Application 2030: Constant Volume Cooling Only

Overview

In Application 2030, 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. See Figures 2030-1 and 2030-2.

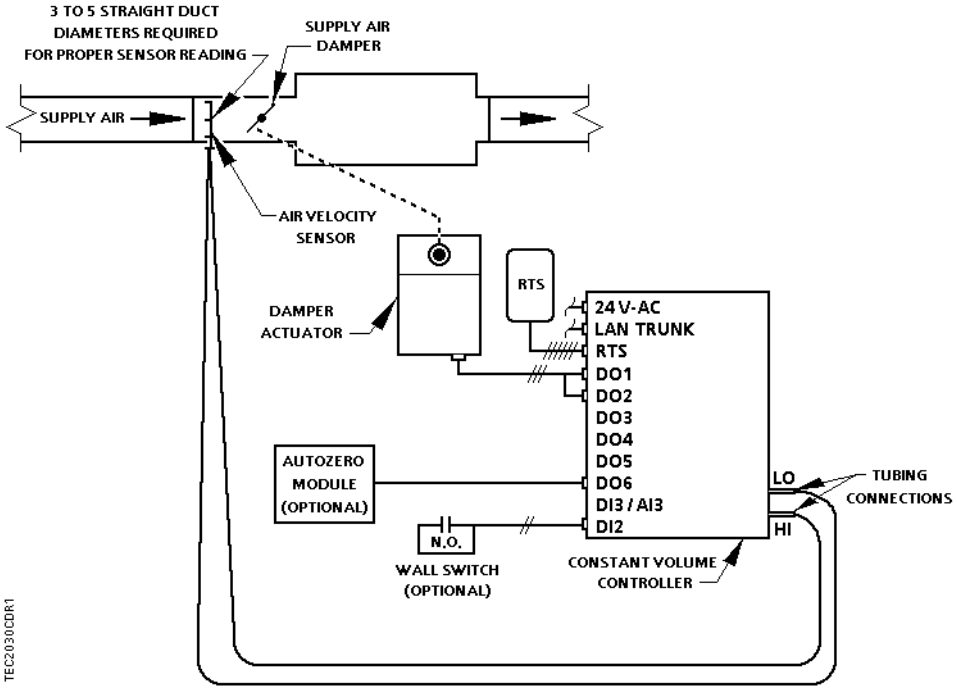

Figure 2030-1. Application 2030 Control Drawing.

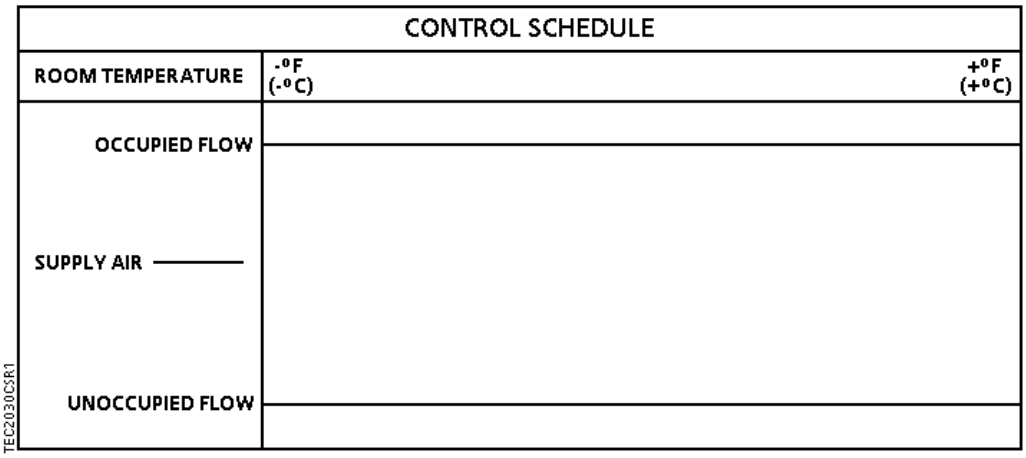

Figure 2030-2. Application 2030 Control Schedule.

Hardware inputs

analog

- air velocity sensor
- room temperature sensor*

*Application 2030 supports a room temperature sensor for monitoring purposes only.

digital

- night mode override (optional)
- wall switch (optional)

Hardware outputs

analog

- none

digital

- Autozero Module (optional)
- damper actuator

Ordering notes

Constant Volume Controller – Electronic Output	540-103
Constant Volume Controller – Electronic Output with Autozero Module**	540-104**

**This controller is used in applications:

- where it is not possible, due to operational restrictions, to calibrate the air velocity transducer by fully closing the damper (e.g., clean rooms, laboratories),
- when a minimum position damper stop is used.

