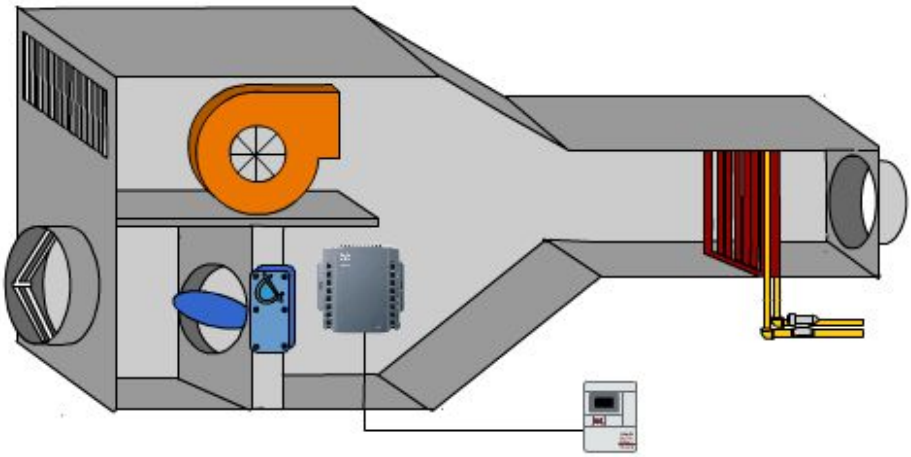
VAV with Parallel Fan and Reheat (Hot Water or Electric) Application Data Sheet

***NOTE**: In addition to the VAV with Parallel Fan and Reheat configuration (this datasheet), the Predator VAV hardware platforms can also be configured to support: VAV with Perimeter Heat, VAV with Hot/Cold Supply Air, VAV Cooling Only, VAV with Reheat (HW or Elec), VAV with Series Fan and Reheat (HW or Elec), CV with Reheat and CV without Reheat. Access the datasheets for these configurations at* http://www.sbt.siemens.com/HVP/Staefa/products/documentation/specifications.asp .



VAV with Parallel Fan and Reheat (HW or Elec)

Features

- LonMark compliant with space-comfort controller functional profile (8502)
- Dynamic minimum airflow input allows demand controlled ventilation
- PID control minimized offset and maintains tighter set point control
- Standby mode enables energy savings during occupied hours for rooms that are not always used. When occupants are sensed, the controller quickly responds to maintain comfort levels.
- Diversity control, through a demand limit input, maximized comfort by maintaining even air distribution to all zones during morning warm-up or pre-cool operation.
- Conforms to the LonMark interoperability guidelines, enabling information sharing with LonMark products from other vendors.

Sequence of Operation

In the VAV with Parallel Fan and Reheat (Hot Water or Electric) core configuration, the Predator operates perimeter heat, the reheat coil, terminal fan and the primary air damper to maintain required room temperature and ventilation conditions.

Occupied Mode

The Predator applies occupied settings for the space temperature setpoints and the primary air flow minimum. The typical result is continuous ventilation, with heating or cooling automatically selected to maintain comfort.

Cooling

The cooling PID maintains the measured space temperature at the occupied cooling setpoint by modulating the primary air flow setpoint between the maximum cooling flow and the minimum cooling flow.

The active minimum air flow may be dynamically adjusted over the network according to air quality considerations.

The primary air flow PID maintains the measured air flow at the varying setpoint by modulating the position of the primary air damper.

The terminal fan runs if the primary air flow drops below a selectable trigger point.

The reheat coil is off.

Perimeter heat is off.

Lighting is on.

Heating

The heating PID maintains the measured space temperature at the occupied heating setpoint by modulating perimeter heat, the reheat coil and the primary air flow setpoint. The setpoint varies between the maximum heating flow and the minimum heating flow. Relative sequencing of perimeter heat, the reheat coil, and the primary air flow is set according to site specific requirements.

The terminal fan runs according to field selectable criteria, either: low primary air flow, reheat output, or the first call for heat in the space.

Lighting is on.

Unoccupied Mode

The Predator applies unoccupied settings for the space temperature setpoints and the primary air flow minimum. The typical result is a wide operating band with no HVAC energy consumption, and heating or cooling applied only at extreme conditions.

Cooling

The cooling PID maintains the measured space temperature at the unoccupied cooling setpoint by modulating the primary air flow setpoint between the maximum cooling flow and the unoccupied minimum flow.

