

BACnet Terminal Box Controller - Electronic Output

Application Notes

VAV with Hot Water Heat

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Overview

In Application 2513, the controller modulates the supply air 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 supply air damper. In order for the terminal box to work properly, the central air-handling unit must provide supply air (Figure 1).

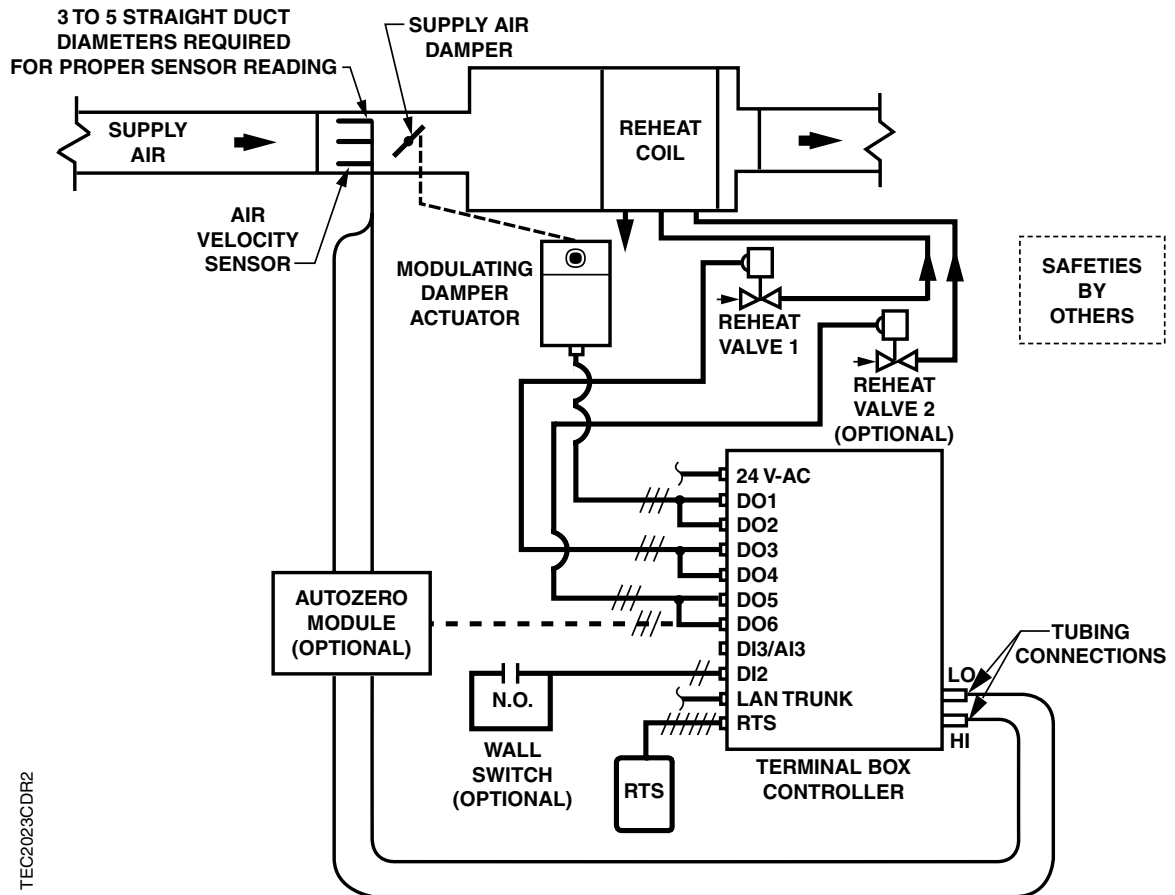


Figure 1. Application 2513 with Hot Water Heat Control Diagram.

