SIEMENS

BACnet VAV with CO2 Monitoring, Parallel or Series Fan and AOV or Floating Point Heat

Application Notes

Application 2581 and Application 2582

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Overview

The controller modulates the supply air damper of the terminal box to provide for cooling and modulates a hot water valve for heating. When in heating, the VAV box either maintains minimum airflow or modulates the VAV box airflow based on the heating needs of the space. If the VAV box airflow is to be modulated in heating mode, the flow loop and the reheat valves can be sequenced as desired (series, parallel and overlapping sequencing are all supported.) Application 2581 controls a series fan and Application 2582 controls a parallel fan that recirculates the room air. This application can also monitor $CO_2$and Supply Air Temperature (Aux Temp). In order for the terminal box to work properly, the central air handling unit must provide supply air.

Unlike most other applications with reheat, Application 2581 and Application 2582 do not limit the user to having only DO commanded reheat or to having only AO (0-10V) commanded reheat. Instead, Application 2581 and Application 2582 allow the user to configure Floating Point and/or 0-10V AO commanded reheat on the same job. See *Modulating Heat* and *Application Notes*, #5 for information on how AOVs can be used to control SCRs.

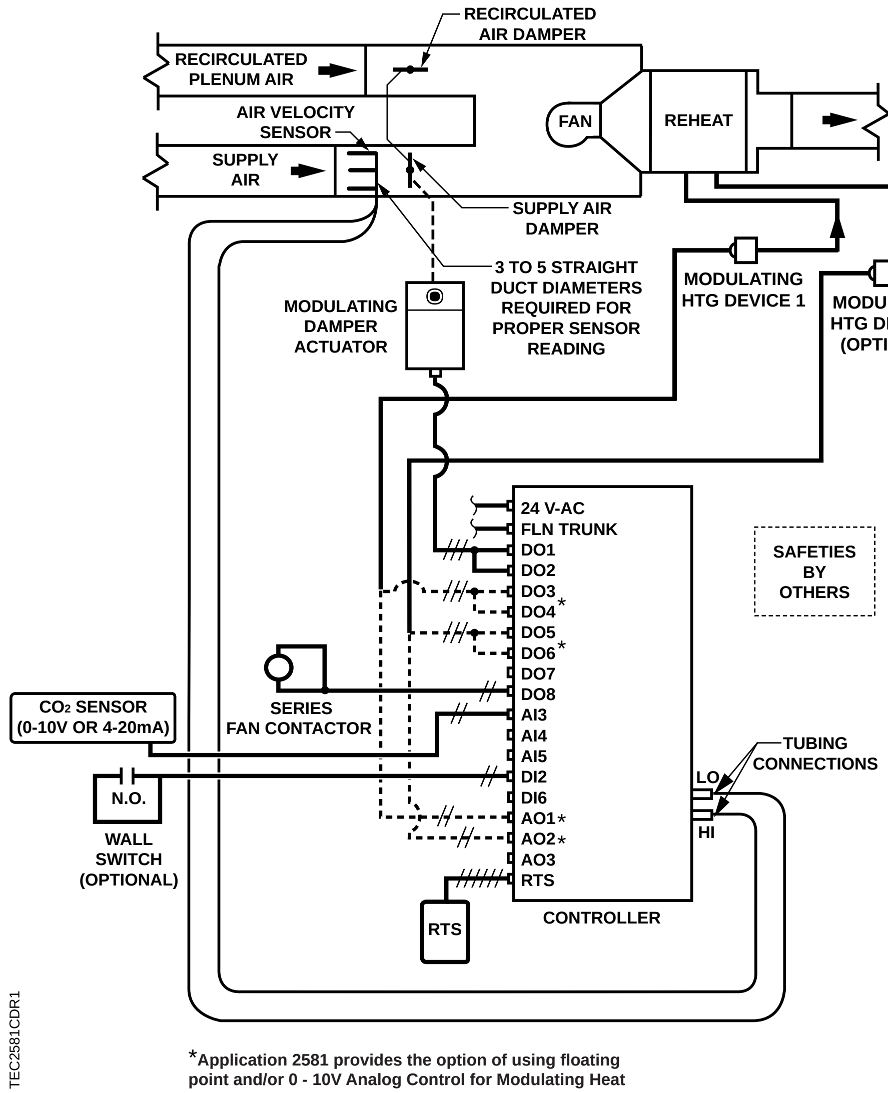

Figure 1. Application 2581 Control Diagram.

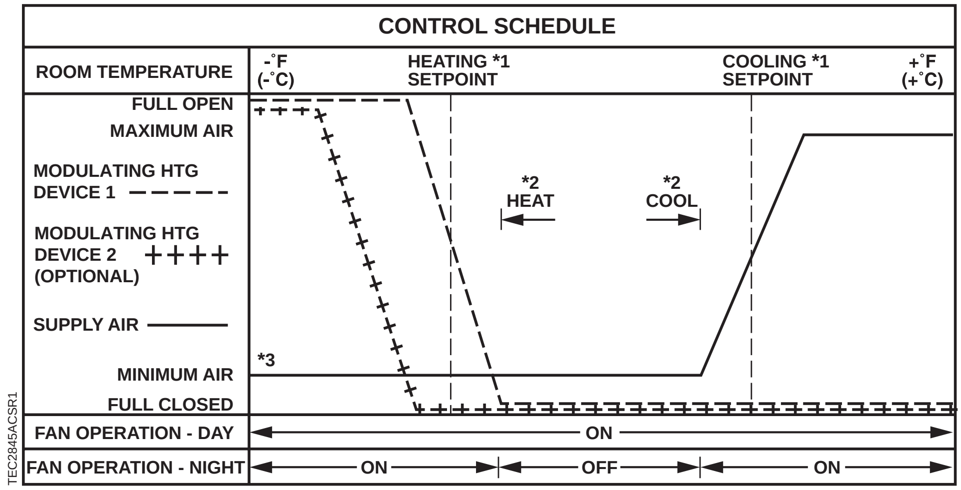

Figure 2. Application 2581 Control Schedule.

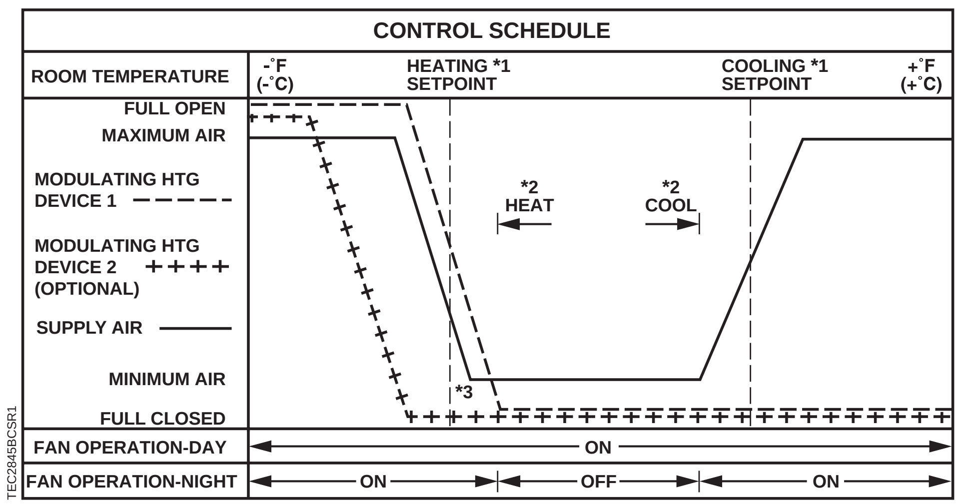

Figure 3. Application 2581 Control Schedule with Modulating Damper in Heating Mode.

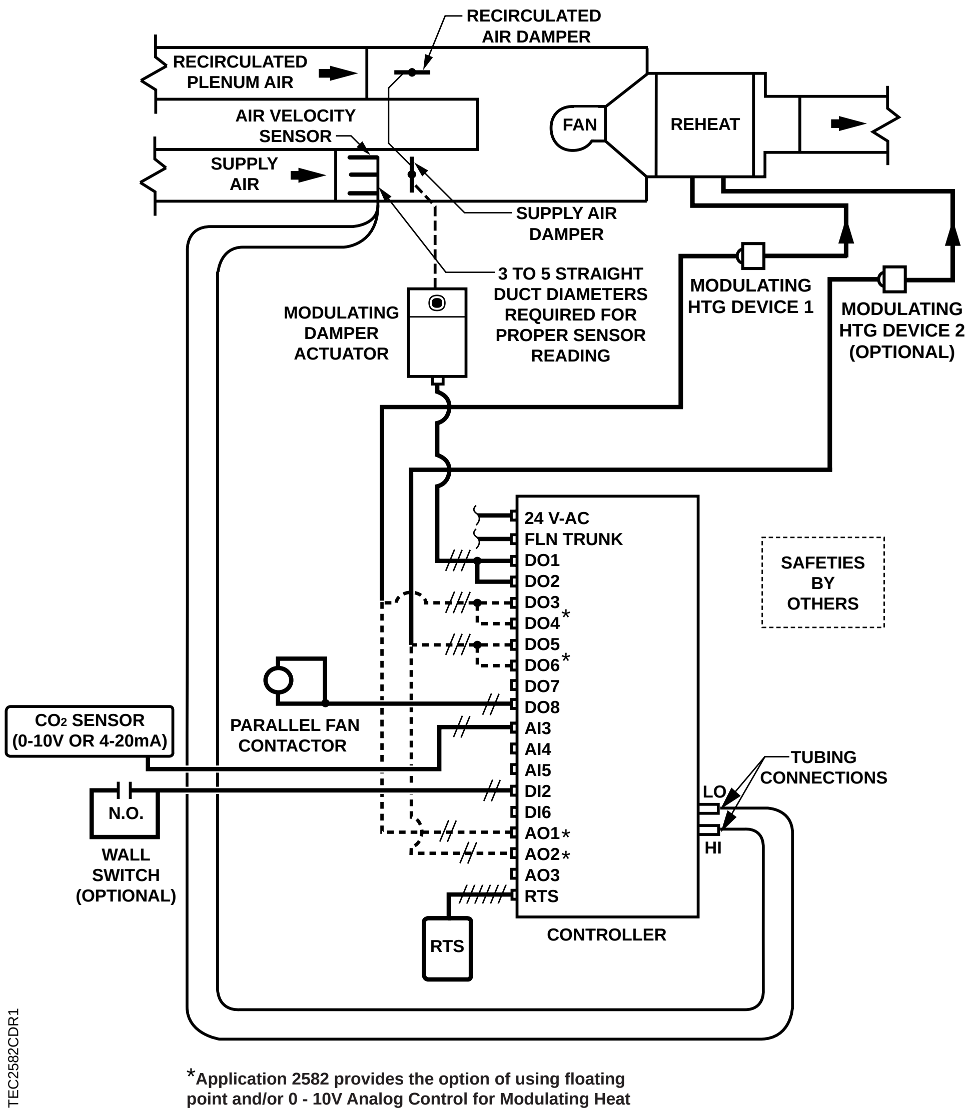

Figure 4. Application 2582 Control Diagram.

