

Application 2281: Heating and/or Chilled Water Cooling, ASHRAE Cycles I and II

Unit Vent Controller – 0-10V Output (Firmware Revision UE10)

Overview

In Application 2281, the Unit Vent Controller – 0-10V Output controls a unit ventilator equipped with a chilled water coil for cooling, and/or a heating coil, which may be hot water, steam, or electric, for ASHRAE Cycles I and II. A face-bypass damper can be controlled, replacing both the modulating (0-10V) heating and cooling actuators. If a face-bypass damper is used, 2-position valves on the coils may be controlled. Heating only and cooling only units can also be controlled with this application by overriding HEAT.COOL (Point 5).

Other features available in this application include morning warm-up/cool-down, night mode override, free-cooling, and auxiliary radiation in heating mode.

NOTE: The use of a low temperature detection thermostat (LTDT) is strongly recommended for hot water and steam systems.

This application controls room temperature by resetting the discharge air temperature. This application also controls an outdoor air damper according to the schedules as defined by ASHRAE Cycles I and II. The free-cooling/ economizer function is turned on and off by the field panel using FREE CLG (Point 23). If free cooling is not available, then the outdoor air damper will be kept at minimum position; otherwise, the outdoor air damper will modulate open in sequence with the heating and cooling actuators. The unit ventilator fan is also controlled in this application.

Illustrations

Table 2281-1 lists control drawings, control schedules, and wiring diagrams that can be used in this application. Use the table to find the illustrations for your particular hardware configuration.

Table 2281-1. Application 2281 Illustration Cross Reference Table.			
Hardware Configuration	Control Drawing	Control Schedule	Wiring Diagram
Chilled water coil, valve control	Figure 2281-1, except: 1. No heating coil, heating valve actuator, or auxiliary radiation.	Figure 2281-6, except: 1. No heating mode.	Figure 2281-9, except: 1. No heating valve actuator or auxiliary radiation.
Chilled water coil, face-bypass damper control	Figure 2281-3, except: 1. No heating coil, heating valve actuator, or auxiliary radiation.	Figure 2281-8, except: 1. No heating mode.	Figure 2281-11, except: 1. No 2-position heating valve actuator or auxiliary radiation.
Hot water coil, valve control	Figure 2281-4, except: 1. LTDT recommended.	Figure 2281-6, except: 1. No cooling mode.	Figure 2281-1, except: 1. No cooling valve actuator. 2. LTDT recommended.
Hot water coil, face-bypass damper control	Figure 2281-1, except: 1. No cooling coil or cooling valve actuator. 2. 2LTDT recommended if 2-position valve is used.	Figure 2281-8, except: 1. No cooling mode.	Figure 2281-11, except: 1. No 2-position cooling valve actuator.
Steam coil, valve control	Figure 2281-4, except: 1. Read <u>steam coil</u> instead of heating coil. 2. LTDT recommended.	Figure 2281-6, except: 1. No cooling mode.	Figure 2281-9, except: 1. No cooling valve actuator. 2. LTDT recommended.
Steam coil, face-bypass damper control	Figure 2281-3, except: 1. No cooling coil or cooling valve actuator. 2. Read <u>steam coil</u> instead of heating coil. 3. LTDT recommended if 2-position valve is used.	Figure 2281-8, except: 1. No cooling mode.	Figure 2281-11, except: 1. No 2-position cooling valve actuator.
Electric coil only	Figure 2281-2, except: 1. No cooling coil or cooling valve actuator. 2. No LTDT.	Figure 2281-7, except: 1. No cooling mode.	Figure 2281-10, except: 1. No cooling valve actuator. 2. No LTDT.

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Table 2281-1. Application 2281 Illustration Cross Reference Table.

Hardware Configuration	Control Drawing	Control Schedule	Wiring Diagram
2-pipe, hot water/chilled water coil, valve control	Figure 2281-1, except: 1. No heating coil or heating valve actuator. 2. Read <u>heating/cooling coil</u> instead of cooling coil. 3. Read <u>heating/cooling valve actuator</u> instead of cooling valve actuator. Terminate heating/cooling valve actuator at AO2. 4. LTDT recommended.	Figure 2281-6, except: 1. Read <u>coil valve</u> instead of HW/STM valve and CHW valve.	Figure 2281-9, except: 1. No heating valve actuator. 2. Read <u>heating/cooling valve actuator</u> instead of cooling valve actuator. Terminate heating/cooling valve actuator at AO2. 3. LTDT recommended.
2-pipe, hot water/chilled water coil, face-bypass damper control	Figure 2281-5, except: 1. LTDT recommended if 2-position valve is used.	Figure 2281-8	Figure 2281-12, except: 1. LTDT recommended if 2-position valve is used.
4-pipe, hot water and chilled water coils, valve control	Figure 2281-1, except: 1. LTDT recommended.	Figure 2281-6	Figure 2281-9, except: 1. LTDT recommended.
4-pipe, hot water and chilled water coils, face-bypass damper control	Figure 2281-3, except: 1. 2-position valves required if automatic heat/cool switchover is required. 2. LTDT recommended if 2-position valve is used.	Figure 2281-8	Figure 2281-11, except: 1. 2-position valves required if automatic heat/cool switchover is required. 2. LTDT recommended if 2-position valve is used.
4-pipe, steam and chilled water coils, valve control	Figure 2281-1, except: 1. Read <u>steam coil</u> instead of heating coil. 2. LTDT recommended.	Figure 2281-6	Figure 2281-9, except: 1. LTDT recommended.
4-pipe, steam and chilled water coils, face-bypass damper control	Figure 2281-3, except: 1. Read <u>steam coil</u> instead of heating coil. 2. 2-position valves required if automatic heat/cool switchover is required. 3. LTDT recommended if 2-position valve is used.	Figure 2281-8	Figure 2281-11, except: 1. 2-position valves required if automatic heat/cool switchover is required. 2. LTDT recommended if 2-position valve is used.
Electric coil, step control, and chilled water coil, valve control	Figure 2281-2	Figure 2281-7	Figure 2281-10

