SIEMENS

Controller Start-up for Custom Solutions Application 2436

VAV with 0-10V Series-Fan Speed Output and HW Reheat

TEC 0160.11

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Before You Begin

NOTE: Update each controller at the field panel immediately after you have completed the controller start-up procedures and made all other changes to the controller's point database, including balancing, tuning, etc.

Verify that the controller is powered up. Check that the BST LED on the controller is flashing. If the BST LED does not flash ON/OFF once per second, refer to the *APOGEE Automation Service Procedures* on InfoLink for troubleshooting information.

Actuators

1. Verify that APPLICATION (Point 2) is set to 2488 (slave mode).
2. Display the STARTUP report.
3. Set the motor timing points (Points 51, 55, and 10) to their correct run times. Check the actuators' installation instructions for run times.
4. For a damper-actuator rotation-angle value other than 90°, set DPR1 ROT ANG (Point 56) to the appropriate value.
5. Set MTR SETUP (Point 58) to its proper value (Table 1).
6. Verify that each actuator closes and remains closed using the damper and valve command points (48, 52, and 54). If an actuator does not close, try reversing its action by changing MTR SETUP.

If an actuator does not close completely, then it has been installed or set up incorrectly. See the actuator installation instructions, setup information, or the *APOGEE Automation Service Procedures* on InfoLink for more information.

Table 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

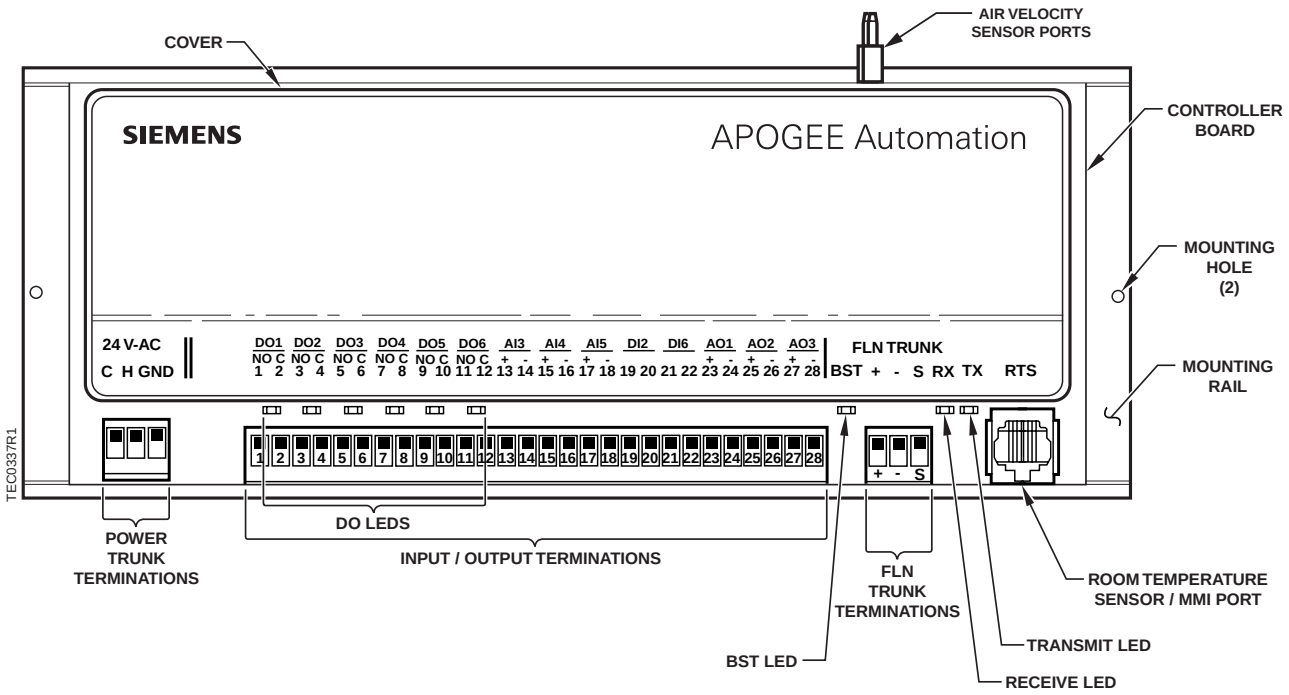

Figure 1. VAV Terminal Box Controller with 0-10V Series Fan Speed Output and HW Reheat.

