SIEMENS

Controller Start-up for Custom Solutions Application 2413

VAV with 0-10V Series-Fan Speed Output and Electric Heat

TEC 0155.11

Table of Contents

Verifying Power to Controller

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.

The Controller Interface Software (CIS) must be Rev. 2.0 or greater.

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* (125-3013) on InfoLink for troubleshooting information.

Enabling the Damper Actuator(s)

Using the portable operator's terminal, follow these steps to set the damper or valve actuator running time:

1. Verify that APPLICATION (Point 2) is set to 2484 (slave mode).
2. Display the STARTUP report.
3. Set MTR1 TIMING (Point 51) to the correct running time of the actuator (see Tables 1 or 2 for actuator run times).

Table 1. Damper Actuator Run Time.

Damper Actuator	Setting (seconds)	
	50 Hz	60 Hz
349-0101	106	88
GDE 131.1U	108	90
GDE 131.1P	108	90
GLB 131.1P	150	125
[1]GBB 171.1U	150	150
[2]GDE 161.1P	108	90
[2]GLB 161.1P	150	125

[1] GBB 171.1U run time is independent of Hz.
[2] Analog output 0-10V.

Table 2. Valve Actuator Run Time.

Valve Actuator	Setting (seconds)	
	50 Hz	60 Hz
SSB81U (Powermite – MZ Series)	180	150
SQS 82	155	130
SQS 65U (analog output 0 to 10V)	35	30
SQS 65.5U (analog output 0 to 10V)	35	30
SSB 61U (analog output 0 to 10V)	N/A	150

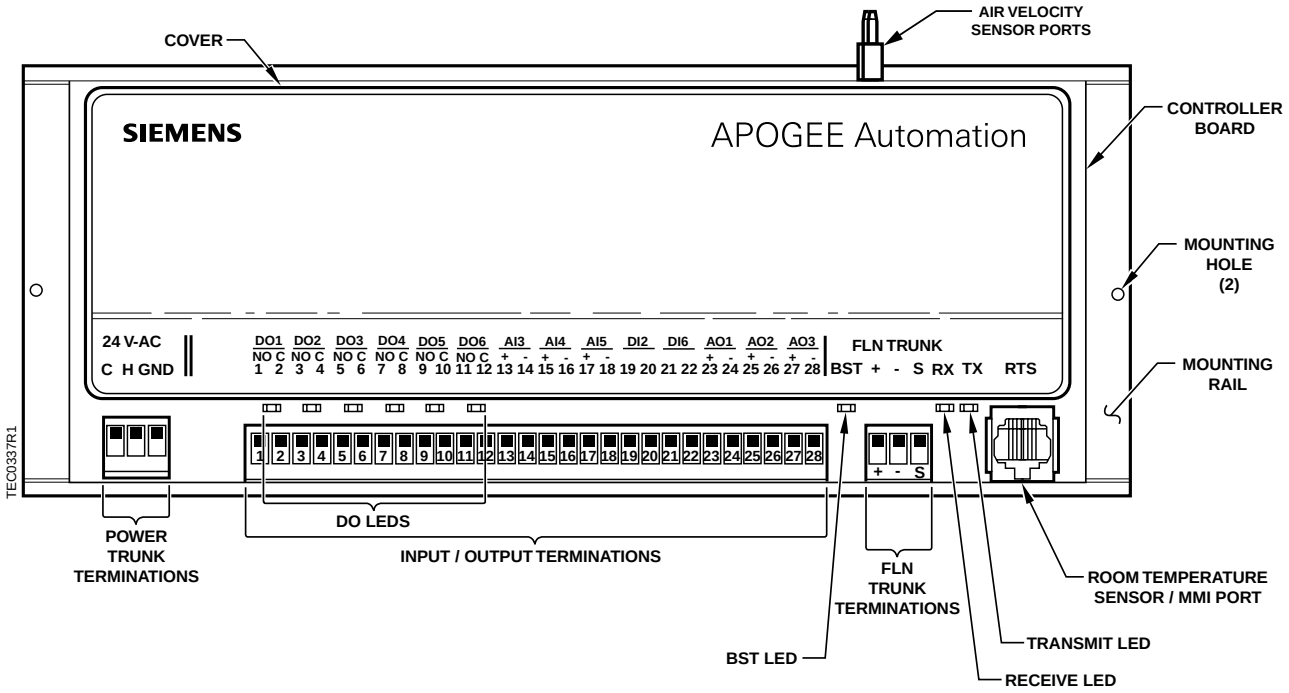

Figure 1. VAV Terminal Box Controller with 0-10V Series Fan Speed Output and Electric Heat.

4. For a damper-actuator rotation-angle value other than 90°, set DPR1 ROT ANG (Point 56) to the appropriate value.

5. Enable the actuator by setting MTR SETUP (Point 58) to 1. Verify that the actuator completely closes the damper or valve and that it remains closed. If it does not close, reverse the action of the actuator by setting MTR SETUP to 3.

If the damper or valve still does not close completely, then the actuator has been installed or set up incorrectly. Refer to the actuator installation instructions, set up information, or the *APOGEE Automation Service Procedures* (125-3013) on InfoLink for more information.

