SIEMENS

TEC Controller

Two Compressor Heat Pump with Reversing Valve & Mixed Air Control, Application 2071

Application Note

140-1041
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Building Technologies

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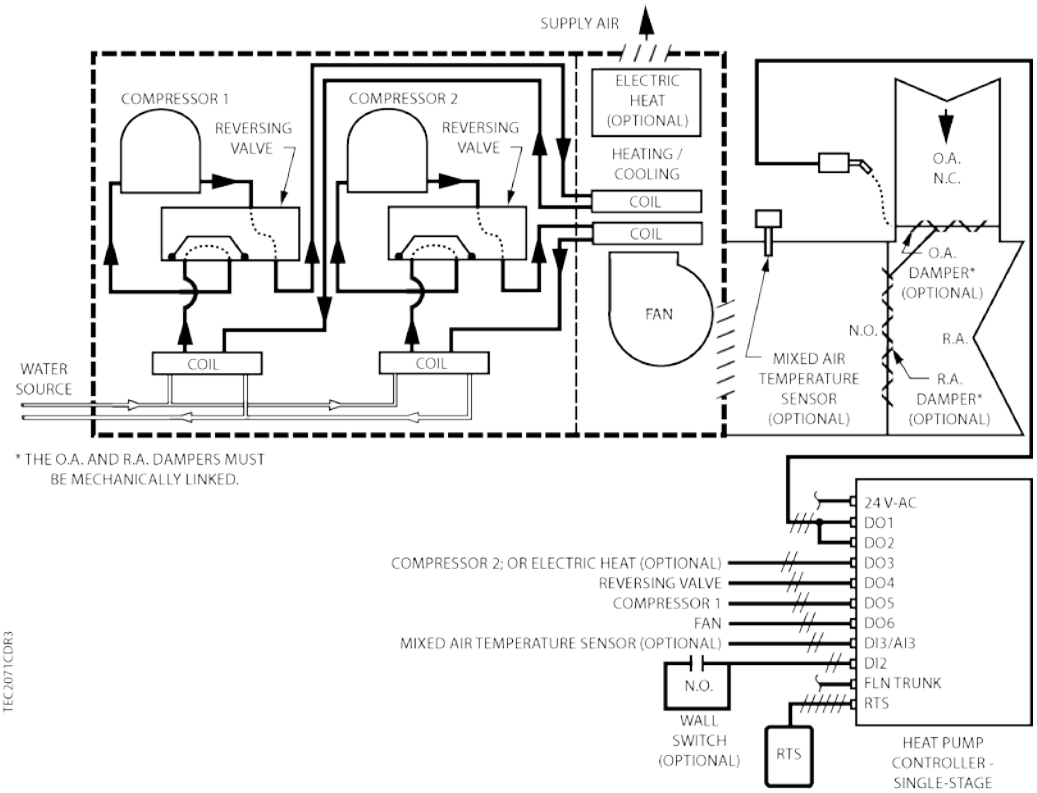
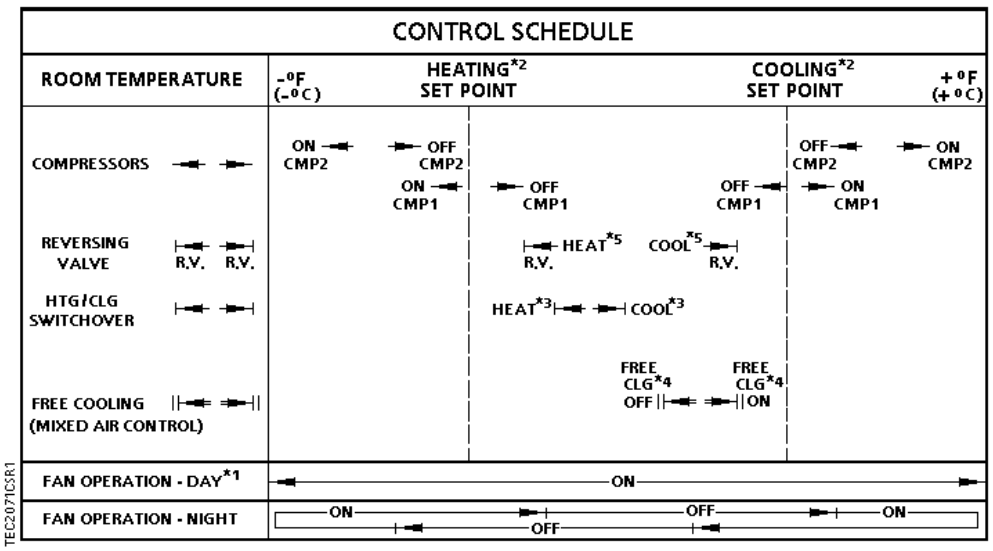
Overview

In Application 2071, the controller controls a two compressor heat pump with a reversing valve. In place of the second compressor, this heat pump may also be equipped with electric heat for auxiliary heat. Mixed air control for ventilation and free cooling is also available.

