SIEMENS

BACnet PTEC Controller

Constant Volume with Electric Reheat, Application 6562

Application Note

140-1003
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Restricted

Building Technologies

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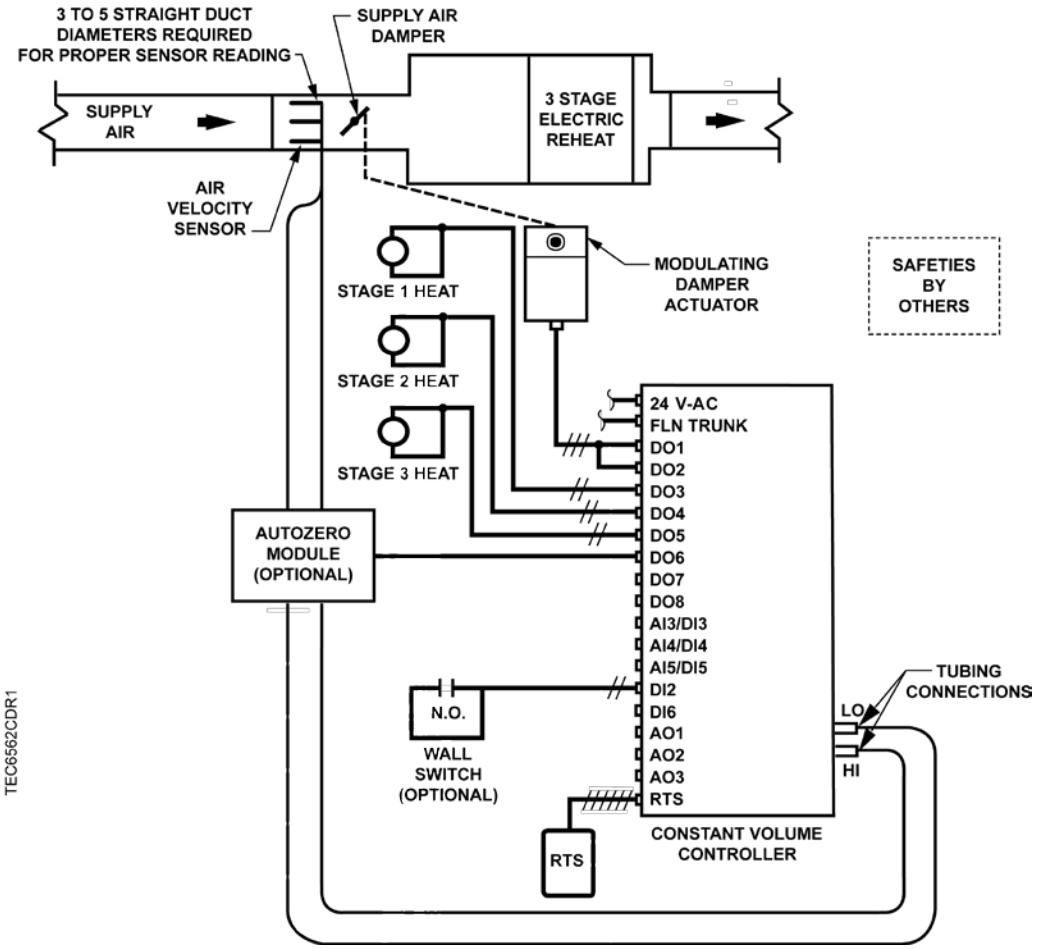
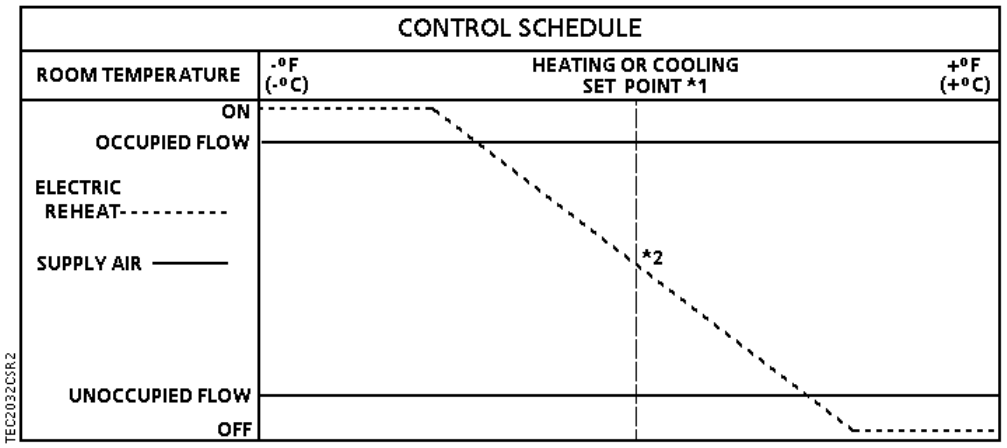
Overview

