Applications Guide

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General Information
(All Applications)

This document gives schematics of sample (new and retrofit) applications, cross-references, troubleshooting, and other related information.

For general mounting and connection details, including power connections and input/output connections, see the CTE-5202 Installation Guide.

For specifications and other information, see the CTE-5202 Data Sheet.

The latest support files are always available on the KMC Controls web site (www.kmccontrols.com).

(Shown adjusting the Cooling setpoint— during normal operation, only room temperature is shown in the upper right of the screen)

Specifications, design, and operation are subject to change without notice.
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Accessories

CSP-4702  Differential pressure VAV controller/actuator

HMO-1161  Wall plate, allows mounting to horizontal 2 x 4", 4 x 4", or other boxes, light almond

HMO-1161W HMO-1161 in white

HPO-0044  Replacement cover hex screws

HPO-1161  Foam insulating gasket

MEP-4xx2  Proportional actuators

REE-50xx  Electric relay modules, staging and reheat

STE-140x  Duct temperature (Type III) sensors

STE-1454/1455 Strap-on temperature (Type III) sensors

VEB-4xxxxxx  Valves (with proportional actuators)

NOTE: See sample applications for additional information.
Connection and Configuration

Connections

| AO2 | 0 | 0 | “Heating” Output |
| AO1 | 0 | 0 | “Cooling” Output |
| AI1 | 0 | 0 | Input |
| ↓   | 0 | 0 | Common |
| ↓   | 0 | 0 | Common |
| ~   | 0 | 0 | Power (AC Phase or DC +) |

Standard connections to the terminal block are:

- **“Heating”** output (REE-50xx reheat relay modules and heating valves) to AO2 and ↓ (Common)
- **“Cooling”** output (VAV dampers and cooling valves) to AO1 and ↓ (Common)
- **Changeover** (temperature) sensor (Type III, 10K ohm thermistor) and/or standby/unoccupied setback contact to AI1 and ↓ (Common). (See External Input (AI1) on page 5.)
- 24 VAC transformer’s neutral lead to ↓ (Common) and phase lead to ~. Alternately, 14–35 VDC can be used with + connected to ~ and – connected to ↓ (Common).

*NOTE: AO1 also controls heating in morning warm-up, changeover, and some other configurations. For examples, see: Heating, RA and DA on page 12, Chilled Beam 2-Pipe Heating and Cooling with Changeover on page 15, Cooling or Heating on page 17, Cooling with 3-Stage Reheat on page 24, Dual Duct, Minimum Air from Cold Duct on page 31, Cooling with Heating Changeover on page 37, Cooling with Morning Warm-Up on page 46, and TP-8101/8102/8103 Replacement (General) on page 55.*

NOTE: For additional information on mounting and installation, see the CTE-5202 Installation Guide.

External Input (AI1)

**Hot/Cold Changeover**

For hot/cold air changeover on Sequence 1 or 2, connect a changeover sensor to the AI1 input. The sensor should be a Type III thermistor (10K ohm @ 77° F), such as KMC STE-140x duct or STE-1454/1455 strap-on sensors. (An internal 10K ohm pullup resistor is provided on AI1.)

See, for example, *Cooling with Heating Changeover on page 26* and *Chilled Beam 2-Pipe Heating and Cooling with Changeover on page 15.*

At power-up, the default mode for Sequences 1 and 2 is Cold Air mode with a default changeover setpoint of 77° F. If the AI1 sensor reads a temperature higher than 79° F, the Hot Air mode becomes active. Hot Air mode stays active until the AI1 temperature falls below 75° F. Then Cold Air mode is active until the AI1 temperature rises above 79° F, which makes Hot Air mode active. At power-up, if the temperature is between 75° F and 79° F, the thermostat will assume Cold Air mode.

For continuous cold air mode, leave the sensor off.

The changeover temperature setpoint is adjustable between 55 and 85° F in the ADVANCE menu, and the default is 77° F. See Change Configuration on page 6.

**Unoccupied/Standby Setback**

Contact closure across AI1 and Common initiates the standby setback offset sequence, which causes the cooling setpoint (in all Sequences) to increase and the heating setpoint in Sequence 2 or 3 to decrease by the amount of the setback offset. This setback does not apply during the morning warm-up sequence.

See, for example, *Cooling with 3-Stage Reheat and Night Setback/Setup on page 25* and *Cooling with 3-Stage Reheat and Night Setback/Setup on page 36.*
**Change Setpoint**

To change the setpoint:

1. Push the Setpoint button (or either Up/Down button) to display the current value.

**NOTE:** Sequences 2 and 3 have two setpoints indicated by “snowflake/cool” and “fire/heat” icons. When the Cooling setpoint is showing, pushing the Setpoint button will display the Heating setpoint.

2. Use the Up/Down buttons to change the value.

3. Press the Setpoint button again, and the thermostat will control at the new setpoint. (Alternately, after about 30 seconds of no activity, the display reverts back to displaying room temperature.)

**NOTE:** Setpoint range is 55 to 85°F (13 to 30°C), with a default of 74°F (for cooling or 70°F for heating).

To change any of the limits (output span) when “LIMITS” is flashing, press the Setpoint button until the desired limit (AO1 MIN, AO1 MAX, AO1 AUX, AO2 MIN, or AO2 MAX) is displayed. (Limits are adjustable from 0 to 12 VDC, with MIN = 0, MAX = 12, and AUX = 0 as defaults.) Use the Up and Down buttons to change the desired values. (If no Auxiliary Flow is desired, set AO1 AUX to 0.)

To change any of the system or advanced features, press the Up or Down button until the desired (flashing) ADVANCE or SYSTEM menu appears and then press the Setpoint button.

The ADVANCE menu enables changing (via the Up/Down buttons) the values of:

- **DEAD BD** — Deadband or “minimum setpoint differential” (adjustable from 1 to 10°F, 2°F default)
- **SETBACK** — Standby/unoccupied setback offset (adjustable from 0 to 10°F, 2°F default)—does not apply to morning warm-up
- **PROP BD** — Loop proportional band or “throttling range” (adjustable from 1 to 10°F, 2°F default)
- **Rm OFST** — Room temperature offset (adjustable ±5°F, 0 default)
- **CNG OVR** — Changeover temperature (adjustable from 55 to 85°F, 77°F default)
- **ITIME** — Loop integral time (adjustable from 0 to 60, 30 minutes default, 0 = cancel integral action)*

The SYSTEM menu enables changing:

- Sequence (SEQ1, SEQ2, or SEQ3)—see Sequences on page 7
- °F (ENGLISH) or °C (METRIC)
- **BLANK** — Display blanking (NO or YES)—when blanked, the temperature will display for no more than 30 seconds after a button is pushed

When done, navigate to (flashing) Exit to save changes. Letting the menu time-out (about 30 seconds) will not permanently save changes.

*NOTE: As long as there is an error between room temperature and setpoint, the integral action will cause the output to integrate up or down. ITIME is the time it takes the integral action to repeat the effect of the proportional action.

**Change Configuration**

Press and hold both the Up and Down arrows buttons for about ten seconds until the display starts flashing “LIMITS.”

**NOTE:** When a menu is flashing (LIMITS, ADVANCE, SYSTEM, or EXIT), pressing Up or Down displays the next menu item and pressing Setpoint selects that menu. When a menu is NOT flashing (e.g., DEAD BD), pressing Up or Down changes the value and pressing Setpoint displays the next menu item.

To change any of the limits (output span) when “LIMITS” is flashing, press the Setpoint button until the desired limit (AO1 MIN, AO1 MAX, AO1 AUX, AO2 MIN, or AO2 MAX) is displayed. (Limits are adjustable from 0 to 12 VDC, with MIN = 0, MAX = 12, and AUX = 0 as defaults.) Use the Up and Down buttons to change the desired values. (If no Auxiliary Flow is desired, set AO1 AUX to 0.)