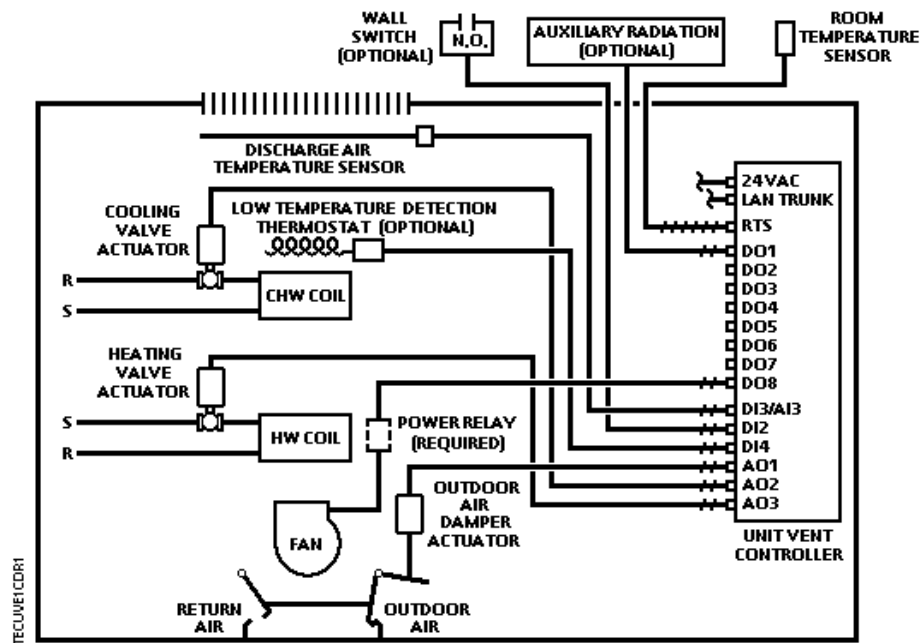


Figure 2281-1. Application 2281 Control Drawing.

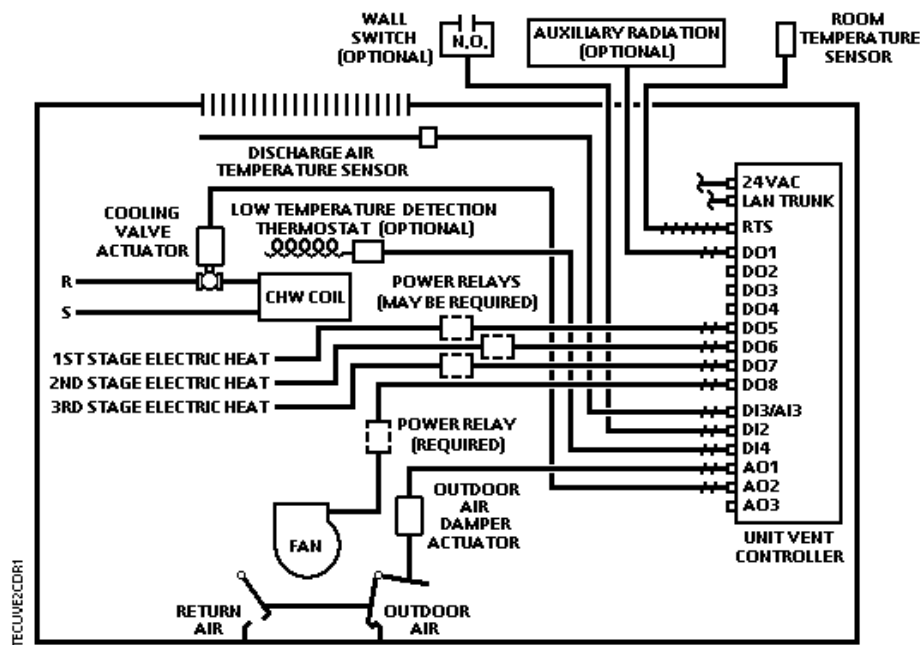


Figure 2281-2. Application 2281 Control Drawing.

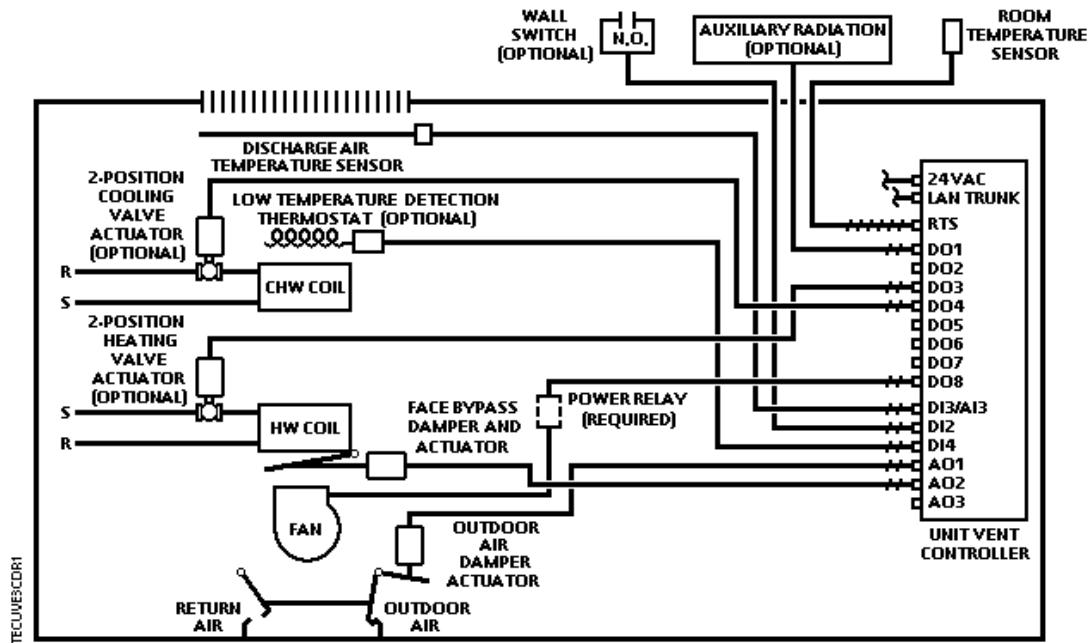


Figure 2281-3. Application 2281 Control Drawing.

