SIEMENS

TEC

VAV with 0-10V AO Heat Modulation and CO2 Monitoring

Start-up Procedures

140-1094
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Building Technologies

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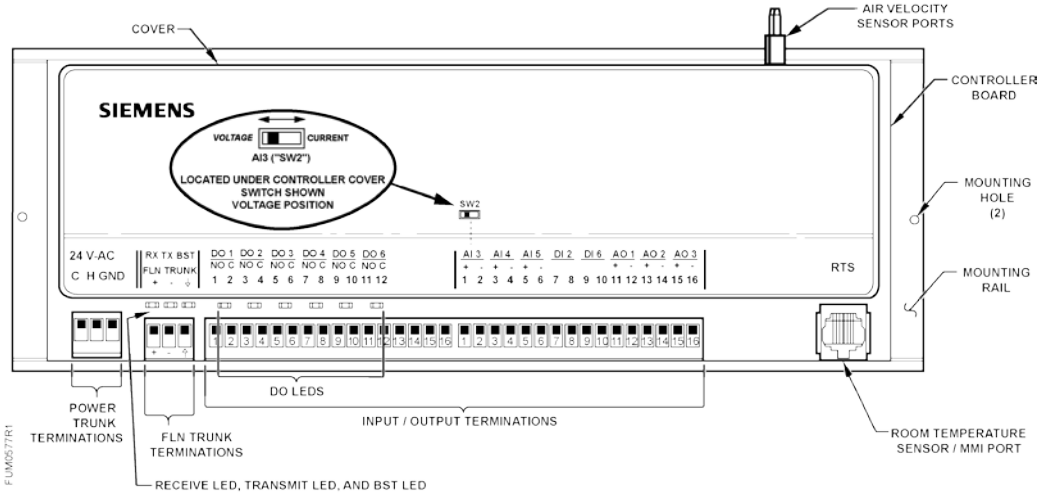
Before You Begin



Generic Controller I/O Layout. See *Wiring Diagram* for application specific details.

NOTE:
The optional Air Velocity Sensor (AVS) is only available in Application 2843 .

Communication and DO Indicators

The Siemens TEC VAV with 0-10V AO Heat Modulation and CO2 Monitoring has LEDs to indicate communication (yellow) and DO (digital output) status BST (yellow).

Verifying Power to the Controller

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, see the *iKnow Troubleshooting Tool* or contact Technical Support for troubleshooting information.

Enabling Actuators

⚠ CAUTION

The controller's DOs control only 24 Vac loads.
The maximum rating is 12 VA for each DO.

The point that determines actuator run times are:

- MTR 1 TIMING
- MTR 2 TIMING
- MTR 3 TIMING

Your application may not have or use all three points.

1. Use the following table to set run time(s) for the actuator used by your application.
2. For damper rotation angles other than 90°, set ROT ANG to the appropriate value.

Damper Actuator Run Time		
Damper Actuator	**Setting (seconds)**	
	50 Hz	**60 Hz**
GDE131.1	125	90
GLB131.1	150	125

Specifying Motor Setup

⚠ CAUTION

If an Autozero Module is used, do not enable MTR3 (valve 2).

MTR SETUP determines which actuators are controlled by the application and whether they are direct or reverse acting. Set MTR SETUP according to Table *MTR SETUP Values*.

NOTE:
When MTR SETUP is changed, all enabled actuators will calibrate. Wait until each actuator has completed its calibration before continuing.

Application 2843:

MTR SETUP Values									
	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

Applications 2845 and 2847:

Motor 1 Not Used	Motor 1 Enabled	Motor 1 Enabled and Reversed
0	1	3

Verifying Actuator Setup

1. Command all actuators closed. Verify that they close and remain closed. If not, adjust the setting for MTR SETUP according to Table *MTR SETUP Values*.
2. If any of the actuators still do not close completely, then the actuators have been installed or set up incorrectly. See the Siemens TEC VAV with 0-10V AO Heat Modulation and CO2 Monitoring Installation Instructions (540-1031), the iKnow Troubleshooting Tool, or contact Field Support.