To change any of the system or advanced features, press the Up or Down button until the desired (flashing) ADVANCE or SYSTEM menu appears and then press the Setpoint button.

The ADVANCE menu enables changing (via the Up/Down buttons) the values of:

- **DEAD BD** — Deadband or “minimum setpoint differential” (adjustable from 1 to 10°F, 2°F default)
- **SETBACK** — Standby/unoccupied setback offset (adjustable from 0 to 10°F, 2°F default)—does not apply to morning warm-up
- **PROP BD** — Loop proportional band or “throttling range” (adjustable from 1 to 10°F, 2°F default)
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The SYSTEM menu enables changing:

- Sequence (SEQ1, SEQ2, or SEQ3)—see Sequences on page 7
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When done, navigate to (flashing) Exit to save changes. Letting the menu time-out (about 30 seconds) will not permanently save changes.

*NOTE: As long as there is an error between room temperature and setpoint, the integral action will cause the output to integrate up or down. ITIME is the time it takes the integral action to repeat the effect of the proportional action.
**Sequences**

**SEQUENCE 1:** Single Duct Cooling, Fan Box (with REE-5002 or REE-5017)

**SEQUENCE 2:** Single Duct Cooling with Reheat and Auxiliary Flow

**SEQUENCE 3:** Independent Heating and Cooling Control (Dual Duct VAV, Baseboard, Single Zone AHU)

**NOTE:** AO1 is typically used to control the cooling output (primary air damper or cooling valve), and AO2 is used to control the heating output (VAV reheat or heating valve).
**Cross-References**

<table>
<thead>
<tr>
<th>Barber Colman (TAC, Invensys, Schneider Electric)</th>
<th>CTE-5202 Sequence Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermostat Replaced</td>
<td></td>
</tr>
<tr>
<td>TP-8101, TP-8102, and TP-8103</td>
<td>#1</td>
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<tr>
<td>TP-8124 and TP-8125</td>
<td>#3</td>
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</tbody>
</table>

For wiring and sample applications, see *Barber Colman TP-81xx Thermostats Replacement Applications on page 54*.

<table>
<thead>
<tr>
<th>KMC / Nailor / Dynacon*</th>
<th>Anemostat (East/West)*</th>
<th>Metal Industries*</th>
<th>Metalaire*</th>
<th>Nailor*</th>
<th>ASC / Titus*</th>
<th>CTE-5202 Sequence Selected</th>
<th>Example Replacement Applications</th>
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<tbody>
<tr>
<td>CTE-1001</td>
<td>13-27, 004100</td>
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<td></td>
<td></td>
<td></td>
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<td>See page 45</td>
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<tr>
<td>CTE-1002</td>
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<td></td>
<td></td>
<td></td>
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<td>#3 (disregard cooling setpoint) or #1 (with 8K–10K ohm resistor for RA mode)</td>
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</tr>
<tr>
<td>CTE-1003</td>
<td>13-29 01EC-2146</td>
<td></td>
<td></td>
<td>B3-3001-015 or B3-015</td>
<td></td>
<td>#3</td>
<td></td>
</tr>
<tr>
<td>CTE-1004</td>
<td>13-28 01EC-2129 THM1004</td>
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<td>#2</td>
<td>See page 47 and page 49</td>
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<tr>
<td>CTE-1005</td>
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<td>#1 (setback used for night setpoint)</td>
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<td>CTE-1008</td>
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<td>#1 (setback used for day setpoint)</td>
<td>See page 45, page 50, and page 51</td>
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<tr>
<td>CTE-1101</td>
<td>004643 THM1101</td>
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<td>#1</td>
<td>See page 45, page 50, and page 51</td>
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<td>CTE-1103</td>
<td>01EC-9229 THM1103</td>
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<td></td>
<td>#1 (single duct) or #3 (dual duct)</td>
<td>See page 48, page 52, and page 53</td>
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<tr>
<td>CTE-1105</td>
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<td>CTE-1108</td>
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<td></td>
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<td>#1 (setback used for day setpoint)</td>
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</tbody>
</table>

*NOTE: CTE-1x0x thermostats require a power supply of **9.1 VDC**, typically supplied by a CEP/CSP-4xxx controller/actuator, and they have a 0–6 VDC output range. The CTE-5202 can also operate on the 9.1 VDC power supplied by CEP/CSP-4xxx controller-actuators, but the CTE-5202's outputs will be reduced to a maximum of about 5.3 VDC (or a maximum of about 2000 fpm from the CEP/CSP-4xxx). In almost all such applications, this is adequate. In a rare application that requires a full 6 VDC output (or 3000 fpm maximum from the CEP/CSP-4xxx), the CTE-5202 can be powered by the 24 VAC transformer, which can be easily done by switching the wire from Terminal #5 (+9.1 VDC) to Terminal #10 (24 VAC, phase) on the CEP/CSP-4xxx. See **9.1 VDC vs. 24 VAC Power Options on page 44**. See also the **CEP-4000 Series Applications Guide**.
**KMC CTE-50xx Thermostat Replaced** | **CTE-5202 Sequence Selected** | **Example Replacement Applications**
---|---|---
CTE-5001/5011* | #1 | See page 45 and page 48 (9.1 VDC)
CTE-5002/5012* | #2 | See page 47 (9.1 VDC)
CTE-5003/5013* | (No Replacement) | (9.1 VDC)
CTE-5006/5016** | #2 | See page 35 (16 VDC)
CTE-5015** | #1 | See page 33 (16 VDC)

*NOTE: These models require a power supply of 9.1 VDC, typically supplied by a CEP/CSP-4xxx controller/actuator, and they have a 0–6 VDC output range. See the discussion on 9.1 VDC power under the CTE-1x0x cross-reference NOTE on page 8. Need for the RCH-1014 in applications is eliminated.

**NOTE: These models require a power supply of 14–20 VDC, typically using the 16 VDC power supplied by a CSP-5001/5002 controller/actuator. The CTE-5202 can use the same 16 VDC power (or 14–35 VDC or 24 VAC).

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<table>
<thead>
<tr>
<th>Thermostat Replaced</th>
<th>CTE-5202 Sequence Selected</th>
<th>Example Replacement Applications</th>
</tr>
</thead>
</table>
| **KMC / Nailor / Dynacon*** | **Anemostat** | **CTE-5001/5011** | #1 | See page 45 and page 48 (9.1 VDC)
| **Carnes** | **Metal Industries** | **CTE-5002/5012** | #2 | See page 47 (9.1 VDC)
| **Nailor** | **Price Industries** | **CTE-5003/5013** | (No Replacement) | (9.1 VDC)
| **ASC / Titus** | **CTE-5006/5016** | **CTE-5015** | #1 | See page 33 (16 VDC)
| **CTE-5015** | #1 | See page 33 (16 VDC)

*NOTE: CTE-510x thermostats require a power supply of 9.1 VDC, typically supplied by a CEP/CSP-4xxx controller/actuator, and they have a 0–6 VDC output range. See the discussion on 9.1 VDC power under the CTE-1x0x cross-reference NOTE on page 8. Need for the RCH-1014 in applications is eliminated.

**NOTE: These models require a power supply of 14–20 VDC, typically using the 16 VDC power supplied by a CSP-5001/5002 controller/actuator. The CTE-5202 can use the same 16 VDC power (or 14–35 VDC or 24 VAC). See also the CSP-5001/5002 Applications Guide.

**For applications requiring limited T1 and/or T2 signals and unlimited T3 and/or T4 signals, flow limits may need to be set on the controller (allowing the controller to use an unlimited signal). Limits for the CTE-5202 and AO1 and AO2 would then be left at the default 0 and 12.

