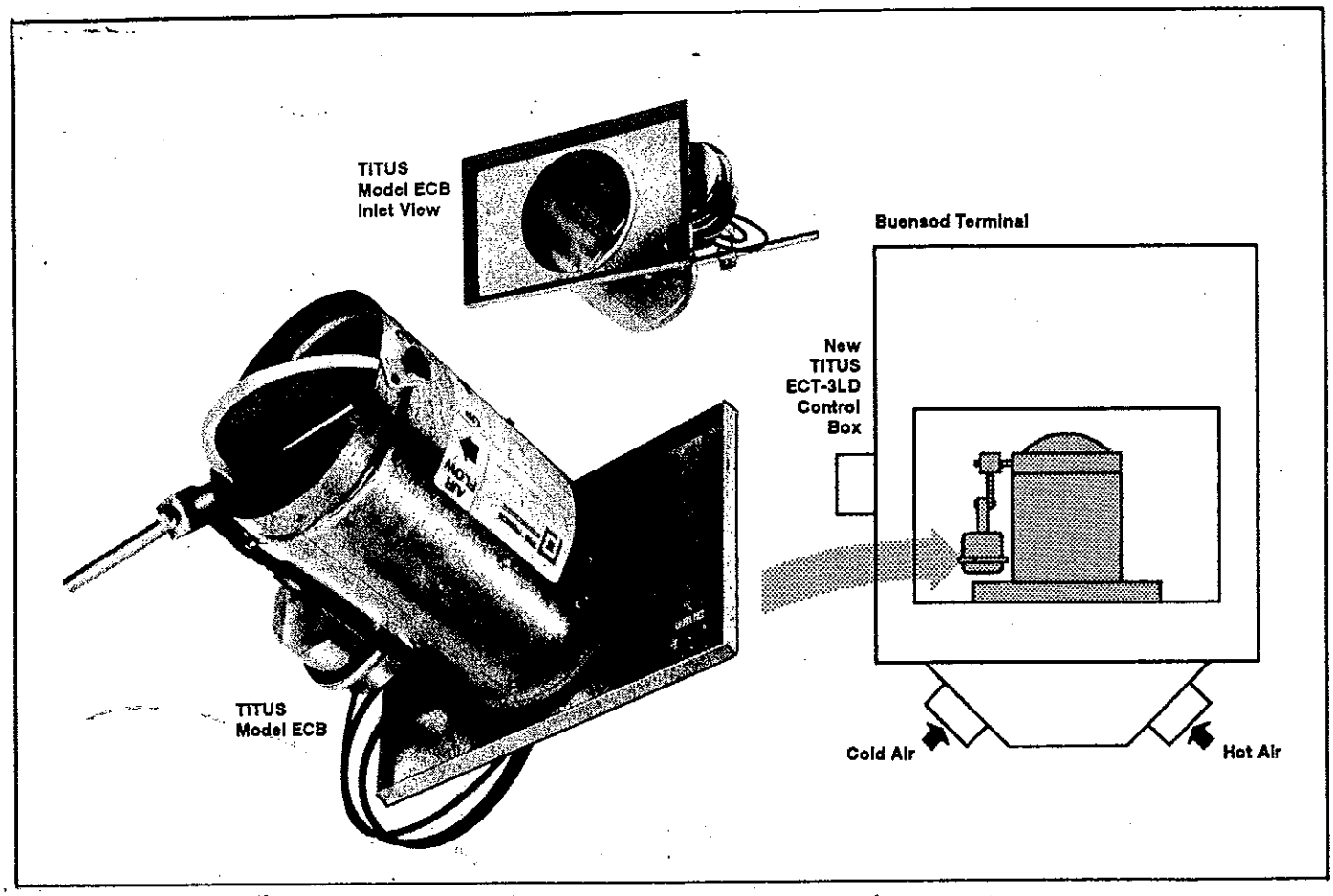
Retrofit • Variable Volume

Model ECB • Retrofit Valve for Buensod Terminals

Models H - Series, Designs 14 and 16



General Description:

ECB is a variable air volume, pneumatic control valve. Designed for retrofitting Buensod Design 14 and 16 mechanically controlled terminals, it directly replaces the mechanical constant volume regulators. This changeout is easily done through the access panel in the bottom of the existing Buensod terminal.

The ECB valves are then connected to an external pneumatic control module (TITUS ECT-L Series), which can be connected and adjusted for various control sequences. The resulting performance approaches that of the current TITUS Model ESV-3000 for single duct operation and EDV-3000 for dual duct operation.

The TITUS ECB valve fits the same space as the original constant volume regulator. The old regulator flange is used as a pattern for drilling the mounting holes in the ECB inlet panel. While most Buensod Design 14 and 16 terminals will require no additional modifications, exceptions may be encountered because of minor variations in original manufacture. Simple relocations of the valves or the sound baffle may be necessary to overcome space limitations.

The *TITUS*® ECB and the external control module controls room temperature by varying the flow of warm or cool air to the room. The terminal also compensates for changes in inlet duct pressure, holding the air flow constant unless signaled to change by the thermostat. In other words, the retrofit assembly is *pressure independent*. Note: Because of this compensating action, the damper may be seen closing when the thermostat is calling for air flow--or opening when the thermostat is satisfied--if it is necessary to counter a change in duct pressure.

Both the room thermostat and the air flow sensor send air pressure signals to the *TITUS*® pneumatic controller. The controller in turn controls the pneumatic damper actuator.

Receiving Inspection

After unpacking the terminal, check it for shipping damage. If any shipping damage is found, report it immediately to the delivering carrier.

