SIEMENS

TEC Controller

Terminal Box Controller (VAV) - Electronic Output

Owner's Manual

125-5075
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Building Technologies

Table of Contents

How To Use This Manual

This manual is written for the owner and user of the TEC Terminal Box Controller. It is designed to help you become familiar with the Siemens TEC and its applications.

This section covers manual organization, manual conventions, symbols used in the manual, and other information that will help you use this manual.

Manual Organization

This manual contains the following chapters:

- *Chapter 1 - Hardware,* describes the hardware components and the accessories that are used with the TEC.
- *Chapter 2 - Applications,* describes the control applications available in the model of the TEC that includes a terminal block for wireable input/output connections.
- *Chapter 3 - Point Database,* defines the point database descriptors and includes address and applications.
- *Chapter 4 – Basic Service and Maintenance,* describes basic corrective measures you can take should you encounter a problem when using the TEC. For issues not covered in this chapter, consult your local Siemens Industry representative.
- The *Glossary* describes the terms and acronyms used in this manual.
- The *Index* helps you locate information presented in this manual.

Manual Conventions

The following table lists conventions to help you use this manual in a quick and efficient manner.

Convention	Examples
Numbered Lists (1, 2, 3…) indicate a procedure with sequential steps.	1. Turn OFF power to the field panel. 2. Turn ON power to the field panel. 3. Contact the local Siemens Industry representative.
Conditions that must be completed or met before beginning a task are designated with a ▹. Intermediate results (what will happen following the execution of a step), are designated with a ⇨. Results, which inform the user that a task was completed successfully, are designated with a ⇨.	▹Composer software is properly installed. ▹A Valid license is available. 1. Select **Start** > **Programs** > **Siemens** > **GMS** > **Composer**. ⇨The Project Management window displays. 2. Open an existing project or create a new one. ⇨The project window displays.
Actions that should be performed are specified in boldface font.	Type **F** for Field panels. Click **OK** to save changes and close the dialog box.
Error and system messages are displayed in Courier New font.	The message `Report Definition successfully renamed` displays in the status bar.
New terms appearing for the first time are italicized.	The field panel continuously executes a user-defined set of instructions called the *control program*.
	This symbol signifies Notes. Notes provide additional information or helpful hints.

Convention	Examples
Cross references to other information are indicated with an arrow and the page number, enclosed in brackets: [→92]	For more information on creating flowcharts, see Flowcharts [→92].
Placeholders indicate text that can vary based on your selection. Placeholders are specified by italicized letters, and enclosed with brackets [ ].	Type **A C D H** [*username*] [*field panel #]*.

Manual Symbols

The following table lists the safety symbols used in this manual to draw attention to important information.

Symbol	Meaning	Description
NOTICE	CAUTION	Equipment damage may occur if a procedure or instruction is not followed as specified. (For online documentation, the NOTICE displays in white with a blue background.)
	CAUTION	Minor or moderate injury may occur if a procedure or instruction is not followed as specified.
	WARNING	Personal injury or property damage may occur if a procedure or instruction is not followed as specified.
	DANGER	Electric shock, death, or severe property damage may occur if a procedure or instruction is not followed as specified.

Getting Help

For more information about the TEC Terminal Box Controller, contact your local Siemens Industry representative.

Where to Send Comments

Your feedback is important to us. If you have comments about this manual, please submit them to SBT_technical.editor.us.sbt@siemens.com

Chapter 1 – Product Overview

The TEC Terminal Box Controller is the Siemens Industry FLN controller used in pressure independent Variable Air Volume applications. It provides Direct Digital Control (DDC) for eight applications and is available in both short and long board hardware assemblies.

- The controller can operate as an independent, stand-alone, DDC room controller or it can be networked with a field panel.
- The controller provides all termination, input/output, system and local communication connections.
- The controller hardware consists of the controller with cover and mounting bracket (See Figure TEC Terminal Box Controller).

The following applications are covered:

- Slave Mode (Application 2091)
- VAV Cooling Only (Application 2020)
- VAV Cooling or Heating (Application 2021)
- VAV with Electric Reheat or Baseboard Radiation (Application 2022)
- VAV with Hot Water Reheat (Application 2023)
- VAV Series Fan Powered with Electric Reheat (Application 2024)
- VAV Series Fan Powered with Hot Water Reheat (Application 2025)
- VAV Parallel Fan Powered with Electric Reheat (Application 2026)
- VAV Parallel Fan Powered with Hot Water Reheat (Application 2027)

Hardware Inputs

Analog

Air velocity sensor	Application 2020 Application 2021 Application 2022 Application 2023 Application 2024 Application 2025 Application 2026 Application 2027
Room temperature sensor	Application 2020 Application 2021 Application 2022 Application 2023 Application 2024 Application 2025 Application 2026 Application 2027
(Optional) Room temperature setpoint dial	Application 2020 Application 2021 Application 2022 Application 2023 Application 2024 Application 2025 Application 2026 Application 2027

(Optional) Auxiliary or duct temperature sensor	Application 2020 Application 2021 Application 2022 Application 2023 Application 2024 Application 2025 Application 2026 Application 2027

Digital

(Optional) Night mode override	Application 2020 Application 2021 Application 2022 Application 2023 Application 2024 Application 2025 Application 2026 Application 2027
(Optional) Wall switch	Application 2020 Application 2021 Application 2022 Application 2023 Application 2024 Application 2025 Application 2026 Application 2027
(Optional) Night mode override	Application 2020 Application 2021 Application 2022 Application 2023 Application 2024 Application 2025 Application 2026 Application 2027
(Optional) Wall switch	Application 2020 Application 2021 Application 2022 Application 2023 Application 2024 Application 2025 Application 2026 Application 2027

Hardware Outputs

Analog

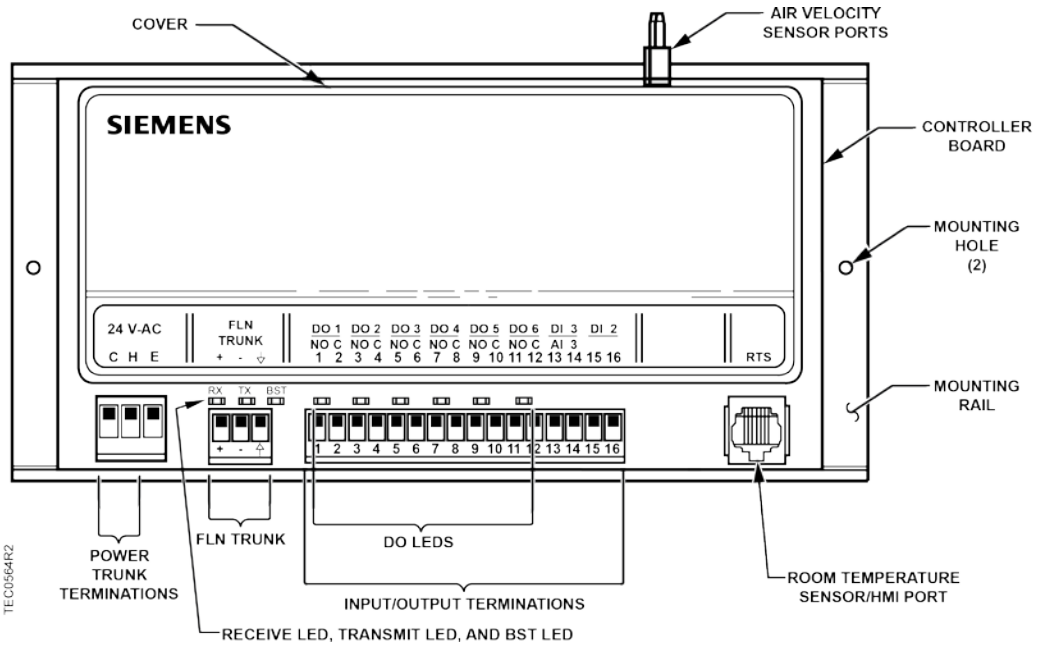
None

Digital

Damper actuator (DO 1/DO 2)	Application 2020 Application 2021 Application 2022 Application 2023 Application 2024 Application 2025 Application 2026 Application 2027
Autozero Module	Application 2020 Application 2021 Application 2022 Application 2023
Stage 1 electric heat or 2-position heating valve	Application 2022
Stage 1 electric heat	Application 2024 Application 2026
Stage 2 electric heat	Application 2022 Application 2024 Application 2026
Stage 3 electric heat	Application 2022 Application 2024 Application 2026
1st heating valve actuator	Application 2023 Application 2025 Application 2027
2nd heating valve actuator	Application 2023
Series Fan	Application 2024 Application 2025
Parallel Fan	Application 2026 Application 2027

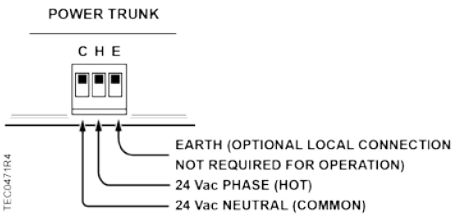
Ordering Notes

TEC Terminal Box Controller	540-100N
TEC Terminal Box Controller with Autozero Module	540-200N



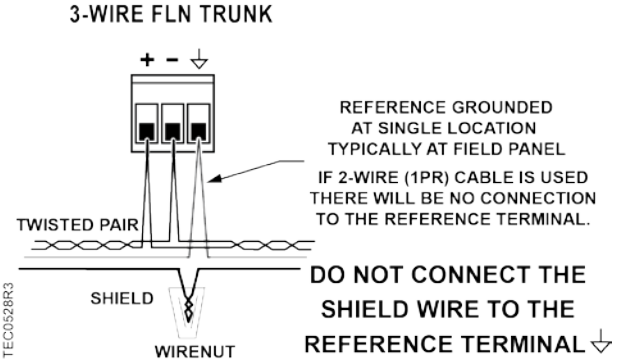
Generic Controller I/O Layout. See *Wiring Diagram* for application specific details.