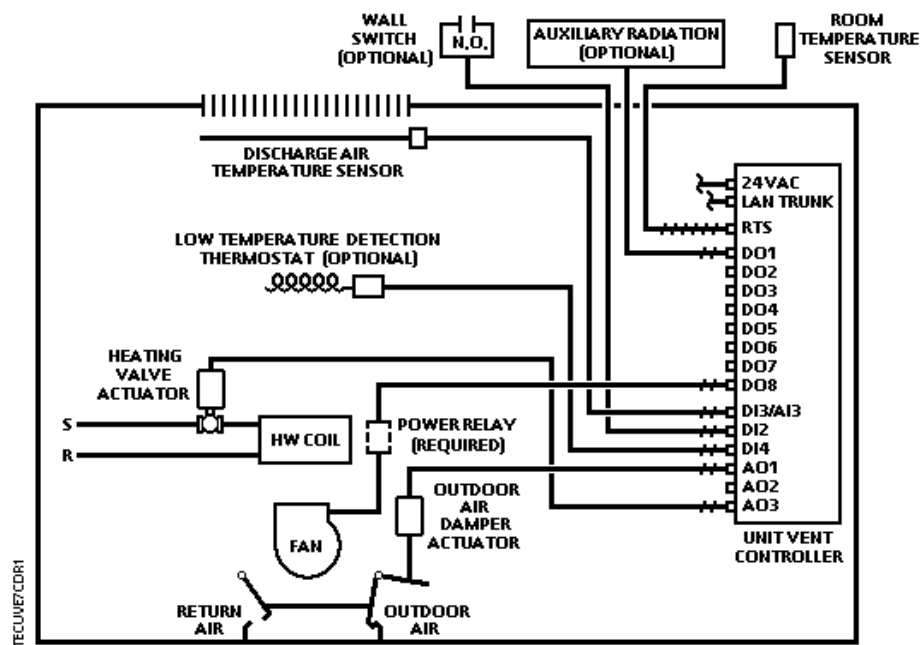


Figure 2281-4. Application 2281 Control Drawing.

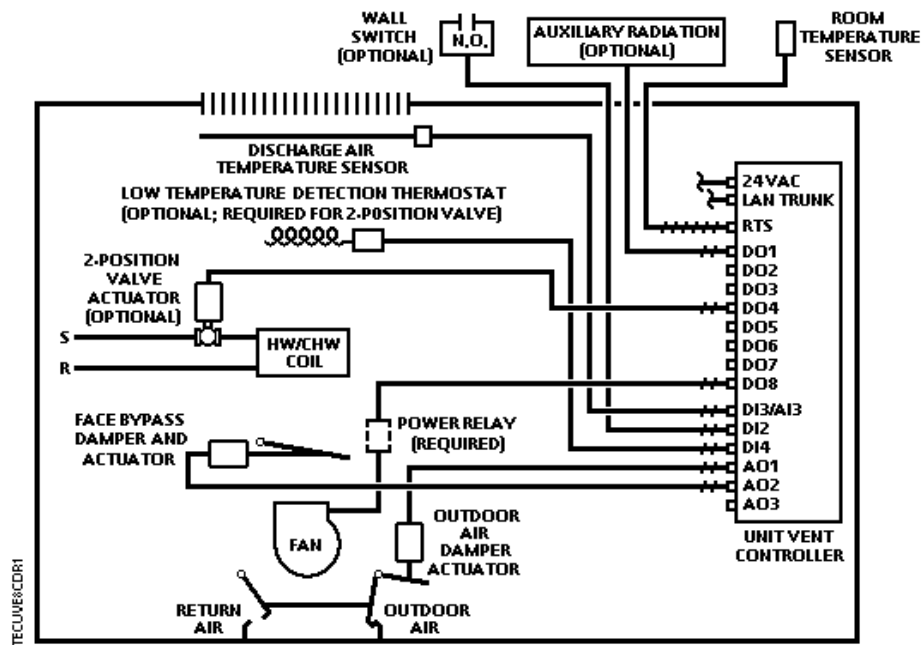


Figure 2281-5. Application 2281 Control Drawing.

NOTE: The auxiliary radiation is an independent loop and is not sequenced with the other control loops. The graphical representation in the figures is an example of what may occur in your system.

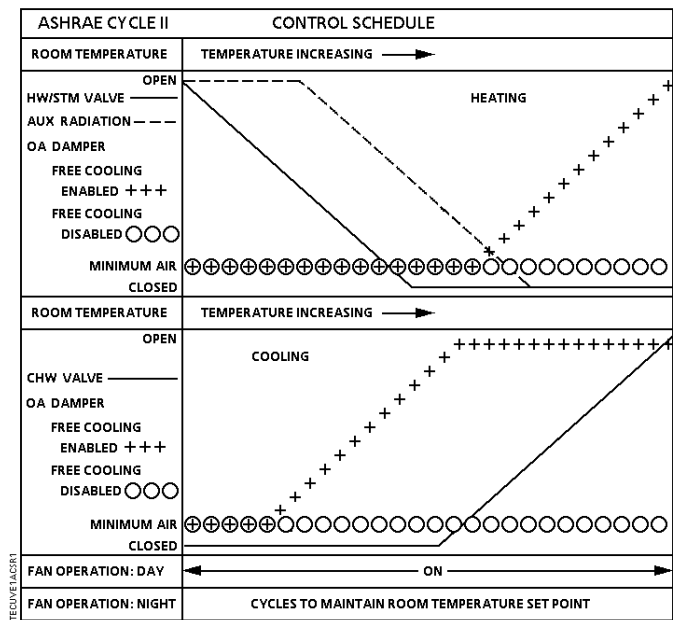


Figure 2281-6. Application 2281 Control Schedule.

NOTE: The auxiliary radiation is an independent loop and is not sequenced with the other control loops. The graphical representation in the figures is an example of what may occur in your system.

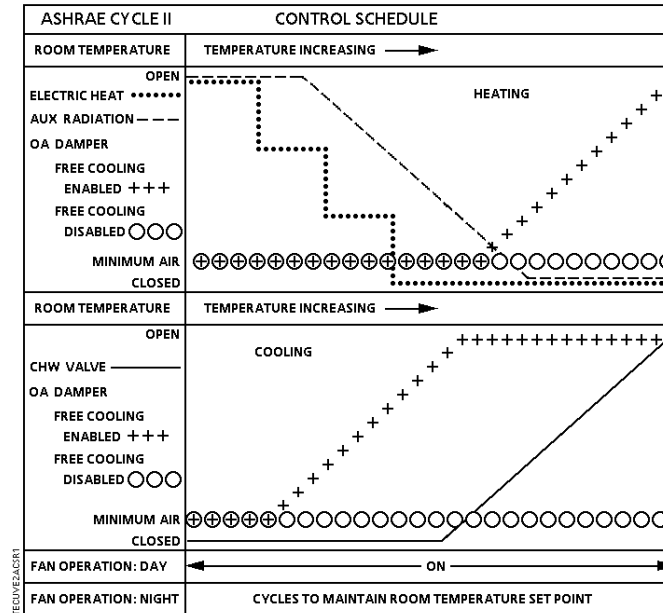


Figure 2281-7. Application 2281 Control Schedule.