Mounting the Assembly

The TITUS Model ECB fits the same space as the original mechanical constant volume regulators in a Buensod mechanically controlled unit. Simply remove the wing nuts from the supporting flange of the regulator and replace the regulator with the ECB using the original mounting bolts and wing nuts.

CONTROL BOX

ECT-3LS, ECT-3LD, ECT-4LD

Each of the ECT series control boxes contains the Titus II controller. Where required, other relays are used. The control box should be mounted so the Titus II controls are dials down. The controls are normally calibrated dials down so the dials are easily accessible through a ceiling opening. The control can be mounted at any convenient location within 50 feet from the ECT valves.

Control Connections

The pneumatic control connections in most installations are made as shown in the diagrams at the right. One Titus II pneumatic controller can control as many as 4 ECB's.

Although just one controller is shown in the diagram, any number of Titus II controllers can be connected in parallel to one room thermostat.

TYPICAL PIPING ECT-3LS

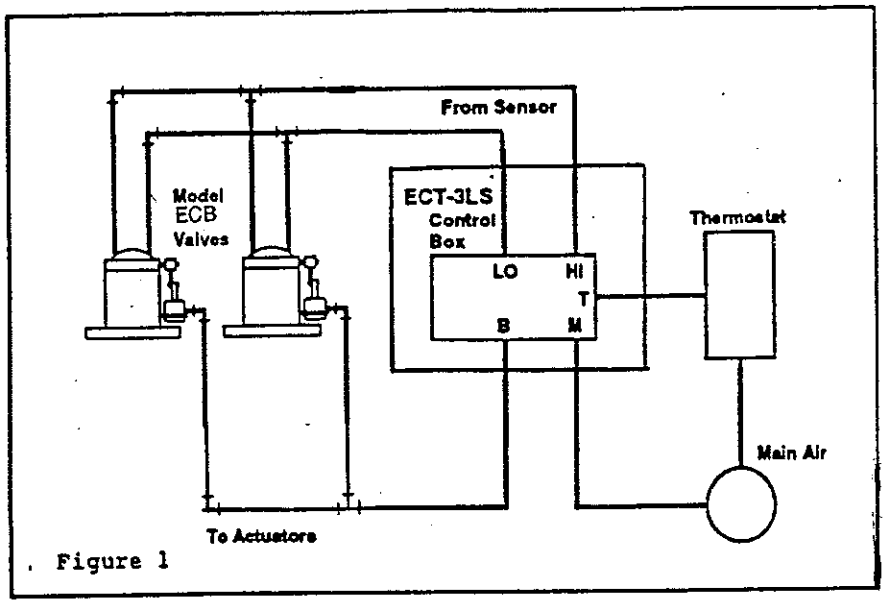


Figure 1

Control Air Consumption for the ECT-3LS Control Box is no more than 1.2 SCFH

TYPICAL PIPING ECT-3LD

The pneumatic control connections shown to the right show the ECB valves connected to a ECT-3LD control box. Both single duct and dual duct applications use the control box. The bias on the reversing relay is normally adjusted to match the start point of the water valve opening for single duct applications. The Titus II is normally adjusted to the P S I valves as shown in the control diagrams. For dual duct applications the reversing relay is normally adjusted to the dual duct mixing actuator start point pressure plus (the actuator throttling range) divided by 2.

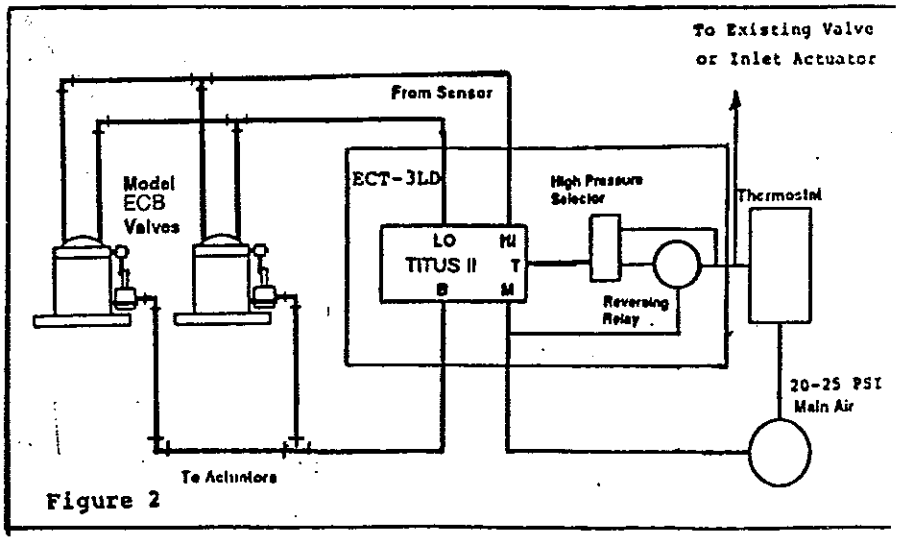


Figure 2

The Control Air Consumption for the ECT-3LD Control Box is no more than 1.7 SCFH.

TYPICAL PIPING ECT-4LD

The pneumatic control connections shown to the right show the ECB valves connected to a ECT-4LD control box. Typically only dual duct boxes uses this control box. The start point of the Titus II is normally set at 8 psi and the switch point of the snap acting diverting relay is also set at 8 psi. The diverting relay is set 8.0 psi in equals 8.0 psi out.

