SIEMENS

BACnet Heat Pump Controller - Electronic Output

Application Notes

Application 2574: Multiple Heating and Cooling with Mixed Air and Internal Reversing Valve Control

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Overview

In Application 2574, the controller controls one or two heating compressors for heating and one or two cooling compressors for cooling. The reversing valve is controlled internally by the heat pump. In addition to compressors, this heat pump may also be equipped with electric heat for auxiliary heat and mixed air control for free cooling. This application also controls small air handling units with two position heating and cooling control. The mixed air control can use either a spring return or a floating control damper motor (Figure 1).

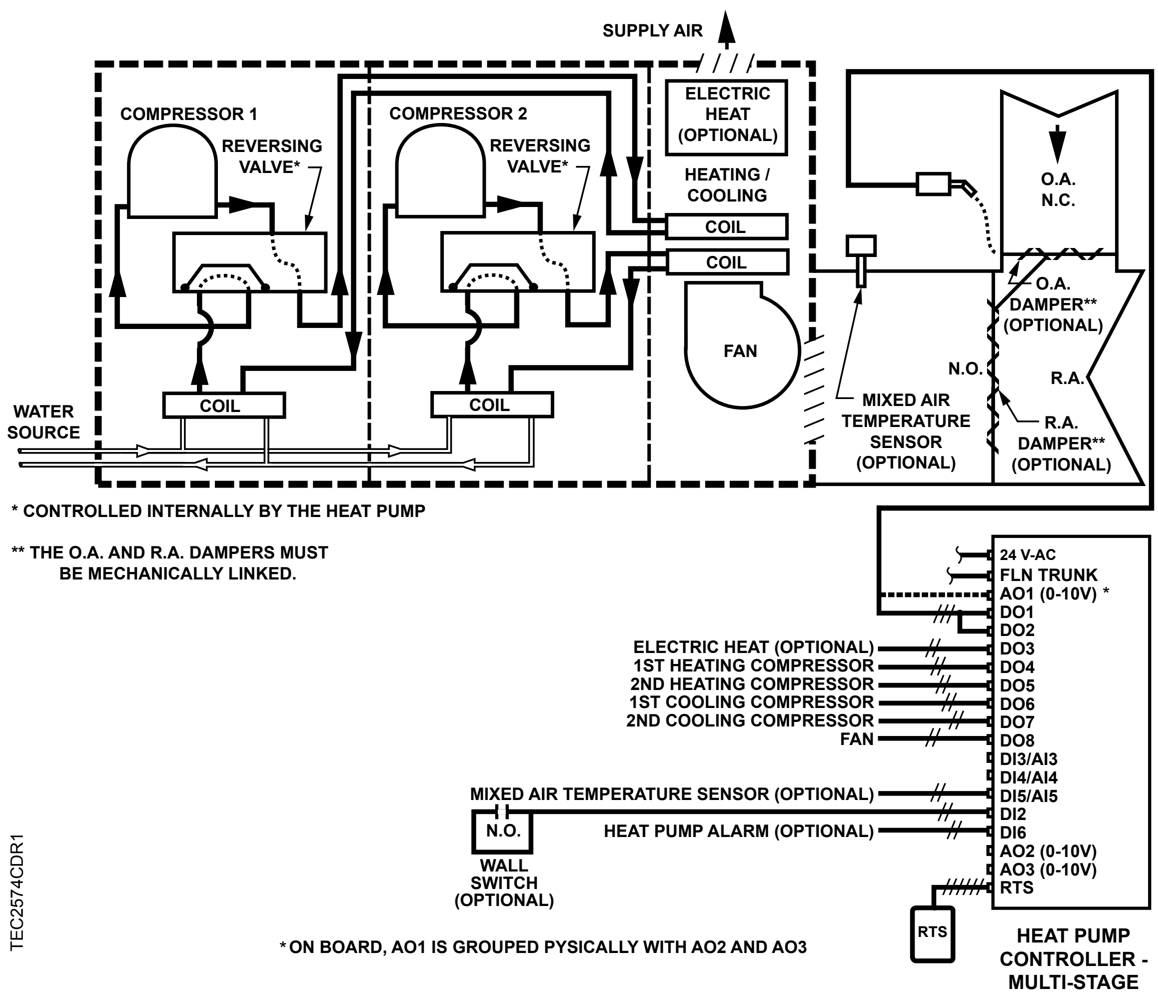


Figure 1. Application 2574 Control Diagram.

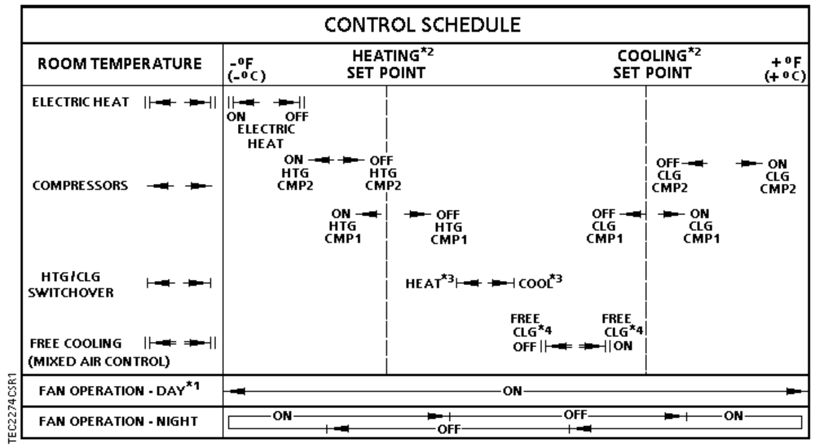


Figure 2. Application 2574 Control Schedule.