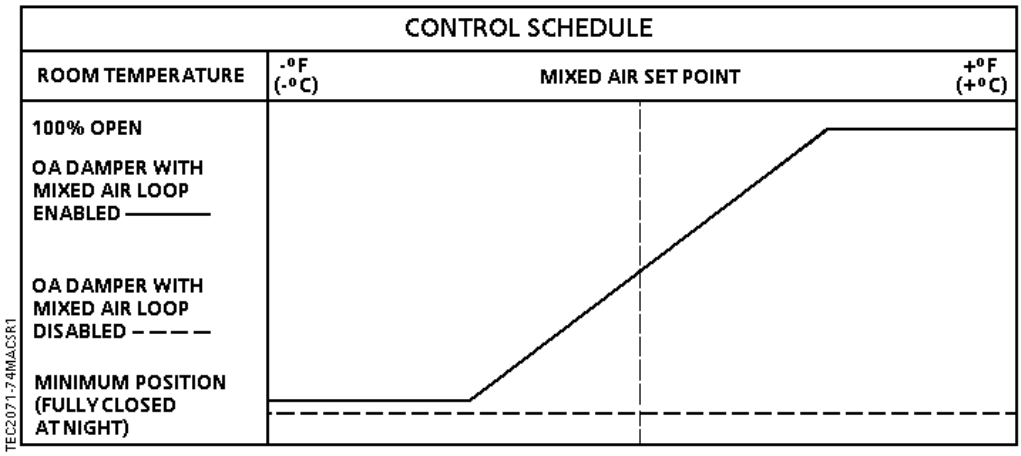


Application 2071 Control Diagram.



Application 2071 Control Schedule.

NOTES:
1. See *Fan Operation*.
2. See *Control Temperature Setpoints*.
3. See *Heating/Cooling Switchover*.
4. See *Mixed Air Control*.
5. See *Compressor Operation*.



Application 2071 Control Schedule for Mixed Air Control.

Hardware Inputs

Analog

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

Digital

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

Hardware Outputs

Analog

- None

Digital

- Compressor 1
- Compressor 2 (optional); or stage 1 electric heat (optional)
- Reversing valve
- Outdoor Air (OA) damper actuator (floating control) (optional)
- Fan

Ordering Notes

540-105N	Siemens TEC Heat Pump Controller Single Stage

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2071 - Two Compressor Heat Pump with Reversing Valve & Mixed Air Control.

Control Temperature Setpoints

This application has a number of different room temperature setpoints (DAY HTG STPT, NGT CLG STPT, RM STPT DIAL, etc.). The application actually controls using the CTL STPT. CTL STPT is set to different values depending on its override status, the time of day, whether or not a temperature deadband (zero energy band) has been configured, and the type of RTS used.

CTL STPT is Overridden:

If CTL STPT is overridden, that value is used regardless of any other settings. This disables the setpoint deadband feature.

CTL STPT in Night Mode:

The controller is in Night Mode if DAY.NGT = NGT and NGT OVRD = NGT.

When the controller is in night mode, CTL STPT holds the value of NGT CLG STPT or NGT HTG STPT depending on the value of HEAT.COOL. When the controller is in night mode the value of RM STPT DIAL is ignored.

CTL STPT in Day Mode:

The controller is in Day Mode if DAY.NGT = DAY or NGT OVRD = DAY.

Without setpoint dial:

When the controller is in day mode and STPT DIAL = NO, CTL STPT holds the value of DAY CLG STPT or DAY HTG STPT depending on the value of HEAT.COOL.

With setpoint dial:

When the controller is in day mode and STPT DIAL = YES. CTL STPT is set based on the value of the setpoint dial and the setpoint deadband.

The setpoint deadband exists to allow the controller to provide a separation of the heating and cooling temperature setpoints when a setpoint dial is enabled.

The setpoint deadband is the difference between the cooling and heating day setpoints (DAY CLG STPT - DAY HTG STPT). The setpoint deadband can be disabled by setting DAY HTG STPT equal to DAY CLG STPT. When DAY HTG STPT does not equal DAY CLG STPT, a setpoint deadband (or zero energy band) is used.