The primary air flow PID maintains the measured air flow at the varying setpoint by modulating the position of the primary air damper.

The reheat coil is off.

Perimeter heat is off.

Lighting is off.

Heating

The heating PID maintains the measured space temperature at the unoccupied heating setpoint. Operation of each HVAC device in response to heating demand is selectable in the unoccupied mode. The behavior of primary air damper, terminal fan and reheat coil may be individually

configured. They may be forced on, locked out, modulated or cycled according to the required sequence.

Lighting is off.

Bypass Mode

During unoccupied periods, an occupant can put the Predator in the bypass mode by pressing the bypass button on the room temperature sensor. This causes the controller to operate exactly as in the occupied mode, for an adjustable amount of time.

Standby Mode

Standby mode applies separately adjustable temperature and ventilation setpoints. These may be adjusted to conserve energy, but allow quicker recovery compared to the unoccupied mode. Otherwise, operation is the same as the unoccupied mode.

Morning Warmup

During unoccupied periods, if the Predator is commanded to warmup mode, it applies the occupied heating setpoint (to restore comfort conditions) and the unoccupied minimum flow (because occupants are not present). Operation of each HVAC device in response to heating demand is selectable in the warmup mode. The behavior of perimeter heat, the primary air damper, terminal fan and the reheat coil may be individually configured. They may be forced on, locked out, modulated or cycled according to the required sequence.

Lighting is off.

Pre-cool

During unoccupied periods, if the Predator is commanded to pre-cool mode, it applies the occupied cooling setpoint (to restore comfort conditions) and the unoccupied minimum flow because the occupants are not present.

The reheat coil is off.

Perimeter heat is off.

The terminal fan is off.

Lighting is off.

Calibrate (Test)

The Predator closes the primary air damper and calibrates the air flow sensor. The terminal fan is commanded off. Once commanded to test mode, the controller remains in this mode (even if it is commanded to another mode) until the recalibration is complete. This process takes approximately two times the damper motor travel time.

The reheat coil is off. If perimeter heat is active, it continues to operate.

Lighting is on or off according to occupancy.

Off

The Predator closes the primary air damper, and turns off the reheat coil, and turns off perimeter heat.

Lighting is off.

Occupancy Control

Occupancy Mode

The Predator controller defaults to the occupied mode of operation. Upon receipt of the 4-state LonMark occupancy override (*nviOccManCmd*), the controller will switch to the appropriate mode of operation. A brief summary of each mode follows below:

LonMark Occupancy State	Mode	Description
(0)	Occupied	Controller in Occupied mode and uses Occupied setpoints.
(1)	Unoccupied	Controller in Unoccupied mode and uses Unoccupied setpoints.
(2)	Bypass	Controller temporarily in Occupied mode and uses Occupied setpoints until the Bypass Time elapses. Controller then returns to previous occupancy state.
(3)	Standby	Controller in Standby mode and uses Standby setpoints.

If a LonMark compatible occupancy schedule input (*nviOccSchedule*) is used, the controller will use the modes and setpoints as shown above. This will allow the Predator controller to utilize the scheduling properties of other devices on the LonTalk Network.

The occupancy signal could also come from a time clock, wall switch, or occupancy sensor physically wired to one of the inputs of the Predator controller. This occupancy signal could then be shared with other controllers via the Lon Network.

Bypass Mode

If enabled (through *stptDialEn*) and the Bypass button on the Predator room sensor is pressed, the controller will be placed in the Bypass mode for the amount of time specified by the controller's configuration parameters (default 60 min. – see Table 2). If the button is subsequently pressed again prior to the expiration of the Bypass time, the timer will reset to the initial value and resume counting down.

Priorities of Occupancy Control

Occupancy overrides are prioritized as follows (listed from highest to lowest):

- Operator Command – A valid occupied command sent from system operator.
- Bypass Button – Button on Talon room sensor, also utilized by occupants of room.
- Occupancy Sensor/Wall Switch – Locally connected or signal via the network.
- Occupancy Schedule – Sent from network.

Optional Functions

Room Temperature Sensor Sharing

The Predator Room Temperature Sensor may share its value with other controllers on the LonTalk network via a network binding. This is most commonly done when multiple terminal units serve a room or area.

Duct Temperature Sensor

An optional duct temperature sensor may be connected to the Predator controller for the purpose of monitoring the source temperature. This is useful for functions such as morning warmup, when you want to be sure warm air is being provided to the box, or as an aid in troubleshooting space comfort problems.