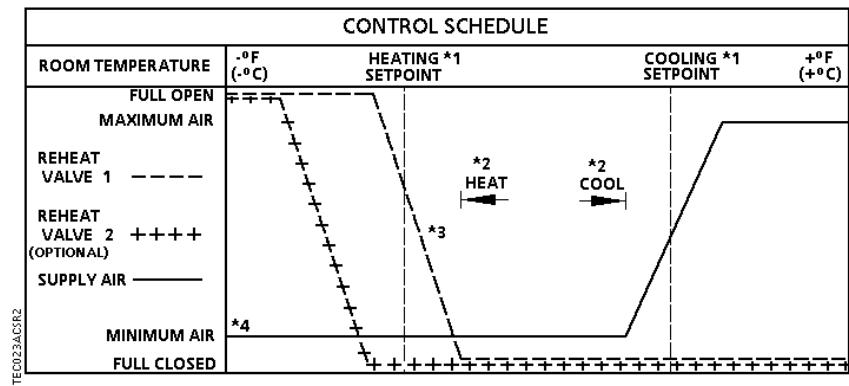


Figure 2. Application 2513 with Hot Water Heat Control Schedule.

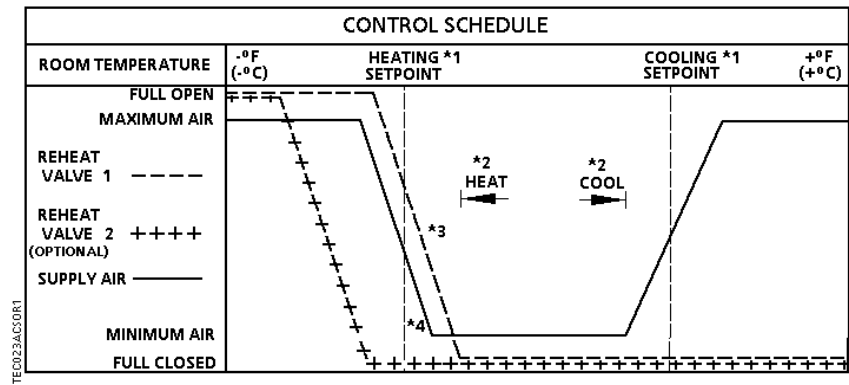


Figure 3. Application 2513 with Hot Water Heat and Modulating Damper (Heating Mode) Control Schedule.

NOTES:

- 1. See *Sequence of Operation, Control Temperature Setpoints*.
- 2. See *Sequence of Operation, Heating/Cooling Switchover*.
- 3. One or two reheat valves may be used. Operation in sequence (optional).
- 4. The airflow is shown operating parallel with the reheat valve (optional). The airflow can operate at minimum flow throughout the entire heating mode (default setting). See *Sequencing Logic (Optional)*.

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-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
- Room temperature sensor
- Room temperature setpoint dial (optional)

Digital

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

Hardware Outputs

Analog

- None

Digital

- Damper actuator
- 1st valve actuator (required)
- 2 nd valve actuator (optional)
-or-
- Autozero Module (optional)

Ordering Notes

BACnet Terminal Box Controller - Electronic Output

550-788A

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

Autozero Module (optional)

Damper Actuator

Terminal Equipment Controller Room Temperature Sensor

1st Valve Actuator (required)

2nd Valve Actuator (optional)

Point Database

Table 2 presents the point database information for Application 2513.

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2513, "VAV with Hot Water Heat".

Control Temperature Setpoints

Depending on the controller's current operational mode (day or night), CTL STPT (Point 92) holds the value of one of the following setpoints:

Day Mode – CTL STPT holds the value of DAY CLG STPT (Point 6). If the room temperature sensor has a setpoint dial and STPT DIAL (Point 14) = YES, CTL STPT holds the value of RM STPT DIAL (Point 13).

If the setpoint dial is used and RM STPT DIAL < RM STPT MIN (Point 11), CTL STPT holds the value of RM STPT MIN. If RM STPT DIAL > RM STPT MAX (Point 12), CTL STPT holds the value of RM STPT MAX.

Night Mode – CTL STPT holds the value of NGT CLG STPT (Point 8).

Room Temperature Offset

Room Temperature Offset, RMTMP OFFSET (Point 3), is a user-adjustable offset that will compensate for deviations between the value of ROOM TMP (Point 4) and the actual room temperature. This corrected value is displayed in CTL TEMP (Point 78).

$\text{CTL TEMP (Point 78)} = \text{ROOM TMP (Point 4)} + \text{RMTMP OFFSET (Point 3)}$.

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 (see Figure 1 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 (125-1895)* 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), 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

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 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 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.

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). 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).

Control Loops

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

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). See *Control Temperature Setpoints*.

Cooling Loop – Generates cooling loopout which is then used to generate FLOW STPT (Point 93). FLOW STPT is the result of scaling the cooling loopout to the appropriate range of values determined by 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 setpoint.