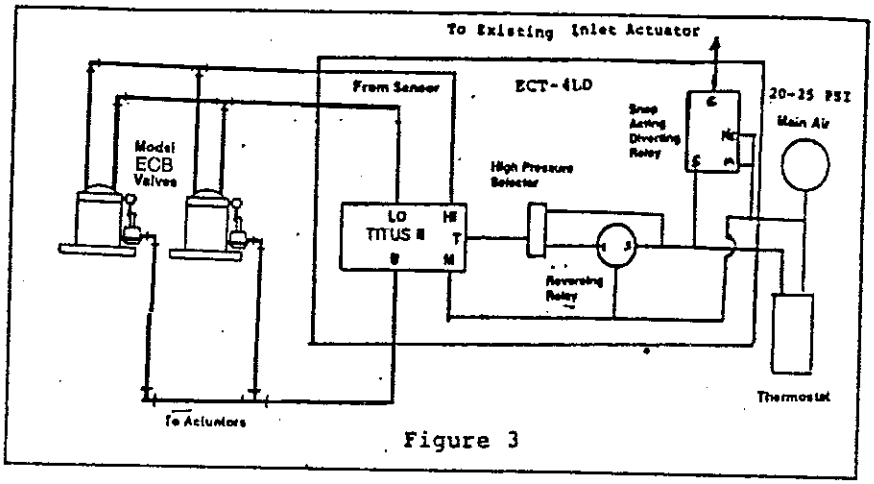


Figure 3

Model ECB • Retrofit Valve for Buensod Terminals

Selection Guide

The table at the right shows the number of original mechanical constant volume regulators in each Buensod terminal size. It also shows the corresponding sizes of TITUS ECB valves needed to replace these regulators.

Each cfm range is the total for the entire terminal. The ECB cfm range represents the typical limit settings for the reset span of the pressure independent controller.

The ECB retrofit valve can also be adjusted for a minimum cfm setting of zero (full shutoff) wth leakage less than 10 cfm at 3 inches pressure differential.

Before the retrofit valves and controls are ordered, we recommend spot checking the existing terminals to determine the condition of the inlet dampers and actuators. The interiors should also be checked for space limitations and mounting conflicts.

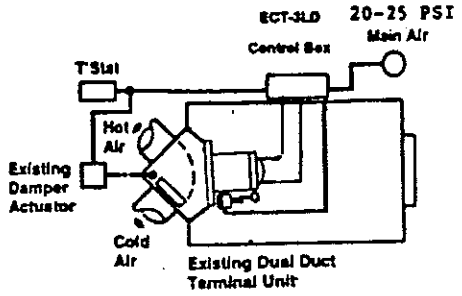
Buensod Terminals				Buensod Regulator Quantity and Size	TITUS ECB Quantity and Size	TITUS Retrofit CFM Range
Design	Single Duct	Single Duct with Reheat	Dual Duct			
14 and 16		4 HS (R)	4 H	1 - 2	1 - A	45 - 200
		5 HS (R)	5 H	1 - 4	1 - B	65 - 350
		6 HS (R)	6 H	1 - 4	1 - C	85 - 450
		7 HS (R)	7 H	1 - 6	1 - D	115 - 650
		8 HS (R)	8 H	1 - 10	1 - E	150 - 800
		9 HS (R)	9 H	1 - 10	1 - E	150 - 800
		10 HS (R)	10 H	1 - 12	1 - F	245 - 1350
14	2010 HLA			2 - 10	2 - E	300 - 1600
	2010 HLB			3 - 10	3 - E	450 - 2400
	2212 HL			4 - 10	4 - E	600 - 3200
16	1413 A	HLAS (R)	HLA	2 - 10	2 - E	300 - 1600
	1413 B	HLBS (R)	HLB	2 - 12	2 - F	500 - 2700
	1615 A	HLCS (R)	HLC	3 - 10	3 - E	450 - 2400
	1615 B	HLDS (R)	HLD	3 - 12	3 - F	750 - 4000

DUAL DUCT APPLICATIONS (continued)

Diagram C

The addition of a reversing relay and a high pressure selector allows pressure independent VAV control of heating, as well as cooling, in the dual duct unit.

In this example the reversing relay bias is set at 10.5 psi. The start point on the Titus II in the ECT-3LD control box is set for minimum cooling cfm at 13 psi thermostat output pressure. From 13 to 8 psi, the original dual duct unit damper modulates from 100% cooling to 100% heating, so that there is mixing at the minimum cfm. From 8 to 3 psi, the ECB valve modulates from minimum to maximum heating cfm.



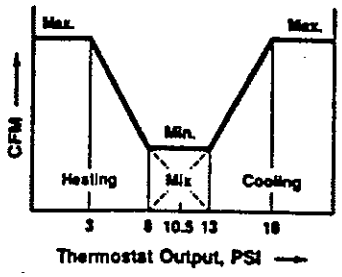
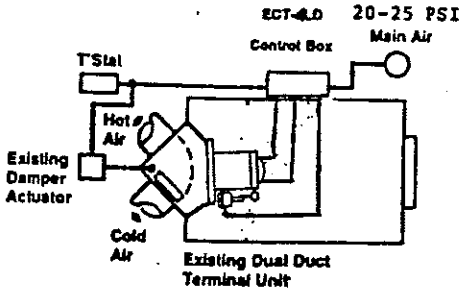
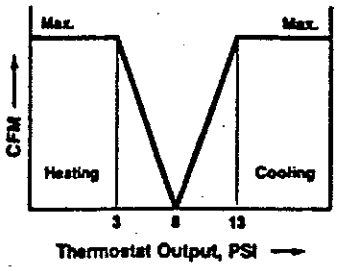


Diagram D

The physical hookup is the same as Diagram C except for the addition of a snap acting diverting relay with its own air supply.