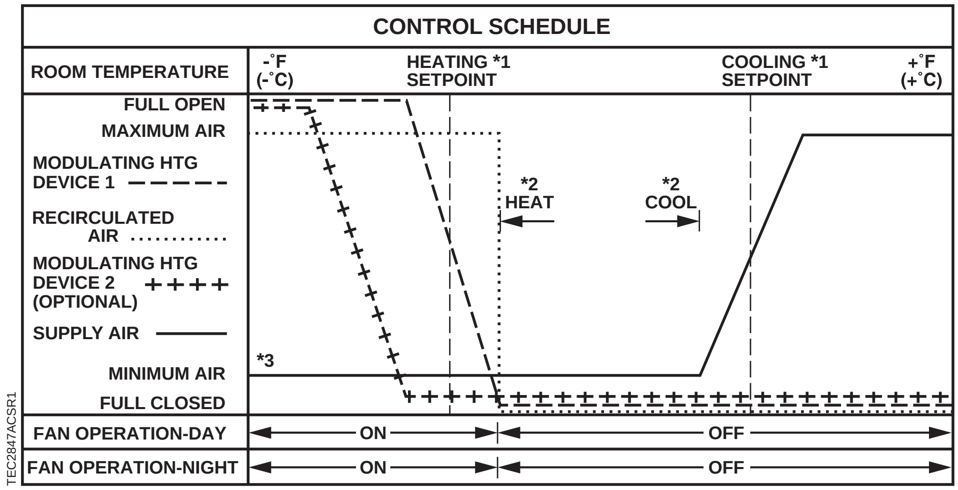

Figure 5. Application 2582 Control Schedule.

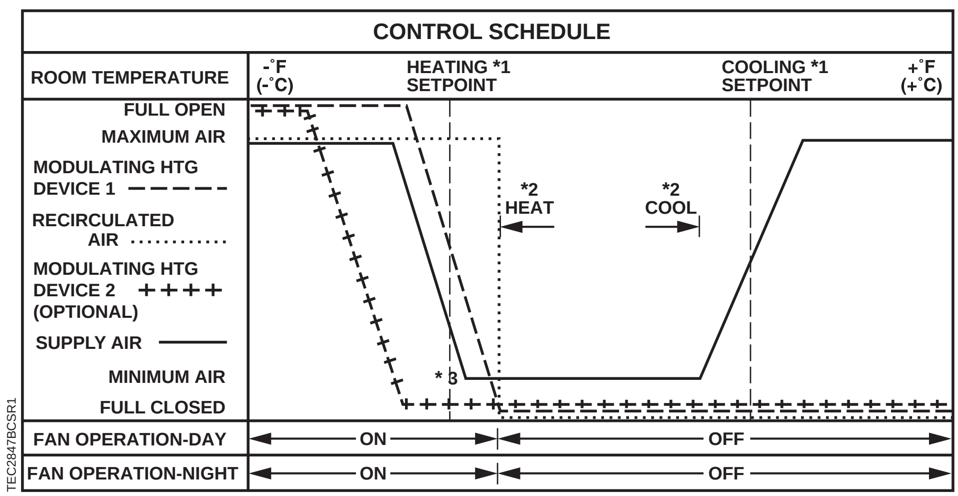

Figure 6. Application 2582 Control Schedule with Modulating Damper in Heating Mode.

BACnet

The BACnet Terminal Box Controller - Electronic Output communicates using BACnet MS/TP protocol for open communications on BACnet MS/TP networks.

Table 1. Supported BIBBS.

Product	Supported BIBBs	BIBB Name
BTEC	DS-RP-B	Data Sharing-ReadProperty-B
	DS-RPM-B	Data Sharing-ReadPropertyMultiple-B
	DS-WP-B	Data Sharing-WriteProperty-B
	DM-DDB-B	Device Management-Dynamic Device Binding-B
	DM-DOB-B	Device Management-Dynamic Object Binding-B
	DM-DDC-B	Device Management-Device Communication Control-B

Hardware Inputs

Analog

- air velocity sensor
- CO_2 sensor (0-10V or 4-20 mA)
- room temperature sensor
- room temperature set point dial (optional)
- auxiliary temperature sensor (100 kOhm thermistor) (optional?)

Digital

- night mode override (optional)
- wall switch (optional)

Hardware Outputs

If AOs are used for modulating heating devices, the DOs are spare but unavailable for motor control. If DOs are used for modulating heating, the AOs are spare but unavailable for motor control.

For example, Motor 2 (DO3 and DO4) and AOV 2 can be used for motor control (other outputs are spare) but Motor 2 (DO3 and DO4) and AOV 1 cannot both be used for motor control.

Analog

- AOV1 - First stage of analog heating. (Spare if DO3,DO4 used for first stage heating)

- AOV2 - Optional second stage of analog heating. (Spare if DO5,DO6 used for optional second stage heating)
- AOV3 - Spare

OR

- up to 3 spare 0 to 10V AOVs if floating point control is used for heating

Digital

- DO1, DO2 Damper Actuator
- D03, DO4 First stage of floating point heating. (Spare if AO1 used for first stage heating)
- DO5, DO6 Optional second stage of floating point heating. (Spare if AO2 used for optional second stage heating)
- DO7 Spare
- DO8 Fan Contactor

Ordering Notes

BACnet VAV with CO2 Monitoring, Parallel or Series Fan and AOV or Floating Point Heat	550–785B

See *APOGEE Automation Configuration and Sizing Guidelines* on InfoLink for product numbers.

Damper Actuator
Terminal Equipment Controller Room Temperature Sensor
Valve Actuator

Sequence of Operation

The following paragraphs present the sequence of operation for BACnet VAV with CO2 Monitoring, Parallel or Series Fan and AOV or Floating Point Heat.

Control Temperature Setpoints

The application has a number of different room temperature setpoints in it (DAY HTG STPT, NGT CLG STPT, RM STPT DIAL, etc.). The application actually controls to CTL STPT. CTL STPT will get set to different values depending on different circumstances. The next several sections will explain this further.

CTL STPT is Overridden - When CTL STPT is overridden, CTL STPT will equal its overridden value and the application will have no effect on the value of CTL STPT. Also when CTL STPT is overridden, CTL STPT will always have a status of Normal, even if the Status of RM STPT DIAL is Failed.

Night Mode – In night mode, CTL STPT holds the value of NGT CLG STPT (Point 08) or NGT HTG STPT (Point 09). This is true whether or not a setpoint dial is being used. Also during night mode, CTL STPT will always have a status of Normal, even if the status of RM STPT DIAL is Failed.

Day Mode (setpoint dial not used) – In the day mode when a setpoint dial is not being used, then CTL STPT holds the value of DAY CLG STPT (Point 06) or DAY HTG STPT (Point 07). Also, CTL STPT will always have a Status of Normal, even if the Status of RM STPT DIAL is Failed.

Room Temperature Setpoint Dial

When STPT DIAL (Point 14) = NO, a room temperature setpoint dial is not being used. A setpoint dial is being used when STPT DIAL is YES. When a setpoint dial is present, it is only used when both of the following 2 conditions hold:

- the controller is in Day mode.
- CTL STPT is not overridden.

If these 2 conditions are both true, then:

When RM STPT DIAL has a status of Normal, CTL STPT will have a status of Normal. The current value of RM STPT DIAL will be used to determine the value of CTL STPT.

When RM STPT DIAL has a status of Failed and RM STPT DIAL is overridden, CTL STPT will have a status of Normal. The current value of RM STPT DIAL will be used to determine the value of CTL STPT.

When RM STPT DIAL has a status of Failed and RM STPT DIAL is not overridden, CTL STPT will have a status of Failed. The last known good value of RM STPT DIAL will be used to determine the value of CTL STPT.

When a setpoint dial is being used, the actual value of CTL STPT will depend on whether or not a there is a deadband being used. The following 2 sections will explain this further. In both of these sections, the following assumptions are made:

- A setpoint dial is being used.
- The controller is in Day mode.
- CTL STPT is not overridden.

Setpoint dial used without a deadband

When DAY HTG STPT equals DAY CLG STPT, a setpoint deadband is not being used. (A space where the deadband is not used may be more comfortable than a space where the deadband is being used.) If a setpoint deadband is not being used, then:

1. CTL STPT will equal RM STPT MAX (Point 12) if RM STPT DIAL > RM STPT MAX.
2. CTL STPT will equal RM STPT MIN (Point 11) if RM STPT DIAL < RM STPT MIN.
3. Otherwise, CTL STPT will equal RM STPT DIAL.

Setpoint dial used with a deadband

When DAY HTG STPT does not equal DAY CLG STPT, a setpoint deadband (or zero energy band) is being used. (A space where the deadband is used can be more energy efficient than a space where the deadband is not being used.) If a setpoint deadband is being used, then:

When HEAT.COOL (Point 5) equals HEAT.

1. If RM STPT DIAL > than RM STPT MAX, then:
   a. If [RM STPT MAX – 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.
   b. If [RM STPT MAX – 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.
   c. Other wise, CTL STPT will equal RM STPT MAX – 0.5 * (DAY CLG STPT – DAY HTG STPT).
2. If RM STPT DIAL < than RM STPT MIN, then:
   a. If [RM STPT MIN – 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.
   b. If [RM STPT MIN – 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.
   c. Other wise, CTL STPT will equal RM STPT MIN – 0.5 * (DAY CLG STPT – DAY HTG STPT).
3. If RM STPT MAX > RM STPT DIAL > RM STPT MIN, then:
   a. If [RM STPT DIAL – 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.
   b. If [RM STPT DIAL – 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.
   c. Other wise, CTL STPT will equal RM STPT DIAL – 0.5 * (DAY CLG STPT – DAY HTG STPT).

When HEAT.COOL (Point 5) equals COOL.

1. If RM STPT DIAL > than RM STPT MAX, then:
   a. If [RM STPT MAX + 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.

   b. If [RM STPT MAX + 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.

   c. Other wise, CTL STPT will equal RM STPT MAX + 0.5 * (DAY CLG STPT – DAY HTG STPT).

2. If RM STPT DIAL < than RM STPT MIN, then:

   a. If [RM STPT MIN + 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.

   b. If [RM STPT MIN + 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.

   c. Other wise, CTL STPT will equal RM STPT MIN + 0.5 * (DAY CLG STPT – DAY HTG STPT).