Verifying Actuator Setup

1. Command all actuators closed. Verify that they close and remain closed. If not, adjust the setting for MTR SETUP according to Table *MTR SETUP Values*.
2. If any of the actuators still do not close completely, then the actuators have been installed or set up incorrectly. See the Installation Instructions, the iKnow Troubleshooting Tool, or contact Field Support.

Setting Voltages to Open and Close 0 to 10V Actuators

If AOV control is used for modulating a valve, the open/close voltages must be set. Otherwise, this section can be skipped.

1. Set AO 1 OPEN to the voltage that fully opens the modulating cooling device connected to AOV 1.
2. Set AOV 1 CLOSE to the voltage that completely closes the modulating cooling device connected to AOV 1.
3. Set AOV 2 OPEN to the voltage that fully opens the modulating heating device connected to AOV 2. (If an SCR is connected to AOV 2, then AOV 2 OPEN is the voltage that causes the SCR to be fully on.)
4. Set AOV 2 CLOSE to the voltage that completely closes the modulating heating device connected to AOV 2. (If an SCR is connected to AOV 2, then AOV 2 CLOSE is the voltage that causes the SCR to be fully off.)

NOTE:
The maximum voltage output for an AO is 10V. The controller will not control the modulating heating device beyond 10V.

Setting Controller Address

NOTE:
If you are going to enter an LCTLR point at the field panel, keep track of the controller address and override time you enter at the WCIS. You will be required to enter these values again at the field panel.

Set the controller address by setting CTLR ADDRESS to the appropriate number. (Addresses 00 to 98 are valid; 00 to 31 are typically used.)

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

Setting the Application

Add the TEC to your job database, set APPLICATION to the appropriate application, and then select one of the following applications.

Application Description	Application Number
VAV with 0-10V AO Heat Modulation and CO2 Monitoring	2843
VAV Series Fan with 0-10V AO Heat Modulation and CO2 Monitoring	2845
VAV Parallel Fan with 0-10V AO Heat Modulation and CO2 Monitoring	2847
VAV Slave Mode	2899

At the start of the calibration cycle, the controller automatically sets CAL AIR to YES. When the cycle is complete, CAL AIR returns to NO.

The air velocity sensor calibration cycle begins within three minutes of an application start-up or initialization, depending on the controller's address. After this delay, the calibration cycle takes from 2 to 5 minutes to complete. The air damper closes during calibration.

NOTE:
You can continue the startup procedure while calibration is underway. However, the controller will ignore commands to control end devices (such as the damper) until calibration of the air velocity sensor is finished.

AVS Calibration

At the start of the air velocity sensor calibration cycle, the controller sets CAL AIR 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.

Wait until the calibration cycle is complete (CAL AIR is set to NO) before continuing with this startup procedure.

Selecting Automatic Calibration Option

1. Using the following table, set CAL SETUP to the value that best meets your job requirements.
2. If appropriate, change CAL TIMER from the default of 12 hours. This setting applies only if your choice for CAL SETUP includes Option 4.

NOTE:
The air velocity sensor should 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.

CAL SETUP Options.	
CAL SETUP (value)	**Description**
0	Calibration occurs ONLY when the point CAL AIR 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 the point CTLR ADDRESS divided by 4. The remainder is 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 pressed.
4 (factory default value)	Calibration occurs on the time interval set in the point CAL TIMER. **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. See the example in Option 1.