NOTE:
For information on applications with Firmware Revision B*x*40 or earlier, see InfoLink and/or Asset Portal for documentation.

In Application 6562, the controller provides a constant volume of air to the room during occupied periods, and a lower constant volume of air to the room during unoccupied periods. Reheat is provided by three stages of electric heat. In order for the application to work properly, the central air handling unit must provide pre-conditioned air to the terminal box.



Application 6562 Control Diagram.



Application 6562 Control Schedule.

BACnet

The controller communicates using BACnet MS/TP protocol for open communications on BACnet MS/TP networks.

Product	Supported BIBBs	BIBB Name
BTEC/PTEC	DS-RP-B B	Data Sharing-Read Property-B
	DS-RPM-B	Data Sharing-Read Property Multiple-B
	DS-WP-B	Data Sharing-Write Property-B
	DM-DDB-B	Device Management-Dynamic Device Binding-B
	DM-DOB-B	Device Management-Dynamic Object Binding-B
	DM-DCC-B	Device Management-Device Communication Control-B
	DM-RD-B	Device Management-Reinitialize Device-B
	DM-BR-B	Device Management-Backup and Restore-B
	DM-OCD-B	Device Management-Object Creation and Deletion-B

Hardware Inputs

Analog

- Air velocity sensor
- Room temperature sensor
- Room temperature setpoint dial (optional)

Digital

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

Hardware Outputs

Analog

- Spare AO 1, AO 2, and AO 3 (0-10V)

Digital

- Autozero Module (optional)
- Damper actuator
- Stage 1 electric reheat or, 2-position heating valve
- Stage 2 electric reheat (optional)
- Stage 3 electric reheat (optional)

Ordering Notes

550-498P	Siemens BACnet PTEC Constant Volume Controller

Sequence of Operation

The following paragraphs present the sequence of operation for Application 6562 -- Constant Volume with Electric Reheat.

Control Temperature Setpoints

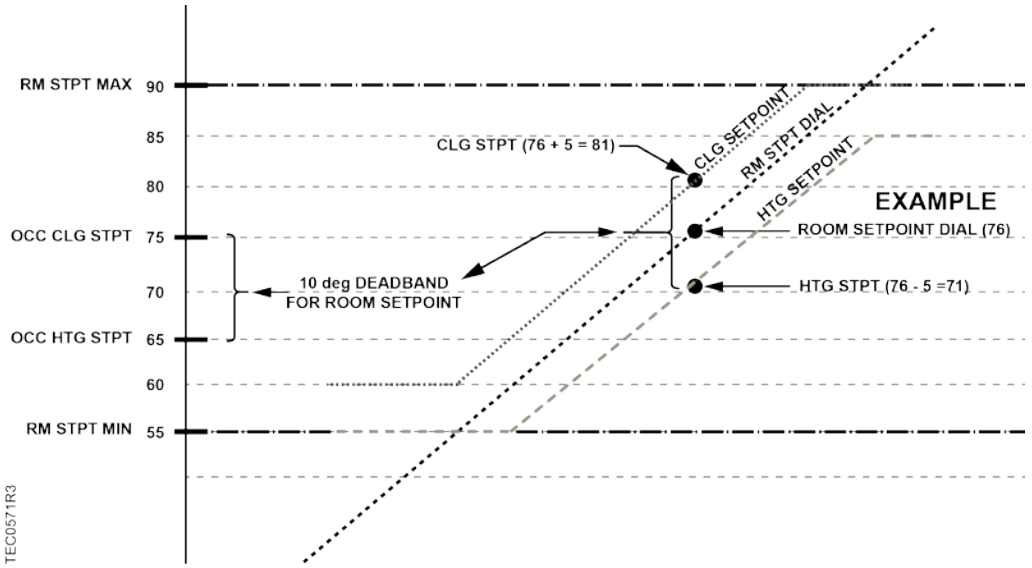
Depending on the controller's current operational mode (occupied or unoccupied), CTL STPT holds the value of one of the following setpoints.