See *Sequence of Operation*, *Fan Operation, Control Temperature Setpoints, Heating/Cooling Switchover, Mixed Air Control and Compressor Operation*.

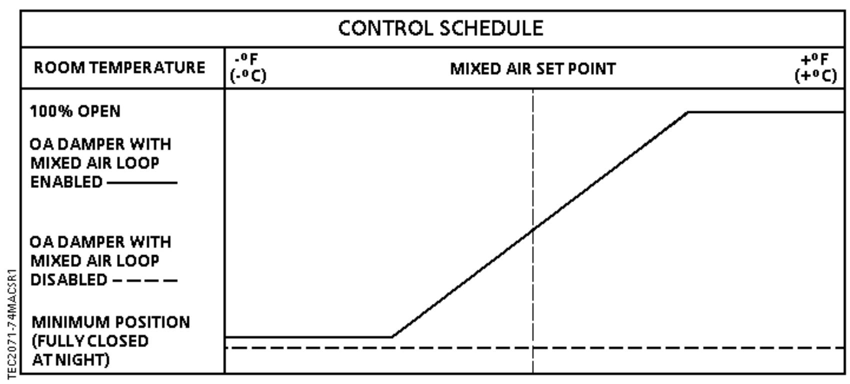


Figure 3. Application 2574 Control Schedule for Mixed Air Control.

BACnet

The BACnet Multiple Heating and Cooling Heat Pump with Mixed Air and Internal Reversing Valve Control communicates using BACnet MS/TP protocol for open communications on BACnet MS/TP networks.

Table 1. Supported BIBBS.

Product	Supported BIBBs	BIBB Name
	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
BTEC	DM-DDC-B	Device Management-Device Communication Control-B

Hardware Inputs

Analog

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

Digital

- Heat pump alarm (optional)
- Night mode override (optional)
- Wall switch (optional)

Hardware Outputs

Analog

- Spring return damper actuator (optional)

Digital

- Floating Control Damper actuator (optional)
- Fan
- Stage 1 cooling compressor (optional)
- Stage 2 cooling compressor (optional)
- Stage 1 heating compressor (optional)
- Stage 2 heating compressor (optional)
- Stage 1 electric heat (optional)

Ordering Notes

BACnet Heat Pump Controller - Electronic Output	550-790A

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

Damper Actuator (spring return or floating)
Mixed Air Temperature Sensor
Terminal Equipment Controller Room Temperature Sensor

Point Database

presents the point database information for Application 2574.

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2574, “BACnet Multiple Heating and Cooling Heat Pump with Mixed Air and Internal Reversing Valve Control”.

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) or DAY HTG STPT (Point 7). 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) or NGT HTG STPT (Point 9)..

Room Temperature Offset

The Room Temperature Offset feature is optional.

RMTMP OFFSET (Point 22), is a user-adjustable offset that will compensate for deviations between the value of ROOM TEMP (Point 4) and the actual room temperature. This corrected value is displayed in CTL TEMP (Point 78).

CTL TEMP (Point 78) = ROOM TMP (Point 4) + RMTMP OFFSET (Point 22).

EXAMPLE: If the actual room temperature is 72°F, and the value of ROOM TEMP is 73.0°F, then the value entered into RMTMP OFFSET is -1.0. In this case, the value of ROOM TEMP would read 73.0°F, but the value of CTL TEMP would read 72.0°F.

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 Figure 5), 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 (Point 78) > 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), the controller switches from cooling to heating mode by setting HEAT.COOL (Point 5) to HEAT:

- CLG LOOPOUT (Point 79) < SWITCH LIMIT (Point 85).
- CTL TEMP (Point 78) < CTL STPT (Point 92) by at least the value set SWITCH DBAND (Point 90).
- CTL TEMP (Point 78) < the appropriate heating setpoint plus SWITCH DBAND (Point 90).

Control Loops

The heat pump is controlled by three Proportional, Integral, and Derivative (PID) control loops; two temperature loops and a mixed air loop.

The two temperature loops are a cooling loop and a heating loop and the value of HEAT.COOL (Point 5) determines which is active. The active temperature loop maintains room temperature at the value in CTL STPT (Point 92). See *Control Temperature Setpoints* . The inputs to the temperature loops are CTL TEMP (Point 78) and CTL STPT. The outputs are CLG LOOPOUT (Point 79) and HTG LOOPOUT (Point 80).

The two temperature loops perform the overall sequencing of the heat pump equipment; they determine when to turn the compressors, fan, and stages of electric heat ON and OFF and when to enable or disable mixed air control.