Application 2413 does not support the use of a second floating control actuator, even if DOs 3 and 4 are available for use. Therefore, if the TEC will be running application 2413, skip the rest of this section and proceed with the next section, *Setting the Application*. If, however, you are using this TEC to run the slave mode (application 2484), then a second floating control actuator can be used if desired. To set up a second floating control actuator in slave mode, do the following:

6. Set MTR2 TIMING (Point 55) to the correct run time of the actuator (see Table 1 for damper actuator run times; see Table 2 for valve actuator run times).

7. If the 2nd actuator is a damper actuator with a rotation angle other than 90°, set DPR2 ROT ANG (Point 57) to the proper value.

8. Enable the 2nd floating control actuator by referring to Table 3 and changing MTR SETUP (Point 58) as follows:

   - If an actuator is present and enabled (MTR SETUP = 1), then enable the 2nd actuator by changing MTR SETUP to 5.
   - If an actuator is present, enabled, and reverse acting (MTR SETUP = 3), then enable the 2nd actuator by changing MTR SETUP to 7.

Table 3. 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	1	3	0
Motor 2 Enabled	5	7	4
Motor 2 Enabled and Reversed	13	15	12

If the 2nd floating control actuator still does not close completely, then the actuator has been installed or set up incorrectly. Refer to the actuator installation instructions, set up information, or the *APOGEE Automation Service Procedures* (125-3013) on InfoLink for more information.

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 2413.

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 with the rest of the start-up procedures.

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. If the room temperature sensor has a set point dial, and if RM STPT DIAL (Point 13) is to be used by the controller, then set STPT DIAL (Point 14) to YES; otherwise, set STPT DIAL to NO.

   NOTE: If STPT DIAL is set to YES, OCC CLG STPT (Point 6) and OCC HTG STPT (Point 7) will not be used. Instead, the value of RM STPT DIAL will be used.
3. If there is no set point dial on the room temperature sensor, verify that STPT DIAL = NO.
4. Set the following points to the appropriate values:
   - OCC CLG STPT (Point 6)
   - OCC HTG STPT (Point 7)
   - UOC CLG STPT (Point 8)
   - UOC HTG STPT (Point 9)
5. If the room temperature sensor has a set point dial that will be used, set RM STPT MIN (Point 11) and RM STPT MAX (Point 12) for the minimum and maximum allowable room temperature set point values, respectively. Valid values range from 55° to 95°F (13° to 35°C). Common values for these points are 65°F (18°C) for RM STPT MIN and 80°F (27°C) for RM STPT MAX.

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 (the default), night override is disabled.

Setting Electric Heat Stages

Check the hardware to verify the number of electric heat stages used. Set STAGE COUNT (Point 88) to this value.

Setting FAN MODE

Set FAN MODE (Point 16) to the desired value, CONST or VARI. (VARI is the default, and means variable volume; CONST means 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 STAGE COUNT (Point 88) equals 2, skip to step 4. If FAN MODE equals CONST but STAGE 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 HEAT STAGE 1 (Point 43) may start modulating. (If you do not want either heating stage 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 STAGE COUNT (Point 88) equals 1, **OR**, when STAGE 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 STAGE 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 Stage Times

1. Enter into STG 1 TIME (Point 27) the amount of time HEAT STAGE 1 (Point 43) must be ON before HEAT STAGE 2 (Point 44) may turn ON.

2. Enter into STG 2 TIME (Point 28) the amount of time HEAT STAGE 2 must be OFF before HEAT STAGE 1 may turn OFF.

Setting HTG DBAND

BASE 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 electric heat will not be allowed to time 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 2413 is configured with only one stage of electric heat (STAGE COUNT, Point 88 equals 1), FAN FLOW (Point 33) will be set equal to FAN FLO HMAX (Point 84) and the heat stage will time 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 stages of electric heat (STAGE 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 heat stages will time 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 stages of electric heat, 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), HEAT STAGE 1 (Point 43) will time 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, HEAT STAGE 2 (Point 44) will time modulate.

Set FLOW 1 END, FLOW 2 START and FLOW END to the desired values. (If you are not sure what value to set these points to, it is recommended that you leave them at their default values.)

Setting Box Size

One of the functions of Application 2413 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 2413'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, this signal is sent to an intelligent motor controller that controls the fan and which is **provided by others**. This controller must be configured to know what airflow corresponds to a given voltage of FAN AOV1. Consult the operating instructions provided by the manufacturer of the intelligent motor controller for proper set-up information.

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. Using the portable operator's terminal, press **<F4>** to display the **Duct Dimensions Menu**.
2. At the Duct Dimensions Menu, use the arrow keys to select the applicable duct shape. Press **<ENTER>**. The software prompts you for the dimensions of the duct.
3. Enter the dimensions as prompted. Press **<ENTER>** after each dimension you enter.

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 the TEC volume is not within 5% of the actual volume, then repeat the procedure until it is within 5%. (It is **crucial** that the volume reading is 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.

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.

A Note on VAV AHU (Point 61)

Under certain circumstances, how application 2413 controls depends on whether VAV AHU is ON or OFF. When VAV AHU is ON, the application interprets this to mean that the central air handling unit that this terminal box is connected to is ON. Likewise, when VAV AHU is OFF, the application interprets this to mean that the central air handling is OFF.

Application 2413 only reacts to VAV AHU; it does not command it. In order to command VAV AHU, this point needs to be unbundled at a field panel and PPCL written to control it. (See the *Control Loops* section in the application bulletin for more information on how the application uses VAV AHU.)