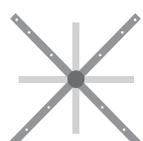
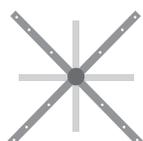
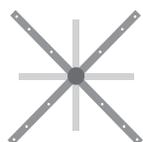
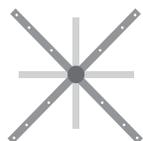
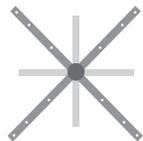
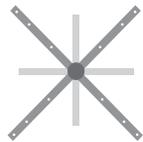
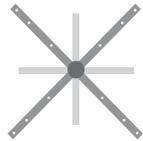
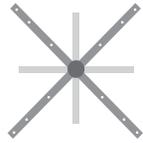


ENVIRO-TEC[®]
ENGINEERING FOR EXCELLENCE



SERIES 600 ANALOG ELECTRONIC CONTROLS

with 2" Thermostat Supplement

INSTALLATION, OPERATION AND BALANCING MANUAL

Stock ID: IOM-600
January, 1998
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Largo, FL

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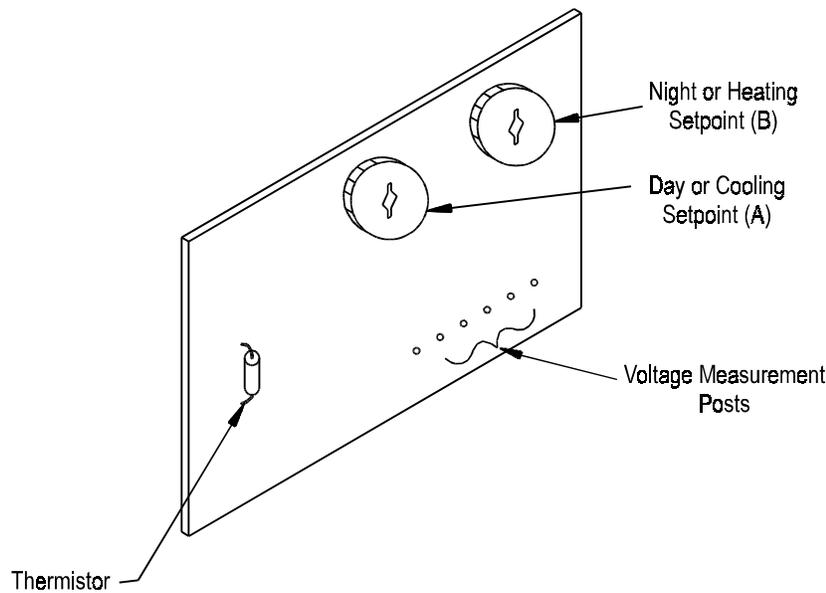
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1.0 DEFINITIONS AND DESCRIPTIONS



Thermostat (Figure 1)

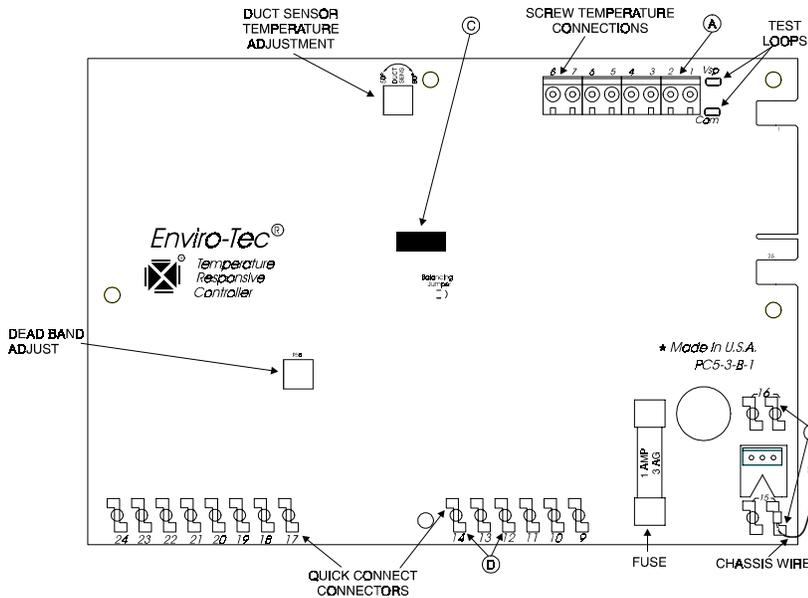
1.0 DEFINITIONS AND DESCRIPTIONS

1.1 THERMOSTAT (FIGURE 1)

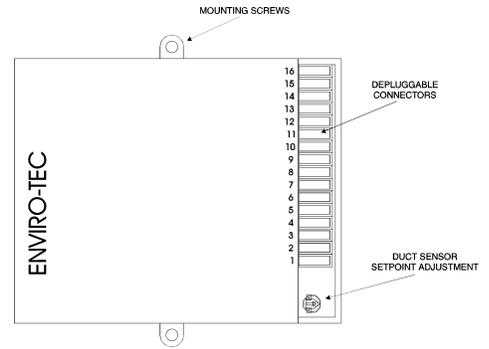
- a. **Thermistor** – Glass encapsulated, hermetically sealed temperature sensing device mounted on front of the thermostat printed circuit board.
- b. **Setpoint Controls “A” and “B”** – Green thumbwheel potentiometers mounted on front of the thermostat printed circuit board. “A” adjusts temperature setpoint for day or cooling operation. “B” adjusts temperature setpoint for night (setback) or heating (changeover) operation.
- c. **Enclosure** – Protects thermostat and provides stable temperature environment for sensing. Vertical fins on cover face must be on left hand side of enclosure directly over thermistor.
- d. **Connectors** – Captive screw type. Terminal designations are etched on solder side of printed circuit board.
- e. **Thermostat Packaging** – Bubble pack design for protection during shipment. Terminal numbers, signal designations, serial number, inventory number and ETI job number are shown on outside of package.

1.2 CONTROLLER (REFER TO FIGURE 2 - PAGE 5)

- a. **Thermostat and Sensor Connectors** - One-piece captive screw terminal type for reliable connections.
- b. **24 VAC and Control Output Connectors** - Male, 1/4”, quick connect type.
- c. **Labels** - Computer printed with serial number, inventory number and ETI job number.
- d. **D.C. Actuator Drive Terminal** - Incorporates reversing and current limit circuitry which removes power from motor when a mechanical stop is met.



