LENNOX Industries Inc.
Corp. 9423-L9
Replaces Corp. 9004-L1
Litho U.S.A.

# SOLID STATE ECONOMIZER CHECKOUT PROCEDURE AND TROUBLESHOOTING GUIDE

An economizer is an automatic outdoor air damper assembly installed in a commercial rooftop air conditioner or heat pump. Controls in the economizer monitor outdoor air conditions continually. The controls open the economizer dampers to allow 0 to 100 percent outdoor air to be used for cooling when outdoor humidity and temperature are acceptable. Damper position continually adjusts to outdoor air conditions. Additional cooling demand (2nd stage) is directed to the 1st stage compressor while the dampers remain open.

If outdoor air becomes unacceptable for cooling (as monitored by controls in the economizer), the outdoor air dampers close to a predetermined minimum position while the compressor cooling circuits cycle as needed.

Lennox model number designations are REMD16 or REMD11 (downflow economizer) and EMDH16 or EMDH11 (horizontal discharge economizer). Two through five ton economizers may be either modulating (dampers continually adjust to changing conditions) or three position (closed, minimum and full open). All other size economizers are modulating type.

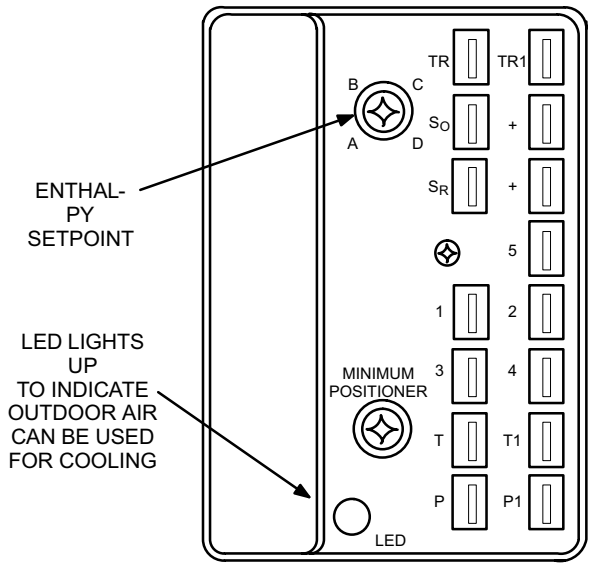
All specifications in this manual are subject to change.

## I-OPERATION (COMPONENTS)

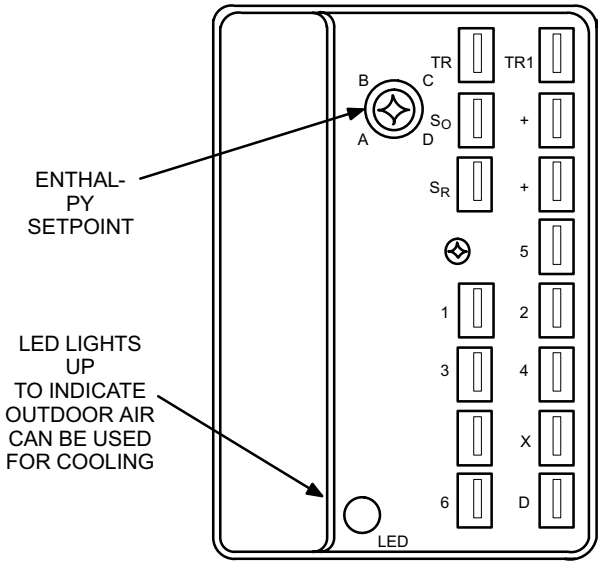
### A-Enthalpy Control

The key to economizer operation is the enthalpy control (figure 1.) The enthalpy control senses the total heat content of the outside air (temperature plus humidity) and uses that information to control the amount of outside air brought into the system. When the enthalpy of the outside air drops below the control setpoint and a cooling demand is present, the control actuates a motor which in turn adjusts the outdoor dampers to meet the cooling demands of the building. With the outdoor air dampers open, the indoor blower draws in outdoor air for cooling and the first stage compressors are disabled. When the heat content rises above the control setpoint, the control de-activates and the dampers close to the preset minimum (not closed) position. The first stage compressors are switched to handle all first stage cooling.

**SOLID STATE ENTHALPY CONTROLS**




**MODULATING ENTHALPY CONTROL**
**HONEYWELL W7459A**




**THREE-POSITION ENTHALPY CONTROL**
**HONEYWELL W7459C**

**FIGURE 1**

Two types of adjustment may be made at the control. The first is the control setpoint. The setpoint determines the temperature and humidity conditions at which the outdoor air dampers will open and close. The recommended setpoint is "A." If the economizer is allowing air which is too warm or too humid into the system, the control may be changed to a lower setpoint (B,C or D).