The following values are used in the calculation of CTL STPT:

- *Dial value* is the value of RM STPT DIAL limited between the value of RM STPT MIN and RM STPT MAX.
- *Deadband* is the value of the difference between DAY CLG STPT and DAY HTG STPT, half of which is applied to establish the current heating and cooling setpoints.
  - *Deadband* = (DAY CLG STPT – DAY HTG STPT)

CTL STPT is calculated as follows:

With Deadband Disabled:

CTL STPT = *Dial value*

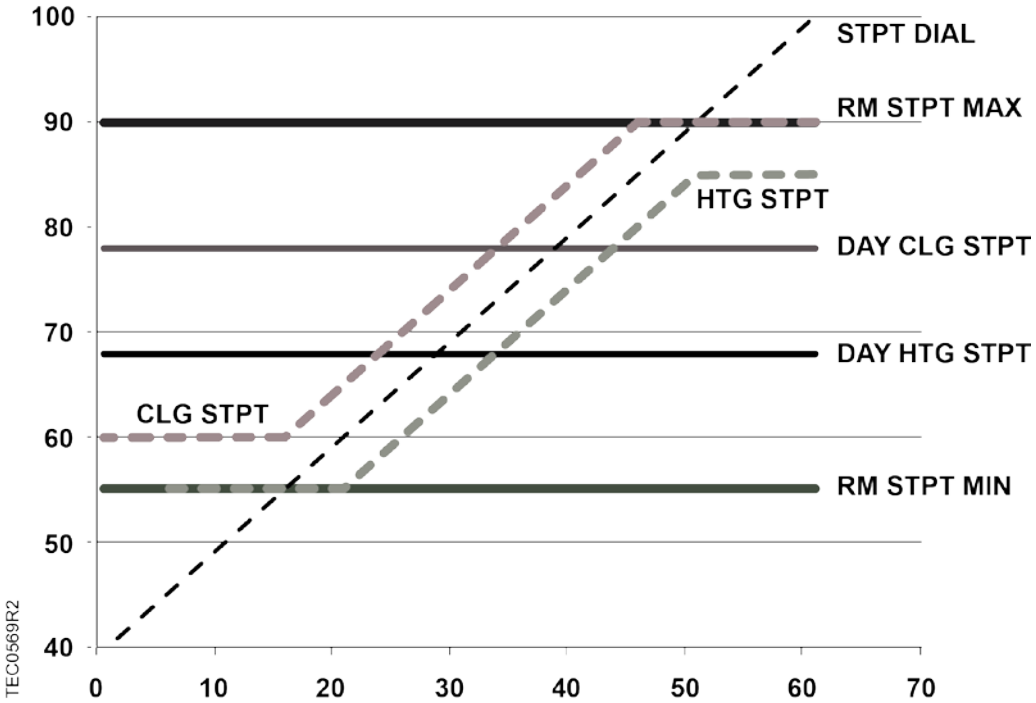
With Deadband enabled in Heat Mode:

CTL STPT = *Dial value* – 0.5 * *Deadband* (limited between the value of RM STPT MIN and RM STPT MAX)

With Deadband enabled in Cool Mode:

CTL STPT = *Dial value* + 0.5 * *Deadband* (limited between the value of RM STPT MIN and RM STPT MAX).

NOTE:
If RM STPT DIAL is failed, it maintains the last known value.



Room Temperature and CTL TEMP

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

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

If CTL TEMP is overridden then:

- CTL TEMP equals its overridden value and ROOM TEMP has no effect on the value of CTL TEMP.

Day and Night Modes

The day/night status of the space is determined by the status of DAY.NGT. 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 DI 2 (see the Control Diagram(s), and WALL SWITCH = YES, the controller monitors the status of DI 2.) When the status of DI 2 is ON (the switch is closed), then DAY.NGT will be set to DAY indicating that the controller is in day mode. When the status of DI 2 is OFF (the switch is open), then DAY.NGT will be set to NIGHT indicating that the controller is in night mode.

When WALL SWITCH = 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. See *Powers Process Control Language (PPCL) User's Manual* (125-1896) and *Field Panel User's Manual* (125-3019) or *BACnet Field Panel User's Manual* (125-3020) 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, 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 changes to DAY. After the override time elapses, the controller returns to night mode and the status of NGT OVRD changes back to NIGHT.

The override switch on the room sensor will only affect the controller when it is 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, the controller switches from heating to cooling mode by setting HEAT.COOL to COOL:

- HTG LOOPOUT < SWITCH LIMIT.
- CTL TEMP > CTL STPT by at least the value set in SWITCH DBAND.
- 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 < SWITCH LIMIT.
- CTL TEMP < CTL STPT by at least the value set SWITCH DBAND.
- CTL TEMP < the appropriate heating setpoint plus SWITCH DBAND.

