17) equals 50%
- REHEAT START (Point 22) equals 50%
- REHEAT END (Point 23) equals 100%

then,

- When HTG LOOPOUT equals 0%, FLOW STPT will equal 0% flow.
- When HTG LOOPOUT equals 25%, FLOW STPT will equal 50% flow.
- When HTG LOOPOUT is greater than or equal to 50%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT is less than or equal to 50%, the electric heat will be OFF all the time.
- When HTG LOOPOUT equals 75%, for every 10 minute period the electric heat will be ON for 5 minutes and OFF for 5 minutes.
- When HTG LOOPOUT equals 100%, the electric heat will be ON all the time.

Example 2: Assume your system has electric heat operating *parallel* with the temperature control duct flow loop. If,

- FLOW START (Point 16) equals 0%
- FLOW END (Point 17) equals 100%
- REHEAT START (Point 22) equals 0%
- REHEAT END (Point 23) equals 100%

then,

- When HTG LOOPOUT equals 0%, FLOW STPT will equal 0% flow.
- When HTG LOOPOUT equals 50%, FLOW STPT will equal 50% flow.
- When HTG LOOPOUT equals 100%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT equals 0%, the electric heat will be OFF all the time.
- When HTG LOOPOUT equals 50%, for every 10 minute period the electric heat will be ON for 5 minutes and OFF for 5 minutes.
- When HTG LOOPOUT equals 100%, the electric heat will be ON all the time.

Example 3: Assume your system has electric heat that is to operate *overlapping* with the temperature control flow loop. If,

- FLOW START (Point 16) equals 0%
- FLOW END (Point 17) equals 75%
- REHEAT START (Point 22) equals 25%
- REHEAT END (Point 23) equals 100%

then,

- When HTG LOOPOUT equals 0%, FLOW STPT will equal 0% flow.
- When HTG LOOPOUT equals 37.5%, FLOW STPT will equal 50% flow.
- When HTG LOOPOUT is greater than or equal to 75%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT is less than or equal to 25%, the electric heat will be OFF all the time.
- When HTG LOOPOUT equals 62.5%, for every 10 minute period the electric heat will be ON for 5 minutes and OFF for 5 minutes.
- When HTG LOOPOUT equals 100%, the electric heat will be ON all the time.

Another option that the sequencing logic provides is to have the temperature control duct flow loop provide an airflow equal to HTG FLOW MIN throughout the heating mode with all of the temperature control being done by the electric heat. The airflow minimum is maintained by setting the FLOW START and FLOW END to 0%. This causes FLOW STPT to hold the value corresponding to minimum flow through the entire heating mode, regardless of the value of HTG LOOPOUT. Example 4 clarifies this:

Example 4: Assume your system has electric heat providing temperature control in heating mode while the temperature control duct flow loop provides the minimum air requirements. Assume,

- HTG FLOW MIN (Point 33) equals 170 CFM
- HTG FLOW MAX (Point 34) equals 1000 CFM
- STAGE COUNT (Point 88) equals 1
- STAGE TIME (Point 89) equals 10 Minutes

If,

- FLOW START (Point 16) equals 0%
- FLOW END (Point 17) equals 0%
- REHEAT START (Point 22) equals 0%
- REHEAT END (Point 23) equals 100%

then,

- When HTG LOOPOUT equals 0%, FLOW STPT will equal (170 CFM / 1000 CFM) × 100% flow = 17% flow. This will cause the flow loop to maintain an airflow of 170 CFM out of the terminal box.
- When HTG LOOPOUT equals 50%, FLOW STPT will equal 17% flow.
- When HTG LOOPOUT equals 100%, FLOW STPT will equal 17% flow.
- When HTG LOOPOUT equals 0%, the electric heat will be OFF all the time.

- When HTG LOOPOUT equals 50%, for every 10 minute period the electric heat will be ON for 5 minutes and OFF for 5 minutes.
- When HTG LOOPOUT equals 100%, the electric heat will be ON all the time.

