

## **CUSTOM SOLUTION #204**

### **Applications 2276, 2277, 2278, 2279 Heat Pump Unit Vent ASHRAE Cycles**

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Application 2276 - One or two stage heat pump, Ashrae Cycles I or II, with or without Auxiliary Radiation, reversing valve is controlled.

Application 2277 - One or two stage heat pump, Ashrae Cycle III, with or without Auxiliary Radiation, reversing valve is controlled.

Application 2278 - One or two stage heat pump, Ashrae Cycles I or II, with or without Auxiliary Radiation, reversing valve is not controlled.

Application 2279 - One or two stage heat pump, Ashrae Cycle III, with or without Auxiliary Radiation, reversing valve is not controlled.

### **Overview**

In application 2276, a one or two stage heat pump, along with the reversing valve is controlled. Control is according to ASHRAE Cycles I or II. Control is available with or without auxiliary radiation and supplemental heating when applicable.

In application 2277, a one or two stage heat pump, along with the reversing valve is controlled. Control is according to ASHRAE Cycle III. Control is available with or without auxiliary radiation when applicable.

In application 2278, a one or two stage heat pump is controlled. Control is according to ASHRAE Cycles I or II. Control is available with or without auxiliary radiation and supplemental heating when applicable.

In application 2279, a one or two stage heat pump is controlled. Control is according to ASHRAE Cycle III. Control is available with or without auxiliary radiation when applicable.

**NOTE:** The analog outputs of each of these applications can be used to control pneumatic actuators as well as electronic actuators. An EP (such as the PXP-2) which converts a 0 - 10 volt signal to a pneumatic pressure must be used for each actuator to be controlled, although steps must be taken to ensure that the actuator can bleed to a normal position on power failure. Special care must also be made during setup but the applications should work equally well.

### **Custom Solutions**

This Custom Solution is not a Standard Product Announcement. This document contains the only technical documentation available and this product is not supported by Field Support. For more details about Custom Solutions see Product Announcement # 346.

### **Ordering and Availability**

Although this Custom Solution has a designated Part Number (540-508), it cannot be ordered through Standard Ordering Procedures. Use the online order form on the Custom Solutions website. Delivery of this Custom Solution is available 4-6 weeks ARO.

## Deliverables

### Application 2276 One or Two Stage Heat Pump with ASHRAE Cycle I or II, with or without Auxiliary Radiation, Reversing Valve Control

Point	Description
DO1	Auxiliary Electric Heat
DO2	Auxiliary Electric Heat
DO3	Auxiliary Electric Heat
DO4	Reversing Valve
DO5	Compressor 1
DO6	Compressor 2
DO7	Auxiliary Radiation
DO8	Fan
DI3/AI3	Discharge Sensor
DI2	Wall Switch
DI4	Low Temperature Detection
AO1	Outside Air Damper
AO2	Auxiliary Heat
AO3	Hot Water/Steam Valve

### Application 2277 One or Two Stage Heat Pump, ASHRAE Cycle III, with or without Auxiliary Radiation, Reversing Valve Control

Point	Description
DO1	Auxiliary Electric Heat
DO2	Auxiliary Electric Heat
DO3	Auxiliary Electric Heat
DO4	Reversing Valve
DO5	Compressor 1
DO6	Compressor 2
DO7	Auxiliary Radiation
DO8	Fan
DI3/AI3	Mixed Air Sensor
DI2	Wall Switch
DI4	Low Temperature Detection
AO1	Outside Air Damper
AO2	Auxiliary Heat
AO3	Hot Water/Steam Valve

### Application 2278 One or Two Stage Heat Pump, ASHRAE Cycles I or II, with or without Auxiliary Radiation

Point	Description
DO1	Auxiliary Electric Heat
DO2	Auxiliary Electric Heat
DO3	Auxiliary Electric Heat
DO4	Heating Compressor 1
DO5	Heating Compressor 2
DO6	Cooling Compressor 1
DO7	Cooling Compressor 2
DO8	Fan
DI3/AI3	Discharge Air Sensor
DI2	Wall Switch
DI4	Low Temperature Detection
AO1	Outside Air Damper
AO2	Auxiliary Heat
AO3	Hot Water/Steam Valve

## Application 2279 One or Two Stage Heat Pump, ASHRAE Cycle III, with or without Auxiliary Radiation

Point	Description
DO1	Auxiliary Electric Heat
DO2	Auxiliary Electric Heat
DO3	Auxiliary Electric Heat
DO4	Heating Compressor 1
DO5	Heating Compressor 2
DO6	Cooling Compressor 1
DO7	Cooling Compressor 2
DO8	Fan
DI3/AI3	Mixed Air Sensor
DI2	Wall Switch
DI4	Low Temperature Detection
AO1	Outside Air Damper
AO2	Auxiliary Heating
AO3	Hot Water/Steam Valve

## Risks

Standard TEC outputs are 24VAC, 12VA. Some heat pump loads are DC powered and require the use of an interposing relay such as the controller relay module.

## Hardware Input/Output Parameter Matrix

The following matrix indicates what hardware is to be connected to each I/O port. In several cases the use of a port is optional (example: DOs 1,2 and 3 are only used if supplemental electric heat is available). The controller must be told during setup whether Aux radiation is available and whether supplemental heating is to be used and whether that heat is to be controlled digitally or through an AO.

## Hardware I/O

I/O	2276	2277	2278	2279
AO-1	MA	MA	MA	MA
AO-2	AUX	AUX	AUX	AUX
AO-3	HW/STM	HW/STM	HW/STM	HW/STM
DO-1	ELEC 1	ELEC 1	ELEC 1	ELEC 1
DO-2	ELEC 2	ELEC 2	ELEC 2	ELEC 2
DO-3	ELEC 3	ELEC 3	ELEC 3/AUX	ELEC 3/AUX
DO-4	REV VALVE	REV VALVE	HEAT1	HEAT1
DO-5	COMP1	COMP1	HEAT2	HEAT2
DO-6	COMP2	COMP2	COOL1	COOL1
DO-7	AUX	AUX	COOL2	COOL2
DO-8	FAN	FAN	FAN	FAN
AI-1	ROOM SENSOR	ROOM SENSOR	ROOM SENSOR	ROOM SENSOR
AI-2	RM STPT DIAL	RM STPT DIAL	RM STPT DIAL	RM STPT DIAL
AI/DI	DISCH SENSOR	MA SENSOR	DISCH SENSOR	MA SENSOR
DI-1	NGT OVRD	NGT OVRD	NGT OVRD	NGT OVRD
DI-2	WALL SWITCH	WALL SWITCH	WALL SWITCH	WALL SWITCH
DI-4	LOW TEMP DET	LOW TEMP DET	LOW TEMP DET	LOW TEMP DET

## **Application 2276**

### **One or two stage Heat Pump Unit Vent, Ashrae Cycles I or II, with or without Auxiliary Radiation, Reversing Valve is Controlled**

#### **Overview**

This application controls a unit ventilator outfitted with a one or two stage heat pump. The heat pump is controlled by three DOs, one for each compressor, and one for the reversing valve. The controller can control auxiliary radiation (modulating or two-position) if it is present, and supplemental heating (one-three stages of electric or modulating valve) if it is present. Heating only and cooling only units can also be controlled with this application by over-riding the point HEAT.COOL.