Here both the reversing relay bias and the Titus II start point are set at 8 psi. The Titus II is also set for a minimum cfm of zero. The original dual duct inlet damper snaps from 100% cooling to 100% heating at 8 psi. Below 8 psi this damper remains in full heating position, while the ECB modulates from minimum to maximum heating cfm.

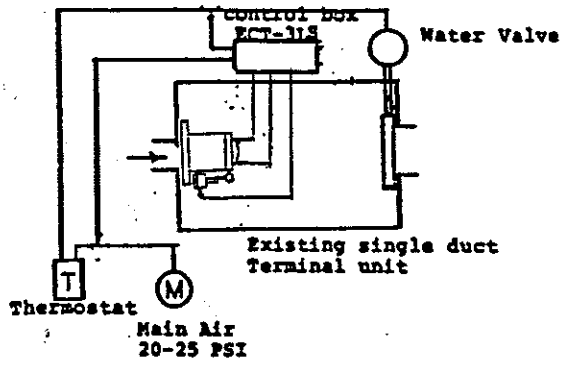


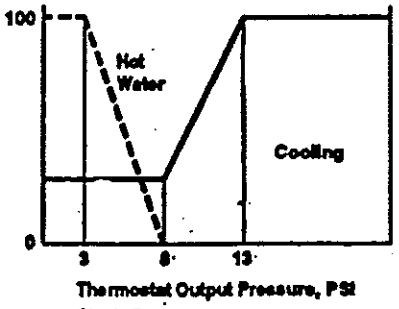


SINGLE DUCT APPLICATIONS

Diagram E

In Diagram E the original single duct terminal has been retrofitted to a single duct variable volume, pressure independent, reheat terminal unit. The application shown here is for a direct acting control sequence, but reverse acting is available. Standard VAV without reheat for all models without reheat coils would also be piped as shown.

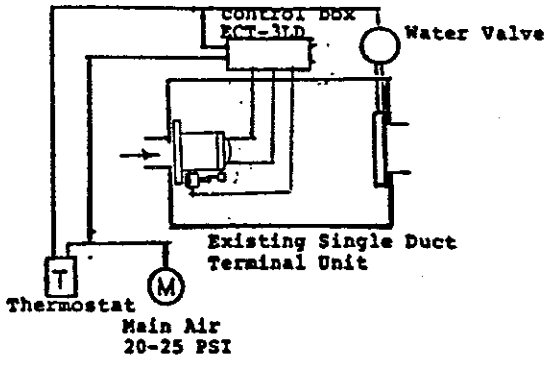


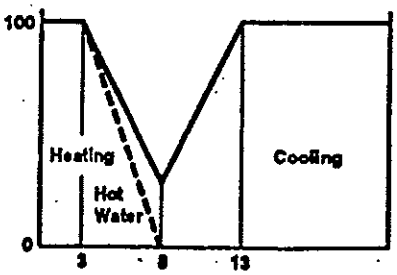


Single Duct with Reheat
Adding Control Package ECT-3LS

Diagram F

In Diagram F the original single duct terminal has been retrofitted to a single duct variable volume, pressure independent reheat terminal unit with a unique "Flip-Flop" control sequence which allows the air flow to return to its maximum volume when maximum heating is required. A direct acting sequence is shown.





Single Duct with Reheat
Adding Control Package ECT-3LD

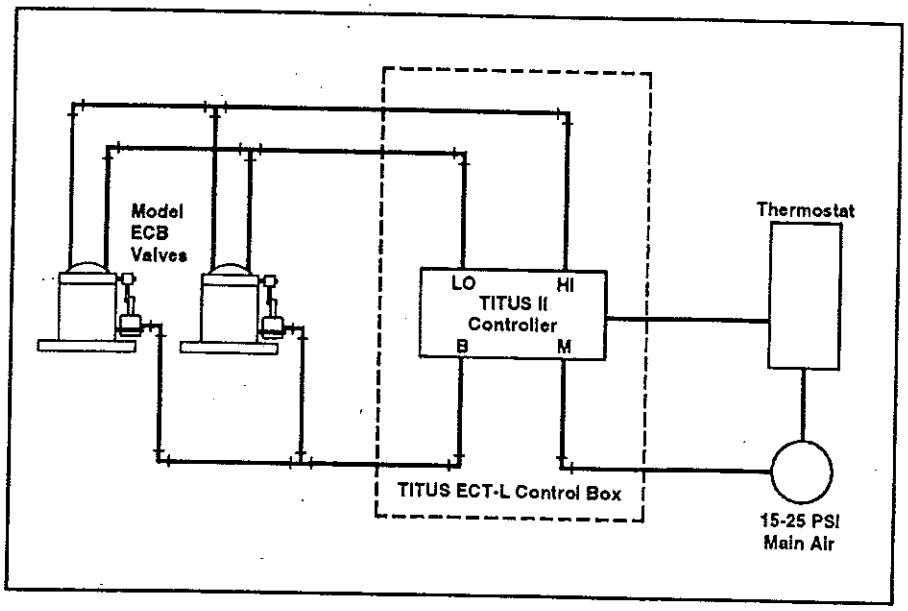
Typical Retrofit Applications

Control Connections

The pneumatic control connections in most installations are made as shown in the diagrams at the right. Since just one TITUS II pneumatic controller can control as many as four ECB's, one ECT-L control box can serve more than one retrofitted TITUS terminal.