Occupancy Sensor/Wall Switch

An optional maintained contact wall switch may be used to control the occupancy mode of a room. Rooms with variable occupancy (conference rooms, etc.) can use this device to control occupancy and the lights with one switch.

Another useful option is to utilize an occupancy sensor to control the occupancy mode of the Predator controller. The function of this device would be similar to the wall switch above, but an occupant entering the room would not perform any manual action to put the room into occupied mode. If the schedule is in the occupied mode and the occupancy sensor does not detect people in the room, the room will go into the standby mode enabling energy savings while maintaining occupant comfort.

Lighting Control Relay

The Predator controller can selectively operate with maintained contacts or pulsed contacts to switch lighting control relays. This is useful in those instances where lighting control is desired, but a lighting control panel with a LonTalk interface is either not present or not feasible.

Analog Damper Actuator

The standard application is setup to use a Siemens GDE or GLB, or similar 3-point floating actuator for air volume control. Alternatively, A Siemens Open Air™ or similar damper actuator could be utilized if 0-10 VDC modulating control is desired.

Perimeter Heat

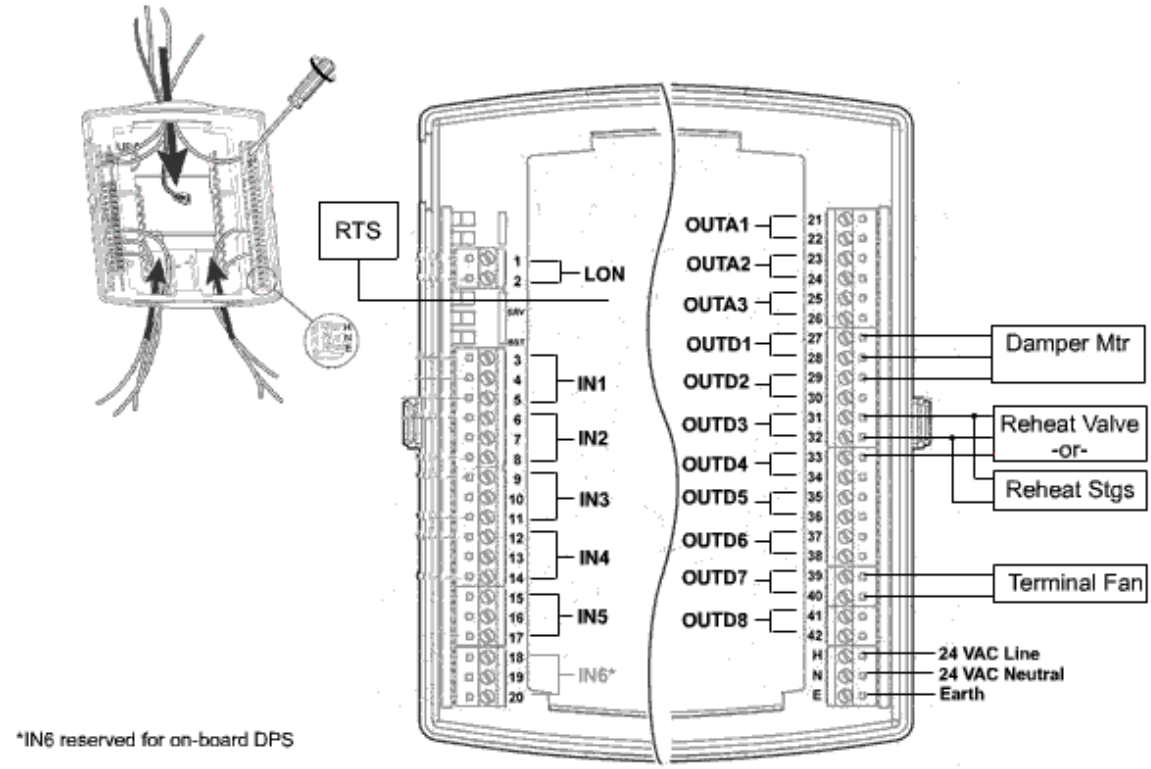
This application also supports the optional control of perimeter heat. The algorithm supports analog, 3-point floating, pulse width modulation, and on/off control of the perimeter heat. Perimeter heat operates independently of terminal airflow or the current state of the terminal fan.