3. If RM STPT MAX > RM STPT DIAL > RM STPT MIN, then:

   a. If [RM STPT DIAL + 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.

   b. If [RM STPT DIAL + 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.

   c. Other wise, CTL STPT will equal RM STPT DIAL + 0.5 * (DAY CLG STPT – DAY HTG STPT).

Room Temperature, Room Temperature Offset and CTL TEMP

ROOM TEMP is the temperature that is being sensed by the room temperature sensor (the RTS).

Room Temperature Offset, RMTMP OFFSET (Point 66), is a user-adjustable offset that will compensate for deviations between the value of ROOM TEMP (Point 4) and the actual room temperature.

CTL TEMP is the room temperature that is used for control purposes. In other words, what the application is trying to do is to maintain CTL TEMP at CTL STPT.

When CTL TEMP is not overridden, CTL TEMP and ROOM TEMP are related by the following equation:

CTL TEMP (Point 78) = ROOM TMP (Point 4) + RMTMP OFFSET (Point 66).

If CTL TEMP is not overridden, then:

If ROOM TEMP has a status of Normal, then CTL TEMP will also have a status of Normal. The current value of ROOM TEMP will be used to determine the value of CTL TEMP.

If ROOM TEMP has a status of Failed and ROOM TEMP is overridden, then CTL TEMP will have a status of Normal. The current value of ROOM TEMP will be used to determine the value of CTL TEMP.

If ROOM TEMP has a status of Failed and ROOM TEMP is not overridden, then CTL TEMP will have a status of Failed. The last known good value of ROOM TEMP will be used to determine the value of CTL TEMP.

If CTL TEMP is overridden then:

1. CTL TEMP equals its overridden value and the points, ROOM TEMP and RMTMP OFFSET, have no effect on the value of CTL TEMP.

2. The status of CTL TEMP will always equal Normal, even if ROOM TEMP is Failed.

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 connected to a field panel.

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

When WALL SWITCH = NO, the controller does not monitor the status of the wall switch, even if one is connected to it. In this case, the controller is operating stand-alone, it stays in day mode all the time. If the controller is operating with centralized control, connected to a field panel, the field panel can send an operator or PPCL command to override the status of DAY.NGT. See *Powers Process Control Language (PPCL) User's Manual (125-1896)* and *Field Panel User's Manual (125-3000)* 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), pressing the override switch will reset the controller to day mode for the time period set in OVRD TIME. The status of NGT OVRD (Point 21) changes to DAY. After the override time elapses, the controller returns to night mode and NGT OVRD changes back to NIGHT.

The override switch on the room sensor will only affect the controller when in night mode.

Heating/Cooling Switchover

This section describes how the heating/cooling switchover feature works when both heating and cooling are enabled (HC.ENDIS (Point 91) = 3).

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

- HTG LOOPOUT (Point 80) < SWITCH LIMIT (Point 85).
- CTL TEMP (Point 78) > CTL STPT (Point 92) by at least the value set in SWITCH DBAND (Point 90).
- CTL TEMP > the appropriate cooling setpoint minus SWITCH DBAND.

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

- CLG LOOPOUT (Point 79) < SWITCH LIMIT.
- CTL TEMP < CTL STPT by at least the value set SWITCH DBAND.
- CTL TEMP < the appropriate heating setpoint plus SWITCH DBAND.

Application 2581 performs heating/cooling switchover based on room load. To perform heating/cooling switchover based on some other criteria, such as time of year, outside air temperature or supply air temperature, unbundle the HEAT.COOL point at a field panel and use PPCL to control it.

Heating only - set HC.ENDIS = 1.

Cooling only - set HC.ENDIS = 2.

Modulate Damper During Heating Mode (optional)

CAUTION:

This heating/cooling switchover mechanism is not affected by the air temperature in the supply duct.

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 flow loop will be used as a source of cooling in cooling mode and a source of heat in heating mode (see Examples 1 through 3 in *Sequencing Logic (Optional)*). If the flow loop is used in heating mode just to meet minimum air requirements, the heating/cooling switchover mechanism operates as described in this section to control HEAT.COOL (see Example 4 in *Sequencing Logic (Optional)*).

Control Loops

Application 2581 and Application 2582 are controlled by three Proportional, Integral, and Derivative (PID) control loops; two temperature loops and a flow loop.

Temperature Loop — Each loop uses CTL STPT (Point 92) and CTL TEMP (Point 78) to modulate the value of its respective loopout point, CLG LOOPOUT (Point 79) or HTG LOOPOUT (Point 80).

The cooling loop is active whenever HEAT.COOL (Point 5) = COOL and the fan is on. The heating loop is active whenever HEAT.COOL = HEAT and the fan is on. Neither loop is active when the fan is off (the loopout point will equal 0).

Loops contain advanced PID algorithms that limit motor movement when the temperature is close to setpoint.

Flow Loop – Maintains minimum airflow and maximum airflow through CTL FLOW MIN (Point 76) and CTL FLOW MAX (Point 77).

When the controller is in cooling mode, CTL FLOW MIN = CLG FLOW MIN, and CTL FLOW MAX = CLG FLOW MAX.

When the controller is in heating mode, CTL FLOW MIN = HTG FLOW MIN, and CTL FLOW MAX = HTG FLOW MAX.

In Application 2581 and Application 2582, you can set CLG FLOW MIN equal to, but not greater than, CLG FLOW MAX, and set HTG FLOW MIN equal to, but not greater than, HTG FLOW MAX. If the minimum and maximum values are set equal, the flow loop becomes a constant volume loop and loses its ability to control temperature.

The flow loop maintains FLOW STPT by modulating the supply air damper, DMPR COMD (Point 48). The flow loop maintains the airflow between CTL FLOW MIN and CTL FLOW MAX.

FLOW (Point 75) is the input value for the flow loop. It is calculated as a percentage based on where AIR VOLUME (Point 35) is between 0 cfm and CTL FLOW MAX. This percentage is referred to as % flow.

- If AIR VOLUME = 0 cfm, FLOW is 0% flow.
- If AIR VOLUME = CTL FLOW MAX, FLOW is 100% flow.

The low limit of FLOW STPT will be the percentage that corresponds to the volume given in CTL FLOW MIN. This percentage can be calculated as:

(CTL FLOW MIN / CTL FLOW MAX) × 100% flow .

The flow loop ensures that the supply air will not be less than CTL FLOW MIN.

Example

If CTL FLOW MIN = 250 cfm, and CTL FLOW MAX = 1000 cfm,
the low limit of FLOW STPT = (250 cfm / 1000 cfm) × 100% flow
= 0.25 × 100% flow
= 25% flow.

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

Modulating Heat

CAUTION:

If using Electric Heat, do not set HTG FLOW MIN (Point 33) to 0 CFM (0 LPS). Safeties provided by others should require a minimum airflow moving across the heating coils when modulating heating device is open.

In Application 2581 and Application 2582, the value of MODHTG COUNT (Point 88) determines how many heating control signals are generated, and the value of MTR SETUP (Point 58) determines what kind of heating control signal(s) are generated. See Table 2.

If Motor 2 (DOs 3 and 4) is being used for floating point control of a valve for heating, then AOV1 (Point 60) is spare. In this case, although AOV1 is spare, AOV1 OPEN (Point 61) and AOV1 CLOSE (Point 62) are not usable, because MODHTG1 COMD is being sent to Motor 2. Likewise, if Motor 3 is being used for Floating Point controlled heat, AOV2 (Point 38) would be spare but AOV2 OPEN (Point 39) and AOV2 CLOSE (Point 40) would not be usable.

In a similar manner, if AOs are used for 0-10V control of a valve(s) for heating, then the DOs that otherwise would be used for heating are spare. For example, if AOV1 is being used for heating (MODHTG1 COMD sent to AOV1), then Motor 2 DOs (DO3 and DO4) are spare. If AOV2 is is being used for heating (MODHTG2 COMD sent to AOV2), then Motor 3 DOs (DO5 and DO6) are spare. Keep in mind that although the DOs in these cases are spare, they cannot be used for additional motor control.

Table 2. Modulating Heating Signals in Application 2581 and Application 2582.

MODHTG COUNT (Point 88)	MTR SETUP (Point 58)	MODHTG1 COMD (Point 52)[a]	MODHTG2 COMD (Point 37)[b]
1[c]	Motor 2 Enabled	Motor 2 (DO3 and DO4)	N/A
	Motor 2 Disabled	AOV1	N/A
2[d]	Motor 2 Enabled, Motor 3 Disabled	Motor 2 (DO3 and DO4)	AOV2
	Motor 2 Disabled, Motor 3 Enabled	AO1	Motor 3 (DO5 and DO6)
	Motor 2 and Motor 3 both Enabled	Motor 2 (DO3 and DO4)	Motor 3 (DO5 and DO6)
	Motor 2 and Motor 3 both Disabled	AOV1	AOV2
0[e]	N/A	N/A	N/A

[a] MODHTG1 COMD drives either AOV1 or Motor 2 (DOs 3 and 4). (Motor 1 is is reserved for the damper.)

[b] MODHTG2 COMD drives either AOV2 or Motor 3 (DOs 5 and 6).

[c] If MODHTG COUNT = 1, only one modulating heat signal is generated (MODHTG1 COMD).

[d] If MODHTG COUNT = 2, two modulating heat signals are generated (MODHTG1 COMD and MODHTG2 COMD).

[e] If MODHTG COUNT = 0, no modulating heat signals are generated. The DOs for Motor 2 and Motor 3 (DOs 3 through 6) will be spare, and AO1 and AO2 will also be spare. (AO3 is always spare.)

The heating loop modulates the modulating heating device(s) in order to warm up the space as follows:

- If MODHTG COUNT (Point 88) = 1, when the heating command varies from 0 to 100% open of the reheat output range, MODHTG1 COMD (Point 52) varies from 0 to 100% open, and MODHTG2 COMD (Point 37) is not used.

- If MODHTG COUNT (Point 88) = 2, when the heating command varies from 0 to 50% of the reheat output range, MODHTG1 COMD varies from 0 to 100% open. When the heating command varies from 50 to 100% of the reheat output range, MODHTG2 COMD varies from 0 to 100% open.

When the controller is in cooling mode, the modulating heating device(s) is closed.

If MODHTG COUNT is set to a value greater than 2, then the MODHTG COUNT will display a 0 when viewed on the screen and the application will treat MODHTG COUNT as though it was set to 0.