Electric Heat Interlock

The electric heat stages will be enabled as long as FLOW (Point 75) is greater than EHEAT FLOW (Point 62). The electric heat stages will not be disabled (turned OFF) until the FLOW is less than EHEAT FLOW – 5%. Once disabled, FLOW must become greater than EHEAT FLOW before the electric heat stages will return to normal control.

CAUTION:

Do not set EHEAT FLOW to less than 5%, otherwise the electric heat interlock will be disabled.

Ventilation Duct Control

The airflow through the ventilation duct is measured by AIR VOLUME 2 (Point 30). How the Ventilation Damper (VENT COMD, Point 52) is controlled depends on the value of VENT PID (Point 91). When VENT PID is NO, the ventilation damper uses two position control and is controlled as follows:

- VENT COMD is set to 0% OPEN when both DAY.NGT (Point 29) and NGT OVRD (Point 21) are UNOCC.
- VENT COMD is set to 100% OPEN when either DAY.NGT or NGT OVRD (or both) are OCC.

When VENT PID is YES, the ventilation damper uses modulating control. In this case the ventilation damper is controlled as follows:

- VENT COMD is set to 0% OPEN when both DAY.NGT (Point 29) and NGT OVRD (Point 21) are UNOCC.
- When either DAY.NGT or NGT OVRD (or both) are OCC, the ventilation airflow is controlled by the ventilation airflow PID loop. The ventilation airflow loop controls VENT COMD in order to maintain the VENT FLO STP (Point 61). The ventilation flow loop maintains the ventilation airflow between VENT FLO MIN (Point 76) and VENT FLO MAX (Point 77).
- The point VENT FLOW (Point 74) is the input value for the ventilation flow loop. It is calculated as a percentage based on where the point AIR VOLUME 2 (Point 30) is between 0 CFM and VENT FLO MAX (Point 77). In the following text, this percentage will be referred to as *% flow*.
- If AIR VOLUME 2 equals 0 CFM, then VENT FLOW is 0% flow.
- If AIR VOLUME 2 equals VENT FLO MAX, then VENT FLOW is 100% flow.

The low limit of VENT FLO STP (Point 61) will be the percentage that corresponds to the volume given in VENT FLO MIN. This percentage can be calculated as:

VENT FLO MIN ÷ VENT FLO MAX) × 100% flow.
The flow loop ensures that the supply air will not be less than VENT FLOW MIN.

For example:

If VENT FLO MIN equals 320 CFM, and if VENT FLOW MAX equals 1000 CFM

then,

the low limit of VENT FLO STP = (320 CFM ÷ 1000 CFM) × 100% flow.
= 0.32 × 100% flow
= 32% flow

Since 32% of 1000 CFM equals 320 CFM, the minimum airflow out of the terminal box will be 320 CFM.

The customer has the option of setting VENT FLO STP directly (as a % value) or VENT CFM STP (as a CFM value). (VENT CFM STP is Point 10.) If the customer sets VENT CFM STP, the application uses a built in table statement to set the value of VENT FLO STP. This calculation will still maintain VENT FLO MIN and VENT FLO MAX. A few examples will illustrate this. In each example, assume that VENT FLO MIN equals 320 CFM and VENT FLO MAX equals 1000 CFM.

Example 1: The customer sets VENT CFM STP to 700 CFM.

Result: VENT FLO STP will equal 70% flow.

Example 2: The customer sets VENT CFM STP to 400 CFM.

Result: VENT FLO STP will equal 40% flow.

Example 3: The customer sets VENT CFM STP to 100 CFM.

Result: VENT FLO STP will equal 32% flow. This corresponds to the VENT FLO MIN value of 320 CFM.

Example 4: The customer sets VENT CFM STP to 2000 CFM.

Result: VENT FLO STP will equal 100% flow. This corresponds to the VENT FLO MAX value of 1000 CFM.

