

## TA1/TA2 Controller, CTE-5202 Thermostat Installation, Operation, and Maintenance Manual

### General Information

#### Power Requirements

TITUS TA1/TA2 controllers operate on 24 VAC power. Power required to operate the controller and actuator is 7 VA plus any output loads for fan relays, heating contactors, and control valves (assume 10 VA each). Always switch control voltage off prior to disconnecting any wires from the controller to prevent possible damage to control components.

#### Damper Control

TITUS TA1/TA2 controllers provide pressure independent VAV control for terminal primary air valves. Primary airflow volume is monitored by means of a multipoint center-averaging velocity sensor located in the inlet duct. Differential pressure is measured by an on-board platinum ceramic transducer. Dampers are always shipped full open and move counter-clockwise (CCW) to close. The primary damper opens and closes to vary air volume to match cooling demand. Changes in static pressure will result in damper position changes for a given flow volume. In automatic changeover (ACO) sequences, the primary damper also moves to match heating demand. If the primary fan system is off and the terminal is calibrated to control a minimum flow limit other than 0 cfm, the damper will drive full open. Flow limit adjustments are at the thermostat (As shown in Figure 1).

#### Live Supply Volume Readout

A voltage output corresponding to actual primary air volume may be monitored at the thermostat to assist in balancing and troubleshooting these units. This output signal follows the same cfm vs DC voltage calibration curve that is shown on Figures 4 and 5.

#### Supply Air Temperature Sensing

A duct-mounted thermistor is used to measure primary air temperature in sequences involving automatic changeover (ACO) or morning warm-up (MWU). It is fastened to the inlet duct with a sheetmetal screw and wired to terminals 'AI1' and '⊥' on the thermostat (As shown in Figure 2).

Alternatively, autochangeover and morning warm-up may be triggered by a contact closure. When controller terminals 'X' and 'Y' are shorted together, the unit will operate in the heating or morning warm-up mode. When there is an open circuit between 'X' and 'Y', the unit will operate in the cooling mode.

#### Night Setback/Unoccupied Signal

Units ordered with optional night setback (NSB) sequences employ a differential pressure switch (As shown in Figure 3) to sense loss of primary duct static pressure. By this method, these units change operating mode when the air handler fan is de-energized.

Alternatively, night setback operation may be triggered by a 24 VAC signal (10 mA) from a source external to the unit. Whenever 24 VAC is applied to controller terminals '-NSB' and 'NSB', unit will operate in night setback mode.

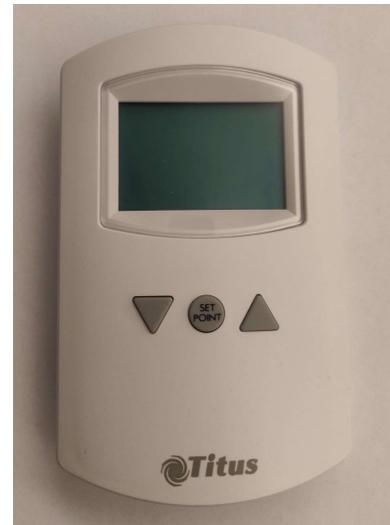


Figure 1.



Figure 2.

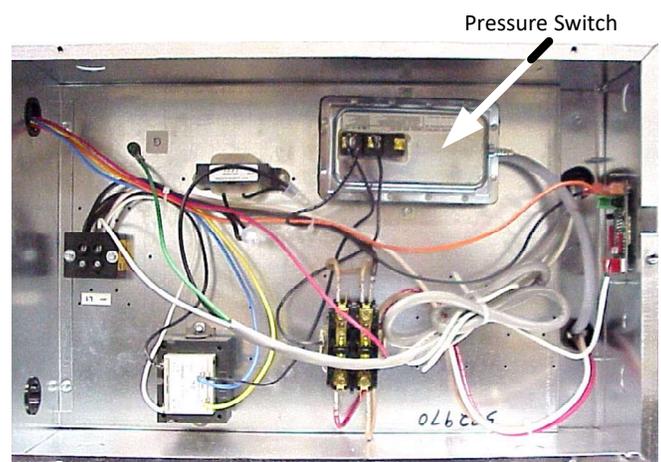


Figure 3.