When CLG FLOW MIN \neq 0 cfm, FLOW STPT \neq CLG LOOPOUT (Point 79). The minimum flow setpoint is (CLG FLOW MIN / CLG FLOW MAX) \times 100% flow. And FLOW STPT is [CLG LOOPOUT \times (100% – minimum setpoint)] + minimum setpoint.

Example

If CLG FLOW MIN = 200 cfm, and CLG FLOW MAX = 1000 cfm, the minimum flow setpoint is
 $(200 \text{ cfm} / 1000 \text{ cfm}) \times 100\% \text{ flow} = 20\%$.

When CLG LOOPOUT is 0%, FLOW STPT = 20% flow.

$[0\% \times (100\% - 20\%)] + 20\% = 20\%$

This ensures that the airflow out of the terminal box is no less than CLG FLOW MIN.

When CLG LOOPOUT is 50%, FLOW STPT = 60% flow.

$[50\% \times (100\% - 20\%)] + 20\% = 60\%$

When CLG LOOPOUT is 100%, FLOW STPT = 100% flow.

$[100\% \times (100\% - 20\%)] + 20\% = 100\%$

Heating Loop – If the controller is in heating mode, the operation of the flow loop is flexible. It can be set up to do one of the following:

- Constantly maintain 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. See *Sequencing Logic (Optional)* for more information.

If the first option described above is chosen, 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, HTG LOOPOUT will control both the flow loop setpoint (FLOW STPT) and the electric reheat in order to maintain the room temperature. See *Sequencing Logic (Optional)* 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 is never set below $(\text{HTG FLOW MIN} / \text{HTG FLOW MAX}) \times 100\%$ flow or above 100% flow.

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 2513, 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:

$$(\text{CTL FLOW MIN} / \text{CTL FLOW MAX}) \times 100\% \text{ flow}$$

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 = $(250 \text{ cfm} / 1000 \text{ cfm}) \times 100\% \text{ flow}$
= $0.25 \times 100\% \text{ flow}$
= 25% flow.

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

Hot Water Heat



CAUTION:

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 the heating valve is open

The heating loop modulates the heating valve(s) to warm up the room.

- If VALVE COUNT (Point 88) = 1,
When $(\text{HTG LOOPOUT} - \text{REHEAT START}) - (\text{REHEAT END} - \text{REHEAT START}) \times 100\%$ varies from 0 to 100% open of the reheat output range, VLV1 COMD (Point 52) varies from 0 to 100% open, and VLV2 COMD (Point 37) is not used in the application.
- If VALVE COUNT = 2,
When HTG LOOPOUT (Point 80) varies from 0 to 50% of the reheat output range, VLV1 COMD varies from 0 to 100% open.
When HTG LOOPOUT varies from 50 to 100% of the reheat output range, VLV2 COMD varies from 0 to 100% open.

When the controller is in cooling mode, the heating valve is closed.

Sequencing Logic (Optional)



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 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%. See the following three examples.

The ladder diagrams in Figure 4 show sequenced, parallel, and overlapping 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.

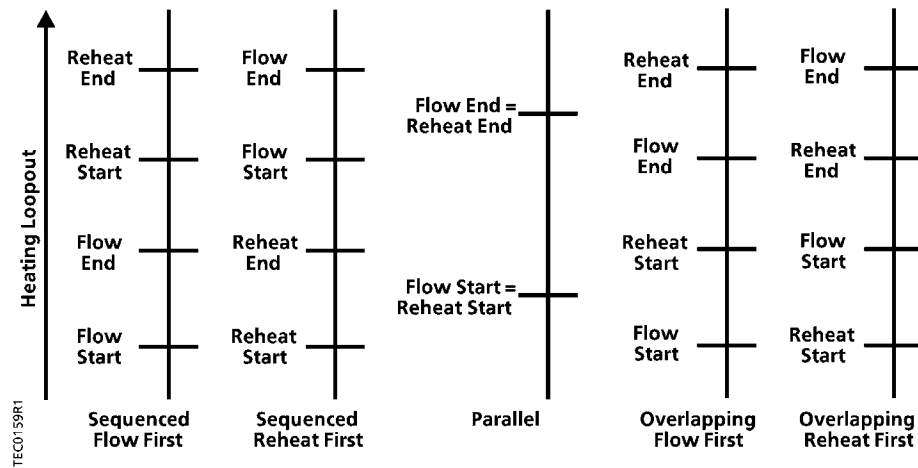


Figure 4. Sequenced, Parallel, and Overlapping Flow Loop Operations with Electric Heat.