In this application MODHTG1 COMD drives AOV1 (Point 60) or MOTOR2 (DO 3 and DO 4). When MODHTG1 COMD equals 0, AOV1 will be set equal to AOV1 CLOSE (Point 62). When MODHTG1 COMD equals 100, AOV1 will be set equal to AOV1 OPEN (Point 61). In a similar fashion, MODHTG2 COMD drives AOV2 (Point 38) or MOTOR3 (DO 5 and DO 6). When MODHTG2 COMD equals 0, AOV2 will be set equal to AOV2 CLOSE (Point 40). When MODHTG2 COMD equals 100, AOV2 will be set equal to AOV2 OPEN (Point 39).

Application 2582 only: If FAN MODE (Point 73) equals VARIED and MODHTG SAFE (Point 74) equals YES and FAN (Point 46) equals OFF, then MODHTG1 COMD and MODHTG2 COMD will be set to 0. Otherwise, MODHTG1 COMD and MODHTG2 COMD will be controlled as described previously.

Sequencing Logic (Optional)

This sequencing logic applies to Application 2582 when FAN MODE equals FIXED. It also applies to Application 2581.

The default setups for FLOW START (Point 16) and FLOW END (Point 17) are 0. This will provide minimum airflow during heating mode.

In heating mode, this application includes logic that allows the flow loop to operate in sequence, parallel, or overlapping with the modulating heat. Portions of the output of the heating loop, HTG LOOPOUT (Point 80), will drive both the flow loop and the modulating heat from 0 to 100%. See the following three examples.

The ladder diagrams in Figure 7 show sequenced, parallel, and overlapping flow loop operations with modulating heat. 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.

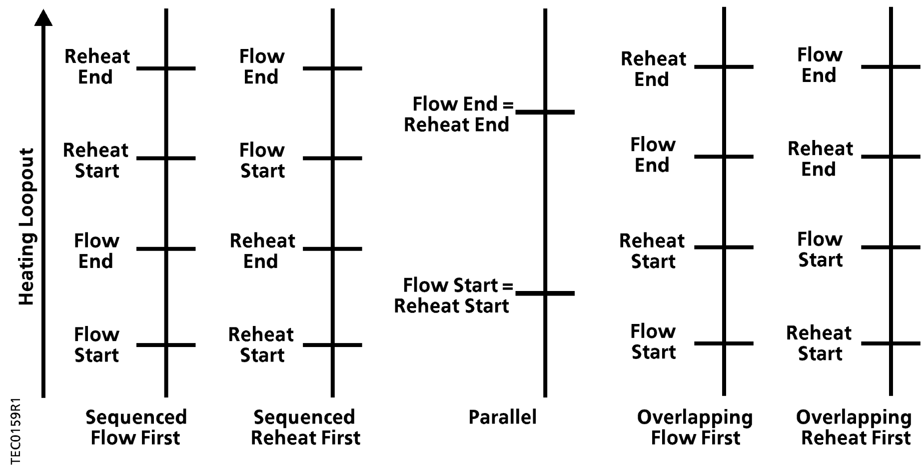

Figure 7. Sequenced, Parallel, and Overlapping Flow Loop Operations with Modulating Heating.

For simplicity, assume that in these examples:

- HTG FLOW MIN (Point 33) = 0 cfm.
- There is only one modulating heat (VALVE COUNT (Point 88) = 1).
- When this is done, FLOW STPT (Point 93) will equal 0 when HTG LOOPOUT = 0.

Example 1

Assume that your system has a modulating heat that is to operate in *sequence* with the flow loop. If:

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

then,

- When HTG LOOPOUT = 0%, FLOW STPT will equal 0% flow.
- When HTG LOOPOUT = 25%, FLOW STPT will equal 50% flow.
- When HTG LOOPOUT ≥ 50%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT ≤ 50%, VLV COMD will equal 0% open.
- When HTG LOOPOUT = 75%, VLV COMD will equal 50% open.

- When HTG LOOPOUT = 100%, VLV COMD will equal 100% open.

Example 2

Assume that your system has a modulating heating device that is to operate in *parallel* with the flow loop. If:

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

then,

- When HTG LOOPOUT = 0%, FLOW STPT will equal 0% flow.
- When HTG LOOPOUT = 50%, FLOW STPT will equal 50% flow.
- When HTG LOOPOUT = 100%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT = 0%, VLV COMD will equal 0% open.
- When HTG LOOPOUT = 50%, VLV COMD will equal 50% open.
- When HTG LOOPOUT = 100%, VLV COMD will equal 100% open.

Example 3

Assume that your system has a modulating heat that is to operate *overlapping* with the flow loop. If:

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

then,

- When HTG LOOPOUT = 0%, FLOW STPT will equal 0% flow.
- When HTG LOOPOUT = 37.5%, FLOW STPT will equal 50% flow.
- When HTG LOOPOUT ≥ 75%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT ≤ 25%, VLV COMD will equal 0% open.
- When HTG LOOPOUT = 62.5%, VLV COMD will equal 50% open.

- When HTG LOOPOUT = 100%, VLV COMD will equal 100% open.

Another option that the sequencing logic provides is to have the flow loop provide an airflow equal to HTG FLOW MIN throughout the heating mode with all of the temperature control being done by the modulating heat(s). The airflow minimum will be maintained by setting the FLOW START and FLOW END to a value of 0%, resulting in the corresponding minimum flow throughout the entire heating mode, regardless of the value of HTG LOOPOUT. Example 4 clarifies this:

Example 4

Assume that your system has a modulating heat that provides the temperature control in the heating mode, while the flow loop provides for the minimum air requirements. Assume:

- HTG FLOW MIN = 170 cfm
- HTG FLOW MAX = 1000 cfm

If:

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

then,

- When HTG LOOPOUT = 0%,
  FLOW STPT will equal (170 cfm / 1000 cfm) × 100% flow = 17% flow. This will cause the flow loop to maintain airflow of 170 cfm out of the terminal box.
- When HTG LOOPOUT = 50%, FLOW STPT will equal 17% flow.
- When HTG LOOPOUT = 100%, FLOW STPT will equal 17% flow.
- When HTG LOOPOUT = 0%, VLV COMD will equal 0% open.
- When HTG LOOPOUT = 50%, VLV COMD will equal 50% open.
- When HTG LOOPOUT = 100%, VLV COMD will equal 100% open.

Sequencing Logic, FAN MODE = VARIED (optional) (Application 2847)

When FAN MODE (Point 73) equals VARIED, the sequencing logic in Application 2847 is more complex than it is when FAN MODE equals FIXED. This is because the parallel fan can now be sequenced along with the modulating heating device(s) and the flow loop. This provides many sequencing combinations. It is not the purpose of this section to provide an example for every type of sequencing possible. Instead, examples are provided that will help you understand how to sequence the parallel fan, modulating heating device(s), and flow loop. For simplicity, assume that in these examples HTG FLOW MIN (Point 33) equals 0 CFM.

The modulating heating device(s) and the supply air damper are sequenced off of HTG LOOPOUT (Point 80). The parallel fan is a bit more complicated. Not only is it controlled by HTG LOOPOUT, but it is also controlled by FLOW (Point 75). If FLOW gets too high the parallel fan shuts OFF to prevent the common duct from rupturing. The following examples illustrate this. (Note: In these examples, it is assumed that MODHTG COUNT equals 1.)

Example 1

Assume that your system has a modulating heating device operating in sequence with the flow loop and parallel fan, the sequence order being fan, modulating heating device, and flow loop. Assume also that the parallel fan will shut OFF when the flow out of the supply duct is greater than 50% of HTG FLOW MAX and that the parallel fan will be allowed to turn back ON once the supply duct airflow drops to less than 30% of HTG FLOW MAX.

If,

- FAN OFF (Point 71) equals 5%
- FAN ON (Point 70) equals 20%
- PARALLEL ON (Point 55) equals 30%
- PARALLEL OFF (Point 57) equals 50%
- REHEAT START (Point 22) equals 35%
- REHEAT END (Point 23) equals 65%
- FLOW START (Point 16) equals 70%
- FLOW END (Point 17) equals 100%

then,

- When HTG LOOPOUT is greater than or equal to 20%, the FAN (Point 46) will turn ON (because the heating load is large enough).
- When HTG LOOPOUT is less than or equal to 35%, MODHTG1 COMD (Point 52) will equal 0% open.
- When HTG LOOPOUT equals 50%, MODHTG1 COMD will equal 50% open.
- When HTG LOOPOUT is equal to or greater than 65%, MODHTG1 COMD will equal 100% open.
- When HTG LOOPOUT is equal to or less than 70%, FLOW STPT (Point 93) will equal 0% flow.

- When HTG LOOPOUT is greater than 85%, FLOW STPT will equal 50% flow. Since this will cause the flow in the supply duct (FLOW, Point 75) to rise above 50% of HTG FLOW MAX, the FAN will shut OFF (to prevent the common duct from rupturing).
- When HTG LOOPOUT is equal to 100%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT is less than 79%, FLOW will be less than 30% of HTG FLOW MAX and the parallel fan will turn back ON.
- When HTG LOOPOUT is less than or equal to 5%, the parallel fan will turn OFF (because the heating load is so small that the fan no longer needs to be ON).

Example 2

Assume that your system has a modulating heating device operating in sequence with the flow loop and parallel fan, the sequence order being modulating heating device, fan, and flow loop. Assume also that the parallel fan will shut OFF when the flow out of the supply duct is greater than 50% of HTG FLOW MAX, and that the parallel fan will be allowed to turn back ON once the supply duct airflow drops to less than 30% of HTG FLOW MAX.

If,

- FAN OFF (Point 71) equals 40%
- FAN ON (Point 70) equals 60%
- PARALLEL ON (Point 55) equals 30%
- PARALLEL OFF (Point 57) equals 50%
- REHEAT START (Point 22) equals 0%
- REHEAT END (Point 23) equals 30%
- FLOW START (Point 16) equals 70%
- FLOW END (Point 17) equals 100%

then,

- When HTG LOOPOUT is equal to 0%, MODHTG1 COMD (Point 52) will equal 0% open.
- When HTG LOOPOUT equals 15%, MODHTG1 COMD will equal 50% open.
- When HTG LOOPOUT is equal to or greater than 30%, MODHTG1 COMD will equal 100% open.
- When HTG LOOPOUT is greater than 60%, the FAN (Point 46) will turn ON (because the heating load is large enough).
- When HTG LOOPOUT is equal to or less than 70%, FLOW STPT will equal 0% flow.

- When HTG LOOPOUT is greater than 85%, FLOW STPT will be greater than 50% flow. Since this will cause the flow in the supply duct (FLOW, Point 75) to rise above 50% of HTG FLOW MAX, the FAN will shut OFF (to prevent the common duct from rupturing).
- When HTG LOOPOUT is equal to 100%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT is less than 79%, FLOW will be less than 30% of HTG FLOW MAX and the parallel fan will turn back ON.
- When HTG LOOPOUT is less than 40%, the parallel fan will turn OFF (because the heating load is so small that the fan no longer needs to be ON).