Table 1. AeroCross™ K-Factors

Terminal Size	K-Factor (CFM)
04	273
05	360
06	448
07	667
08	904
09	1167
10	1436
12	1891
14	3015
16	3839
8x14	2106
8x18	2498
40(16x24)	7176

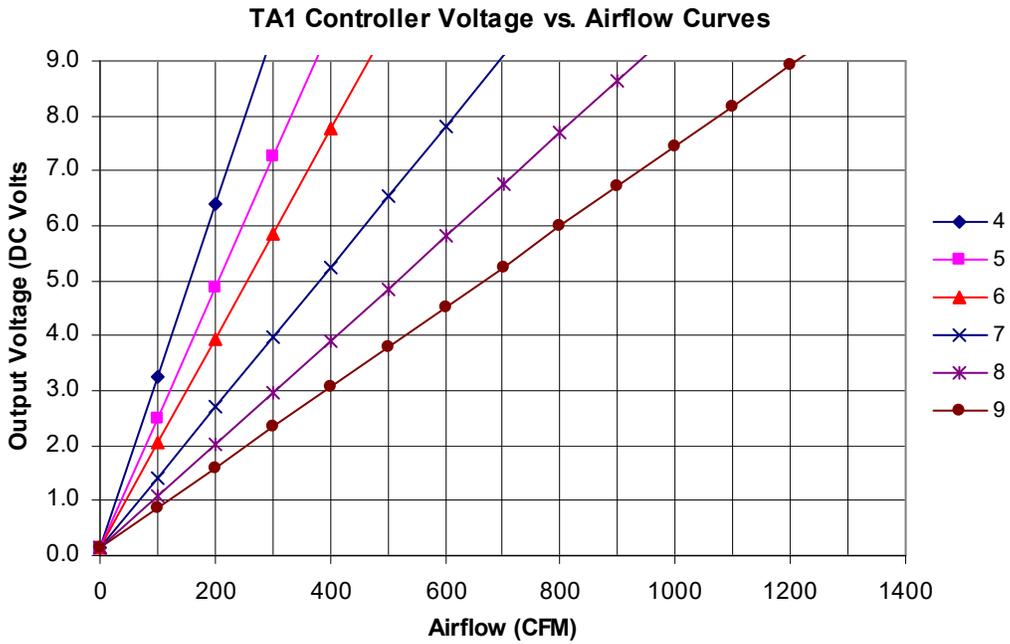


Figure 4.

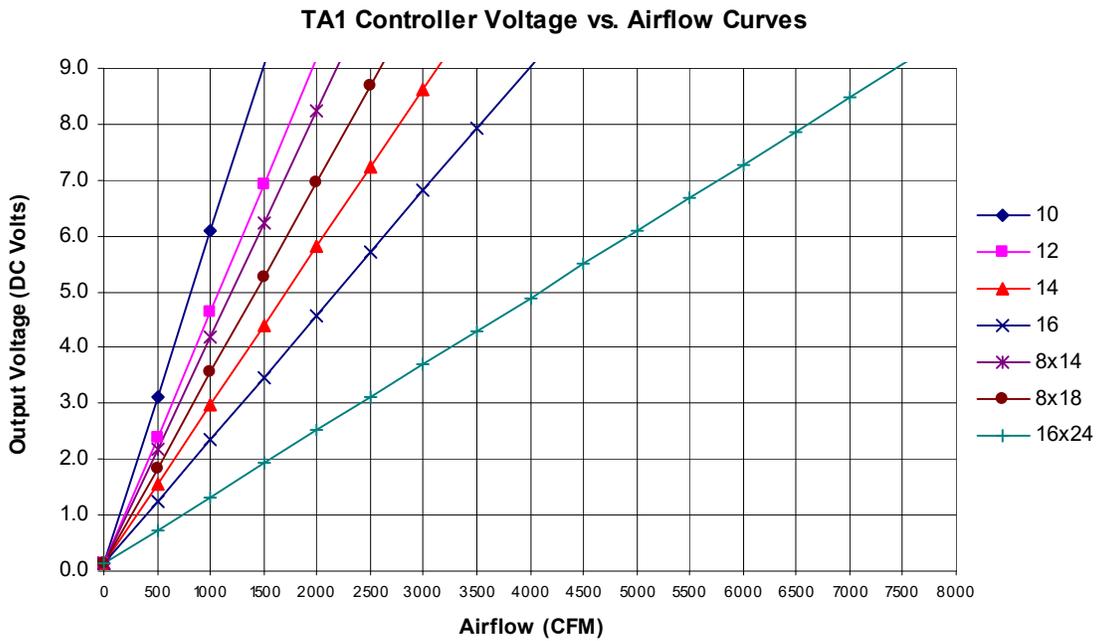


Figure 5.