For simplicity, assume that in these examples:

- HTG FLOW MIN (Point 33) = 0 cfm.
- There is only one hot water valve (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 hot water valve 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 \geq 50%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT \leq 50%, VLV1 COMD will equal 0% open.
- When HTG LOOPOUT = 75%, VLV1 COMD will equal 50% open.

- When HTG LOOPOUT = 100%, VLV1 COMD will equal 100% open.

Example 2

Assume that your system has electric heat 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%, VLV1 COMD will equal 0% open.
- When HTG LOOPOUT = 50%, VLV1 COMD will equal 50% open.
- When HTG LOOPOUT = 100%, VLV1 COMD will equal 100% open.

Example 3

Assume that your system has electric 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 \geq 75%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT \leq 25%, VLV1 COMD will equal 0% open.
- When HTG LOOPOUT = 62.5%, VLV1 COMD will equal 50% open.

- When HTG LOOPOUT = 100%, VLV1 CMD 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 hot water valve(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 electric 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
- STAGE COUNT = 1
- STAGE TIME = 10 Minutes

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 $(170 \text{ cfm} / 1000 \text{ cfm}) \times 100\% \text{ flow} = 17\% \text{ flow}$. 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%, VLV1 CMD will equal 0% open.
- When HTG LOOPOUT = 50%, VLV1 CMD will equal 50% open.
- When HTG LOOPOUT = 100%, VLV1 CMD will equal 100% open.

If:

- VALVE COUNT = 2

then,

- When HTG LOOPOUT = 0%, VLV2 COMD will equal 0% open, VLV1 COMD = 0%.
- When HTG LOOPOUT = 50%, VLV2 COMD will equal 0% open, VLV1 COMD = 100%.
- When HTG LOOPOUT = 100%, VLV2 COMD will equal 100% open.

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.

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

Hot Water Valve – Calibration of a hot water valve (if used) 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.

Damper Status Operation

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, DMPR POS (Point 49), 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 DMPR POS. DMPR STATUS will be set to RECAL if all of the following conditions are true:

- DMPR POS = 100%
- AIR VOLUME (Point 35) > 0 cfm
- FLOW (Point 75) < FLOW STPT (Point 93)

OR

- DMPR POS = 0%
- AIR VOLUME > 0 cfm
- FLOW > FLOW STPT



To change 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 6 and CAL MODULE (Point 87) is set to YES.

Fail-safe Operation

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

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

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, MTR2 and MTR3 must be enabled using the correct setting for VALVE COUNT (Point 88).
3. BACnet Terminal Box Controller - Electronic Output, 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. DO 3 and DO 4 or DO 5 and DO 6 may be used as auxiliary motor points. If using a pair of spare DOs to control a motor, you must unbundle the corresponding motor command point.

Wiring Diagram

The point wiring for Application 2513 is shown in Figure 5 and Figure 6.



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.