Hardware Map – VAV/CV

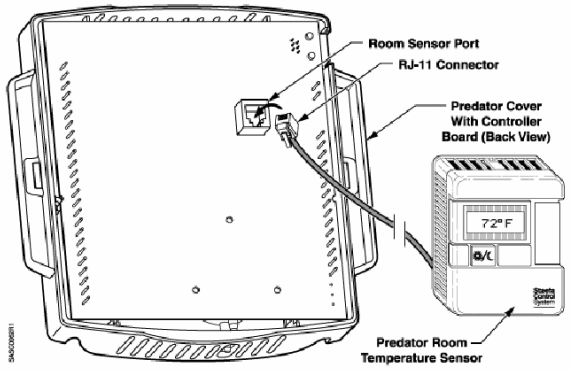
Sample Hardware Map for the VAV with Parallel Fan and Reheat (HW or Elec) Application Configuration

Configuration Property	**Element**	**Input/Output Type**	**Factory Hardware Setting (VAV/CV)**	**Desired Setting** Settings that **need to be changed** from the factory defaults are shown in **BOLD** face type.
inStat	statTempOffset	-	0°F 0°C	0°F 0°C
	statSetptOffset	-	0°F 0°C	0°F 0°C
Inputs	statTemp	TEMP	SPACE_TEMP	SPACE_TEMP
	statSetpt	TEMP	SPACE_SETPT_TEMP	SPACE_SETPT_TEMP
	statOvrd	DI	STAT_SWITCH_DI	STAT_SWITCH_DI
	IN1	DI, TEMP	SPARE2_IN	**IN_UNUSED**
	IN2	DI, TEMP	SOURCE_TEMP	**IN_UNUSED**
	IN3	DI, PCT, TEMP	OCC_SENSOR_DI	**IN_UNUSED**
	IN4	DI, PCT, TEMP	SPACE1_IN	**IN_UNUSED**
	IN5	DI, PCT, TEMP	SPARE3_IN	**IN_UNUSED**
	IN6	PCT	ONBD_PRESSURE_PCT	ONBD_PRESSURE_PCT
outputs	OUTA1	AO	FLOW_DMPR_AO	**OUT_UNUSED**
	OUTA2	AO	TRM_H_COIL_AO	**OUT_UNUSED**
	OUTA3	AO	SPARE2_OUT	**OUT_UNUSED**
	OUTD1	DO, FLT_MTR	FLOW_DMPR_FLT_MTR	FLOW_DMPR_FLT_MTR
	OUTD2	DO, FLT_MTR	FLOW_DMPR_FLT_MTR	FLOW_DMPR_FLT_MTR
	OUTD3	DO, FLT_MTR	TRM_H_COIL_FLT_MTR	TRM_H_COIL_FLT_MTR
	OUTD4	DO, FLT_MTR	TRM_H_COIL_FLT_MTR	TRM_H_COIL_FLT_MTR
	OUTD5	DO, FLT_MTR	PERIM_H_COIL_FLT_MTR	**OUT_UNUSED**
	OUTD6	DO, FLT_MTR	PERIM_H_COIL_FLT_MTR	**OUT_UNUSED**
	OUTD7	DO, FLT_MTR	TRM_FAN_DO	TRM_FAN_DO
	OUTD8	DO, FLT_MTR	SPARE1_OUT	**OUT_UNUSED**

Sample Wiring Diagram for VAV with Parallel Fan and Reheat (HW or Elec) Application Configuration



Note: Route wiring from either the bottom opening when using a J-box or from the base sides as shown in the picture when flat or din rail mounting. The image above is for illustrative purposes only



RJ-11 6-Pin Connector from the Predator Room Temperature Sensor to the Controller.

Wiring Recommendations:

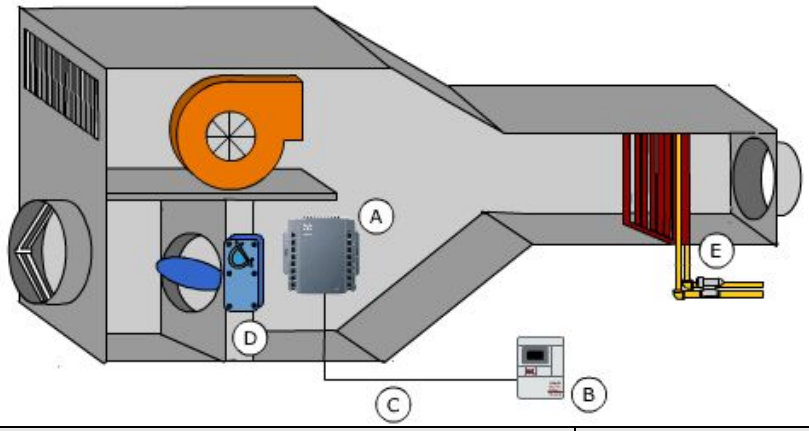
IN and AO:	20 to 22 AWG
DO:	18 to 22 AWG
Power:	16 to 18 AWG
LON Network:	22 AWG Level 4

