BACnet Points for Dual Compressor Water to Air PRODCWA-04

The network variables will be listed by point type instance convention. 2:1 would mean point type 2, point instance 1. All volatile points will revert to the uncommanded values after a power interruption. These have no limit on the number of writes in a lifetime. The nonvolatile (Value) type points have their values stored in flash memory and they retain their values through a power outage. These have a limited life-time number of write cycles, about 2,000,000.

Analog Input (Type 0)

0:1	Space Temp	[Read, shows the sensor value connected to terminals RS and AIC on the terminal board]
0:2	Eff Clg Setpt	[Read, shows the active cooling setpoint value]
0:3	Eff Htg Setpt	[Read, shows the active heating setpoint value]
0:4	Disch Air Temp	[Read, shows sensor value connected to AI4 on the FX10]
0:5	Alarms	[Read, shows the current alarm status of the heat pump, 0=No alarms, 1=Condensate detected, 2=Compressor 1 Hi Discharge Pressure, 3=Compressor 1 Low Suction Pressure 4=Low Temp Limit on Coax 1, 5=Compressor 2 Hi Discharge Pressure, 6=Compressor 1 Low Suction Pressure, 7=Low Temp Limit on Coax 2, 8=Bad Refrigerant Temp Sensor Ckt 1, 9=Bad Refrigerant Temp Sensor Ckt 2]
0:6	Freeze 1 Temp	[Read, shows the water coil heat exchanger temperature For circuit 1.]
0:7	Freeze 2 Temp	[Read, shows the water coil heat exchanger temperature For circuit2.]

. **Analog Output (Type 1)** *These are volatile memory and allow unlimited writes.*

1:1	Space Temp Override	[Write, Network override for the space temperature]
1:2	Space Setpoint Ovrd	[Read/Write, Provides a single command to adjust the Midpoint value between the Eff Clg Setpt and Eff Htg Setpt.]

Analog Value (Type 2) *These are written in Flash memory and have about 2,000,000 write cycles. Should only be written to by manual or scheduled writes, not by automated reset process.* ***Excessive writes will cause controller failure.***

2:1	Occ Cool Setpt	[Read/Write, Occupied cooling setpoint, nonvolatile]
2:3	Occ Heat Setpt	[Read/Write, Occupied heating setpoint, nonvolatile]
2:2	Unocc Cool Setpt	[Read/Write, Unoccupied cooling setpoint, nonvolatile]

2:4	Unocc Heat Setpt	[Read/Write, Unoccupied heating setpoint, nonvolatile] Shutdown with antifreeze, nonvolatile.]
2:5	Max Htg Setpt	[Read/Write, The upper limit that the heating setpoint may be adjusted to.]
2:6	Min Clg Setpt	[Read/Write, The lower limit that the cooling setpoint may be adjusted to.]
2:7	Remote Setpt Max	[Read/Write, Sets the upper value for the remote setpoint adjust. A 2 setting gives you + 2 degrees maximum.]
2:8	Remote Setpt Min	[Read/Write, Sets the lower value for the remote setpoint adjust. A 2 setting gives you - 2 degrees maximum.]

Multistate Input (Type 13)

13:1	Effective Occupancy	[Read, shows the occupancy status of the heat pump. 1=Occupied, 2=Unoccupied, 3=Bypass (temporary occupancy)]
13:2	Unit Status	[Read, shows heat pump as normal or emergency shutdown 1=Auto(normal), 7=Off(shutdown)]
13:3	Fan Command Status	[Read, shows the commanded status of the fan. 1=Off,2=On]
13:4	Comp1 Command Status	[Read, shows the commanded status of compressor 1. 1=Off,2=On]
13:5	Comp2 Command Status	[Read, shows the commanded status of compressor 2. 1=Off,2=On]
13:6	Rev Valve Status	[Read, shows the reversing valve position, 1=Heat,2=Cool]
13:7	Accessory 1 Output	[Read, shows the commanded status Accessory 1 (X1) 1=Off,2=On]
13:8	Accessory 2 Output	[Read, shows the commanded status Accessory 2 (X2) 1=Off,2=On]

Multistate Output (Type 14) *These are volatile memory and allow unlimited writes.*