**Night Setback Temperature Adjustment**

Adjustment of setback temperature is made by means of a plug-in resistor (As shown in Figure 6). All TA1 controls provide a 47k ohm resistor that provides an approximate 10° F setback in heating. Other 1/4 watt resistors may be substituted in the field to achieve various setback temperatures (see Table 2).

Table 2.

Setback Resistor Values	
Setback (°F)	Resistance (K Ohm)
4.5	100
5.0	91
5.5	82
6.5	75
7.0	68
8.0	62
9.0	56
10.0	51
11.0	47
12.5	43
14.0	39
15.5	36
17.0	33
19.0	30
22.0	27
25.0	24
27.0	22

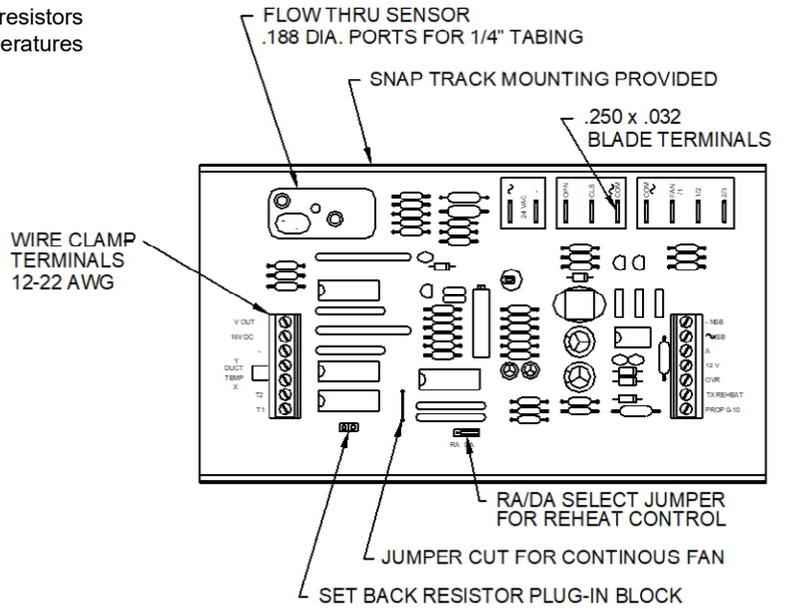


Figure 6.

**Fan Control**

The TITUS TA1 provides sequencing for continuous and intermittent unit fan operation. Fan relays with 24 VAC coils (10 VA max) are wired to terminal 'FAN/1'. Fan will run intermittently for parallel fan sequences if jumper 'J1' on board is intact. Cutting jumper 'J1' will result in continuous operation during occupied mode suitable for series fan sequences. Fan volume adjustments are made with a screwdriver by means of a silicon-controlled rectifier (SCR) or ECM Speed Controller located on the side of the hi voltage control box. (As shown in Figure 7 and Figure 8)

**On/Off Reheat Control**

The TITUS TA1 provides sequencing for up to three stages of on/off heat. Heat contactors with 24 VAC coils (10 VA max each) are wired to terminals 'Fan/1', '1/2', and '2/3'. Fan-powered sequences are limited to two stages of heat. Two position, normally closed hot water valves (10 VA max) are wired to 'FAN/1' for single duct sequences and '1/2' for fan-powered sequences. Jumper 'J1' must be intact to properly operate reheat for single duct sequences.