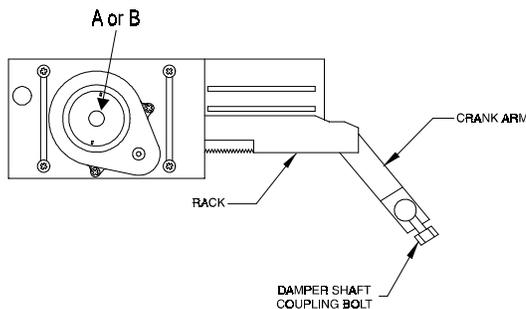
Current Controller (Figure 2a)
(Refer to page 4)



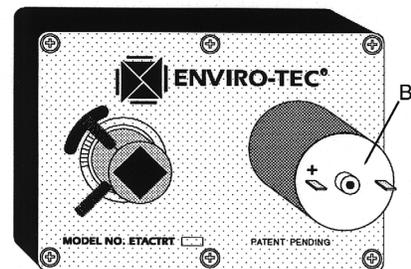
Old Controller (Figure 2b)
(No longer available)

1.3 ACTUATOR (FIGURE 3)

- a. **A.C. Motor** – Hansen “Synchronization” model is actually two motors “pancaked” together, each with 24 VAC, 5 W winding. The output at pinion gear is 1 RPM. White wires are used for common, blue wire connects to CW motor, yellow to CCW motor. A 13 ohm resistor was provided on the controller to prevent damage by high voltage (used throughout 1990). Replacement rotary model is ETACTRTADS or, if position switch is required, ETACTRTADSA.
- b. **D.C. Motor** – Reversible D.C. motor. Output at pinion gear is approximately 2 RPM, depending on load. Connections are made using 3/16" quick connect receptacles (see 1.2.d above for drive circuitry description).
- c. **Rack & Pinion Drive Train** – Rack and pinion type with lubricated steel gear insert in rack for strength. Pin at end of rack attaches to damper shaft with bolt. Rack contains internal stops. Full travel time is approximately 70 seconds for 45° damper travel (used through August 1992). This drive train with D.C. motor is no longer available. Replacement rotary model is ETACTRT or, if damper position switch is required, ETACTRTA.
- d. **Rotary** – 90° rotation. Slides over damper shaft and uses two set screws. Full travel time is 2 to 3 minutes for 90° rotation. (Attach to damper shaft with approximately 1/8" gap between bottom of actuator and bottom of control enclosure.)



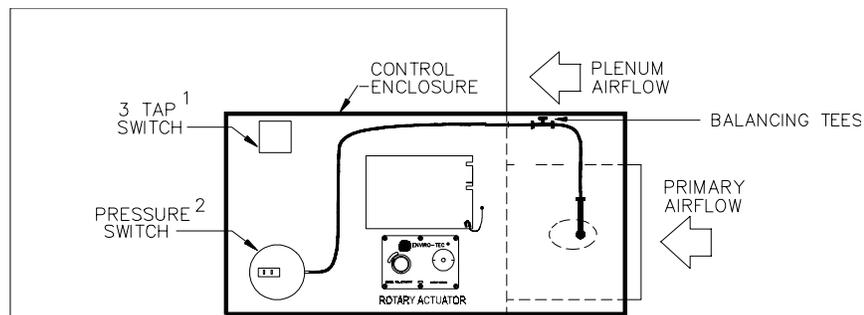
(c) Rack & Pinion Type



(d) Rotary Type

Actuator (Figure 3)

2.0 INSTALLATION



¹Units with electric heater, 3 tap switch is located inside heater cabinet.

²Units with electric heater, pressure switch is mounted on side of heater panel facing inlet collar.

Typical Component Mounting (Figure 4)

2.0 INSTALLATION

2.1 INSPECTION

Upon receipt of VAV terminals, check controls for shipping damage such as loose or broken connectors, broken actuator or controller housing, loose or disconnected tubing and loose wiring. Also inspect both before and after installation for damage caused by abuse or mishandling. A diagram of a typical control component mounting configuration is provided in Figure 4.

2.2 COORDINATION OF TRADES

Contractor should see that all trades involved with both the VAV terminals and the electronic controls (including thermostats) have a copy of the documentation and submitted control sequence data prior to installation.

2.3 THERMOSTAT MOUNTING

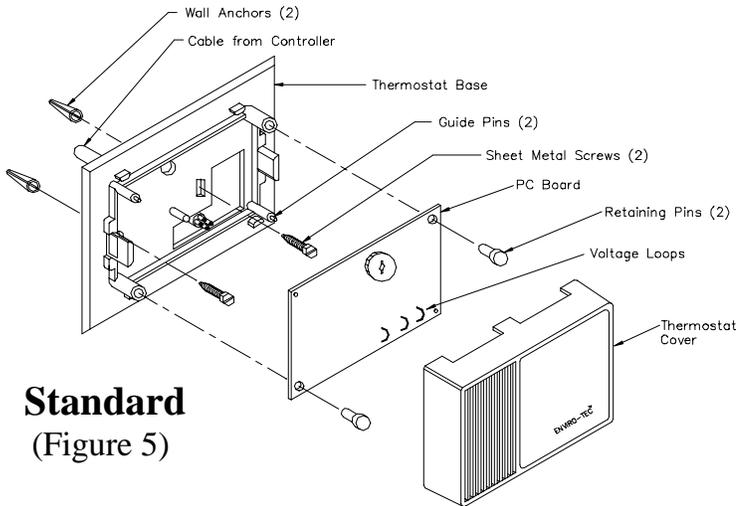
Thermostats are shipped separately from the terminal units via UPS or in the terminal control enclosure as per sales representative request. The thermostat may be mounted directly to drywall or, optionally, to a horizontally mounted, single gang junction box.

2.3.1 Drywall Mounting (Figures 5 & 6.)

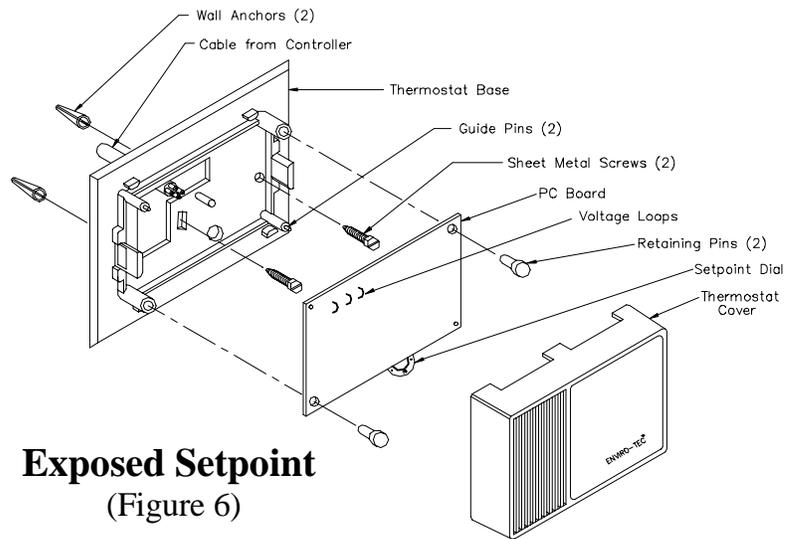
- Drill holes in wall for cable from controller and 2 wall anchors. Insert wall anchors in wall.
- Run cable through L-shaped hole in thermostat base and fasten base to wall with screws provided as shown in sketch.
- Mount PC Board on base so Setpoint Dial is at bottom between board and base (exposed set point unit) or at top (standard unit). Use guide pins to align. Fasten PC Board to base using plastic retaining pins provided.
- Snap cover onto base making sure vertical slots are on left side (“ENVIRO-TEC[®]” is right side up).