Calibration

Air Velocity Transducers – Calibration of the controller’s internal air velocity transducers is periodically required to maintain accurate air velocity readings. CAL SETUP (Point 95) is set with the desired calibration option during controller startup. Depending upon the value of CAL SETUP, calibration may be set to take place automatically or manually. If the status of CAL AIR (Point 94) is YES, then calibration is in progress.

- For a controller used without an Autozero Module (CAL MODULE (Point 87) = NO), the ventilation damper is commanded closed to get a zero ventilation airflow reading during calibration; then, the temperature control damper is commanded closed to get a zero temperature control airflow reading during calibration.
- For a controller used with an Autozero Module (CAL MODULE = YES), calibration of the airflow sensors occurs without closing the dampers.

At the end of a calibration sequence, CAL AIR returns to NO automatically. A status of NO indicates that the controller is not in a calibration sequence.

Damper Status

Under normal operation DMPR STATUS (Point 84) reads CAL. However, if using an Autozero Module, it is possible after a period of operation for the calculated damper position points, DMPR POS (Point 49) or VENT POS (Point 53), to differ from the actual (physical) damper position.

If this occurs, the controller will automatically compensate for any difference by setting DMPR STATUS to RECAL which readjusts the value of the damper position points.

DMPR STATUS is set to RECAL and the temperature control damper will be adjusted if all of the following conditions are true:

- DMPR POS and VENT POS = 100%
- Temperature Control Air velocity (AIR VOLUME 1 / DUCT AREA) > 200 FPM
- FLOW < FLOW STPT

-or-

- DMPR POS and VENT POS = 0%
- Temperature Control Air velocity (AIR VOLUME 1 / DUCT AREA) > 200 FPM
- FLOW > FLOW STPT

DMPR STATUS is set to RECAL and the Ventilation Damper will be adjusted if all of the following conditions are true:

- DMPR POS and VENT POS = 100%
- Ventilation Air Velocity (AIR VOLUME 2 / DUCT AREA 2) > 200 FPM
- VENT FLOW < VENT FLO STP

-or-

- DMPR POS and VENT POS = 0%
- Ventilation Air velocity (AIR VOLUME 2 / DUCT AREA 2) > 200 FPM
- VENT FLOW > VENT FLO STP

NOTE: To change the value of DMPR STATUS from RECAL back to CAL, set DMPR STATUS to CAL and then release it.

The Autozero Module is enabled when it is wired to DO 8 and CAL MODULE (Point 87) is set to YES.

Fail-Safe Operation

If the ventilation duct damper is being controlled by a flow loop and the air velocity sensor in the ventilation duct fails, then VENT COMD will be set equal to VENT FLO STP.

If the air velocity sensor in the temperature control duct fails, then:

- DMPR COMD will be set equal to CLG LOOPOUT if HEAT.COOL equals COOL.
- DMPR COMD will be set equal to FLOW STPT if HEAT.COOL equals HEAT.

If the room temperature sensor fails, then the controller operates using the last known temperature value.

Application Notes

1. If the temperature swings in the room are excessive or if there is trouble in maintaining the set point, then either the cooling loop, the heating loop or both need to be tuned. If FLOW (Point 75) is oscillating while FLOW STPT (Point 93) is constant, then the temperature control flow loop requires tuning. If VENT FLOW (Point 74) is oscillating while VENT FLO STP (Point 61) is constant, then the ventilation flow loop requires tuning. Refer to *Apogee Automation Service Procedures Manual* (125-3013) for more information.

2. The Controller, as shipped from the factory, keeps all associated equipment OFF. Refer to the Equipment Controllers tab in *Apogee Automation Start-up Procedures Manual* (125-3014) for information on how to release the controller and its equipment to application control.

3. Spare DOs can be used as auxiliary points that are controlled by the field panel after being defined in the field panel's database.

Wiring Diagram

The point wiring for Application 2359 is shown in Figure 2359-7.