NOTE:
This application will not automatically switch between heating and cooling. If a seasonal switchover (for example, summer to winter) is to occur, the field panel must command HEAT.COOL. This allows the controller to use the appropriate setpoints for the season.

Occupied Mode – CTL STPT holds the value of OCC CLG STPT in cooling mode and OCC HTG STPT in heating mode. If the room temperature sensor has a setpoint dial and STPT DIAL = YES, CTL STPT holds the value of RM STPT DIAL.

If the setpoint dial is used and RM STPT DIAL < RM STPT MIN, CTL STPT holds the value of RM STPT MIN. If RM STPT DIAL > RM STPT MAX, CTL STPT holds the value of RM STPT MAX.

Unoccupied Mode – CTL STPT holds the value of UOC CLG STPT in cooling mode and UOC HTG STPT in heating mode. The setpoint dial is not used in unoccupied mode.



Occupied and Unoccupied Modes

The occupied/unoccupied status of the space is determined by the status of OCC.UNOCC. The control of this point differs depending on whether the controller is monitoring the status of a wall switch or if the controller is connected to a field panel.

When a wall switch is physically connected to the termination strip on the controller at DI 2 and WALL SWITCH = YES, the controller monitors the status of DI 2. When the status of DI 2 is ON (the switch is closed), OCC.UNOCC will be set to OCC indicating that the controller is in occupied mode. When the status of DI 2 is OFF (the switch is open), OCC.UNOCC will be set to UNOCC indicating that the controller is in unoccupied 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, the controller stays in occupied mode all the time. If the controller is operating with centralized control (connected to a field panel), the field panel can send an operator or PPCL command to override the status of OCC.UNOCC. See the APOGEE Powers Process Control Language (PPCL) User's Manual (125-1896) and the APOGEE P2 ALN Field Panel User's Manual (125-3019) or the APOGEE BACnet ALN Field Panel User's Manual (125-3020) (125-3019 or 125-3020) for more information.

Unoccupied 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, then by pressing the override switch, a room occupant can reset the controller to occupied mode for the length of time set in OVRD TIME. The status of UNOCC OVRD changes to OCC and remains there until OVRD TIME elapses, at which point UNOCC OVRD changes back to UNOCC and the controller returns to unoccupied mode.

NOTE:
Only during unoccupied mode (MODE = Unoccupied) can a room sensor’s override switch set the controller to occupied mode; if MODE equals anything other than Unoccupied, UNOCC OVRD will equal UNOCC.

Control Loops

Flow Loop – maintains the point FLOW STPT by modulating the supply air damper point, DMPR COMD. The flow loop maintains the airflow at either OCC FLOW or UNOCC FLOW depending on the value of OCC.UNOCC.

FLOW is the input value for the flow loop. It is calculated as a percentage based on where AIR VOLUME is between 0 cfm (LPS) and OCC FLOW. In the following text, this percentage is referred to as % flow.

- If AIR VOLUME equals 0 cfm (LPS), then FLOW is 0% flow.
- If AIR VOLUME equals OCC FLOW, then FLOW is 100% flow.

The FLOW STPT percentage that corresponds to UNOCC FLOW is calculated as: (UNOCC FLOW ÷ OCC FLOW) × 100% flow.