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**Other thermostats** that the CTE-5202 can be a functional/upgrade replacement for include:

- Honeywell TB7980 (check application and specifications)
- Johnson Controls (various—check application and specifications)
- Kele RTC-2P (with one or less remote inputs—check application and specifications)
- PEKO (various—check application and specifications)
- Siemens (various—check application and specifications)
- Viconics (various—check application and specifications)

NOTE: Products and name brands mentioned may be trademarks of their respective companies.
CTE-5202 Troubleshooting

Display Is Blank

- If the display comes on for no more than 30 seconds after a button is pushed and then blanks out, Display Blanking is enabled in the SYSTEM menu. See Change Configuration on page 6.

- Check for a tripped circuit breaker to the transformer.

- Check for proper supply voltage from the transformer and that the transformer has enough capacity (VA) for all connected devices. See their respective data sheets and Tips for Connecting 24-Volt Power Application Note (AN0604D).

Setpoint Is Not Maintained

- Check that room temperature is being sensed correctly. See Temperature Reading Is Incorrect on page 10.

- Check that the appropriate sequence is selected in the SYSTEM menu. See Change Configuration on page 6 and the relevant sample application.

- If changeover is used on AI1, check the sensor and the changeover setting in the ADVANCE menu. If a resistor is used on AI1 to force a changeover without a temperature sensor, the value of the resistor may be too high or too low. See External Input (AI1) on page 5, Change Configuration on page 6, and the relevant sample application.

- If a setback switch/relay is used on AI1, the switch may be (stuck) in the setback position. See page 36.

- If an override switch/relay is used on AO1, the switch may be (stuck) in the override position. See page 18, page 34, and page 46.

- Check settings of auxiliary flow and other limits as relevant in the LIMITS menu. See Change Configuration on page 6.

- If the HVAC system has trouble recovering from the unoccupied setback to the occupied setpoint during very cold weather, adjust the setback in the ADVANCE menu. See Change Configuration on page 6.

- If space temperature is overshooting the setpoint or oscillating, try increasing the proportional band by a degree in the ADVANCE menu. If the problem persists, try increasing the integral value slightly (up to 20%). If the problem still persists, try setting the integral value to 0. (The optimal integral value is dependent on the characteristics of the particular space and HVAC system.) See Change Configuration on page 6.

Temperature Reading Is Incorrect

- Check that the correct °F/C temperature scale is selected in the SYSTEM menu. See Change Configuration on page 6.

- If the discrepancy is small, adjust the room temperature offset in the ADVANCE menu. See Change Configuration on page 6.

- Check that the thermostat is NOT mounted on an exterior wall, mounted on or near a large thermal mass (e.g., concrete block wall), blocked from normal air circulation by obstructions, exposed to heat sources (e.g., lights, computers, copiers, coffee makers) or to sunlight (at any time of the day), exposed to drafts from windows or air vents, or exposed to air flow through the conduit from leaks in plenum ducts (put plumber’s putty or other sealant inside conduit to block air leaks).

Wiring Issues

- Check for correct wiring for the application. See Connections on page 5 and the various application examples in this document.

- Remove the thermostat from the backplate and inspect the terminals for loose wires. See the CTE-5202 Installation Guide.

- Check the wiring at the connected devices.

- Use a voltmeter and ohmmeter to check the terminals for expected values.

NOTE: Wiring must be adequate to avoid excessive voltage drop on long runs! Allow plenty of “cushion” in measurements. A meter may be too slow to register transient dips or peaks during startup.
Single-Zone Proportional Heating and Cooling Applications

This section gives sample applications for using the CTE-5202 in single zone proportional heating (baseboard heaters) and cooling (chilled beams) with valves or SCR control.

NOTE: For chilled beam applications, separate control of humidity is required to prevent condensation.
Heating, RA and DA

CTE-5202 thermostats can use a variety of valves for heating/cooling applications with hot and chilled water. For **Reverse Acting control**, connect a 5K to 10K ohm resistor between Common and A11. Select Sequence 1 (from the CTE-5202 SYSTEM menu) and lower the Changeover (in the ADVANCE menu) to the lowest setting (55° F). See **Change Configuration on page 6**. The resistor simulates a changeover sensor and puts the thermostat in Reverse Acting mode.

**NOTE:** If the resistor value is too high, the thermostat will not go into RA mode. If the resistor value is too low, the thermostat may go into setback mode.

This RA control works for NO 2–10 and 0–10 VDC valves or NC 10–2 and 10–0 VDC valves as well as equivalent SCR controls.

For **Direct Acting control**, select Sequence 1 (from the CTE-5202 SYSTEM menu). See **Change Configuration on page 6**. (Do not connect the resistor.)

This DA control works for NC 2–10 and 0–10 VDC valves or NO 10–2 and 10–0 VDC valves as well as equivalent SCR controls.
Chilled Beam Cooling

This application controls cooling in a chilled beam or equivalent installation.

This works for NC 2–10 and 0–10 VDC valves or NO 10–2 and 10–0 VDC valves.

Chilled Beam 4-Pipe Heating and Cooling

This application enables both heating and cooling in a chilled beam and baseboard or equivalent installation.

This works for NC 2–10 and 0–10 VDC valves or NO 10–2 and 10–0 VDC valves.

Select Sequence 3 from the CTE-5202 SYSTEM menu. See Change Configuration on page 6.
Chilled Beam 2-Pipe Heating and Cooling with Changeover

An STE-1454/1455 strap-on (Type III) temperature sensor provides the CTE-5202 an automatic changeover for heating/cooling applications using hot and chilled water. The sensor will switch the thermostat between cooling and heating modes based on the temperature of the water in the pipe. A water temperature higher than changeover temperature, switches control to heating mode, and a temperature lower than changeover temperature, switches control to cooling mode.

Select Sequence 1 from the CTE-5202 SYSTEM menu. Change the default changeover temperature to the maximum of 85°F in the CTE-5202 ADVANCE menu. See Change Configuration on page 6 and Hot/Cold Changeover on page 5.
Pressure Dependent VAV Applications with MEP-4xx2

This section gives sample applications for using the CTE-5202 with the MEP-4xx2 actuator in pressure dependent VAV applications.

The MEP-4xx2’s default direction is CCW to close (CW to open or CW with increasing voltage), but this can be reversed by a switch during installation and configuration.

See also the MEP-4000 Series Installation Guide.

For additional applications, see Pressure Independent VAV Applications with CSP-5001/5002 on page 32 and make the corresponding wiring adjustments for power to the MEP-4xx2 and CTE-5202.
CTE-5202 thermostats can use MEP-4xx2 actuators to operate damper boxes in a pressure-dependent VAV system. As shown in the diagram, a “requested flow” voltage signal (AO1) is connected to the MEP-4002 to adjust airflow from minimum to maximum flow according to space demand. Minimum and maximum flow limit adjustments can be made at the thermostat (recommended) or at the actuator. (See the MEP-4000 Series Installation Guide.)

For cooling, select Sequence 1 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6.

For heating, connect a 5K to 10K ohm resistor between Common and AI1. Select Sequence 1 and lower the Changeover to the lowest setting (55°F). See Change Configuration on page 6. The resistor simulates a changeover sensor and puts the thermostat in Reverse Acting mode.

NOTE: If the resistor value is too high, the thermostat will not go into RA mode. If the resistor value is too low, the thermostat may go into setback mode.
Auto and Override (to Fully Closed)

Adding a Normally Closed SPST relay or switch enables overriding the air flow to fully closed. (Otherwise the example below is the same as the configuration in Cooling or Heating on page 17). The default setting is Auto. When the NC relay energizes, the thermostat signal is removed from the actuator’s input. The resulting 0 VDC “signal” on the actuator’s input overrides the actuator to fully closed.

NOTE: An override to fully open does not apply to the MEP-4xx2 in a way that is analogous to the CSP-5001 as shown in Auto and Override (to Fully Closed or Fully Open) on page 34.