14:1	Occ Man Cmd	[Read/Write, controls the occupancy mode of the heat Pump. 1=Occupied, 2=Unoccupied, 3=Bypass (Temporary Occupancy), 4=Standby, 255= Uncommanded]
14:2	Fan Command (G)	[Read/Write, network command to run the fan]
14:3	Comp1 Command (Y1)	[Read/Write, network Y1 command (compressor 1 call).]
14:4	Comp2 Command (Y2)	[Read/Write, network Y2 command (compressor 2 call).]
14:5	Rev Vlv Cmd (O)	[Read/Write, network O command. 1= heating, 2= cooling.]
14:6	Emergency Override	[Read/Write, provide means of emergency shutdown]
14:7	Alarm Reset	[Read/Write, allows remote reset of manual reset alarms, Command to a '2' value for reset action, 1 for normal

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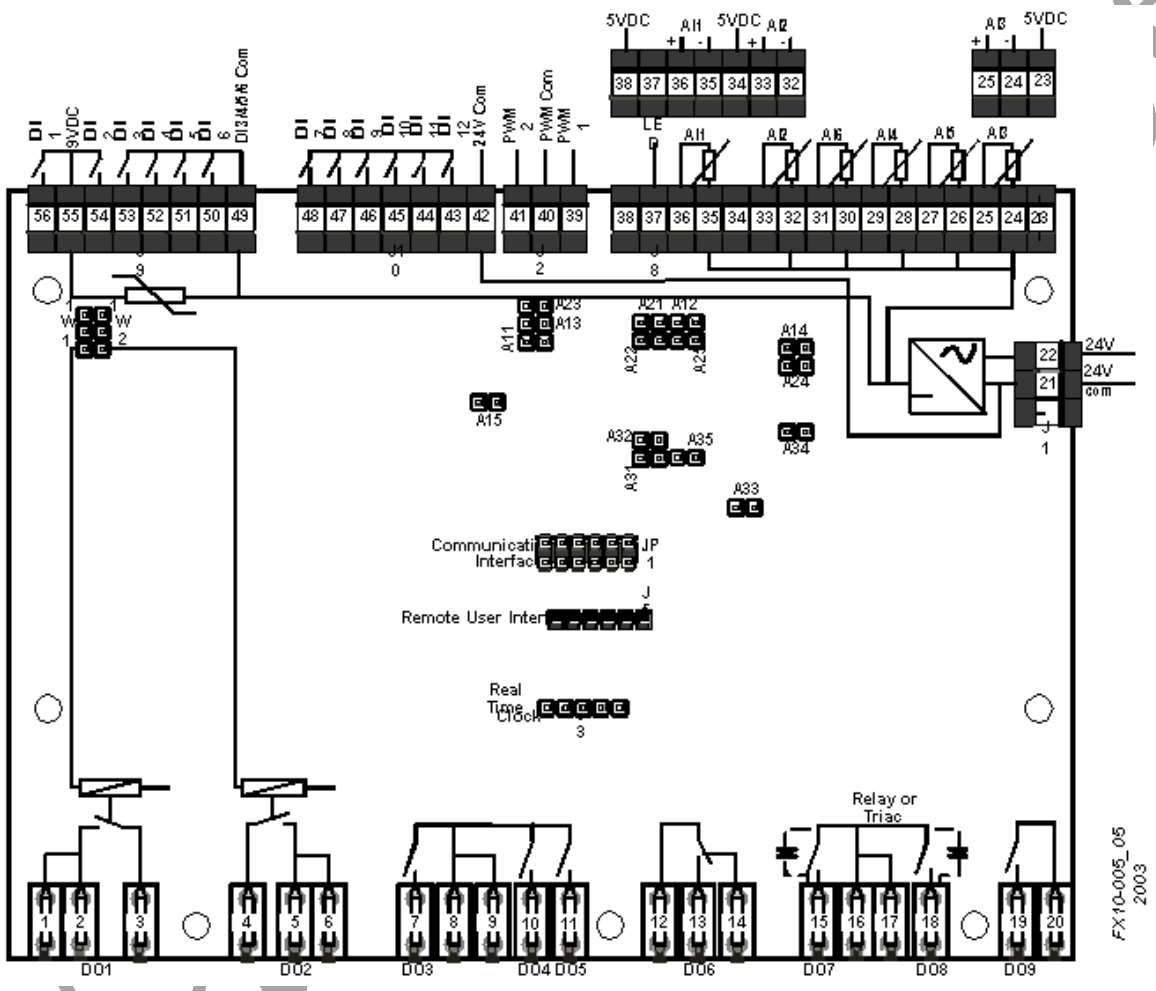
Operation.]