This application controls room temperature by turning on and off the heat pump's compressor(s). This application also controls an outside air damper according to two schedules as defined by Ashrae cycles I and II. Cycle I is achieved by setting the point OA MIN POS to 100 %. The free-cooling/economizer function is turned on and off by the connected field panel using the point FREE CLG. If free cooling is not available, the outside air damper will be kept at minimum position, other wise the outside air damper will modulate open in sequence with the heat pump's compressor(s). The unit ventilator fan is also controlled in this application.

Other features available in this application include morning warm-up/cool-down and night over-ride.

The controller can operate as a stand-alone unit, but will operate with some loss of functionality (no centralized control of free cooling, day/night modes controlled by wall switch only). It is recommended that the controller operate using centralized control to take full advantage of global optimization schemes.

## **2276 Module Descriptions**

### **Room Setpoints**

This module determines which setpoint to use as the control setpoint.

**Day mode:** If STPT DIAL = YES, CTL STPT is set equal to the RM STPT DIAL, though it is limited by RM STPT MIN and RM STPT MAX. If STPT DIAL = NO, CTL STPT is set to the DAY HTG STPT or the DAY CLG STPT, depending on whether the controller is in heating or cooling mode.

**Night mode:** If NGT OVRD = DAY, CTL STPT is set as in day mode. If NGT OVRD = NIGHT, CTL STPT is set to the NGT HTG STPT or the NGT CLG STPT, depending on whether the controller is in heating or cooling mode.

### **Night Over-ride Logic**

If, while in night mode, the night override switch is pressed, the controller will run as if in day mode for a period of time equal to OVRD TIME. In normal operation, the point NGT OVRD = NIGHT. When the override switch is pressed, the point NGT OVRD is switched to DAY and the timer is reset. When the timer expires, NGT OVRD is set back to NIGHT, and the controller reverts to normal night control.

### **Day/Night Mode**

If a wall switch is being used, when the switch is off, the controller operates in night mode. If the switch is on, the controller operates in day mode. If WALL SW = NO, the point DAY.NGT will keep its last value.

**NOTE:** If a field panel is commanding the controller to or from day mode, this module will have no effect (field panel commands take precedence).

## Heat/Cool Switch-over

The internal variable *sw loopout* is set to OAMPR SET if FREE CLG = NO, or to SWITCH LIMIT if FREE CLG = YES. This is because when free cooling is not available, we ought to begin to consider switching to cooling when the heating compressors are all off. Likewise, we should consider switching to heating when the cooling compressors are all off. When free cooling is available, we should only consider switching over when the outside air damper has also traveled its full range (open for heating, and closed for cooling). Refer to Diagrams 1 and 2.

### Heating to cooling:

Four conditions must be met before the operating mode will change from heating to cooling.

1. The point HTG LOOPOUT must be less than *sw loopout*, indicating that all available sources of heating are off,
2. The point CTL TEMP must be greater than or equal to the appropriate heating setpoint (DAY HTG STPT, NGT HTG STPT, or RM STPT DIAL) and SWITCH DBAND, indicating that the room has indeed been heated,
3. The point CTL TEMP must be greater than or equal to the difference between the appropriate cooling setpoint (DAY CLG STPT, NGT CLG STPT, or RM STPT DIAL) and SWITCH DBAND (to prevent spurious switching between modes when the cooling setpoint is much higher than CTL STPT), and
4. The above three conditions must have been met for the amount of time shown in the point SWITCH TIME.

### Cooling to heating:

Four conditions must be met before the operating mode will change from cooling to heating.

1. The point CLG LOOPOUT must be less than *sw loopout*, indicating that all available sources of cooling are off,
2. The point CTL TEMP must be less than or equal to the difference between the appropriate cooling setpoint (DAY CLG STPT, NGT CLG STPT, or RM STPT DIAL) and SWITCH DBAND, indicating that the room has indeed been cooled,
3. The point CTL TEMP must be less than or equal to the sum of the appropriate heating setpoint (DAY HTG STPT, NGT HTG STPT, or RM STPT DIAL) and SWITCH DBAND (to prevent spurious switching between modes when the heating setpoint is much lower than CTL STPT), and
4. The above three conditions must have been met for the amount of time shown in the point SWITCH TIME.

If night cooling is not available, as indicated by the point NGT CLG MODE, the controller remains in heating mode during the night.

## Fan Logic and Control

The fan is ON during the day.

**In night heating**, the fan turns ON when the temperature drops to or below the value of NGT HTG STPT - NGT DBAND. When the temperature rises back up to or above NGT HTG STPT the fan turns OFF.

**In night cooling**, the fan turns ON when the temperature rises to or above the value of NGT CLG STPT + NGT DBAND. When the temperature drops back down to or below NGT CLG STPT the fan turns OFF. If there is electric heat and one of the heating DOs (1,2, or 3) is on, or if one of the compressors is on, then the fan must stay on. If the electric heat turns off, or if the compressors turn off, the fan must stay on for at least 30 more seconds to protect the coils.

## Morning Warm-up/Cool-down

This module sets the point WRMUP.COOLDN from OFF to ON when the point DAY.NGT changes from NIGHT to DAY, or on a return from power loss. During morning warmup or cooldown, the outside air damper is shut and all of the appropriate heating or cooling sources are cycled on. Commanding WRMUP.COOLDN will have no effect on the controller's operation.

**In heating mode**, WRMUP.COOLDN turns OFF when the point CTL TEMP rises to or above the value of CTL STPT minus MORN DBAND.

In **cooling mode**, WRMUP.COOLDN turns OFF when the point CTL TEMP falls to or below the value of CTL STPT plus MORN DBAND.

## Control loops

### Heating Loop:

Maintains CTL TEMP at CTL STPT by modulating HTG LOOPOUT. This point is then used to sequence the heating equipment.

### Cooling Loop:

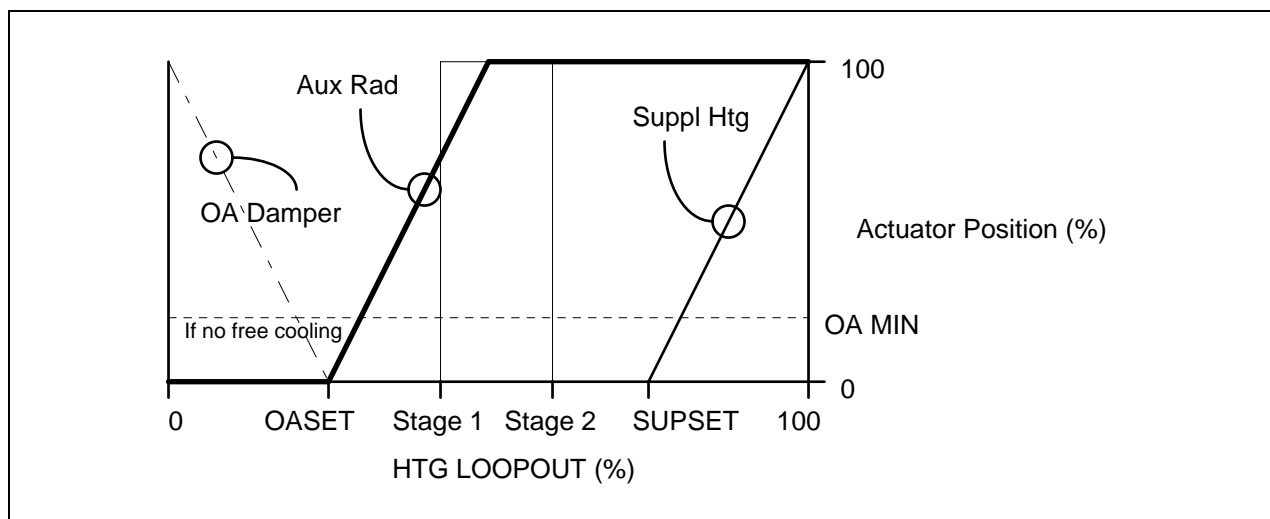
Maintains CTL TEMP at CTL STPT by modulating CLG LOOPOUT. This point is then used to sequence the cooling equipment.