Power Wiring



Communication Wiring

The controller connects to the field panel by means of a Floor Level Network (FLN) trunk. Communication wiring connects to the three screw terminals on the controller labeled “+” (positive), “-“ (negative), and “⏚” (reference).



Controller LED Indicators

NOTE:
The TX and RX LEDs indicate communication over the FLN.

To determine if the controller is powered up and working, verify that the Basic Sanity Test (BST) Light Emitting Diode (LED) is flashing ON/OFF once per second. The controller has nine Light Emitting Diode (LED) indicators (see Figure Siemens BACnet VAV Controller).

Controller LEDs.			
LED Type	**Label (if present)***	**LED Number**	**Indication**
DO	LED 1 - LED 6	1 – 6	Indicates the ON/OFF status of the DO associated with it. A glowing LED indicates that the DO is energized.
Transmit	TX	7	Indicates, when flashing, that the controller is transmitting information to the field panel.
Receive	RX	8	Indicates, when flashing, that the controller is receiving information from the field panel.
BST ”Basic Sanity Test”	BST	9	Indicates, when flashing ON and OFF once per second, that the controller is functioning properly.

* Some LED labels and numerals may be hidden by the controller cover.

Temperature Sensors

Temperature sensors used with the TEC Terminal Box Controller include an electronic room temperature sensor and an optional duct temperature sensor.

Room Temperature Sensor

The room temperature sensor connects to the controller by means of a cable terminated at both ends with a six-conductor RJ-11 plug-in connector.

See the Ordering Notes section for the location of the room temperature sensor/Human Machine Interface (HMI) port.

Duct Temperature Sensor

An optional duct temperature sensor provides duct air temperature sensing inputs to the controller.

For more information about temperature sensors, contact your local Siemens Industry representative.

Actuators

Actuators used with the TEC Terminal Box Controller include electronic damper motors, electronic valve motors, and electronic valve assemblies. These actuators are powered through the controller to position cooling and/or reheat valves or supply air dampers.

Related Equipment

- *(Optional)* Autozero Module
- *(Optional)* Relay Module
- Damper Actuator(s)
- *(Optional)* Duct Temperature Sensor
- Room Temperature Sensor
- *(Optional)* Valve Actuator

Contact your local Siemens Industry representative for product numbers and more information.

Chapter 2 – Applications

Basic Operation

The TEC Terminal Box Controller provides Direct Digital Control (DDC) for Variable Air Volume (VAV) terminal box applications. Temperature control varies with the application. If present, heating can be provided by hot water, up to three stages of electric reheat, or optional baseboard radiation.

Control Temperature Setpoints

The controller maintains a specified temperature setpoint based on Day/Night mode, the heating/cooling mode, or the setpoint dial (if used).

This application has a number of different room temperature setpoints (DAY HTG STPT, NGT CLG STPT, RM STPT DIAL, and so on.). The application actually controls using the CTL STPT. CTL STPT is set to different values depending on its override status, the time of day, whether or not a temperature deadband (zero energy band) has been configured, and the type of RTS used.

Day/Night Mode

The controller maintains the specified day setpoint temperature during daytime hours and the specified night setpoint at night.

Night Mode Override Switch

If the ROOM TEMPERATURE SENSOR has an override switch, it can be used to command the controller into day mode for an adjustable period of time. This only affects a controller in night mode.

Control Loops

Temperature Loop – Heating Loop – Cooling Loop

Maintain temperature setpoint by changing the flow setpoint or modulating the heat source (valve/electric heat).

Flow Loop

Maintains flow setpoint by modulating the damper actuator.

Calibration

Air Velocity Sensor

Calibration of the controller's internal air velocity sensor is periodically required to maintain accurate air velocity readings. Calibration may be set to take place automatically or manually.

Additional calibration is provided by driving the valve or damper fully closed or open, whenever they are commanded to 0 or 100 percent.

Fail-Mode Operation

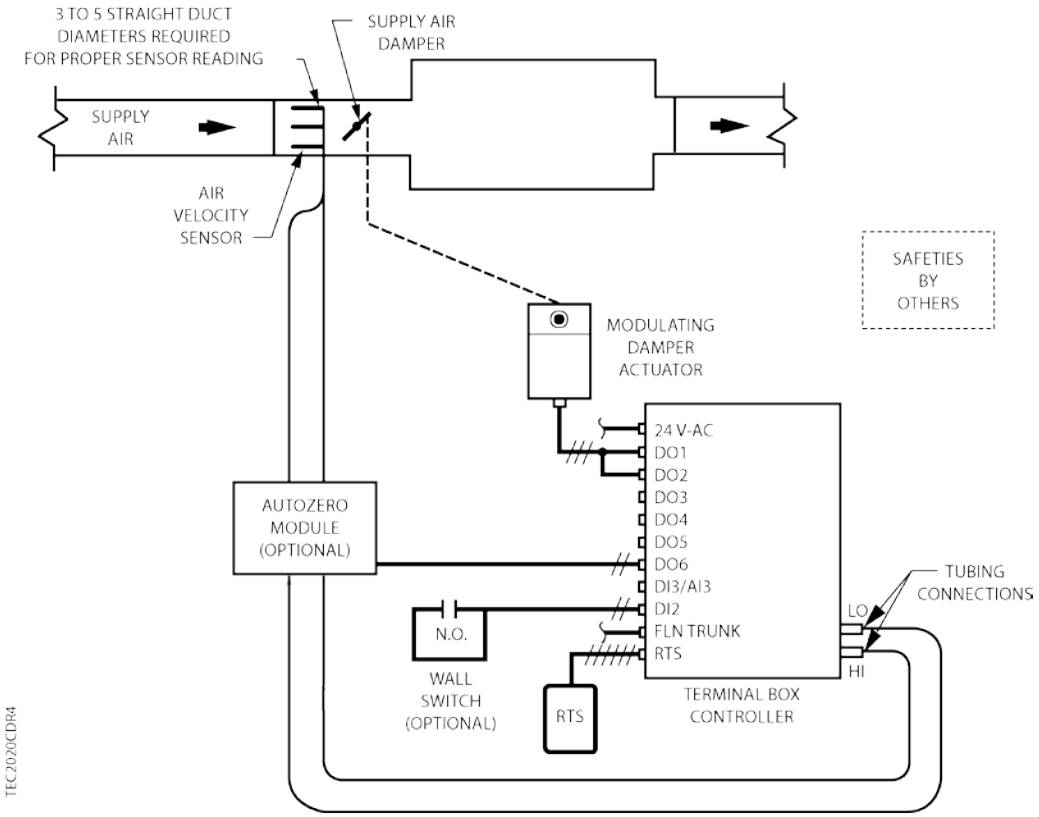
If the RTS or the setpoint dial fails, then the controller operates using the last known temperature value.

Notes

1. If the temperature swings in the room are excessive, or if there is trouble in maintaining the setpoint, contact your local Siemens Industry representative for more information.
2. The TEC Terminal Box Controller, as shipped from the factory, keeps all associated equipment OFF. The controller and its equipment are released to application control at start up.