The reversible chiller is equipped with an OEM DDC controller produced by Johnson Controls, Inc. This controller—the FX10—has 6 analog inputs, 12 digital inputs, and 9 digital outputs. The FX10 is depicted below.



Physical I/O Assignment

The asterisk * denotes a point that is integral to the heatpump control algorithms.

Channel	Name	Pin Number	Type
AI1*	Zone Temperature Sensor (AI1)	36	A99
AI2*	Warm/Cool Adjustment (AI2)	33	A99

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AI3*	Condensate Level Input (AI3)	25	RatioMetric
AI4	Discharge Air Temperature Sensor (AI4)	29	A99
AI5*	Heating Freeze Protection 1 Temperature (AI5)	27	A99
AI6*	Heating Freeze Protection 2 Temperature (AI6)	31	A99
DI1*	Occupancy Input (BI1)	56	Binary
DI2*	Emergency Shutdown (BI2)	54	Binary
DI3*	1st Stage Low Pressure Switch (BI3)	53	Binary
DI4	Temporary Occupancy Input (BI4)	52	Binary
DI5	Heating Freeze Protection Setpoint Selection (BI5)	51	Binary
DI6*	2nd Stage Low Pressure Switch (BI6)	50	Binary
DI7*	Y1 Compressor Command (BI7)	48	Binary
DI8*	Y2 Compressor Command (BI8)	47	Binary
DI9	O Reversing Valve Command (BI9)	46	Binary
DI10	G Fan Command (BI10)	45	Binary
DI11*	1st Stage High Pressure Switch (BI11)	44	Binary
DI12*	2nd Stage High Pressure Switch (BI12)	43	Binary
DO1	Fan Output (BO1)	3	Binary

DO2*	1st Stage Compressor Output (BO2)	4	Binary
DO3	Reversing Valve 1 Output (BO3)	7	Binary
DO4*	2nd Stage Compressor Output (BO4)	10	Binary
DO5	Reversing Valve 2 Output (BO5)	11	Binary
DO6*	Alarm Output (BO6)	13	Binary
DO7	Accessory Output 1 (BO7)	15	Binary
DO8	Accessory Output 2 (BO8)	18	Binary

When power is applied to the FX10, the processor executes a power-on start-up sequence that includes the generation of a random length program start delay which varies between 1 and 120 seconds. Upon the termination of the start-delay, the zone sensor input is examined to determine whether setpoint mode or thermostatic operation is chosen. If the zone sensor is detected as reliable, the mode is setpoint and the thermostatic Y, O, and G input signals are ignored.

Initialization

The processor then determines the Occupancy status of the heatpump by examining the signal at the Occupancy input (DI-1) and the network command at *nviOccManCmd*. If the Occupancy status is determined to be Unoccupied, the fan will be operated in a cycled fashion such that it will be off unless the zone temperature is above the Unoccupied Cooling setpoint or below the Unoccupied Heating setpoint. The network variables *nvoEffClgSetpt* and *nvoEffHtgSetpt* will show the controlling cooling and heating setpoints as determined by the occupancy status of the heatpump, the values of the basic occupied and unoccupied heat and cool setpoints and the value of the warm/cool adjust when the occupancy status is Occupied.

Temperature Control

Reversing Valve

The position of the reversing valve is determined by the zone temperature's relationship to the setpoints. If the reversing valve is energized (cooling position), it will remain so until the zone temperature drops below the effective heating setpoint. If de-energized, the reversing valve will remain so until the zone temperature rises above the effective cooling setpoint.