Other Applications

See the corresponding application in Pressure Independent VAV Applications with CSP-5001/5002 on page 32 and make the corresponding wiring adjustments for power to the MEP-4xx2 and CTE-5202. The MEP-4xx2’s default direction is the same as the CSP-5001.
Pressure Independent VAV Applications with CSP-4702

This section describes using the new CSP-4702 VAV controller-actuators in new installations as well as in the place of older CSP-5001/5002, CEP-4xxx, and CSP-40xx/42xx/44xx/46xx VAV controller-actuators.

The CSP-4702 uses a differential pressure sensor rather than the flow sensors of the older models. The differential pressure sensor provides greater accuracy at low air speeds and is much less affected by the length and quality of the tubing and connections to the SSS-1000 series air flow sensors.

NOTE: Air flow volume is determined from the differential pressure by the formula

\[
\text{Volume (cfm)} = K \sqrt{\Delta P}
\]

(\(K\) factor of the VAV box multiplied by the square root of the differential pressure in “wc”). The \textbf{K factor should be in the information supplied by the VAV box’s manufacturer. If using a KMC SSS-10xx sensor, see the K chart and formulas in the SSS-1000 Series Installation Guide. If using an SSS-101x sensor (instead of an SSS-100x), the 3/8” tubing and adapters shown in the illustration are unnecessary.}

NOTE: For CSP-4702 specifications, see the CSP-4702 Data Sheet. For information on mounting, wiring, configuration, and other information, see the CSP-4702 Installation Guide.

NOTE: In addition to VAV applications, the CSP-4702 can also act as a \textit{static pressure controller in such applications as AHU/RTU bypass control}. It is not then connected to a thermostat. See the CSP-4702 Static Pressure (Bypass) Control Application Guide for more information.
Replacing a CSP-5001/5002

The CSP-4702 can be used in any of the CSP-5001/5002 applications shown in the section Pressure Independent VAV Applications with CSP-5001/5002 on page 32. However, there are some differences among the models of which the installer must be aware:

- Output torque of the CSP-4702 is 40 in. lb. instead of the CSP-500x’s 50 in. lb. Check torque requirements of the damper when replacing a CSP-500x.

- Factory-set rotation direction of the CSP-4702 is CCW to close and CW to open, the same as the CSP-5001. The direction can be reversed by changing the position of a jumper.

- If a CSP-4702 is used to replace an existing CSP-500x and limits were set in the CSP-500x, the limits will need to be set (in either the CSP-4702 or the thermostat). If a CSP-4702 is used to replace an existing CSP-500x and limits were set in the thermostat, the limits in the thermostat should be checked and adjusted to ensure accuracy.

- The terminals on the CSP-4702 terminal strips are in a different order than on a CSP-500x.

- “Override to Fully Closed” shown in Auto and Override (to Fully Closed or Fully Open) on page 34 will not work as described with the CSP-4702. See the Operation Test section of the CSP-4702 Installation Guide.

NOTE: Compare the wiring of the CSP-4702 version of cooling with heating changeover below to the CSP-5001 version in Cooling with Heating Changeover on page 37. See also Cooling with Heating Changeover on page 26.
Replacing a CEP-4xxx or CSP-40xx/42xx/44xx/46xx or CSE-484x

With changes to the sensors, the CSP-4702 can generally be used in any of the older CEP-4xxx and CSP-40xx/42xx/44xx/46xx applications shown in the section Pressure Independent VAV and CAV Applications with CEP/CSP-4000 Series on page 43.

Although it may sound as if it belongs in the same series, the new CSP-4702 is quite different from the discontinued CSP-40xx/42xx/44xx/46xx models. There are some differences among the models of which the installer must be aware:

- CEP-4xxx and CSP-40xx/42xx/44xx/46xx controllers supply 9.1 VDC for connected thermostats. The CSP-4702 (like the CSP-500x controllers) outputs 16 VDC. When replacing an older controller, any connected thermostat that operates from 9.1 VDC power must also be:
  - Replaced with the CTE-5202 that operates from the 16 VDC supplied by the CSP-4702.
  - Or powered by an XEE-4002 power supply (connected to the transformer) to deliver 9.1 VDC to the existing thermostat.

- If replacing a CEP-4xxx, an attached SSE-xxxx sensor must be replaced with an SSS-100x sensor. (See the SSS-1000 Series Installation Guide.) For an existing SSE-200x used for duct temperature sensing, terminals X and Y can continue to be used for duct temperature sensing, and an SSS-100x air flow sensor can be installed separately.

- If a CSP-4702 is used to replace an existing CxP-4xxx and limits were set in the CxP-4xxx, the limits will need to be set (in either the CSP-4702 or the thermostat). If a CSP-4702 is used to replace an existing CxP-4xxx and limits were set in the thermostat, the limits in the thermostat should be checked and adjusted to ensure accuracy.

- The terminals on a CxP-4xxx are very different than on a CSP-4702:
  - 10 = 24 VAC phase
  - 9 = 24 VAC neutral/common
  - 6 = Input from thermostat
  - 5 = Power (VDC) to thermostat
  - 4 = Common
  - 3, 2, and 1 = to SSE-1xxx flow sensor, no longer used (but SSE-2xxx sensors can still be used for duct temperature sensing)

NOTE: Compare the wiring of the CSP-4702 version of cooling with heating changeover below to the CEP-4xxx version in Cooling with Heating Changeover on page 48. See also Cooling with Heating Changeover on page 26.

NOTE: The discontinued CSE-484x is similar to a CEP-4xxx, but it does not have a built-in actuator. A CSP-4702 can replace a CSE-484x together with its external actuator.
Cooling or Heating

CTE-5202 thermostats can use CSP-4702 electronic VAV controllers to operate damper boxes in the pressure-independent VAV system. As shown in the diagram, a “requested flow” voltage signal (AO1) is connected to the CSP-4702 to adjust airflow from minimum to maximum flow according to space demand. Minimum and maximum flow limit adjustments can be made at the thermostat or at the controller.

For cooling, select Sequence 1 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6.

For heating, connect a 5K to 10K ohm resistor between Common and AI1. Select Sequence 1 and lower the Changeover to the lowest setting (55°F). See Change Configuration on page 6. The resistor simulates a changeover sensor and puts the thermostat in Reverse Acting mode.

NOTE: If the resistor value is too high, the thermostat will not go into RA mode. If the resistor value is too low, the thermostat may go into setback mode.
Auto and Override (to Fully Open)

Adding a SPDT relay or switch enables overriding the air flow to fully open. (Otherwise the example below is the same as the cooling configuration in Cooling or Heating on page 22.)

The SPDT relay selects one of the two modes (Auto/ Open). In the relay position shown below (Open), the controller will override the flow setting. (Jumping “2-10 IN” and “16 VDC OUT” drives the CSP-4702 fully open.)

NOTE: If a maximum limit was set in the CSP-4702 controller, the damper will only open to the maximum limit setting. See also the Operation Test section of the CSP-4702 Installation Guide.

When the relay switches to Auto, the thermostat will then control the VAV box based on demand.
Cooling with 3-Stage Reheat

This application uses a CSP-4702 along with a REE-5001 relay module and three 24 VAC contactors for three stages of reheat.

As the temperature drops below setpoint, the first stage of reheat begins. As the temperature continues to drop, the second stage and later the third stage begin as needed.

Select Sequence 2 (from the CTE-5202 SYSTEM menu), with or without Auxiliary Flow (AO1 AUX in LIMITS menu). See Change Configuration on page 6.

NOTE: Triac outputs on the REE-5001 are for 24 VAC loads only. The phase side of the transformer connects to the “common” side of the load (contactors).