**Proportional Reheat Control**

The TITUS TA1 provides sequencing for one stage of proportional heat. Hot water valves with 0-10 VDC control signals (10 mA max) are wired with (+) to terminal 'T2' on the thermostat and (-) to terminal '-' on the controller. (See Figure 6)

**Thermostat Calibration**

Thermostats are factory calibrated to specified flow limits. If field adjustments are necessary, desired limit control can be calculated using Table 1 and the following formulas, or Figures 4 and 5.

$$CFM = K[(0.1171 \text{ VDC}) - 0.016]$$

$$VDC = \{[CFM + (K \times 0.016)] / (K \times 0.1171)\}$$

Voltage can be adjusted under 'LIMITS' menu in the thermostat (As Shown on Figure 1). Always set minimum flow limits before setting maximum flow limits. Voltages corresponding to desired flow limits are modified using 'UP' and 'Down' arrows on thermostat under 'LIMITS' menu (As Shown on Figure 1).



Figure 7.



Figure 8.

## Single Duct Terminal Units Without Reheat Thermostat Calibration Procedure

Press and hold both Up and Down arrows buttons for about 10 seconds until the display starts flashing "LIMITS". Use Up or Down arrow to display a flashing "SYSTEM". Press "Set Point" button. Select Sequence 01, SE01 and press "Set Point" button, press Up or Down arrow to flashing "Exit". Use Up or Down arrows to navigate to "LIMITS" and press "Set Point" Button. Set cooling minimum by adjusting voltage for A01 MIN corresponding to desired minimum flow volume from Figures 4 and 5. Set cooling maximum by adjusting voltage for A01 Max corresponding to desired maximum flow volume from Figures 4 and 5.

### Optional Morning Warm-Up (MWU) Operation

If this option has been ordered, the unit damper will drive full open regardless of flow limit settings whenever supply air temperature is above 80° F.

### Check-Out Procedure

Push the Setpoint button (or either Up/Down button) to display the current setpoint value. Use the Up/Down buttons to change the value below room temp. Press the Setpoint button again, and the thermostat will control at the new setpoint. Observe damper movement. After a few minutes check to see that the unit has reached maximum flow limit.

## Single Duct Terminal Units with Reheat Thermostat Calibration Procedure

Press and hold both Up and Down arrows buttons for about 10 seconds until the display starts flashing "LIMITS". Use Up or Down arrow to display a flashing "SYSTEM". Press "Set Point" button. Select Sequence 02 SE02 and press "Set Point" button, press Up or Down arrow to flashing "Exit". Use Up or Down arrows to navigate to "LIMITS" and press "Set Point" Button. Set cooling minimum by adjusting voltage for A01 MIN corresponding to desired minimum flow volume from Figures 4 and 5. Set cooling maximum by adjusting voltage for A01 Max corresponding to desired maximum flow volume from Figures 4 and 5. Set heating minimum by adjusting voltage for A02 MIN corresponding to desired minimum flow volume from Figures 4 and 5. Set heating maximum by adjusting voltage for A02 Max corresponding to desired maximum flow volume from Figures 4 and 5. If no Auxiliary Flow is desired, set A01 Aux to 0.

### Check-Out Procedure

Push the Setpoint button (or either Up/Down button) to display the current setpoint value. Use the Up/Down buttons to change the snowflake/cool value above room temp. Press the Setpoint button again, and the thermostat will control at the new setpoint. Observe damper movement. After a few minutes check to see that the unit has reached maximum flow limit. Push the Setpoint button (or either Up/Down button) to display the current setpoint value. Use the Up/Down buttons to change the fire/heat value above room temp. Press the Setpoint button again, and the thermostat will control at the new setpoint. Observe damper movement. After a few minutes check to see that the unit has reached minimum flow limit.

## Single Duct Terminal Units with Heating/ Cooling Autochangeover(ACO)

### Thermostat Calibration Procedure

Snowflake/cool is the cooling setpoint used to control damper operation when supply air is below 70° F. Fire/heat is the heating setpoint used to control operation when supply air is

above 80° F. Press and hold both Up and Down arrows buttons for about 10 seconds until the display starts flashing "LIMITS". Use Up or Down arrow to display a flashing "SYSTEM". Press "Set Point" button. Select Sequence 02 SE02 and press "Set Point" button, press Up or Down arrow to flashing "Exit". Use Up or Down arrows to navigate to "LIMITS" and press "Set Point" Button. Set cooling minimum by adjusting voltage for A01 MIN corresponding to desired minimum flow volume from Figures 4 and 5. Set cooling maximum by adjusting voltage for A01 Max corresponding to desired maximum flow volume from Figures 4 and 5. Set heating minimum by adjusting voltage for A02 MIN corresponding to desired minimum flow volume from Figures 4 and 5. Set heating maximum by adjusting voltage for A02 Max corresponding to desired maximum flow volume from Figures 4 and 5. If no Auxiliary Flow is desired, set A01 Aux to 0.