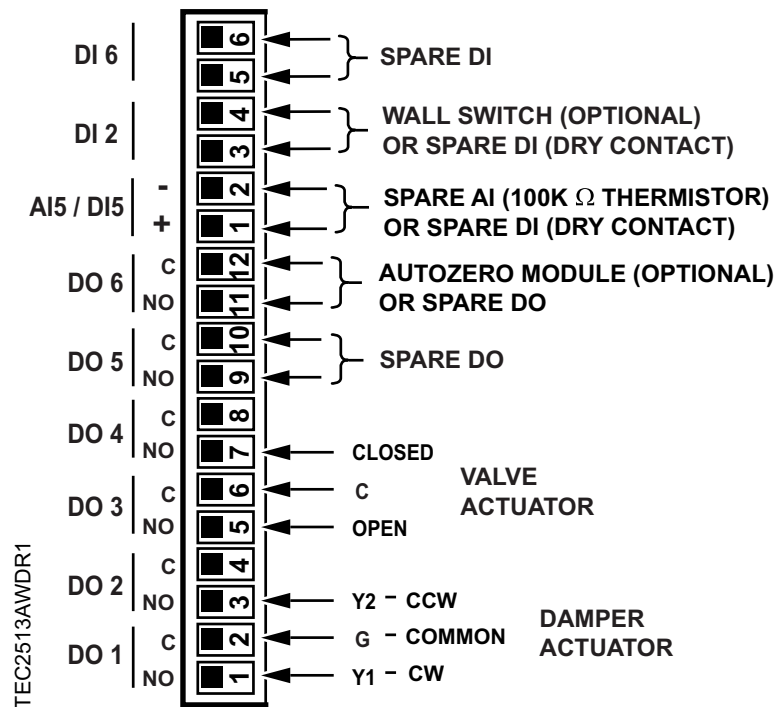


Figure 5. Application 2513 with 1 Hot Water Valve and Optional Autozero Module Wiring Diagram.

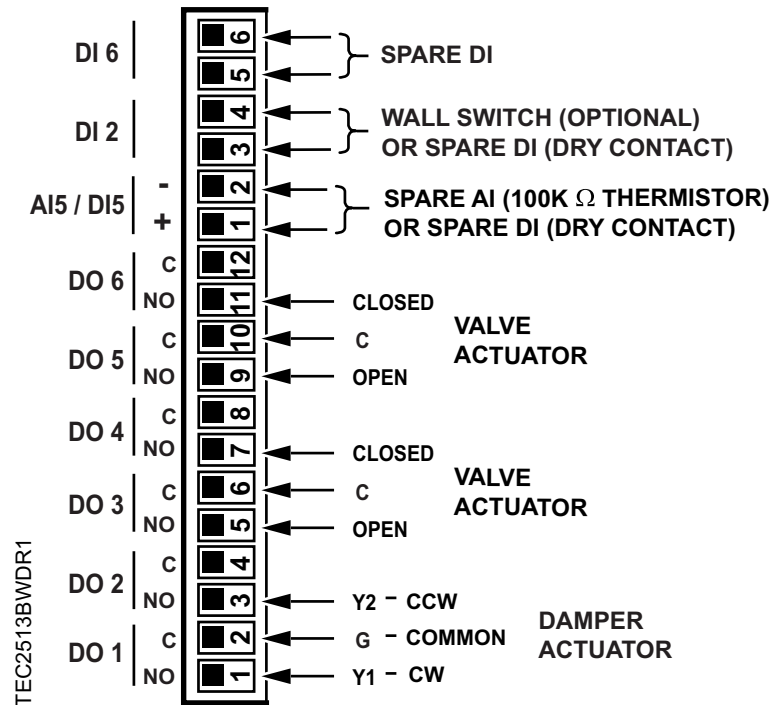


Figure 6. Application 2513 with 2 Hot Water Valves Wiring Diagram.

Table 2. Point Database for Application 2513.

| Object Type ^a | Object Instance (Point Number) ^b | Object Name and Description | Factory Default (SI Units) ^c | Eng Units (SI Units) ^c | Range | Active Text | Inactive Text |
|--------------------------|---|-----------------------------|---|-----------------------------------|-----------------------|-------------|---------------|
| AO | 1 | CTLR ADDRESS | 99 | – | 0 to 254 | – | – |
| AO | 2 | APPLICATION | 2587 | – | 2510 to 2517 and 2587 | – | – |
| AO | 3 | RMTMP OFFSET | 0.0 (0.0) | DEG F (DEG C) | -31.75 to 32.0 | – | – |
| AI | {04} ^d | ROOM TEMP | 74.0 (23.44888) | DEG F (DEG C) | 48 to 111.75 | – | – |
| BO | {05} | HEAT.COOL | COOL | – | Binary | HEAT | COOL |
| AO | 6 | DAY CLG STPT | 74.0 (23.44888) | DEG F (DEG C) | 48 to 111.75 | – | – |
| AO | 7 | DAY HTG STPT | 70.0 (21.20888) | DEG F (DEG C) | 48 to 111.75 | – | – |
| AO | 8 | NGT CLG STPT | 82.0 (27.92888) | DEG F (DEG C) | 48 to 111.75 | – | – |
| AO | 9 | NGT HTG STPT | 65.0 (18.40888) | DEG F (DEG C) | 48 to 111.75 | – | – |
| BI | {10} | DI 6 | OFF | – | Binary | ON | OFF |
| AO | 11 | RM STPT MIN | 55.0 (12.80888) | DEG F (DEG C) | 48 to 111.75 | – | – |
| AO | 12 | RM STPT MAX | 90.0 (32.40888) | DEG F (DEG C) | 48 to 111.75 | – | – |
| AI | {13} | RM STPT DIAL | 74.0 (23.44888) | DEG F (DEG C) | 48 to 111.75 | – | – |
| BO | 14 | STPT DIAL | NO | – | Binary | YES | NO |
| AI | {15} | AUX TEMP AI5 | 37.5 (3.055556) | DEG F (DEG C) | 37.5 to 165 | – | – |
| AO | 16 | FLOW START | 0 | PCT | 0 to 102 | – | – |
| AO | 17 | FLOW END | 0 | PCT | 0 to 102 | – | – |
| BO | 18 | WALL SWITCH | NO | – | Binary | YES | NO |
| BI | {19} | DI OVRD SW | OFF | – | Binary | ON | OFF |
| AO | 20 | OVRD TIME | 0 | HRS | 0 to 255 | – | – |
| BO | {21} | NGT OVRD | NIGHT | – | Binary | NIGHT | DAY |
| AO | 22 | REHEAT START | 0 | PCT | 0 to 102 | – | – |