Setting the Application

NOTE: If you are going to enter an LCTLR point at the field panel, keep track of the application, override time, controller address, duct shape, and duct dimensions you enter at the portable operator's terminal. You will be required to enter these values again at the field panel.

Set APPLICATION (Point 2) to 2436.

After you set the application, the controller will go through a shut-down/load sequence as it switches from slave mode to the application selected. After the application loads, the OVERVIEW report appears and the calibration cycle begins.

Waiting for AVS Calibration

At the start of the air velocity sensor calibration cycle, the controller sets CAL AIR (Point 94) to YES. The damper is then commanded closed to get a zero airflow reading during calibration.

NOTE: The calibration cycle takes from 2 to 5 minutes. You must wait until the calibration cycle is complete (CAL AIR is set to NO) before continuing.

Selecting Automatic Calibration Option

In order to choose the most efficient method of triggering the calibration routine, follow this procedure to set CAL SETUP (Point 95):

NOTE: The air velocity sensor must be calibrated at least once every 24 hours. Make sure that the sensor has been calibrated before balancing takes place, as this will affect the balancer's results.

1. Display the first report in the REPORTS selection box. The report will be named *VAVapp*, where *app* is a description of the application.

2. Select the automatic calibration option desired from Table 4 that best meets your job requirements.

3. Set CAL SETUP to the value chosen.

Table 4. CAL SETUP Options.

CAL SETUP Options	Description
0	Calibration occurs ONLY when CAL AIR (Point 94) is set to YES.
1	Calibration occurs when the field panel commands a day/night mode changeover. Actual calibration is subject to a time delay of 0, 1, 2, or 3 minutes. The delay is determined by dividing the value of CTLR ADDRESS (Point 1) by 4 and using the remainder as the time delay in minutes. **Example:** If CTLR ADDRESS = 11, then the controller will wait 3 minutes (11 ÷ 4 = 2 **R3**) after it receives the day/night mode changeover command before beginning the calibration routine.
2	Calibration occurs immediately after the override switch is depressed.
4 (factory default value)	Calibration occurs on the time interval set in CAL TIMER (Point 96). For example, if CAL TIMER = 12, the calibration period is 12 hours. Actual calibration is subject to a time delay based on the value of CTLR ADDRESS. Refer to the example in Option 1. (Note: Option 1 is recommended when using a controller with an Autozero Module.

NOTE: Options can be combined by summing their numbers. For example, to calibrate as in Options 1 and 2, set CAL SETUP to 3.

Setting Room Temperature Set Points

1. Display the SETPOINTS report.
2. Do one of the following:
   - If the room temperature sensor has no setpoint dial—or has one that will not be used—skip to step 5.
   - If the room temperature sensor has a setpoint dial—and this setpoint dial will be used—set STPT DIAL (Point 14) to YES and proceed with step 3.

     NOTE: When STPT DIAL = YES, the values of DAY CLG STPT and DAY HTG STPT (Points 6 and 7) are not used. RM STPT DIAL (Point 13) is used instead.
3. Set NGT CLG STPT (Point 8) and NGT HTG STPT (Point 9) to the desired values.
4. Set RM STPT MIN (Point 11) and RM STPT MAX (Point 12) for the minimum and maximum allowable room temperature setpoint values. Valid values range from 55°F to 95°F (13°C to 35°C). Common values are 65°F (18°C) and 80°F (27°C).
5. If the room temperature sensor has no setpoint dial—or has one that will not be used—verify that STPT DIAL = NO and set the following points to the desired values:
   - DAY CLG STPT (Point 6)
   - DAY HTG STPT (Point 7)
   - NGT CLG STPT (Point 8)
   - NGT HTG STPT (Point 9)

Setting Override Time

1. Display the STARTUP report.
2. If using night override, then set OVRD TIME (Point 20) to the number of whole hours that an override should last. If set at zero (default), night override is disabled.

Setting HW Reheat

Check the hardware to verify the number of heating valves used. Set VAVLE COUNT (Point 88) to this value.

Setting FAN MODE

Set FAN MODE (Point 16) to the desired value, CONST or VARI. (VARI = variable volume; CONST = constant volume.)