## Heating Sequence

This module controls the condition of the heating compressors, outdoor damper, aux radiation , and supplemental heating actuator while in the heating mode.

### Day mode:

The following diagram shows the heating control schedule, and the impact of the setup points OASET, SUPSET, HTG CMP1 SET (Stage 1), HTG CMP2 SET (stage 2), OA MIN, and FREE CLG.



### Night mode:

The outside air damper is kept closed at night to limit the chance of coil-freeze. The heating loop is allowed to continue calculating the HTG LOOPOUT for use by the heat/cool switchover module. Aux radiation, supplemental heating, and compressor stages are on when the fan is on and off when the fan is off (safeties permitting).

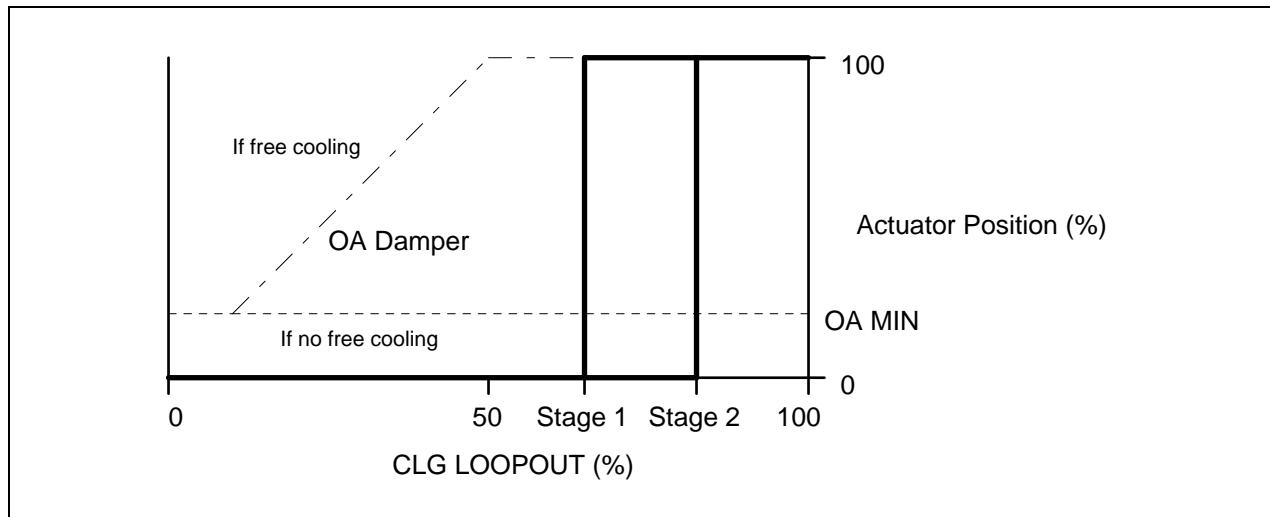
**Exception:** If NGT HW HTG is set to YES, the supplemental heating source is kept open at night (it might be set this way if it is a hot water coil in danger of freezing at night). Control of the fan at night is handled in the Fan Control module.

## Cooling Sequence

This module controls the position of the cooling compressors and the outdoor air damper while in the cooling mode.

**Day mode:**

The following diagram shows the cooling control schedule, and the impact of the setup points CLG CMP1 SET (Stage 1), CLG CMP2 SET (stage 2), OA MIN, and FREE CLG.

**Night mode:**

The outside air damper is kept closed at night to limit the chance of coil-freeze. The cooling loop is allowed to keep calculating CLG LOOPOUT for use by the heat/cool switchover module. Compressor stages are on when the fan is on and off when the fan is off (safeties permitting).

**Exception:** If NGT HW HTG is set to YES, the supplemental heating source is kept open at night (it might be set this way if it is a hot water coil in danger of freezing at night). Control of the fan at night is handled in the Fan Control module.

**Aux Heating**

If the point AUX.NOAUX = NOAUX or if the controller is in cooling mode, then aux radiation is kept off. If the controller is in night heating mode, the aux radiation is on when the fan is on and off when the fan is off.

**DAY HEATING MODE:**

If the aux radiation is controlled by DO (AUXHT AO.DO=DO), then it is cycled according to a PWM scheme where the ON-time is a percentage of the PWM period, AUX HTG TIME. This percentage is equal to the value of AUX OUTPUT.

If the aux radiation is controlled by AO (AUXHT AO.DO=AO), then its position is set by the point AUX OUTPUT.

If WRMUP.COOLDN = ON in heating mode, the aux radiation will be turned fully on.

**Supplemental Electric Heating Output**

Three stages of electric heat are hard coded into the firmware. SUPHT OUTPUT is set by the heating sequencer.

When SUPHT OUTPUT = 0%, all stages are off.

When 0% < SUPHT OUTPUT ≤ 33%, stage one turns on or stage two turns off.

When 33% < SUPHT OUTPUT ≤ 67%, stage two turns on or stage three turns off.

When 67% < SUPHT OUTPUT ≤ 100% stage three turns on.

In addition, no stage may turn on or off until 30 seconds 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. The electric elements in the unit vent should be wired to the DOs in the following order depending on how many elements there are:

Number of Elements	DO 1	DO 2	DO 3
1	1		
2	1	2	
3	1	2	3
4	1	2	3,4
5	1	2,5	3,4
6	1,6	2,5	3,4
7	1,6	2,5	3,4,7
...etc.	...	...	...

The controller need not know how many supplemental electric elements are actually attached.

### Discharge Low Limit Control

While in heating mode, if the discharge temp drops below the low limit (DSH MIN TEMP), the damper is slowly closed until the discharge temp is back above the limit. If the discharge temperature rises past 3 degrees above the limit, the damper is gradually opened until it is within 3 degrees of the limit.

Control of the damper is returned to the heating sequencer when normal operatino of the damper would move it to a position that is less than the low limit position.

### Heat Pump Control

#### Reversing valve:

If the minimum OFF time for the first compressor has been met and if the time held in the point RVAL SW TIME has passed, the reversing valve may switch states as dictated by the point HEAT.COOL.

#### First compressor:

**Heating mode:** The first stage turns ON if HTG LOOPOUT > HTG CMP1 SET or if it is night mode and the fan is commanded ON, if its minimum OFF time has been met, and if the reversing valve has switched to provide heating. It may turn OFF if HTG LOOPOUT < HTG CMP1 SET or if it is night mode and the fan is commended OFF, if its minimum ON time has been met, and if the second compressor has been off for more than 30 seconds.