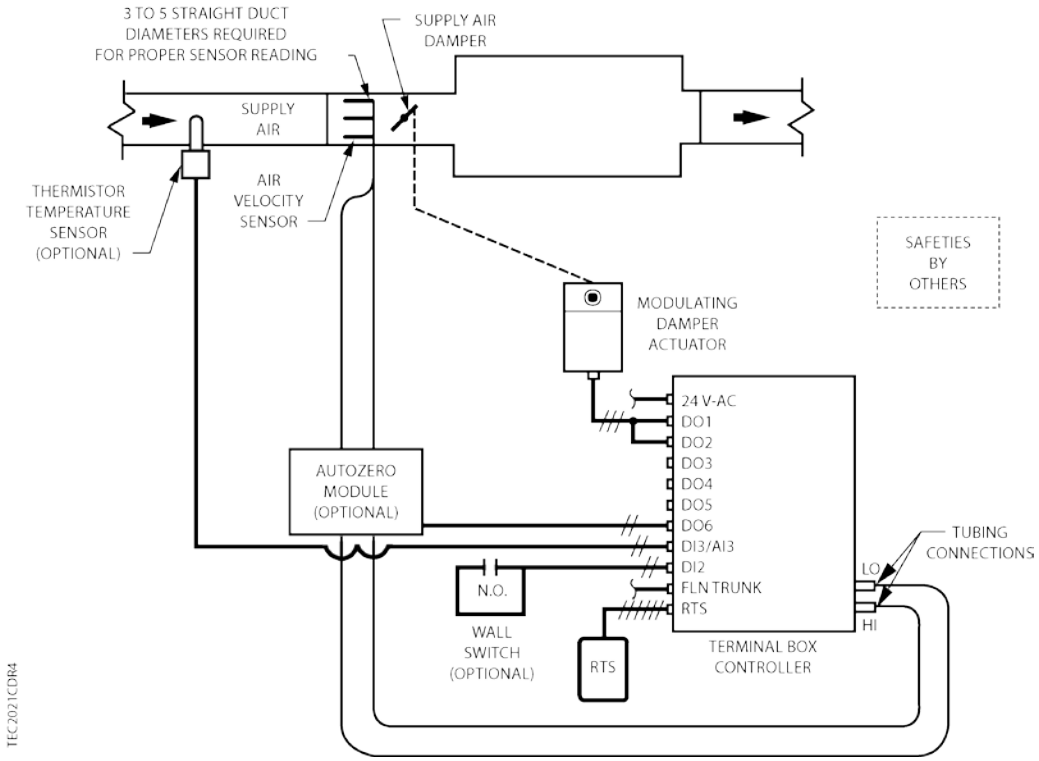
Application 2020 VAV Cooling Only

In Application 2020, the controller modulates the supply air damper of the terminal box for cooling. In order for it to work properly, the central air-handling unit must provide cool supply air.



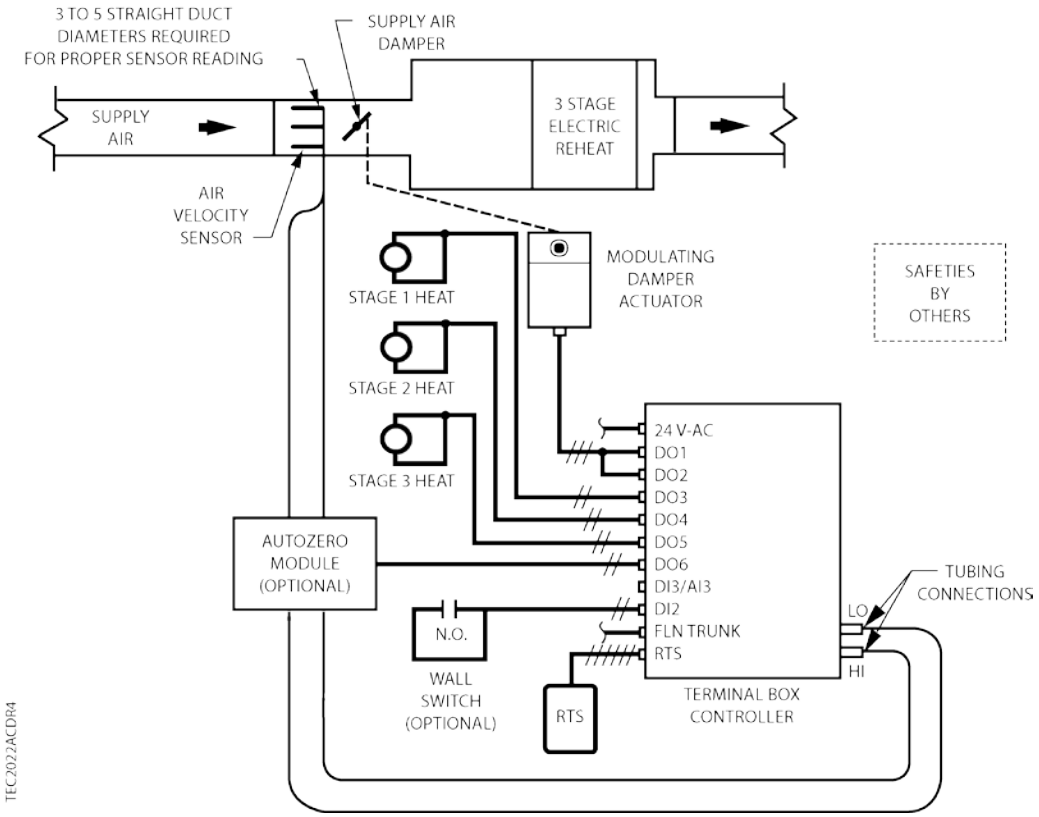
Application 2021 VAV Cooling or Heating

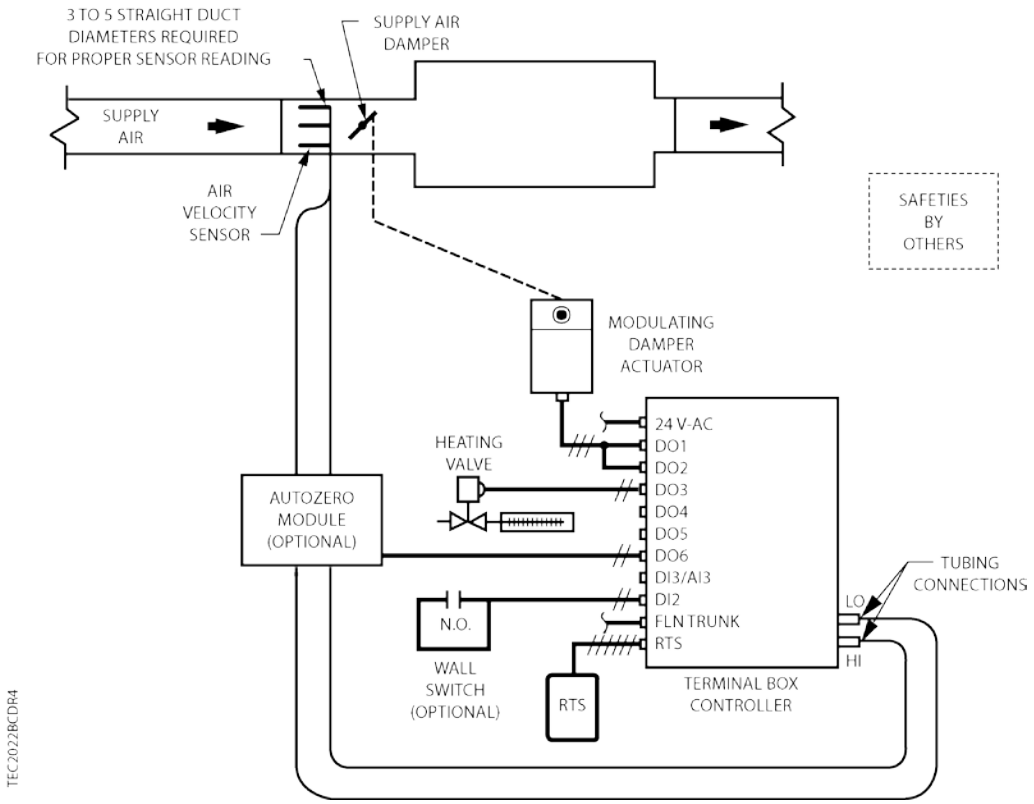
In Application 2021, the controller modulates the supply air damper of the terminal box for cooling or heating. In order for it to work properly, the central air-handling unit must provide cool supply air in cooling mode and warm air during heating mode.