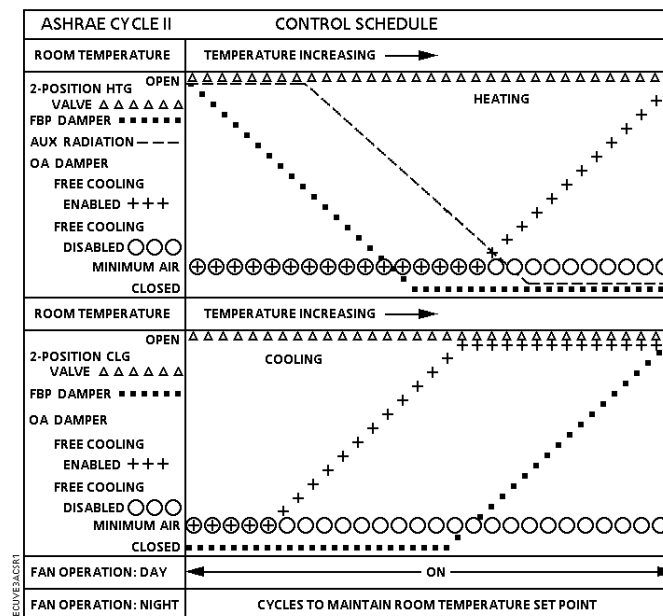


Figure 2281-8. Application 2281 Control Schedule.

Hardware Inputs

Analog

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

Digital

- Low Temperature Detection Thermostat (LTDT)
- Night mode override (optional)
- Wall switch (optional)

Hardware Outputs

The following is a list of devices that can be used by this application depending on your hardware configuration. See Table 2281-1.

Analog (0-10V)

- Cooling valve actuator
- Face-bypass damper actuator
- Heating valve actuator
- Outdoor air damper actuator

Digital

- Auxiliary radiation electric coil contact; or, auxiliary radiation 2-position valve actuator
- Unit fan
- 1st stage electric heat
- 2nd stage electric heat
- 3rd stage electric heat
- 2-position cooling valve actuator
- 2-position heating valve actuator

Ordering Notes

Unit Vent Controller – 0-10V Output (540-509)

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

Powers Averaging Air Temperature Sensor

Terminal Equipment Controller Room Temperature Sensor

Point Database

Table 2281-2 presents the point database information for Application 2281.

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2281, “Heating and/or Chilled Water Cooling, ASHRAE Cycles I and II”.

Control Temperature Setpoints

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

Day Mode – In day mode, CTL STPT (Point 92) holds the value of DAY CLG STPT (Point 6) or DAY HTG STPT (Point 7). If the room temperature sensor has a setpoint dial and STPT DIAL (Point 14) is set to YES, then CTL STPT holds the value of RM STPT DIAL (Point 13).

If the setpoint dial is used and the value of RM STPT DIAL (Point 13) is less than the value of RM STPT MIN (Point 11), then CTL STPT (Point 92) 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 (Point 92) 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 (Figure 2281-1 through Figure 2281-5 and Figure 2281-9 through Figure 2281-12), and WALL SWITCH (Point 18) = 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 (Point 29) 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 (Point 18) = NO, the controller does not monitor the status of the wall switch, even if one is connected to it. In this case, 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 (that is, it is connected to a field panel), then the field panel can send an operator or PPCL command to override the status of DAY.NGT (Point 29). 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 operational mode for the time period that is 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 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.

Valve Configuration

Definition of "2-pipe heat/cool":

- If the unit has one valve, controlling a coil that may have hot water or chilled water, depending on the season, then 1 VLV HTGCLG (Point 16) is set to YES. This configuration is often referred to as "2-pipe heat/cool".
- If the unit has any other setup, then 1 VLV HTGCLG (Point 16) is set to NO. This includes units which are heating or cooling only, units with a heating and a cooling coil (often referred to as "4-pipe"), units with electric heating, etc.

Day Heating Operation

In day heating operation, the controller maintains the room temperature at the value stored in CTL STPT (Point 92) by doing the following:

- Resetting the unit ventilator's discharge temperature setpoint, DISCH STPT (Point 93), based on the difference between CTL TEMP (Point 78) and CTL STPT (Point 92). If CTL TEMP goes below CTL STPT, then the discharge temperature setpoint increases. If the reverse occurs, then the setpoint decreases. DISCH STPT may not drop below the value of DSH MIN TEMP (Point 94), nor may it rise above DSH MAX TEMP (Point 95).
- Modulating the available coil control device based on the difference between the discharge temperature point, DISCH TEMP (Point 15), and DISCH STPT (Point 93). If DISCH TEMP goes below DISCH STPT, then the heating valve actuator opens, the face-bypass damper opens, or the stages of electric heat energize. If DISCH TEMP goes above DISCH STPT, then the reverse occurs.
- Controlling auxiliary radiation (if provided) using a pulse-width modulation algorithm. The auxiliary radiation will be on for a percentage of the time held in AUX HTG TIME (Point 57). The on-time is based on the difference between DISCH STPT (Point 93) and AUX DSH STPT (Point 91). If DISCH STPT goes below AUX DSH STPT, then the on-time of the auxiliary radiation valve decreases. If the reverse occurs, then the on-time increases.
- Positioning the outdoor air damper as follows:
 - For ASHRAE Cycle I, OADPR MINPOS (Point 10) is set to 100%.
 - For ASHRAE Cycle II, OADPR MINPOS (Point 10) is set to a value less than 100% to satisfy the minimum outdoor air requirements.
 - When the coil is providing heat, the damper is positioned at its minimum setting. When the coil is not providing heat and FREE CLG (Point 23) is set to ENABLE, the damper is positioned from minimum to maximum open to provide ventilation cooling. If FREE CLG is set to DISABL, then the damper is kept at minimum at all times.

Day Cooling Operation

In day cooling operation, the controller maintains the room temperature at the value stored in CTL STPT (Point 92) by doing the following:

- Resetting the unit ventilator's discharge temperature setpoint, DISCH STPT (Point 93), based on the difference between CTL TEMP (Point 78) and CTL STPT (Point 92). If CTL TEMP goes below CTL STPT, then the discharge temperature setpoint increases. If the reverse occurs, then the setpoint decreases. DISCH STPT may not drop below the value of DSH MIN TEMP (Point 94), nor may it rise above DSH MAX TEMP (Point 95).
- Modulating the available coil control device based on the difference between the discharge temperature point, DISCH TEMP (Point 15), and DISCH STPT (Point 93). If DISCH TEMP goes above DISCH STPT, then the cooling valve actuator opens or the face-bypass damper opens. If DISCH TEMP goes below DISCH STPT, then the reverse occurs.

- Positioning the outdoor air damper as follows:
 - For ASHRAE Cycle I, OADPR MINPOS (Point 10), is set to 100%.
 - For ASHRAE Cycle II, OADPR MINPOS is set to a value less than 100% to satisfy the minimum outdoor air requirements.
 - When the coil is providing cooling and FREE CLG (Point 23) is set to ENABLE, the damper is kept open. When the coil is not providing cooling and FREE CLG is set to ENABLE, the damper is modulated between minimum and maximum. If FREE CLG is set to DISABL, then the damper is kept at minimum at all times.