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

Setting Room Temperature Setpoints

- Day (or OCC) cooling setpoint: DAY CLG STPT
- Day (or OCC) heating setpoint: DAY HTG STPT
- Night (or UOC) cooling setpoint: NGT CLG STPT
- Night (or UOC) heating setpoint: NGT HTG STPT

1. If the room temperature sensor has a setpoint dial that will be used, set STPT DIAL to **YES**. Otherwise, set STPT DIAL to **NO**.
   - Set RM STPT MIN and RM STPT MAX for the minimum and maximum allowable room temperature setpoint values, respectively. Valid values range from 55° to 95°F (13° to 35°C). Default values are 55°F (13°C) for RM STPT MIN and 90°F (32°C) for RM STPT MAX.
2. Setpoint dial configured with a heating/cooling deadband (default).
   - To allow the controller to operate with a heating/cooling deadband (functioning the same as provided when the setpoint dial is not present), use the following configuration:
   - Set the DAY HTG STPT less than the DAY CLG STPT by the deadband (or zero energy band) that is desired. (for example, DAY HTG STPT = 70°F; DAY CLG STPT = 74°F, providing a deadband of 4 degrees). Only the difference between these values is used to determine the setpoint that will be used.
   - As described below, the setpoint(s) for heating/cooling will be 1/2 of the deadband above or below the setpoint dial value.
   ⇨ When HEAT.COOL equals HEAT, then:
   ⇨ CTL STPT will equal RM STPT DIAL – 0.5 * (DAY CLG STPT – DAY HTG STPT) and will be limited by RM STPT MIN and RM STPT MAX.
   ⇨ When HEAT.COOL equals COOL, then:
   ⇨ CTL STPT will equal RM STPT DIAL + 0.5 * (DAY CLG STPT – DAY HTG STPT) and will be limited by RM STPT MIN and RM STPT MAX.
   NOTE: A space where the deadband is used can be more energy efficient than a space where the deadband is not being used.
3. Setpoint dial configured for zero heating/cooling deadband.
   - When the job specification requires a common heating and cooling temperature setpoint, use the following configuration:
   - Set DAY HTG STPT equal to DAY CLG STPT. This will configure the setpoint deadband equal to zero.
   - If a setpoint deadband equals zero, then:
     CTL STPT will equal RM STPT DIAL, and will be limited by RM STPT MIN and RM STPT MAX.
     NOTE: A space where the heating/cooling deadband is zero may be more comfortable than a space where the deadband is being used, but may use more energy.
4. Set the room temperature setpoints to the desired values. Heating setpoints are not present in cooling only applications.

Setting HC.ENDIS

HC.ENDIS determines whether the application is heating only, cooling only, or if it uses both heating and cooling modes. Set HC.ENDIS to the desired value.

- 3 = heating and cooling (default)
- 1 = heating only
- 2 = cooling only

Setting Override Time

If using night/unoccupied override, set OVRD TIME to the number of whole hours that an override should last. If OVRD TIME equals 0 (default), this feature is disabled.

Setting the Number of 0 - 10V Heating Devices

MODHTG COUNT determines the number of 0 – 10 Volt heating device that the TEC is controlling. These heating devices can be either modulating heating valves or SCRs. When used, these devices are connected to AOV1 and AOV2.

If there are no heating devices connected to AOV1 or AOV2, set MODHTG COUNT to **0**. If there is a heating device connected to AOV1, but not AOV2, set MODHTG COUNT to **1**. If there is a heating device connected to AOV1 and AOV2, then set MODHTG COUNT to **2**.

NOTE:
If you set MODHTG COUNT to a value greater than 2, then MODHTG COUNT will display as 0 when viewed on the screen, and the application will control as though MODHTG COUNT was set to 0.

This application cannot directly control an SCR. It can only control an SCR provided that the SCR has a built-in controller that will modulate the SCR based on a 0 – 10 Volt input signal. If this is the case, then the application can control the SCR by connecting either AOV1 or AOV2 on the TEC to the 0 – 10 Volt input on the controller that resides on the SCR.

Setting Duct Area

If provided, enter the duct area (sq ft or sq m) into DUCT AREA and continue to *Setting Flow Coefficient*.