2.3.2 Single Junction Box Mounting (Figure 7)

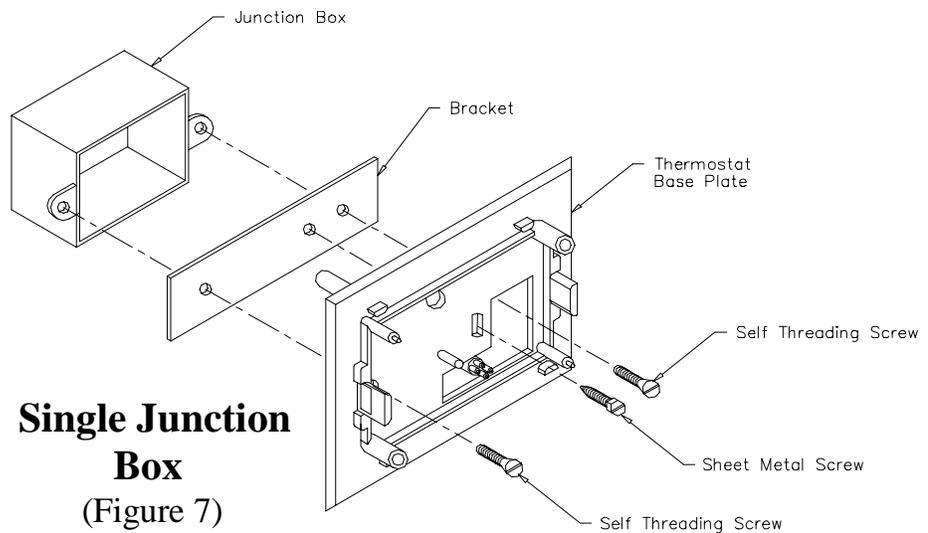
- Install right-hand screw (left-hand for exposed set point thermostat) through bracket & fix bracket to junction box.
- Install left-hand screw (right-hand for exposed set point thermostat) through thermostat base plate and bracket, into junction box. Do not tighten fully.
- Install center screw through thermostat base plate and bracket.
- Tighten screws. Mount PC Board on base per Step 2.3.1.c.
- Snap cover onto base making sure vertical slots are on left side (“ENVIRO-TEC[®]” is right side up).



Standard
(Figure 5)



Exposed Setpoint
(Figure 6)



**Single Junction
Box**
(Figure 7)

2.0 INSTALLATION

2.4 WIRING INSTALLATION

WARNING – Disconnect all power supplies to the system before wiring to avoid damage to the equipment or possible electrical shock.

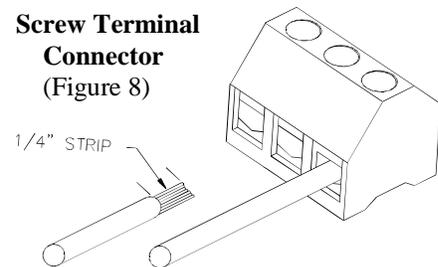
- a. Required wire type for external control connections – 18 to 20 AWG stranded copper.
- b. Wiring diagrams – Refer to ENVIRO-TEC[®] Submittal Data to determine correct terminals for wiring. A copy of the wiring diagram submittal may be obtained from the sales representative. Before beginning wiring, ensure that submittal sequence matches the control model number. (Refer to parts in Section 6).
- c. Control wiring to thermostat and optional remote contact closures should not be routed close to power (line voltage) wiring, electrical machinery or lighting, to reduce the possibility of electrical interference.

2.5 CONTROLLER WIRING

- a. Thermostat and Control Input Connections:

1. Using a small screwdriver, turn screw fully CCW.
2. Insert stripped wire(s) 18-20 AWG stranded copper (Figure 8).
3. Turn screw fully CW. Make sure connector clamps uninsulated portion of wire.

Screw Terminal Connector
(Figure 8)



- b. VAC Input and Control Output Connections:

1. Strip 1/4" of insulation from 18-20 AWG stranded copper wire.
2. Attach a 1/4" quick connect receptacle to the uninsulated portion of the wire using a set of crimpers.
3. Push receptacle over spade on printed circuit board. **CAUTION** – *Fit is tight. If removal is required, do not wiggle or pull; carefully pry off with a screw driver.*

2.6 THERMOSTAT WIRING

- a. Remove cover from thermostat. If a locking cover has been provided, a 1/16 inch allen wrench will be required to remove the two allen screws which lock the cover in place.
- b. Remove printed circuit board from base. If plastic retaining pins are tight, pry up the pins with a small screwdriver. **CAUTION** – *Take care not to damage components on printed circuit board when prying out plastic retaining pins.*
- c. Strip 1/4 inch of insulation from the wire.
- d. Insert wire in connector and tighten screw. **CAUTION** – *Do not overtighten screws. Make sure connector clamps uninsulated portion of wire.*
- e. Repeat Steps c and d for all wires and terminals. Each terminal present should have a single wire inserted when wiring is complete.
- f. Replace board on base using guide pins to align. Insert plastic retaining pins into large holes in printed circuit board and push through into base.
- g. Replace cover, making sure vertical openings on face are positioned on left side. If the cover is locking, reinsert allen screws removed in Step (a) so that cover cannot be removed.

CAUTION – Always verify that wiring is correct before applying power.

3.0 START-UP & BALANCE PROCEDURE

3.1 INITIAL START-UP PROCEDURE

WARNING – Lethal voltages are present on the transformer primary windings and associated terminal connections.

CAUTION – Always verify that wiring is correct before applying power.

The following items must be checked before beginning the air balancing procedure.

- a. Inspect all electrical connections to assure proper fit and location, in accordance with the proper wiring diagram.
- b. Check primary voltage to the transformer, if a control voltage transformer is utilized. Use caution, as the primary power connections to the transformer are lethal. Check output voltage from the transformer. This should be between 22 and 27.6 VAC. If outside these limits, immediately remove power and determine the reason for improper power. (See Troubleshooting – Section 4.0.)
- c. Check the position of the VAV damper in relation to the end stops of the actuator, to ensure that the damper can travel through its full arc.
- d. Check for primary airflow (or static pressure if the damper is closed) in the inlet duct.
- e. The unit should be checked for proper sequence response before attempting to balance system. Refer to submitted control sequence for description of operation.

3.2 BALANCING PROCEDURES

NOTE: If a minimum other than zero is desired for an odd numbered 600 Series control sequence (601, 603, 605, etc.) it is not possible to also set a maximum limit.

3.2.1 Minimum Flow Adjustment

1. Turn the green temperature setpoint dial fully clockwise to call for full heating.
2. Loosen the damper shaft set screws, shown in Figure 3.
3. Wait for actuator to reach its mechanical limit.
4. Rotate damper shaft to obtain the desired minimum airflow.
5. Tighten the damper shaft set screws securely.

3.2.2 Maximum Flow Adjustment

NOTE: Making this adjustment will set the minimum flow to zero (damper closed).

1. Turn the green temperature setpoint dial fully counter-clockwise to call for full cooling.
2. Loosen the damper shaft set screws shown in Figure 3.
3. Wait for actuator to reach its mechanical limit.
4. Rotate damper shaft to obtain the desired maximum airflow.
5. Tighten the damper shaft set screws securely.

3.0 START-UP & BALANCE PROCEDURE ---

3.2.3 Fan Start/Stop Adjustment

(Depending on the sequence of operation, may not be applicable)

A position (end) switch is used in 600 Series variable volume fan powered sequences to cause the unit fan to start/stop by damper position (which equates to a specific airflow capacity). Always make this adjustment after the minimum and/or maximum airflow adjustments described above have been accomplished.

1. On the ETACTRRTA damper actuator, loosen, but do not remove, the two cam-locking screws.
2. Run the actuator to the desired damper position by adjusting the thermostat for cooling or heating.
3. Stop the actuator at the desired position by removing one of the two wires connected to the actuator.
CAUTION – do not allow this wire to touch the actuator, sheet metal enclosure or controller.
4. Slide the cam to the position where the CW side of the cam bevel partially depresses the button of the position switch. The bevel should be positioned so that the CW motion of the damper shaft will fully depress the switch.
5. Tighten the two cam-locking screws.

