

Start-up Procedures for TEC Custom Solutions Application 2369

VAV Parallel Fan with Hot Water Reheat — Electronic Output

TEC 0128.11

Table of Contents

Verifying Power to Controller.....	2
Enabling Damper Actuator.....	2
Enabling Valve 1 Actuator	4
Setting the Application.....	4
Waiting for Air Velocity Sensor Calibration	5
Selecting Automatic Calibration Option.....	5
Setting the Room Temperature Set Points:	6
Setting Override Time	7
Setting Controller Address	7
Selecting Fan Mode	7
Selecting Proper Value for VALVE SAFETY.....	7
Choosing Values for FAN ON and FAN OFF.....	7
Setting Duct Area	8
Setting Flow Coefficient.....	8
Setting MIN and MAX Airflow Set Points.....	12
Enabling Wall Switch.....	12

Verifying Power to Controller

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

Verify that the Terminal Box 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, then refer to the *Apogee Automation Service Procedures* in InfoLink for troubleshooting information.

NOTE: The Controller Interface Software (CIS) used with the Terminal Box Controller with Modified Parallel Fan Operation – Electronic Output (firmware revision VB10 or higher) must be Rev. 2.0 or greater. Voyager's point database may also be used for start-up.

Enabling Damper Actuator

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

1. Verify that APPLICATION (Point 02) is set to **2091** (slave mode) for Rev. VB10 or higher.
2. Display the STARTUP report.
3. Set MTR1 TIMING (Point 51) to the correct running time of the actuator. Refer to Table 1.

Table 1. Damper Actuator Run Time.

Damper Actuator	Setting (seconds)	
	50 Hz	60 Hz
349-0100	113	90
SQR 81.1	155	130
GDE 131.1U	108	90
GBB 171.1U	150	150*

*GBB 171.1U run time is independent of Hz.

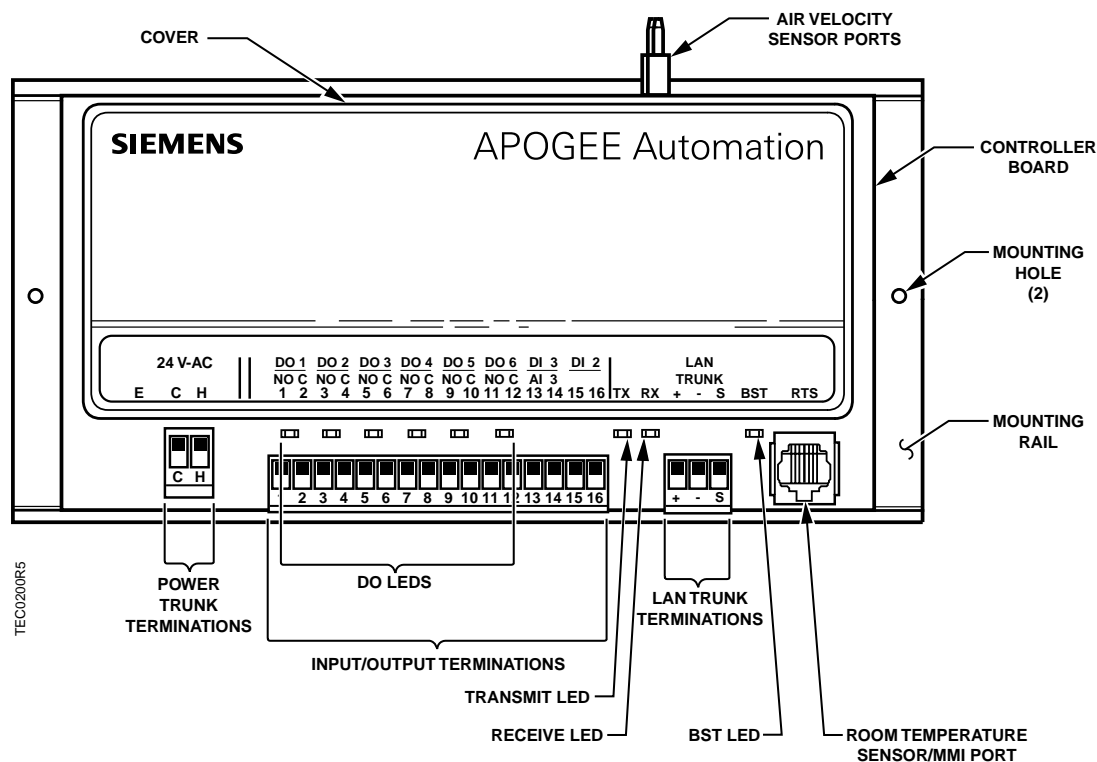


Figure 1. Terminal Box Controller with Modified Parallel Fan Operation – Electronic Output.