**Cooling mode:** The first stage turns ON if CLG LOOPOUT > CLG CMP1 SET or if it is night mode and the fan is commanded ON, if its minimum OFF time has been met, and if the reversing valve has switched to provide cooling. It may turn OFF CLG LOOPOUT < CLG CMP1 SET or if it is night mode and the fan is commended OFF, if its minimum ON time has been met, and if the second compressor has been off for more than 30 seconds.

#### Second compressor:

If CMP TOTL = 1, the second compressor is not turned on.

**Heating mode:** The second stage turns ON if HTG LOOPOUT > HTG CMP2 SET or if it is night mode and the fan is commanded ON, if its minimum OFF time has been met, and if the first compressor has been ON for more than 30 seconds. It may turn OFF if HTG LOOPOUT < HTG CMP2 SET or if it is night mode and the fan is commended OFF, and if its minimum ON time has been met.

**Cooling mode:** The second stage turns ON if CLG LOOPOUT > CLG CMP1 SET or if it is night mode and the fan is commanded ON, if its minimum OFF time has been met, and if the first compressor has been ON for more than 30 seconds. It may turn OFF if CLG LOOPOUT < CLG CMP1 SET or if it is night mode and the fan is commended OFF, and if its minimum ON time has been met.



## Safeties

If the LOW TEMP DET has tripped, a full shut down is initiated. All outputs are set to their normal positions and all loops are disabled.

If a failed sensor returns, or if the LTDT turns off, then normal operation and control of the unit resumes. For additional safety controls see the following table:

Safety/Failure	Applications 2276, 2278	Applications 2277, 2279
LTDT = ON	<b>"Shut Down"</b> * Close OA DMPR * Compressors OFF * Supplemental htg valve ON * Supplemental electric htg OFF * Fan OFF * Aux OFF	"Shut Down"
Disch/MA sensor fails	* Continue running htg/clg loops  If last valid disch temp > 150° * Keep OA DMPR at minimum If last valid disch temp < 150° * Close OA DMPR	* Continue running htg/clg loops  * Close OA DMPR.
Room Temp. sensor fails	"Shut Down"	"Shut Down"
Any Combination of the above	"Shut Down"	"Shut Down"

## Analog Outputs

### Points adjustable from CIS:

- AO DIR.REV - Masking point used to determine NO/NC status of actuators attached to analog outputs.
- AO1,2,3 START - Points indicating the lower end of the voltage range where the actuators move.
- AO1,2,3 SPAN - Points indicating the width of the voltage range where the actuators move.

The points AOx START and AOx SPAN are used to translate the controller's desired actuator positions into voltages on the AOs. The point AO DIR.REV is used to determine if the hardware attached to each AO is normally open or normally closed (direct or reverse acting). The formulas used are as follows:  
 If hardware is normally closed or direct acting:

$$\text{AOx voltage} = \text{AOx START} + \frac{(\text{position from safeties module})}{100} * \text{AOx SPAN}$$

If hardware

is normally open, or reverse acting:

$$\text{AOx voltage} = \text{AOx START} + \text{AOx SPAN} * \left( 1 - \frac{(\text{position from safeties module})}{100} \right)$$

These formulas scale the actuator position across the desired voltage range as determined by the start and span points.

These are the voltages which are actually sent to the AOs as well as shown on the handheld in the points AO-1,2,3.

## **Application 2277**

### **One or two stage Heat Pump Unit Vent, Ashrae Cycles III, with or without Auxiliary Radiation, Reversing Valve is Controlled**

#### **Overview**

This application controls a unit ventilator outfitted with a one or two stage heat pump. The heat pump is controlled by three DOs, one for each compressor, and one for the reversing valve. The controller can control an auxiliary radiation coil if one is present. Heating only and cooling only units can also be controlled with this application by over-riding the point HEAT.COOL.

This application controls room temperature by turning on and off the heat pump's compressor(s). This application also controls an outside air damper according to the schedule defined as Ashrae cycle III, to maintain a given mixed air temperature setpoint. The free-cooling/economizer function is turned on and off by the connected field panel using the point FREE CLG. If free cooling is not available, outside air damper will be kept at minimum position, other wise the outside air damper will modulate to maintain the mixed air temperature setpoint. The unit ventilator fan is also controlled in this application.

Other features available in this application include morning warm-up/cool-down and night over-ride (see module descriptions).

The controller can operate as a stand-alone unit, but will operate with some loss of functionality (no centralized control of free cooling, day/night modes controlled by wall switch only). It is recommended that the controller operate using centralized control to take full advantage of global optimization schemes.

#### **2277 Module Descriptions**

All modules are the same as 2276, except those below:

##### **Heat/Cool Switch-over**

Same as application 2276, except that in cooling the internal variable *sw loopout* is always set to SWITCH LIMIT, while in heating, *sw loopout* is set to SWITCH LIMIT if there is aux radiation or to 50 if there is no aux radiation.

##### **Control loops**

The heating and cooling loops are the same. There is an additional loop, the mixed air loop: Maintains MA TEMP at MA STPT by modulating MA LOOPOUT. This point is then used to set the outside air damper position.

If the point FREE CLG = NO, the damper is set to OA MIN. The mixed air loop is disabled.

If the point FREE CLG = YES, the damper is set to MA LOOPOUT, which is not allowed to drop below OA MIN.

If the room temperature ever drops below the mixed air setpoint, the *ma position* is set to OA MIN.

##### **Heating Sequence**

Same as application 2276, except that the outside air damper is not sequenced, and the aux radiation will be sequenced according to the following schedule:

HTG LOOPOUT = 0%	=> <i>aux position</i> = 0%
HTG LOOPOUT = 50%	=> <i>aux position</i> = 100%
HTG LOOPOUT > 50%	=> <i>aux position</i> = 100%

## Application 2278

### One or two stage Heat Pump Unit Vent, Ashrae Cycles I or II, with or without Auxiliary Radiation, Reversing Valve is not Controlled

#### Overview

This application controls a unit ventilator outfitted with a one or two stage heat pump. The heat pump is controlled by four DOs, one for each heating stage, and one for each cooling stage. The controller can control auxiliary radiation (modulating or two-position) if it is present, and supplemental heating (one-three stages of electric or modulating valve) if it is present. Heating only and cooling only units can also be controlled with this application by over-riding the point HEAT.COOL.

This application controls room temperature by turning on and off the heat pump's compressor(s). This application also controls an outside air damper according to two schedules as defined by Ashrae cycles I and II. Cycle I is achieved by setting the point OA MIN POS to 100 %. The free-cooling/economizer function is turned on and off by the connected field panel using the point FREE CLG. If free cooling is not available, the outside air damper will be kept at minimum position, other wise the outside air damper will modulate open in sequence with the heat pump's compressor(s) (see heating and cooling sequencer modules). The unit ventilator fan is also controlled in this application.

Other features available in this application include morning warm-up/cool-down and night over-ride (see module descriptions).

The controller can operate as a stand-alone unit, but will operate with some loss of functionality (no centralized control of free cooling, day/night modes controlled by wall switch only). It is recommended that the controller operate using centralized control to take full advantage of global optimization schemes.

