Custom Solutions Application 2100: Constant Volume Controller – Electronic Output with Hot Water Reheat, Humidity Control, and Secure Mode

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Custom Solutions Application 2100: Constant Volume Controller – Electronic Output with Hot Water Reheat, Humidity Control, and Secure Mode

Overview

NOTE: For the latest on Custom Solutions Applications and Controllers, visit the Custom Solutions Web site

In Application 2100, 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 modulating a hot water valve for heating, and a humidity valve is modulated for humidification. In order for the application to work properly, the central air-handling unit must provide pre-conditioned air to the terminal box. See Figure 2100-1 and Figure 2100-2.

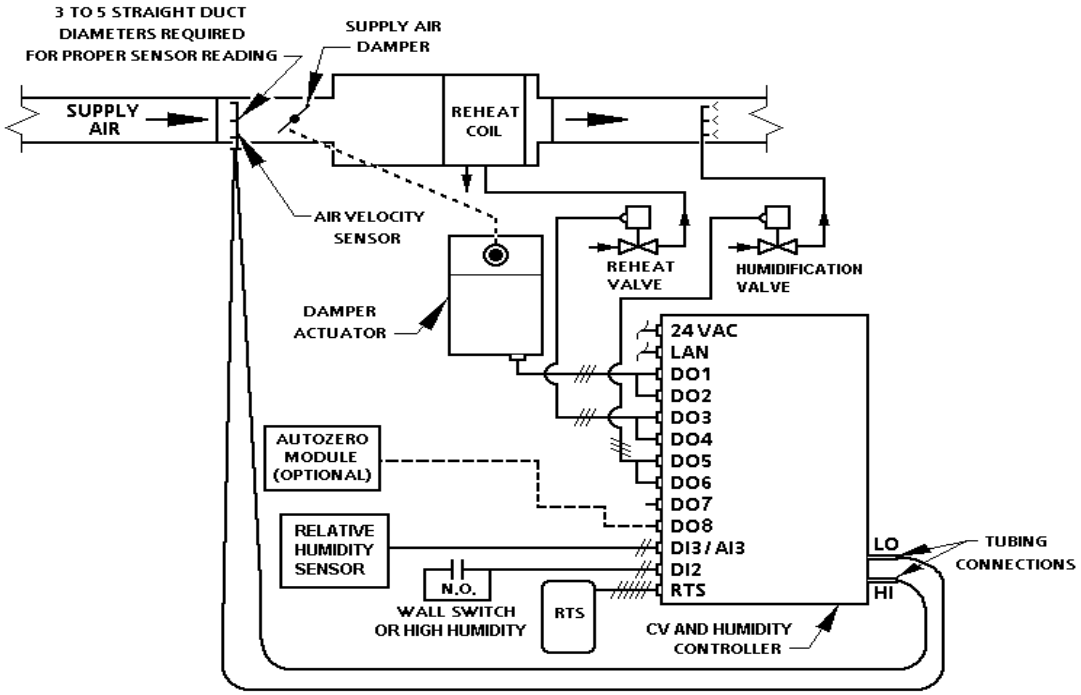
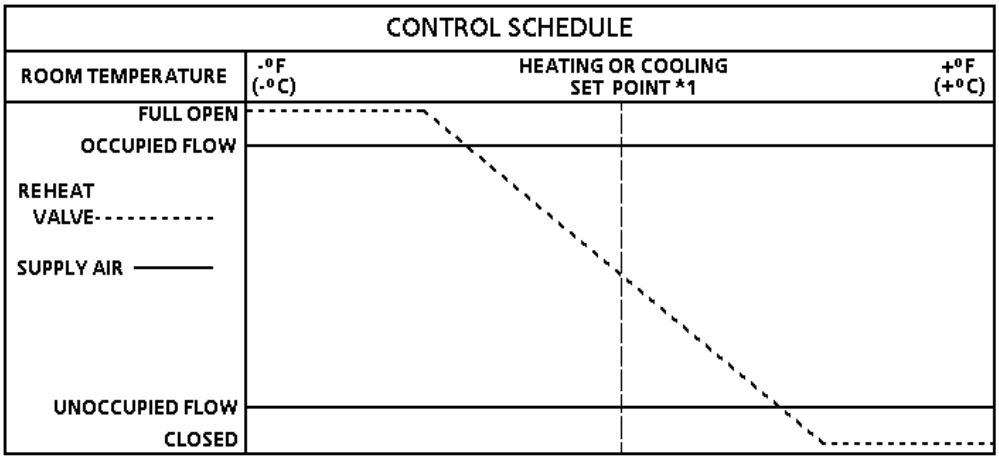


Figure 2100-1. Application 2100 Control Drawing.