Setting Fan Flow Points

1. Set FAN FLO CMAX (Point 85) to the maximum desired value that FAN FLOW (Point 33) should be during the occupied cooling mode. FAN FLO CMAX is also the value of FAN FLOW if FAN MODE equals CONST and the fan is ON.

   If FAN MODE (Point 16) equals VARI, proceed with step 2 of this section. If FAN MODE equals CONST, and VAVLE COUNT (Point 88) equals 2, skip to step 4. If FAN MODE equals CONST but VAVLE COUNT is less than 2, skip steps 2 through 4 but **read the NOTE** at the end of this section, then proceed with the following section, *Setting FAN TIME.*

2. Enter into FAN FLOW MIN (Point 82) the minimum value that you want FAN FLOW to be during the occupied heating and cooling modes.

3. Enter into FAN FLO HMAX (Point 84) the maximum value that you want FAN FLOW to be during the occupied heating mode.

4. Enter into FAN FLOW MID (Point 83) the CFM value that FAN FLOW must be before the first heating valve may start modulating. (If you do not want either heating valve to modulate until the airflow out of the fan is equal to FAN FLO HMAX, then set FAN FLOW MID equal to or greater than FAN FLO HMAX.)

   NOTE: If FAN MODE = CONST, it is **STRONGLY** recommended that FAN FLO MID be set equal to or greater than FAN FLO HMAX.

Setting FAN TIME

FAN TIME (Point 71) is used as a speed limit. It means different things under different circumstances.

- When VALVE COUNT (Point 88) equals 1, **OR**, when VALVE COUNT equals 2 and FAN FLOW MID is equal to or greater than FAN FLO HMAX, FAN FLOW (Point 33) is not allowed to change from FAN FLOW MIN to FAN FLO HMAX (or vice versa) faster than the length of time set in FAN TIME.

- When VALVE COUNT equals 2 and FAN FLOW MID is **less** than FAN FLO HMAX, FAN FLOW is not allowed to change from FAN FLOW MIN to FAN FLOW MID (or vice versa) faster than the length of time set in FAN TIME. Also, under these conditions, the same length of time is required for FAN FLOW to change from FAN FLOW MID to FAN FLO HMAX (or vice versa).

Enter the desired value for FAN TIME.

Setting Valve Times

1. Enter into VLV 1 TIME (Point 27) the amount of time the first heating valve must be fully opened before heating valve may begin to open.

2. Enter into VLV 2 TIME (Point 28) the amount of time the second heating valve must be completely closed before the first heating valve may begin to close.

Setting CLOSE TIME

NOTE: If FAN MODE (Point 16) equals CONST, then skip this section. If FAN MODE equals VARI, then proceed with this section.

CLOSE TIME (Point 89) affects how the fan is controlled when HEAT.COOL equals HEAT. (It does not effect fan operation during the Cooling Mode.)

CLOSE TIME means different things under different circumstances:

- When VALVE COUNT (Point 89) equals 1, the heating valve must be closed longer than CLOSE TIME before FAN FLOW (Point 33) can be set below FAN FLO HMAX (Point 84)
- When VALVE COUNT equals 2 and FAN FLOW MID (Point 83) is equal to or greater than FAN FLO HMAX, both heating valves must be closed longer than CLOSE TIME before FAN FLOW can be set below FAN FLO HMAX
- When VALVE COUNT equals 2 and FAN FLOW MID is less than FAN FLO HMAX:
  - The second heating valve must be closed longer than CLOSE TIME before FAN FLOW can be set below FAN FLO HMAX.
  - The first heating valve must be closed longer than CLOSE TIME before FAN FLOW can be set below FAN FLO MID.

Set CLOSE TIME to the desired value.

Setting HTG DBAND

DO5 (Point 45) will not be allowed to turn ON in the unoccupied mode unless CTL TEMP (Point 78) < CTL STPT (Point 92) − HTG DBAND (Point 73).

Enter the desired value for HTG DBAND.

Setting MORN DBAND

At the beginning of the occupied mode, WARMUP (Point 60) will not be allowed to turn ON unless CTL TEMP (Point 78) < CTL STPT (Point 92) − MORN DBAND (Point 74).

Enter the desired value for MORN DBAND.