#### 2278 Module Descriptions

All modules are the same as 2276, except those below:

#### Supplemental Electric Heating Output

Same as application 2276, except that DO-3 may be used to control aux radiation or the third stage of supplemental heat.

If AUX.NOAUX = AUX and AUXHT AO.DO = DO, then DO-3 is according to the sequencing. Otherwise, DO-3 is controlled as in application 2276.

If DO-3 is used for aux radiation, the supplemental electric heating elements in the unit vent, if present, should be wired to the DOs in the following order depending on how many elements there are:

Number of Elements	DO 1	DO 2
1	1	
2	1	2
3	1	2,3
4	1,4	2,3
5	1,4	2,3,5
6	1,4,6	2,3,5
7	1,4,6	2,3,5,7
...etc.	...	...

## Heat Pump Control

### Heating:

The first stage turns ON if HTG LOOPOUT > HTG CMP1 SET or if it is night mode and the fan is commanded ON, and if the minimum OFF time has been met. It may turn OFF if HTG LOOPOUT < HTG CMP1 SET or if it is night mode and the fan is commanded OFF, if the minimum ON time has been met, and if the second compressor has been OFF for more than 30 seconds.

The second stage turns ON if HTG LOOPOUT > HTG CMP2 SET or if it is night mode and the fan is commanded ON, if the minimum OFF time has been met, and if the first compressor has been ON for more than 30 seconds. It may turn OFF if HTG LOOPOUT < HTG CMP2 SET or if it is night mode and the fan is commanded OFF, and if the minimum ON time has been met.

If CMP TOTL = 1, the second stage is not turned on.

### Cooling:

The first stage turns ON if CLG LOOPOUT > CLG CMP1 SET or if it is night mode and the fan is commanded ON, and if the minimum OFF time has been met. It may turn OFF if CLG LOOPOUT < CLG CMP1 SET or if it is night mode and the fan is commanded OFF, if the minimum ON time has been met, and if the second compressor has been OFF for more than 30 seconds.

The second stage turns ON if CLG LOOPOUT > CLG CMP1 SET or if it is night mode and the fan is commanded ON, if the minimum OFF time has been met, and if the first compressor has been ON for more than 30 seconds. It may turn OFF if CLG LOOPOUT < CLG CMP1 SET or if it is night mode and the fan is commanded OFF, and if the minimum ON time has been met.

If CMP TOTL = 1, the second stage is not turned on.

## **Application 2279**

### **One or two stage Heat Pump Unit Vent, Ashrae Cycles III, with or without Auxiliary Radiation, Reversing Valve is not Controlled**

#### **Overview**

This application controls a unit ventilator outfitted with a one or two stage heat pump. The heat pump is controlled by four DOs, one for heating stage, and one for each cooling stage. The controller can control an auxiliary radiation coil if one is present. Heating only and cooling only units can also be controlled with this application by over-riding the point HEAT.COOL.

This application controls room temperature by turning on and off the heat pump's compressor(s). This application also controls an outside air damper according to the schedule defined as Ashrae cycle III, to maintain a given mixed air temperature setpoint. The free-cooling/economizer function is turned on and off by the connected field panel using the point FREE CLG. If free cooling is not available, outside air damper will be kept at minimum position, other wise the outside air damper will modulate to maintain the mixed air temperature setpoint. The unit ventilator fan is also controlled in this application.

Other features available in this application include morning warm-up/cool-down and night over-ride (see module descriptions).

The controller can operate as a stand-alone unit, but will operate with some loss of functionality (no centralized control of free cooling, day/night modes controlled by wall switch only). It is recommended that the controller operate using centralized control to take full advantage of global optimization schemes.

## **2279 Module Descriptions**

All modules are the same as 2277, except those below:

### **Heat Pump Control**

Same as application 2278.

### **Setup Information, All Applications**

This application has some unique setup. The controller must be told what hardware configuration will be controlled. This is done by setting the value of a number of setup points.

These setup points are:

ELEC.NOELEC	If set to ELEC, lets the controller know that if there is supplemental heating, it is electric, and the DOs will be used. If set to NOELEC, the controller knows that if there is supplemental heating, it is controlled by AO-3. (All applications)
AUX.NOAUX	If set to AUX, lets the controller know that there is aux radiation to control. (All applications)
AUXHT AO.DO	If set to AO, lets the controller know that if there is aux radiation, it is to be controlled by a DO. If set to AO, the controller knows that if there is aux radiation, it is controlled by AO-2. (All applications)
DO DIR.REV	Masking code to determine normal position of DOs.
AO DIR.REV	Masking code to determine normal position of AOs.
CMP TOTL	The number of compressors to be controlled (1 or 2). (All applications)

Different actuators use different voltage operating ranges, sometimes with manually adjustable starting voltage and operating span. Since each AO may use a different actuator, setup points are required to define the starting voltage ("START" point) and the operating voltage span for each AO.

AO1 START	
AO2 START	
AO3 START	Points used to set low voltage position of actuators
AO1 SPAN	
AO2 SPAN	
AO3 SPAN	Points used to set voltage span of actuators

Electronic-to-pneumatic devices may also be used to control pneumatic actuators electronically. Determining the correct starting voltage and operating voltage span is somewhat more difficult. The PXP-2 is one possible EP to use; it should be set such that 0 - 10 volts is proportional to 0 - 15 psi. To determine the voltage starting point, simply divide the pressure starting point of the actuator (minus 1/2 psi to cover any slop) by 1.5. To determine the voltage span, simply divide the pressure starting point of the actuator (plus 1 psi to cover slop) by 1.5.

For example, to determine the voltage starting point and span for an 8 - 13 psi actuator to be controlled by AO-2, do the calculations:

$$\text{AO2 START} = \frac{8 \text{ psi} - 0.5 \text{ psi}}{1.5 \frac{\text{psi}}{\text{volt}}} = 5 \text{ volts}$$

$$\text{AO2 SPAN} = \frac{5 \text{ psi} + 1 \text{ psi}}{1.5 \frac{\text{psi}}{\text{volt}}} = 4 \text{ volts}$$