continued on next page...

Table 2. Point Database for Application 2513. (continued)

| Object Type ^a | Object Instance (Point Number) ^b | Object Name and Description | Factory Default (SI Units) ^c | Eng Units (SI Units) ^c | Range | Active Text | Inactive Text |
|--------------------------|---|-----------------------------|---|-----------------------------------|-------------|-------------|---------------|
| AO | 23 | REHEAT END | 100 | PCT | 0 to 102 | – | – |
| BI | {24} | DI 2 | OFF | – | Binary | ON | OFF |
| BI | {25} | DI 5 | OFF | – | Binary | ON | OFF |
| BO | {29} | DAY.NGT | DAY | – | Binary | NIGHT | DAY |
| AO | 31 | CLG FLOW MIN | 220 (103.818) | CFM (LPS) | 0 to 131068 | – | – |
| AO | 32 | CLG FLOW MAX | 2200 (1038.18) | CFM (LPS) | 0 to 131068 | – | – |
| AO | 33 | HTG FLOW MIN | 220 (103.818) | CFM (LPS) | 0 to 131068 | – | – |
| AO | 34 | HTG FLOW MAX | 2200 (1038.18) | CFM (LPS) | 0 to 131068 | – | – |
| AI | {35} | AIR VOLUME | 0 (0.0) | CFM (LPS) | 0 to 131068 | – | – |
| AO | 36 | FLOW COEFF | 1 | – | 0 to 2.55 | – | – |
| AO | {37} | VLV2 COMD | 0 | PCT | 0 to 102 | – | – |
| AO | {38} | VLV2 POS | 0 | PCT | 0 to 102 | – | – |
| AO | 39 | MTR3 TIMING | 130 | SEC | 0 to 511 | – | – |
| BO | {41} | DO 1 | OFF | – | Binary | ON | OFF |
| BO | {42} | DO 2 | OFF | – | Binary | ON | OFF |
| BO | {43} | DO 3 | OFF | – | Binary | ON | OFF |
| BO | {44} | DO 4 | OFF | – | Binary | ON | OFF |
| BO | {45} | DO 5 | OFF | – | Binary | ON | OFF |
| BO | {46} | DO 6 | OFF | – | Binary | ON | OFF |
| AO | {48} | DMPR COMD | 0 | PCT | 0 to 102 | – | – |
| AO | {49} | DMPR POS | 0 | PCT | 0 to 102 | – | – |
| AO | 51 | MTR1 TIMING | 95 | SEC | 0 to 511 | – | – |
| AO | {52} | VLV1 COMD | 0 | PCT | 0 to 102 | – | – |
| AO | {53} | VLV1 POS | 0 | PCT | 0 to 102 | – | – |
| AO | 55 | MTR2 TIMING | 130 | SEC | 0 to 511 | – | – |
| AO | 56 | DMPR ROT ANG | 90 | – | 0 to 255 | – | – |
| AO | 58 | MTR SETUP | 0 | – | 0 to 255 | – | – |