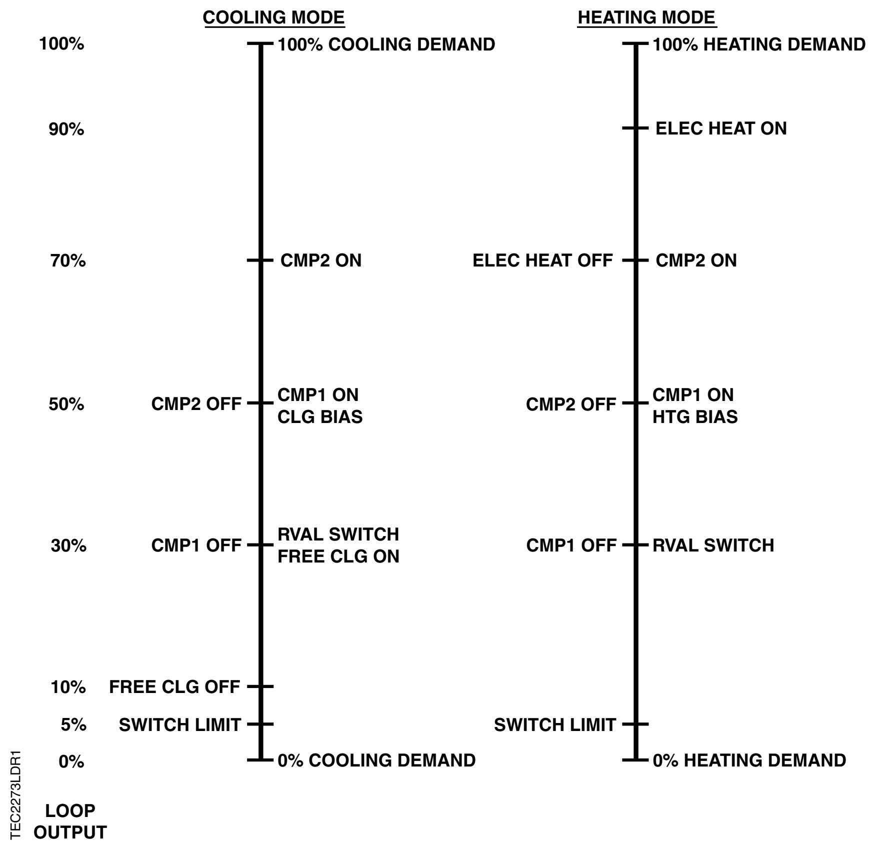


Figure 4. Heating and Cooling Loops.

The values used in this diagram are for example purposes only. They may be set to different values to suit your specific needs.

In heating mode, as the room temperature drops below the heating setpoint, the heating loop calls for more heating (the heating loop output rises). In cooling mode, if the room temperature rises above the cooling setpoint, the cooling loop calls for more cooling (the cooling loop output rises). The output of the inactive loop will remain at zero (Figure 4).

The ladder diagrams in Figure 4 show the heating and cooling loop sequencing of multiple compressors with one stage of electric heat. The diagrams show the outputs of the heating and cooling loops as vertical bars from 0 to 100%. The right side of each ladder diagram reflects a rising loop output. The left side of each ladder diagram reflects a falling loop output.

No action occurs when the loop outputs rise above or drop below the values of CLG BIAS (Point 66) and HTG BIAS (Point 70). The purpose of these points is to provide a starting place for the loops at startup.

Cooling Loop – CLG LOOPOUT (Point 79) must be greater than FREE CLG ON (Point 61) before free cooling will be used. The controller accomplishes free cooling by enabling the mixed air loop to modulate the mixed air damper.

CLG CMP 1 (Point 46) will not be allowed to turn ON until CLG LOOPOUT (Point 79) becomes greater than the value of CLG CMP1 ON (Point 30). CLG CMP 1 will not be allowed to turn OFF until CLG LOOPOUT drops below the value of CLG CMP1 OFF (Point 31).

CLG CMP 2 will not be allowed to turn ON until CLG LOOPOUT (Point 79) becomes greater than the value of CLG CMP2 ON (Point 34). CLG CMP 2 (Point 47) will not be allowed to turn OFF until CLG LOOPOUT drops below the value of CLG CMP2 OFF (Point 35).

CLG LOOPOUT (Point 79) must be less than the value of FREE CLG OFF (Point 62) before free cooling will be turned OFF. The controller turns OFF free cooling by disabling the mixed air loop. When the loop is disabled, the mixed air damper will be sent to either minimum position for day mode or to 0% open for night mode.

When CLG LOOPOUT (Point 79) becomes less than SWITCH LIMIT (Point 85), the controller will be allowed to change to heating mode if all other criteria for the change have been met.

Heating Loop – HTG LOOPOUT (Point 80) must be greater than ELEC HEAT ON (Point 81) before ELEC HEAT (Point 43) is turned ON. When HTG LOOPOUT drops below HTG CMP2 ON, ELEC HEAT will shut OFF.

HTG CMP 1 (Point 44) will not be allowed to turn ON until HTG LOOPOUT (Point 80) becomes greater than the value of HTG CMP1 ON (Point 82). HTG CMP 1 will not be allowed to turn OFF until HTG LOOPOUT drops below the value of HTG CMP1 OFF (Point 83).