Application 2022 VAV with Electric Reheat or Baseboard Radiation

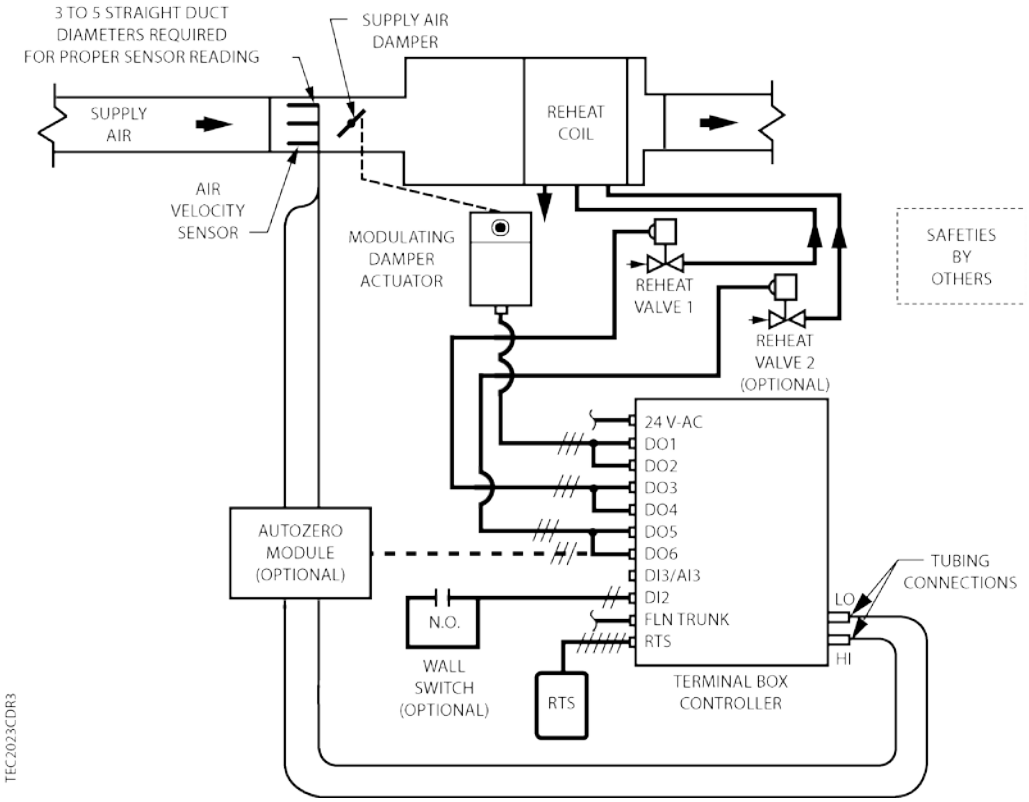
In Application 2022, the controller modulates the supply air damper of the terminal box for cooling and controls stages of electric reheat or baseboard radiation for heating. When in heating, the terminal box either maintains minimum airflow or modulates the supply air damper. In order for the terminal box to work properly, the central air-handling unit must provide supply air.




3 TO 5 STRAIGHT DUCT DIAMETERS REQUIRED FOR PROPER SENSOR READING
SUPPLY AIR DAMPER
SUPPLY AIR
AIR VELOCITY SENSOR
SAFETIES BY OTHERS
MODULATING DAMPER ACTUATOR
24 V-AC
DO1
DO2
DO3
DO4
DO5
DO6
DI3/AI3
DI2
FLN TRUNK
RTS
HEATING VALVE
AUTOZERO MODULE (OPTIONAL)
TUBING CONNECTIONS
LO
HI
N.O.
WALL SWITCH (OPTIONAL)
RTS
TERMINAL BOX CONTROLLER
TEC2022BCDR4

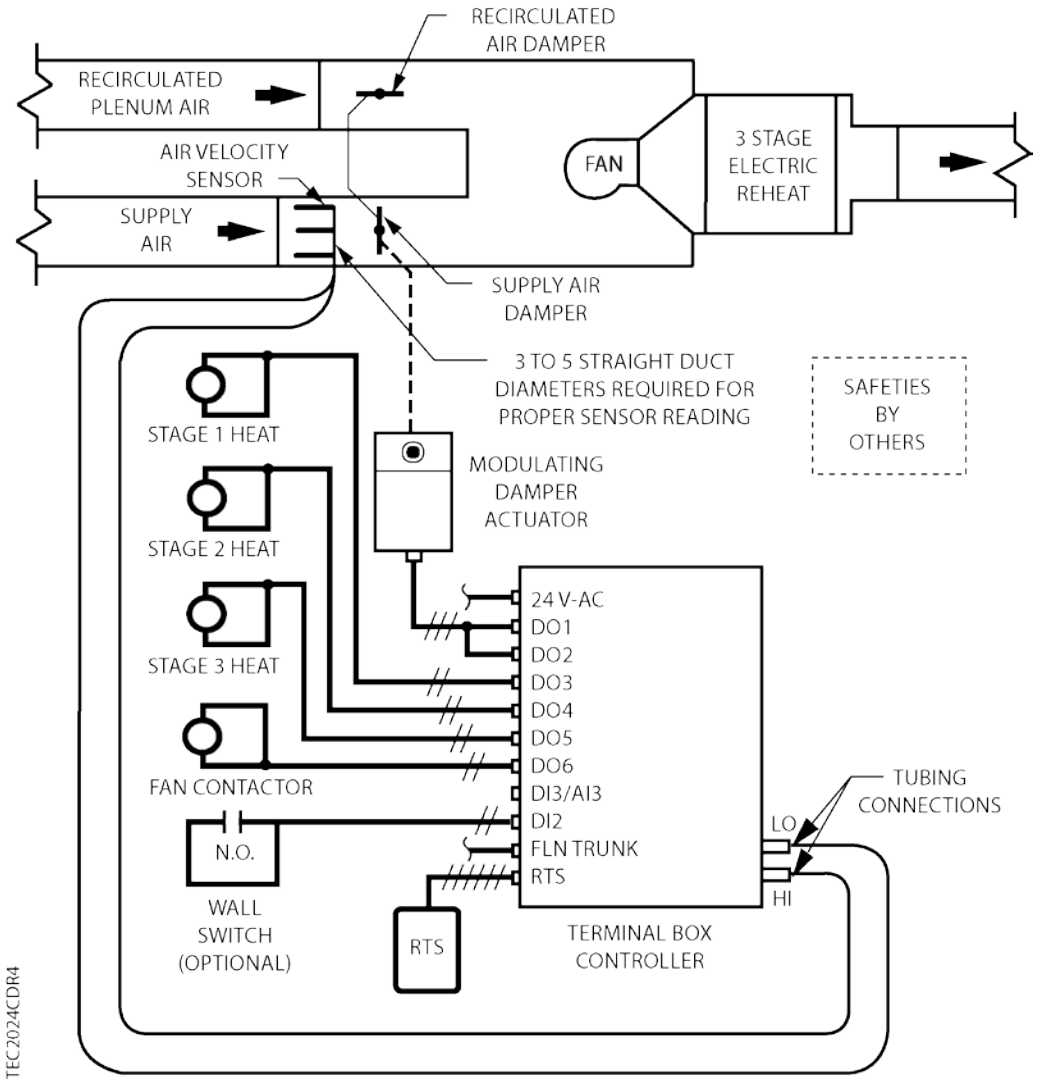
Application 2023 VAV with Hot Water Reheat

In Application 2023, the controller modulates the supply air damper of the terminal box for cooling and controls a hot water valve (or valves) for heating. When in heating, the terminal box either maintains minimum airflow or modulates the supply air damper. In order for the terminal box to work properly, the central air-handling unit must provide supply air for cooling.



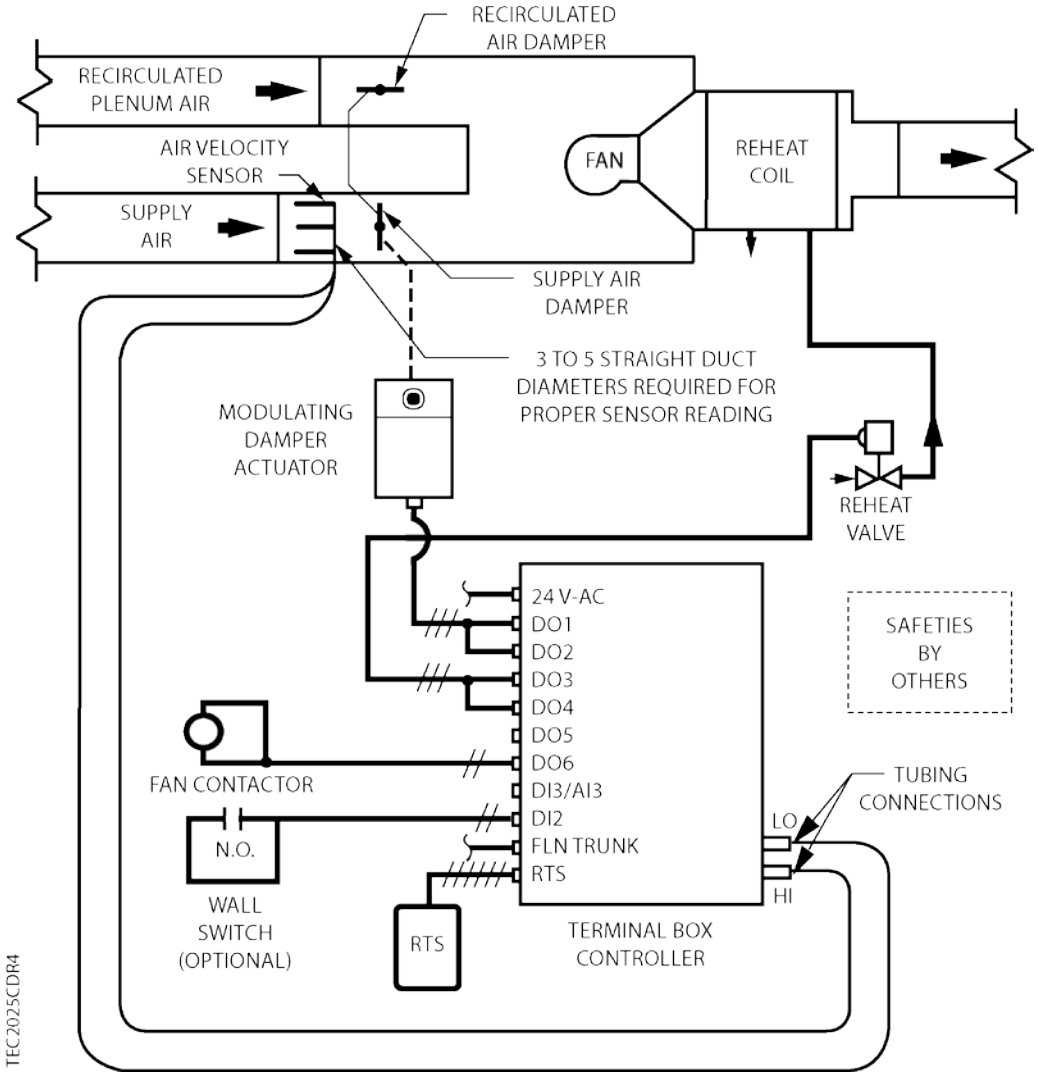
Application 2024 VAV Series Fan Powered with Electric Reheat