## B-Minimum Positioner (Potentiometer)

Each economizer has a minimum positioner switch (potentiometer) which allows the outdoor dampers to be adjusted to a preset minimum position. This allows a preset amount of air exchange at all times during unit operation. When unit operation stops, the dampers drive fully closed. The potentiometer is located on the enthalpy control face (modulating economizer - figure 1, top) or on the damper motor (three-position economizer - figure 2.)

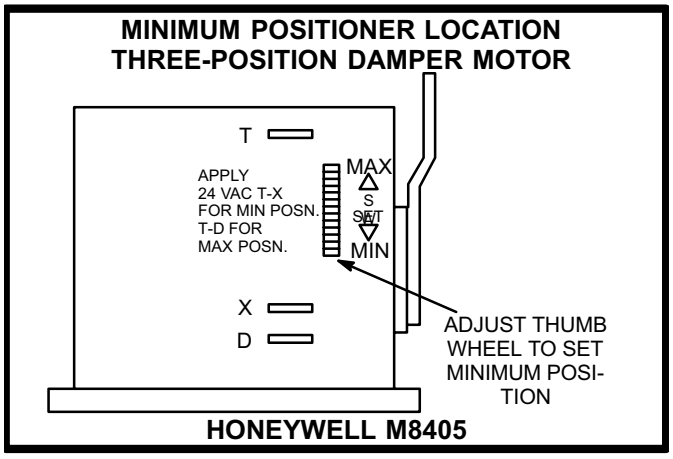



**FIGURE 2**

## C-Enthalpy Sensor

The enthalpy sensor is located on the outside portion of the outdoor damper blades (as shown in figure 3.) The sensor monitors the total heat of the outdoor air (temperature plus humidity) and sends the information to the enthalpy control. The enthalpy control uses the information to determine if outdoor air can be used for cooling.