HTG CMP 2 (Point 45) will not be allowed to turn ON until HTG LOOPOUT (Point 80) becomes greater than the value of HTG CMP2 ON (Point 16). HTG CMP 2 will not be allowed to turn OFF until HTG LOOPOUT drops below the value of HTG CMP2 OFF (Point 17).

When HTG LOOPOUT (Point 80) drops below the value of SWITCH LIMIT (Point 85), the controller will be allowed to change to cooling mode if all other criteria for the change have been met.

Mixed Air Loop – The heat pump is controlled by two Proportional, Integral, and Derivative (PID) control loops: a cooling loop and a heating loop. This section describes the mixed air control loop.

The mixed air loop controls only the mixed air portion of the application. The inputs to the mixed air loop are MA TEMP (Point 15) and MA STPT (Point 93). The output is DMPR COMD (Point 48).

Mixed Air Control

Day Mode – If the fan is ON, the mixed air damper, DMPR COMD (Point 48), will be set to minimum position (as stored in DMPR MIN POS (Point 10)) when at least one of the following conditions occurs:

- HEAT.COOL (Point 5) = HEAT. Free cooling is not needed in the heating season.
- MA TEMP (Point 15) is failed. When this point is failed, mixed air control is not possible.
- FREE CLG (Point 23) = DISABL. The outside air temperature is too warm to be used for free cooling. During day mode, the damper is at its minimum position. During night mode, the damper is at its closed position.
- CLG LOOPOUT (Point 79) < FREE CLG OFF (Point 62). The cooling load is so small that no cooling is required.

If the fan is OFF, DMPR COMD (Point 48) will be set to 0%.

DMPR COMD will be modulated by the mixed air temperature control loop when all of the following conditions have been met:

- HEAT.COOL (Point 5) = COOL.
- MA TEMP (Point 15) is normal. (Not failed.)
- FREE CLG (Point 23) = ENABLE. The outside air is cool enough to be used for free cooling.
- CLG LOOPOUT (Point 79) > FREE CLG ON (Point 61). The cooling load is large enough to require cooling.
- DMPR COMD (Point 48) > DMPR MIN POS (Point 10).

DMPR COMD (Point 48) will not be set below minimum position (DMPR COMD = DMPR MIN POS (Point 10)). This is done to make sure that the ventilation requirements are being met.

Night Mode – DMPR COMD (Point 48) = 0% OPEN if at least one of the following conditions occurs:

- HEAT.COOL (Point 5) = HEAT. Free cooling is not needed in the heating season.
- MA TEMP (Point 15) is failed. When this point is failed, mixed air control is not possible.
- NGT MA CTL (Point 91) = NO. Mixed air control is not being used during the night mode.
- FREE CLG (Point 23) = DISABL. The outside air is too warm to be used for free cooling.
- CLG LOOPOUT (Point 79) < FREE CLG OFF (Point 62). The cooling load is so small that no cooling is required.

DMPR COMD (Point 48) will be modulated by the mixed air temperature control loop when all of the following conditions have been met:

- HEAT.COOL (Point 5) = COOL.
- MA TEMP (Point 15) is normal. (Not failed)
- NGT MA CTL (Point 91) = YES. (See *Application Notes*)

- FREE CLG (Point 23) = ENABLE. The outside air is cool enough to be used for free cooling.
- CLG LOOPOUT (Point 79) > FREE CLG ON (Point 61). The cooling load is large enough to require cooling.

If CLG LOOPOUT (Point 79) is between FREE CLG ON (Point 61) and FREE CLG OFF (Point 62) and all other conditions have been met for enabling the mixed air loop, the action taken will depend on the following:

- If CLG LOOPOUT (Point 79) was previously above FREE CLG ON (Point 61), the mixed air loop will remain enabled.
- If CLG LOOPOUT (Point 79) was previously below FREE CLG OFF (Point 62), the mixed air loop will remain disabled.

This will happen whether or not the heat pump is in day or night mode.

The mixed air damper motor can be either a spring return damper motor or a floating control damper motor.

- For a spring return damper, set DAMPER TYPE (Point 38) = SPRING. The mixed air loop will control the damper through its 0 – 10 volt analog output, AOV1 (Point 40), and DO 1 (Point 41) and DO 2 (Point 42) will be spare DOs.
- For a floating control damper, set DAMPER TYPE (Point 38) = FLOAT. The mixed air loop will control the damper through DO 1 (Point 41) and DO 2 (Point 42), and AOV1 (Point 40) will be a spare analog output.

CAUTION:

This application does not have built in low temperature detection for the mixed air dampers. The low temperature detection is handled differently depending on the type of damper used (spring return or floating control).

Spring Return Damper – Stand-alone low temperature detection can be accomplished with an external low limit thermostat. In order to do this, the damper should be set up to be normally closed and the external low temperature thermostat should cut power to the damper actuator upon reaching a low limit condition. When this happens, the spring will drive the damper shut.

Floating Control Damper – Stand-alone low temperature detection is not possible. A PPCL program can be written to close the damper when a low temperature situation occurs. In order to do this, an outside air temperature sensor needs to be connected to the field panel and DMPR COMD (Point 48) needs to be unbundled. Even though this is possible, make sure that the customer will allow it before attempting it.