**POINT LIST, 2276**

Point	Descriptor	Unit	Slope	Intercept	ON	OFF	Default
01	CTLR ADDRESS	-	1	0			99
02	APPLICATION	-	1	0			2299
03							
{04}	ROOM TEMP	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			72.00
{05}	HEAT.COOL	-	1	0	HEAT	COOL	COOL
06	DAY CLG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
07	DAY HTG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			70.00 (21.21)
08	NGT CLG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			82.00 (27.93)
09	NGT HTG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			65.00 (18.41)
10	OADPR MINPOS	PCT	0.4	0			14.8
11	RM STPT MIN	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			55.00 (12.81)
12	RM STPT MAX	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			90.00 (32.41)
13	RM STPT DIAL	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
14	STPT DIAL	-	1	0	YES	NO	NO
{15}	DISCH TEMP	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)			74.00 (23.5)
16							
17							
18	WALL SWITCH	-	1	0	YES	NO	NO
{19}	DI OVRD SW	-	1	0	ON	OFF	OFF
20	OVRD TIME	HRS	1	0			1
{21}	NGT OVRD	-	1	0	NIGHT	DAY	NIGHT
22	AUX.NOAUX	-	1	0	AUX	NOAUX	NOAUX
{23}	FREE CLG	-	1	0	ENABLE	DISABL	DISABL
{24}	DI 2	-	1	0	ON	OFF	OFF
{25}	DI 3	-	1	0	ON	OFF	OFF
{26}	LOW TEMP DET	-	1	0	OFF	ON	ON
27	ELEC.NOELEC	-	1	0	ELEC	NOELEC	NOELEC
28							
{29}	DAY.NGT	-	1	0	NIGHT	DAY	DAY
{30}	WRMUP.COOLDN	-	1	0	ON	OFF	ON
31	AOV1 SPAN	VOLTS	0.01	0			10
32	AOV1 START	VOLTS	0.01	0			0
33	AOV2 SPAN	VOLTS	0.01	0			10
34	AOV2 START	VOLTS	0.01	0			0
35	AOV3 SPAN	VOLTS	0.01	0			10
36	AOV3 START	VOLTS	0.01	0			0
37	AO DIR.REV	-	1	0			0
{38}	AOV1	VOLTS	0.01	0			0
{39}	AOV2	VOLTS	0.01	0			0
{40}	AOV3	VOLTS	0.01	0			0
{41}	EHEAT 1	-	1	0	ON	OFF	OFF
{42}	EHEAT 2	-	1	0	ON	OFF	OFF
{43}	EHEAT 3	-	1	0	ON	OFF	OFF
{44}	REV VALVE	-	1	0	HEAT	COOL	COOL
{45}	COMP 1	-	1	0	ON	OFF	OFF
{46}	COMP 2	-	1	0	ON	OFF	OFF
{47}	AUX	-	1	0	ON	OFF	OFF
48							
49							
{50}	FAN	-	1	0	ON	OFF	OFF
51							
52							
53	NGT HW HTG	-	1	0	NO	YES	YES
54	NGT CLG MODE	-	1	0	YES	NO	NO
{55}	AUX OUTPUT	PCT	0.4	0			0
56	CMP TOTL	-	1	0	2	1	1
57	AUX HTG TIME	MIN	1	0			10

58	EHT STG DELY	SEC	1	0			30
59	DO DIR.REV	-	1	0			0
60	AUXHT AO.DO	-	1	0	DO	AO	AO
{61}	SUPHT OUTPUT	PCT	0.4	0			0
{62}	OA DMPR POS	PCT	0.4	0			0
63	CLG P GAIN	-	0.1 (0.18)	0			6 (10.8)
64	CLG I GAIN	-	0.001 (0.0018)	0			0.01 (0.018)
65	CLG D GAIN	-	1 (1.8)	0			200 (360)
66	CLG BIAS	PCT	0.1	0			50.00
67	HTG P GAIN	-	0.1 (0.18)	0			4 (7.2)
68	HTG I GAIN	-	0.0001 (0.00018)	0			0.004 (0.0072)
69	HTG D GAIN	-	1 (1.8)	0			150 (270)
70	HTG BIAS	PCT	0.1	0			26.00
71	HTG CMP1 SET	PCT	0.4	0			48.8
72	HTG CMP2 SET	PCT	0.4	0			60
73	CLG CMP1 SET	PCT	0.4	0			64.8
74	CLG CMP2 SET	PCT	0.4	0			80
75	CMP MIN OFF	MIN	1	0			5
76	CMP MIN ON	MIN	1	0			5
77							
{78}	CTL TEMP	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
{79}	CLG LOOPOUT	PCT	0.1	0			0.00
{80}	HTG LOOPOUT	PCT	0.1	0			0.00
81							
82							
83							
84							
85	SWITCH LIMIT	PCT	0.4	0			4.8
86	SWITCH TIME	MIN	1	0			10
87	RVAL SW TIME	SEC	1	0			30
88	NGT DBAND	DEG F (DEG C)	0.25 (0.14)	0			3 (1.68)
89	MORN DBAND	DEG F (DEG C)	0.25 (0.14)	0			2 (1.12)
90	SWITCH DBAND	DEG F (DEG C)	0.25 (0.14)	0			2 (1.12)
91	SUPHT SET	PCT	0.4	0			76
{92}	CTL STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
93							
94	DSH MIN TEMP	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)			60.00 (15.66)
95	OADPR SET	PCT	0.4	0			26
96							
97							
98	LOOP TIME	SEC	1	0			5
{99}	ERROR STATUS	-	1	0			0



**POINT LIST, 2277**

Point	Descriptor	Unit	Slope	Intercept	ON	OFF	Default
01	CTLR ADDRESS	-	1	0			99
02	APPLICATION	-	1	0			2299
03							
{04}	ROOM TEMP	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			72.00
{05}	HEAT.COOL	-	1	0	HEAT	COOL	COOL
06	DAY CLG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
07	DAY HTG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			70.00 (21.21)
08	NGT CLG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			82.00 (27.93)
09	NGT HTG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			65.00 (18.41)
10	OADPR MINPOS	PCT	0.4	0			14.8
11	RM STPT MIN	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			55.00 (12.81)
12	RM STPT MAX	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			90.00 (32.41)
13	RM STPT DIAL	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
14	STPT DIAL	-	1	0	YES	NO	NO
{15}	MA TEMP	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)			74.00 (23.5)
16							
17							
18	WALL SWITCH	-	1	0	YES	NO	NO
{19}	DI OVRD SW	-	1	0	ON	OFF	OFF
20	OVRD TIME	HRS	1	0			1
{21}	NGT OVRD	-	1	0	NIGHT	DAY	NIGHT
22	AUX.NOAUX	-	1	0	AUX	NOAUX	NOAUX
{23}	FREE CLG	-	1	0	ENABL E	DISABL	DISABL
{24}	DI 2	-	1	0	ON	OFF	OFF
{25}	DI 3	-	1	0	ON	OFF	OFF
{26}	LOW TEMP DET	-	1	0	OFF	ON	ON
27	ELEC.NOELEC	-	1	0	ELEC	NOELE C	NOELEC
28							
{29}	DAY.NGT	-	1	0	NIGHT	DAY	DAY
{30}	WRMUP.COOLD N	-	1	0	ON	OFF	ON
31	AOV1 SPAN	VOLTS	0.01	0			10
32	AOV1 START	VOLTS	0.01	0			0
33	AOV2 SPAN	VOLTS	0.01	0			10
34	AOV2 START	VOLTS	0.01	0			0
35	AOV3 SPAN	VOLTS	0.01	0			10
36	AOV3 START	VOLTS	0.01	0			0
37	AO DIR.REV	-	1	0			0
{38}	AOV1	VOLTS	0.01	0			0
{39}	AOV2	VOLTS	0.01	0			0
{40}	AOV3	VOLTS	0.01	0			0
{41}	EHEAT 1	-	1	0	ON	OFF	OFF
{42}	EHEAT 2	-	1	0	ON	OFF	OFF
{43}	EHEAT 3	-	1	0	ON	OFF	OFF
{44}	REV VALVE	-	1	0	HEAT	COOL	COOL
{45}	COMP 1	-	1	0	ON	OFF	OFF
{46}	COMP 2	-	1	0	ON	OFF	OFF
{47}	AUX	-	1	0	ON	OFF	OFF
48							
49							
{50}	FAN	-	1	0	ON	OFF	OFF
51							
52							
53	NGT HW HTG	-	1	0	NO	YES	YES
54	NGT CLG MODE	-	1	0	YES	NO	NO
{55}	AUX OUTPUT	PCT	0.4	0			0