Although just one controller is shown in the diagram, any number of TITUS II controllers can be connected in parallel to one room thermostat.

In addition to the components pictured in the diagram, a reversing relay and high pressure selector switch are used in some dual duct applications.

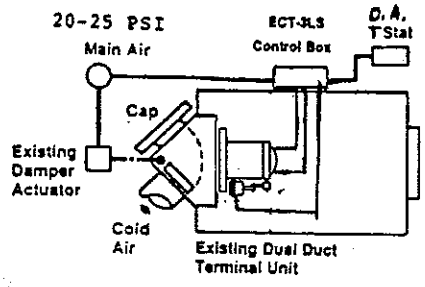


DUAL DUCT APPLICATIONS

DIAGRAM A

The original dual duct terminal unit has been converted to single duct, cooling only, to serve an interior zone.

Notice that the hot duct connection has been capped. The dual duct inlet damper is normally closed with respect to the cold air duct. Since the main control air feeds directly into the existing damper actuator, the damper goes full open when the main control air is turned on. The Titus ECB with the ECT-3LS then provides pressure independent VAV control.



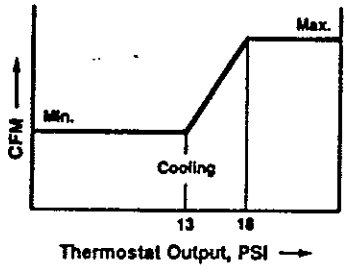
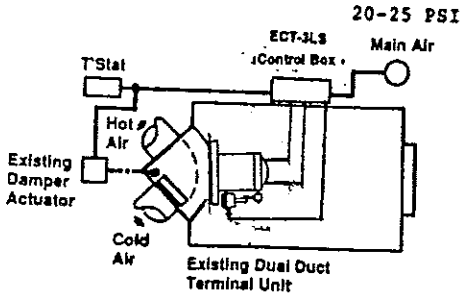
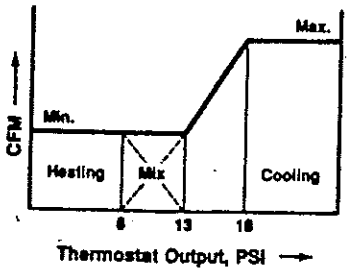


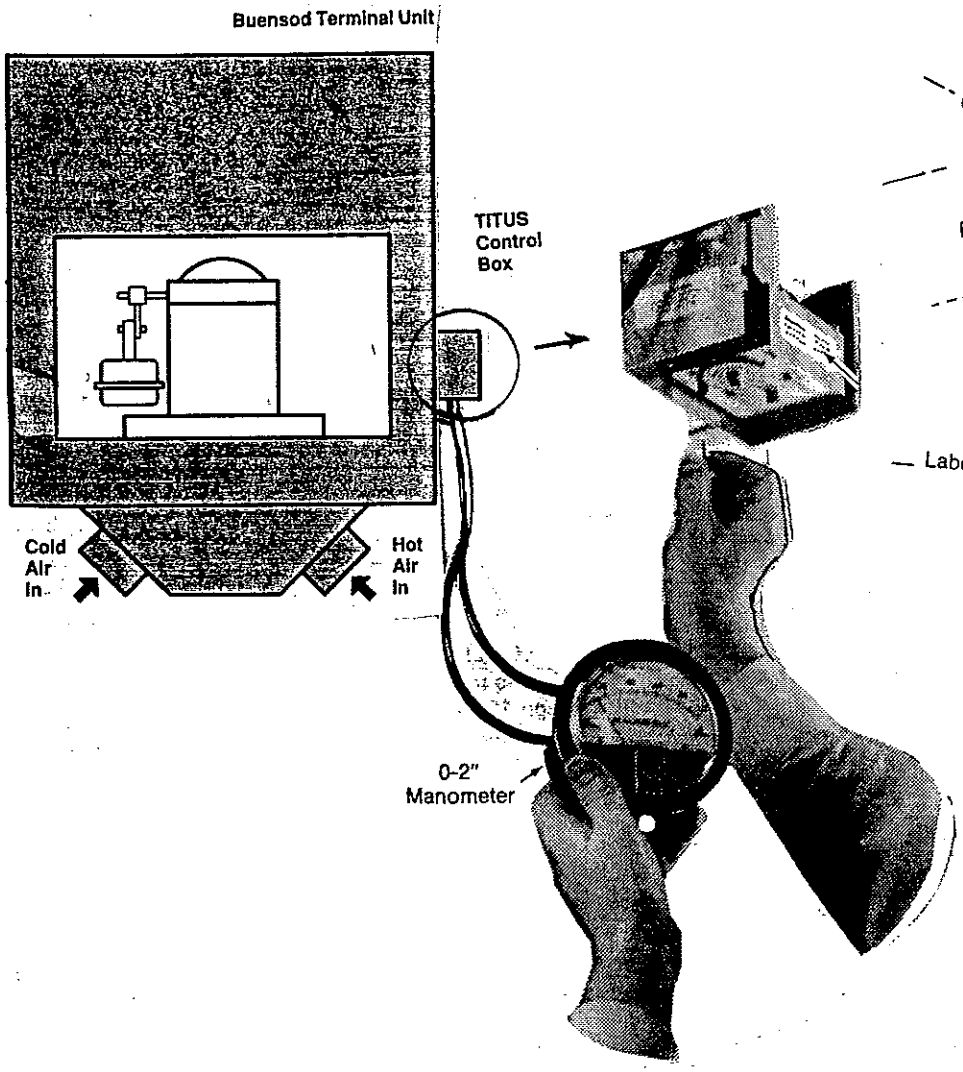
DIAGRAM B

The dual duct function is retained for use in an exterior zone. The Titus ECB provides pressure independent control for both cooling and heating. Cooling is variable air volume, while heating is constant air volume at the minimum cfm setting of the Titus II controller. The original inlet damper modulates from 100% cold to 100% hot as the thermostat calls for more heat, but the mixing occurs at the minimum air setting.