In Application 2024, the controller modulates the supply air damper of the terminal box for cooling and controls stages of electric reheat for heating. When in heating, the terminal box either maintains minimum airflow or modulates the supply air damper. Application 2024 has a series fan for air circulation. In order for the terminal box to work properly, the central air-handling unit must provide supply air.



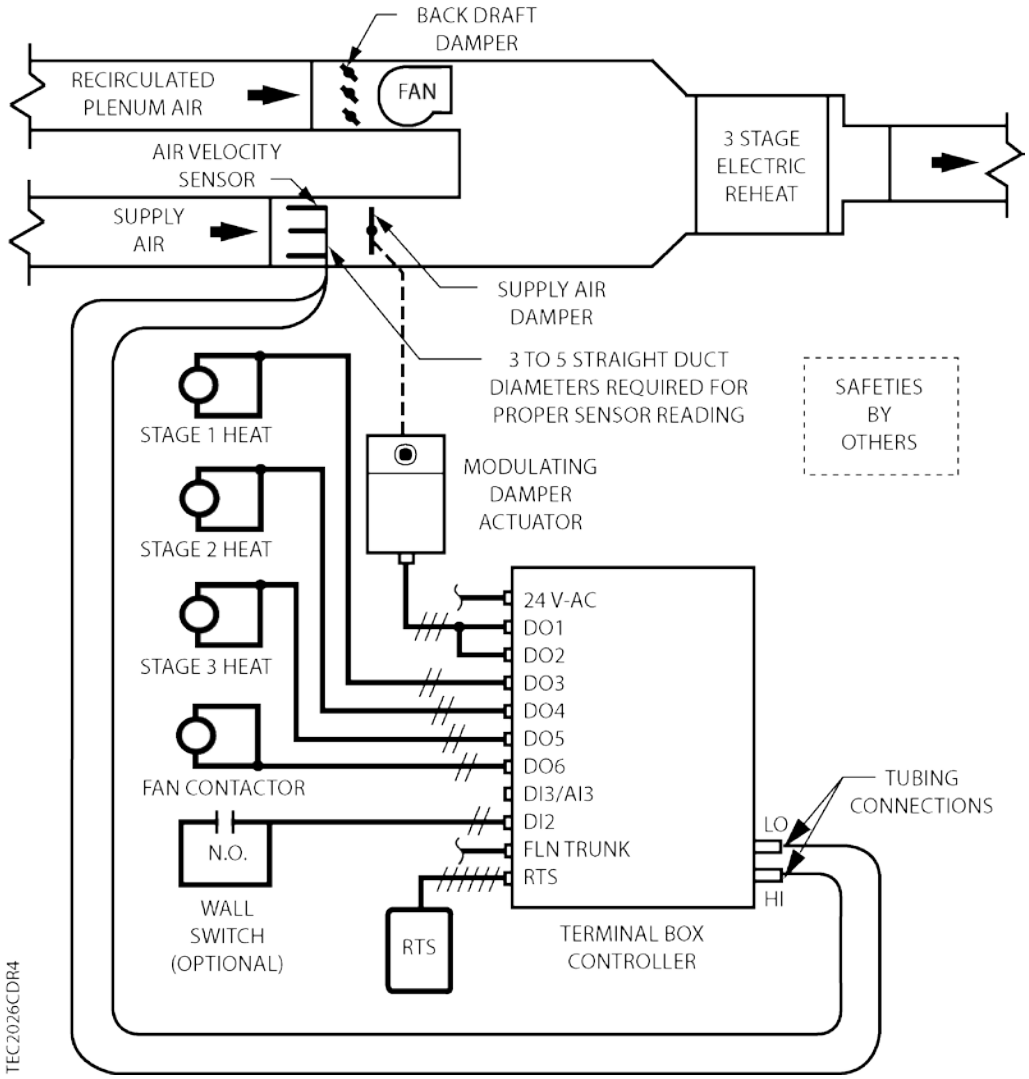
Application 2025 VAV Series Fan Powered with Hot Water Reheat

In Application 2025, the controller modulates the supply air damper of the terminal box for cooling and modulates a hot water valve for heating. When in heating, the terminal box either maintains minimum airflow or modulates the supply air damper. Application 2025 has a series fan for air circulation. In order for the terminal box to work properly, the central air-handling unit must provide supply air.



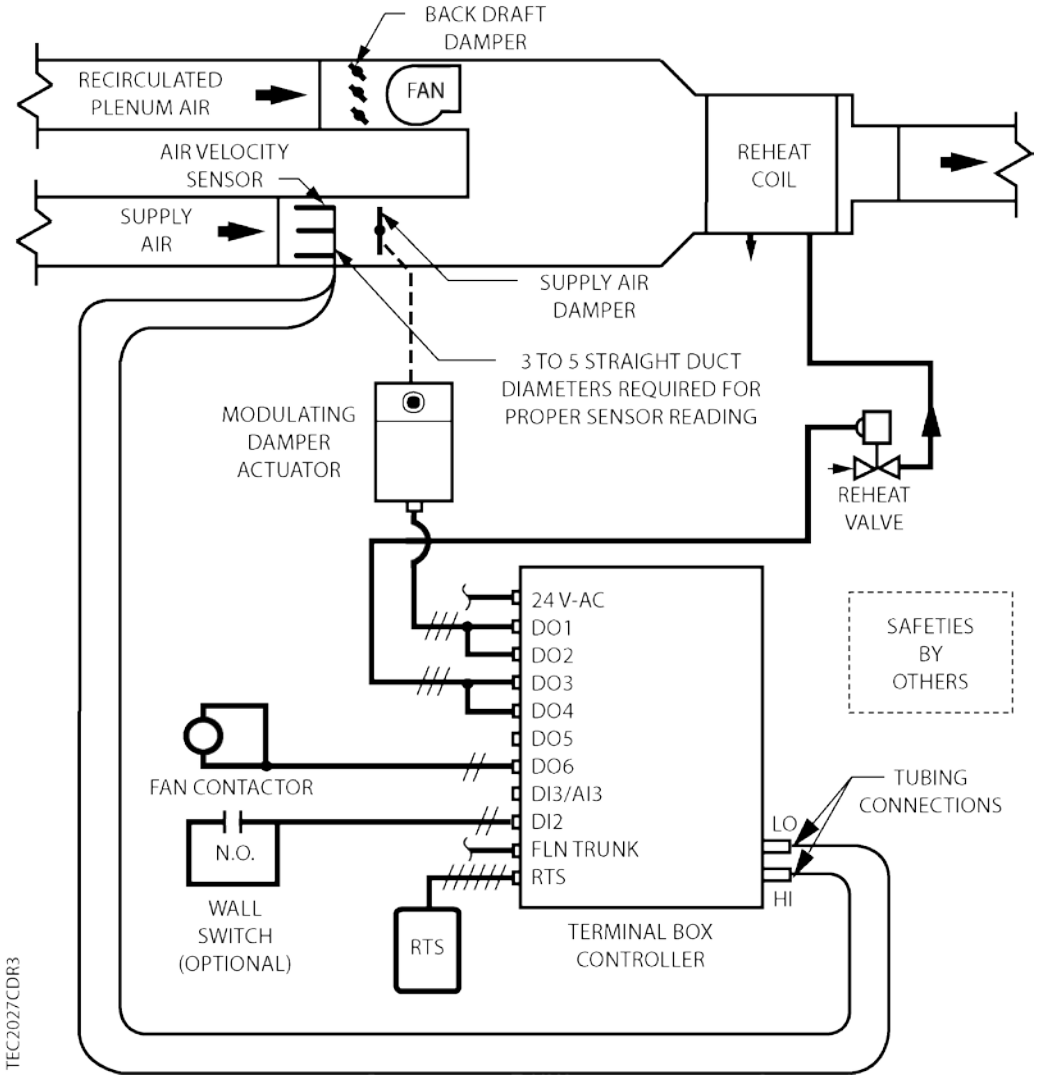
Application 2026 VAV Parallel Fan Powered with Electric Reheat

In Application 2026, the controller modulates the supply air damper of the terminal box for cooling and controls stages of electric reheat for heating. When in heating, the terminal box either maintains minimum airflow or modulates the supply air damper. Application 2026 has a parallel fan that re-circulates the room air in heating mode. In order for the terminal box to work properly, the central air-handling unit must provide supply air.