When the controller switches to heating mode, the span would be applied to the DAY HTG STPT (70°F) and you are able to adjust the heating setpoint from 68°F to 72°F.

Digital Room Units (2200/2300 Series)

The digital room unit will display a graphical bar indicating the number of steps above or below the current operating temperature setpoint. When the controller switches modes (heating to cooling) the span adjustment set will be applied to the new heating/cooling mode center value.

Analog Room Units (1000 Series)

When the controller switches to heating mode, the span is applied to the DAY HTG STPT (70°F) and you are able to adjust the heating setpoint from 68°F to 72°F.

Control Loops

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

The two temperature loops are a cooling loop and a heating loop and the value of HEAT.COOL determines which is active. The active temperature loop maintains room temperature at the value in CTL STPT. The inputs to the temperature loops are CTL TEMP and CTL STPT. The outputs are CLG LOOPOUT and HTG LOOPOUT.

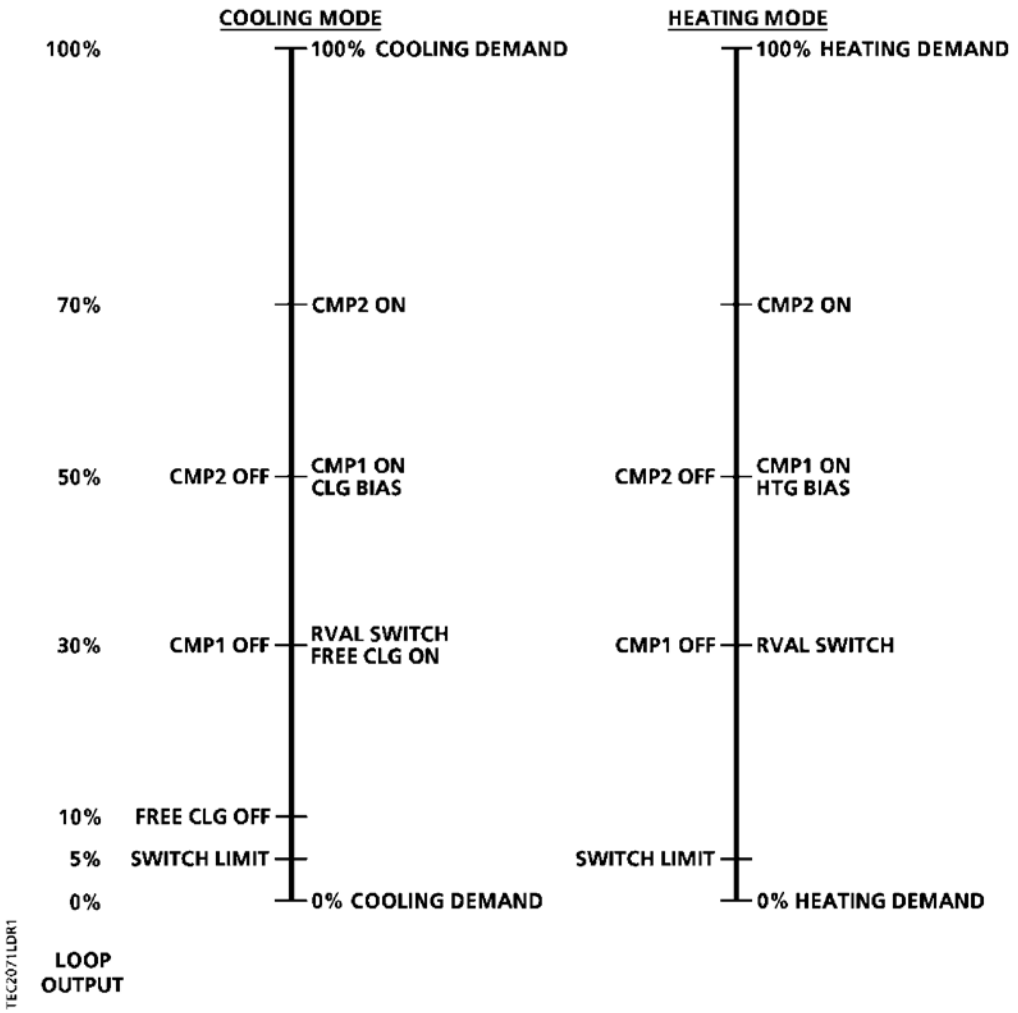
The two temperature loops perform the overall sequencing of the heat pump equipment; they determine when to turn the compressors, fan, and stages of electric heat ON and OFF.

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.

The ladder diagram shows the heating and cooling loop sequencing of single compressor 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 output rises above or drops below the values of CLG BIAS and HTG BIAS. The purpose of these points is to provide a starting place for the loops at startup.