Adjusting Minimum and Maximum Air Flow



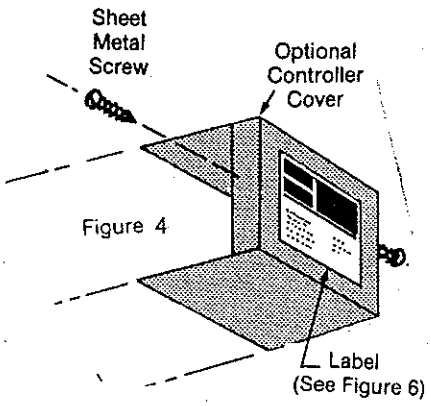


Figure 4

TITUS II CONTROLS

If field adjustment becon necessary, follow the proced outlined below.

Air Flow Adjusting Procedure

1. Remove the optional contro cover (figure 4).
2. The action of the controller m match the settings printed on the lab (figures 5 and 6).
   a. TITUS II - Check thermos and damper compatibi selectors, verify that settir are as marked on the label
3. Remove the caps from the tees the Hi and Lo tubes (red and gre stripe). Connect a manometer gauge both tees (gauge with 0 to 2 inch sc is recommended).
4. Refer to the calibration curve the size terminal being serviced, a the number of ECT valves. From t curve read the differential pressu across the sensors for the required flow.
5. After the flow rates are adjusted:
   a. Remove the gauge a replace the caps on the tee
   b. Replace the optio controller cover.

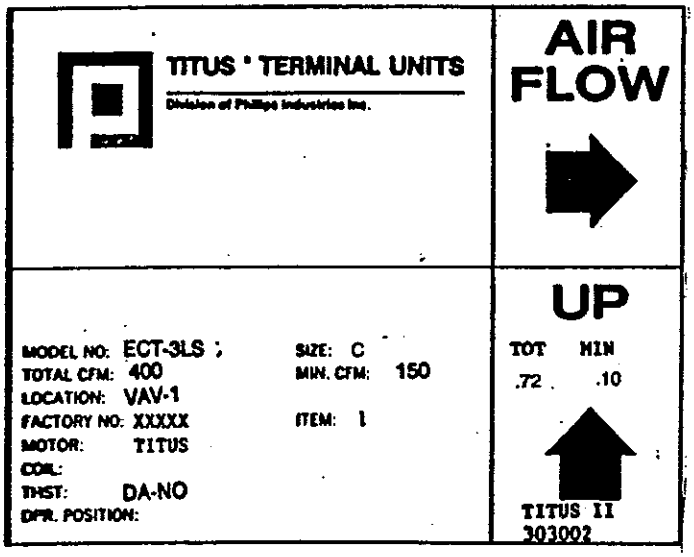


Figure 6

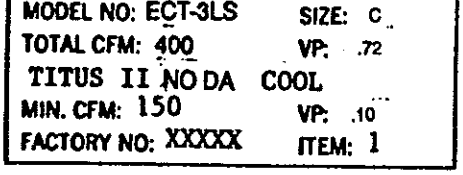


Figure 5 Controller Label

Calibration Procedure for TITUS II Controller

A. Direct Acting Cooling or Reverse Acting Heating.

1. Adjusting minimum air flow:
   a. Apply zero PSI signal to port T on the controller.
   b. If the minimum CFM equals zero, the damper should assume a closed position (observe the indicator on the end of the damper shaft). If not, adjust the LO knob on the controller until the damper is closed.
   c. If a non-zero minimum CFM is required, read the differential pressure for the desired CFM from the calibration curve corresponding to the number of ECT's in the terminal being calibrated (Figure 9). Adjust the LO knob until the desired differential pressure is read on the manometer gauge. Allow several seconds for the controls to react to the system pressure and stabilize.
2. Adjusting maximum air flow:
   a. Apply 15-25 PSI signal to port T on the controller.
   b. Refer again to the calibration curve (Figure 9). to determine the differential pressure necessary for the required CFM.
   c. Adjust the HI knob on the controller until the manometer gauge reads the required differential pressure from the curve.

NOTE: If actuator fails to respond, see Guide to Service Procedures Page.

B. Reverse Acting Cooling and Direct Acting Heating.

1. Adjusting minimum air flow:
   a. Apply 15-25 PSI signal to port T on the controller.
   b. If the minimum CFM equals zero, the damper should assume a closed position (observe the indicator on the end of the damper shaft). If not, adjust LO knob on the controller until the damper closes.
   c. If a non-zero minimum CFM is required, read the differential pressure for the desired CFM from the calibration curve corresponding to the number of ECT's in the terminal being calibrated (Figure 9). Adjust the LO knob until the desired differential pressure is read on the manometer gauge. Allow several seconds for the controls to react to the system and stabilize.
2. Adjusting maximum air flow:
   a. Apply zero signal to port T on the controller.
   b. Refer again to the calibration curve (Figure 9) to determine the differential pressure necessary for the required maximum CFM.
   c. Adjust the HI knob on the controller until the manometer gauge reads the required differential pressure from the curve.

NOTE: If actuator fails to respond, see Guide to Service Procedures Page.