Example

If UNOCC FLOW = 250 cfm, and if OCC FLOW = 1000 cfm

then, in unoccupied mode the FLOW STPT

= (250 cfm ÷ 1000 cfm) × 100% flow
= 0.25 × 100% flow
= 25% flow

Since 25% of 1000 cfm equals 250 cfm, the flow setpoint in unoccupied mode will be 25%.

UNOCC FLOW can be set less than or equal to, but not greater than OCC FLOW.

Temperature Loop – The temperature loop will modulate HTG LOOPOUT and control the heating elements in order to maintain the room temperature in both heating and cooling modes.

Electric Reheat

⚠ CAUTION

Verify that the equipment is supplied with safeties by others, to ensure there is airflow across the heating coils when they are to be energized.

The heating loop controls up to three stages of electric reheat to warm up the room. The electric reheat is time modulated using a duty cycle as shown in the following example.

When the controller is in cooling mode, the electric heat is OFF at all times.

Example

If the duty cycle is 10 minutes (STAGE TIME = 10 minutes), and the heating loop is calling for 60% of heating (HTG LOOPOUT = 60%) for every 10-minute period, the stages of electric auxiliary heat cycle are as follows:

	Stage 1: minutes		Stage 2: minutes		Stage 3: minutes	
	ON	OFF	ON	OFF	ON	OFF
With 1 stage of electronic heat	6	4	--	--	--	--
With 2 stages of electric heat	10	0	2	8	--	--
With 3 stages of electric heat	10	0	8	2	0	10

Calibration

Calibration of the controller's internal air velocity sensor(s) is periodically required to maintain accurate air velocity readings. CAL SETUP is set with the desired calibration option during controller startup.

Depending on the value of CAL SETUP, calibration may be set to take place automatically or manually. If CAL AIR = YES, calibration is in progress.

NOTE:
The first time after startup or initialization, the controller will calibrate the dampers as if not using Autozero Modules, although the Autozero Modules will be activated. All subsequent calibrations will use the Autozero Modules only.

At the end of a calibration sequence, CAL AIR automatically returns to NO. A status of NO indicates that the controller is not in a calibration sequence.

The Autozero Module is enabled when it is wired to DO 6 and CAL MODULE is set to YES.

Floating Control Actuation Auto-correct

In addition to the existing options for floating control actuator full stroke actions, all floating control actuators are provided with additional logic to fully drive open or closed when commanded to 100% or 0%.

Electric Heat Interlock

Terminal unit heat stages:

The electric heat stages will be enabled as long as FLOW > EHEAT FLOW. The electric heat stages will not be disabled (turned OFF) until FLOW < EHEAT FLOW - 5%. Once disabled, FLOW must become greater than EHEAT FLOW before the electric heat stages will return to normal control.

	⚠ CAUTION
	Do not set EHEAT FLOW to less than 5%; otherwise, the electric heat interlock will be disabled.

AI 4/AI 5 OFFSET (Optional)

AI 4 OFFSET works like RMTMP OFFSET. It can be used to calibrate AI 4 aux temp sensor input if necessary. The actual temperature plus AI 4 OFFSET will equal AI 4 display temperature.

AI 5 OFFSET works the same as AI 4 OFFSET.

Room Unit Operation

Stat Supervision

STAT SUPV is a configurable, enumerated point (values are additive). This point tells the controller how to handle loss of data when used with a digital room unit.

Room Temperature

- When the digital room unit (Series 2200/2300) is used, STAT SUPV enables loss of communication indication:

  - Temperature sensing with a value of 1.
  - Relative humidity sensing with a value of 2.
  - CO2 sensing with a value of 4.
- Communication for Series 2200 sensor baud rate must be set to 1200.
- When the analog room unit (Series 1000/2000) is used, default temperature sensing (0) is enabled (relative humidity and CO2 sensing are not available and should not be selected).

Other Inputs (only available on Digital Room Unit)

- Use the following table to enable communications supervision of room temperature, relative humidity or CO2 for additive values of 2 or 4.

STAT SUPV Value * (additive)	Description (include values to enable feature)
1	Room temperature sensing
2	Relative Humidity (RH) sensing
4	CO_2 sensing

⚠ CAUTION

Digital Room Units that have the RH and/or the CO2 feature will always update the present value and put the associated points (RM TEMP, RM RH, and RM CO2) in override mode, preventing external (or PPCL) commands from being used. STAT SUPV is only provided to allow these points to report a FAIL mode when the room unit fails to update these points.