NOTE: See also the REE-5001 Installation Guide.
Cooling with 3-Stage Reheat and Night Setback/Setup

This configuration is the same as on the previous page except for the addition of an SPST relay or switch. See Cooling with 3-Stage Reheat on page 24.

The switch or relay is driven by a night/unoccupied setback/setup signal from other equipment not shown. When the contact is closed (e.g., by a timer), setback/setup mode initiates, changing the setpoint by the offset selected in ADVANCE > SETBACK menu. See Change Configuration on page 6 and Unoccupied/Standby Setback on page 5.

NOTE: The night/unoccupied setback offset does not apply to morning warm-up.

NOTE: This configuration requires the system fan to be on during setback/setup mode.

NOTE: Triac outputs on the REE-5001 are for 24 VAC loads only. The phase side of the transformer connects to the “common” side of the load (contactors).

NOTE: See also the REE-5001 Installation Guide.
Cooling with Heating Changeover

Using a duct sensor with the CTE-5202, an automatic changeover is provided for cooling/heating applications. The duct sensor will switch the thermostat between cooling and heating modes based on the temperature of the duct supply air. A duct temperature higher than changeover temperature switches control to heating mode, and a temperature lower than changeover temperature switches control to cooling mode.

Select Sequence 1 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6 and Hot/Cold Changeover on page 5. The default changeover temperature is 77°F, configurable from 55 to 85°F in the CTE-5202 ADVANCE menu.

NOTE: Minimums can be set at zero air flow, but a minimum of greater than zero is required for a quick changeover.
Cooling with Heating Changeover and Electric Reheat

This configuration is the same as the previous page except for the addition of an REE-5001 relay module connected to AO2 (for three stages of reheat) and selecting Sequence 2 from the CTE-5202 SYSTEM menu. See Change Configuration on page 6, Hot/Cold Changeover on page 5 and Cooling with Heating Changeover on page 26. See also Cooling with 3-Stage Reheat on page 24.

NOTE: Minimums can be set at zero air flow, but a minimum of greater than zero is required for a quick changeover.

NOTE: Triac outputs on the REE-5001 are for 24 VAC loads only. The phase side of the transformer connects to the “common” side of the load (contactors).

NOTE: See also the REE-5001 Installation Guide.
Cooling with Heating Changeover and Hot Water Reheat

See *Cooling with Heating Changeover and Electric Reheat* on page 27. This application operates the same except for using a hot water valve instead of electric heating elements for reheat (a VEB-43/46 series valve in place of the REE-5001 relay).

When there is hot air in the duct, changeover initiates, allowing the heating signal from AO1 to control airflow and AO2 to control the valve. When there is a call for heat, the thermostat modulates the hot water valve.

![Diagram of system components and flow](image-url)
Cooling with Hot Water Reheat

See *Cooling with 3-Stage Reheat on page 24*. This application operates the same except for using a hot water valve instead of electric heating elements for reheat (a VEB-43/46 series valve in place of the REE-5001 relay).

AO1 controls airflow and AO2 controls the valve. When there is a call for heat, the thermostat modulates the hot water valve.
Fan Induction with 2-Stage Electric Heat

This fan induction application uses the thermostat with a REE-5002 relay module, a fan, and two coils (for two stages of reheat). The REE-5002 was designed primarily for use with VAV fan-powered induction boxes.

If the temperature drops below setpoint, the REE-5002 senses the decrease in voltage on AO2 and starts the fan. As the temperature continues to drop, the first stage of reheat begins, and the second stage of reheat follows if the thermostat is still not satisfied. The process reverses as the room temperature begins to rise.

Sequence 1 should be selected from the CTE-5202 SYSTEM menu. See Change Configuration on page 6.

NOTE: The REE-5002 provides the fan an adjustable start point between 3 and 8 VDC, with a 1 VDC switching differential. The “X” Terminal is used for measuring fan trip voltage. See the REE-5002 Installation Guide for details.

NOTE: Triac outputs on the REE-5002 are for 24 VAC loads only. The phase side of the transformer connects to the “common” side of the load (contactors).
Dual Duct, Minimum Air from Cold Duct

Dual duct applications can use two CSP-4702s with a CTE-5202. In this application, the CSP-4702s are mounted separately on the cold and hot air duct dampers with each using its own flow sensor.

The cold-deck controller receives the AO1 signal from the thermostat while the hot-deck controller receives its requested flow signal from AO2. Both CSP-4702s can be set independently for minimum and maximum flow settings.

Select Sequence 3 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6.
Pressure Independent VAV Applications with CSP-5001/5002

This section gives sample applications for using the CTE-5202 as a substitute for the CTE-5100 series thermostats with the CSP-5001/5002 VAV controller-actuator. (For replacement of the CSP-500x by the CSP-4702, see Replacing a CSP-5001/5002 on page 20.)

Factory-set rotation direction of the CSP-5001 is CCW to close (CW to open or CW with increasing voltage), and the CSP-5002’s is CW to close (CCW to open or CCW with increasing voltage). The direction can be reversed by changing the position of a jumper. The CSP-5001 (with default direction) is used in the examples of this section.

See also the CSP-5001/5002 Applications Guide.

Concerning replacements of the CTE-510x thermostats, see Cross-References on page 8.

To manually open the box, remove wiring from Terminal IN and jumper Terminal IN to Terminal 16 VDC. This will tell unit to control at 3300 fpm (full airflow), the green LED should turn on, and the box should drive open.

To manually close the box, remove wiring from Terminal IN, and jumper Terminal IN to Terminal –. This will tell unit to control at zero fpm (no airflow), the red LED should be on and the box should drive closed.

NOTE: If using an SSS-101x sensor (instead of an SSS-100x), the 3/8” tubing and adapters shown in the illustration are unnecessary.

NOTE: See also Auto and Override (to Fully Closed or Fully Open) on page 34. Full rotation may take five to six minutes because the actuator rotates at 18° per minute.
Cooling or Heating

CTE-5202 thermostats can use CSP-5000 series electronic VAV controllers to operate damper boxes in the pressure-independent VAV system. As shown in the diagram, a “requested flow” voltage signal (AO1) is connected to the CSP-5001 to adjust airflow from minimum to maximum flow according to space demand. Minimum and maximum flow limit adjustments can be made at the thermostat or at the controller.

For cooling, select Sequence 1 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6. (This replaces a CTE-5101 or a CTE-5015.)

For heating, connect a 5K to 10K ohm resistor between Common and AI1. Select Sequence 1 and lower the Changeover to the lowest setting (55° F). See Change Configuration on page 6. The resistor simulates a changeover sensor and puts the thermostat in Reverse Acting mode. (This replaces a CTE-5102 with Reverse Acting reset.)

NOTE: If the resistor value is too high, the thermostat will not go into RA mode. If the resistor value is too low, the thermostat may go into setback mode.

(See also the Cooling or Heating section in the CSP-5001/5002 Applications Guide.)
Auto and Override (to Fully Closed or Fully Open)

Adding a SPDT relay or switch enables overriding the air flow to fully open or fully closed. (Otherwise the examples below are the same as the cooling configuration in Cooling or Heating on page 33.)

The “Override to Fully Closed” wiring diagram below allows the CTE-5202 thermostat to control the CSP-5001 controller as normal (Auto) or override the flow setting to fully closed.

The SPDT relay selects one of the two modes (Auto/Fully Closed). In the relay position shown below, the controller will override the flow setting. (Jumping “–” and “IN” drives the CSP-5001 fully closed.)

NOTE: If a minimum limit was set in the CSP-500x controller, the damper will only close to the minimum limit setting.

When the relay switches to Auto, the thermostat will then control the VAV box based on demand.

The “Override to Fully Open” wiring illustration below allows the CTE-5202 thermostat to control the CSP-5001 controller as normal (Auto) or override the flow setting to fully open.