Compressor Operation

> To prevent damage to the heat pump, HTG CMP 1 (Point 44), HTG CMP 2 (Point 45), CLG CMP 1 (Point 46), and CLG CMP 2 (Point 47) are not operator commandable at the portable operator's terminal or the field panel.

This application can support from 0 to 2 cooling compressors (as defined by the value of CLG CMP TOTL (Point 77)) and from 0 to 2 heating compressors (as defined by the value of HTG CMP TOTL (Point 75)).

When HEAT.COOL (Point 5) = COOL, HTG LOOPOUT (Point 80) will be set to 0. CLG LOOPOUT (Point 79) will also equal 0 until all of the heating compressors have been OFF for at least their minimum OFF time. This is a safety feature that prevents the simultaneous operation of the heating and cooling compressor DOs.

When the heating compressors have been OFF for the MIN OFF time, CLG LOOPOUT (Point 79) is placed under normal control.

As cooling demand increases, the cooling compressors are controlled as follows:

- CLG CMP 1 (Point 46) will turn ON when CLG LOOPOUT (Point 79) > CLG CMP1 ON (Point 30) provided that the first cooling compressor has been OFF for at least the time set in CLG1 MIN OFF (Point 32).
- If CLG CMP TOTL (Point 77) = 2, CLG CMP 2 (Point 47) will turn ON when CLG LOOPOUT (Point 79) > CLG CMP2 ON (Point 34) provided that the following conditions are met:
  - The second cooling compressor has been OFF for at least the time set in CLG2 MIN OFF (Point 36).
  - The first cooling compressor has been ON for at least 30 seconds. (This creates less demand than having more than one compressor start at once).

As cooling demand decreases, the cooling compressors are controlled as follows:

- CLG CMP 2 (Point 47) will turn OFF when CLG LOOPOUT (Point 79) < CLG CMP2 OFF (Point 35) provided that the second cooling compressor has been ON for at least the time set in CLG2 MIN ON (Point 37).
- CLG CMP 1 (Point 46) will turn OFF when CLG LOOPOUT (Point 79) < CLG CMP1 OFF (Point 31) provided that the following conditions are met:
  - The first cooling compressor has been ON for at least the time set in CLG1 MIN ON (Point 33).
  - The second cooling compressor has been OFF for at least 30 seconds. This will prevent the first cooling compressor from turning OFF before the second cooling compressor is OFF.

When HEAT.COOL (Point 5) = HEAT, CLG LOOPOUT (Point 79) will be set to 0. HTG LOOPOUT (Point 80) will also equal 0 until all of the cooling compressors have been OFF for at least their minimum OFF time. This is a safety feature that prevents the simultaneous operation of the heating and cooling compressor DOs.

When the cooling compressors have been OFF for the MIN OFF time, HTG LOOPOUT (Point 80) is placed under normal control.

As heating demand increases, the heating compressors are controlled as follows:

- HTG CMP 1 (Point 44) will turn ON when HTG LOOPOUT (Point 80) > HTG CMP1 ON (Point 82) provided that the first heating compressor has been OFF for at least the time set in HTG1 MIN OFF (Point 87)
- If HTG CMP TOTL (Point 75) is 2, HTG CMP 2 (Point 45) will turn ON when HTG LOOPOUT (Point 80) > HTG CMP2 ON (Point 16) provided that the following conditions are met:
    - The second heating compressor has been OFF for at least the time set in HTG2 MIN OFF (Point 27).
    - The first heating compressor has been ON for at least 30 seconds. (This creates less demand than having more than one compressor start at once.)

As heating demand goes from decreases, the heating compressors are controlled as follows:

- HTG CMP 2 (Point 45) will turn OFF when HTG LOOPOUT (Point 80) < HTG CMP2 OFF (Point 17) provided that the second heating compressor has been ON for at least the time set in HTG2 MIN ON (Point 28).
- HTG CMP 1 (Point 44) will turn OFF when HTG LOOPOUT (Point 80) < HTG CMP1 OFF (Point 83) provided that the following conditions are met:
    - The first heating compressor has been ON for at least the time set in HTG1 MIN ON (Point 88).
    - The second heating compressor has been OFF for at least 30 seconds. This will prevent the first heating compressor from turning OFF before the second heating compressor is OFF.

Electric Heat (optional)

If no stages of electric heat are being used (EHTG STG CNT (Point 76) = 0), this control is omitted.

If the stage of electric heat is being used (EHTG STG CNT (Point 76) = 1) and HEAT.COOL (Point 5) = COOL, the stage of electric heat is OFF.

When the stage of electric heat is being used and HEAT.COOL (Point 5) = HEAT, the electric heat is controlled as follows:

- If HTG LOOPOUT (Point 80) > ELEC HEAT ON (Point 81), the electric heat point, ELEC HEAT (Point 43), is turned ON.
- ELEC HEAT (Point 43) will turn OFF differently depending on the number of heating compressors being used (as determined by HTG CMP TOTL (Point 75)).
  - If HTG CMP TOTL = 0 or 1 and HTG LOOPOUT < HTG CMP1 ON (Point 82), ELEC HEAT is turned OFF.
  - If HTG CMP TOTL = 2 and HTG LOOPOUT < HTG CMP2 ON (Point 16), ELEC HEAT is turned OFF.