Night Heating Operation

The controller maintains the room temperature at the value stored in CTL STPT (Point 92) by doing the following:

- If CTL TEMP (Point 78) drops below the value of NGT HTG STPT (Point 9) minus the value of NGT DBAND (Point 88):
 - The fan turns ON
 - Heating turns ON
- If CTL TEMP (Point 78) rises above NGT HTG STPT (Point 9):
 - The fan turns OFF
 - Heating turns OFF

When the fan turns ON, the heating actuators and auxiliary radiation are opened. When the fan turns OFF, all heating and auxiliary radiation are closed. If electric heat is being controlled, then the fan will remain ON for 30 seconds after the last stage of electric heat is turned OFF. If NGT HW HTG (Point 53) is set to YES, (for hot water coils), then the heating actuator is kept open at all times during the night.

In night heating operation, the controller operates as follows:

- For units with hot water coils, NGT HW HTG (Point 53) must be set to YES, so that the valve will be positioned to full open.
- For units with steam or electric coils, NGT HW HTG (Point 53) must be set to NO, so that the coils can be cycled.
- The face-bypass damper is at full face when the fan is ON and full bypass when the fan is OFF and the 2-position heating valve actuator is open.
- The controller may switch to cooling mode when appropriate if NGT CLG MODE (Point 54) is set to YES.
- Heating only is provided when NGT CLG MODE (Point 54) is set to NO.

Night Cooling Operation

In night cooling operation, the controller maintains the room temperature at the value stored in CTL STPT (Point 92) by doing the following:

- If CTL TEMP (Point 78) rises above the sum of NGT CLG STPT (Point 8) and NGT DBAND (Point 88):
 - The fan turns ON
 - Cooling turns ON
- If CTL TEMP (Point 78) drops below NGT CLG STPT (Point 8):
 - The fan turns OFF
 - Cooling turns OFF
- When NGT CLG MODE (Point 54) is set to NO, the unit will operate in night heating mode only.

In night cooling operation, the controller operates as follows:

- For units with hot water coils, NGT HW HTG (Point 53) must be set to YES, so that the valve will be positioned to full open.
- For units with steam or electric coils, NGT HW HTG (Point 53) must be set to NO, so that the heating coils can be kept OFF.
- The face-bypass damper is at full face when the fan is ON and at full bypass when the fan is OFF and the 2-position cooling valve actuator is open.

Heating/Cooling Switchover

For 2-pipe heating/cooling units, (1 VLV HTGCLG (Point 16) is set to YES), and the switchover between heating and cooling must be controlled by the field panel which commands HEAT.COOL (Point 5).

For all other units (1 VLV HTGCLG (Point 16) is set to NO), the heating/cooling switchover is determined as follows:

If 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 below 50% if free cooling is disabled, or below SWITCH LIMIT (Point 85) if free cooling is enabled.
- CTL TEMP (Point 78) is greater than the sum of CTL STPT (Point 92) plus SWITCH DBAND (Point 90).
- CTL TEMP (Point 78) is greater than the appropriate cooling setpoint minus SWITCH DBAND (Point 90).

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

- CLG LOOPOUT (Point 79) is below 50% if free cooling is disabled, or below SWITCH LIMIT (Point 85) if free cooling is enabled.
- CTL TEMP (Point 78) is less than CTL STPT (Point 92) minus SWITCH DBAND (Point 90).
- CTL TEMP (Point 78) is less than the appropriate heating setpoint plus SWITCH DBAND (Point 90).

If night cooling is not available, as indicated by NGT CLG MODE (Point 54), then the controller remains in heating mode during the night.

Control Loops

The unit ventilator is controlled by four Proportional, Integral, and Derivative (PID) control loops: a room loop, a heating loop, a cooling loop, and an auxiliary loop.

Room Loop – The room loop uses the values of CTL STPT (Point 92) and CTL TEMP (Point 78) to set the discharge setpoint, DISCH STPT (Point 93), between the values of DSH MIN TEMP (Point 94) and DSH MAX TEMP (Point 95).

Heating Loop – The heating loop uses the value of DISCH STPT (Point 93) and DISCH TEMP (Point 15) to modulate the value of HTG LOOPOUT (Point 80).

Cooling Loop – The cooling loop uses the value of DISCH STPT (Point 93) and DISCH TEMP (Point 15) to modulate the value of CLG LOOPOUT (Point 79).

Auxiliary Loop – The auxiliary loop uses AUX DSH STPT (Point 91) and DISCH STPT (Point 93) to modulate the value of AUX LOOPOUT (Point 77).

Morning Warm-up/Cool-down

Morning warm-up or cool-down occurs after the controller switches from night mode to day mode, upon power-up, or if the controller is reset. During morning warm-up or cool-down, the controller provides maximum heating or cooling with the outdoor air damper closed until the temperature of the space reaches the value of CTL STPT (Point 92) plus or minus the value of MORN DBAND (Point 89). In morning cool-down, if FREE CLG (Point 23) is set to ENABLE, then the outdoor air damper is opened.

In heating mode, normal day heating operation begins when the temperature of the room reaches the value of CTL STPT (Point 92) minus MORN DBAND (Point 89).

In cooling mode, normal day cooling operation begins when the temperature of the room reaches the value of CTL STPT (Point 92) plus MORN DBAND (Point 89).

For example, in day heating mode, if CTL STPT (Point 92) is 72°F (22.2°C) and MORN DBAND (Point 89) is 3°F (1.6°C), then normal day heating operation begins when the temperature of the room reaches 69°F (20.6°C).

ON/OFF Coil Valve Control

When a face-bypass configuration is used, the coils may be turned ON and OFF with 2-position valves using DOs. There are two conditions when this might occur:

1. In the case where a 4-pipe configuration is used with a face-bypass damper, the cooling valve actuator will be shut while in heating, and the heating valve actuator will be shut while in cooling. In this configuration, 2-position valves must be used to prevent both coils from being ON at the same time.

NOTE: In night cooling, if NGT HW HTG (Point 53) is set to YES, the heating coil is kept open.

2. When in heating or cooling, if the face-bypass damper is all the way closed (bypass) for more than two minutes, then the active coil can be closed to conserve energy. This is an option which is performed when FBP.2PSVCTL (Point 28) is set to ENABLE. Otherwise, the valve is kept open when the damper is closed.

NOTE: In night cooling, if NGT HW HTG (Point 53) is set to YES, the heating coil is kept open.