In the relay position shown, the controller will override the flow setting. (Jumping “16 VDC” and “IN” drives the CSP-5001 fully open.)

NOTE: If a maximum limit was set in the CSP-500x controller, the damper will only open to the maximum limit setting.

When the relay switches to Auto, the thermostat will control the VAV box based on demand.

(See also the Auto, Override to Fully Closed, or Override to Fully Open section with a CTE-5101 in the CSP-5001/5002 Applications Guide.)

Override to Closed

Override to Open

Select Sequence 1
Cooling with 3-Stage Reheat

This application uses a CSP-5001 along with an REE-5001 relay module and three 24 VAC contactors for three stages of reheat.

As the temperature drops below setpoint, the first stage of reheat begins. As the temperature continues to drop, the second stage and later the third stage begin as needed.

Select Sequence 2 (from the CTE-5202 SYSTEM menu), with or without Auxiliary Flow (AO1 AUX in LIMITS menu). See Change Configuration on page 6.

(See also the Cooling with 3-Stage Reheat section with a CTE-5104 for auxiliary flow or a CTE-5103 without auxiliary flow in the CSP-5001/5002 Applications Guide.)

NOTE: Triac outputs on the REE-5001 are for 24 VAC loads only. The phase side of the transformer connects to the “common” side of the load (contactors).

NOTE: See also the REE-5001 Installation Guide.
Cooling with 3-Stage Reheat and Night Setback/Setup

This configuration is the same as on the previous page except for the addition of an SPST relay or switch. See *Cooling with 3-Stage Reheat on page 35.*

The switch or relay is driven by a night/unoccupied setback/setup signal from other equipment not shown. When the contact is closed (e.g., by a timer), setback/setup mode initiates, changing the setpoint by the offset selected in *ADVANCE > SETBACK* menu. See *Change Configuration on page 6* and *Unoccupied/Standby Setback on page 5.*

NOTE: The night/unoccupied setback offset does not apply to morning warm-up.

NOTE: This configuration requires the system fan to be on during setback/setup mode.

NOTE: Triac outputs on the REE-5001 are for 24 VAC loads only. The phase side of the transformer connects to the “common” side of the load (contactors).

NOTE: See also the *REE-5001 Installation Guide.*

(See also the Cooling with 3-Stage Reheat and Night Setback/Setup section with a CTE-5104 in the *CSP-5001/5002 Applications Guide.*)
Cooling with Heating Changeover

Using a duct sensor with the CTE-5202, an automatic changeover is provided for heating/cooling applications. The duct sensor will switch the thermostat between cooling and heating modes based on the temperature of the duct supply air. A duct temperature higher than changeover temperature switches control to heating mode, and a temperature lower than changeover temperature switches control to cooling mode.

Select Sequence 1 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6 and Hot/Cold Changeover on page 5. The default changeover temperature is 77° F, configurable from 55 to 85° F in the CTE-5202 ADVANCE menu.

NOTE: The CTE-5202 uses the 16 VDC power from the CSP-5001. If replacing a CTE-5103 thermostat as described in the Cooling and Heating Changeover section of the CSP-5001/5002 Applications Guide, the REE-1005 relay module is no longer needed with the CTE-5202.

NOTE: If using an existing TTE-2001 duct sensor/transmitter (instead of an STE-140x duct sensor), connect to Terminals 1 and 2.

NOTE: Minimums can be set at zero air flow, but a minimum of greater than zero is required for a quick changeover.

![Diagram of CTE-5202 and CSP-5001 connections]

CSP-5001 Controller-Actuator

CTE-5202 Thermostat

TTE-2001 or STE-140x Duct Sensor

Cold Air Sequence:

- AO1 (DA)
- AO1 MIN
- Temp. Increasing
- Setpoint
- 2° F

Hot Air Sequence:

- AO1 (RA)
- AO1 MAX
- Temp. Increasing
- Setpoint
- 2° F
Cooling with Heating Changeover and Electric Reheat

This configuration is the same as the previous page except for the addition of an REE-5001 relay module connected to AO2 (for three stages of reheat) and selecting Sequence 2 from the CTE-5202 SYSTEM menu. See Change Configuration on page 6, Hot/Cold Changeover on page 5 and Cooling with Heating Changeover on page 37. See also Cooling with 3-Stage Reheat on page 35.

NOTE: The CTE-5202 uses the 16 VDC power from the CSP-5001. If replacing a CTE-5103 thermostat as described in the Cooling with Heating Changeover and Electric Reheat section of the CSP-5001/5002 Applications Guide, the REE-1005 relay module is no longer needed with the CTE-5202.

NOTE: If using an existing TTE-2001 duct sensor/transmitter (instead of an STE-140x duct sensor), connect to Terminals 1 and 2.

NOTE: Minimums can be set at zero air flow, but a minimum of greater than zero is required for a quick changeover.

NOTE: Triac outputs on the REE-5001 are for 24 VAC loads only. The phase side of the transformer connects to the “common” side of the load (contactors).

NOTE: See also the REE-5001 Installation Guide.
Cooling with Heating Changeover and Hot Water Reheat

See *Cooling with Heating Changeover and Electric Reheat* on page 38. This application operates the same except for using a hot water valve instead of electric heating elements for reheat (a VEB-43/46 series valve in place of the REE-5001 relay).

To retrofit a CTE-510x thermostat in an existing installation with a different valve than a VEB-43/46 series, see the corresponding installation guide for that valve and actuator.

When there is hot air in the duct, changeover initiates, allowing the heating signal from AO1 to control airflow and AO2 to control the valve. When there is a call for heat, the thermostat modulates the hot water valve.

**NOTE:** If using an existing TTE-2001 duct sensor/transmitter (instead of an STE-140x duct sensor), connect to Terminals 1 and 2.

**NOTE:** See also the Cooling with Heating Changeover and Hot Water Reheat section with a CTE-5103 in the *CSP-5001/5002 Applications Guide.*
Cooling with Hot Water Reheat

See *Cooling with 3-Stage Reheat on page 35*. This application operates the same except for using a hot water valve instead of electric heating elements for reheat (a VEB-43/46 series valve in place of the REE-5001 relay).

To retrofit a CTE-510x thermostat in an existing installation with a different valve than a VEB-43/46 series, see the corresponding installation guide for that valve and actuator.

AO1 controls airflow and AO2 controls the valve. When there is a call for heat, the thermostat modulates the hot water valve.

(See also the Cooling with Hot Water Reheat section with a CTE-5104 in the CSP-5001/5002 Applications Guide.)

NOTE: See also the use of the CTE-5202 with discontinued VEP-12/22/34 series valves in *Cooling with Hot Water Reheat on page 49*. 

![Diagram of Cooling with Hot Water Reheat](image-url)

**COLD AIR SEQUENCE**

- **12 Volts**
- **AUX**
- **0 Volts**

- 10% Of Loop
- AO1 MAX
- AO1 MIN

- **2° F** Heating Setpoint
- **2° F** Cooling Setpoint
- **Temp. Increasing**
Fan Induction with 2-Stage Electric Heat

In this fan induction application, the CTE-5202 thermostat is used with a REE-5002 relay module, a fan, and two coils (for two stages of reheat). The REE-5002 was designed primarily for use with VAV fan-powered induction boxes.

If the temperature drops below setpoint, the REE-5002 senses the decrease in voltage on AO2 and starts the fan. As the temperature continues to drop, the first stage of reheat begins, and the second stage of reheat follows if the thermostat is still not satisfied. The process reverses as the room temperature begins to rise.

Sequence 1 should be selected from the CTE-5202 SYSTEM menu. See Change Configuration on page 6.

(See also the Fan Induction with 2-Stage Electric Heat section with a CTE-5101 in the CSP-5001/5002 Applications Guide.)