Example 3

Assume that your system has a modulating heating device operating parallel with the flow loop, and that the fan turns ON before either the modulating heating device or the flow loop modulates. Assume also that the parallel fan will shut OFF when the flow out of the supply duct is greater than 60% of HTG FLOW MAX, and that the parallel fan will be allowed to turn back ON once the supply duct airflow drops to less than 50% of HTG FLOW MAX.

If,

- FAN OFF (Point 71) equals 5%
- FAN ON (Point 70) equals 30%
- PARALLEL ON (Point 55) equals 50%
- PARALLEL OFF (Point 57) equals 60%
- FLOW START (Point 16) equals 30%
- FLOW END (Point 17) equals 100%
- REHEAT START (Point 22) equals 30%
- REHEAT END (Point 23) equals 100%

then,

- When HTG LOOPOUT is greater than or equal to 30%, FAN (Point 46) will turn ON (because the heating load is large enough).
- When HTG LOOPOUT is equal to or less than 30%, MODHTG1 COMD will equal 0% open.
- When HTG LOOPOUT equals 65%, MODHTG1 COMD will equal 50% open.
- When HTG LOOPOUT equals 100%, MODHTG1 COMD will equal 100% open.
- When HTG LOOPOUT is equal to or less than 30%, FLOW STPT will equal 0% flow.

- When HTG LOOPOUT is equal to 65%, FLOW STPT will equal 50% flow.
- When HTG LOOPOUT is greater than 72%, FLOW STPT will be greater than 60% flow. Since this will cause the flow in the supply duct (FLOW, Point 75) to rise above 60% of HTG FLOW MAX, the fan will shut OFF (to prevent the common duct from rupturing).
- When HTG LOOPOUT equals 100%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT is less than 65%, FLOW will be less than 50% of HTG FLOW MAX and the parallel fan will turn back ON.
- When HTG LOOPOUT is less than or equal to 5%, the parallel fan will turn OFF (because the heating load is so small that the fan no longer needs to be ON).

Another option that the sequencing logic provides is to have the flow loop provide an airflow equal to HTG FLOW MIN throughout the heating mode with all of the temperature control being done by the modulating heating device and the parallel fan. When FLOW START and FLOW END are both set equal to 0%, the minimum flow will be maintained throughout the entire heating mode, regardless of the value of HTG LOOPOUT. See Example 4.

Example 4

Assume that the fan turns ON before the heating device modulates. Assume also that the parallel fan will shut OFF when the flow out of the supply duct is greater than 60% of HTG FLOW MAX, and that the parallel fan will be allowed to turn back ON once the supply duct airflow drops to less than 50% of HTG FLOW MAX. Finally, assume that HTG FLOW MIN equals 170 CFM and that HTG FLOW MAX equals 1000 CFM.

If,

- FAN OFF (Point 71) equals 5%
- FAN ON (Point 70) equals 30%
- PARALLEL ON (Point 55) equals 50%
- PARALLEL OFF (Point 57) equals 60%
- FLOW START (Point 16) equals 0%
- FLOW END (Point 17) equals 0%
- REHEAT START (Point 22) equals 30%
- REHEAT END (Point 23) equals 100%

then,

- When HTG LOOPOUT equals 0%, FLOW STPT will equal (170 CFM̦ 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 is equal to or less than 30%, MODHTG1 COMD will equal 0% open.
- When HTG LOOPOUT equals 65%, MODHTG1 COMD will equal 50% open.
- When HTG LOOPOUT equals 100%, MODHTG1 COMD will equal 100% open.
- When HTG LOOPOUT is greater than 30%, the FAN (Point 46) will turn ON (because the heating load is large enough).
- When HTG LOOPOUT is less than or equal to 5%, the parallel fan will turn OFF (because the heating load is so small that the fan no longer needs to be ON).

In this example the fan never turned OFF due to high supply airflow, because the supply airflow never rose above HTG FLOW MIN.

CO_2 Monitoring

The CO_2 (Point 3) holds the $CO_2$2 value in units of parts-per-million (PPM). This value takes the sensor input (0-100%) and scales it using CO_2 SCALE (Point 10). CO_2 can be unbundled for monitoring purposes.

Calibration

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

The damper is commanded closed to get a zero airflow reading during calibration.

Modulating Heating Valve – Calibration of a modulating heating valve(s) (motor 2 and motor 3) is done by commanding the valve to closed.

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

Series Fan Operation — Application 2581

CAUTION:

On series fan powered terminal boxes, the terminal box fan must be controlled/interlocked to start either before or at the same time as the central air handler. Failure to do so may cause the terminal box fan to rotate backwards and cause consequent damage at start up.

In day mode, FAN (Point 46), is ON all the time.
In night mode, the way the fan is controlled depends on the value of MODHTG COUNT (Point 88).

If it is the night mode and MODHTG COUNT equals 0, then:

- The fan will turn ON when the airflow out of the supply duct, FLOW (Point 75), is greater than the value stored in SERIES ON (Point 26).
- The fan will turn OFF when the airflow out of the supply duct, FLOW, is less than the value stored in SERIES OFF (Point 27).

Otherwise, the fan will remain in its last commanded state.
If it is the night mode and MODHTG COUNT equals 1, then:

The fan will turn ON when at least one of the following two conditions has been met:

- The modulating heating device, MODHTG1 COMD (Point 52), is greater than 0 (or has been 0 for less than MODHTG TIME). (The heating device is not completely shut or has not been shut long enough.)
- The airflow out of the supply duct, FLOW (Point 75), is greater than the value stored in SERIES ON (Point 26).

The fan will turn OFF only when the following two conditions have been met:

- The modulating heating device, MODHTG1 COMD, has been equal to 0 for longer than MODHTG TIME (Point 83). (The modulating heating device has been completely shut long enough.)
- The airflow out of the supply duct, FLOW, is less than the value stored in SERIES OFF (Point 27).

If the conditions don't exist to turn on the fan and the conditions don't exist to turn off the fan, then the fan will remain in its last commanded state.

If it is the night mode and MODHTG COUNT equals 2, then:
The fan will turn ON when at least one of the following two conditions has been met:

- The modulating heating device, MODHTG1 COMD (Point 52), is greater than 0 (or has been 0 for less than MODHTG TIME) and/or modulating heating device MODHTG2 COMD (Point 37) is greater than 0 (or has been 0 for less than MODHTG TIME). (At least one modulating heating device is not completely shut, or has not been shut long enough)).
- The airflow out of the supply duct, FLOW (Point 75), is greater than the value stored in SERIES ON (Point 26).

The fan will turn OFF only when the following two conditions have been met:

- Both modulating heating devices, MODHTG1 COMD and MODHTG2 COMD, have been equal to 0 for longer than MODHTG TIME (Point 83). (Both modulating heating devices have been completely shut long enough.)

- The airflow out of the supply duct, FLOW, is less than the value stored in SERIES OFF (Point 27).

If the conditions don't exist to turn on the fan and the conditions don't exist to turn off the fan, then the fan will remain in its last commanded state.

Parallel Fan Operation — Application 2582

When HEAT.COOL (Point 05) equals COOL, FAN (Point 46) is OFF. In heating mode, the type of fan control depends on the value of FAN MODE (Point 73).

When HEAT.COOL equals HEAT and FAN MODE equals FIXED the fan will turn ON only when both of the following two conditions have been met:

- Any modulating heating device controlled by this application is at least partially opened (greater than 0% opened) or has been completely closed for less than MODHTG TIME. (The number of modulating heating devices controlled by this application is determined by the value of MODHTG COUNT (Point 88).
- The airflow out of the supply duct, FLOW (Point 75), is less than the value stored in PARALLEL ON (Point 55). (This means that there is not enough airflow out of the supply duct to transfer heat supplied by the modulating heating device(s) into the room.)

The fan will turn OFF when at least one of the following two conditions has been met:

- All modulating heating devices controlled by this application have been completely closed for at least the amount of time stored in MODHTG TIME (Point 83).
- The airflow out of the supply duct, FLOW (Point 75) is greater than the value stored in PARALLEL OFF (Point 57). (This means that there is enough airflow out of the supply duct to transfer heat supplied by the modulating heating device into the room.)

If the conditions have not been satisfied to turn the fan either ON or OFF, then the state of the fan remains unchanged. (If it is ON, it remains ON; if OFF, it remains OFF.)

When HEAT.COOL equals HEAT and FAN MODE equals VARIED, the fan is controlled as follows:

Whenever the flow out of the supply duct (FLOW) is greater than the value in PARALLEL OFF, the parallel fan will shut OFF. (This is to prevent the common duct from rupturing.)

If the flow out of the supply duct (FLOW) is less than the value in PARALLEL OFF, but greater than the value in PARALLEL ON, the state of the parallel fan remains unchanged. (If it is ON, it remains ON; if OFF, it remains OFF.)

If the flow out of the supply duct (FLOW) is less than the value in PARALLEL ON, then HTG LOOPOUT will control the fan as follows:

- If HTG LOOPOUT is less than FAN OFF (Point 71), FAN (Point 46) will be OFF.
- If HTG LOOPOUT is greater than FAN ON (Point 70), FAN will be ON.

If HTG LOOPOUT is between FAN OFF and FAN ON, the state of FAN remains unchanged.

It is possible for the fan to be ON in the cooling mode. If HEAT.COOL equals COOL but a modulating heating device used by this application has been closed for less than MODHTG TIME (Point 83), then the Fan will be controlled as though HEAT.COOL equals HEAT and FAN MODE equals FIXED. This could cause the fan to turn on. This is a rare situation and will most likely only occur after the HEAT.COOL point has just changed from HEAT to COOL. This is an added safety to ensure that heat has dissipated from the heating coils when the modulating heating devices have recently turned off.

CAUTION:

It is strongly recommended that PARARLLEL OFF be set greater than PARALLEL ON. If this is not done, the fan could shut off prematurely. This could cause the airflow across the heating coil to be insufficient to dissipate heat. (The point database has PARALLEL OFF greater than PARALLEL ON by default.)

Fail-safe Operation

If the air velocity sensor fails, the controller uses pressure dependent control. The temperature loop controls the operation of the damper.

Refer to the section of this document for information on what happens if the room temperature setpoint dial fails.

Refer to the *Room Temperature, Room Temperature Offset and CTL TEMP* section of this document for information on what happens if the room temperature sensor fails.