CAUTION:

The Controller's Digital Outputs (DOs) control 24 Vac loads only. The maximum rating is 12 VA for each DO. Use an interposing 220 V 4-relay module for any of the following:

- VA requirements higher than the maximum
- 110 or 220 Vac
- DC Power
- Separate transformers used to power the load

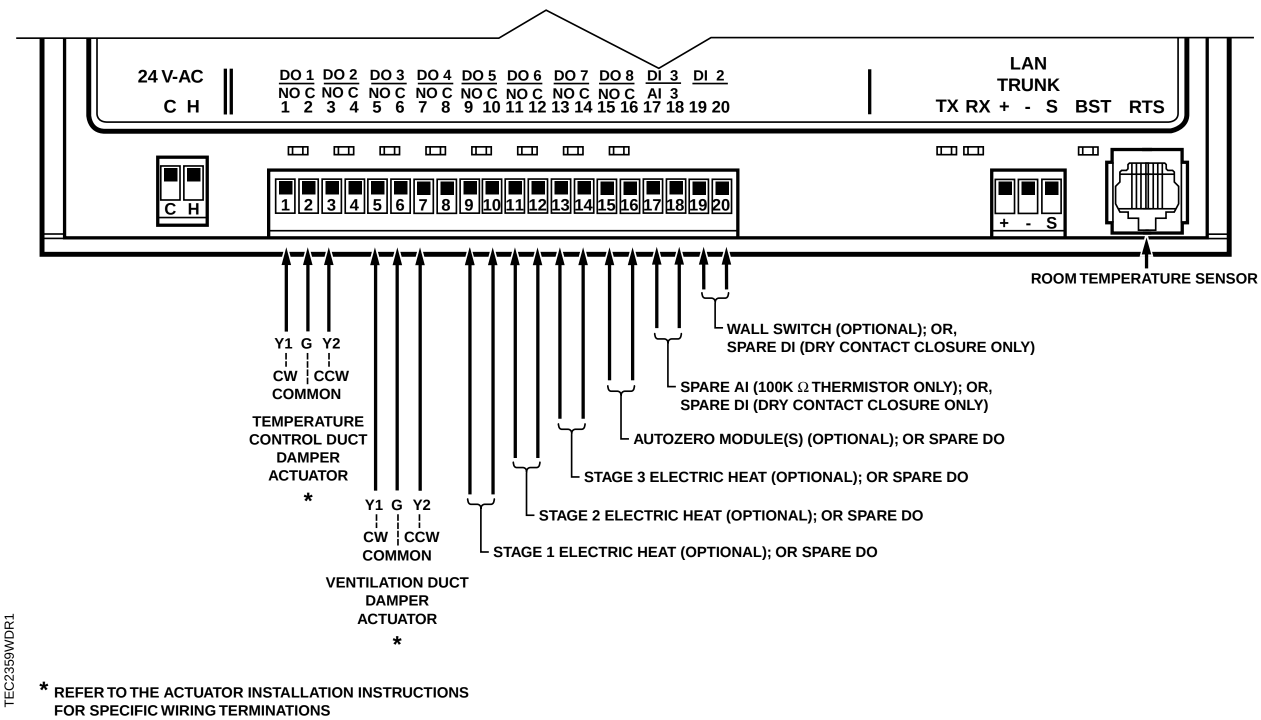


Figure 2359-7. Application 2359 Wiring Diagram.

Table 2359-1. Point Database for Application 2359.