3.2.4 Duct Temperature Adjustment

(Depending on the sequence of operation, may not be applicable)

A duct sensor is used to sense the presence of warm air at the inlet of the VAV terminal, causing the controller to reverse the damper's direction of operation. The temperature at which this reversal occurs is adjusted by a potentiometer on the controller (see Figure 2). Set this potentiometer to the temperature midway between expected warm and cold air temperatures. Recommended minimum difference in warm and cold air temperatures is 10°F.

3.2.5 Bypass Terminal (BT Sequence) Adjustments

NOTE: ETI Submittal Drawings require the installation of an upstream balancing damper provided by others for proper operation of this type of terminal.

1. Adjust the green temperature setpoint knob on the thermostat to open the terminal damper to the space. The upstream balancing damper may need to be temporarily adjusted to allow the bypass terminal's damper to open fully to the space.
2. Adjust the upstream balancing damper for the desired maximum airflow to the space and lock it in position.
3. If a minimum airflow adjustment is desired, set it as previously described in "Minimum Flow Adjustment."

4.0 TROUBLESHOOTING

PROCEDURE

1. With all electrical devices, there is a danger of shock. Lethal voltages are present at the supply connection of all power transformers. Use caution when measuring operating voltages with these units.
2. At the beginning of each section are “Common Problems.” To save time, check these items first.
3. Many of the procedures in this section require taking voltage readings. This may be done easily by using meter leads which have spring-loaded clips instead of the usual probes. These leads free your hands for other work; they may be purchased at consumer electronics stores, or from your ETI representative.

For controller terminals not having test loops, voltages may be read by holding the meter lead directly on the screw terminal or tab connector (as applicable). Test points followed by “(+)” are to be attached to the “+” jack of your meter, which is usually the red lead. Test points followed by “(-)” are to be attached to the “-” jack of your meter, which is usually the black lead.

Since most of the procedures are temperature related, you must ensure that the ambient temperature at the thermostat is 55-85°F. In addition, the primary air supply must be 55-85°F at 0.5-2.5"W.C.

The following table is a list of possible unit malfunctions, along with referenced unit diagnostic procedures.

TABLE 4.0 – QUICK REFERENCE	
Problem With	Proceed to
Damper Motion	4.1
Fan	4.2
Electric Heat	4.3
Night Setback	4.4
Night Mode	4.5
SSD with Morning Warm-up	4.6
Fan Unit with Morning Warm-up	4.7
Changeover	4.8
No Response to Thermostat	4.9
Corrective Actions	4.10

4.0 TROUBLESHOOTING

4.1 DAMPER MOTION

NOTE – The current 600 Series Controller drives a DC actuator motor and can be identified by its green color. Since the output is time-proportioned, it will be necessary to observe the actuator for up to 30 seconds before proceeding with each step.

COMMON PROBLEMS

1. Output wires are backward: On SSD, VVF, CVF and Left Side BT, ensure that Terminal 13 is OPEN, Terminal 14 is CLOSED. On Right Side BT, ensure that Terminal 13 is CLOSED and Terminal 14 is OPEN.
2. Option Mode is enabled: Verify that unit is in Normal Mode before continuing with this procedure.

TABLE 4.1

STEP	ACTION	RESULT	PROCEED TO
4.1.1	Make sure the unit is in its Normal Mode.		4.1.2
4.1.2	Connect a voltmeter between controller terminals “Vsp” (+) and Com (-). Turn Temperature Setpoint "A" fully CW and verify voltage of 17-19 VDC. Turn Temperature Setpoint "A" fully CCW and verify voltage of 0-1.5 VDC.	Good Bad	4.1.3 4.9.1
4.1.3	Turn Temperature Setpoint "A" fully CW and verify that the damper shaft rotates in the CW direction at least once every 30 seconds. Then turn “A” fully CCW and verify that the damper shaft rotates in the CCW direction at least every 30 seconds.	Good Bad	4.1.7 4.1.4
4.1.4	There is a possibility that the controls are working but that the shaft is indexed wrong, i.e., the shaft bolt was tightened when the actuator was fully CW, but the damper was fully CCW, or vice versa. All ETI VAV terminals are set and shipped with the damper fully open (CCW) and the actuator fully CCW. However, this relationship is sometimes altered by field personnel during startup for various reasons. To test, loosen the damper shaft bolt and turn Temperature Setpoint "A" fully CW. Verify that the actuator collar rotates in the CW direction at least once every 30 seconds. Then turn “A” fully CCW and verify that the actuator collar rotates in the CCW direction at least once every 30 seconds.	Good Bad	4.10.2 4.1.5
4.1.5	Note the color of the wires on Terminals 13 and 14. Remove these two wires, touch the yellow wire to Controller Terminal 8, and the blue wire to Terminal 7. Verify that the actuator collar is rotating CW.	Good Bad	4.1.6 4.10.13
4.1.6	Touch the blue wire to Terminal 8 and the yellow wire to Terminal 7. Verify that the actuator collar is rotating CCW.	Good Bad	4.10.3 4.10.13
4.1.7	Damper actuator controls are working correctly. Restore the wiring per the note you made in Step 4.1.4. If you have other problems, refer to Table 4.0.		

4.2 FAN

NOTE – On VVF terminals, the fan contactor is controlled by a Damper Position switch in Normal (Day Mode), and is field adjustable. In the Option Mode, the fan is either a) CYCLED to maintain temperature, or b) kept OFF, depending on your sequence. On CVF terminals, the fan contactor is kept ON in Normal Mode. In the Option Mode, the fan is either a) CYCLED to maintain temperature, or b) kept OFF, depending on your sequence.

COMMON PROBLEMS

1. Blown fan motor fuse.
2. Option Mode is enabled: Verify that unit is in Normal Mode before continuing with this procedure.
3. Damper Position Switch (VVF models) mis-adjusted.
4. Blue and yellow wires swapped between transformer and controller

TABLE 4.2			
STEP	ACTION	RESULT	PROCEED TO
4.2.1	If the unit in question is a VVF, go to Step 4.2.2 If the unit in question is a CVF, go to Step 4.2.7		
4.2.2	Verify that the Damper Position Switch has been set correctly, per Section 3.2 "Fan Start/Stop Adjustment."		4.2.3
4.2.3	Connect DC voltmeter between test loops "Vsp" (+) and Com (-) on controller. Vary Temperature Setpoint "A" and verify that voltage goes from approximately 1 VDC (CCW) to 17 VDC (CW).	Good Bad	4.2.4 4.9
4.2.4	FV601A-608A, go to Step 4.2.6. FV609A-616A, go to Step 4.2.5.		
4.2.5	Connect a voltmeter across the "NO" (+) and "C" (-) terminals of the Damper Position Switch. Turn Temperature Setpoint "A" fully CCW. After the switch is released, verify 17-19 VDC across the terminals. Turn Setpoint "A" fully CW. After the switch is closed (plunger depressed by the rack bevel), verify 0-1.5 VDC across the terminals.	Good Bad	4.2.7 4.10.10
4.2.6	Connect a voltmeter across the "NO" (+) and "C" (-) terminals of the Damper Position Switch. Turn Temperature Setpoint "A" fully CCW. After the switch is released, verify 22-28 VAC across the terminals. Turn Setpoint "A" fully CW. After the switch is closed, verify 0-2 VAC across the terminals.	Good Bad	4.2.7 4.10.10
4.2.7	Open the metal controls cover and locate the fan contactor.		4.2.8
4.2.8	Verify that the fan contactor is engaged and the fan is running.	Good Bad	4.2.11 4.2.9
4.2.9	Carefully check wiring to the fan contactor per the sequence.	Good Bad	4.2.10 4.10.1
4.2.10	Remove the wire from controller Terminal 9 and momentarily touch it to Terminal 15. Verify that the fan contactor engages.	Good Bad	4.10.3 4.10.4
4.2.11	Fan controls are operating correctly in Normal Mode. If you wish to test the fan in an option mode, or if you have other problems, refer to Table 4.0.		