Application 2027 VAV Parallel Fan Powered with Hot Water Reheat

In Application 2027, the controller modulates the supply air damper of the terminal box for cooling and modulates a hot water valve for heating. When in heating, the terminal box either maintains minimum airflow or modulates the supply air damper. Application 2027 has a parallel fan that re-circulates the room air. In order for the terminal box to work properly, the central air-handling unit must provide supply air.



Application 2091 Slave Mode

Application 2091 is the slave mode application for the TEC (see Ordering Notes for product numbers). Slave mode is the default application that comes up when power is first applied to the controller. Slave mode provides no control. Its purpose is to allow the operator to perform equipment checkout before a control application is put into effect and to set some basic controller parameters (CTLR ADDRESS, APPLICATION, etc.).

Chapter 3 – Point Database

Chapter 3 presents a description of the TEC Terminal Box Controller point database, including point descriptors, point addresses, and a listing of applications in which each point is found.

Descriptor	Address[1]	Application	Description
CTLR ADDRESS	01	All	Identifies the controller on the FLN trunk.
APPLICATION	02	All	Identification number of the program running in the controller.
ROOM TEMP	{04}[2]	All	Actual reading from the room temperature sensor.
HEAT.COOL	{05}	All *except* 2020, 2091	Current mode of operation for applications that can be in either a heating mode or a cooling mode.
DAY CLG STPT	06	All *except* 2091	The temperature setpoint in degrees that the controller maintains during day periods in cooling mode if a room temperature sensor setpoint dial is not present or is not used. See *STPT DIAL*.
NGT CLG STPT	08	All *except* 2091	The temperature setpoint in degrees that the controller maintains during the night periods in cooling mode.
DAY HTG STPT	07	All *except* 2020, 2091	The temperature setpoint in degrees that the controller maintains during day periods in heating mode if a room temperature sensor setpoint dial is not present or is not used. See *STPT DIAL*.
NGT HTG STPT	09	All *except* 2020, 2091	The temperature setpoint in degrees that the controller maintains during the night periods in heating mode.
RM STPT MIN	11	All *except* 2091	The minimum temperature setpoint in degrees that the controller can use from the setpoint dial. This overrides any temperature setpoint from the setpoint dial that falls below this minimum.
RM STPT MAX	12	All *except* 2091	The maximum temperature setpoint in degrees that the controller can use from the setpoint dial. This overrides any temperature setpoint from the setpoint dial that falls above this maximum.
RM STPT DIAL	{13}	All	The temperature setpoint in degrees from the room temperature sensor (not available on all temperature sensor models). This setpoint will be used for control in day mode (heating or cooling) when enabled by STPT DIAL.
STPT DIAL	14	All *except* 2091	YES indicates that there is a room setpoint dial on the room temperature sensor and it should be used as the temperature setpoint for control in day/occupied mode. NO indicates that the appropriate preset setpoint will be used as the temperature setpoint for control in day/occupied heating or cooling mode. Valid input: YES or NO.
AUX TEMP	{15}	All *except* 2021	Actual reading from a 100K Ω thermistor.
SUPPLY TEMP	{15}	2021	Actual reading from a 100K Ω thermistor. The controller uses this value to determine whether it is in heating or cooling mode.
FLOW START	16	All *except* 2020, 2021, 2091	Determines how the damper modulation will be sequenced while in heating mode. When HTG LOOPOUT is above this value, then FLOW STPT starts to increase.

Descriptor	Address[1]	Application	Description
FLOW END	17	All *except* 2020, 2021, 2091	Determines how the damper modulation will be sequenced while in heating mode. When HTG LOOPOUT is below this value, then FLOW STPT starts to decrease.
WALL SWITCH	18	All	YES indicates that the controller is to monitor the status of a wall switch that is connected to UI 2. NO indicates that the controller will not monitor the status of a wall switch, even if one is connected. Valid input: YES or NO.
DI OVRD SW	{19}	All	Actual indication of the status of the override switch (not physically available on all temperature sensor models) at the room temperature sensor. ON indicates that the switch is being pressed. OFF indicates that the switch is released. Valid input: ON or OFF.
OVRD TIME	20	All *except* 2091	The amount of time in hours that the controller will operate in day/occupied mode when the override switch is pressed while the controller is in night/unoccupied mode.
NGT OVRD	{21}	All *except* 2091	Indicates the mode that the controller is operating in with respect to the override switch. NIGHT indicates that the switch has not been pressed and the override timer is not active. DAY indicates that the switch has been pressed and the override timer is active. The controller then uses a day mode temperature setpoint. This point is only in effect when DAY.NGT indicates night mode.
REHEAT START	22	All *except* 2020, 2021, 2091	Determines how the reheat modulation will be sequenced while in heating mode. When HTG LOOPOUT is above this value, then the reheat modulates upward.
REHEAT END	23	All *except* 2020, 2021, 2091	Determines how the reheat modulation will be sequenced while in heating mode. When HTG LOOPOUT is below this value, then the reheat modulates downward.
DI 2	{24}	All	Actual status of a contact connected to the controller at DI 2. ON indicates that the contact is closed; OFF indicates that the contact is open. If a wall switch is used, it is connected to DI 2. See *WALL SWITCH*.
DI 3	{25}	All *except* 2021	Actual status of a contact connected to the controller at AI 3/DI 3. ON indicates that the contact is closed; OFF indicates that the contact is open. When a contact is connected at DI 3, AI 3 is not available. See *AUX TEMP*.
SERIES ON	26	2024, 2025	When flow rises above this value, the series fan will turn ON.
SERIES ON	26	2026	This point is present, but not used in this application.
SERIES OFF	27	2024, 2025	When flow drops below this value and other conditions have been met, the series fan will turn OFF.
SERIES OFF	27	2026	This point is present, but not used in this application.
PARALLEL ON	28	2024	This point is present, but not used in this application.
PARALLEL ON	28	2026, 2027	When flow drops below this value and other conditions have been met, the parallel fan will turn ON.
DAY.NGT	{29}	All	Indicates the mode in which the controller is operating. Day temperature setpoints will be used in day mode. Night temperature setpoints will be used in night mode. This point is normally set by the field panel.
PARALLEL OFF	30	2024	This point is present, but not used in this application.
PARALLEL OFF	30	2026, 2027	When flow rises above this value, the parallel fan will turn

Descriptor	Address[1]	Application	Description
			OFF.
CLG FLOW MIN	31	All *except* 2091	The minimum amount of air in CFM (LPS) to be supplied to the space in cooling mode.
CLG FLOW MAX	32	All *except* 2091	The maximum amount of air in CFM (LPS) to be supplied to the space in cooling mode.
HTG FLOW MIN	33	All *except* 2020, 2091	The minimum amount of air in CFM (LPS) to be supplied to the space in heating mode.
HTG FLOW MAX	34	All *except* 2020, 2091	The maximum amount of air in CFM (LPS) to be supplied to the space in heating mode.
AIR VOLUME	{35}	All	Actual amount of air in CFM (LPS) currently passing through the air velocity sensor.
FLOW COEFF	36	All	Calibration factor for the airflow sensor.
MTR3 COMD	{37}	2020, 2021, 2022, 2091	The value to which the Motor 3 actuator is commanded in percent of full value.
VLV2 COMD	{37}	2023	The value to which the valve 2 actuator is commanded in percent of full travel for applications using a second water valve.
MTR3 POS	{38}	2020, 2021, 2022, 2091	The current position of the Motor 3 actuator in percent of full travel. This value is calculated based on motor run time.
VLV2 POS	{38}	2023	The current position of Valve 2 in percent of full travel. This value is calculated based on valve run time.
MTR3 TIMING	39	All except 2024, 2025, 2026, 2027	The time, in seconds, required for the Motor 3 actuator to travel from the full closed position to the full open position.
DO 1	{41}	All	Digital output 1 controls a 24 Vac load with an ON or OFF status. If Motor 1 is enabled, DO 1 is coupled with DO 2 to control an actuator.
DO 2	{42}	All	Digital output 2 controls a 24 Vac load with an ON or OFF status. If Motor 1 is enabled, DO 2 is coupled with DO 1 to control an actuator.
DO 3	{43}	All *except* 2022, 2024, 2026	Digital output 3 controls a 24 Vac load with an ON or OFF status. If Motor 2 is enabled, DO 3 is coupled with DO 4 to control an actuator.
HEAT STAGE 1	{43}	2022, 2024, 2026	This point is DO 3 in applications with electric reheat. This digital output controls the contact for the first stage of heating and has a status of ON or OFF.
DO 4	{44}	All *except* 2022, 2024, 2026	Digital output 4 controls a 24 Vac load with an ON or OFF status. If Motor 2 is enabled, DO 4 is coupled with DO 3 to control an actuator.
HEAT STAGE 2	{44}	2022, 2024, 2026	This point is DO 4 in applications with electric reheat. This digital output controls the contact for the second stage of heating and has a status of ON or OFF.
DO 5	{45}	2020, 2021, 2023, 2091	Digital output 5 controls a 24 Vac load with an ON or OFF status. If Motor 3 is enabled, DO 5 is coupled with DO 6 to control an actuator.
DO 5	{45}	2025, 2027	Digital output 5 controls a 24 Vac load with an ON or OFF status.
HEAT STAGE 3	{45}	2022, 2024, 2026	This point is a digital output used to control the contact for the third stage of heating and has a status of ON or OFF.