When a 2-pipe heat/cool configuration is used (1 VLV HTGCLG (Point 16) is set to YES), with or without a face-bypass damper, NGT HW HTG (Point 53) should be set to YES. The 2-pipe heat/cool coil will then stay open during both night heating and night cooling.

Electric Heat

If electric heat is used, then it is controlled as follows:

HTG OUTPUT (Point 60)	Stage 1	Stage 2	Stage 3
0% - 33%	ON	OFF	OFF
34% - 66%	ON	ON	OFF
67% - 100%	ON	ON	ON

In addition, no stage may turn ON or OFF until the number of seconds held in EHT STG DELY (Point 58) have elapsed since the last time any stage turned ON or OFF. Stage one will always be the first stage to turn ON and the last stage to turn OFF.

Fan Operation

In day mode, FAN (Point 50), is ON all of the time.

In night mode, the fan only operates when required for heating or cooling.

In night heating, the fan turns ON when the temperature drops below the value of CTL STPT (Point 92) minus NGT DBAND (Point 88). When the temperature rises above CTL STPT, the fan turns OFF. If any stage of electric heat is ON, then the fan will be ON. The fan will remain ON for 30 seconds after the last stage of electric heat is turned OFF.

In night cooling, the fan turns ON when the temperature rises above the value of CTL STPT (Point 92) plus NGT DBAND (Point 88). When the temperature drops below CTL STPT, the fan turns OFF.

Fail-safe Operation

The Unit Vent Controller has a fail-safe operation that can be triggered by several occurrences.

A low temperature detection thermostat (LTDT) can be used to signal the controller when the temperature sensed by the LTDT is below the low temperature limit.

If the room temperature sensor input to the Unit Vent Controller fails or the LTDT equals ON, the controller goes through the following shutdown sequence:

- Outdoor air damper is closed.
- Heating is full ON (except electric which is OFF).
- Cooling is full OFF.
- Face-bypass damper is open to face.
- Fan is OFF.
- Auxiliary radiation is OFF.
- 2-position heating valve actuator is open.
- 2-position cooling valve actuator is closed.

NOTE: DO 2 will not be commanded by the fail-safe mode, all other DOs can be affected.

If the discharge air temperature sensor fails, the following conditions occur:

- If the last valid value is greater than 150 degrees, then the heat is turned OFF, the outdoor air damper is closed, and the fan is turned ON.
- If the sensor does not come back within 10 minutes or if the last valid value is less than 150 degrees, then the controller shuts down as described above.

If a failed sensor returns or if the LTDT turns OFF, then normal control resumes.

Analog and digital outputs cannot be commanded when the controller is in fail-safe mode, however, failed points may be overridden, allowing the controller to return from fail-safe mode. In this instance, room temperature control is not possible.

Application Notes

1. If the unit ventilator cycles excessively, if the temperature swings in the room are excessive or if there is trouble in maintaining the setpoint, then either the cooling loop, the heating loop, or both need to be tuned. See *APOGEE Automation Service Procedures* on InfoLink for more information.

2. The Unit Vent Controller – 0-10V Output, as shipped from the factory, keeps all associated equipment OFF. See the “Equipment Controllers” section in *APOGEE Automation Start-up Procedures* on InfoLink for information on how to release the controller and its equipment to application control.
3. When the fan is manually switched OFF at the unit fan speed switch, the actuators should be wired so they return to their normal state.

Wiring Diagrams

Figure 2281-9 through Figure 2281-12 present the point wiring for Application 2281.



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

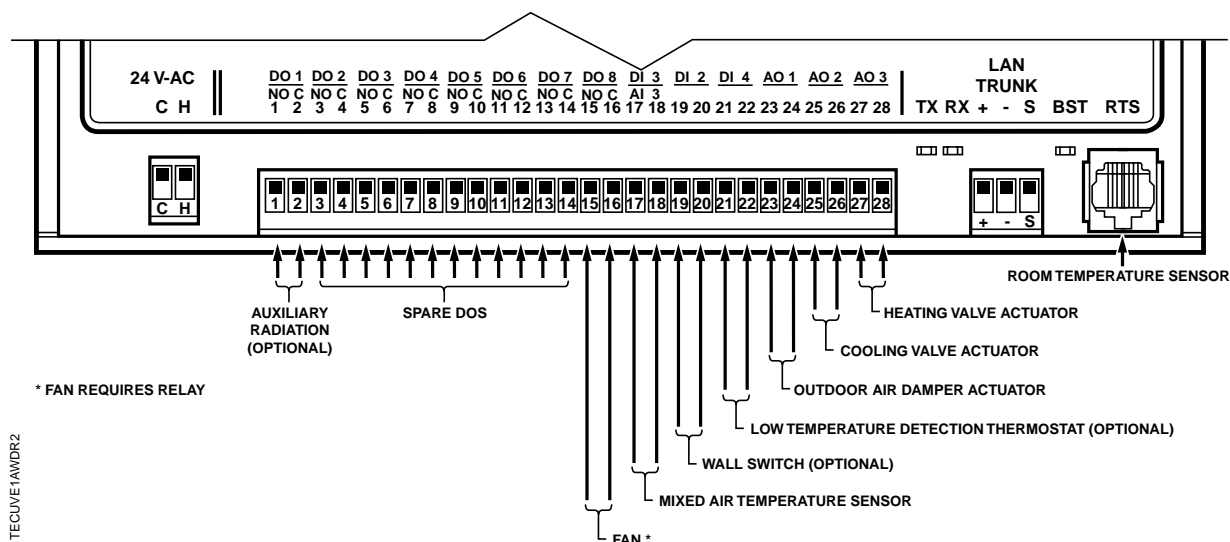


Figure 2281-9. Application 2281 Wiring Diagram.