56	CMP TOTL	-	1	0	2	1	1
57	AUX HTG TIME	MIN	1	0			10
58	EHT STG DELY	SEC	1	0			30
59	DO DIR.REV	-	1	0			0
60	AUXHT AO.DO	-	1	0	DO	AO	AO
{61}	SUPHT OUTPUT	PCT	0.4	0			0
{62}	OA DMPR POS	PCT	0.4	0			0
63	CLG P GAIN	-	0.1 (0.18)	0			6 (10.8)
64	CLG I GAIN	-	0.001 (0.0018)	0			0.01 (0.018)
65	CLG D GAIN	-	1 (1.8)	0			200 (360)
66	CLG BIAS	PCT	0.1	0			50.00
67	HTG P GAIN	-	0.1 (0.18)	0			4 (7.2)
68	HTG I GAIN	-	0.0001 (0.00018)	0			0.004 (0.0072)
69	HTG D GAIN	-	1 (1.8)	0			150 (270)
70	HTG BIAS	PCT	0.1	0			26.00
71	HTG CMP1 SET	PCT	0.4	0			48.8
72	HTG CMP2 SET	PCT	0.4	0			60
73	CLG CMP1 SET	PCT	0.4	0			64.8
74	CLG CMP2 SET	PCT	0.4	0			80
75	CMP MIN OFF	MIN	1	0			5
76	CMP MIN ON	MIN	1	0			5
{77}	MA LOOPOUT	PCT	0.4	0			0
{78}	CTL TEMP	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
{79}	CLG LOOPOUT	PCT	0.1	0			0.00
{80}	HTG LOOPOUT	PCT	0.1	0			0.00
{81}	MA P GAIN	-	0.1 (0.18)	0			1 (1.8)
{82}	MA I GAIN	-	0.0005 (0.0009)	0			0.05 (0.09)
{83}	MA D GAIN	-	0.5 (0.9)	0			5 (9)
{84}	MA BIAS	PCT	0.4	0			14.8
85	SWITCH LIMIT	PCT	0.4	0			4.8
86	SWITCH TIME	MIN	1	0			10
87	RVAL SW TIME	SEC	1	0			30
88	NGT DBAND	DEG F (DEG C)	0.25 (0.14)	0			3 (1.68)
89	MORN DBAND	DEG F (DEG C)	0.25 (0.14)	0			2 (1.12)
90	SWITCH DBAND	DEG F (DEG C)	0.25 (0.14)	0			2 (1.12)
91	SUPHT SET	PCT	0.4	0			76
{92}	CTL STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
{93}	MA SETPT	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)			74.00 (23.45)
94							
95							
96							
97							
98	LOOP TIME	SEC	1	0			5
{99}	ERROR STATUS	-	1	0			0

**POINT LIST, 2278**

Point	Descriptor	Unit	Slope	Intercept	ON	OFF	Default
01	CTLR ADDRESS	-	1	0			99
02	APPLICATION	-	1	0			2299
03							
{04}	ROOM TEMP	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			72.00
{05}	HEAT.COOL	-	1	0	HEAT	COOL	COOL
06	DAY CLG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
07	DAY HTG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			70.00 (21.21)
08	NGT CLG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			82.00 (27.93)
09	NGT HTG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			65.00 (18.41)
10	OADPR MINPOS	PCT	0.4	0			14.8
11	RM STPT MIN	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			55.00 (12.81)
12	RM STPT MAX	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			90.00 (32.41)
13	RM STPT DIAL	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
14	STPT DIAL	-	1	0	YES	NO	NO
{15}	DISCH TEMP	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)			74.00 (23.5)
16							
17							
18	WALL SWITCH	-	1	0	YES	NO	NO
{19}	DI OVRD SW	-	1	0	ON	OFF	OFF
20	OVRD TIME	HRS	1	0			1
{21}	NGT OVRD	-	1	0	NIGHT	DAY	NIGHT
22	AUX.NOAUX	-	1	0	AUX	NOAUX	NOAUX
{23}	FREE CLG	-	1	0	ENABLE	DISABL	DISABL
{24}	DI 2	-	1	0	ON	OFF	OFF
{25}	DI 3	-	1	0	ON	OFF	OFF
{26}	LOW TEMP DET	-	1	0	OFF	ON	ON
27	ELEC.NOELEC	-	1	0	ELEC	NOELEC	NOELEC
28							
{29}	DAY.NGT	-	1	0	NIGHT	DAY	DAY
{30}	WRMUP.COOLD N	-	1	0	ON	OFF	ON
31	AOV1 SPAN	VOLTS	0.01	0			10
32	AOV1 START	VOLTS	0.01	0			0
33	AOV2 SPAN	VOLTS	0.01	0			10
34	AOV2 START	VOLTS	0.01	0			0
35	AOV3 SPAN	VOLTS	0.01	0			10
36	AOV3 START	VOLTS	0.01	0			0
37	AO DIR.REV	-	1	0			0
{38}	AOV1	VOLTS	0.01	0			0
{39}	AOV2	VOLTS	0.01	0			0
{40}	AOV3	VOLTS	0.01	0			0
{41}	EHEAT 1	-	1	0	ON	OFF	OFF
{42}	EHEAT 2	-	1	0	ON	OFF	OFF
{43}	EHEAT 3.AUX	-	1	0	ON	OFF	OFF
{44}	HTG CMP 1	-	1	0	ON	OFF	OFF
{45}	HTG CMP 2	-	1	0	ON	OFF	OFF
{46}	CLG CMP 1	-	1	0	ON	OFF	OFF
{47}	CLG CMP 2	-	1	0	ON	OFF	OFF
48							
49							
{50}	FAN	-	1	0	ON	OFF	OFF
51							
52							
53	NGT HW HTG	-	1	0	NO	YES	YES
54	NGT CLG MODE	-	1	0	YES	NO	NO
{55}	AUX OUTPUT	PCT	0.4	0			0
56	CMP TOTL	-	1	0	2	1	1