Transformer Requirements:

Type: Class 2, 24 VAC, 50/60Hz

Predator Wiring Diagrams (Full Point Board Shown)

Bill of Materials



Tag	Description	Product #
A	Predator VAV Actuator*	587-102
	Predator VAV Actuator 10 Pack*	587-102P10
	Predator 10K SD VAV/CV 5IN, 8DO, 2AO, 1RTS, 1DPS	587-135
	Predator Full Point Wiring Base	587-175
	Predator 10K SD VAV/CV 4IN, 6DO, 1RTS, 1DPS	587-115
	Predator Reduced Point Wiring Base	587-170
B	Predator Room Sensors:	
	Sensing Only	587-180
	Override	587-181
	Setpoint	587-182
	Temperature Display**	587-183
	Setpoint and Override	587-184
	Override and Temperature Display**	587-185
	Setpoint and Temperature Display**	587-186
	Setpoint and Temperature Display**	587-187
	Predator Room Sensors *without* Logos	
	No Logo Sensing Only	587-550B
	No Logo Setpoint	587-552B
	No Logo Setpoint and Override	587-554B
	No Logo Setpoint, Override and Temp Display	587-557B
	Mylar Tabs – 20 pack (covers RJ-11 opening for 4 conductor cables)	544-634P20
	Flush Mount 10K Room Sensor	536-994B
C	Predator Room Sensor RJ-11 Pre-terminated 6 Conductor Plenum Rated Cables	
	25 Foot	588-100A
	50 Foot	588-100B
	100 Foot	588-100C
	Predator RS RJ-11 Pre-terminated 4-Conductor (no network connection) Plenum Rated Cables	
	25 Foot	588-101A
	50 Foot	588-101B
	100 Foot	588-101C
D	3-Point Floating Damper Actuator 44 lb. in. 3-Point Floating Damper Actuator 88 lb. in.	GDE.131.P GLB.131.1P
E	Analog 24V Valve Actuators *** Powermite (5.5mm stroke) 3 position, fail in place, NC Zone (2.5mm stroke) 3 position, fail in place, NC on/off, fail safe, NC on/off, fail safe, NO	 SSB81U SSA81 SFA71U SFP71U
Not Shown	Duct Temperature 10K Thermistor	587-691
Not shown	Outside Air Temperature 10K Thermistor 0 to 120°F	587-692

* Predator VAV Actuator does not need separate wiring base.
** Sensors will display Fahrenheit or Celsius
***Analog valve is only supported on Full Point 587-135

Configuration Table

The following table lists all of the configuration properties (CPs) available with this application. For more information on how to set these properties for a CV with Reheat configuration, please consult the *Predator VAV/CV Application Guide*.

Configuration Properties - VAV/CV

Configuration Property	Element	Factory Value
actDisplay		command
airTermType		no_Fan
bypassTime		60 minutes
clgDmdCtrB		
	Pb	1.8°C 53.2°F)
	Ti	300.0 seconds
	Td	0.0 seconds
ductArea		1.0764 ft2 (0.1000 m2)
dynMinScope		off
fanUnoccHtg		modulate
fanWarmup		on
flowDmprMotr		
	TravelTime	90.0 sec
	Reverse	False
	SyncDirection	close
flowDmprSat		
	SaturationLoad	110%
	PrctDeadband	2%
	TimeDelay	10 min
flowFanRq		
	PercentOn	110.00%
	PercentOff	100.00%
flowUnoccHtg		modulate
flowVav		
	Enable	TRUE
	DmdAtMin	0.00%
	DmdAtMax	100.00%
flowWarmup		off
hCoilFanRq		
	PercentOn	3.00%
	PercentOff	0.00%
hCoilUnocc		Cycle
hCoilWrmup		Cycle
hStageCyc		10 minutes
htgClgSwit		
	DmdDeadband	5.00%