NOTE: The REE-5002 provides the fan an adjustable start point between 3 and 8 VDC, with a 1 VDC switching differential. The “X” Terminal is used for measuring fan trip voltage. See the REE-5002 Installation Guide for details.

NOTE: Triac outputs on the REE-5002 are for 24 VAC loads only. The phase side of the transformer connects to the “common” side of the load (contactors).
Dual Duct, Minimum Air from Cold Duct

Dual duct applications can use two CSP-5001s with a CTE-5202. In this application, the CSP-5001s are mounted separately on the cold and hot air duct dampers with each using its own flow sensor.

The cold-deck controller receives the AO1 signal from the thermostat while the hot-deck controller receives its requested flow signal from AO2. Both CSP-5001s can be set independently for minimum and maximum flow settings.

Select Sequence 3 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6.

(See also the Dual Duct, Minimum Air from Cold Duct section with a CTE-5103 in the CSP-5001/5002 Applications Guide.)
Pressure Independent VAV and CAV Applications with CEP/CSP-4000 Series

This section gives sample applications for using the CTE-5202 as a substitute for the CTE-1000 series thermostats with the CEP/CSP-4000 series VAV controller-actuators. (See also the CEP-4000 Series Applications Guide. For replacement of the CxP-4xxx with the CSP-4702, see Replacing a CEP-4xxx or CSP-40xx/42xx/44xx/46xx or CSE-484x on page 21.)

The CEP-4000 series uses SSE-1000/2000 series flow (“hot wire anemometer”) sensors. These sensors consists of two coils of wire mounted in the air stream: one monitors airflow, while the other is a reference used for duct temperature compensation. These sensors also include a temperature sensor for use with heating/cooling “changeover” applications (which requires an additional relay module).

The CSP-4000 series uses SSS-1000 series differential air flow sensors or a pitot tube instead of the SSE-1000/2000s. Otherwise wiring is the same as with the CEP-4000 series used in these examples.

To manually drive the controller/damper open or closed (with 24 VAC on terminals 9 and 10), remove the wiring to terminal 6, and temporarily jumper terminal 6 to:

- Terminal 5 (9.1 VDC) = Open
- Terminal 4 (– VDC) = Closed

NOTE: Full rotation may take five to six minutes because the actuator rotates at 18° per minute.

NOTE: For replacements of the CTE-1x1x thermostats, see Cross-References on page 8.

NOTE: The old CSP-40xx/42xx/44xx/46xx models were discontinued in Jan. 2014 and are very different from the new CSP-4702. See Pressure Independent VAV Applications with CSP-4702 on page 19.

⚠️ CAUTION
Do not short terminals 12 and 14, 4 and 5, or 2 and 4.
9.1 VDC vs. 24 VAC Power Options

The CTE-5202 can operate from the 9.1 VDC output supplied by the CEP/CSP-4xxx, but AO1 and AO2 will not be able to attain a full 6 VDC (e.g., a maximum of about 5.3 VDC) output to the 0–6 VDC CEP/CSP-4xxx inputs. This means the maximum air flow controlled by the CEP-4xxx can be only around 2000 fpm instead of 3000 fpm. However, this will still cover nearly all applications.

(See the Voltage/Velocity Correlation chart in the CEP-4000 Series Applications Guide.)

If more than about 2000 fpm is required, use 24 VAC from a transformer to power the CTE-5202. This can easily be done by connecting the ~ terminal on the CTE-5202 to Terminal 10 (24 VAC, phase) on the CEP-4xxx instead of Terminal 5 (+9.1 VDC).

⚠️ CAUTION

Connect the CTE-5202 to the CEP-4xxx's Terminal 5 OR 10, but not jumpered to both.
CTE-5202 thermostats can use CEP/CSP-4000 series electronic VAV controllers to operate damper boxes in a pressure-independent VAV system. As shown in the diagram, a “requested flow” voltage signal (AO1) is connected to the CEP-4xxx to adjust airflow from minimum to maximum flow according to space demand. Minimum and maximum flow limit adjustments can be made at the thermostat or at the controller.

Select Sequence 1 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6. (This replaces a CTE-1001/1101/5001/5011 with Direct Acting reset.)

(See also the Cooling section in the CEP-4000 Series Applications Guide.)
Cooling with Morning Warm-Up

Using the thermistor in an SSE-2001/2002 sensor enables the sensing of morning warm-up, and adding a SPDT relay or switch enables overriding the air flow to fully open for morning warm-up. Otherwise the example below is the same as the configuration in Cooling on page 45.

The SPDT relay selects one of the two modes (Auto or Fully Open). Terminal 6 on the CEP-4xxx is connected to either Terminal 5 (Fully Open) or to AO1 on the CTE-5202 (Auto, the default). When Terminal 6 is connected to Terminal 5, the 9.1 VDC causes full flow.

(See also the Cooling with Morning Warm-Up section in the CEP-4000 Series Applications Guide.)
Cooling with 3-Stage Reheat

The application below uses an SSE-1000 series sensor, an REE-4001/5001 relay module, and three 24 VAC contactors for three stages of reheat.

The transformer must supply a minimum of 10 VA plus the requirements for the reheat contactor coils (10 VA maximum per stage).

As the temperature drops below setpoint, the first stage of reheat begins. If the temperature continues to drop, the second stage begins, and finally the third stage if necessary.

Select Sequence 2 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6. (This replaces a CTE-1004 or a CTE-5002/5012 thermostat.)

If no Auxiliary Flow is desired, set AO1 AUX to 0 in the LIMITS menu.)

NOTE: Triac outputs on the REE-4001/5001 are for 24 VAC loads only. The phase side of the transformer connects to the “common” side of the load (contactors).

NOTE: See also the REE-4001 Installation Guide and/or REE-5001 Installation Guide.
Cooling with Heating Changeover

Using a duct sensor with the CTE-5202, an automatic changeover is provided for cooling/heating applications. The duct sensor will switch the thermostat between cooling and heating modes based on the temperature of the duct supply air. A duct temperature higher than changeover temperature, switches control to heating mode, and a temperature lower than changeover temperature, switches control to cooling mode.

Select Sequence 1 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6 and Hot/Cold Changeover on page 5. The default changeover temperature is 77° F, configurable from 55 to 85° F in the CTE-5202 ADVANCE menu.

NOTE: If replacing a CTE-1103 thermostat as described in the Cooling Heating Changeover section of the CEP-4000 Series Applications Guide or a CTE-5001/5011 as described in the CTE-5001/5011 Installation Guide, the REE-1005 or REE-1014 relay module is not needed with the CTE-5202.

NOTE: Minimums can be set at zero air flow, but a minimum of greater than zero is required for a quick changeover.

NOTE: For an SSE-2001/2002 flow sensor, connect the X and Y terminals to the CTE-5202’s A11 and Common terminals.
Cooling with Hot Water Reheat

See *Cooling with 3-Stage Reheat on page 47*. This application operates similarly except for using a hot water valve instead of electric heating elements for reheat.

AO1 controls airflow and AO2 controls the valve. When there is a call for heat, the thermostat modulates the hot water valve.

The CTE-5202 here replaces a CTE-1004 (DA cooling and RA heating) and is used in conjunction with an REE-4006 time proportioning relay module and a (NC) VEP-12/22/34 series hot water valve. The REE-4006 relay is designed for time proportioning control of thermic electrical hot water valves.

**NOTE:** The VEP-12/22/34 series valves and REE-4006 relay module have been discontinued. Replacement actuators (MEP-3001s) for those valves may still be available. The REE-4006 can be replaced by an REE-4106 or REE-5106, which have built-in power supplies that could be used to power the CTE-5202 if desired. See also use of a VEB-43/46 valve in *Cooling with Hot Water Reheat on page 40.*

(See also the REE-4106 Installation Guide, REE-5106 Installation Guide, and the Cooling with Proportional Reheat section with a CTE-1004 in the CEP-4000 Series Applications Guide.)
Fan Induction with 2-Stage Electric Heat

In this fan induction application, the CTE-5202 thermostat is used with a REE-4002/5002 relay module, a fan, and two coils (for two stages of heat). The REE-4002/5002 was designed primarily for use with VAV fan-powered induction boxes.