Point Number	Descriptor	Factory Default (SI Units)	Engr Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
01	CTLR ADDRESS	99	--	1	0	--	--
02	APPLICATION	2293	--	1	0	--	--
{04}	ROOM TEMP	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0(8.88888)	--	--
{05}	HEAT.COOL	COOL	--	--	--	HEAT	COOL
06	DAY CLG STPT	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0(8.88888)	--	--
07	DAY HTG STPT	70.0 (21.20888)	DEG F (DEG C)	0.25 (0.14)	48.0(8.88888)	--	--
08	NGT CLG STPT	82.0 (27.92888)	DEG F (DEG C)	0.25 (0.14)	48.0(8.88888)	--	--
09	NGT HTG STPT	65.0 (18.40888)	DEG F (DEG C)	0.25 (0.14)	48.0(8.88888)	--	--
{10}	VENT CFM STP	1000 (471.9)	CFM (LPS)	4 (1.8876)	0	--	--
11	RM STPT MIN	55.0 (12.80888)	DEG F (DEG C)	0.25 (0.14)	48.0(8.88888)	--	--
12	RM STPT MAX	90.0 (32.40888)	DEG F (DEG C)	0.25 (0.14)	48.0(8.88888)	--	--
{13}	RM STPT DIAL	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0(8.88888)	--	--
14	STPT DIAL	NO	--	--	--	YES	NO
{15}	AUX TEMP	74.0 (23.495556)	DEG F (DEG C)	0.5 (0.28)	37.5(3.055556)	--	--
16	FLOW START	0.0	PCT	0.4	0.0	--	--
17	FLOW END	0.0	PCT	0.4	0.0	--	--
18	WALL SWITCH	NO	--	--	--	YES	NO
{19}	DI OVRD SW	OFF	--	--	--	ON	OFF
20	OVRD TIME	0	HRS	1	0	--	--
{21}	NGT OVRD	NIGHT	--	--	--	NIGHT	DAY
22	REHEAT START	0.0	PCT	0.4	0.0	--	--
23	REHEAT END	100.0	PCT	0.4	0.0	--	--
{24}	DI 2	OFF	--	--	--	ON	OFF
{25}	DI 3	OFF	--	--	--	ON	OFF
26	VENT FLO PG	0.0	--	0.05	0.0	--	--
27	VENT FLO IG	0.01	--	0.001	0.0	--	--
28	VENT FLO DG	0	--	2	0	--	--
{29}	DAY.NGT	DAY	--	--	--	NIGHT	DAY
{30}	AIR VOLUME 2	0 (0.0)	CFM (LPS)	4 (1.8876)	0	--	--
{31}	CLG FLOW MIN	220 (103.818)	CFM (LPS)	4 (1.8876)	0	--	--

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3. Point numbers that appear in brackets {} may be unbundled at the field panel.

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Table 2359-1. Point Database for Application 2359.

Point Number	Descriptor	Factory Default (SI Units)	Engr Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
{32}	CLG FLOW MAX	2200 (1038.18)	CFM (LPS)	4 (1.8876)	0	--	--
{33}	HTG FLOW MIN	220 (103.818)	CFM (LPS)	4 (1.8876)	0	--	--
{34}	HTG FLOW MAX	2200 (1038.18)	CFM (LPS)	4 (1.8876)	0	--	--
{35}	AIR VOLUME 1	0 (0.0)	CFM (LPS)	4 (1.8876)	0	--	--
36	FLOW COEFF	1.0	--	0.01	0.0	--	--
{37}	MTR3 COMD	0.0	PCT	0.4	0.0	--	--
{38}	MTR3 POS	0.0	PCT	0.4	0.0	--	--
39	MTR3 TIMING	130	SEC	1	0	--	--
{40}	VENT LOOPOUT	0.0	PCT	0.4	0.0	--	--
{41}	DO 1	OFF	--	--	--	ON	OFF
{42}	DO 2	OFF	--	--	--	ON	OFF
{43}	DO 3	OFF	--	--	--	ON	OFF
{44}	DO 4	OFF	--	--	--	ON	OFF
{45}	HEAT STAGE 1	OFF	--	--	--	ON	OFF
{46}	HEAT STAGE 2	OFF	--	--	--	ON	OFF
{47}	HEAT STAGE 3	OFF	--	--	--	ON	OFF
{48}	DMPR COMD	0.0	PCT	0.4	0.0	--	--
{49}	DMPR POS	0.0	PCT	0.4	0.0	--	--
{50}	DO 8	OFF	--	--	--	ON	OFF
51	MTR1 TIMING	95	SEC	1	0	--	--
{52}	VENT COMD	0.0	PCT	0.4	0.0	--	--
{53}	VENT POS	0.0	PCT	0.4	0.0	--	--
54	FLOW COEFF 2	1.0	--	0.01	0.0	--	--
55	MTR2 TIMING	130	SEC	1	0	--	--
56	DMPR ROT ANG	90	--	1	0	--	--
57	VENT ROT ANG	90	--	1	0	--	--
58	MTR SETUP	0	--	1	0	--	--
59	DO DIR. REV	0	--	1	0	--	--
60	DUCT AREA 2	1.0 (0.09292)	SQ. FT (SQ M)	0.025 (0.002323)	0.0	--	--
{61}	VENT FLO STP	0.0	PCT	0.25	0.0	--	--