4.0 TROUBLESHOOTING

4.3 ELECTRIC HEAT

NOTE – SSD Units must have adequate airflow present to operate electric heat.

COMMON PROBLEMS

1. Blown fan motor fuse.
2. Option Mode is enabled: Verify that unit is in Normal Mode before continuing with this procedure.

TABLE 4.3

STEP	ACTION	RESULT	PROCEED TO
4.3.1	Connect DC voltmeter between controller test loops Vsp (+) and Com (-). Slowly turn Temperature Setpoint "A" and verify that voltage goes from approximately 1 VDC (CCW) to 17 VDC (CW).	Good Bad	4.3.2 4.9
4.3.2	Open the metal cover and locate the heat contactor(s).		
4.3.3	Turn Temperature Setpoint "A" fully CCW, then slowly turn it CW. Verify that the first stage heat contactor engages when Setpoint "A" is 2-3 degrees above ambient temperature. NOTE: Some contactor "chatter" may occur when rotating the setpoint by hand; this is acceptable and should not occur during normal operation.	Good Bad	4.3.4 4.3.5
4.3.4	If you have only one stage of electric heat, go to 4.3.7, otherwise continue. Continue to slowly rotate Setpoint "A," and verify that each additional stage of heat comes on independently, at approximately 1 degree increments.	Good Bad	4.3.7 4.3.5
4.3.5	Carefully check wiring to the heat contactors per the sequence.	Good Bad	4.3.6 4.10.1
4.3.6	Remove the wire from the faulty controller terminal output (10 through 12) and momentarily touch it to Terminal 15. Verify that the heat contactor engages.	Good Bad	4.3.7 4.10.5
4.3.7	Set Temperature Setpoint "A" approximately ½ degree above the point at which the fan contactor engages. Breath warm air on the thermistor (see Figure 1). Listen for the contactor to release. Verify that no "chatter" occurs.	Good Bad	4.3.8 4.10.3
4.3.8	Heat controls are working correctly in Normal Mode. Restore all wiring. If you wish to test the heat in an option mode, or if you have other problems, refer to Table 4.0.		

4.4 NIGHT SETBACK COMMON PROBLEMS

1. Air hose on pressure switch connected to LOW fitting instead of HIGH.
2. Wires on pressure switch not connected to NC and COM.
3. Insufficient static pressure to keep pressure switch open.

TABLE 4.4

STEP	ACTION	RESULT	PROCEED TO
4.4.1	Using a DC voltmeter, measure between controller terminal 1 (+) and test loop Com (-). Verify that the voltage is 14-19 VDC>	Good	4.4.6
		Bad	4.4.2
4.4.2	Verify that the air pressure switch and controller wiring are all correct. Remove the wire from controller Terminal 1 and verify voltage from Terminal 1 (+) to Com (-) is 14-19 VDC.	Good	4.4.3
		Bad	4.10.3
4.4.3	Temporarily disconnect the hose going to the pressure switch. Reconnect the wire to Terminal 1 and verify that the voltage from controller Terminal 1 (+) to Com (-) is 0-1 VDC.	Good	4.4.4
		Bad	4.10.6
4.4.4	Gently blow in the hose leading to the pressure switch. Verify that the voltage from controller Terminal 1 (+) to Com (-) jumps up to 14-19 VDC.	Good	4.4.5
		Bad	4.10.6
4.4.5	Verify primary static pressure above 0.3" w.g.	Good	4.10.6
		Bad	4.10.7
4.4.6	Disconnect air hose from pressure switch. Verify voltage is 0-1 VDC.	Good	4.4.7
		Bad	4.4.2
4.4.7	Connect voltmeter from controller Terminal 2 (+) to Com (-) and verify 0-1 VDC.	Good	4.4.8
		Bad	4.10.3
4.4.8	Reconnect air hose to pressure switch. Verify voltage is 14-19 VDC.	Good	4.4.9
		Bad	4.10.3
4.4.9	Connect voltmeter between thermostat Terminal 3 (+) and TP1 (-). Verify voltage is 14-19 VDC.	Good	4.4.10
		Bad	4.10.1
4.4.10	Vary Temperature Setpoint "B" and verify that it turns the fan on/off.	Good	4.4.11
4.4.11	Reconnect air hose. Vary Temperature Setpoint "A" and verify that it controls the damper.	Good	4.4.12
		Bad	4.10.8
4.4.12	Night Setback is operating correctly. If you wish to test the controls in an option mode, or if you have other problems, refer to Table 4.0.		

4.0 TROUBLESHOOTING

4.5 NIGHT MODE COMMON PROBLEMS

1. Air hose on pressure switch connected to LOW fitting instead of HIGH.
2. Wires on pressure switch not connected to NC and COM (-).
3. Insufficient static pressure to keep pressure switch open.

TABLE 4.5

STEP	ACTION	RESULT	PROCEED TO
4.5.1	If the unit in question is FC601-FC607, to Step 4.5.2. If the unit in question is FC625-FC631, to Step 4.5.10.		
4.5.2	Connect a DC voltmeter between controller Terminal 5 (+) and test loop Com (-). Verify voltage is 14-19 VDC.	Good Bad	4.5.7 4.5.3
4.5.3	Verify that the air pressure switch and controller WIRING are all correct. Remove the wire from controller Terminal 5 (+) and verify voltage from Terminal 5 (+) to Com (-) is 14-18 VDC.	Good Bad	4.5.4 4.10.3
4.5.4	Temporarily disconnect the hose going to the pressure switch. Reconnect the wire to Terminal 5 and verify that the voltage from controller Terminal 5 (+) to Com (-) is 0-1 VDC.	Good Bad	4.5.5 4.10.6
4.5.5	Gently blow in the hose leading to the pressure switch. Verify that the voltage jumps up to 14-19 VDC.	Good Bad	4.5.6 4.10.6
4.5.6	Verify primary static pressure above 0.3" w.g.	Good Bad	4.10.6 4.10.7
4.5.7	Remove air hose from pressure switch and verify voltage is 0-1 VDC.	Good Bad	4.5.8 4.5.3
4.5.8	Turn Temperature Setpoint "A" fully CW. Verify fan (and heat, if applicable) are OFF, and damper closes.	Good Bad	4.5.9 4.10.3
4.5.9	Reconnect air hose. Verify fan (and heat, if applicable) are ON.	Good Bad	4.5.18 4.10.3
4.5.10	Remove wire from controller Terminal 3. Connect a DC voltmeter between controller Terminals 2 (+) and test loop Com (-). Verify voltage is 14-18 VDC.	Good Bad	4.5.15 4.5.11
4.5.11	Verify that the air pressure switch and controller wiring are correct. Remove the wire from controller Terminal 2 and verify voltage from Terminal 2 (+) to Com (-) is 14-19 VDC.	Good Bad	4.5.12 4.10.3
4.5.12	Temporarily disconnect the hose going to the pressure switch. Reconnect the wire to Terminal 2 and verify that the voltage from controller Terminal 2 (+) to Com (-) is 0-1 VDC.	Good Bad	4.5.13 4.10.6
4.5.13	Blow in the hose and verify that the voltage jumps up to 14-18 VDC.	Good Bad	4.5.14 4.10.6
4.5.14	Verify primary static pressure above 0.3" w.g.	Good Bad	4.10.6 4.10.7