Application Notes

1. If temperature swings in the room are excessive or there is trouble maintaining the setpoint, the cooling loop needs to be tuned. If FLOW (Point 75) is oscillating while FLOW STPT (Point 93) is constant, the flow loop requires tuning. See *iKnow Troubleshooting Tool* for more information.

2. In order for the heating loopout to work, use the correct setting for MODHTG COUNT (Point 88).

3. BACnet VAV with CO2 Monitoring, Parallel or Series Fan and AOV or Floating Point Heat, as shipped from the factory, keeps all associated equipment OFF. See the *Equipment Controllers* section in the *APOGEE Automation Start-up Procedures* on InfoLink for information on how to release the controller and its equipment to application control.

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

5. AOV1 and AOV2 are not restricted to controlling valves; they can control SCRs if desired. In order to do this, the SCR must have its own controller that will modulate the SCR based on the value of a 0 to 10 V input. In this case, the TEC can control the SCR by connecting either AOV1 or AOV2 on the TEC to the 0 to 10 V input on the SCR.

Wiring Diagram

The point wiring for Application 2581 and Application 2582 is shown in Figure 8.

CAUTION:

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

• VA requirements higher than the maximum

• 110 or 220 Vac requirements

• DC power requirements

• Separate transformers used to power the load.

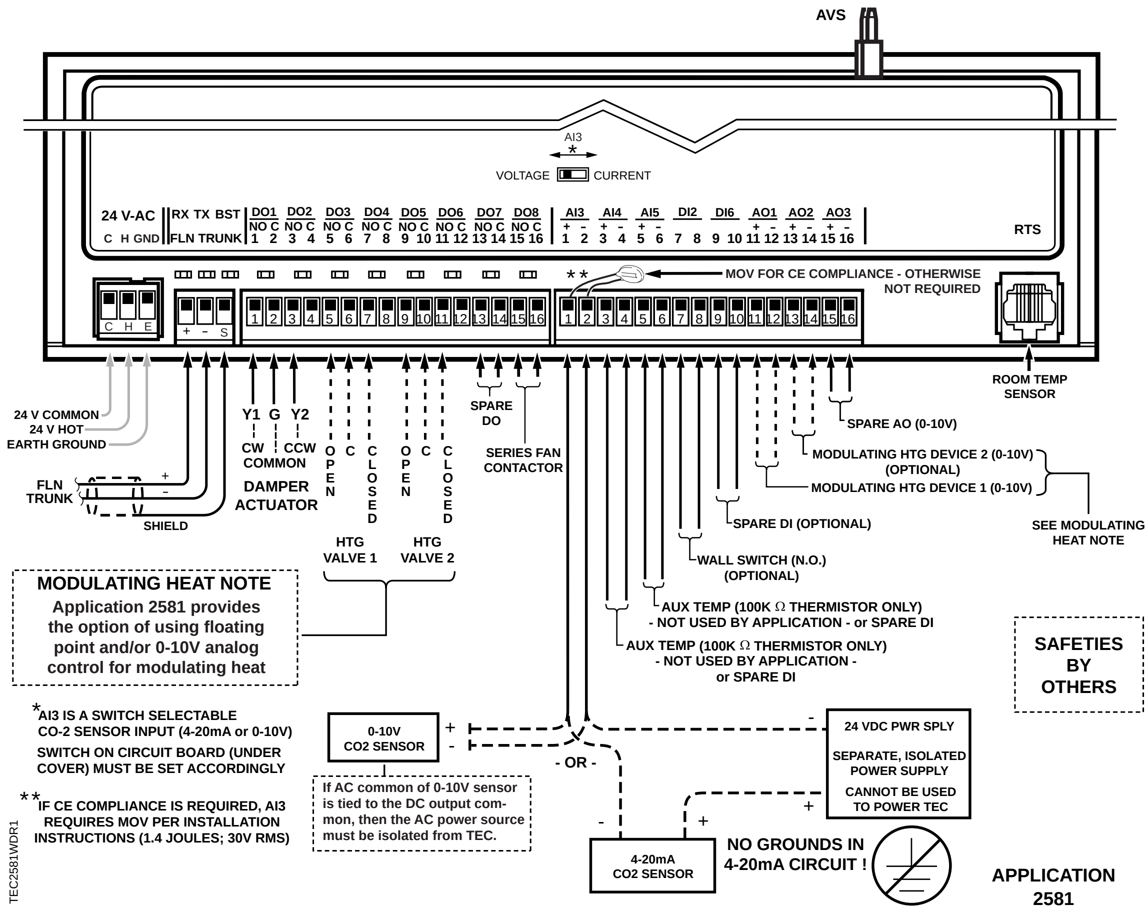

Figure 8. Application 2581 Wiring Diagram.

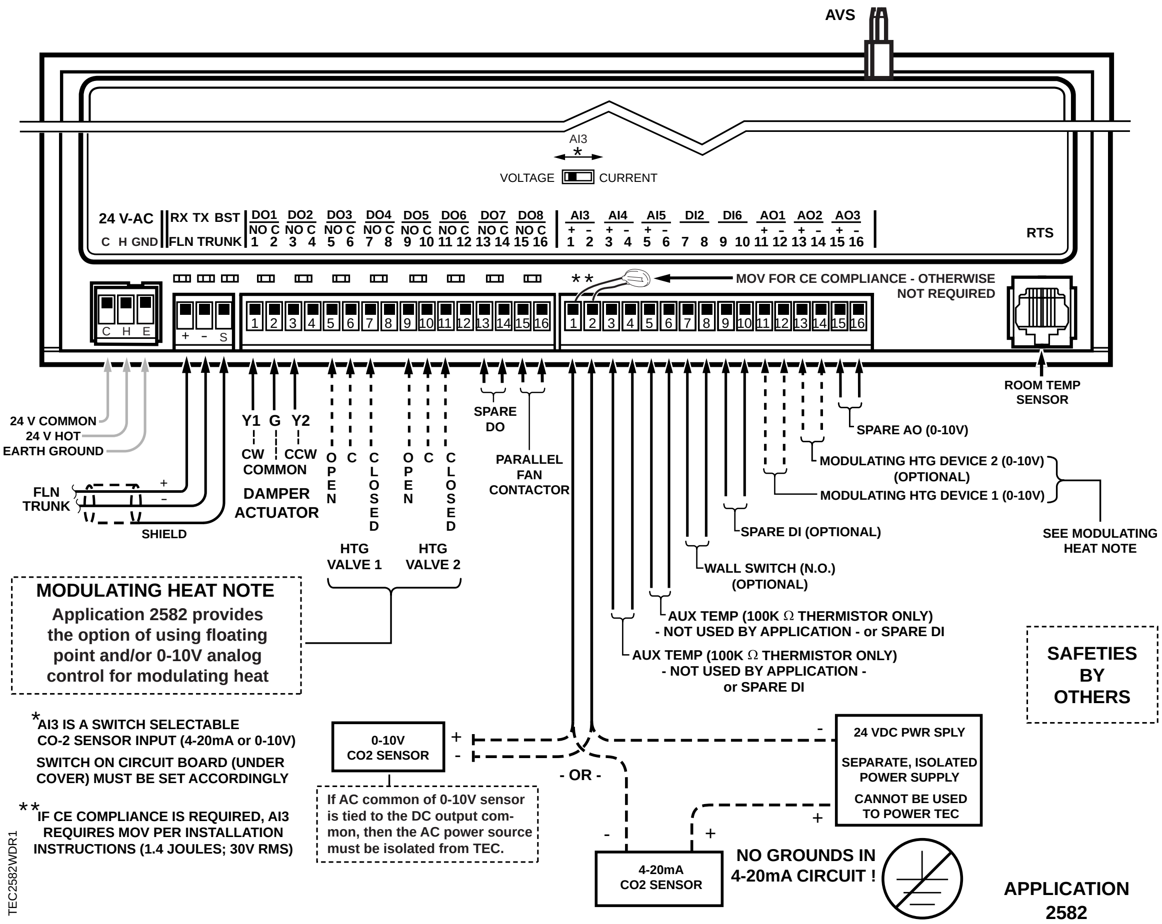

Figure 9. Application 2582 Wiring Dieagram.

Point Database

Table 3. Application 2581 Point Database.

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	1	CTLR ADDRESS	99	–	0-255	0- 255	–	–
AO	2	APPLICATION	2598	–	0-32767	0- 32767	–	–
AO	{03}[c]	CO2	2000	PPM	0-8191	0- 8191	–	–
AI	{04}	ROOM TEMP	74.0 (23.44888)	DEG F (DEG C)	48- 111.75	8.88888- 44.58888	–	–
BO	{05}	HEAT.COOL	COOL	–	Binary	0- 1	HEAT	COOL
AO	6	DAY CLG STPT	74.0 (23.44888)	DEG F (DEG C)	48- 111.75	8.88888- 44.58888	–	–
AO	7	DAY HTG STPT	70.0 (21.20888)	DEG F (DEG C)	48- 111.75	8.88888- 44.58888	–	–
AO	8	NGT CLG STPT	82.0 (27.92888)	DEG F (DEG C)	48- 111.75	8.88888- 44.58888	–	–
AO	9	NGT HTG STPT	65.0 (18.40888)	DEG F (DEG C)	48- 111.75	8.88888- 44.58888	–	–
AO	{10}	CO2 SCALE	5000	PPM	0-8191	0- 8191	–	–
AO	11	RM STPT MIN	55.0 (12.80888)	DEG F (DEG C)	48- 111.75	8.88888- 44.58888	–	–
AO	12	RM STPT MAX	90.0 (32.40888)	DEG F (DEG C)	48- 111.75	8.88888- 44.58888	–	–
AI	{13}	RM STPT DIAL	74.0 (23.44888)	DEG F (DEG C)	48- 111.75	8.88888- 44.58888	–	–
BO	14	STPT DIAL	NO	–	Binary	0- 1	YES	NO
AI	{15}	AI 3	100	PCT	0-102	0- 102	–	–
AO	16	FLOW START	0	PCT	0-102	0- 102	–	–
AO	17	FLOW END	0	PCT	0-102	0- 102	–	–
BO	18	WALL SWITCH	NO	–	Binary	0- 1	YES	NO
BI	{19}	DI OVRD SW	OFF	–	Binary	0- 1	ON	OFF
AO	20	OVRD TIME	0	HRS	0-255	0- 255	–	–
BO	{21}	NGT OVRD	NIGHT	–	Binary	0- 1	NIGHT	DAY
AO	22	REHEAT START	0	PCT	0-102	0- 102	–	–

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Table 3. Application 2581 Point Database. ***(continued)***