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Table 2359-1. Point Database for Application 2359.

Point Number	Descriptor	Factory Default (SI Units)	Engr Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
62	EHEAT FLOW	20.0	PCT	0.4	0.0	--	--
63	CLG P GAIN	20.0 (36.0)	--	0.25 (0.45)	0.0	--	--
64	CLG I GAIN	0.01 (0.018)	--	0.001 (0.0018)	0.0	--	--
65	CLG D GAIN	0 (0.0)	--	2 (3.6)	0	--	--
66	CLG BIAS	0.0	PCT	0.4	0.0	--	--
67	HTG P GAIN	10.0 (18.0)	--	0.25 (0.45)	0.0	--	--
68	HTG I GAIN	0.01 (0.018)	--	0.001 (0.0018)	0.0	--	--
69	HTG D GAIN	0 (0.0)	--	2 (3.6)	0	--	--
70	HTG BIAS	0.0	PCT	0.4	0.0	--	--
71	FLOW P GAIN	0.0	--	0.05	0.0	--	--
72	FLOW I GAIN	0.01	--	0.001	0.0	--	--
73	FLOW D GAIN	0	--	2	0	--	--
{74}	VENT FLOW	0.0	PCT	0.25	0.0	--	--
{75}	FLOW	0.0	PCT	0.25	0.0	--	--
{76}	VENT FLO MIN	220 (103.818)	CFM (LPS)	4 (1.8876)	0	--	--
{77}	VENT FLO MAX	2200 (1038.18)	CFM (LPS)	4 (1.8876)	0	--	--
{78}	CTL TEMP	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0(8.88888)	--	--
{79}	CLG LOOPOUT	0.0	PCT	0.4	0.0	--	--
{80}	HTG LOOPOUT	0.0	PCT	0.4	0.0	--	--
{81}	AVG HEAT OUT	0	--	2	0	--	--
82	STAGE MAX	90.0	PCT	0.4	0.0	--	--
83	STAGE MIN	10.0	PCT	0.4	0.0	--	--
{84}	DMPR STATUS	CAL	--	--	--	RECAL	CAL
85	SWITCH LIMIT	5.2	PCT	0.4	0.0	--	--
86	SWITCH TIME	10	MIN	1	0	--	--
87	CAL MODULE	NO	--	--	--	YES	NO
88	STAGE COUNT	1	--	1	0	--	--
89	STAGE TIME	10	MIN	1	0	--	--
90	SWITCH DBAND	1.0 (0.56)	DEG F (DEG C)	0.25 (0.14)	0.0	--	--
{91}	VENT PID	NO	--	--	--	YES	NO

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Table 2359-1. Point Database for Application 2359.

Point Number	Descriptor	Factory Default (SI Units)	Engr Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
{92}	CTL STPT	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0(8.88888)	--	--
{93}	FLOW STPT	0.0	PCT	0.25	0.0	--	--
{94}	CAL AIR	NO	--	--	--	YES	NO
95	CAL SETUP	4	--	1	0	--	--
96	CAL TIMER	12	HRS	1	0	--	--
97	DUCT AREA	1.0 (0.09292)	SQ. FT (SQ M)	0.025 (0.002323)	0.0	--	--
98	LOOP TIME	5	SEC	1	0	--	--
{99}	ERROR STATUS	0	--	1	0	--	--

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