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



Application 2071 Heating and Cooling Loops.

Cooling Loop – The value of CLG LOOPOUT must be greater than RVAL SWITCH before the reversing valve will switch from heating to cooling. When the reversing valve is in cooling mode, the compressors operate as cooling compressors. Before turning on any compressors, the controller will try to use free cooling if it is enabled by the field panel.

The value of CLG LOOPOUT must be greater than FREE CLG ON before free cooling will be used. The controller accomplishes free cooling by enabling the mixed air loop to modulate the mixed air damper. The value of COMPRESSOR 1 will not be allowed to turn ON until CLG LOOPOUT becomes greater than the value of CMP1 ON.

When a second compressor is available, EHEAT1.CMP2 will not be allowed to turn ON until CLG LOOPOUT becomes greater than the value of CMP2 ON. EHEAT1.CMP2 will not be allowed to turn OFF until CLG LOOPOUT drops below the value of CMP2 OFF. COMPRESSOR 1 will not be allowed to turn OFF until CLG LOOPOUT drops below the value of CMP1 OFF.

The value of CLG LOOPOUT must be less than the value of FREE CLG OFF 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 becomes less than SWITCH LIMIT, the controller can change to heating mode if all other criteria for the change have been met.

Heating Loop – The value of HTG LOOPOUT must be greater than RVAL SWITCH before the reversing valve will switch from cooling to heating. When the reversing valve is in heating mode, the compressors operate as heating compressors. COMPRESSOR 1 will not be allowed to turn ON until HTG LOOPOUT becomes greater than CMP1 ON.

When a second compressor is available, EHEAT1.CMP2 will not be allowed to turn ON until HTG LOOPOUT becomes greater than CMP2 ON. EHEAT1.CMP2 will not be allowed to turn OFF until HTG LOOPOUT drops below CMP2 OFF. COMPRESSOR 1 will not be allowed to turn OFF until HTG LOOPOUT drops below CMP1 OFF.

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

When HTG LOOPOUT drops below the value of SWITCH LIMIT, 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 third PID that controls 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 and MA STPT. The output is DMPR COMD.

Mixed Air Control

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

- HEAT.COOL = HEAT. Free cooling is not needed in the heating season.
- MA TEMP is failed. When this point is failed, mixed air control is not possible.
- FREE CLG = 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 < FREE CLG OFF. The cooling load is so small that no cooling is required.

If the fan is OFF, DMPR COMD 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 = COOL.
- MA TEMP is normal. (Not failed.)
- FREE CLG = ENABLE. The outside air is cool enough to be used for free cooling.
- CLG LOOPOUT > FREE CLG ON. The cooling load is large enough to require cooling.
- DMPR COMD > DMPR MIN POS.

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

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

- If CLG LOOPOUT was previously above FREE CLG ON, the mixed air loop will remain enabled.
- If CLG LOOPOUT was previously below FREE CLG OFF, the mixed air loop will remain disabled.

NOTE:
This happens whether or not the heat pump is in day or night mode.

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

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

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

- HEAT.COOL = COOL.
- MA TEMP is normal. (Not failed)
- NGT MA CTL = YES. (See Application Notes)
- FREE CLG = ENABLE. The outside air is cool enough to be used for free cooling.
- CLG LOOPOUT > FREE CLG ON. The cooling load is large enough to require cooling.

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

⚠ 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 non-spring return).

• Spring Return Floating Control Dampers – 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 (134-1504) should cut power to the damper actuator upon reaching a low limit condition. When this happens, the spring will drive the damper shut. Note: There are versions of the OpenAir damper actuators that have the spring return functionality for floating (3-position) control actuators.

• Non-Spring Return Floating Control Damper Actuators – 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 needs to be unbundled. Even though this is possible, make sure that the customer will allow it before attempting it.

Reversing Valve Operation

NOTE:
To prevent damage to the heat pump, the default setting of HP DO OVRD does not allow operator command of the reversing valve. See Overriding Critical Heat Pump DOs section for more information.

The status of REV VALVE determines the operation of the heat pump's compressors (heating or cooling). The reversing valve changes from heating to cooling when the following conditions have been met:

- HEAT.COOL = COOL.
- Compressor stage 1 has been OFF longer than the time stored in RVAL SW TIME.
- CLG LOOPOUT > the value set in RVAL SWITCH.

The reversing valve changes from cooling to heating when the following conditions have been met:

- HEAT.COOL = HEAT.
- Compressor stage 1 has been OFF longer than the time stored in RVAL SW TIME.
- HTG LOOPOUT > the value set in RVAL SWITCH.