4. If the damper rotation angle is a value other than 90°, then set DPR1 ROT ANG (Point 56) to the appropriate value.
5. Enable the damper actuator by setting MTR SETUP (Point 58) to 1. Verify that the damper closes completely. If it does not close completely, reverse the action of the damper actuator by setting MTR SETUP to 3.

If the damper still does not close completely, then the actuator has been installed or set up incorrectly. Refer to the damper actuator installation instructions, set up information, Table 2, or the *Apogee Automation Service Procedures* in InfoLink for more information.

Table 2. 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

Enabling Valve 1 Actuator

1. Set MTR2 TIMING (Point 55) to the correct running time of the valve 1 actuator. Refer to Table 3.
2. Enable the valve 1 actuator by changing MTR SETUP (Point 58) as follows:
 - If a damper actuator is present and is enabled (MTR SETUP = 1), then also enable the valve 1 actuator by changing MTR SETUP to **5**.
 - If a damper actuator is present, enabled, and reverse acting (MTR SETUP = 3), then also enable the valve 1 actuator by changing MTR SETUP to **7**.
3. Verify that valve 1 closes and remains closed. If the valve does not close, then reverse the action of the valve 1 actuator by changing MTR SETUP as follows:
 - If the damper actuator is enabled, change MTR SETUP to **13**.
 - If the damper actuator is enabled and reverse acting, change MTR SETUP to **15**.

Table 3. Valve Actuator Run Time.

Valve Actuator	Setting (seconds)	
	50 Hz	60 Hz
SQS 82	155	130
SSB81U (Powermite – MZ Series)	180	150
Powers VE 339 series actuator with a 1/2-inch (13 mm) stroke (used with Powertop valves)	25	21
Powers VE 339 series actuator with a 3/4-inch (19 mm) stroke ¹	38	32

¹ Settings given are for Johnson and Honeywell valves with a 3/4" stroke. Stroke may be from 1/2" to 3/4", depending on the model. Consult the manufacturer's valve literature for actual stroke and calculate the setting accordingly.

Setting the Application

NOTE: If you are going to enter an LCTLR point at the field panel, then 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 02) to the appropriate Terminal Box Controller application. See Table 4.

Table 4. Terminal Box Controller – Electronic Output Applications.

Application	Revision VB10 or Higher
VAV Parallel Fan Powered with Hot Water Reheat	2369
Slave Mode	2091

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 Air Velocity Sensor Calibration

Air velocity sensor calibration cycle takes 2 to 5 minutes to complete. The supply air damper closes during calibration.

At the start of the calibration cycle, the controller automatically sets CAL AIR (Point 94) to YES. When the cycle is complete, it sets CAL AIR to NO.

NOTE: The damper is commanded closed to get a zero airflow reading during calibration. Calibration of a hot water valve (if used) is done while the controller is calibrating the transducer by commanding the valve to closed.

Wait until the calibration cycle is complete (CAL AIR is set to NO) before continuing with the following 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 "VAV HW PF" in Application 2369.)
2. Select the automatic calibration option desired from Table 5 that best meets your job requirements.
3. Set CAL SETUP to the value chosen.

Table 5. CAL SETUP Options.

Option	
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. This delay is determined by CTLR ADDRESS (Point 01) divided by 4, with the remainder being the time delay in minutes. Example: If CTLR ADDRESS = 11, then the controller will wait 3 minutes ($11 \div 4 = 2 \text{ R}3$) after it receives the day/night mode changeover command before beginning the calibration routine.
2	Calibration occurs immediately after the override switch is pressed.
4 (factory default value)	Calibration occurs on the time interval set in CAL TIMER (Point 96). For example, if CAL TIMER = 12, then 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: Options can be combined by summing their numbers. For example, to calibrate as in Options 1 and 2, set CAL SETUP to 3.

Setting the 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, then DAY HTG STPT (Point 07) and DAY CLG STPT (Point 06) are not used. Instead, the value of RM STPT DIAL is used.

3. If there is no set point dial on the room temperature sensor, then verify that STPT DIAL is set to NO and set the following points to the appropriate values:
 - DAY CLG STPT (Point 06)
 - DAY HTG STPT (Point 07)
 - NGT CLG STPT (Point 08)
 - NGT HTG STPT (Point 09)
4. If the room temperature sensor has a set point dial and the set point dial is to be used, then 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°F to 95°F (13°C 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

Follow these steps to set the override time:

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

Setting Controller Address

Set the controller address by setting CTLR ADDRESS (Point 01) to the appropriate number.

Selecting Fan Mode

FAN MODE (Point 40) is a digital point that can have either the value FIXED or VARIED. FIXED refers to a FIXED sequence between the valve and the parallel fan; the valve and fan operate exactly as they do in Application 2027. When FAN MODE equals VARIED, the sequence between the valve and the fan can be varied. Select the desired fan mode.