TABLE 4.5 Night Mode (continued)

STEP	ACTION	RESULT	PROCEED TO
4.5.15	Remove air hose from pressure switch and verify voltage is 0-1 VDC.	Good	4.5.16
		Bad	4.5.11
4.5.16	Turn Temperature Setpoint "A" fully CW. Verify fan (and heat, if applicable) are OFF.	Good	4.5.17
		Bad	4.10.3
4.5.17	Reconnect air hose. Verify fan (and heat, if applicable) are ON.	Good	4.5.18
		Bad	4.10.3
4.5.18	Night Mode is operating correctly. Reconnect wire Terminal 3 if removed. If you wish to test the controls in an option mode or if you have other problems, refer to Table 4.0.		

4.6 SSD/BT WITH MORNING WARM-UP COMMON PROBLEMS

1. Duct Sensor Setpoint out of adjustment. For normal operation, this should be set midway between expected cold supply and hot supply air temperatures. Or, in lieu of this, set it to 70°F.

TABLE 4.6

STEP	ACTION	RESULT	PROCEED TO
4.6.1	Turn Duct Sensor Setpoint control fully CW. Turn Temperature Setpoint "A" fully CW. Verify that the damper is closing, heat stages (if applicable) are on.	Good	4.6.4
		Bad	4.6.2
4.6.2	Verify all wiring is correct between thermostat and controller per control sequence. If correct, disconnect both Duct Sensor wires from controller and verify Duct Sensor resistance is between 19K-23K ohms.	Good	4.6.3
		Bad	4.10.9
4.6.3	Reconnect Duct Sensor and replace thermostat with a known good thermostat. Connect DC voltmeter between controller terminals "Vsp" (+) and Com (-). Turn Temperature Setpoint "A" back and forth. Verify that the voltage goes from a high reading of 15-19 VDC (with "A" CW) to 0-2 VDC (with "A" CCW).	Good	4.10.8
		Bad	4.10.3
4.6.4	Turn Duct Sensor Setpoint control fully CCW. Verify that the damper is opening and the heat stages (if applicable) are OFF.	Good	4.6.5
		Bad	4.6.2
4.6.5	Morning Warm-up is operating correctly. If you wish to test the controls in an option mode or if you have other problems, refer to Table 4.0.		

4.0 TROUBLESHOOTING

4.7 VVF/CVF WITH MORNING WARM-UP COMMON PROBLEMS

1. Duct Sensor Setpoint out of adjustment. For normal operation, this should be set midway between expected cold supply and hot supply air temperatures. Or, in lieu of this, set it to 70°F.
2. Option mode enabled. If the unit also has Night Setback, verify that it is NOT in setback.

TABLE 4.7

STEP	ACTION	RESULT	PROCEED TO
4.7.1	If the unit in question is CVF, go to Step 4.7.8. If the unit in question is VVF, go to Step 4.7.2.		
4.7.2	Turn Duct Sensor Setpoint control fully CW. Turn Temperature Setpoint "A" fully CW. Verify that the damper is closing, heat stages (if applicable) are ON.	Good Bad	4.7.3 4.7.5
4.7.3	Verify that the fan starts when the Damper Position Switch is activated by the actuator.	Good Bad	4.7.4 4.2.9
4.7.4	Turn Temperature Setpoint "A" fully CCW. Verify that the damper is opening, fan and heat stages (if applicable) are OFF.	Good Bad	4.7.7 4.7.5
4.7.5	Verify all wiring is correct between thermostat and controller per control sequence. If correct, disconnect both Duct Sensor wires from controller. Verify Duct Sensor resistance is between 19K-23K ohms.	Good Bad	4.7.6 4.10.9
4.7.6	Reconnect Duct Sensor and replace thermostat with a known good thermostat. Connect DC voltmeter between controller "Vsp" (+) and Com (-). Turn Temperature Setpoint "A" back and forth. Verify that the voltage goes from a high reading of 15-19 VDC (with "A" CW) to a low reading of 0-2 VDC (with "A" CCW).	Good Bad	4.10.8 4.10.3
4.7.7	Turn Duct Sensor Setpoint control fully CCW. Verify that the damper is closing, fan and heat stages (if applicable) are OFF.	Good Bad	4.7.10 4.7.5
4.7.8	Turn Duct Sensor Setpoint control fully CW. Turn Temperature Setpoint "A" fully CW. Verify that the damper is closing, fan is ON and heat stages (if applicable) are ON.	Good Bad	4.7.9 4.7.5
4.7.9	Turn Duct Sensor Setpoint control fully CCW. Verify that the damper is opening, fan is ON and heat stages (if applicable) are OFF.	Good Bad	4.7.10 4.7.5
4.7.10	Morning Warm-up is operating correctly. If you wish to test the controls in an option mode or if you have other problems, refer to Table 4.0.		

4.8 CHANGEOVER

COMMON PROBLEMS

1. Duct Sensor Setpoint out of adjustment. This should be set midway between expected cold supply air temperatures. Or, in lieu of this, set it to 70°F.

TABLE 4.8			
STEP	ACTION	RESULT	PROCEED TO
4.8.1	Turn Duct Sensor potentiometer on controller fully CW. Connect DC voltmeter between Terminals 2 (+) and test loop Com (-). Verify voltage is 14-18 VDC.	Good	4.8.4
		Bad	4.8.2
4.8.2	Verify all wiring is correct between thermostat and controller per control sequence. If correct, disconnect both Duct Sensor wires from controller and verify Duct Sensor resistance is between 19K-23K ohms.	Good	4.8.3
		Bad	4.10.9
4.8.3	Reconnect Duct Sensor and replace thermostat with a known good thermostat. Connect DC voltmeter between controller Terminals 2 (+) and 7 (-). Verify voltage is 14-18 VDC.	Good	4.10.8
		Bad	4.10.3
4.8.4	Turn Duct Sensor potentiometer on controller fully CCW. Connect DC voltmeter between Terminals 2 (+) and 7 (-). Verify voltage is 0-1 VDC.	Good	4.8.5
		Bad	4.8.2
4.8.5	Turn Temperature Setpoint "A" and "B" fully CW. VERIFY damper is opening and heat (if applicable) is OFF.	Good	4.8.6
		Bad	4.9
4.8.6	Turn Temperature Setpoint "B" fully CCW. Verify damper is closing and heat (if applicable) is OFF.	Good	4.8.7
		Bad	4.9
4.8.7	Turn Temperature Setpoint "A" fully CCW. Turn Duct Sensor potentiometer on controller fully CW. Verify damper is opening.	Good	4.8.8
		Bad	4.9
4.8.8	Turn Temperature Setpoint "A" fully CW. Verify damper is closing.	Good	4.8.9
		Bad	4.9
4.8.9	Changeover is operating correctly. If you wish to test the controls in an option mode or if you have other problems, refer to Table 4.0.		