See Sequence of Operation, Control Temperature Setpoints.

Figure 2100-2. Application 2100 Control Schedule.

Hardware Inputs

Analog

- Air velocity sensor
- Humidity sensor (0 - 10V or 4 - 20 mA)*
- Room temperature sensor
- Room temperature setpoint dial (optional)

*A 24 Vdc Power Supply is required to drive the input circuit if a 4 - 20 mA sensor is used. See the Installation Instructions for this controller.

Digital

- Night mode override (optional)
- Wall switch or high humidity cut-off (optional)

Hardware Outputs

Analog

- None

Digital

- Autozero Module (optional)
- Damper actuator
- Humidity valve actuator (or PTS-4 from ACT for controlling pneumatic valve)
- Valve actuator

Ordering Notes

Constant Volume Controller – Electronic Output with Hot Water Reheat, Humidity Control, and Secure Mode	540-501C Custom Solution No. 205

Autozero modules should be used in applications if:

- It is not possible, due to operational restrictions, to calibrate the air velocity transducer by fully closing the damper (for example, clean rooms, laboratories).
- A minimum position damper stop is used.

See the *APOGEE Automation Configuration and Sizing Guidelines* on InfoLink for product numbers.

Autozero Module (optional)
Damper Actuator
Humidity Sensor
Humidity Valve Actuator
Terminal Equipment Controller Room Temperature Sensor
Valve Actuator

Point Database

Table 2100-1 presents the point database information for Application 2100. Each point is represented on a line in the point database table.

Secure Mode Operation

Secure Mode prevents unauthorized users from making changes to the TEC through the MMI port or room sensor. This mode can only be enabled/disabled through an Insight command. When Secure Mode is enabled, any attempts to make point changes in the TEC will be rejected and result in an error message indicating that the priority is too low.

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2100, “Constant Volume Controller – Electronic Output with Hot Water Reheat, Humidity Control, and Secure Mode”.

Control Temperature Setpoints

Depending on the controller’s current operational mode (occupied or unoccupied), the control temperature setpoint, CTL STPT (Point 92), holds the value of one of the following setpoints:

NOTE: Application 2100 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 (Point 5). This allows the controller to use the appropriate setpoints for the season.

Occupied Mode – CTL STPT holds the value of OCC CLG STPT (Point 6) in cooling mode and OCC HTG STPT (Point 7) in heating mode. If the room temperature sensor has a setpoint dial and STPT DIAL (Point 14) is set to YES, then CTL STPT holds the value of RM STPT DIAL (Point 13).

If the setpoint dial is used and the value of RM STPT DIAL < RM STPT MIN (Point 11), CTL STPT holds the value of RM STPT MIN. If RM STPT DIAL > RM STPT MAX (Point 12), CTL STPT holds the value of RM STPT MAX.

Unoccupied Mode – CTL STPT holds the value of UOC CLG STPT (Point 8) in cooling mode and UOC HTG STPT (Point 9) in heating mode. The setpoint dial is not used in unoccupied mode.

Room Temperature Offset

Room Temperature Offset, RMTMP OFFSET (Point 3), is a user-adjustable offset that will compensate for deviations between the value of ROOM TEMP (Point 4) and the actual room temperature. This corrected value is displayed in CTL TEMP (Point 78).

CTL TEMP (Point 78) = ROOM TEMP (Point 4) + RMTMP OFFSET (Point 3).

Occupied and Unoccupied Modes

The occupied/unoccupied status of the space is determined by the status of OCC.UNOCC (Point 29). 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 (Point 18) = YES, the controller monitors the status When DI 2 (Point 24) is ON (the switch is closed), OCC.UNOCC will be set to OCC indicating that the controller is in occupied mode. When 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 uses DI 2 as a humidity safety cutoff. See *Fail-safe Operation.*

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 (Point 20), pressing the override switch will set the controller to occupied mode for the time period set in OVRD TIME. The status of UNOCC OVRD (Point 21) changes to OCC. When the override time elapses, the UNOCC OVRD point changes back to UNOCC and the controller returns to unoccupied mode.