If the temperature drops below setpoint, the REE-4002/5002 senses the decrease in voltage on AO2 and starts the fan. As the temperature continues to drop, the first stage of reheat begins, and the second stage of reheat follows if the thermostat is still not satisfied. The process reverses as the room temperature begins to rise.

Sequence 1 should be selected from the CTE-5202 SYSTEM menu. See Change Configuration on page 6.

(See also the Fan Box with Reheat section with a CTE-1101 in the CEP-4000 Series Applications Guide.)

NOTE: The REE-4002/5002 provides the fan an adjustable start point. The “X” Terminal is used for measuring fan trip voltage. See the REE-5002 Installation Guide or the REE-4002 Installation Guide for details.

NOTE: Triac outputs on the REE-4002/5002 are for 24 VAC loads only. The phase side of the transformer connects to the “common” side of the load (contactors).
Damper Tracking (Master/Slave)

The configuration is used for special applications where a differential pressure is needed (either positive or negative). The thermostat controls the “master” CEP-4xxx controller-actuator and a (discontinued) REE-1013 relay controls the “slave.” The relay takes the voltage reading from the master CEP-4xxx and repeats it to the slave CEP-4xxx plus or minus a given offset.

As an example, the master CEP-4xxx is supplying a velocity of 450 fpm (4.0 VDC on terminal 6), and the relay commands the slave controller to exhaust 550 fpm (4.1 VDC). The amount of voltage “offset” would be 0.10 VDC to set-up the REE-1013. See the Voltage/Velocity Correlation section in the CEP-4000 Series Applications Guide. With the REE-1013, the maximum offset is ±2 VDC as measured by a voltmeter between the + and – terminals.)

Select Sequence 1 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6. (This replaces a CTE-1101 with Direct Acting reset.)

NOTE: Manufacturing of the REE-1013 was discontinued in October 2013.
Dual Duct Heating and Cooling VAV

Dual duct applications connect two CEP-4000 series controllers, mounted separately on the hot and cold air-duct dampers, with each controller using its own flow sensor.

The hot deck controller receives its requested flow signal from AO2 on the CTE-5202, while the cold deck uses the AO1 signal. Both controllers can be set independently for minimum and maximum flow settings.

Sequence 3 should be selected from the CTE-5202 SYSTEM menu. See Change Configuration on page 6.

(See also the (Dual Duct) Heating and Cooling VAV section with a CTE-1103 in the CEP-4000 Series Applications Guide.)
Dual Duct Heat/Cool Constant Volume with Hot Deck Make-Up

This application is designed for dual-duct installations requiring constant air volume (CAV). In this application, a single-duct cooling controller is mounted on the cold air duct, and its minimum and maximum flow is reset by the room thermostat. A second “slave” controller is mounted on the hot air duct as a constant volume unit, with the flow sensor measuring downstream “total flow” into the space. (The “slave” controller has no reset from the thermostat.)

As the cold deck resets from maximum to minimum flow, the hot deck controller senses a decrease in “total flow” to the space, opens the hot air duct to compensate, and thus maintains a constant combined airflow into the room.

NOTE: Minimum and maximum to be set on the cooling side (AO1) in the CTE-5202 LIMITS menu. (Heating side makes up the remainder for the constant volume.) Constant volume setting must be equal to or greater than cooling maximum.

Set constant volume on the heating side by adjusting maximum for AO2 to 10 VDC and adjusting AO2 minimum (volts) for the desired constant volume. (See the Voltage/Velocity Correlation chart in the CEP-4000 Series Applications Guide.)

Select Sequence 3 should be selected from the CTE-5202 SYSTEM menu. See Change Configuration on page 6.

(See also the Dual Heating/Cooling Constant Volume w/ Hot Deck Make-Up section with a CTE-1103 in the CEP-4000 Series Applications Guide.)

Sequence 3 should be selected from the CTE-5202 SYSTEM menu. See Change Configuration on page 6.

(See also the Dual Heating/Cooling Constant Volume w/ Hot Deck Make-Up section with a CTE-1103 in the CEP-4000 Series Applications Guide.)
Barber Colman TP-81xx Thermostats
Replacement Applications

This section gives sample applications for using the CTE-5202 in the place of a Barber Colman (TAC, Invensys, Schneider Electric) TP-81xx thermostat. Some of the applications include use with MP-52xx “beer can” actuators.

**TP-8101, TP-8102, and TP-8103 Leads and Terminals**

<table>
<thead>
<tr>
<th>Function</th>
<th>CTE-5202 Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Wire Lead</td>
<td>+20 VDC</td>
</tr>
<tr>
<td>Yellow Wire Lead</td>
<td>Proportional Output</td>
</tr>
<tr>
<td>Blue Wire Lead</td>
<td>Common</td>
</tr>
<tr>
<td>Terminal 1</td>
<td>Common</td>
</tr>
<tr>
<td>Terminal 2</td>
<td>Auxiliary Input</td>
</tr>
</tbody>
</table>

**NOTE:** Use Sequence 1. See sample applications on **page 55** and **page 56**.

**TP-8124 and TP-8125 Terminals**

<table>
<thead>
<tr>
<th>Function</th>
<th>CTE-5202 Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP2</td>
<td>2–15 VDC Cooling (DA)</td>
</tr>
<tr>
<td>+20</td>
<td>+20 VDC (Input)</td>
</tr>
<tr>
<td>OP1</td>
<td>15–2 VDC Heating (RA)</td>
</tr>
<tr>
<td>Common</td>
<td>Common</td>
</tr>
</tbody>
</table>

**NOTE:** Use Sequence 3. See sample applications on **page 57** and **page 58**.
TP-8101/8102/8103 Replacement (General)

CTE-502 thermostats can replace TP-8101/8102/8103 thermostats and use the 20 VDC supplied by a controlled device. (For more information, see the manufacturer’s installation guide for the controlled devices.)

⚠️ CAUTION

Never connect together the red leads (or +20 VDC terminals) of controlled devices with internal power supplies (with the exception of MP-52xx actuators—see TP-8101/8102/8103 Replacement with MP-52xx Actuators on page 56).


For **heating**, connect a 5K to 10K ohm resistor between Common and AI1. Select Sequence 1 and lower the Changeover to the lowest setting (55° F). See Change Configuration on page 6. The resistor simulates a changeover sensor and puts the thermostat in Reverse Acting mode.

NOTE: If the resistor value is too high, the thermostat will not go into RA mode. If the resistor value is too low, the thermostat may go into setback mode.
TP-8101/8102/8103 Replacement with MP-52xx Actuators

See TP-8101/8102/8103 Replacement (General) on page 55. This is the same configuration except for the addition of MEP-52xx actuators and changes to the connections to the red leads.
TP-8124/8125 Replacement with One or No MP-52xx Actuators

CTE-5202 thermostats can replace TP-8101/8102/8103 thermostats and use the 20 VDC supplied by a controlled device. (For more information, see the manufacturer’s installation guide for the controlled devices.)

⚠️ CAUTION

Never connect together the red leads (or +20 VDC terminals) of controlled devices with internal power supplies (with the exception of MP-52xx actuators).

Select Sequence 3 (from the CTE-5202 SYSTEM menu). See Change Configuration on page 6.
TP-8124/8125 Replacement with Two MP-52xx Actuators

See TP-8124/8125 Replacement with One or No MP-52xx Actuators on page 57. This is the same configuration except for having two MEP-52xx actuators and changes to the connections to the red leads.
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