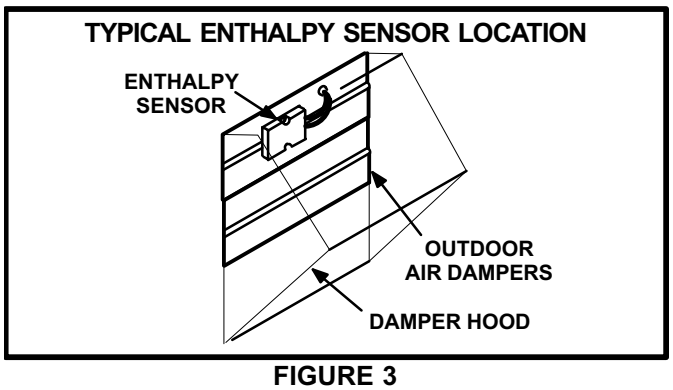



**FIGURE 3**

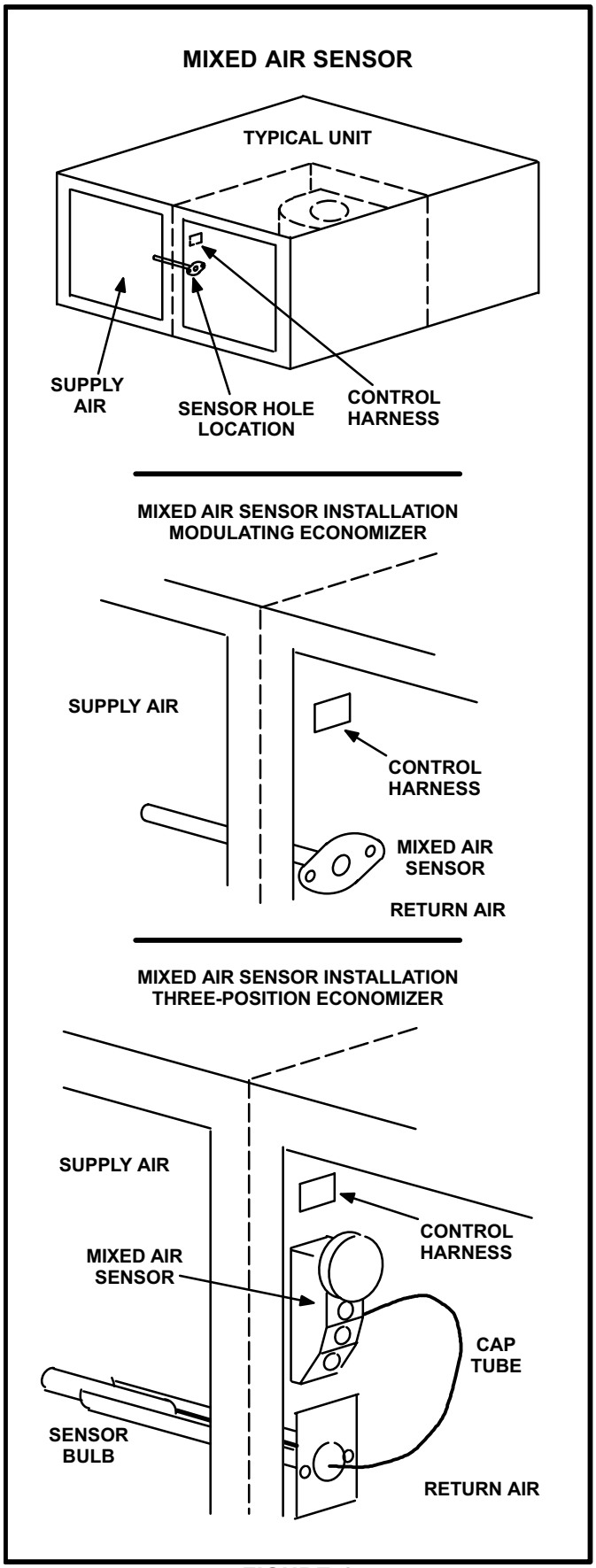



**FIGURE 4**

## D-Mixed Air Sensor

The mixed air sensor measures the resultant temperature of the mixed air downstream of the indoor coil. The mixed air temperature is used by the enthalpy control when outdoor air dampers are open to help determine whether outdoor dampers should close. Modulating economizers are equipped with a single mixed air sensor. Three position economizers are equipped with a separate sensor (switch) and sensing bulb which are connected by a cap tube.

The mixed air sensor (or sensing bulb) is located in the supply air downstream of the evaporator coil. The sensor (modulating economizer) or sensing bulb (three-position economizer) fits through a factory supplied hole in the panel dividing the return and supply air (see figure 4.) The three-position economizer sensor (switch) mounts to pre-drilled holes in the return air compartment.

## E-Relay K11

Relay K11 is a N.C. relay which is used to drive the outdoor dampers closed during night setback and morning warm-up functions When energized, relay terminals 3-9 open to interrupt the minimum positioner circuit and drive the dampers closed. Simultaneously, terminals 1-7 open (used in electro-mechanical thermostat systems only) to interrupt power to thermostat S1 during night setback.

## II-ADJUSTMENTS

Two types of adjustment may be made to the economizer. The first is the control setpoint. The setpoint determines the temperature and humidity conditions at which the outdoor air dampers will open and close. A switch is provided on the face of the enthalpy control (figure 1) for adjusting the setpoint. The recommended setpoint is "A". If the economizer is allowing air which is too warm or too humid into the system, the control may be changed to a lower setpoint (B,C or D.) Refer to enthalpy chart figure 5.

### Example:

*If the enthalpy control is set at setpoint "A" as shown in figure 5, the following situation could occur. A cooling demand when the outside air is at 75° and 20 percent humidity would drive the economizer outdoor air dampers open to utilize outdoor air for cooling. The compressor cooling circuit would be disabled. However, if the outdoor air should change to 70° F (a drop in temperature) and 70 percent humidity (a dramatic rise in humidity), the "total heat content" of the outdoor air would rise above the enthalpy control setpoint and de-activate the damper motor to the preset minimum position. If cooling demand is still present when the total heat of the outside air rises above the control setpoint, cooling demand is routed from the economizer to the compressor cooling circuit.*