See *System 600 Configuration and Sizing Guidelines* (125-1830) for product numbers.

Autozero Module (optional)

damper actuator

Terminal Equipment Controller room temperature sensor

Point database

Table 2030-1 presents the point database information for Application 2030.

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2030, “Constant Volume Cooling Only”.

Occupied and unoccupied modes

The occupied/unoccupied status of the space is determined by the status of the point 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 (Figures 2030-1 and 2030-3), and WALL SWITCH (Point 18) equals YES, the controller monitors the status of DI 2. When the status of the point DI 2 (Point 24) is ON (the switch is closed), then 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), then OCC.UNOCC will be set to UNOCC indicating that the controller is in unoccupied mode.

When WALL SWITCH equals 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, then the controller stays in occupied mode all the time. If the controller is operating with centralized control (that is, it is connected to a field panel), then the field panel can send an operator or PPCL command to override the status of the point OCC.UNOCC. See *Powers Process Control Language (PPCL) User's Manual* (125-1896) and *Field Panel User's Manual* (125-1895) 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 (Point 20), then by pressing the override switch a room occupant can reset the controller to occupied operational mode for the amount of time that is set in OVRD TIME. The status of UNOCC OVRD (Point 21) changes to OCC. After the override time elapses, the controller returns to unoccupied mode and the status of UNOCC OVRD changes back to UNOCC.

It is only when the controller is in unoccupied mode that the override switch on the room temperature sensor will have any effect on the controller.

Control loops

The flow loop maintains the point FLOW STPT (Point 93) by modulating the supply air damper point, 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 (Point 29).

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 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 equals 250 cfm, and if OCC FLOW equals 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.

Calibration

Calibration of the controller's internal air velocity transducer is periodically required to maintain accurate air velocity readings. The point 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) is 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 dampers as if not using an Autozero Module, although the Autozero Module will be activated. All subsequent calibrations will use the Autozero Module only.

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 6 and CAL MODULE (Point 87) is set to YES.

Damper status operation

Under normal operation DMPR STATUS (Point 84) reads "CAL". However, when using an Autozero Module, it is possible after a period of operation for the calculated damper position point, 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 true:

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 (that is, 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.

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 equals OPEN and the velocity sensor fails, then the damper will open. If FAIL MODE equals CLOSED (the default) and the velocity sensor fails, then the damper will close.

If the room temperature sensor fails, then the controller holds the last known temperature value. In this application, the room temperature is not controlled, it is for monitoring purposes only.

Application notes

1. If FLOW (Point 75) is oscillating while FLOW STPT (Point 93) is constant, then the flow loop requires tuning. See *APOGEE Automation Service Procedures* on InfoLink for more information.

2. The Constant Volume Controller – Electronic Output, as shipped from the factory, keeps all associated equipment OFF. See the *Equipment Controllers* tab in *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. 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 MTR2 COMD (Point 52) and set MTR SETUP (Point 58) as described in the *APOGEE Automation Start-up Procedures* on InfoLink.

Wiring diagram

The point wiring for Application 2030 is shown in Figure 2030-3.

CAUTION:
The Constant Volume Controller controls 24 Vac loads only. The maximum rating is 12 VA for each DO. For higher VA requirements, 110 or 220 Vac requirements, or DC power requirements, use an interposing 220V 4-relay module (P/N 540-147).