The override switch on the room sensor will only affect the controller when in unoccupied mode.

If OCC.UNOCC (Point 29) changes to OCC during the unoccupied override time, the UNOCC OVRD point immediately changes back to UNOCC.

Control Loops

Flow Loop – The flow loop maintains FLOW STPT (Point 93) by modulating the supply air damper, DMPR COMD (Point 48). The flow loop maintains the airflow at either OCC FLOW (Point 32) or UNOCC FLOW (Point 31) depending on the value of OCC.UNOCC.

FLOW (Point 75) is the input value for the flow loop. It is calculated as a percentage based on where AIR VOLUME (Point 35) is between 0 cfm (lps) and OCC FLOW. In the following text, this percentage will be referred to as % flow.

- If AIR VOLUME = 0 cfm (lps), then FLOW is 0% flow.
- If AIR VOLUME = 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 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 = 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 (Point 80) and control the hot water valve in order to maintain the room temperature in both heating and cooling modes.

Humidity Loop – The humidity loop and its associated control algorithm maintain the relative humidity, ROOM RH (Point 15), at its setpoint, ROOM RH STPT (Point 16). The humidity loop itself controls the specific humidity using SPEC HUM (Point 26) and SPH CTL SET (Point 28) by modulating the humidity valve. The specific humidity setpoint is reset to control relative humidity.

Relative humidity is affected by both the quantity of moisture in the air (specific humidity) and the temperature of the air. When the room temperature changes (rises), the relative humidity changes (decreases), even though the amount of moisture in the air stays the same. This is because relative humidity is the percentage ratio between the amount of moisture is in the air and the amount of moisture the air can hold at a particular temperature. When the temperature rises, it is capable of holding more moisture, so the percentage ratio drops.

By controlling specific humidity, some of this interaction between temperature and relative humidity is eliminated. When the temperature setpoint is raised, the specific humidity setpoint is automatically recalculated to a higher level. This new level corresponds to the amount of moisture necessary to keep the relative humidity at its setpoint when the temperature reaches its new setpoint. The result is that both the temperature and the specific humidity will rise at the same time, while the relative humidity will stay constant.

The specific humidity and the specific humidity setpoint are constantly recalculated using the relative humidity and temperature readings and the relative humidity and temperature setpoints.

Hot Water Reheat

The temperature loop modulates the heating valve in order to maintain the room temperature setpoint. The reheat valve will be modulated whenever necessary to maintain the room temperature regardless of the status of HEAT.COOL (Point 5).

Calibration

Air Velocity Transducer – Calibration of the controller's internal air velocity transducer is periodically required to maintain accurate air velocity readings. CAL SETUP (Point 95) is set with the desired calibration option during controller start-up. Depending upon the value of CAL SETUP, calibration may be set to take place automatically or manually. If the status of CAL AIR (Point 94) = YES, then calibration is in progress.

- For a controller used without an Autozero Module (CAL MODULE (Point 87) = NO), the damper is commanded closed to get a zero airflow reading during calibration.
- For a controller used with an Autozero Module (CAL MODULE = YES), calibration occurs without closing the damper.

NOTE: The first time after start-up or initialization, the controller will calibrate the damper as if not using an Autozero Module, although the Autozero Module will be activated. All subsequent calibrations will use the Autozero Module only.

Hot Water and Humidity Valves – Calibration of the valves is done by commanding the valves to closed.

At the end of a calibration sequence, CAL AIR returns to NO automatically. 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 8 and CAL MODULE (Point 87) is set to YES.

Damper Status Operation

Under normal operation, DMPR STATUS (Point 84) = CAL.

However, if using an Autozero Module, it is possible after a period of operation for the calculated damper position, DMPR POS (Point 49), to differ from the actual (physical) damper position.

If this occurs, the controller will *automatically* compensate for any difference by setting DMPR STATUS to RECAL which readjusts the value of DMPR POS. DMPR STATUS will be set to RECAL if all of the following conditions are met:

DMPR POS = 100%

Air velocity (AIR VOLUME (Point 35) ÷ DUCT AREA (Point 97)) > 200 fpm

FLOW (Point 75) < FLOW STPT (Point 93)

-or-

DMPR POS = 0%

Air velocity (AIR VOLUME ÷ DUCT AREA) > 200 fpm

FLOW > FLOW STPT

If DMPR STATUS has been changed to RECAL in response to one of the conditions described above, then do one of the following:

1. If flow is now being properly controlled, then set DMPR STATUS to CAL and release it.
2. If flow is still not being properly controlled (one of the conditions described above is still present) or if it is important that the damper position be accurate, then initialize the controller.