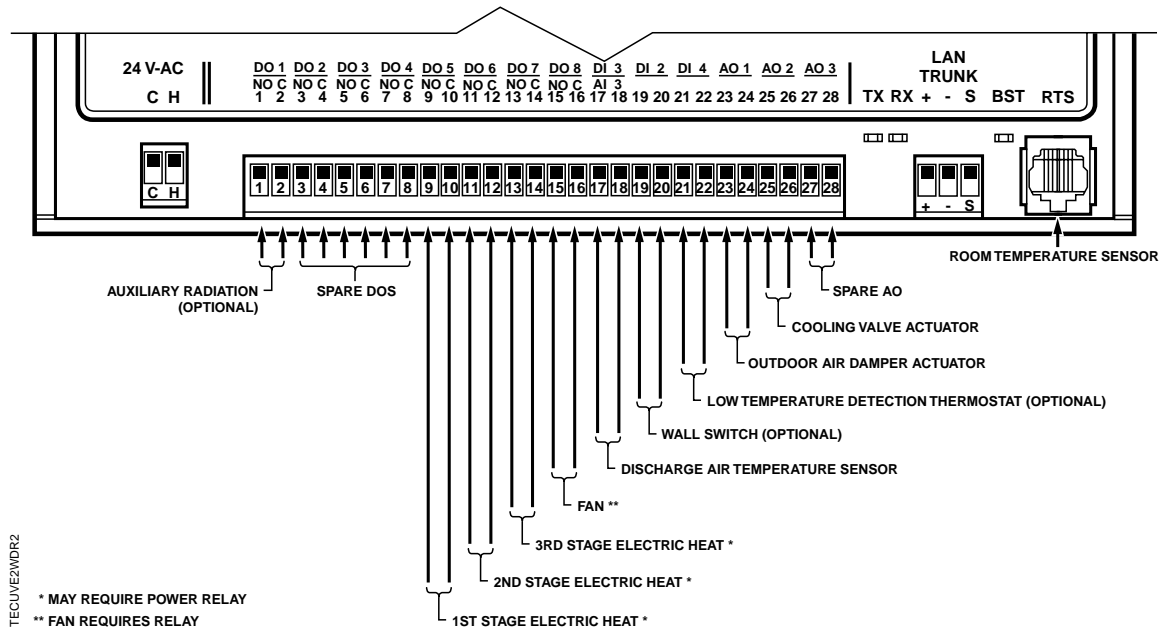


Figure 2281-10. Application 2281 Wiring Diagram.



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

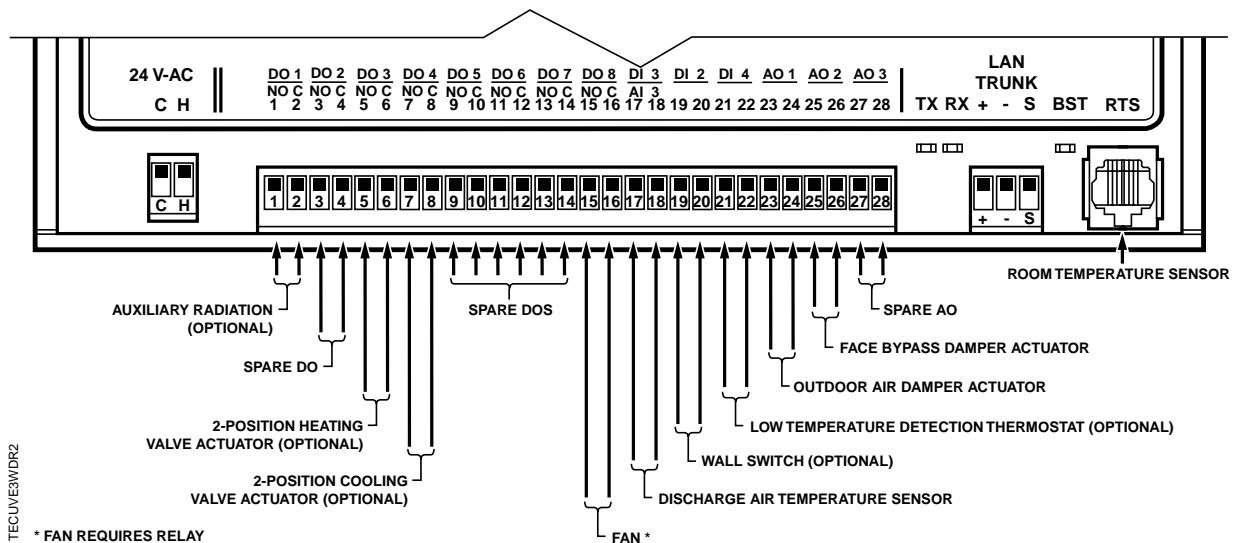


Figure 2281-11. Application 2281 Wiring Diagram.

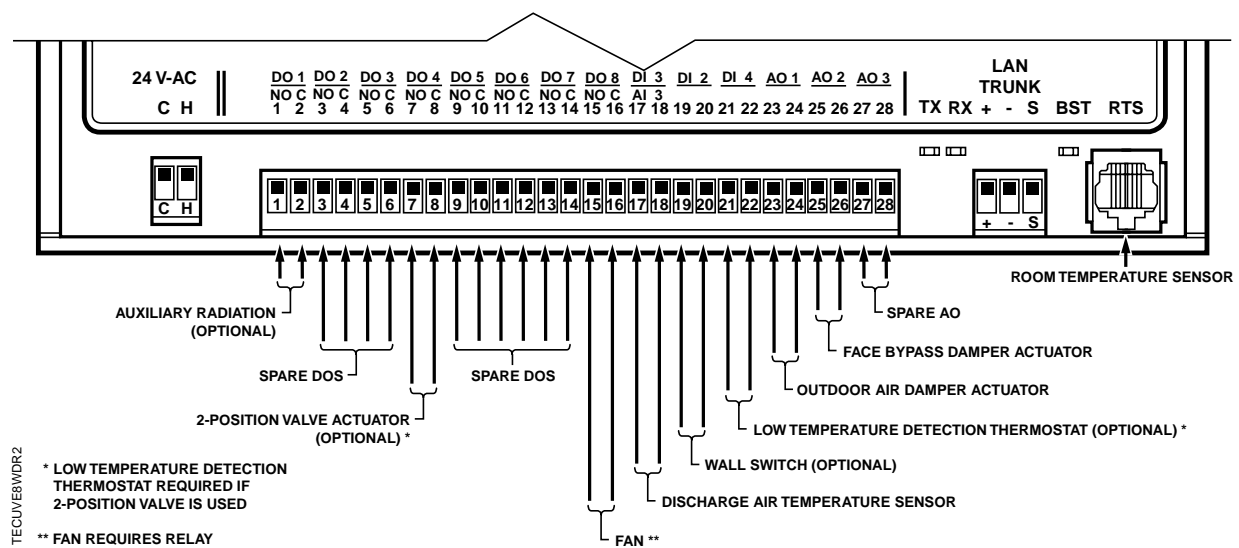


Figure 2281-12. Application 2281 Wiring Diagram.

Table 2281-2. Point Database for Application 2281.