57	AUX HTG TIME	MIN	1	0			10
58	EHT STG DELY	SEC	1	0			30
59	DO DIR.REV	-	1	0			0
60	AUXHT AO.DO	-	1	0	DO	AO	AO
{61}	SUPHT OUTPUT	PCT	0.4	0			0
{62}	OA DMPR POS	PCT	0.4	0			0
63	CLG P GAIN	-	0.1 (0.18)	0			6 (10.8)
64	CLG I GAIN	-	0.001 (0.0018)	0			0.01 (0.018)
65	CLG D GAIN	-	1 (1.8)	0			200 (360)
66	CLG BIAS	PCT	0.1	0			50.00
67	HTG P GAIN	-	0.1 (0.18)	0			4 (7.2)
68	HTG I GAIN	-	0.0001 (0.00018)	0			0.004 (0.0072)
69	HTG D GAIN	-	1 (1.8)	0			150 (270)
70	HTG BIAS	PCT	0.1	0			26.00
71	HTG CMP1 SET	PCT	0.4	0			48.8
72	HTG CMP2 SET	PCT	0.4	0			60
73	CLG CMP1 SET	PCT	0.4	0			64.8
74	CLG CMP2 SET	PCT	0.4	0			80
75	CMP MIN OFF	MIN	1	0			5
76	CMP MIN ON	MIN	1	0			5
77							
{78}	CTL TEMP	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
{79}	CLG LOOPOUT	PCT	0.1	0			0.00
{80}	HTG LOOPOUT	PCT	0.1	0			0.00
81							
82							
83							
84							
85	SWITCH LIMIT	PCT	0.4	0			4.8
86	SWITCH TIME	MIN	1	0			10
87							
88	NGT DBAND	DEG F (DEG C)	0.25 (0.14)	0			3 (1.68)
89	MORN DBAND	DEG F (DEG C)	0.25 (0.14)	0			2 (1.12)
90	SWITCH DBAND	DEG F (DEG C)	0.25 (0.14)	0			2 (1.12)
91	SUPHT SET	PCT	0.4	0			76
{92}	CTL STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
93							
94	DSH MIN TEMP	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)			60.00 (15.66)
95	OADPR SET	PCT	0.4	0			26
96							
97							
98	LOOP TIME	SEC	1	0			5
{99}	ERROR STATUS	-	1	0			0

**POINT LIST, 2279**

Point	Descriptor	Unit	Slope	Intercept	ON	OFF	Default
01	CTLR ADDRESS	-	1	0			99
02	APPLICATION	-	1	0			2299
03							
{04}	ROOM TEMP	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			72.00
{05}	HEAT.COOL	-	1	0	HEAT	COOL	COOL
06	DAY CLG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
07	DAY HTG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			70.00 (21.21)
08	NGT CLG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			82.00 (27.93)
09	NGT HTG STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			65.00 (18.41)
10	OADPR MINPOS	PCT	0.4	0			14.8
11	RM STPT MIN	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			55.00 (12.81)
12	RM STPT MAX	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			90.00 (32.41)
13	RM STPT DIAL	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
14	STPT DIAL	-	1	0	YES	NO	NO
{15}	MA TEMP	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)			74.00 (23.5)
16							
17							
18	WALL SWITCH	-	1	0	YES	NO	NO
{19}	DI OVRD SW	-	1	0	ON	OFF	OFF
20	OVRD TIME	HRS	1	0			1
{21}	NGT OVRD	-	1	0	NIGHT	DAY	NIGHT
22	AUX.NOAUX	-	1	0	AUX	NOAUX	NOAUX
{23}	FREE CLG	-	1	0	ENABL E	DISABL	DISABL
{24}	DI 2	-	1	0	ON	OFF	OFF
{25}	DI 3	-	1	0	ON	OFF	OFF
{26}	LOW TEMP DET	-	1	0	OFF	ON	ON
27	ELEC.NOELEC	-	1	0	ELEC	NOELE C	NOELEC
28							
{29}	DAY.NGT	-	1	0	NIGHT	DAY	DAY
{30}	WRMUP.COOLDN	-	1	0	ON	OFF	ON
31	AOV1 SPAN	VOLTS	0.01	0			10
32	AOV1 START	VOLTS	0.01	0			0
33	AOV2 SPAN	VOLTS	0.01	0			10
34	AOV2 START	VOLTS	0.01	0			0
35	AOV3 SPAN	VOLTS	0.01	0			10
36	AOV3 START	VOLTS	0.01	0			0
37	AO DIR.REV	-	1	0			0
{38}	AOV1	VOLTS	0.01	0			0
{39}	AOV2	VOLTS	0.01	0			0
{40}	AOV3	VOLTS	0.01	0			0
{41}	EHEAT 1	-	1	0	ON	OFF	OFF
{42}	EHEAT 2	-	1	0	ON	OFF	OFF
{43}	EHEAT 3.AUX	-	1	0	ON	OFF	OFF
{44}	HTG CMP 1	-	1	0	ON	OFF	OFF
{45}	HTG CMP 2	-	1	0	ON	OFF	OFF
{46}	CLG CMP 1	-	1	0	ON	OFF	OFF
{47}	CLG CMP 2	-	1	0	ON	OFF	OFF
48							
49							
{50}	FAN	-	1	0	ON	OFF	OFF
51							
52							
53	NGT HW HTG	-	1	0	NO	YES	YES
54	NGT CLG MODE	-	1	0	YES	NO	NO
{55}	AUX OUTPUT	PCT	0.4	0			0

56	CMP TOTL	-	1	0	2	1	1
57	AUX HTG TIME	MIN	1	0			10
58	EHT STG DELY	SEC	1	0			30
59	DO DIR.REV	-	1	0			0
60	AUXHT AO.DO	-	1	0	DO	AO	AO
{61}	SUPHT OUTPUT	PCT	0.4	0			0
{62}	OA DMPR POS	PCT	0.4	0			0
63	CLG P GAIN	-	0.1 (0.18)	0			6 (10.8)
64	CLG I GAIN	-	0.001 (0.0018)	0			0.01 (0.018)
65	CLG D GAIN	-	1 (1.8)	0			200 (360)
66	CLG BIAS	PCT	0.1	0			50.00
67	HTG P GAIN	-	0.1 (0.18)	0			4 (7.2)
68	HTG I GAIN	-	0.0001 (0.00018)	0			0.004 (0.0072)
69	HTG D GAIN	-	1 (1.8)	0			150 (270)
70	HTG BIAS	PCT	0.1	0			26.00
71	HTG CMP1 SET	PCT	0.4	0			48.8
72	HTG CMP2 SET	PCT	0.4	0			60
73	CLG CMP1 SET	PCT	0.4	0			64.8
74	CLG CMP2 SET	PCT	0.4	0			80
75	CMP MIN OFF	MIN	1	0			5
76	CMP MIN ON	MIN	1	0			5
{77}	MA LOOPOUT	PCT	0.4	0			0
{78}	CTL TEMP	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
{79}	CLG LOOPOUT	PCT	0.1	0			0.00
{80}	HTG LOOPOUT	PCT	0.1	0			0.00
{81}	MA P GAIN	-	0.1 (0.18)	0			1 (1.8)
{82}	MA I GAIN	-	0.0005 (0.0009)	0			0.05 (0.09)
{83}	MA D GAIN	-	0.5 (0.9)	0			5 (9)
{84}	MA BIAS	PCT	0.4	0			14.8
85	SWITCH LIMIT	PCT	0.4	0			4.8
86	SWITCH TIME	MIN	1	0			10
87							
88	NGT DBAND	DEG F (DEG C)	0.25 (0.14)	0			3 (1.68)
89	MORN DBAND	DEG F (DEG C)	0.25 (0.14)	0			2 (1.12)
90	SWITCH DBAND	DEG F (DEG C)	0.25 (0.14)	0			2 (1.12)
91	SUPHT SET	PCT	0.4	0			76
{92}	CTL STPT	DEG F (DEG C)	0.25 (0.14)	48.00 (8.89)			74.00 (23.45)
{93}	MA SETPT	DEG F (DEG C)	0.5 (0.28)	37.5 (3.06)			74.00 (23.45)
94							
95							
96							
97							
98	LOOP TIME	SEC	1	0			5
{99}	ERROR STATUS	-	1	0			0