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	23	REHEAT END	100	PCT	0-102	0- 102	–	–
BI	{24}	DI 2	OFF	–	Binary	0- 1	ON	OFF
BI	{25}	DI 3	OFF	–	Binary	0- 1	ON	OFF
BI	{26}	DI 4	OFF	–	Binary	0- 1	ON	OFF
BI	{27}	DI 5	OFF	–	Binary	0- 1	ON	OFF
BI	{28}	DI 6	OFF	–	Binary	0- 1	ON	OFF
BO	{29}	DAY.NGT	DAY	–	Binary	0- 1	NIGHT	DAY
AO	31	CLG FLOW MIN	220 (103.818)	CFM (LPS)	0- 131068	0- 61850.9892	–	–
AO	32	CLG FLOW MAX	2200 (1038.18)	CFM (LPS)	0- 131068	0- 61850.9892	–	–
AO	33	HTG FLOW MIN	220 (103.818)	CFM (LPS)	0- 131068	0- 61850.9892	–	–
AO	34	HTG FLOW MAX	2200 (1038.18)	CFM (LPS)	0- 131068	0- 61850.9892	–	–
AI	{35}	AIR VOLUME	0 (0.0)	CFM (LPS)	0- 131068	0- 61850.9892	–	–
AO	36	FLOW COEFF	1	–	0-2.55	0- 2.55	–	–
AO	{37}	MODHTG2 COMD	0	PCT	0-102	0- 102	–	–
AO	{38}	AOV2	0	VOLTS	0-10.23	0- 10.23	–	–
AO	39	AOV2 OPEN	0	VOLTS	0-10.23	0- 10.23	–	–
AO	40	AOV2 CLOSE	10	VOLTS	0-10.23	0- 10.23	–	–
BO	{41}	DO 1	OFF	–	Binary	0- 1	ON	OFF
BO	{42}	DO 2	OFF	–	Binary	0- 1	ON	OFF
BO	{43}	DO 3	OFF	–	Binary	0- 1	ON	OFF
BO	{44}	DO 4	OFF	–	Binary	0- 1	ON	OFF
BO	{45}	DO 5	OFF	–	Binary	0- 1	ON	OFF
BO	{46}	DO 6	OFF	–	Binary	0- 1	ON	OFF
AI	{47}	AUX TEMP AI4	74.0 (23.495556)	DEG F (DEG C)	37.5-165	3.055556-74.455556	–	–
AO	{48}	DMPR COMD	0	PCT	0-102	0- 102	–	–

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Table 3. Application 2581 Point Database. *(continued)*

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	{49}	DMPR POS	0	PCT	0-102	0- 102	–	–
AO	50	SERIES ON	20	PCT	0-102	0- 102	–	–
AO	51	MTR1 TIMING	95	SEC	0-511	0- 511	–	–
AO	{52}	MODHTG1 COMD	0	PCT	0-102	0- 102	–	–
AO	53	SERIES OFF	10	PCT	0-102	0- 102	–	–
AO	{54}	AOV3	0	VOLTS	0-10.23	0- 10.23	–	–
AO	56	DMPR ROT ANG	90	–	0-255	0- 255	–	–
AO	58	MTR SETUP	0	–	0-255	0- 255	–	–
AO	59	DO DIR. REV	0	–	0-255	0- 255	–	–
AO	{60}	AOV1	0	VOLTS	0-10.23	0- 10.23	–	–
AO	61	AOV1 OPEN	0	VOLTS	0-10.23	0- 10.23	–	–
AO	62	AOV1 CLOSE	10	VOLTS	0-10.23	0- 10.23	–	–
AO	63	CLG P GAIN	20.0 (36.0)	–	0-63.75	0- 114.75	–	–
AO	64	CLG I GAIN	0.01 (0.018)	–	0-1.023	0- 1.8414	–	–
AO	65	CLG D GAIN	0 (0.0)	–	0-510	0- 918	–	–
AO	66	TEMP OFFSET	0.0 (0.0)	DEG F (DEG C)	-63.75	-35.7	–	–
AO	67	HTG P GAIN	10.0 (18.0)	–	0-63.75	0- 114.75	–	–
AO	68	HTG I GAIN	0.01 (0.018)	–	0-1.023	0- 1.8414	–	–
AO	69	HTG D GAIN	0 (0.0)	–	0-510	0- 918	–	–
AO	72	FLOW I GAIN	0.01	–	0-1.023	0- 1.023	–	–
AO	{75}	FLOW	0	PCT	0- 1023.75	0- 1023.75	–	–
AO	{76}	CTL FLOW MIN	220 (103.818)	CFM (LPS)	0-131068	0- 61850.9892	–	–
AO	{77}	CTL FLOW MAX	2200 (1038.18)	CFM (LPS)	0-131068	0- 61850.9892	–	–
AI	{78}	CTL TEMP	74.0 (23.44888)	DEG F (DEG C)	48- 111.75	8.88888- 44.58888	–	–
AO	{79}	CLG LOOPOUT	0	PCT	0-102	0- 102	–	–

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Table 3. Application 2581 Point Database. ***(continued)***

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	{80}	HTG LOOPOUT	0	PCT	0-102	0- 102	–	–
BO	{81}	DO 7	OFF	–	Binary	0- 1	ON	OFF
AI	{82}	AUX TEMP AI5	74.0 (23.495556)	DEG F (DEG C)	37.5-165	3.055556-74.455556	–	–
AO	83	MODHTG TIME	120	SEC	0-255	0- 255	–	–
AO	85	SWITCH LIMIT	5.2	PCT	0-102	0- 102	–	–
AO	86	SWITCH TIME	10	MIN	0-255	0- 255	–	–
AO	88	MODHTG COUNT	1	–	0-255	0- 255	–	–
BO	{89}	FAN	OFF	–	Binary	0- 1	ON	OFF
AO	90	SWITCH DBAND	1.0 (0.56)	DEG F (DEG C)	0-63.75	0- 35.7	–	–
AO	91	HC.ENDIS	3	–	1-256	1- 256	–	–
AI	{92}	CTL STPT	74.0 (23.44888)	DEG F (DEG C)	48- 111.75	8.88888-44.58888	–	–
AO	{93}	FLOW STPT	0	PCT	0-255.75	0- 255.75	–	–
BO	{94}	CAL AIR	NO	–	Binary	0- 1	YES	NO
AO	95	CAL SETUP	4	–	0-255	0- 255	–	–
AO	96	CAL TIMER	12	HRS	0-255	0- 255	–	–
AO	97	DUCT AREA	1.0 (0.09292)	SQ. FT (SQ M)	0-6.375	0-0.592365	–	–
AO	98	LOOP TIME	5	SEC	0-255	0- 255	–	–
AO	{99}	ERROR STATUS	0	–	0-255	0- 255	–	–
AO	{101}	MODHTG1 POS	0	PCT	0-102	0- 102	–	–
AO	102	MTR2 TIMING	130	SEC	0-511	0- 511	–	–
AO	103	MHTG1 ROTANG	90	–	0-255	0- 255	–	–

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Table 3. Application 2581 Point Database. ***(continued)***

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	{104}	MODHTG2 POS	0	PCT	0-102	0- 102	–	–
AO	105	MTR3 TIMING	130	SEC	0-511	0- 511	–	–
AO	106	MHTG2 ROTANG	90	–	0-255	0- 255	–	–

[a] Object Types: Analog Input (AI), Analog Output (AO), Binary Input (BI) and Binary Output (BO).

[b] A single value in a column means that the value is the same in English units and in SI units.

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

Table 4. Application 2582 Point Database.

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	1	CTLR ADDRESS	99	–	0-255	0-255	–	–
AO	2	APPLICATION	2598	–	0-32767	0-32767	–	–
AO	{03}[c]	CO2	2000	PPM	0-8191	0-8191	–	–
AI	{04}	ROOM TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
BO	{05}	HEAT.COOL	COOL	–	Binary	Binary	HEAT	COOL
AO	6	DAY CLG STPT	74.0 (23.44888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
AO	7	DAY HTG STPT	70.0 (21.20888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
AO	8	NGT CLG STPT	82.0 (27.92888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
AO	9	NGT HTG STPT	65.0 (18.40888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
AO	{10}	CO2 SCALE	5000	PPM	0-8191	0-8191	–	–
AO	11	RM STPT MIN	55.0 (12.80888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
AO	12	RM STPT MAX	90.0 (32.40888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
AI	{13}	RM STPT DIAL	74.0 (23.44888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–

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Table 4. Application 2582 Point Database. ***(continued)***

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
BO	14	STPT DIAL	NO	–	Binary	Binary	YES	NO
AI	{15}	AI 3	100	PCT	0-102	0-102	–	–
AO	16	FLOW START	0	PCT	0-102	0-102	–	–
AO	17	FLOW END	0	PCT	0-102	0-102	–	–
BO	18	WALL SWITCH	NO	–	Binary	Binary	YES	NO
BI	{19}	DI OVRD SW	OFF	–	Binary	Binary	ON	OFF
AO	20	OVRD TIME	0	HRS	0-255	0-255	–	–
BO	{21}	NGT OVRD	NIGHT	–	Binary	Binary	NIGHT	DAY
AO	22	REHEAT START	0	PCT	0-102	0-102	–	–
AO	23	REHEAT END	100	PCT	0-102	0-102	–	–
BI	{24}	DI 2	OFF	–	Binary	Binary	ON	OFF
BI	{25}	DI 3	OFF	–	Binary	Binary	ON	OFF
BI	{26}	DI 4	OFF	–	Binary	Binary	ON	OFF
BI	{27}	DI 5	OFF	–	Binary	Binary	ON	OFF
BI	{28}	DI 6	OFF	–	Binary	Binary	ON	OFF
BO	{29}	DAY.NGT	DAY	–	Binary	Binary	NIGHT	DAY
AO	31	CLG FLOW MIN	220 (103.818)	CFM (LPS)	0-131068	0-61850.9892	–	–
AO	32	CLG FLOW MAX	2200 (1038.18)	CFM (LPS)	0-131068	0-61850.9892	–	–
AO	33	HTG FLOW MIN	220 (103.818)	CFM (LPS)	0-131068	0-61850.9892	–	–
AO	34	HTG FLOW MAX	2200 (1038.18)	CFM (LPS)	0-131068	0-61850.9892	–	–
AI	{35}	AIR VOLUME	0 (0.0)	CFM (LPS)	0-131068	0-61850.9892	–	–
AO	36	FLOW COEFF	1	–	0-2.55	0-2.55	–	–
AO	{37}	MODHTG2 COMD	0	PCT	0-102	0-102	–	–
AO	{38}	AOV2	0	VOLTS	0-10.23	0-10.23	–	–
AO	39	AOV2 OPEN	0	VOLTS	0-10.23	0-10.23	–	–

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Table 4. Application 2582 Point Database. *(continued)*