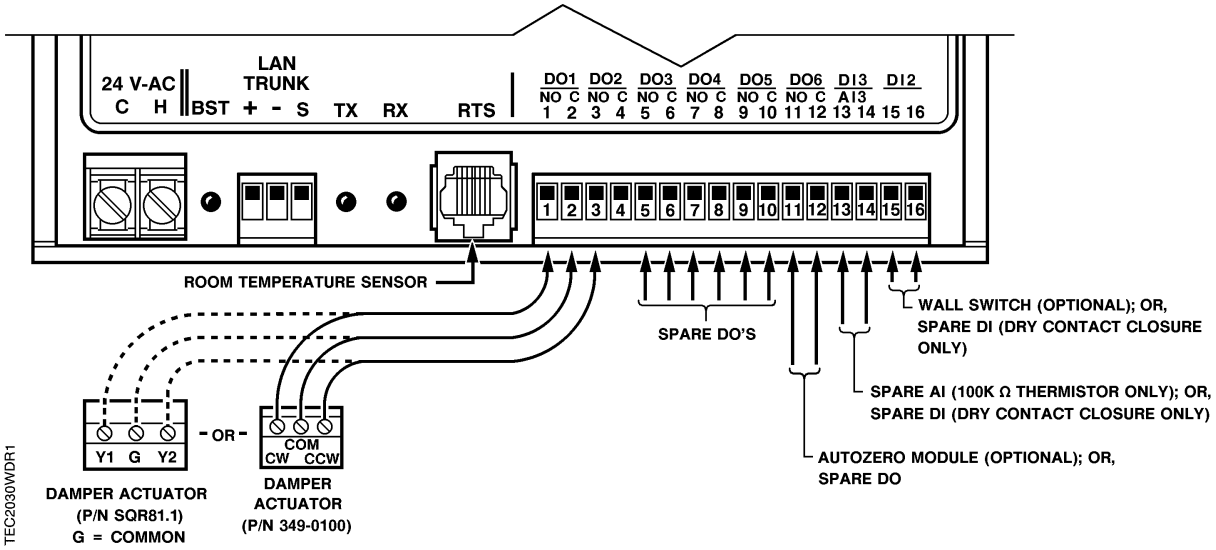

Figure 2030-3. Application 2030 Wiring Diagram.

Table 2030-1. Point Database for Application 2030.

Point Number	Descriptor	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
01	CTLR ADDRESS	99.000	--	1.000	0.000	--	--
02	APPLICATION	2092	--	1.000	0.000	--	--
{04}	ROOM TEMP	74.000 (23.449)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
{15}	AUX TEMP	74.000 (23.496)	DEG F (DEG C)	0.500 (0.280)	37.500 (3.056)	--	--
18	WALL SWITCH	NO	--	--	--	YES	NO
{19}	DI OVRD SW	OFF	--	--	--	ON	OFF
20	OVRD TIME	0.000	HRS	1.000	0.000	--	--
{21}	UNOCC OVRD	UNOCC	--	--	--	UNOCC	OCC
{24}	DI 2	OFF	--	--	--	ON	OFF
{25}	DI 3	OFF	--	--	--	ON	OFF
{29}	OCC.UNOCC	OCC	--	--	--	UNOCC	OCC
{31}	UNOCC FLOW	220.000 (103.818)	CFM (LPS)	4.000 (1.888)	0.000	--	--
{32}	OCC FLOW	2200.000 (1038.180)	CFM (LPS)	4.000 (1.888)	0.000	--	--
{35}	AIR VOLUME	0.000	CFM (LPS)	4.000 (1.888)	0.000	--	--
36	FLOW COEFF	1.000	--	0.010	0.000	--	--
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
{48}	DMPR COMD	0.000	PCT	0.400	0.000	--	--
{49}	DMPR POS	0.000	PCT	0.400	0.000	--	--
51	MTR1 TIMING	95.000	SEC	1.000	0.000	--	--
{52}	MTR2 COMD	0.000	PCT	0.400	0.000	--	--
{53}	MTR2 POS	0.000	PCT	0.400	0.000	--	--
55	MTR2 TIMING	130.000	SEC	1.000	0.000	--	--

NOTES:

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.

Table 2030-1. Point Database for Application 2030.

Point Number	Descriptor	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
56	DPR1 ROT ANG	90.000	--	1.000	0.000	--	--
57	DPR2 ROT ANG	90.000	--	1.000	0.000	--	--
58	MTR SETUP	0.000	--	1.000	0.000	--	--
59	DO DIR.REV	0.000	--	1.000	0.000	--	--
71	FLOW P GAIN	0.250	--	0.050	0.000	--	--
72	FLOW I GAIN	0.018	--	0.001	0.000	--	--
73	FLOW D GAIN	0.000	--	2.000	0.000	--	--
74	FLOW BIAS	50.000	PCT	0.400	0.000	--	--
{75}	FLOW	0.000	PCT	0.250	0.0000	--	--
{78}	CTL TEMP	74.000 (23.449)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
{84}	DMPR STATUS	CAL	--	--	--	RECAL	CAL
87	CAL MODULE	NO	--	--	--	YES	NO
{91}	TOTAL VOLUME	0.000	CF (L)	4.000 (113)	0.000	--	--
{93}	FLOW STPT	0.000	PCT	0.250	0.000	--	--
{94}	CAL AIR	NO	--	--	--	YES	NO
95	CAL SETUP	4.000	--	1.000	0.000	--	--
96	CAL TIMER	12.000	HRS	1.000	0.000	--	--
97	DUCT AREA	1.000 (0.093)	SQ. FT (SQ M)	0.025 (0.002)	0.000	--	--
98	LOOP TIME	5.000	SEC	1.000	0.000	--	--
99	ERROR STATUS	--	--	--	--	--	--

NOTES:

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.