Selecting Proper Value for VALVE SAFETY

VALVE SAFETY (Point 54) is only used if FAN MODE equals VARIED. If FAN MODE equals VARIED, and VALVE SAFETY is set to YES, then the heating valve will be closed whenever the fan is OFF. If VALVE SAFETY is set to NO, then the heating valve will not automatically close when the fan is OFF; instead, it will still be controlled by the heating PID Loop. Select the desired value for VALVE SAFETY.

Choosing Values for FAN ON and FAN OFF

FAN ON (Point 47) and FAN OFF (Point 50) are only used if FAN MODE equals VARIED. When FAN MODE equals VARIED, FAN ON and FAN OFF work as follows:

The fan turns OFF whenever HTG LOOPOUT is less than FAN OFF.

Once OFF, the fan will not turn back ON unless HTG LOOPOUT is greater than the value of FAN ON.

Select the desired values for FAN ON and FAN OFF.

Setting Duct Area

Set the duct area by following these steps:

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**.
3. Enter the duct dimensions as prompted. Press **ENTER** after each dimension you enter.

Setting Flow Coefficient

Follow these steps to set the flow coefficient:

1. Display the BALANCING report.
2. Set FLOW COEFF (Point 36) to the appropriate value found in Table 6, 7, or 8. This value is a starting point for the air balancer.
3. To fine tune the flow coefficient use the following formula:

$$\text{new flow coefficient} = (\text{actual volume} \div \text{TEC volume}) \times \text{old flow coefficient}$$

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%.

Table 6. Suggested TEC Initial Flow Coefficients for VAV Manufacturer and Box Sizes.

	Air velocity sensor type	Round ductwork (inlet) sizes in inches.												
		4	5	6	7	8	9	10	12	14	16	18	19	20
Anemostat	PX-2 cross, "P" range		0.77	0.74	0.75	0.78	0.74	0.81	0.81	0.85	0.80			
Anemostat	Traverse, "H" range		0.77	0.74	0.75	0.78	0.74	0.81	0.81	0.85	0.80			
Anemostat	PX-2 cross, "Q" range		0.56	0.51	0.56	0.57	0.59	0.60	0.64	0.65	0.72			
Anemostat	Traverse, "L" range		0.51	0.51	0.56	0.57	0.59	0.60	0.64	0.65	0.72			
Carrier	Linear averaging	0.75	0.71	0.64	0.63	0.62	0.62	0.61	0.61	0.58	0.54	0.58		
Carnes	"Standard sensor"		0.77	0.70	0.69	0.68		0.67	0.69	0.69	0.70			
Carnes	"Cross-flow sensor"		0.68	0.60	0.65	0.68		0.65	0.68	0.70	0.69			
Continental	AVS model "RSZ"			0.73		0.67		0.72	0.64	0.62	0.57		0.99	0.99
E.H. Price	CP101	1.04	0.83	0.64	0.68	0.66	0.72	0.75	0.80	0.85	0.80			
Environmental Tech.	sdr, vfr, cfr	0.79	0.78	0.59		0.62		0.64	0.65	0.66	0.66		0.59	0.66
H&C/Tuttle & Bailey	"Flo-cross" sensor	0.69	0.67	0.60	0.56	0.57		0.56	0.60	0.57	0.60	0.58		
H&C/Tuttle & Bailey	Flo-cross w/ total	0.59	0.55	0.50							0.51			
Krueger	General sensor	0.77	0.73	0.66	0.68	0.70	0.68	0.69		0.67				
Metal Ind. Fan powered only.	Fvi, fc, sv, rt, th, ct, dd (6 DO)									0.70	0.70			
Metal Ind. VAV & dual duct.	fvi, fc, sv, rt, th, ct, dd (6 DO)								0.50					
* Metal Ind. Dual duct only	fvi, fc, sv, rt, th, ct, dd (8 DO)			0.74		0.68		0.72						
Nailor Industries	Flow sensor	0.74		0.73		0.75		0.64						
Pottorff Inc.	TU-100			0.85		0.95		0.82	0.91	0.89	0.88			
Reddi-I-Inc.	Flowmaster			0.66		0.60		0.61	0.55	0.58	0.65			
Titus Inc.	Flowcross	0.92	0.81	0.63	0.61	0.64	0.62	0.63	0.64					
Trane (Rushville)	Air-valve (ring type)		0.64	0.60		0.64		0.65	0.65	0.65				
Tempmaster/York	All VAV, DD round	0.81	0.76		0.70	0.71		0.65	0.65	0.72	0.73			
Tempmaster/York	All VAV, DD Oval													
Warren Tech.	Kreuter SSS series			1.00		1.00		1.00	1.00	1.00	1.00			

* Inlet "Low Flow" air sensors should not be used if flow is less than 300 FPM.