Configuration Property	Element	Factory Value
	TmpDeadband	0.0°C (0.0°F)
	TimeDelay	0.0 minutes
htgDmdCtrB		
	Pb	1.8°C (3.2°F)
	Ti	300.0 seconds
	Td	0.0 seconds
htgDmdFanRq		
	PercentOn	110.00%
	PercentOff	100.00%
htgFanDelay		2 minutes
htgSwitMeth		deadBand
lightsLag		10 minutes
maxFlow		4721 l/s (1000 CFM)
maxFlowHotPri		1180 l/s (2500 CFM)
maxFlowHeat		236 l/s (500 CFM)
minFlow		94 l/s (200 CFM)
minFlowHeat		94 l/s (200 CFM)
minFlowStby		94 l/s (200 CFM)
minFlowUnoc		0 l/s (0 CFM)
numHStages		0
numPerimStgs		0
occSensPrior		Unoccupied
occSensorEn		False
perimHUnocc		modulate
perimHWrmup		Cycle
perimHeatSat		
	SaturationLoad	110%
	TempDeadband	2°C (3.6°F)
	TimeDelay	10 min
perimHtgCoil		
	Enable	False
	DmdAtMin	0.00%
	DmdAtMax	100.00%
perimHtgMotr		
	TravelTime	125 seconds
	Reverse	False
	SyncDirection	Close
sensConstVAV		0.63
seriesStDelay		0.0 seconds
sourceTempLim		
	NeededToCool	18.0°C (64.4°F)
	NeededToHeat	25.0°C (77.0°F)

Configuration Property	Element	Factory Value
statSwitchEn		False
stptDialEn		False
stptOffstSpan		2.0 deg C
tempStptLim		
	MinTemp	19.0°C (66.2°F)
	MaxTemp	25.0°C (77.0°F)
trmFlowCtrB		
	Pb	4°C (7.2°F)
	Ti	12.0 seconds
	Td	0.0 seconds
trmFlowSat		
	SaturationLoad	110%
	TempDeadband	2°C (3.6°F)
	TimeDelay	10 min
trmHeatSat		
	SaturationLoad	110%
	TempDeadband	2°C (3.6°F)
	TimeDelay	10 min
trmHtgCoil		
	Enable	False
	DmdAtMin	0.00%
	DmdAtMax	100.00%
trmHtgEnrgy		Hot Water
trmHtgMotr		
	TravelTime	125.0 seconds
	Reverse	False
	SyncDirection	close

* Available on some models of the Predator Room Temperature Sensor.

Network Configuration Inputs (nci) - VAV/CV

NV Name	Element	Factory Value
nciPrOffset		0.00%
nciSetPnts		
	Occupied Cooling Setpoint	73.4°F (23.0°C)
	Standby Cooling Setpoint	77.0°F (25.0°C)
	Unoccupied Cooling Setpoint	82.4°F (28.0°C)
	Occupied Heating Setpoint	69.8°F (21.0°C)
	Standby Heating Setpoint	66.2°F (19.0°C)
	Unoccupied Heating Setpoint	60.8°F (16.0°C)

Control Mode Interaction Table – VAV/CV

	Heat		Warmup	Cool		PreCool Unocc	Off	Test (Calibrate)	Emerg Heat Unocc	Fan Only
	Occ	Unocc	Unocc	Occ	Unocc					
Term Htg Coil	Heat Loop	Heat Loop Cycle Off Max	Heat Loop Cycle Off Max	Closed	Closed	Closed	Closed		Heat Loop	Closed
Perim Heat	Heat Loop	Heat Loop Cycle Off Max	Heat Loop Cycle Off Max	Closed	Closed	Closed	Closed	Heat Loop	Heat Loop	Closed
Flow Dmpr	Heat Loop	Heat Loop Cycle Off Max	Heat Loop Max Min	Cool Loop	Cool Loop	Cool Loop	Closed	Closed	Heat Loop	Closed
Series Fan	ON	Demand	Demand	ON	Demand	Demand	OFF	OFF	Demand	ON
Parallel Fan	Demand	Demand	Demand	Demand	OFF	OFF	OFF	OFF	Demand	ON
Flow Limits	Htg Max Htg Min	Htg Max Unocc Min	Htg Max Unocc Min	Clg Max Clg Min	Clg Max Unocc Min	Clg Max Unocc Min	No Flow	No Flow	Max Min	No Flow
Temp Stpt	Occ Heat	Unocc Heat	Occ Heat	Occ Cool	Unocc Cool	Occ Cool	N/A	N/A	Unocc	N/A

Color Key: Red = OFF (not used); Green = Active (fixed in application); Yellow = Selectable (configurable)

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