4.0 TROUBLESHOOTING

4.9 NO RESPONSE TO THERMOSTAT COMMON PROBLEMS

1. Incorrect wiring: Check control sequence carefully.
2. Insufficient static air pressure.
3. Option mode is enabled: Verify that the unit is in Normal Mode before continuing with this procedure.

TABLE 4.9

STEP	ACTION	RESULT	PROCEED TO
4.9.1	Measure AC voltage between terminals 15 (either quick-connect) and 16 (either quick-connect) at the controller. Verify 22-28 VAC.	Good Bad	4.9.2 4.10.11
4.9.2	Remove the wire from controller terminal 8 and measure the voltage from terminal 8 (+) to Com (-). Verify voltage is 17.4-18.6 VDC.	Good Bad	4.9.4 4.9.3
4.9.3	Turn power off to the controller, remove the fuse and verify that fuse resistance is 0-1 ohm.	Good Bad	4.9.4 4.9.12
4.9.4	Reconnect wire to terminal 8. Measure voltage between thermostat terminals 1 (+) and 2 (-). Verify voltage is 17.4-18.6 VDC.	Good Bad	4.9.5 4.10.1
4.9.5	Disconnect the wires from terminals 3 and 4 (if applicable) of the thermostat. Turn Temperature Setpoint (left, if dual setpoint) fully CCW. Measure voltage between terminal 4 (+) (terminal 3, if no terminal 4) and terminal 2 (-). Verify 0-4 VDC.	Good Bad	4.9.6 4.10.8
4.9.6	Turn Temperature Setpoint (left if dual setpoint) fully CW. Measure voltage between terminal 4 (+) (terminal 3, if no terminal 4) and terminal 2 (-). Verify 14-18 VDC.	Good Bad	4.9.7 4.10.8
4.9.7	Reconnect the wire to terminal 4 (+) (terminal 3, if no terminal 4) of the thermostat. Repeat Steps 4.9.5 and 4.9.6.	Good Bad	4.9.9 4.9.8
4.9.8	Check wiring carefully per control sequence.	Good Bad	4.10.3 4.10.1
4.9.9	Thermostat is operating correctly. If Damper, Fan, Heat or an Option are not operating, see Table 4.0.		

4.10 CORRECTIVE ACTIONS

TABLE 4.10	
STEP	ACTION
4.10.1	Wiring is bad. Your electronic components can withstand several types of wiring errors, but not all. Check sequence closely and, if in doubt as to any part of the diagram, call your representative for assistance BEFORE apply power. A quick phone call will save you time and prevent equipment damage.
4.10.2	Damper shaft is not indexed correctly. Loosen the damper shaft set screws. Turn Temperature Setpoint "A" to full cooling and wait for the actuator to drive to its fully open (CCW) position. Open the damper by manually rotating the shaft fully CCW and re-tightening the bolt. Repeat Step 4.1.2.
4.10.3	Controller is bad.
4.10.4	Fan contactor is bad.
4.10.5	Heat contactor is bad.
4.10.6	Air pressure switch is bad.
4.10.7	Insufficient primary static air pressure. Check static pressure controller on the main air handler and/or balancing dampers upstream of the VAV terminal that may have swung closed.
4.10.8	Thermostat is potentially bad.
4.10.9	Duct Sensor is bad. Since Duct Sensor is calibrated at controller, both Duct Sensor and controller will need to be replaced.
4.10.10	Damper Position switch is bad.
4.10.11	Transformer and/or incoming line voltage is bad.
4.10.12	Fuse is blown. Replace with a standard 1 amp/3 AG fuse, easily obtainable anywhere.
4.10.13	Actuator is bad.

5.0 WARRANTY POLICY

Environmental Technologies, Inc. and its Subsidiaries, hereinafter referred to as ETI, do hereby extend the following limited warranty of the manufactured products and components of complete assembled units, e.g., Analog Electronic Controls.

All component parts manufactured by ETI are warranted against defects in materials and workmanship for a period of *18 months* from date of shipment.

Environmental Technologies, Inc. warranty is limited to replacement of product(s) and/or part(s) furnished by ETI. No replacement labor is included, nor extraneous labor or materials related to the repair and field replacement function. Furthermore, ETI makes no other warranties, expressed or implied, of its product(s) or any other product(s) so included as a component of its product(s).

6.0 PARTS LIST

ACTUATOR REPLACEMENT

Models with AC Motors and/or Rack and Pinion Drive Train (Section 1.3.a) are no longer manufactured. A DC actuator with a rectifier circuit mounted on it (Model ETACTRTAD) is available for controllers incorporating AC drive (black case). Controllers incorporating DC drive (green circuit board) should use actuator Model ETACTRT. Both current actuators use a rotary drive; consequently, some relocation of components in the control enclosure may be required when replacing units originally equipped with Rack and Pinion Drive actuators.

CONTROLLER REPLACEMENT

Controllers with AC actuator drive are no longer manufactured or repaired. These controllers must be replaced with a new controller with DC actuator drive (green circuit board). If still functional, the old AC actuator can still be used by ordering ETAC, an interface board that allows the DC outputs to drive an AC actuator.

6.1 THERMOSTAT

SINGLE DUCT	
Sequence	Inventory #
SD601A-616A	ETSTAT4H
SD617A0624A	ETSTAT6H

VARIABLE VOLUME FAN	
Sequence	Inventory #
FV601A-608A FV633A-640A	ETSTAT4H
FV609A-616A FV641A-648A	ETSTAT8H

CONSTANT VOLUME FAN	
Sequence	Inventory #
FC601A-608A FC617A-632A	ETSTAT4H
FC609A-616A FC633A-640A	ETSTAT8H

6.2 CONTROLLER

VARIABLE VOLUME FAN			
Sequence	Inventory #	Sequence	Inventory #
FV601A-602A	ETRD0	FV633A-634A	ETRD0FWD
FV603A-604A	ETRD1	FV635A-636A	ETRD1FWD
FV605A-606A	ETRD2	FV637A-638A	ETRD2FWD
FV607A-608A	ETRD3	FV639A-640A	ETRD3FWD
FV609A-610A	ETRD0S	FV641A-642A	ETRD0SWD
FV611A-612A	ETRD1S	FV643A-644A	ETRD1SWD
FV613A-614A	ETRD2S	FV645A-646A	ETRD2SWD
FV615A-616A	ETRD3S	FV647A-648	ETRD3SWD

5.0, 6.0 WARRANTY POLICY AND PARTS LIST

6.2 CONTROLLER (continued)

CONSTANT VOLUME FAN	
Sequence	Inventory #
FC601A-602A	ETRD0Y
FC603A-604A	ETRD1Y
FC605A-606A	ETRD2Y
FC607A-608A	ETRD3Y
FC609A-610A	ETRD0SY
FC611A-612A	ETRD1SY
FC613A-614A	ETRD2SY
FC615A-616A	ETRD3SY
FC617A-718A	ETRD0
FC619A-620A	ETRD1
FC621A-622A	ETRD2
FC623A-624A	ETRD3
FC625A-626A	ETRD0YWD
FC627A-628A	ETRD1YWD
FC629A-630A	ETRD2YWD
FC631A-632A	ETRD3YWD
FC633A-634A	ETRD0SYWD
FC635A-636A	ETRD1SYWD
FC637A-638A	ETRD2SYWD
FC639A-640A	ETRD3SYWD