Compressor Operation

NOTE:
To prevent damage to the heat pump, the default setting of HP DO OVRD does not allow operator command of compressors. See the *Overriding Critical Heat Pump DOs* section for more information.

If CMP TOTL = 0, the application does not control COMPRESSOR 1.

If CMP TOTL ≥ 1, the application controls COMPRESSOR 1 as follows:

- If the loop that is currently active (either CLG LOOPOUT or HTG LOOPOUT), > CMP1 ON and the first compressor has been OFF for at least the time set in CMP1 MIN OFF, COMPRESSOR 1 is turned ON.
- COMPRESSOR 1 is turned OFF when the loop currently under control is less than CMP1 OFF provided the following conditions have been met:
  - The first compressor has been ON for at least the time set in CMP1 MIN ON.
  - EHEAT1.CMP2 is OFF for more than 30 seconds. If the heat pump is not equipped with the second compressor, this is not applicable.

If CMP TOTL is 1, the application does not control EHEAT1.CMP2. If CMP TOTL is 2, the application controls EHEAT1.CMP2 as follows:

- EHEAT1.CMP2 is turned ON when the loop currently under control > CMP2 ON provided that the following conditions have been met:
  - The second compressor has been OFF for at least the time set in CMP2 MIN OFF.
  - The first compressor has been ON for at least 30 seconds to lessen the demand of having more than one compressor start at once.
- EHEAT1.CMP2 is turned OFF when the loop currently under control is less than CMP2 OFF provided that the second compressor has been ON for at least the time set in CMP2 MIN ON.

Electric Heat (Optional)

In this section, EHEAT1.CMP2 refers to the stage of electric heat.

If the stage of electric heat is being used (EHTG STG CNT = 1), and either HEAT.COOL or REV VALVE equals COOL, the stage of electric heat is OFF.

When both HEAT.COOL and REV VALVE equal HEAT, the electric heat is controlled as follows:

- If HTG LOOPOUT > EHEAT 1 ON, the stage of electric heat, point EHEAT1.CMP2, is turned ON.
- If HTG LOOPOUT < CMP1 ON, EHEAT1.CMP2 is turned OFF.

Fan Operation

NOTE:
To prevent damage to the heat pump, the default setting of HP DO OVRD does not allow operator command of the fan. See the *Overriding Critical Heat Pump DOs* section for more information.

Day Mode – FAN is ON when CYCLE FAN = 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 the following condition has been met:

- The compressor or stage of electric heat is ON.

The fan will turn OFF only after the following condition has been met:

- The compressor and stages of electric heat have been OFF for at least 30 seconds.

Damper Operation

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

In the cooling mode, the damper may also be controlled by the mixed air loop if FREE CLG is equal to ENABLE and the cooling loopout is greater than FREE CLG ON. See *Mixed Air Control* for more information.

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, however the fan turns ON. In addition to the equipment being OFF, both CLG LOOPOUT and HTG LOOPOUT 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 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 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. This lessens the demand of having all the electrical equipment starting at once.

Overriding DOs

This application is designed to prevent you from directly commanding critical DOs ON or OFF. Specifically, the fan, reversing valve, electric heat and compressor 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 or HTG LOOPOUT). This is done to protect the equipment.

You will be able to directly turn any spare DOs ON or OFF. Also, you will always be able to command the damper via DMPR COMD.

Fail Mode Operation

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

If the mixed air temperature sensor fails, the damper will be controlled at the minimum position (day) or closed (night).