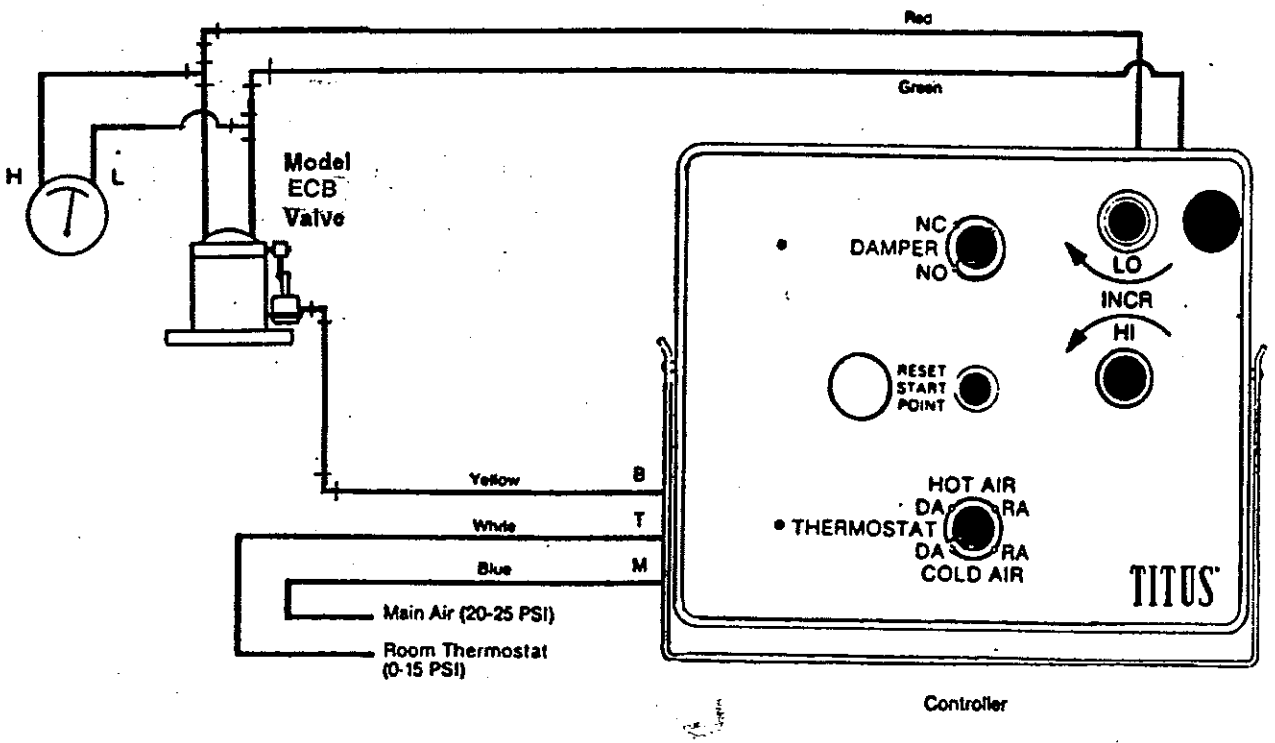


Figure 8

Guide To Service Procedures

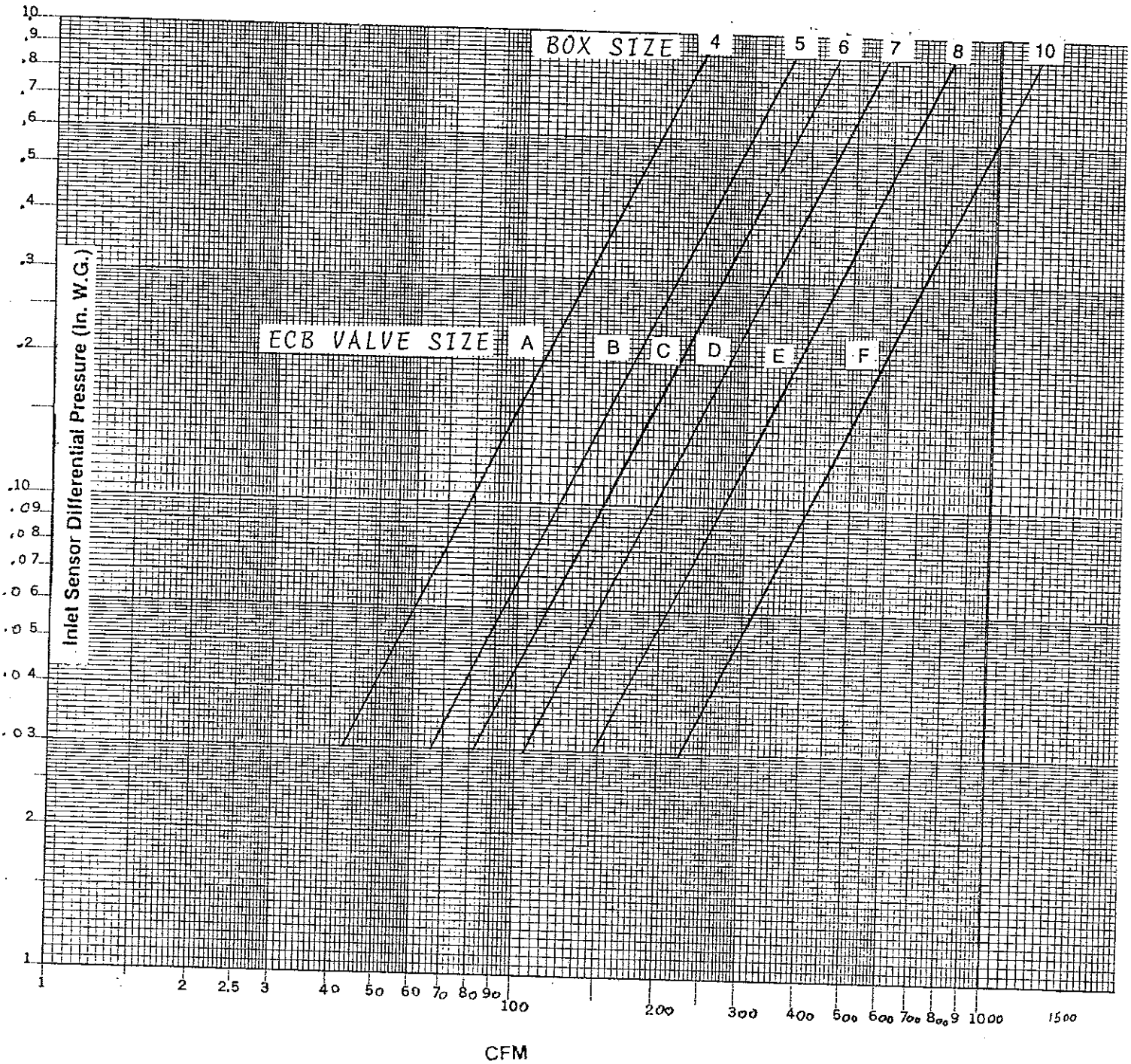
Symptom	Probable Cause	Correction
Actuator will not stroke. (General. Any setting of the damper compatibility selector on the face of the controller).	1. Leak in the control line between the controller and the actuator. 2. Leak in the actuator. 3. Insufficient main air supply pressure. 4. Faulty controller. 5. Pneumatic thermostat and main air line connections are reversed at the controller. 6. Control lines from the sensor to the controller are reversed.	1. Repair the leak. 2. Apply 20-25 psi air from the main a supply to the actuator. The actuator shou stroke. Pinch the air supply line. If th actuator retracts, it is leaking; contact yo *Titus*® distributor. 3. The controller must receive compresse air from the main supply at 20-25 psi. E sure all connections are as shown in Figu 10. 4. If the controller appears to be fault contact your *Titus*® distributor. 5. See Figure 1. The thermostat must b connected to Port T and the main air to Pc M. 6. See Figure 1. Make the connections a shown.
Actuator will not stroke. (Normally open setting of the damper compatibility selector on the face of the controller.)	1-6. As above. 7. Rubber caps on HI or both balancing tee are missing. 8. HI control line or the HI passage of the sensor is plugged. 9. Damper compatibility selector on the face of the controller is set wrong. 10. Low differential pressure at the sensor.	1-6. As above. 7. Replace the caps on the balancing tee 8. Clean out the passage or control line. 9. Set the damper compatibility selector match the action of the damper. 10. Increase the air flow rate to the termin inlet if necessary.
Actuator will not stroke. (Normally closed setting of the damper compatibility selector on the face of the controller.)	1-6. As above. 7. Rubber cap on the LO balancing tee is missing. 8. LO control line or the LO passage in the sensor is plugged.	1-6. As above. 7. Replace the cap. 8. Clean out the passage or control line.