If these steps do not fix the problem of maintaining flow, then a mechanical problem might exist.

Temperature and Humidity Interaction Protection

Under most conditions the interaction between temperature and relative humidity is prevented because specific humidity is used as the loop input instead of relative humidity (see *Control Loops*). Occasionally, additional protections are needed to prevent potentially hazardous conditions.

In some circumstances, the temperature loop is held constant while the humidity loop operates. In other circumstances, the humidity loop is held constant while the temperature loop operates. This protection only takes place when allowing both loops to operate simultaneously may lead to dangerously high or low relative humidity levels.

The temperature loop is held still under the following conditions:

1. **Temperature and humidity are low:** The temperature and humidity setpoints are raised or the temperature setpoint is raised and the relative humidity is below its setpoint by RH LIMIT (Point 83) or more.

   If both loops are allowed to operate, the temperature loop may move faster than the humidity loop, which would cause the relative humidity to dip to unacceptably low levels.

2. **Temperature and humidity are high:** The temperature and humidity setpoints are lowered or the temperature setpoint is lowered and the relative humidity is above its setpoint by RH LIMIT (Point 83) or more.

   If both loops are allowed to operate, the temperature loop may move faster than the humidity loop, which would cause the relative humidity to rise to unacceptably high levels.

The humidity loop is held constant under the following conditions (these are more rare):

1. Temperature is low and humidity is high, both temperature and humidity setpoints are raised, and the relative humidity setpoint, although it has been raised, is still far below the relative humidity.

   It is possible that the specific humidity needs to increase to meet the new setpoint requirements, although the relative humidity needs to decrease. The humidity loop is held constant until the relative humidity is within RH LIMIT of the relative humidity setpoint to prevent the relative humidity from going even higher. This condition might occur in the winter on a night-to-day changeover.

2. Temperature is high and humidity is low, both temperature and humidity setpoints are lowered, and the relative humidity setpoint, although it has been lowered, is still far above the relative humidity.

   It is possible that the specific humidity needs to decrease to meet the new setpoint requirements, although the relative humidity needs to increase. The humidity loop is held constant until either the temperature reaches its setpoint, or the relative humidity is within RH LIMIT of the relative humidity setpoint to prevent the relative humidity from dropping any further.

Fail-safe Operation

If the air velocity sensor fails, then the controller determines the status of FAIL MODE (Point 40) and positions the damper accordingly. If FAIL MODE = OPEN and the velocity sensor fails, then the damper will open. If FAIL MODE = CLOSED (the default) and the velocity sensor fails, then the damper will close.

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

If WALL SWITCH (Point 18) is set to NO, and DI2 is closed, the humidity valve will be closed and the humidity loop suspended to prevent wind-up. DI 2 is used to indicate high duct humidity or low duct flow.

If AIR VOLUME (Point 35) falls below the value held in LOW FLOW (Point 30), the humidity valve will be closed to prevent condensation in the duct. The air volume must then rise above the value held in UNOCC FLOW (Point 31) for the humidity control to be re-enabled.

Application Notes

1. If temperature swings in the room are excessive or if there is trouble maintaining the room temperature setpoint, the temperature loop needs to be tuned. If FLOW (Point 73) is oscillating while FLOW STPT (Point 93) is constant, the flow loop requires tuning. See the *iKnow Troubleshooting Tool* for more information.
2. The Constant Volume and Humidity Controller – Electronic Output, as shipped from the factory, keeps all associated equipment OFF. See the *Equipment Controllers* section in the *APOGEE Automation Start-up Procedures* on InfoLink for information on how to release the controller and its equipment to application control.
3. Spare DOs can be used as auxiliary points that are controlled by the field panel after being defined in the field panel's database. If not using a heating valve, the combination of DO 3 and DO 4 may be used as auxiliary motor points. If using this pair of spare DOs to control a motor, you must unbundle VLV COMD (Point 52) and set MTR SETUP (Point 58) as described in the *Start-up* document for this application.