Fan Operation

To prevent damage to the heat pump, FAN (Point 50) is not operator commandable at the portable operator's terminal or the field panel.

Day Mode – FAN (Point 50) is ON when CYCLE FAN (Point 60) = NO. If CYCLE FAN = YES, the fan control in day mode is the same as it is in night mode.

Night Mode – The fan is controlled as follows:

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

1. Free cooling is being provided by the mixed air control loop.
2. At least one compressor or stage of electric heat is ON.

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

1. Free cooling is not being provided by the mixed air control loop.
2. All compressors and stages of electric heat have been OFF for at least 30 seconds.

Damper Status Operation (optional)

If the heat pump has a damper, it is set at the value of DMPR MIN POS (Point 10) during day mode and is fully closed during night mode.

Power Failure Recovery

Upon return from a power failure, the heating and cooling compressors are kept OFF, the optional electric heat (if used), is kept OFF and the fan is kept OFF. In addition to the equipment being OFF, both CLG LOOPOUT (Point 79) and HTG LOOPOUT (Point 80) are set to 0. This situation will remain in effect until the power failure recovery period is over for this controller.

The controller returns to normal control when its power failure recovery period is over. The power failure recovery time for a heat pump is based on the following formula:

RETURN DELAY + (CTLR ADDRESS × 10 seconds)

RETURN DELAY (Point 3) is useful for water to air heat pumps because it allows the central equipment to be running before the heat pumps start coming back on-line. This gives the water loop a chance to stabilize its temperature before the compressors start using it and therefore minimizes the chance that the heat pumps will trip the high temperature/pressure alarms.

CTLR ADDRESS (Point 1) is used so the power failure recovery time of the controllers will be different from each other even if they all have the same value for RETURN DELAY (Point 3). This lessens the demand of having all the electrical equipment starting at once.

Centralized Alarm Monitoring

DI 6 (Point 26) can be used to monitor an input that changes state when the heat pump is in alarm. DI 6 can be unbundled to send alarm information to the field panel for centralized alarm monitoring.

Overriding DOs

This application is designed to prevent you from directly commanding critical DOs ON or OFF. Specifically, the fan, reversing valve, and compressor(s) cannot be directly commanded ON or OFF. Commanding these DOs can only be done indirectly by overriding the output of the loop currently under control (either CLG LOOPOUT (Point 79) or HTG LOOPOUT (Point 80)). This is done to protect the equipment.

You will be able to directly turn the stages of electric heat and any spare DOs ON or OFF. Also, you will always be able to command the damper via DMPR COMD (Point 48).

Fail-safe Operation

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

Application Notes

1. If the heat pump cycles excessively, temperature swings in the room are excessive, or there is trouble maintaining the setpoint, the cooling loop, the heating loop or both need to be tuned. See *iKnow Troubleshooting Tool* for more information.

2. BACnet Heat Pump 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.

3. Running the mixed air loop during night mode can increase energy savings by taking advantage of free cooling at night to pre-cool the building in time for day mode. This can lessen the need to use mechanical cooling during day mode. Pre-cooling the building this way can also improve the indoor air quality because this type of cooling is accomplished with fresh air.

   Some field panel involvement is necessary to pre-cool the building with this application. For instance, the field panel needs to adjust the night cooling setpoint downward whenever the outside can be used for free cooling at night. This would require unbundling FREE CLG (Point 23) and CTL STPT (Point 92).

4. In this application the maximum configurations are as follows:

   - The maximum of HTG CMP TOTL (Point 75) = 2.
   - The maximum of CLG CMP TOTL (Point 77) = 2.
   - The maximum of EHTG STG CNT (Point 76) = 1.

   If these limits are exceeded, HTG CMP TOTL (Point 75), CLG CMP TOTL (Point 77), and EHTG STG CNT (Point 76) will be set to 0. These points will remain at 0 until they are set correctly. (This prevents the application from trying to control equipment that it does not have.)

Wiring Diagram

The point wiring for Application 2574 is shown in Figure 5.

CAUTION:

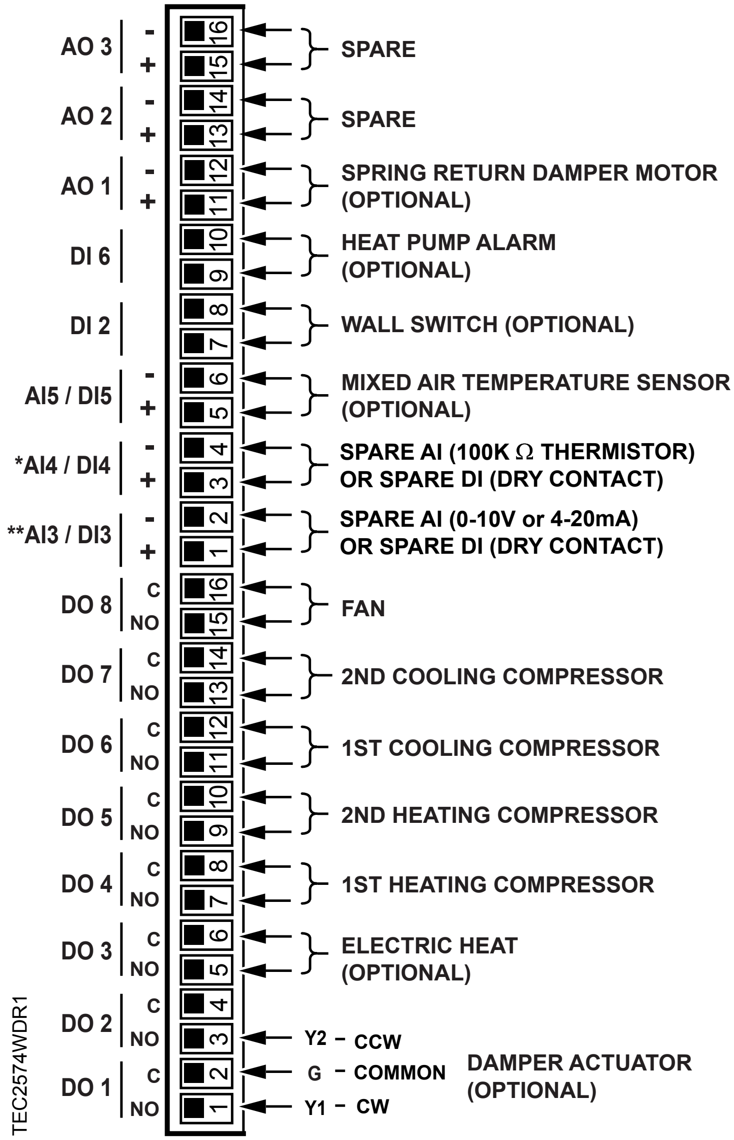
The controller's DOs control 24 Vac loads only. The maximum rating is 12 VA for each DO. Use an interposing 220V 4-relay module for any of the following:

• VA requirements higher than the maximum

• 110 or 220 Vac requirements

• DC power requirements

• Separate transformers used to power the load.



* SPARE AI / DI POINTS CANNOT BE USED AS AI AND DI AT SAME TIME
**AI3 IS SWITCH SELECTABLE FOR VOLTAGE OR CURRENT
(ON CTLR BOARD UNDER COVER)

Figure 5. Application 2574 Wiring Diagram.

Table 2. Point Database for Application 2574.

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 255	–	–
AO	2	APPLICATION	2590	–	2573, 2574 and 2590	–	–
AO	3	RETURN DELAY	10	MIN	0 to 255	–	–
AI	{04}[d]	ROOM TEMP	74.0 (23.45)	DEG F (DEG C)	48.0 to 111.75	–	–
BO	{05}	HEAT.COOL	COOL	–	Binary	HEAT	COOL
AO	6	DAY CLG STPT	74.0 (23.45)	DEG F (DEG C)	48.0 to 111.75	–	–
AO	7	DAY HTG STPT	70.0 (21.21)	DEG F (DEG C)	48.0 to 111.75	–	–
AO	8	NGT CLG STPT	82.0 (27.93)	DEG F (DEG C)	48.0 to 111.75	–	–
AO	9	NGT HTG STPT	65.0 (18.41)	DEG F (DEG C)	48.0 to 111.75	–	–
AO	10	DMPR MIN POS	14.8	PCT	0.0 to 102.0	–	–
AO	11	RM STPT MIN	55.0 (12.81)	DEG F (DEG C)	48.0 to 111.75	–	–
AO	12	RM STPT MAX	90.0 (32.41)	DEG F (DEG C)	48.0 to 111.75	–	–
AI	{13}	RM STPT DIAL	74.0 (23.45)	DEG F (DEG C)	48.0 to 111.75	–	–
BO	14	STPT DIAL	NO	–	Binary	YES	NO
AI	{15}	MA TEMP	74.0 (23.496)	DEG F (DEG C)	37.5 to 165.0	–	–
AO	16	HTG CMP2 ON	70	PCT	0.0 to 102.0	–	–
AO	17	HTG CMP2 OFF	50	PCT	0.0 to 102.0	–	–
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

continued on next page...