### Check-Out Procedure

With primary fan system supplying cold air (below 70°F), Push the Setpoint button (or either Up/Down button) to display the current setpoint value. Use the Up/Down buttons to change the snowflake/cool value above room temp. Press the Setpoint button again, and the thermostat will control at the new setpoint. Observe damper movement. After a few minutes check to see that the unit has reached maximum flow limit. With primary fan system supplying hot air (above 80°F), Push the Setpoint button (or either Up/Down button) to display the current setpoint value. Use the Up/Down buttons to change the fire/heat value above room temp. Press the Setpoint button again, and the thermostat will control at the new setpoint. Observe damper movement. After a few minutes check to see that the unit has reached minimum flow limit.

## Fan Powered Terminal Units without Heat Thermostat Calibration Procedure

Press and hold both Up and Down arrows buttons for about 10 seconds until the display starts flashing "LIMITS". Use Up or Down arrow to display a flashing "SYSTEM". Press "Set Point" button. Select Sequence 01, SE01 and press "Set Point" button, press Up or Down arrow to flashing "Exit". Use Up or Down arrows to navigate to "LIMITS" and press "Set Point" Button. Set cooling minimum by adjusting voltage for A01 MIN corresponding to desired minimum flow volume from Figures 4 and 5.

### Optional Morning Warm-Up (MWU) Operation

If this option has been ordered, the unit damper will drive full open regardless of flow limit settings whenever supply air temperature is above 80° F.

### Optional Night Shutdown (NSD) Operation

Units ordered with optional night shutdown (NSD) sequences employ a differential pressure switch to sense loss of supply duct static pressure. By this method, these units change operating mode when the air handler fan is de-energized. If this option has been ordered, the unit fan will de-energize whenever the air handler unit (AHU) is off. If a minimum flow limit has been set at the thermostat, the unit damper will drive full open.

### Optional Night Setback (NSB) Operation

Units ordered with optional night setback (NSB) sequences employ a differential pressure switch to sense loss of supply duct static pressure.

By this method, these units change operating mode when the air handler fan is de-energized. If this option has been ordered, the unit fan will operate intermittently to maintain a temperature setpoint approximately 10° F below the thermostat setting whenever the air handler unit (AHU) is off. If a minimum flow limit has been set at the thermostat, the unit damper will drive full open.

#### **Check-Out Procedure**

Fan should be energized regardless of mode on series fan-powered units (ATQS/ATFS/AFLS). Push the Setpoint button (or either Up/Down button) to display the current setpoint value. Use the Up/Down buttons to change the value above room temp to energize fan on parallel fan-powered units (ATQP/AFLP). Press the Setpoint button again, and the thermostat will control at the new setpoint. Observe damper movement. After a few minutes check to see that the unit has reached minimum flow limit.

#### **Check-Out Procedure (Night/Unoccupied Mode)**

Push the Setpoint button (or either Up/Down button) to display the current setpoint value. Use the Up/Down buttons to change the value above room temp to energize fan. Press the Setpoint button again, and the thermostat will control at the new setpoint.

## **Fan Powered Terminal Units with Heat**

#### **Thermostat Calibration Procedure**

Press and hold both Up and Down arrows buttons for about 10 seconds until the display starts flashing "LIMITS". Use Up or Down arrow to display a flashing "SYSTEM". Press "Set Point" button. Select Sequence 02 SE02 and press "Set Point" button, press Up or Down arrow to flashing "Exit". Use Up or Down arrows to navigate to "LIMITS" and press "Set Point" Button. Set cooling minimum by adjusting voltage for A01 MIN corresponding to desired minimum flow volume from Figures 4 and 5. Set cooling maximum by adjusting voltage for A01 Max corresponding to desired maximum flow volume from Figures 4 and 5. Set heating minimum by adjusting voltage for A02 MIN corresponding to desired minimum flow volume from Figures 4 and 5. Set heating maximum by adjusting voltage for A02 Max corresponding to desired maximum flow volume from Figures 4 and 5. If no Auxiliary Flow is desired, set A01 Aux to 0.