If an alternative source is selected you must insure that the room unit is not provided with the same sensor option.

See *Sensors and Transducers Configuration and Sizing* for part numbers and ordering information.

Room CO2

RM CO2 displays the CO_2 value in units of parts-per-million (PPM). RM CO2 can be used with PPCL in the PTEC controller or unbundled for control or monitoring purposes.

Room RH

RM RH displays the relative humidity value in percent. RM RH can be used for PPCL in the PTEC or unbundled for control or monitoring purposes.

Fail Mode Operation

If the air velocity sensor fails, the controller determines the status of FAIL MODE and positions the damper accordingly. If FAIL MODE = OPEN and the velocity sensor fails, the damper will open. If FAIL MODE = CLOSED (the default) and the velocity sensor fails, the damper will close.

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

Application Notes

- If temperature swings in the room are excessive or there is trouble maintaining the room temperature setpoint, the temperature loop needs to be tuned.
- If FLOW is oscillating while FLOW STPT is constant, then the flow loop requires tuning.
- 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.
- Spare DOs can be used as auxiliary points that are controlled by the field panel after being defined in the field panel's database. The combination of DO 3 and DO 4 may be used as auxiliary motor points. If using a pair of spare DOs to control a motor, you must unbundle the corresponding motor command point.
- Spare DOs can be used as auxiliary points that are controlled by the field panel after being defined in the field panel's database. DO 3 (HEAT STAGE 1), DO 4 (HEAT STAGE 2), and DO 5 (HEAT STAGE 3) control the stages of electric heat. If less than three stages are being controlled by the application, the DOs that are not used will be spare. If DO 6 is not used for an Autozero Module, it will be a spare.

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

Wiring Diagrams

⚠ CAUTION

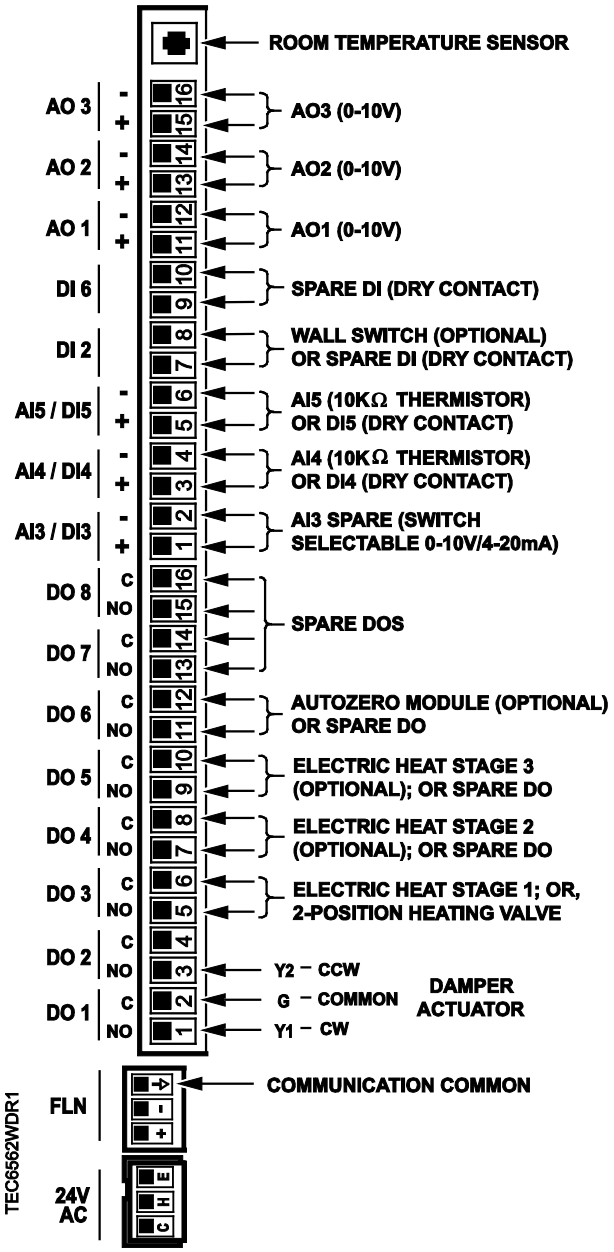
The controller’s DOs control 24 Vac loads only. The maximum rating is 12 VA for each DO. An external interposing relay is required for any of the following:

• 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 6562 – Constant Volume with Electric Reheat.