Table 7. Suggested TEC Initial Flow Coefficients for VAV manufacturer and Box Sizes.

	Air velocity sensor type	Rectangular ductwork (inlet) sizes in inches													
		4x7	4x10	6x9	6x12	6x15	8x11	8x14	8x17	8x20	8x24	9x12	9x14	19(-3)	22(-3)
Anemostat	PX-2 cross, "P" range														
Anemostat	Traverse, H" range														
Anemostat	PX-2 cross, "Q" range														
Anemostat	Traverse, "L" range														
Carrier	Linear averaging														
Carnes	"Standard sensor"											0.68			
Carnes	"Cross-flow sensor"											0.65			
Continental	AVS model "RSZ"														
E.H. Price	CP101														
***Environmental Tech.	sdr, vfr, cfr													0.61	0.64
H&C/Tuttle & Bailey	"Flo-cross" sensor														
H&C/Tuttle & Bailey	Flo-cross w/ total.														
Krueger	General sensor														
Metal Ind. Fan powered only.	Fvi ,fc, sv, rt, th, ct, dd (6 DO)														
Metal Ind. VAV & dual duct.	fvi, fc, sv, rt, th, ct, dd (6 DO)														
* Metal Ind. Dual duct only.	fvi, fc, sv, rt, th, ct, dd (8 DO)														
Nailor Industries	Flow sensor														
Pottorff Inc.	TU-100														
Reddi-I-Inc.	Flowmaster														
Titus Inc.	Flowcross														
Trane (Rushville)	Air-valve (ring type)														
Tempmaster/York	All VAV, DD round														
**Tempmaster/York	All VAV, DD Oval	0.72	0.73	0.73	0.73	0.72	0.73	0.74	0.72	0.72	0.74				
Warren Tech.	Kreuter SSS series														

* Inlet "Low Flow" air sensors should not be used if flow is less than 300 FPM.

** Tempmaster oval duct area and COF were calculated as rectangular duct shapes.

***ETI 19" has a rectangular area of 2.72 sq/ft. ETI 22" (32.25" X 15.875") rectangular area is 3.555 sq/ft.

Table 8. Suggested TEC Initial Flow Coefficients for VAV manufacturer and Box Sizes.

	Air velocity sensor type	Rectangular ductwork (inlet) sizes In Inches									Oval sizes		
		12x14	12x16	12x18	12x28	12x24	16x18	16x24	16x28	20x26	12"	14"	16"
Anemostat	PX-2 cross, "P" range							0.79					
Anemostat	Traverse, "H" range												
Anemostat	PX-2 cross, "Q" range												
Anemostat	Traverse, "L" range												
Carrier	Linear averaging												
Carnes	"Standard sensor"						0.68	0.75					
Carnes	"Cross-flow sensor"						0.70	0.75					
Continental	AVS model "RSZ"												
E.H. Price	CP101		0.76					0.76					
H&C/Tuttle&Bailey	"Flo-cross" sensor												
H&C/Tuttle&Bailey	Flo-cross w/ total.												
Krueger	General sensor							0.71					
Metal Ind. Fan powered only.	fvi, fc, sv, rt, th, ct, dd												
	(6 DO)												
Metal Ind. VAV & dual duct.	fvi, fc, sv, rt, th, ct, dd	0.56	0.57	0.58	0.62	0.57				0.58	0.50	0.70	0.70
	(6 DO)												
* Metal Ind. Dual duct only	fvi, fc, sv, rt, th, ct, dd									0.60	0.64	0.67	0.68
	(8 DO)												
Nailor Industries	Flow sensor										0.58	0.63	0.68
Pottorff Inc.	TU-100							0.80					
Reddi-I-Inc.	Flowmaster												
Titus Inc.	Flowcross												
Trane(Rushville)	Air-valve (ring type)												
Tempmaster/York	All VAV, DD round												
**Tempmaster/York	All VAV, DD Oval												
Warren Tech.	Kreuter SSS series												

* Inlet "Low Flow" air sensors should not be used if flow is less than 300 FPM.

** Tempmaster oval duct area and COF were calculated as rectangular duct shapes.

Setting MIN and MAX Airflow Set Points

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

1. Set CLG FLOW MIN (Point 31) to the desired minimum cooling airflow set point.
2. Set CLG FLOW MAX (Point 32) to the desired maximum cooling airflow set point.
3. Set HTG FLOW MIN (Point 33) to the desired minimum heating airflow set point.
4. Set HTG FLOW MAX (Point 34) to the desired maximum heating airflow set point.

Enabling Wall Switch

If a wall switch is used for day/night control, then enable it by setting WALL SWITCH (Point 18) to **YES**.

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

Start-up is complete.