#### **Optional Night Shutdown (NSD) Operation**

Units ordered with optional night shutdown (NSD) sequences employ a differential pressure switch to sense loss of supply duct static pressure. By this method, these units change operating mode when the air handler fan is de-energized. If this option has been ordered, the unit fan will de-energize whenever the air handler unit (AHU) is off. This will effectively lock-out all heat operation. If a minimum flow limit has been set at the thermostat, the unit damper will drive full open.

#### **Optional Night Setback (NSB) Operation**

Units ordered with optional night setback (NSB) sequences employ a differential pressure switch to sense loss of supply duct static pressure. By this method, these units change operating mode when the air handler fan is de-energized. If this option has been ordered, the unit fan and

heat will operate intermittently to maintain a temperature setpoint approximately 10°F below the thermostat heating setpoint whenever the air handler unit (AHU) is off. If a minimum flow limit has been set at the thermostat, the unit damper will drive full open.

#### **Check-Out Procedure (Day/Occupied Mode)**

Fan should be energized regardless of mode on series fan-powered units (ATQS/ATFS/AFLS). Push the Setpoint button (or either Up/Down button) to display the current setpoint value. Use the Up/Down buttons to change the value above room temp to energize fan on parallel fan-powered units (ATQP/AFLP). Press the Setpoint button again, and the thermostat will control at the new setpoint. Observe damper movement. After a few minutes check to see that the unit has reached minimum flow limit.

#### **Check-Out Procedure (Night/Unoccupied Mode)**

Push the Setpoint button (or either Up/Down button) to display the current setpoint value. Use the Up/Down buttons to change the value above room temp to energize fan. Press the Setpoint button again, and the thermostat will control at the new setpoint.

**NOTE: LETTING THE MENU TIME-OUT (ABOUT 30 SECONDS) WILL NOT PERMANENTLY SAVE CHANGES.**

## **Troubleshooting Procedures**

Note: TURN OFF POWER BEFORE MAKING ANY WIRING CHANGES TO THE UNIT FOR TROUBLESHOOTING.

#### **To Check Operation of Controller's Damper Output Circuit and Actuator**

Disconnect wire from terminal 'T1' on controller and put a wire nut on it. If unit is equipped with morning warm-up or autochangeover, disconnect wire from terminal 'Y' on controller and put a wire nut on it. Connect a jumper wire between terminals '16VDC' and 'T1', and observe actuator driving full open. Move jumper wire to connect terminals '-' and 'T1', and observe actuator driving damper full closed. Remove jumper wire and reconnect wires to terminals 'T1' and 'Y'.

#### **If Actuator Appears to be Inoperative**

Check to see if the damper blade is free to move and that the actuator gears are engaged. Press in the red linkage release button on the actuator. It should be possible to turn the actuator collar whenever this button is held down. After releasing the button always check to make sure the collar is properly engaged by attempting to turn it by hand. No movement should be possible when the button is released.

#### **To Check Operation of Controller's On/Off Reheat Output Circuit**

Disconnect wire from terminal 'TX REHEAT' and put a wire nut on it. Connect a jumper wire between terminals '16VDC' and 'TX REHEAT' and observe that all the heat stages are energized.

#### **If Desired Thermostat Voltage Settings Cannot be Achieved**

Make sure that minimum flow limit setting is made prior to setting maximum flow limit setting. If procedure are followed correctly and problem persists, thermostat will need to be replaced.

**If Voltage Reading Float or Appears to be Unstable during Thermostat Calibration**

Check to make sure that the wire connecting '-' on the controller to 'L' on the thermostat is tight and properly connected. This is the reference ground wire for the regulated 16VDC thermostat supply output. A loose connection will result in unstable readings due in part to atmospheric static electricity.

**If Unit Fan Runs Intermittently During Day/Occupied Operation on a Series Fan Powered Terminal**

Check the 'J1' jumper on controller to see if it has been cut. When this jumper is cut and removed, fan will run continuously for Day/Occupied mode. This jumper should be left intact for all applications other than series fan powered terminals.

**Important Operational Note**

To guarantee proper autochangeover operation, it is recommended that minimum flow limits are used for both heating and cooling modes. This allows airflow to constantly pass through the unit for accurate supply air temperature measurement.