Descriptor	Address[1]	Application	Description
DO 6	{46}	All *except* 2024, 2025, 2026, 2027	Digital output 6 controls a 24 Vac load with an ON or OFF status. If Motor 3 is enabled, DO 6 is coupled with DO 5 to control an actuator. In applications with CAL MODULE set to YES, this digital output controls the Autozero Module to calibrate the controller's internal air velocity transducer.
FAN	{46}	2024, 2025, 2026, 2027	This point is a digital output used to control the fan. ON indicates that the DO is energized; OFF indicates that the DO is de-energized.
DMPR COMD	{48}	All *except* 2091	The value to which the damper motor is commanded in percent of full travel.
MTR1 COMD	{48}	2091	The value to which the Motor 1 actuator is commanded in percent of full travel.
DMPR POS	{49}	All *except* 2091	The current position of the damper motor in percent of full travel. This value is calculated based on motor run time.
MTR1 POS	{49}	2901	The current position of Motor 1 in percent of full travel. This value is calculated based on motor run time. See *MTR1 TIMING*.
MTR1 TIMING	51	All	The time, in seconds, required for the Motor 1 actuator to travel from full closed to the full open position.
MTR2 COMD	{52}	2020, 2021, 2091	The value to which the Motor 2 actuator is commanded in percent of full travel (for use as an auxiliary slave point).
VLV COMD	{52}	2025, 2027	The value to which the valve actuator is commanded in percent of full travel for applications using a water valve.
VLV1 COMD	{52}	2023	The value to which the valve 1 actuator is commanded in percent of full travel for applications using a water valve.
MTR2 POS	{53}	2020, 2021, 2091	The current position of the Motor 2 actuator in percent of full travel (for use as an auxiliary slave point). This value is calculated based on motor run time. See *MTR2 TIMING*.
VLV POS	{53}	2025	The current position of the valve in percent of full travel for applications using a water valve. This value is calculated based on motor run time.
VLV1 POS	{53}	2023	The current position of valve 1 in percent of full travel for applications using a water valve. This value is calculated based on motor run time.
MTR2 TIMING	55	All *except* 2022, 2024, 2026	The time, in seconds, required for the Motor 2 actuator to travel from full closed to the full open position.
DMPR ROT ANG	56	All *except* 2091	The number of degrees the damper is free to travel.
DPR1 ROT ANG	56	2091	The number of degrees that damper 1 is free to travel.
DPR2 ROT ANG	57	2091	The number of degrees that damper 2, the hot duct damper, is free to travel.
MTR SETUP	58	All	The configuration setup code for Motors 1 and 2. This enables the motors individually and sets each motor to be either direct or reverse acting. **Note:** When a motor is enabled, its associated DOs are enabled.
DO DIR.REV	59	All	The configuration setup code for DOs. Allows the DOs to be direct or reverse acting (enabled equals energized or disabled equals de-energized).

Descriptor	Address[1]	Application	Description
EHEAT FLOW	60	2022	The flow required before the electric heat will be enabled.
COOL TEMP	61	2021	The discharge air temperature where the controller will switch from heating to cooling mode. Used only in applications with SUPPLY TEMP.
HEAT TEMP	62	2021	The discharge air temperature where the controller will switch from cooling to heating mode. Used only in applications with SUPPLY TEMP.
CLG P GAIN	63	All *except* 2091	The proportional gain value for the cooling temperature control loop.
CLG I GAIN	64	All *except* 2091	The integral gain value for the cooling temperature control loop.
CLG D GAIN	65	All *except* 2091	The derivative gain value for the cooling temperature control loop.
CLG BIAS	66	All *except* 2091	The biasing of the cooling temperature control loop. See *CLG LOOPOUT*.
HTG P GAIN	67	All *except* 2020, 2091	The proportional gain value for the heating temperature control loop.
HTG I GAIN	68	All *except* 2020, 2091	The integral gain value for the heating temperature control loop.
HTG D GAIN	69	All *except* 2020, 2091	The derivative gain value for the heating temperature control loop.
HTG BIAS	70	All *except* 2020, 2091	The biasing of the heating temperature control loop. See *LOOPOUT*.
FLOW P GAIN	71	All *except* 2091	The proportional gain value for the flow control loop.
FLOW I GAIN	72	All *except* 2091	The integral gain value for the flow control loop.
FLOW D GAIN	73	All *except* 2091	The derivative gain value for the flow control loop.
FLOW BIAS	74	All *except* 2091	The biasing of the flow control loop.
FLOW	{75}	All *except* 2091	Indicates the amount of air currently passing the air velocity sensor. The value is calculated as a percentage based on where the value of AIR VOLUME is in the range between 0 and CTL FLOW MAX.
CTL FLOW MIN	{76}	All *except* 2091	The active minimum flow used as a limit for the flow control loop. This value is the same as CLG FLOW MIN if the controller is in cooling mode, or is the same as HTG FLOW MIN if the controller is in heating mode, unless it is overridden.
CTL FLOW MAX	{77}	All *except* 2091	The active maximum flow used as a limit for the flow control loop. This value is the same as CLG FLOW MAX if the controller is in cooling mode, or is the same as HTG FLOW MAX if the controller is in heating mode unless, it is overridden.
CTL TEMP	{78}	All *except* 2091	The temperature used as input for the temperature control loops. This value is the same as the value in ROOM TEMP unless it is overridden.
CLG LOOPOUT	{79}	All *except* 2091	The cooling temperature control loop output value in percent.

Descriptor	Address[1]	Application	Description
HTG LOOPOUT	{80}	All *except* 2020, 2091	The heating temperature control loop output value in percent.
AVG HEAT OUT	{81}	2022, 2024, 2026	This point is used to determine what stages of electric heat are used for a given loop output value. The ranges for the value are determined by the number of stages used: 0 to 100 for 1 stage of electric heat, 0 to 200 for 2 stages of electric heat, and 0 to 300 for 3 stages of electric heat. With electric heat, this value is equal to: HTG LOOPOUT × STAGE COUNT.
STAGE MAX	82	2022, 2024, 2026	The value, in percent, which the heating loop must exceed for the electric heat to be ON for the full duty cycle (STAGE TIME).
STAGE FAN	83	2025, 2027	The valve must be opened greater than this value before the fan will turn ON.
STAGE MIN	83	2022, 2024, 2026	The value, in percent, which the heating loop must go below for the electric heat to be OFF for the full duty cycle (STAGE TIME).
DMPR STATUS	{84}	2020, 2021, 2022, 2023	This point is used only when CAL MODULE set to YES. It readjusts the damper position if the command value is not equal to the actual position of the damper. CAL indicates that the damper is operating normally. RECAL indicates that the damper position was adjusted (recalibrated) by 25% because the desired airflow was not obtainable under its current status.
SWITCH LIMIT	85	All *except* 2020, 2021, 2091	The active temperature control loop output must be less than this value to switch between cooling mode and heating mode. Actual switchover depends on SWITCH DBAND being exceeded and is subject to SWITCH TIME being expired.
SWITCH TIME	86	All *except* 2020, 2021, 2091	The time, in minutes, before the heat/cool mode can change over when the other parameters are appropriate.
CAL MODULE	87	All *except* 2024, 2025, 2026, 2027	YES indicates that the Autozero Modules are enabled to calibrate the air velocity transducers. The dampers will not be used for calibration. NO indicates that Autozero Modules are disabled and that the air velocity transducers will be calibrated by closing the dampers. Valid input: YES or NO.
STAGE COUNT	88	2022, 2024, 2026	The number of electric heating stages used by the application. DOs associated with unused stages may be used as spare DOs.
VALVE COUNT	88	2023	The number of heating valves available.
STAGE TIME	89	2022, 2024, 2026	The cycle time in minutes for the electric reheat stages. For example, if there are three stages of electric heat and STAGE TIME = 10 minutes, STAGE COUNT = 3, and AVG HEAT OUT = 150% then, Stage 1 is ON for 10 minutes (100% of the time), Stage 2 is ON for 5 minutes (50% of 10 minutes) and OFF for 5 minutes, and Stage 3 is OFF.
SWITCH DBAND	90	All *except* 2020, 2021, 2091	The temperature range in degrees which is compared to the difference between CTL TEMP and CTL STPT. The difference must exceed this value for temperature control mode to change over. Changeover is also subject to the active temperature control loop output being below SWITCH LIMIT (Point 85) and SWITCH TIME being expired.
TOTAL VOLUME	{91}	All *except* 2091	The total amount of air delivered to a space in CF (L) since the last time the point was reset or rolled over.