SINGLE DUCTS	
Sequence	Inventory #
SD601A-602A	ETRD0
SD603A-604A	ETRD1
SD605A-606A	ETRD2
SD607A-608A	ETRD3
SD609A-610A	ETRD0WD
SD611A-612A	ETRD1WD
SD613A-614A	ETRD2WD
SD615A-616A	ETRD3WD
SD617A-618A	ETRD0CD
SD619A-620A	ETRD1CD
SD621A-622A	ETRD2CD
SD623A-624A	ETRD3CD

6.2 CONTROLLER (continued)

BYPASS TERMINALS	
Sequence	Inventory #
BT601A	ETRD0
BT602A	ETRD02
BT603A	ETRD1
BT604A	ETRD12
BT605A	ETRD2
BT606A	ETRD22
BT607A	ETRD3
BT608A	ETRD32
BT609A	ETRD0WD
BT610A	ETRD0WD2
BT611A	ETRD1WD
BT612A	ETRD1WD2
BT613A	ETRD2WD
BT614A	ETRD2WD2
BT615A	ETRD3WD
BT616A	ETRD3WD2
BT617A	ETRD0CD
BT618A	ETRD0CD2
BT619A	ETRD1CD
BT620A	ETRD1CD2
BT621A	ETRD2CD
BT622A	ETRD2CD2
BT623A	ETRD3CD
BT624A	ETRD3CD2

5.0, 6.0 WARRANTY POLICY AND PARTS LIST

6.3 MISCELLANEOUS

Sequence	Inventory #
Thermostat Cover and Base	ETCVR
Locking Thermostat Cover and Base	ETCVRL
Thermostat Junction Box Adapter	JBA
Test Leads	BXM-32
Electric Actuator	ETACTRT

ETST4H 2" SQUARE THERMOSTAT MOUNTING INSTRUCTIONS

Drywall Mounting

(see Figure 2)

- 1) Decide where to mount the thermostat and drill a 1-3/8" hole for the wire mounting block, on the back of the thermostat, to fit into the wall.
- 2) Hold the thermostat on the wall with the mounting block in the hole drilled in step 1. Mark the location of the two mounting holes to either side of the center hole. DO NOT drill the mounting holes with the thermostat on the wall, use the thermostat only to locate the holes.
- 3) Remove the thermostat and drill two 3/16" mounting holes. Insert the wall anchors into the mounting holes.
- 4) Connect the wires to the appropriate terminals according to the sequence of operation.
- 5) Position the thermostat on the wall. Fasten the thermostat with the two 6-20x1" sheet metal screws and insulating washers provided.
- 6) (Optional) For exposed set point stats, turn the set point potentiometer to the desired temperature and place the set point knob onto the set point potentiometer with the desired temperature marking at the top of the dial.
- 7) Snap the cover back in place with the ENVIRO-TEC® logo at the bottom of the thermostat.

Junction Box Mounting

(see Figure 1)

- 1) The junction box cover provided can be used either horizontally or vertically by simply breaking out the appropriate tab. To mount horizontally break out tab "B", to mount vertically breakout tab "A".
- 2) Attach the 2 inch thermostat to the junction box cover with the two 6-32X1/2" round head screws, nuts, washers, and insulating washers provided.
- 3) Connect the wires to the appropriate terminals according to the sequence of operation.
- 4) Mount the cover to the junction box using the two 6-32X1/2" counter sunk screws provided.
- 5) (Optional) For exposed set point stats, turn the set point potentiometer to the desired temperature and place the set point knob onto the set point potentiometer with the desired temperature marking at the top of the dial.
- 6) Snap the cover back in place with the ENVIRO-TEC® logo at the bottom of the thermostat.

FIGURE 2: DRY WALL MOUNTING SHOWN WITH CONCEALED SET POINT

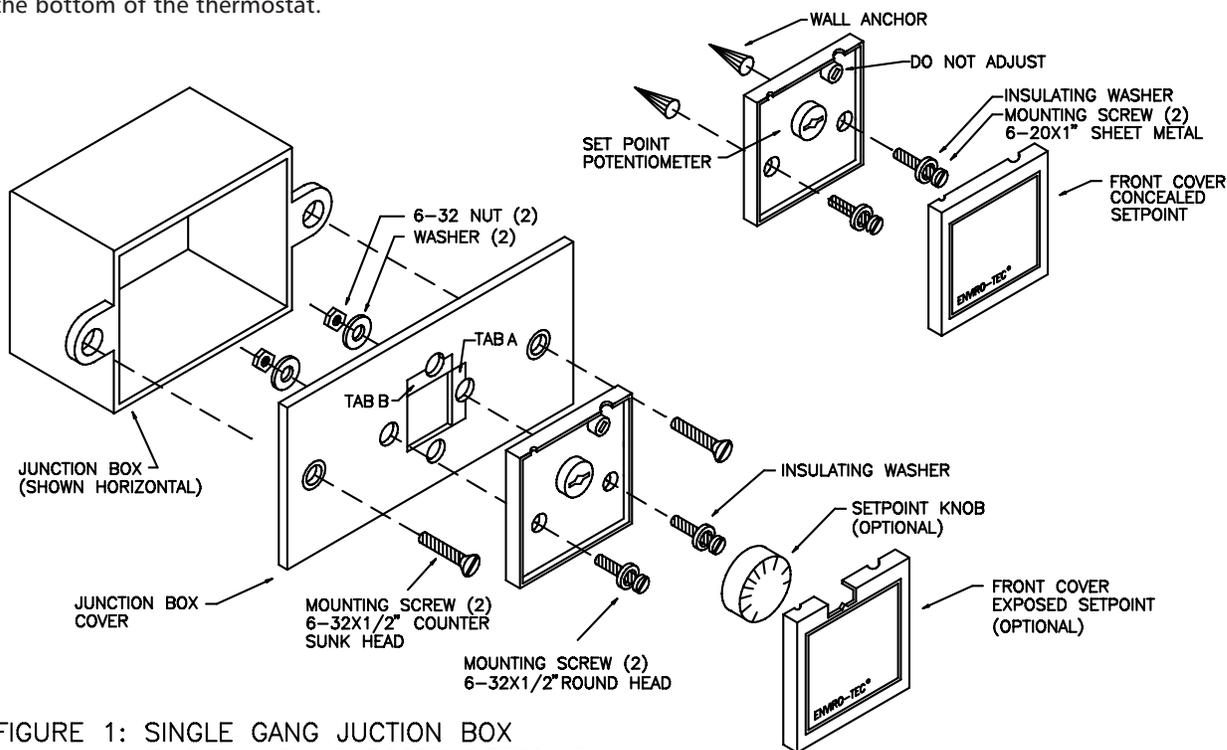


FIGURE 1: SINGLE GANG JUNCTION BOX SHOWN WITH EXPOSED SETPOINT

NOTE: The temperature setpoint adjustment on the ETST4H thermostat is reversed from the older (ETSTAT) series thermostats. When using the 600 Series IOM manual in conjunction with the ETST4H, the direction of rotation of this setpoint should be reversed from the direction stated in manual's instructions.