Compressor

If the zone temperature falls outside of the bounds of the Effective heating and cooling setpoints, the first indication of an eventual compressor operation is that the X1

(Accessory 1) output will energize. Ninety seconds later, the compressor will run if the safeties permit. The 'turn-on' point of the compressor control is when the temperature exceeds the controlling effective setpoint plus the value of the parameter '*nciPropBand*' which by default is 1.0 degrees F. The compressor operation will continue until the temperature crosses back inside the setpoints band.

Compressor Protection

There are several conditions that will prevent or interrupt compressor operation. Also minimum operation times are enforced.

Minimum Run

Once the compressor starts, a 120 second run time is enforced. Only a high pressure fault emergency stop, or detected condensate are intended to halt the compressor during this period. This period is essential to ensuring proper oil return to the compressor.

Minimum Off

When the compressor stops, a minimum off time of 5 minutes is enforced. This is intended to allow time for the gas pressures to equalize and minimize the starting load on the compressor as well as giving time for the windings to cool prior to heat up experienced during a start-up high current condition.

High Pressure

If the high pressure switch opens at any time, the compressor is immediately disabled. Three high pressure events in any 60 minute period will result in a manual reset Lock-out. An alarm is generated for this condition.

Low Pressure

If the low pressure switch is open prior to compressor start, it is deemed a loss of charge condition and the compressor will not start. An alarm is generated for this condition. Once the compressor is started, the low pressure switch is ignored for the first 2 minutes. Thereafter, if the low pressure switch is open for 30 continuous seconds, compressor operation is halted. Three low pressure events in any 60 minute period will result in a manual reset Lock-out. An alarm is generated for this condition.

Low Temperature

To prevent freeze damage to the coaxial heat exchanger, the refrigerant temperature is monitored after the minimum run time has expired. If the refrigerant temperature is below the low limit for 30 seconds continuous, compressor operation is halted. Three low temperature events in any 60 minute period will result in a manual reset Lock-out. An alarm is generated for this condition.

Condensate detection

Two electrodes are positioned in the condensate pan so that if the pan does not drain properly, the presence of excessive water will trigger a detected condensate condition. If the condition exists for 30 continuous seconds, compressor operation is halted. Three condensate events in any 60 minute period will result in a manual reset Lock-out. An alarm is generated for this condition.

Reversing Valve change

If the compressor is running and the minimum run time has expired, a change in the reversing valve command will halt the compressor.

Additional Features

Occupancy

If the network Occupancy variable (*nviOccManCmd*) is uncommanded, the occupancy will be controlled by the status of DI-1 (Occupancy input). If the Occupancy variable is commanded, it will override the Occupancy input and the Effective Occupancy status variable (*nvoEffectOccup)* show the ruling occupancy status in the heatpump. When the heatpump occupancy status is Unoccupied, a temporary occupancy may be initiated by pressing the Occupancy Override button on the zone temperature sensor. This temporary occupancy will last for two hours after the button is pressed.

Space Temperature Override

Normally, the space temperature sensor connected to Analog Input 1 will control the heatpump. If a value is written to the variable, the heatpump control will respond to the written value rather than the sensor value. The written value is reflected on the variable *nvoSpaceTemp*.

Alarm Reset

In the event of a manual reset lockout, the condition may be reset by turning off primary power for 20 seconds or longer, or by commanding the variable *nviAlarmReset* from an uncommanded or Off value to a Low_ST_On value, or if a Medium User Interface (MUI) is connected, by simultaneous pressing of the Return and ESC keys on the display.

Thermostatic Control

In the absence of a sensor connection to the heat pump control box terminal board terminals 'RS' and 'AIC' (Analog Input 1) and with no value written to the space temperature override variable, the heatpump control operates in a standard heat pump thermostatic control mode. On the heat pump control box terminal board, terminals R, G, O, Y1, Y2, and C are used in the industry-standard fashion to control the heat pump.

Accessory Outputs

On the heatpump terminal board, X1 and X2 may be used for controlling an isolation valve (from X1) and a damper (from X2). Typically the X1 output is energized (has 24 VAC) when the controller senses the need for a compressor operation. The X2 output typically mirrors the fan command status for damper control.

General Fault

When an alarm condition is actively preventing compressor operation, the 'L' terminal on the terminal board will be energized.

Network Alarm Variable

The network variable *nvoAlarms* has a numeric output that shows the alarm condition of the heatpump.