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Table 2. Point Database for Application 2513. (continued)

| Object Type ^a | Object Instance (Point Number) ^b | Object Name and Description | Factory Default (SI Units) ^c | Eng Units (SI Units) ^c | Range | Active Text | Inactive Text |
|--------------------------|---|-----------------------------|---|-----------------------------------|--------------|-------------|---------------|
| AO | 59 | DO DIR. REV | 0 | — | 0 to 255 | — | — |
| AO | 63 | CLG P GAIN | 20.0 (36.0) | — | 0 to 63.75 | — | — |
| AO | 64 | CLG I GAIN | 0.01 (0.018) | — | 0 to 1.023 | — | — |
| AO | 65 | CLG D GAIN | 0 (0.0) | — | 0 to 510 | — | — |
| AO | 67 | HTG P GAIN | 10.0 (18.0) | — | 0 to 63.75 | — | — |
| AO | 68 | HTG I GAIN | 0.01 (0.018) | — | 0 to 1.023 | — | — |
| AO | 69 | HTG D GAIN | 0 (0.0) | — | 0 to 510 | — | — |
| AO | 71 | FLOW P GAIN | 0 | — | 0 to 51.15 | — | — |
| AO | 72 | FLOW I GAIN | 0.01 | — | 0 to 1.023 | — | — |
| AO | 73 | FLOW D GAIN | 0 | — | 0 to 510 | — | — |
| AO | 74 | FLOW BIAS | 50 | PCT | 0 to 102 | — | — |
| AO | {75} | FLOW | 0 | PCT | 0 to 1023.75 | — | — |
| AO | {76} | CTL FLOW MIN | 220 (103.818) | CFM (LPS) | 0 to 131068 | — | — |
| AO | {77} | CTL FLOW MAX | 2200 (1038.18) | CFM (LPS) | 0 to 131068 | — | — |
| AO | {78} | CTL TEMP | 74.0 (23.44888) | DEG F (DEG C) | 48 to 111.75 | — | — |
| AO | {79} | CLG LOOPOUT | 0 | PCT | 0 to 102 | — | — |
| AO | {80} | HTG LOOPOUT | 0 | PCT | 0 to 102 | — | — |
| BO | {84} | DMPR STATUS | CAL | — | Binary | RECAL | CAL |
| AO | 85 | SWITCH LIMIT | 5.2 | PCT | 0 to 102 | — | — |
| AO | 86 | SWITCH TIME | 10 | MIN | 0 to 255 | — | — |
| BO | 87 | CAL MODULE | NO | — | Binary | YES | NO |
| AO | 88 | VALVE COUNT | 1 | — | 0 to 255 | — | — |
| AO | 90 | SWITCH DBAND | 1.0 (0.56) | DEG F (DEG C) | 0 to 63.75 | — | — |
| AO | {92} | CTL STPT | 74.0 (23.44888) | DEG F (DEG C) | 48 to 111.75 | — | — |
| AO | {93} | FLOW STPT | 0 | PCT | 0 to 255.75 | — | — |

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Table 2. Point Database for Application 2513. (continued)

| Object Type ^a | Object Instance (Point Number) ^b | Object Name and Description | Factory Default (SI Units) ^c | Eng Units (SI Units) ^c | Range | Active Text | Inactive Text |
|---|---|-----------------------------|---|-----------------------------------|------------|-------------|---------------|
| BO | {94} | CAL AIR | NO | – | Binary | YES | NO |
| AO | 95 | CAL SETUP | 4 | – | 0 to 255 | – | – |
| AO | 96 | CAL TIMER | 12 | HRS | 0 to 255 | – | – |
| AO | 97 | DUCT AREA | 1.0 (0.09292) | SQ. FT (SQ M) | 0 to 6.375 | – | – |
| AO | 98 | LOOP TIME | 5 | SEC | 0 to 255 | – | – |
| AO | {99} | ERROR STATUS | 0 | – | 0 to 255 | – | – |
| ^a Object Types are; Analog Input (AI), Analog Output (AO), Binary Input (BI) and Binary Output (BO). ^b Points not listed are not used in this application. ^c A single value in a column means that the value is the same in English units and in SI units. ^d Point numbers that appear in brackets {} may be unbundled at the field panel. | | | | | | | |