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	2299	–	1	0	–	–
{04}	ROOM TEMP	74.00 (23.45)	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)	–	–
{05}	HEAT.COOL	COOL	–	1	0	HEAT	COOL
06	DAY CLG STPT	74.00 (23.45)	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)	–	–
07	DAY HTG STPT	70.00 (21.21)	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)	–	–
08	NGT CLG STPT	82.00 (27.93)	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)	–	–
09	NGT HTG STPT	65.00 (18.41)	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)	–	–
10	OADPR MINPOS	14.8	PCT	0.4	0	–	–
11	RM STPT MIN	55.00 (12.81)	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)	–	–
12	RM STPT MAX	90.00 (32.41)	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)	–	–
13	RM STPT DIAL	74.00 (23.45)	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)	–	–
14	STPT DIAL	NO	–	1	0	YES	NO
{15}	DISCH TEMP	74.00 (23.5)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)	–	–
16	1 VLV HTGCLG	NO	–	1	0	YES	NO
17	FBP.MODVALVE	VALVE	–	1	0	FBP	VALVE
18	WALL SWITCH	NO	–	1	0	YES	NO
{19}	DI OVRD SW	OFF	–	1	0	ON	OFF
20	OVRD TIME	1	HRS	1	0	–	–
{21}	NGT OVRD	NIGHT	–	1	0	NIGHT	DAY
22	AUX.NOAUX	NOAUX	–	1	0	AUX	NOAUX
{23}	FREE CLG	DISABL	–	1	0	ENABLE	DISABL
{24}	DI 2	OFF	–	1	0	ON	OFF

1. Points not listed are not used in this application.
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3. Point numbers that appear in brackets { } may be unbundled at the field panel.

continued on the next page...

Table 2281-2. Point Database for Application 2281.

Point Number	Descriptor	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
{25}	DI 3	OFF	–	1	0	ON	OFF
{26}	LOW TEMP DET	ON	–	1	0	OFF	ON
27	ELEC.NOELEC	NOELEC	–	1	0	ELEC	NOELEC
28	FBP.2PSVCTL	DISABL	–	1	0	ENABLE	DISABL
{29}	DAY.NGT	DAY	–	1	0	NIGHT	DAY
{30}	WRMUP.COOLDN	ON	–	1	0	ON	OFF
31	AOV1 SPAN	10	VOLTS	0.01	0	–	–
32	AOV1 START	0	VOLTS	0.01	0	–	–
33	AOV2 SPAN	10	VOLTS	0.01	0	–	–
34	AOV2 START	0	VOLTS	0.01	0	–	–
35	AOV3 SPAN	10	VOLTS	0.01	0	–	–
36	AOV3 START	0	VOLTS	0.01	0	–	–
37	AO DIR.REV	0	–	1	0	–	–
{38}	AOV1	0	VOLTS	0.01	0	–	–
{39}	AOV2	0	VOLTS	0.01	0	–	–
{40}	AOV3	0	VOLTS	0.01	0	–	–
{41}	AUX RAD	OFF	–	1	0	ON	OFF
{42}	DO 2	OFF	–	1	0	ON	OFF
{43}	HTG 2POS VLV	OFF	–	1	0	ON	OFF
{44}	CLG 2POS VLV	OFF	–	1	0	ON	OFF
{45}	EHEAT 1	OFF	–	1	0	ON	OFF
{46}	EHEAT 2	OFF	–	1	0	ON	OFF
{47}	EHEAT 3	OFF	–	1	0	ON	OFF
{50}	FAN	OFF	–	1	0	ON	OFF
53	NGT HW HTG	YES	–	1	0	YES	NO
54	NGT CLG MODE	NO	–	1	0	YES	NO
{55}	AUX OUTPUT	0	PCT	0.4	0	–	–
57	AUX HTG TIME	10	MIN	1	0	–	–
58	EHT STG DELY	30	SEC	1	0	–	–
59	DO DIR.REV	0	–	1	0	–	–

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

Table 2281-2. Point Database for Application 2281.

Point Number	Descriptor	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
<i>continued on the next page...</i>							
{60}	HTG OUTPUT	0	PCT	0.4	0	–	–
{61}	CLG OUTPUT	0	PCT	0.4	0	–	–
{62}	OA DMPR POS	0	PCT	0.4	0	–	–
63	CLG P GAIN	1.6 (2.88)	–	0.2 (0.36)	0	–	–
64	CLG I GAIN	0.05 (0.09)	–	0.0005 (0.0009)	0	–	–
65	CLG D GAIN	10 (18)	–	2 (3.6)	0	–	–
66	CLG BIAS	50.00	PCT	0.2	0	–	–
67	HTG P GAIN	0.4 (0.72)	–	0.05 (0.09)	0	–	–
68	HTG I GAIN	0.015 (0.027)	–	0.0002 (0.00036)	0	–	–
69	HTG D GAIN	5 (9)	–	1 (1.8)	0	–	–
70	HTG BIAS	50.00	PCT	0.2	0	–	–
71	ROOM P GAIN	2.3 (4.14)	–	0.05 (0.09)	0	–	–
72	ROOM I GAIN	0.00504 (0.009072)	–	0.00009 (0.000162)	0	–	–
73	ROOM D GAIN	76 (136.8)	–	2 (3.6)	0	–	–
74	ROOM BIAS	72 (22.38)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)	–	–
{77}	AUX LOOPOUT	0	PCT	0.2	0	–	–
{78}	CTL TEMP	74.00 (23.45)	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)	–	–
{79}	CLG LOOPOUT	0.00	PCT	0.2	0	–	–
{80}	HTG LOOPOUT	0.00	PCT	0.2	0	–	–
{81}	AUX P GAIN	0.2 (0.36)	–	0.02 (0.036)	0	–	–
{82}	AUX I GAIN	0.00054 (0.000972)	–	0.00009 (0.000162)	0	–	–
{83}	AUX D GAIN	24 (43.2)	–	1 (1.8)	0	–	–
{84}	AUX BIAS	0	PCT	0.2	0	–	–
85	SWITCH LIMIT	4.8	PCT	0.4	0	–	–
86	SWITCH TIME	10	MIN	1	0	–	–

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Table 2281-2. Point Database for Application 2281.

Point Number	Descriptor	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
<i>continued on the next page...</i>							
88	NGT DBAND	3 (1.68)	DEG F (DEG C)	0.25 (0.14)	0	–	–
89	MORN DBAND	2 (1.12)	DEG F (DEG C)	0.25 (0.14)	0	–	–
90	SWITCH DBAND	2 (1.12)	DEG F (DEG C)	0.25 (0.14)	0	–	–
91	AUX DSH STPT	80.00 (26.86)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)	–	–
{92}	CTL STPT	74.00 (23.45)	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)	–	–
{93}	DISCH STPT	74.00 (23.5)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)	–	–
94	DSH MIN TEMP	60.00 (15.66)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)	–	–
95	DSH MAX TEMP	110.00 (43.66)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)	–	–
98	LOOP TIME	5	SEC	1	0	–	–
{99}	ERROR STATUS	0	–	1	0	–	–

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