Setting TEMP HLIMIT and TEMP LLIMIT

The supply air damper will not be allowed to modulate in the unoccupied mode until CTL TEMP (Point 78) rises above TEMP HLIMIT (Point 69).

1. Enter the desired value for TEMP HLIMIT.

The heating valves will not be allowed to modulate in the unoccupied mode until CTL TEMP drops below TEMP LLIMIT (Point 65).

2. Enter the desired value for TEMP LLIMIT.

Setting the Heat Sequencing Points

When FAN MODE equals CONST, the airflow out of the fan is constant at FAN FLO CMAX. In this case, the electric heat works best if FLOW END (Point 17) is set equal to 0.

- If FAN MODE equals CONST, enter the desired value for FLOW END and skip the rest of this section. If FAN MODE equals VARI, continue with the rest of this section.

When application 2436 is configured with only one heating valve (VALVE COUNT, Point 88 equals 1), FAN FLOW (Point 33) will be set equal to FAN FLO HMAX (Point 84) and the heating valve will modulate whenever HTG LOOPOUT (Point 80) is equal to or greater than FLOW END (Point 17).

- Enter the desired value for FLOW END and skip the rest of this section. (If you are not sure where to set FLOW END, it is recommended that you set it to 33.)

If the application is configured with two heating valves (VALVE COUNT equals 2), and FAN FLOW MID (Point 83) is set **equal to or greater than** FAN FLO HMAX, FAN FLOW will be set equal to FAN FLO HMAX (and both reheat valves will modulate) whenever HTG LOOPOUT is equal to or greater than FLOW END.

- Enter the desired value for FLOW END and skip the rest of this section. (If you are not sure where to set FLOW END, it is recommended that you set it to 33.)

If the application is configured with two hot water coils, and FAN FLOW MID (Point 83) is set **less** than FAN FLO HMAX, then the following four conditions apply:

- When HTG LOOPOUT is equal to FLOW 1 END (Point 23), FAN FLOW will be set equal to FAN FLOW MID.
- When HTG LOOPOUT is between FLOW 1 END and FLOW 2 START (Point 22), the first heating valve will modulate.
- When HTG LOOPOUT goes from FLOW 2 START to FLOW END, FAN FLOW will go from FAN FLOW MID to FAN FLO HMAX.
- When HTG LOOPOUT is greater than FLOW END, the second heating valve will modulate.

Set FLOW 1 END, FLOW 2 START, and FLOW END to the desired values. (Lleave them at their default values if you are not sure what value to set them to.

Setting Box Size

One of the functions of Application 2436 is to determine the proper airflow value for the terminal box's VAV fan. This value is stored in FAN FLOW (Point 33). Once a value for FAN FLOW has been determined, a Table Statement embedded in application 2436's firmware uses it to determine the proper value for FAN AOV1 (Point 66). The application actually contains 4 such Table Statements, but only one will be used. Selecting the correct Table Statement depends on the value of BOX SIZE (Point 31).

- BOX SIZE (Point 31) should be set to 3, 5, or 7 when a Nailor box of size 3, 5, or 7 is being used, respectively. When this is done, the application will use 1 of 3 pre-coded Table Statements with pre-determined FAN AOV1 voltage levels that correspond to airflow values of FAN FLOW. The voltage and flow values in these pre-coded Table statements are fixed and cannot be changed by the user.

- BOX SIZE should be set to 0 when a box other than a Nailor box is being used, or when a Nailor Box of a size *other* than 3, 5 or 7 is being used. When this is done, the application uses an embedded, general purpose Table Statement to adjust the value of FAN AOV1 based on the value of FAN FLOW (Point 33). The flow and voltage values of this table statement are not pre-coded and must be entered into the TEC.

Enter the desired value for BOX SIZE.

If BOX SIZE is set to a value other than 0, skip the following but **read the NOTE** at the end of this section, then proceed with *Setting Controller Address.*

If BOX SIZE is set to 0, the controller needs to have the following fan AOV Table Statement parameters entered into it:

- FLO LO (Point 39) – This is the lowest flow the fan can produce. (FLO LO must be equal to or less than FAN FLOW MIN (Point 82.) (FLO LO may be set to 0 CFM if desired).