Descriptor	Address[1]	Application	Description
CTL STPT	{92}	All *except* 2091	The actual setpoint value being used as input for the active temperature control loop.
FLOW STPT	{93}	All *except* 2091	The setpoint of the flow control loop.
CAL AIR	{94}	All	YES commands the controller to go through calibration sequence for the air velocity transducers. YES is also displayed when the calibration sequence is started automatically. CAL AIR automatically returns to NO after the calibration sequence is completed. Valid input: YES or NO.
CAL SETUP	95	All	The configuration setup code for the calibration sequence options.
CAL TIMER	96	All	Time interval, in hours, between the calibration sequence initiations if a timed calibration option is selected in CAL SETUP.
DUCT AREA	97	All	Area, in square feet (square meters), of the duct where the air velocity sensor is located. This is a calculated value (calculated by the field panel or computer being used) that depends on duct shape and size. It is used in calculating all points in units of CFM, CF, LPS and L. Valid input: .025 ft2 (.002 m2) through 6.375 ft2 (.5923 m2).
LOOP TIME	98	All *except* 2091	The time, in seconds, between control loop calculations.
ERROR STATUS	{99}	All	The status code indicating any errors detected during controller power up. A status of 0 indicates there are no problems.

1) Points not listed are not used in this application.

2) Point numbers that appear in brackets { } may be unbundled at the field panel.

Chapter 4 – Basic Service and Maintenance

This chapter describes basic service and maintenance measures you can take when using a TEC.

You may want to contact your local Siemens Industry representative if a problem occurs or you have any questions about the controller.

NOTE:
When troubleshooting, record the problem and what actions were performed immediately before the problem occurred. Being able to describe the problem in detail is important should you need assistance from your local Siemens Industry representative.

Basic Service Information

Always remove power to the TEC when installing or replacing it. Since the controller does not have a power switch, the recommended method of removing power to a locally powered controller is to turn OFF the power to the 24 Vac transformer. The recommended method of removing power to a controller on a power cable (even to service a single controller) is to turn OFF the power at the transformer.

NOTE:
When removing power to a controller to perform maintenance or service, make sure that the person in charge of the facility is aware of this and that appropriate steps are taken to keep the building in control.

Never remove the cover from the TEC. There are no serviceable parts inside. If a problem is found with this device, contact your local Siemens Industry representative for replacement. An anti-static wrist strap is recommended when installing or replacing controllers.

Preventive Maintenance

Most controller components are designed so that, under normal circumstances, they do not require preventive maintenance. Periodic inspections, voltage checks, and point checks are normally not required. The rugged design makes most preventive maintenance unnecessary. However, devices that are exposed to dusty or dirty environments may require periodic cleaning to function properly.

Safety Features

The controller board stores the controller's address, applications, and point values. In the event of a power failure or a reset, these values are retrieved from the controller's permanent memory and are used by the controller unless overridden by a field panel. If one of the following conditions occurs, the controller will activate safety features present in its fail-safe mode.

- Sensor failure.
- Loss of power. Upon controller power loss, communication with the controller is also lost. The controller will appear as failed (*F*) at the field panel.

Glossary

This glossary contains the collected terms and acronyms that are used in Siemens BACnet PTEC and TEC Controllers. For definitions of point database descriptors, see Chapter 3 - Point Database, in this manual.

airflow

Rate at which a volume of air moves through a duct. Usually expressed in cubic feet per minute (cfm) or liters per second (lps).

algorithm

Mathematical formula and control logic that uses varying inputs to calculate an output value.

AVS

Air Velocity Sensor. An electronic device that converts differential pressure from a pilot tube or multi-point pickup to an analog rate of fluid flow (air velocity in fpm, m/s) to provide calculations of air volume rate (cfm, lps) in a duct. The air velocity sensor may be an external device or an internal component of a controller.

centralized control

Type of control offered by a controller that is connected by means of Field Level Network (FLN).

cfm

Cubic Feet per Minute.

Chilled Beam

A cooling device that provides a cooling system by taking care of both the sensible and latent heat gains of a room in a single package by a series of chilled water coils mounted near or in the ceiling. Coupled with a CV or VAV terminal ventilation system, a chilled beam induces air movement over the coil in the way that it discharges fresh air into the room. This allows for both fresh air and cooling to be taken care of at the same time.

control loop

An algorithm, such as PI or PID, that is used to control an output based on a setpoint and an input reading from a sensor.

CO_2

Carbon dioxide, a naturally occurring chemical compound composed of two oxygen atoms and a single carbon atom. Among other production sources, carbon dioxide is produced as the result of breathing of humans and animals and can therefore be an indirect indication of the concentration of humans in a zone.

CV

Constant air volume. Ventilation system that provides a fixed air volume supplied to and exhausted from the rooms served. The fixed volume may be different during occupied and unoccupied times

Demand Control Ventilation

A control algorithm that provides for the control or reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is at less than design occupancy.

DCV

Demand Control Ventilation.

DDC

Direct Digital Control.

Direct digital control

The automated control of a condition or process by a digital device (computer).

DO

Digital Output. Physical output point that sends a two-state signal (ON/OFF, OPEN/CLOSED, YES/NO).

English units

The foot-pound-second system of units for weights and measurements.

equipment controller

FLN device, such as a BACnet PTEC or ATEC, that provides individual room or mechanical equipment control or additional point capacity to a field panel.

field panel

A DDC control device containing a microprocessor for centralized control and monitoring of system components and equipment controllers.

Floating Control

The combination of a modulating controlled device with the use of a pair of two position outputs. The control signal will either activate one or the other outputs to drive the controlled device towards its open or closed position. When both outputs are off, the controlled device maintains its last position. Also referred to as tri-state control.

FLN

Field Level Network. Network consisting of equipment controllers, FLN end devices, fume hoods, etc.

lps

Liters per Second.

loopout

Output of the control loop expressed as a percentage.

Heat pump

An HVAC device used for both space heating and space cooling. When a heat pump is used for heating, it employs the same basic refrigeration-type cycle used by an air conditioner but in the opposite direction, releasing heat into the conditioned-space rather than the surrounding environment. In this use, heat pumps generally draw heat from the cooler external air or from the ground.

HMI

Human Machine Interface. Terminal and its interface program that allows you to communicate with a field panel or equipment controller.

Occupancy sensor

A control device that detects presence of people in a space by using infrared or ultrasonic technology. Occupancy sensors are used to save energy by controlling lighting and temperature and, along with CO2 sensors, to provide control input of demand control ventilation (DCV) algorithms.

override switch

Button on a room temperature sensor that an occupant can press to change the status of a room from unoccupied to occupied (or from night to day) for a predetermined time.

pressure dependent

Variable Air Volume (VAV) room temperature control system in which the temperature drives a damper such that the air volume delivered to the space at any damper position is dependent on the duct static pressure.

pressure independent

Variable Air Volume (VAV) room temperature control system in which the temperature drives an airflow setpoint such that the air volume delivered to the space is independent of variations in the duct static pressure.

PID

Proportional, Integral, Derivative.

RTS

Room Temperature Sensor.

setpoint

Data point that stores a value such as a temperature setting. In contrast, points that monitor inputs, such as temperature, report actual values.

SI units

Systeme International d'Unites. The international metric system.

slave mode

Default application that displays when power is first applied to an equipment controller. No control action is initiated in the slave mode. Input and output points in the slave application can be monitored or controlled by a field panel (or by PPCL in a BACnet PTEC controller).

stand-alone control

Type of control offered by a controller that is providing independent DDC control to a space.

Terminal Equipment Controller

Siemens Industry, Inc. product family of equipment controllers that house the applications software used to control terminal units, such as heat pumps, VAV terminal boxes, fan coil units, unit ventilators, etc.

UI

Universal Input. Can be used as an AI or DI. An AI input is a point receiving a signal that represents a condition that has more than two states. A DI input is a physical input point that receives a two-state signal.

unbundle

Term used to describe the entering of a point that resides in a controller's database into the field panel's database so that it can be monitored and controlled from the field panel.

VAV

Variable air volume. Ventilation system that changes the amount of air supplied to and exhausted from the rooms served.

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