Application Notes

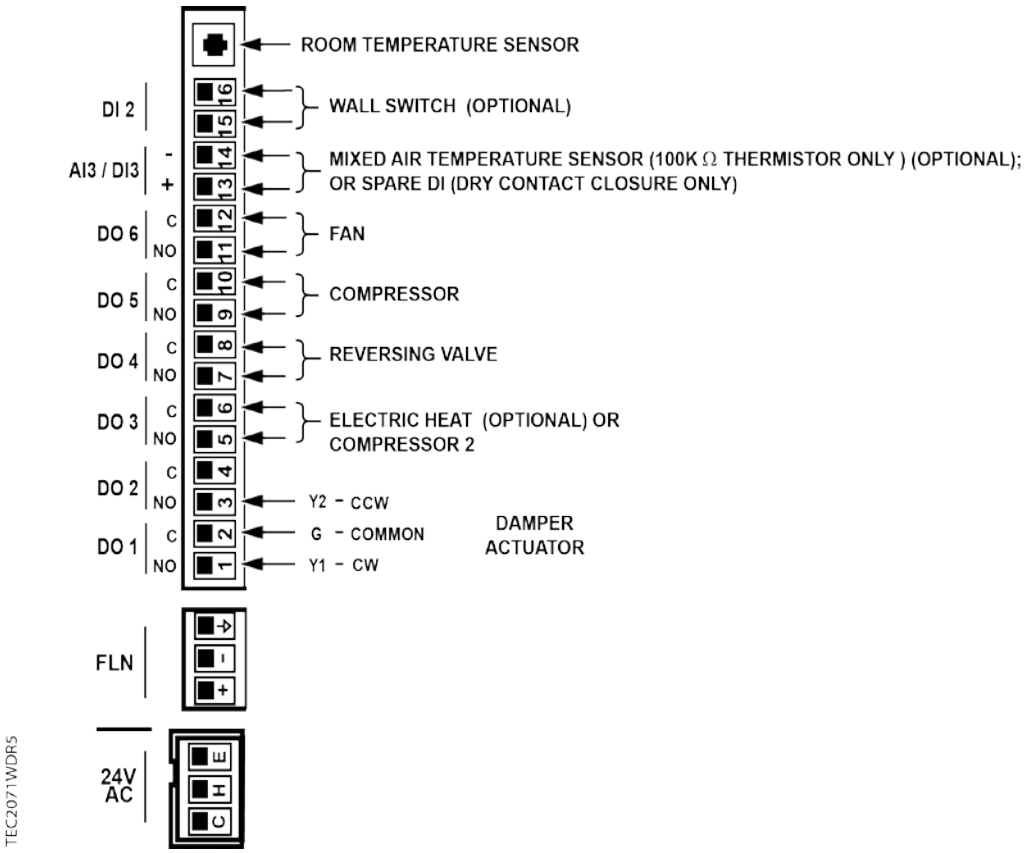
- If the heat pump cycles excessively, the temperature swings in the room are excessive, or there is trouble maintaining the setpoint, the cooling loop, the heating loop or both need to be tuned.
- The controller, as shipped from the factory, keeps all associated equipment OFF. See the *Start-up* document for how to release the controller and its equipment to application control.
- 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 and CTL STPT.
- In this application the maximum configurations are as follows:
  - The maximum of CMP TOTL = 2.
  - The maximum of EHTG STG CNT = 1.
  - The maximum of CMP TOTL + EHTG STG CNT = 2.

If these limits are exceeded, CMP TOTL will be set to 0 and EHTG STG CNT will be set to 0. These points will remain at 0 until they are set correctly. (This prevents the application from trying to use the same DO as both a compressor and a stage of electric heat.)

For more information, contact your nearest Siemens Industry, Inc. representative.

Wiring Diagrams

	⚠ CAUTION
	The controller's DOs control 24 Vac loads only. The maximum rating is 12 VA for each DO. An external interposing relay is required 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 (for example part number 540-147, Terminal Equipment Controller Relay Module)



Application 2071 – Two Compressor Heat Pump with Reversing Valve and Mixed Air Control.

Application 2071 Point Database

Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
1	CTLR ADDRESS	99	--	1	0	--	--
2	APPLICATION	2090	--	1	0	--	--
3	RETURN DELAY	10	MIN	1	0	--	--
{04}	ROOM TEMP	74.0 (23.45)	DEG F (DEG C)	0.25 (0.14)	48.0(8.89)	--	--
{05}	HEAT.COOL	COOL	--	--	--	HEAT	COOL
6	DAY CLG STPT	74.0 (23.45)	DEG F (DEG C)	0.25 (0.14)	48.0(8.89)	--	--
7	DAY HTG STPT	70.0 (21.21)	DEG F (DEG C)	0.25 (0.14)	48.0(8.89)	--	--
8	NGT CLG STPT	82.0 (27.93)	DEG F (DEG C)	0.25 (0.14)	48.0(8.89)	--	--
9	NGT HTG STPT	65.0 (18.41)	DEG F (DEG C)	0.25 (0.14)	48.0(8.89)	--	--
10	DMPR MIN POS	14.8	PCT	0.4	0	--	--
11	RM STPT MIN	55.0 (12.81)	DEG F (DEG C)	0.25 (0.14)	48.0(8.89)	--	--
12	RM STPT MAX	90.0 (32.41)	DEG F (DEG C)	0.25 (0.14)	48.0(8.89)	--	--
{13}	RM STPT DIAL	74.0 (23.45)	DEG F (DEG C)	0.25 (0.14)	48.0(8.89)	--	--
14	STPT DIAL	NO	--	--	--	YES	NO
{15}	MA TEMP	74.0 (23.496)	DEG F (DEG C)	0.5 (0.28)	37.5(3.056)	--	--
16	CMP2 ON	70	PCT	0.4	0	--	--
17	CMP2 OFF	50	PCT	0.4	0	--	--
18	WALL SWITCH	NO	--	--	--	YES	NO
{19}	DI OVRD SW	OFF	--	--	--	ON	OFF
20	OVRD TIME	0	HRS	1	0	--	--
{21}	NGT OVRD	NIGHT	--	--	--	NIGHT	DAY
{23}	FREE CLG	DISABL	--	--	--	ENABLE	DISABL
{24}	DI 2	OFF	--	--	--	ON	OFF
{25}	DI 3	OFF	--	--	--	ON	OFF
27	CMP2 MIN OFF	3	MIN	1	0	--	--
28	CMP2 MIN ON	3	MIN	1	0	--	--
{29}	DAY.NGT	DAY	--	--	--	NIGHT	DAY
{41}	DO 1	OFF	--	--	--	ON	OFF

Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
{42}	DO 2	OFF	--	--	--	ON	OFF
{43}	EHEAT1.CMP2	OFF	--	--	--	ON	OFF
{44}	REV VALVE	COOL	--	--	--	HEAT	COOL
{45}	COMPRESSOR 1	OFF	--	--	--	ON	OFF
{46}	FAN	OFF	--	--	--	ON	OFF
{48}	DMPR COMD	0	PCT	0.4	0	--	--
{49}	DMPR POS	0	PCT	0.4	0	--	--
51	MTR TIMING	130	SEC	1	0	--	--
56	DMPR ROT ANG	90	--	1	0	--	--
58	MTR SETUP	0	--	1	0	--	--
59	DO DIR.REV	0	--	1	0	--	--
60	CYCLE FAN	NO	--	--	--	YES	NO
61	FREE CLG ON	30	PCT	0.4	0	--	--
62	FREE CLG OFF	10	PCT	0.4	0	--	--
63	CLG P GAIN	10.0 (18.0)	--	0.25 (0.45)	0	--	--
64	CLG I GAIN	0.01 (0.018)	--	0.001 (0.0018)	0	--	--
65	CLG D GAIN	24 (43.2)	--	2 (3.6)	0	--	--
66	CLG BIAS	50	PCT	0.4	0	--	--
67	HTG P GAIN	10.0 (18.0)	--	0.25 (0.45)	0	--	--
68	HTG I GAIN	0.01 (0.018)	--	0.001 (0.0018)	0	--	--
69	HTG D GAIN	24 (43.2)	--	2 (3.6)	0	--	--
70	HTG BIAS	50	PCT	0.4	0	--	--
{71}	MA P GAIN	5.0 (9.0)	--	0.25 (0.45)	0	--	--
{72}	MA I GAIN	0.024 (0.0432)	--	0.001 (0.0018)	0	--	--
{73}	MA D GAIN	0 (0.0)	--	2 (3.6)	0	--	--
{74}	MA BIAS	0	PCT	0.4	0	--	--
75	CMP TOTL	1	--	1	0	--	--
76	EHTG STG CNT	1	--	1	0	--	--
{78}	CTL TEMP	74.0 (23.45)	DEG F (DEG C)	0.25 (0.14)	48.0(8.89)	--	--
{79}	CLG LOOPOUT	0	PCT	0.4	0	--	--
{80}	HTG LOOPOUT	0	PCT	0.4	0	--	--
81	EHEAT 1 ON	90	PCT	0.4	0	--	--
82	CMP1 ON	50	PCT	0.4	0	--	--
83	CMP1 OFF	30	PCT	0.4	0	--	--

Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
84	RVAL SWITCH	30	PCT	0.4	0	--	--
85	SWITCH LIMIT	4.8	PCT	0.4	0	--	--
86	SWITCH TIME	10	MIN	1	0	--	--
87	CMP1 MIN OFF	3	MIN	1	0	--	--
88	CMP1 MIN ON	3	MIN	1	0	--	--
89	RVAL SW TIME	30	SEC	1	0	--	--
90	SWITCH DBAND	2.0 (1.12)	DEG F (DEG C)	0.25 (0.14)	0	--	--
{91}	NGT MA CTL	NO	--	--	--	YES	NO
{92}	CTL STPT	74.0 (23.45)	DEG F (DEG C)	0.25 (0.14)	48.0(8.89)	--	--
{93}	MA SETPT	55.0 (12.856)	DEG F (DEG C)	0.5 (0.28)	37.5(3.056)	--	--
96	CAL TIMER	12	HRS	1	0	--	--
98	LOOP TIME	5	SEC	1	0	--	--
{99}	ERROR STATUS	0	--	1	0	--	--

1) Points not listed are not used in this application.

2) A single value in a column means that the value is the same in English units and in SI units.

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

* This point may be unbundled at the field panel as an input for monitoring purposes only.

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