- FLO LO VOLTS (Point 37) – This is the voltage value that FAN AOV1 must have in order to get the fan to produce the amount of airflow that is stored in FLO LO.

- FLO HI (Point 87) – This is the highest flow that the fan can produce. FLO HI must be set greater than or equal to both FAN FLO HMAX (Point 84) and FAN FLO CMAX (Point 84).

- FLO HI VOLTS (Point 38) – This is the voltage value that FAN AOV1 (Point 66) must have in order to get the fan to produce the amount of airflow that is stored in FLO HI.

Enter the desired values for FLO LO, FLO HI, FLO LO VOLTS and FLO HI VOLTS.

When properly set up, the Table Statement works as follows:

- When FAN FLOW is equal to or less than FLO LO, FAN AOV1 will be set to FAN LO VOLTS.

- When FAN FLOW is equal to or greater than FAN HI, FAN AOV1 will be set to FAN HI VOLTS.
- When FAN FLOW is in between FLO LO and FLO HI, the Table Statement will use linear interpolation to set the value of FAN AOV1 to a value that is between FAN LO VOLTS and FAN HI VOLTS.

NOTE: Once FAN AOV1 is set to a particular voltage, the signal is sent to an intelligent motor controller that controls the fan. This intelligent motor controller is **provided by others**. It must be set up to know what the fan's airflow should be for a given value of FAN AOV1 voltage. Consult the operating instructions provided by the manufacturer for information on how to do this.

Setting Controller Address

Set CTLR ADDRESS (Point 1) to the appropriate number. Each controller requires a unique address. Normal values are 00 to 31, but the controller will accept values as high as 98.

Setting Duct Area

1. Display the **Duct Dimensions Menu**.
2. Use the arrow keys to select the applicable duct shape.
3. Enter the dimensions as prompted.

Setting Flow Coefficient

1. Display the BALANCING report.
2. Set FLOW COEFF (Point 36) to the appropriate value found in Table 5.
3. The value found in Table 5 is a starting point for the air balancer. To fine tune the flow coefficient, use the following formula:

   new flow coefficient = (actual volume ÷ TEC volume) × old flow coefficient

Table 5. Box Manufacturer Flow Coefficients.

Box Manufacturer	Sensor Type	Flow Coefficient
Anemostat	2-pipe sensor without orifice 2-pipe sensor with orifice Spider sensor without orifice Spider sensor with orifice	0.79 0.59 0.73 0.39
Carnes	2-pipe sensor Flow cross	0.66 0.59
Carrier		0.59
Continental Air Products		0.79

E.H. Price		0.78
Environmental Technologies		0.79
Hart & Cooley/Tuttle & Bailey	Flow cross Orifice	0.59 0.73
Krueger		0.68
Metal Aire		0.72
Nailor Industries		0.69
Redd-I-Inc.		0.59
Tempmaster		0.73
Titus		0.60
Trane		0.66

The actual volume is the actual value obtained from the balancer's measurements. The TEC volume is the value obtained from AIR VOLUME (Point 35). If AIR VOLUME is not within 5% of actual, the procedure must be repeated until it is. (It is **crucial** for the volume to be accurate.)

Set MIN and MAX Airflow Set Points

NOTE: The maximum flow must be greater than or equal to the minimum flow.

Follow these steps to set the minimum and maximum airflow set points:

1. Set CTL FLOW MIN (Point 76) to the desired minimum airflow set point. (This will be used as both the heating and cooling minimum airflow.)

2. Set CLG FLOW MAX (Point 32) to the desired maximum cooling airflow set point.

3. Set HTG FLOW MAX (Point 34) to the desired maximum heating airflow set point.

Enabling the Wall Switch

If a wall switch will be used for day/night control, set WALL SWITCH (Point 18) to YES.

The start-up is complete.

NOTES: Update each controller at the field panel immediately after you have completed the controller start-up procedures and made all other changes to the controller's point database, including balancing, tuning, etc.

Certain control features of application 2436 depend on whether the central air handling unit is ON or OFF. Application 2436 monitors VAV AHU (Point 61) for this information. Application 2436 does not command VAV AHU — it only reacts to it. To command VAV AHU, it must be unbundled at the field panel and PPCL must be written for it. (See the *Control Loops* section in the application bulletin for more information on how the application uses VAV AHU.)