If you do not know the duct area, use the following table:

Area =	Round Duct	Rectangular Duct
Area in Sq. Ft.	$(\pi \times R^2)/144$ (where π = 3.14 and R = radius of duct in inches)	Width x Height/144 (in inches)
Area in Sq. M	$(\pi \times R^2)/10{,}000$ (where π = 3.14 and R = radius of duct in centimeters)	Width x Height/10,000 (in centimeters)

Setting Flow Coefficient

1. Set FLOW COEFF to the appropriate value found in the following table. This value is a starting point for the air balancer.
2. To fine tune the flow coefficient use the following formula:

   ⇨ **New Flow Coefficient = (Actual Volume ÷ Controller Volume) × Old Flow Coefficient**
   The actual volume is the actual value obtained from the balancer's measurements. The controller volume is the value obtained from AIR VOLUME.
3. If the controller volume is not within 5% of the actual volume, repeat the procedure until it is within 5%.

Box Manufacturer Flow Coefficients		
Manufacturer	**Sensor Type**	**Value**
Anemostat	2-pipe without orifice 2-pipe with orifice Spider without orifice Spider with orifice	0.79 0.59 0.73 0.39
Carnes	2-pipe Flow cross	0.66 0.59
Carrier		0.59
E.H. Price/Siemens Industry Terminal Boxes		0.78
Environmental Technologies		0.79
Krueger		0.68
Metal Aire		0.72
Nailor Industries		0.69
Titus		0.60
Trane		0.66

Setting Airflow Setpoints

NOTE:
Maximum flow(s) must be set ≥ minimum flow(s).

1. Set CLG FLOW MIN to the desired minimum cooling airflow setpoint.
2. Set CLG FLOW MAX to the desired maximum cooling airflow setpoint.
3. Set HTG FLOW MIN to the desired minimum heating airflow setpoint.

4. Set HTG FLOW MAX to the desired maximum heating airflow setpoint.

⚠ CAUTION

If using electric heat, enter a value for HTG FLOW MIN.
Equipment damage may occur at 0 cfm with electric heat ON.

⚠ CAUTION

As a safety feature, MODHTG FLOW ensures that adequate airflow is present before an electric heating element is energized. Since the application has a default of one heating valve (MODHTG COUNT = 1), MODHTG FLOW has the default of 20 pct (of HTG FLOW MAX). If flow safety is not required, set MODHTG FLOW = 0 to eliminate the dependency.

The default value is 20, which means that the airflow must be at least 20% of HTG FLOW MAX before heating outputs are enabled. (Note that if CTL FLOW MAX is overridden, MODHTG FLOW becomes the minimum required percentage of CTL FLOW MAX rather than the minimum required percentage of HTG FLOW MAX.) If hot water heat is used rather than electric heat, then, using WCIS you can set the value of MODHTG FLOW to a lower value to allow heating at lower airflows.
For installations that include radiant heating panels (either ceiling or wall mounted), MODHTG FLOW should b set to zero.

Enabling Wall Switch

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

Otherwise, leave WALL SWITCH at its default value of **NO**.

Autozero Module

For a controller without an Autozero Module, the damper is commanded closed to get a zero airflow reading during calibration.

Setting Room Temperature Offset (Optional)

When the room has stabilized, take a precision temperature reading over a period of time at the room temperature sensor, record any difference between this reading and the value of ROOM TEMP and set this difference value (to the nearest 0.25°F (0.14°C)) into TEMP OFFSET.

Example

If the actual room temperature is 72.0°F (22.2°C), and the value of ROOM TEMP is 73.0°F (23.8°C), then the value entered into TEMP OFFSET is –1.0. In this case, the value of ROOM TEMP would read the raw value 73.0°F (23.8°C), but the value of CTL TEMP would read 72.0°F (22.2°C).

CTL TEMP = ROOM TEMP + TEMP OFFSET

Setting the CO2 Sensor

1. Set CO2 SCALE to the value, in PPM, represented by a sensor reading of 10V or 20 mA.
2. Set the Dip switch (located on circuit board) to indicate the sensor type, either current or voltage.

Issued by
Siemens Industry, Inc.
Building Technologies Division
1000 Deerfield Pkwy
Buffalo Grove IL 60089
Tel. +1 847-215-1000