Application 6562 Point Database

Object Type	Object Number	Object Name Descriptor	Factory Defaults (SI Units)	Eng Units (SI Units)	Range	Active Text	Inactive Text
AO	1	CTLR ADDRESS	99	--	0-255	--	--
AO	2	APPLICATION	6594	--	0-32767	--	--
AI	{04}	ROOM TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	--	--
BO	{05}	HEAT.COOL	COOL	--	Binary	HEAT	COOL
AO	{06}	OCC CLG STPT	70.0 (21.20888)	DEG F (DEG C)	48-111.75	--	--
AO	{07}	OCC HTG STPT	70.0 (21.20888)	DEG F (DEG C)	48-111.75	--	--
AO	{08}	UOC CLG STPT	65.0 (18.40888)	DEG F (DEG C)	48-111.75	--	--
AO	{09}	UOC HTG STPT	65.0 (18.40888)	DEG F (DEG C)	48-111.75	--	--
AO	{11}	RM STPT MIN	55.0 (12.80888)	DEG F (DEG C)	48-111.75	--	--
AO	{12}	RM STPT MAX	90.0 (32.40888)	DEG F (DEG C)	48-111.75	--	--
AI	{13}	RM STPT DIAL	74.0 (23.44888)	DEG F (DEG C)	48-111.75	--	--
BO	{14}	STPT DIAL	NO	--	Binary	YES	NO
AI	{15}	AUX TEMP AI5	74.0 (23.495556)	DEG F (DEG C)	37.5-165	--	--
BO	{18}	WALL SWITCH	NO	--	Binary	YES	NO
BI	{19}	DI OVRD SW	OFF	--	Binary	ON	OFF
AO	{20}	OVRD TIME	0	HRS	0-255	--	--
BO	{21}	UNOCC OVRD	UNOCC	--	Binary	UNOCC	OCC
BI	{24}	DI 2	OFF	--	Binary	ON	OFF
BI	{25}	DI 3	OFF	--	Binary	ON	OFF
BO	{29}	OCC.UNOCC	OCC	--	Binary	UNOCC	OCC
AO	{31}	UNOCC FLOW	220 (103.818)	CFM (LPS)	0-131068	--	--
AO	{32}	OCC FLOW	2200 (1038.18)	CFM (LPS)	0-131068	--	--

Object Type	Object Number	Object Name Descriptor	Factory Defaults (SI Units)	Eng Units (SI Units)	Range	Active Text	Inactive Text
AI	{35}	AIR VOLUME	0 (0.0)	CFM (LPS)	0-131068	--	--
AO	{36}	FLOW COEFF	1	--	0-2.55	--	--
BO	{40}	FAIL MODE	OPEN	--	Binary	CLOSED	OPEN
BO	{41}	DO 1	OFF	--	Binary	ON	OFF
BO	{42}	DO 2	OFF	--	Binary	ON	OFF
BO	{43}	HEAT STAGE 1	OFF	--	Binary	ON	OFF
BO	{44}	HEAT STAGE 2	OFF	--	Binary	ON	OFF
BO	{45}	HEAT STAGE 3	OFF	--	Binary	ON	OFF
BO	{46}	DO 6	OFF	--	Binary	ON	OFF
BO	{47}	DO 7	OFF	--	Binary	ON	OFF
AO	{48}	DMPR COMD	0	PCT	0-102	--	--
AO	{49}	DMPR POS	0	PCT	0-102	--	--
BO	{50}	DO 8	OFF	--	Binary	ON	OFF
AO	{51}	MTR1 TIMING	95	SEC	0-511	--	--
AO	{56}	DPR1 ROT ANG	90	--	0-255	--	--
AO	58	MTR SETUP	0	--	0-255	--	--
AO	59	DO DIR. REV	0	--	0-255	--	--
AO	{60}	EHEAT FLOW	20	PCT	0-102	--	--
AO	{67}	HTG P GAIN	10.0 (18.0)	--	0-63.75	--	--
AO	{68}	HTG I GAIN	0.012 (0.0216)	--	0-1.023	--	--
AO	{69}	HTG D GAIN	0 (0.0)	--	0-510	--	--
AO	{70}	HTG BIAS	0	PCT	0-102	--	--
AO	{71}	FLOW P GAIN	0.25	--	0-51.15	--	--
AO	{72}	FLOW I GAIN	0.018	--	0-1.023	--	--
AO	{73}	FLOW D GAIN	0	--	0-510	--	--
AO	{74}	FLOW BIAS	50	PCT	0-102	--	--