Table 2. Point Database for Application 2574. ***(continued)***

AO	22	RMTMP OFFSET	0.0 (0.0)	DEG F (DEG C)	-31.75 to 32.0	–	–
BO	{23}	FREE CLG	DISABL	–	Binary	ENABLE	DISABL
BI	{24}	DI 2	OFF	–	Binary	ON	OFF
BI	{25}	DI 5	OFF	–	Binary	ON	OFF
BI	{26}	DI 6	OFF	–	Binary	ON	OFF
AO	27	HTG2 MIN OFF	3	MIN	0 to 255	–	–
AO	28	HTG2 MIN ON	3	MIN	0 to 255	–	–
BO	{29}	DAY.NGT	DAY	–	Binary	NIGHT	DAY
AO	30	CLG CMP1 ON	50	PCT	0.0 to 102.0	–	–
AO	31	CLG CMP1 OFF	30	PCT	0.0 to 102.0	–	–
AO	32	CLG1 MIN OFF	3	MIN	0 to 255	–	–
AO	33	CLG1 MIN ON	3	MIN	0 to 255	–	–
AO	34	CLG CMP2 ON	90	PCT	0.0 to 102.0	–	–
AO	35	CLG CMP2 OFF	70	PCT	0.0 to 102.0	–	–
AO	36	CLG2 MIN OFF	3	MIN	0 to 255	–	–
AO	37	CLG2 MIN ON	3	MIN	0 to 255	–	–
BO	38	DAMPER TYPE	FLOAT	–	Binary	SPRING	FLOAT
AO	39	AO DIR.REV	0	–	0 to 255	–	–
AO	{40}	AOV1	0	VOLTS	0.0 to 10.23	–	–
BO	{41}	DO 1	OFF	–	Binary	ON	OFF
BO	{42}	DO 2	OFF	–	Binary	ON	OFF
BO	{43}	ELEC HEAT	OFF	–	Binary	ON	OFF
BO	{44}	HTG CMP 1	OFF	–	Binary	ON	OFF
BO	{45}	HTG CMP 2	OFF	–	Binary	ON	OFF
BO	{46}	CLG CMP 1	OFF	–	Binary	ON	OFF
BO	{47}	CLG CMP 2	OFF	–	Binary	ON	OFF
AO	{48}	DMPR COMD	0	PCT	0.0 to 102.0	–	–
AO	{49}	DMPR POS	0	PCT	0.0 to 102.0	–	–
BO	{50}	FAN	OFF	–	Binary	ON	OFF
AO	51	MTR TIMING	130	SEC	0 to 511	–	–
AI	{52}	AI 3	0.0	PCT.	0.0 to 102.0	–	–

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Table 2. Point Database for Application 2574. ***(continued)***

AI	{53}	AI 4	37.5 (3.056)	DEG F (DEG C)	37.5 to 165.0	–	–
AO	{54}	AOV2	0	VOLTS	0.0 to 10.23	–	–
BI	{55}	DI 3	OFF	–	Binary	ON	OFF
AO	56	DMPR ROT ANG	90	–	0 to 255	–	–
BI	{57}	DI 4	OFF	–	Binary	ON	OFF
AO	58	MTR SETUP	0	–	0 to 255	–	–
AO	59	DO DIR.REV	0	–	0 to 255	–	–
BO	60	CYCLE FAN	NO	–	Binary	YES	NO
AO	61	FREE CLG ON	30	PCT	0.0 to 102.0	–	–
AO	62	FREE CLG OFF	10	PCT	0.0 to 102.0	–	–
AO	63	CLG P GAIN	10.0 (18.0)	–	0.0 to 63.75	–	–
AO	64	CLG I GAIN	0.01 (0.018)	–	0.0 to 1.023	–	–
AO	65	CLG D GAIN	24 (43.2)	–	0 to 510	–	–
AO	66	CLG BIAS	50	PCT	0.0 to 102.0	–	–
AO	67	HTG P GAIN	10.0 (18.0)	–	0.0 to 63.75	–	–
AO	68	HTG I GAIN	0.01 (0.018)	–	0.0 to 1.023	–	–
AO	69	HTG D GAIN	24 (43.2)	–	0 to 510	–	–
AO	70	HTG BIAS	50	PCT	0.0 to 102.0	–	–
AO	{71}	MA P GAIN	5.0 (9.0)	–	0.0 to 63.75	–	–
AO	{72}	MA I GAIN	0.024 (0.0432)	–	0.0 to 1.023	–	–
AO	{73}	MA D GAIN	0 (0.0)	–	0 to 510	–	–
AO	{74}	MA BIAS	0	PCT	0.0 to 102.0	–	–
AO	75	HTG CMP TOTL	1	–	0 to 255	–	–
AO	76	EHTG STG CNT	1	–	0 to 255	–	–
AO	77	CLG CMP TOTL	1	–	0 to 255	–	–
AO	{78}	CTL TEMP	74.0 (23.45)	DEG F (DEG C)	48.0 to 111.75	–	–
AO	{79}	CLG LOOPOUT	0	PCT	0.0 to 102.0	–	–
AO	{80}	HTG LOOPOUT	0	PCT	0.0 to 102.0	–	–
AO	81	ELEC HEAT ON	90	PCT	0.0 to 102.0	–	–
AO	82	HTG CMP1 ON	50	PCT	0.0 to 102.0	–	–

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Table 2. Point Database for Application 2574. ***(continued)***

AO	83	HTG CMP1 OFF	30	PCT	0.0 to 102.0	–	–
AO	85	SWITCH LIMIT	4.8	PCT	0.0 to 102.0	–	–
AO	86	SWITCH TIME	10	MIN	0 to 255	–	–
AO	87	HTG1 MIN OFF	3	MIN	0 to 255	–	–
AO	88	HTG1 MIN ON	3	MIN	0 to 255	–	–
AO	90	SWITCH DBAND	2.0 (1.12)	DEG F (DEG C)	0.0 to 63.75	–	–
BO	{91}	NGT MA CTL	NO	–	Binary	YES	NO
AO	{92}	CTL STPT	74.0 (23.45)	DEG F (DEG C)	48.0 to 111.75	–	–
AO	{93}	MA SETPT	55.0 (12.856)	DEG F (DEG C)	37.5 to 165.0	–	–
AO	96	CAL TIMER	12	HRS	0 to 255	–	–
AO	{97}	AOV3	0	VOLTS	0.0 to 10.23	–	–
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.