Wiring Diagram

CAUTION:

The Controller's DOs control 24 Vac loads only. The maximum rating is 12 VA for each DO. Use an interposing 220V 4-relay module 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

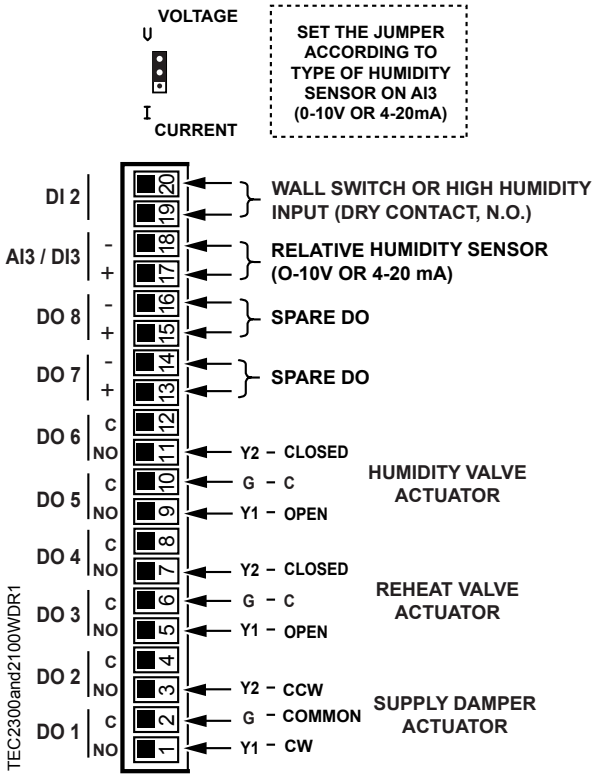


Figure 2100-3. Application 2100 Wiring Diagram.

CAUTION:

IMPORTANT! If a 4 - 20 mA sensor is used at AI 3, special wiring precautions must be followed. See Figure 2100-4.

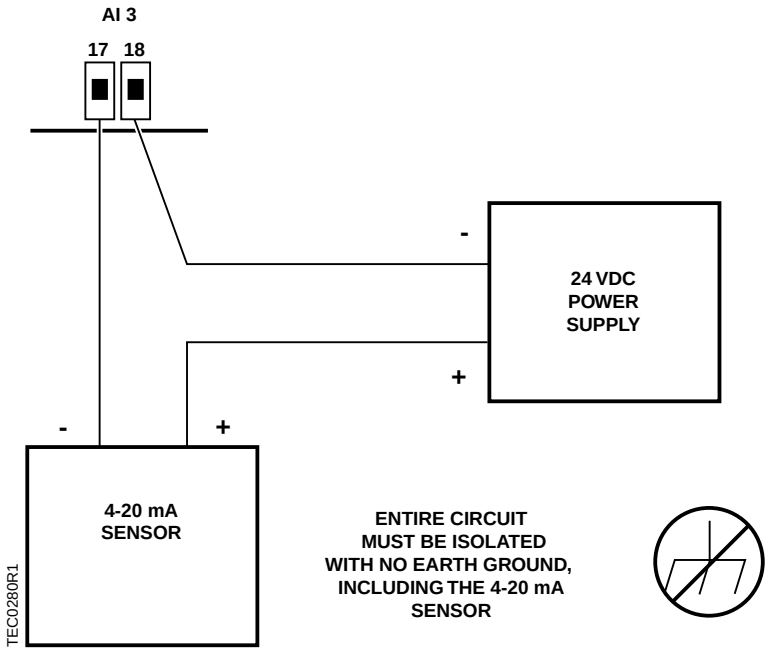


Figure 2100-4. Special Wiring Requirements if 4 - 20 mA Sensor Used at AI 3.

CAUTION:

You **CANNOT** use the same transformer to power the TEC and the 4 - 20 mA sensor(s). A **SEPARATE** power supply is required for the 4 - 20 mA sensor(s).

Table 2100-1. Point Database for Application 2100.

Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
01	CTLR ADDRESS	99	–	1	0	–	–
02	APPLICATION	2190	–	1	0	–	–
03	RMTMP OFFSET	0.0 (0.0)	DEG F (DEG C)	0.25 (0.14)	-31.75 (-17.78)	–	–
{04}	ROOM TEMP	74.0 (23.449)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
{05}	HEAT.COOL	COOL	–	–	–	HEAT	COOL
06	OCC CLG STPT	70.0 (21.209)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
07	OCC HTG STPT	70.0 (21.209)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
08	UOC CLG STPT	65.0 (18.409)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
09	UOC HTG STPT	65.0 (18.409)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
11	RM STPT MIN	55.0 (12.809	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
12	RM STPT MAX	90.0 (32.409)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
{13}	RM STPT DIAL	74.0 (23.449)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
14	STPT DIAL	NO	–	–	–	YES	NO
{15}	ROOM RH	29.2	PCT	0.4	0.0	–	–
{16}	ROOM RH STPT	50.0	PCT	0.4	0.0	–	–
18	WALL SWITCH	NO	–	–	–	YES	NO
{19}	DI OVRD SW	OFF	–	–	–	ON	OFF
20	OVRD TIME	0	HRS	1	0	–	–
{21}	UNOCC OVRD	UNOCC	–	–	–	UNOCC	OCC
{24}	DI 2	OFF	–	–	–	ON	OFF
{25}	DI 3	OFF	–	–	–	ON	OFF
{26}	SPEC HUM	0.0	–	0.1	0.0	–	–
{27}	SPEC HUM SET	50.0	–	0.1	0.0	–	–
{28}	SPH CTL SET	50.0	–	0.1	0.0	–	–

1. Points not listed are not used in this application.
2. A single value in a column means that the value is the same in English units and in SI units.
3. Point numbers that appear in brackets {} may be unbundled at the field panel.

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Table 2100-1. Point Database for Application 2100.

Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
{29}	OCC.UNOCC	OCC	–	–	–	UNOCC	OCC
30	LOW FLOW	220 (103.818)	CFM (LPS)	4 (1.888)	0	–	–
{31}	UNOCC FLOW	220 (103.818)	CFM (LPS)	4 (1.888)	0	–	–
{32}	OCC FLOW	2200 (1038.18)	CFM (LPS)	4 (1.888)	0	–	–
{35}	AIR VOLUME	0 (0.0)	CFM (LPS)	4 (1.888)	0	–	–
36	FLOW COEFF	1.0	–	0.01	0.0	–	–
{37}	HMD VLV CMD	0.0	PCT	0.4	0.0	–	–
{38}	HMD VLV POS	0.0	PCT	0.4	0.0	–	–
39	MTR3 TIMING	90	SEC	1	0	–	–
40	FAIL MODE	CLOSED	–	–	–	CLOSED	OPEN
{41}	DO 1	OFF	–	–	–	ON	OFF
{42}	DO 2	OFF	–	–	–	ON	OFF
{43}	DO 3	OFF	–	–	–	ON	OFF
{44}	DO 4	OFF	–	–	–	ON	OFF
{45}	DO 5	OFF	–	–	–	ON	OFF
{46}	DO 6	OFF	–	–	–	ON	OFF
{47}	DO 7	OFF	–	–	–	ON	OFF
{48}	DMPR COMD	0.0	PCT	0.4	0.0	–	–
{49}	DMPR POS	0.0	PCT	0.4	0.0	–	–
{50}	DO 8	OFF	–	–	–	ON	OFF
51	MTR1 TIMING	90	SEC	1	0	–	–
{52}	VLV COMD	0.0	PCT	0.4	0.0	–	–
{53}	VLV POS	0.0	PCT	0.4	0.0	–	–
54	AI3 VOLT.CUR	VOLT	–	–	–	CURENT	VOLT
55	MTR2 TIMING	90	SEC	1	0	–	–
56	DPR1 ROT ANG	90	–	1	0	–	–
58	MTR SETUP	0	–	1	0	–	–

1. Points not listed are not used in this application.
2. A single value in a column means that the value is the same in English units and in SI units.
3. Point numbers that appear in brackets {} may be unbundled at the field panel.

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Table 2100-1. Point Database for Application 2100.

Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
59	DO DIR.REV	0	–	1	0	–	–
65	HTG P GAIN	10.0 (18.0)	–	0.25 (0.45)	0.0	–	–
66	HTG I GAIN	0.012 (0.022)	–	0.001 (0.0018)	0.0	–	–
67	HTG D GAIN	0 (0.0)	–	2 (3.6)	0	–	–
68	HTG BIAS	0.0	PCT	0.4	0.0	–	–
69	FLOW P GAIN	0.0	–	0.05	0.0	–	–
70	FLOW I GAIN	0.018	–	0.001	0.0	–	–
71	FLOW D GAIN	0	–	2	0	–	–
72	FLOW BIAS	50.0	PCT	0.4	0.0	–	–
{73}	FLOW	0.0	PCT	0.25	0.0	–	–
74	SPH P GAIN	5.0 (9.0)	–	0.25 (0.45)	0.0	–	–
75	SPH I GAIN	0.005 (.009)	–	0.001 (0.0018)	0.0	–	–
76	SPH D GAIN	0 (0.0)	–	2 (3.6)	0	–	–
77	SPH BIAS	0.0	PCT	0.4	0.0	–	–
{78}	CTL TEMP	74.0 (23.449)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
{80}	HTG LOOPOUT	0.0	PCT	0.4	0.0	–	–
83	RH LIMIT	2.0	PCT	0.4	0.0	–	–
{84}	DMPR STATUS	CAL	–	–	–	RECAL	CAL
87	CAL MODULE	NO	–	–	–	YES	NO
{91}	TOTAL VOLUME	0 (0)	CF (L)	4 (113)	0	–	–
{92}	CTL STPT	74.0 (23.449)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
{93}	FLOW STPT	0.0	PCT	0.25	0.0	–	–
{94}	CAL AIR	NO	–	–	–	YES	NO
95	CAL SETUP	4	–	1	0	–	–

1. Points not listed are not used in this application.
2. A single value in a column means that the value is the same in English units and in SI units.
3. Point numbers that appear in brackets {} may be unbundled at the field panel.

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Table 2100-1. Point Database for Application 2100.

Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
96	CAL TIMER	12	HRS	1	0	–	–
97	DUCT AREA	1.0 (0.093)	SQ FT (SQ M)	0.025 (0.002)	0.0	–	–
98	LOOP TIME	5	SEC	1	0	–	–
{99}	ERROR STATUS	0	–	1	0	–	–

1. Points not listed are not used in this application.
2. A single value in a column means that the value is the same in English units and in SI units.
3. Point numbers that appear in brackets {} may be unbundled at the field panel.

Custom Solutions Application 2190: Constant Volume Controller – Electronic Output Slave Mode with Secure Mode

Overview

Application 2190 is the slave mode application for the Constant Volume Controller – Electronic Output with Hot Water Reheat, Humidity Control, and Secure Mode (P/N 540-501C, Custom Solution No. 205). Slave mode is the default application that comes up when power is first applied to the controller. Slave mode provides no control. Its purpose is to allow the operator to perform equipment checkout before a control application is put into effect and to set some basic controller parameters (CTLR ADDRESS, APPLICATION, etc.).

Secure Mode Operation

Secure Mode prevents unauthorized users from making changes to the TEC through the MMI port or room sensor. This mode can only be enabled/disabled through an Insight command. When Secure Mode is enabled, any attempts to make point changes in the TEC will be rejected and result in an error message indicating that the priority is too low.

Using Auxiliary Points

It is possible to have extra points available on a Constant Volume Controller – Electronic Output in addition to the ones used by the current application that is running in the controller. If these extra points are to be controlled by a field panel, they must be unbundled at the field panel.

Using the Controller as a Point Extension Device

If the controller is used *only* as a point extension device, with no control application in effect, its application must be set to slave mode *and* the points must be unbundled at the field panel. All of these points must be controlled from the field panel in order to be used. See for point database information.

All Digital Outputs (DOs) may be used as separate DOs. They may also be used in pairs, (DO 1 and DO 2), (DO 3 and DO 4), and (DO 5 and DO 6), to control a motor as shown in the example.

NOTE: If using either a motor or DOs as auxiliary points, be sure to set MTR SETUP (Point 58) to the correct value. See Table 2190-1. If using a pair of DOs to control a motor, the DOs cannot be unbundled or commanded separately. Only MTR 1 COMD (Point 48), MTR 2 COMD (Point 52), and MTR3 COMD (Point 37) can be unbundled to control the motors.

Table 2190-1. Motor Enable/Reverse Values for MTR SETUP (Point 58).