Object Type	Object Number	Object Name Descriptor	Factory Defaults (SI Units)	Eng Units (SI Units)	Range	Active Text	Inactive Text
AO	{75}	FLOW	0	PCT	0-1023.75	--	--
AO	{78}	CTL TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	--	--
AO	{80}	HTG LOOPOUT	0	PCT	0-255	--	--
AO	{81}	AVG HEAT OUT	0	PCT	0-32767	--	--
AI	{82}	STAGE MAX	90	PCT	48-111.75	--	--
BO	{83}	STAGE MIN	10	PCT	Binary	--	--
AO	{84}	DMPR STATUS	CAL	--	48-111.75	RECAL	CAL
AO	{87}	CAL MODULE	NO	--	48-111.75	YES	NO
AO	{88}	STAGE COUNT	3	--	48-111.75	--	--
AO	{89}	STAGE TIME	10	MIN	48-111.75	--	--
AO	{91}	TOTAL VOLUME	0 (0)	CF (L)	48-111.75	--	--
AO	{92}	CTL STPT	74.0 (23.44888)	DEG F (DEG C)	48-111.75	--	--
AI	{93}	FLOW STPT	0	PCT	48-111.75	--	--
BO	{94}	CAL AIR	NO	--	Binary	YES	NO
AI	{95}	CAL SETUP	4	--	37.5-165	--	--
BO	{96}	CAL TIMER	12	HRS	Binary	--	--
BI	{97}	DUCT AREA	1.0 (0.09292)	SQ. FT (SQ M)	Binary	--	--
AO	{98}	LOOP TIME	5	SEC	0-255	--	--
BO	{99}	ERROR STATUS	0	--	Binary	--	--
BI	{102}	AOV 1	0	VOLTS	Binary	--	--
BI	{103}	AOV 2	0	VOLTS	Binary	--	--
BO	{104}	AOV 3	0	VOLTS	Binary	--	--
AO	{105}	AI 3	0	PCT	0-131068	--	--
AO	{106}	AI 4	74.0 (23.495556)	DEG F (DEG C)	0-131068	--	--
AI	{107}	RMTMP OFFSET	0.0 (0.0)	DEG F (DEG C)	0-131068	--	--
AO	{108}	DI 4	OFF	--	0-2.55	ON	OFF
BO	{109}	DI 5	OFF	--	Binary	ON	OFF

Object Type	Object Number	Object Name Descriptor	Factory Defaults (SI Units)	Eng Units (SI Units)	Range	Active Text	Inactive Text
BO	{110}	DI 6	OFF	--	Binary	ON	OFF
BO	{122}	AI 4 OFFSET	0.0 (0.0)	DEG F (DEG C)	Binary	--	--
BO	{123}	AI 5 OFFSET	0.0 (0.0)	DEG F (DEG C)	Binary	--	--
BO	{124}	STAT SUPV	0	--	Binary	--	--
BO	{125}	RM CO2	1000	PPM	Binary	--	--
BO	{126}	RM RH	50	PCT	Binary	--	--
BO	{127}	PPCL STATE	EMPTY	--	Binary	LOADED	EMPTY

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