Actuator remains fully stroked at all times. (Normally opened setting of the damper compatibility selector on the face of the controller.)	1. Faulty controller. 2. Rubber cap on the LO balancing tee is missing. 3. LO control line or the LO passage of the sensor is plugged.	1. If the controller appears to be fault contact your *Titus*® distributor. 2. Replace the cap. 3. Clean out the passage or control line.
Actuator remains fully stroked at all times. (Normally closed setting of the damper compatibility selector on the face of the controller.)	1. Faulty controller. 2. Control lines from the sensor to the controller are reversed. 3. Rubber caps on HI or both balancing tees are missing. 4. HI control line or the HI passage of the sensor is plugged. 5. Damper compatibility selector on the face of the controller is set wrong. 6. Low differential pressure at the sensor.	1. If the controller appears to be fault contact your *Titus*® distributor. 2. See Figure 10. Make the connectior as shown. 3. Replace the caps on the balancing tee 4. Clean out the passage or control line. 5. Set the damper compatibility selector match the action of the damper. 6. Increase the air flow rate to the termin inlet as necessary.
Inaccurate or erratic air flow control.	1. Leakage in the duct work. 2. Assembly mounted in a non-level position or upside down. 3. controller adjustment dials are not set correctly. 4. Low velocity pressure in the inlet duct. 5. Thermostat compatibility selector. on the face of the controller is set wrong. 6. Thermostat is out of calibration.	1. Repair the leakage. 2. See "Supporting the Assembly", page 3. See "Adjusting the Minimum ar Maximum Air Flow". 4. Increase the air flow rate to the termin inlet as necessary. 5. Set the thermostat compatibility select to match the action of the thermostat. 6. Turn the thermostat adjusting di through its full travel. The air pressu signal delivered by the thermostat to Port on the back of the controller must vary fro 0 to main air supply pressure (20-25 psi). this pressure range is not correc recalibrate the thermostat or consult yo *Titus*® distributor.

Calibration Curves

Model ECB • Retrofit Valve for Buensod Terminals

H - Series, Designs 14 and 16

MULTI-POINT SENSORS



Calibration Curves

Model ECB • Retrofit Valve for Buensod Terminals

MULTI-POINT SENSORS

H - Series, Designs 14 and 16