	Motor 1 Enabled			**Motor 1 Enabled and Reversed**			**Motor 1 Not Used**		
	Motor 2 Not Used	**Motor 2 Enabled**	**Motor 2 Enabled and Reversed**	**Motor 2 Not Used**	**Motor 2 Enabled**	**Motor 2 Enabled and Reversed**	**Motor 2 Not Used**	**Motor 2 Enabled**	**Motor 2 Enabled and Reversed**
Motor 3 Not Used	1	5	13	3	7	15	0	4	12
Motor 3 Enabled	17	21	29	19	23	31	16	20	28
Motor 3 Enabled and Reversed	49	53	61	51	55	63	48	52	60

Example

If using DO 1 and DO 2 as the physical terminations for a direct acting motor, follow these steps:

1. Set MTR SETUP to **1** to enable the motor.
2. Unbundle MTR 1 COMD at the field panel to command the motor from the field panel.

NOTE: Motor 3 (DOs 5 and 6) is available only in slave mode.

For other combinations of DOs and motors, see the *APOGEE Automation Start-up Procedures* on InfoLink for complete motor enable/reverse procedures.

Table 2190-2. Point Database for Application 2190.

Point Number	Descriptor	Factory Default (SI Units)	Eng. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
01	CTLR ADDRESS	99	–	1	0	–	–
02	APPLICATION	2190	–	1	0	–	–
03	RMTMP OFFSET	0.0 (0.0)	DEG F (DEG C)	0.25 (0.14)	-31.75 (-17.78)	–	–
{04}	ROOM TEMP	74.0 (23.449)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
{13}	RM STPT DIAL	74.0 (23.449)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.889)	–	–
{15}	AUX AI3	74.0 (23.496)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	–	–
18	WALL SWITCH	NO	–	–	–	YES	NO
{19}	DI OVRD SW	OFF	–	–	–	ON	OFF
{24}	DI 2	OFF	–	–	–	ON	OFF
{25}	DI 3	OFF	–	–	–	ON	OFF
{29}	OCC.UNOCC	OCC	–	–	–	UNOCC	OCC
{35}	AIR VOLUME	0 (0.0)	CFM (LPS)	4 (1.888)	0	–	–
36	FLOW COEFF	1.0	–	0.01	0.0	–	–
{37}	MTR3 COMD	0.0	PCT	0.4	0.0	–	–
{38}	MTR3 POS	0.0	PCT	0.4	0.0	–	–
39	MTR3 TIMING	90	SEC	1	0	–	–
{41}	DO 1	OFF	–	–	–	ON	OFF
{42}	DO 2	OFF	–	–	–	ON	OFF
{43}	DO 3	OFF	–	–	–	ON	OFF
{44}	DO 4	OFF	–	–	–	ON	OFF
{45}	DO 5	OFF	–	–	–	ON	OFF
{46}	DO 6	OFF	–	–	–	ON	OFF
{47}	DO 7	OFF	–	–	–	ON	OFF
{48}	MTR1 COMD	0.0	PCT	0.4	0.0	–	–
{49}	MTR1 POS	0.0	PCT	0.4	0.0	–	–
{50}	DO 8	OFF	–	–	–	ON	OFF
51	MTR1 TIMING	90	SEC	1	0	–	–

1. Points not listed are not used in this application.
2. A single value in a column means that the value is the same in English units and in SI units.
3. Point numbers that appear in brackets {} may be unbundled at the field panel.

Continued on next page…

Table 2190-2. Point Database for Application 2190.

{52}	MTR2 COMD	0.0	PCT	0.4	0.0	–	–
{53}	MTR2 POS	0.0	PCT	0.4	0.0	–	–
55	MTR2 TIMING	90	SEC	1	0	–	–
56	DPR1 ROT ANG	90	–	1	0	–	–
57	DPR2 ROT ANG	90	–	1	0	–	–
58	MTR SETUP	0	–	1	0	–	–
59	DO DIR.REV	0	–	1	0	–	–
87	CAL MODULE	NO	–	–	–	YES	NO
{94}	CAL AIR	NO	–	–	–	YES	NO
95	CAL SETUP	4	–	1	0	–	–
96	CAL TIMER	12	HRS	1	0	–	–
97	DUCT AREA	1.0 (0.093)	SQ. FT (SQ M)	0.025 (0.002)	0.0	–	–
{99}	ERROR STATUS	0	–	1	0	–	–

1. Points not listed are not used in this application.
2. A single value in a column means that the value is the same in English units and in SI units.
3. Point numbers that appear in brackets {} may be unbundled at the field panel.