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	40	AOV2 CLOSE	10	VOLTS	0-10.23	0-10.23	–	–
BO	{41}	DO 1	OFF	–	Binary	Binary	ON	OFF
BO	{42}	DO 2	OFF	–	Binary	Binary	ON	OFF
BO	{43}	DO 3	OFF	–	Binary	Binary	ON	OFF
BO	{44}	DO 4	OFF	–	Binary	Binary	ON	OFF
BO	{45}	DO 5	OFF	–	Binary	Binary	ON	OFF
BO	{46}	DO 6	OFF	–	Binary	Binary	ON	OFF
AI	{47}	AUX TEMP AI4	74.0 (23.495556)	DEG F (DEG C)	37.5-165	3.055556-74.455556	–	–
AO	{48}	DMPR COMD	0	PCT	0-102	0-102	–	–
AO	{49}	DMPR POS	0	PCT	0-102	0-102	–	–
AO	51	MTR1 TIMING	95	SEC	0-511	0-511	–	–
AO	{52}	MODHTG1 COMD	0	PCT	0-102	0-102	–	–
AO	{54}	AOV3	0	VOLTS	0-10.23	0-10.23	–	–
AO	55	PARALLEL ON	20	PCT	0-102	0-102	–	–
AO	56	DMPR ROT ANG	90	–	0-255	0-255	–	–
AO	57	PARALLEL OFF	30	PCT	0-102	0-102	–	–
AO	58	MTR SETUP	0	–	0-255	0-255	–	–
AO	59	DO DIR. REV	0	–	0-255	0-255	–	–
AO	{60}	AOV1	0	VOLTS	0-10.23	0-10.23	–	–
AO	61	AOV1 OPEN	0	VOLTS	0-10.23	0-10.23	–	–
AO	62	AOV1 CLOSE	10	VOLTS	0-10.23	0-10.23	–	–
AO	63	CLG P GAIN	20.0 (36.0)	–	0-63.75	0-114.75	–	–
AO	64	CLG I GAIN	0.01 (0.018)	–	0-1.023	0-1.8414	–	–
AO	65	CLG D GAIN	0 (0.0)	–	0-510	0-918	–	–
AO	66	TEMP OFFSET	0.0 (0.0)	DEG F (DEG C)	-63.75	-35.7	–	–

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Table 4. Application 2582 Point Database. ***(continued)***

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	67	HTG P GAIN	10.0 (18.0)	–	0-63.75	0-114.75	–	–
AO	68	HTG I GAIN	0.01 (0.018)	–	0-1.023	0-1.8414	–	–
AO	69	HTG D GAIN	0 (0.0)	–	0-510	0-918	–	–
AO	70	FAN ON	20	PCT	0-102	0-102	–	–
AO	71	FAN OFF	10	PCT	0-102	0-102	–	–
AO	72	FLOW I GAIN	0.01	–	0-1.023	0-1.023	–	–
BO	73	FAN MODE	FIXED	–	Binary	Binary	VARIED	FIXED
BO	74	MODHTG SAFE	NO	–	Binary	Binary	YES	NO
AO	{75}	FLOW	0	PCT	0-1023.75	0- 1023.75	–	–
AO	{76}	CTL FLOW MIN	220 (103.818)	CFM (LPS)	0-131068	0-61850.9892	–	–
AO	{77}	CTL FLOW MAX	2200 (1038.18)	CFM (LPS)	0-131068	0-61850.9892	–	–
AI	{78}	CTL TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
AO	{79}	CLG LOOPOUT	0	PCT	0-102	0-102	–	–
AO	{80}	HTG LOOPOUT	0	PCT	0-102	0-102	–	–
BO	{81}	DO 7	OFF	–	Binary	Binary	ON	OFF
AI	{82}	AUX TEMP AI5	74.0 (23.495556)	DEG F (DEG C)	37.5-165	3.055556-74.455556	–	–
AO	83	MODHTG TIME	120	SEC	0-255	0-255	–	–
AO	85	SWITCH LIMIT	5.2	PCT	0-102	0-102	–	–
AO	86	SWITCH TIME	10	MIN	0-255	0-255	–	–
AO	88	MODHTG COUNT	1	–	0-255	0-255	–	–
BO	{89}	FAN	OFF	–	Binary	Binary	ON	OFF
AO	90	SWITCH DBAND	1.0 (0.56)	DEG F (DEG C)	0-63.75	0-35.7	–	–

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Table 4. Application 2582 Point Database. *(continued)*

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	91	HC.ENDIS	3	–	1-256	1-256	–	–
AI	{92}	CTL STPT	74.0 (23.44888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
AO	{93}	FLOW STPT	0	PCT	0-255.75	0-255.75	–	–
BO	{94}	CAL AIR	NO	–	Binary	Binary	YES	NO
AO	95	CAL SETUP	4	–	0-255	0-255	–	–
AO	96	CAL TIMER	12	HRS	0-255	0-255	–	–
AO	97	DUCT AREA	1.0 (0.09292)	SQ. FT (SQ M)	0-6.375	0- 0.592365	–	–
AO	98	LOOP TIME	5	SEC	0-255	0-255	–	–
AO	{99}	ERROR STATUS	0	–	0-255	0-255	–	–
AO	{101}	MODHTG1 POS	0	PCT	0-102	0-102	–	–
AO	102	MTR2 TIMING	130	SEC	0-511	0-511	–	–
AO	103	MHTG1 ROTANG	90	–	0-255	0-255	–	–

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Table 4. Application 2582 Point Database. ***(continued)***

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	{104}	MODHTG2 POS	0	PCT	0-102	0-102	–	–
AO	105	MTR3 TIMING	130	SEC	0-511	0-511	–	–
AO	106	MHTG2 ROTANG	90	–	0-255	0-255	–	–

[a] Object Types: Analog Input (AI), Analog Output (AO), Binary Input (BI) and Binary Output (BO).

[b] A single value in a column means that the value is the same in English units and in SI units.

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

Table 5. Slave Mode Application 2598 Point Database.

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	1	CTLR ADDRESS	99	–	0-255	0-255	–	–
AO	2	APPLICATION	2598	–	0-32767	0-32767	–	–
AI	{04}[c]	ROOM TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
AI	{13}	RM STPT DIAL	74.0 (23.44888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
AI	{15}	AI 3	100	PCT	0-102	0-102	–	–
BO	18	WALL SWITCH	NO	–	Binary	Binary	YES	NO
BI	{19}	DI OVRD SW	OFF	–	Binary	Binary	ON	OFF
BI	{24}	DI 2	OFF	–	Binary	Binary	ON	OFF
BI	{25}	DI 3	OFF	–	Binary	Binary	ON	OFF
BI	{26}	DI 4	OFF	–	Binary	Binary	ON	OFF
BI	{27}	DI 5	OFF	–	Binary	Binary	ON	OFF
BI	{28}	DI 6	OFF	–	Binary	Binary	ON	OFF
BO	{29}	DAY.NGT	DAY	–	Binary	Binary	NIGHT	DAY
AI	{35}	AIR VOLUME	0 (0.0)	CFM (LPS)	0-131068	0-61850.9892	–	–
AO	36	FLOW COEFF	1	–	0-2.55	0-2.55	–	–

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Table 5. Slave Mode Application 2598 Point Database. *(continued)*

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	{37}	MTR3 COMD	0	PCT	0-102	0-102	–	–
AO	{38}	AOV2	0	VOLTS	0-10.23	0-10.23	–	–
BO	{41}	DO 1	OFF	–	Binary	Binary	ON	OFF
BO	{42}	DO 2	OFF	–	Binary	Binary	ON	OFF
BO	{43}	DO 3	OFF	–	Binary	Binary	ON	OFF
BO	{44}	DO 4	OFF	–	Binary	Binary	ON	OFF
BO	{45}	DO 5	OFF	–	Binary	Binary	ON	OFF
BO	{46}	DO 6	OFF	–	Binary	Binary	ON	OFF
AI	{47}	AUX TEMP AI4	74.0 (23.495556)	DEG F (DEG C)	37.5-165	3.055556-74.455556	–	–
AO	{48}	MTR1 COMD	0	PCT	0-102	0-102	–	–
AO	{49}	MTR1 POS	0	PCT	0-102	0-102	–	–
AO	51	MTR1 TIMING	95	SEC	0-511	0-511	–	–
AO	{52}	MTR2 COMD	0	PCT	0-102	0-102	–	–
AO	{54}	AOV3	0	VOLTS	0-10.23	0-10.23	–	–
AO	56	DPR1 ROT ANG	90	–	0-255	0-255	–	–
AO	58	MTR SETUP	0	–	0-255	0-255	–	–
AO	59	DO DIR. REV	0	–	0-255	0-255	–	–
AO	{60}	AOV1	0	VOLTS	0-10.23	0-10.23	–	–
AO	66	TEMP OFFSET	0.0 (0.0)	DEG F (DEG C)	-63.75	-35.7	–	–
AI	{78}	CTL TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	8.88888-44.58888	–	–
BO	{81}	DO 7	OFF	–	Binary	Binary	ON	OFF
AI	{82}	AUX TEMP AI5	74.0 (23.495556)	DEG F (DEG C)	37.5-165	3.055556-74.455556	–	–
BO	87	CAL MODULE	NO	–	Binary	Binary	YES	NO
BO	{89}	DO 8	OFF	–	Binary	Binary	ON	OFF
BO	{94}	CAL AIR	NO	–	Binary	Binary	YES	NO

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Table 5. Slave Mode Application 2598 Point Database. ***(continued)***

Object Type[a]	Object Instance	Object Name	Factory Default (SI Units)[b]	Engr Units (SI Units)	Range	SI Range	Active Text	Inactive Text
AO	95	CAL SETUP	4	–	0-255	0-255	–	–
AO	96	CAL TIMER	12	HRS	0-255	0-255	–	–
AO	97	DUCT AREA	1.0 (0.09292)	SQ. FT (SQ M)	0-6.375	0-0.592365	–	–
AO	{99}	ERROR STATUS	0	–	0-255	0-255	–	–
AO	{101}	MTR2 POS	0	PCT	0-102	0-102	–	–
AO	102	MTR2 TIMING	130	SEC	0-511	0-511	–	–
AO	103	MTR2 ROT ANG	90	–	0-255	0-255	–	–
AO	{104}	MTR3 POS	0	PCT	0-102	0-102	–	–
AO	105	MTR3 TIMING	130	SEC	0-511	0-511	–	–
AO	106	MTR3 ROT ANG	90	–	0-255	0-255	–	–

[a] Object Types: Analog Input (AI), Analog Output (AO), Binary Input (BI) and Binary Output (BO).

[b] A single value in a column means that the value is the same in English units and in SI units.

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