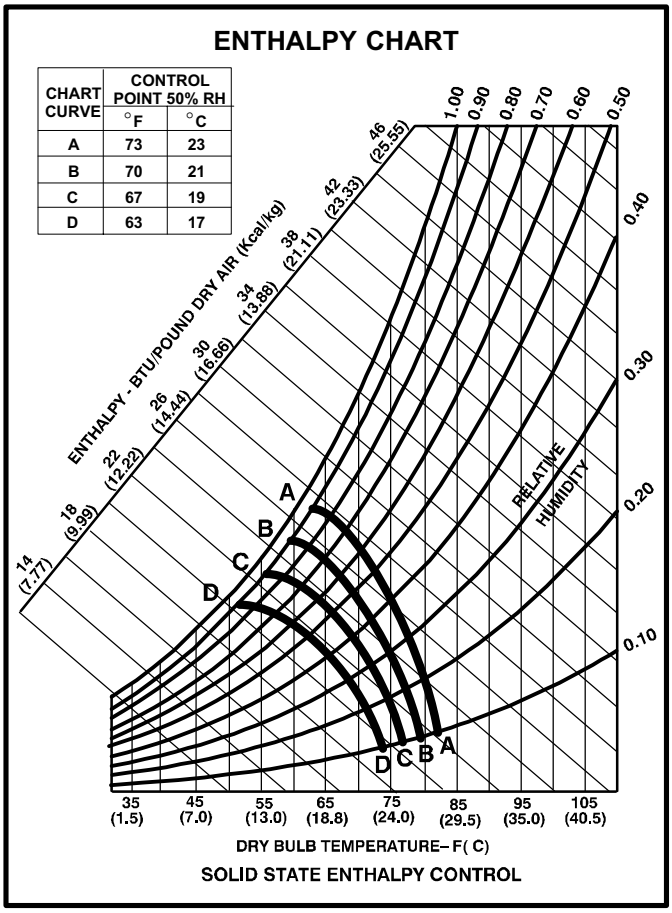
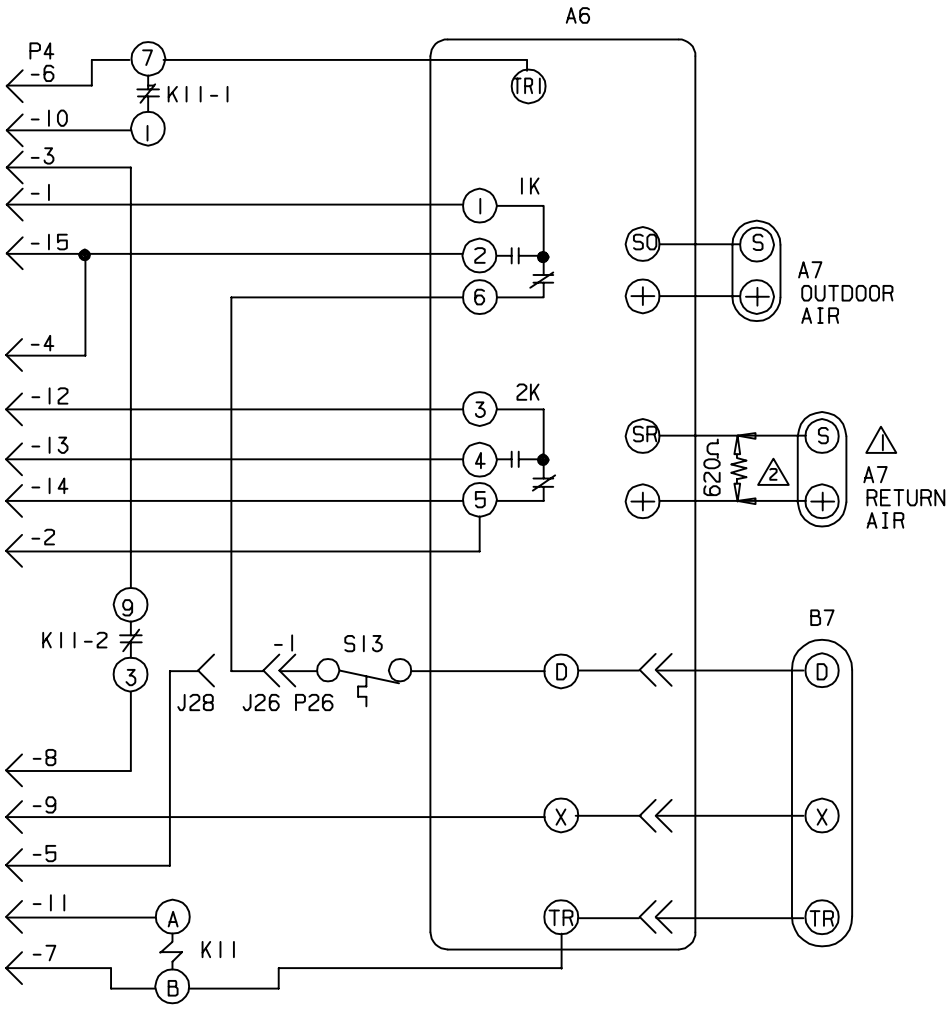



**FIGURE 5**

The second type of adjustment which may be made is the minimum position of the outdoor damper blades (refer to section B-Minimum Positioner.) If the economizer is installed, minimum position must be adjusted while unit blower is operating without a cooling demand.

## III-WIRING DIAGRAMS

The following two pages show the factory wiring diagrams used with Lennox solid state economizers. Figure 6 shows three-position economizers and figure 7 shows modulating economizers.




⚠1 OPTIONAL-SECOND A7 INSTALLED IN RETURN AIR PROVIDES DIFFERENTIAL ENTHALPY CONTROL

⚠2 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR. REMOVE WHEN SECOND A7 SENSOR IS INSTALLED TO PROVIDE DIFFERENTIAL ENTHALPY CONTROL

| LENNOX® Industries Inc. | WIRING DIAGRAM | 10/89 |
|---|---|---|
| ACCESS-COMBINATION UNITS-ROOFTOP | | |
| REMD16 SERIES<br>EMDH16 SERIES<br>(3 POSITION) | | |
| ECONOMIZER-SECTION D8 | | |
| Supersedes Form No. | New Form No. | |

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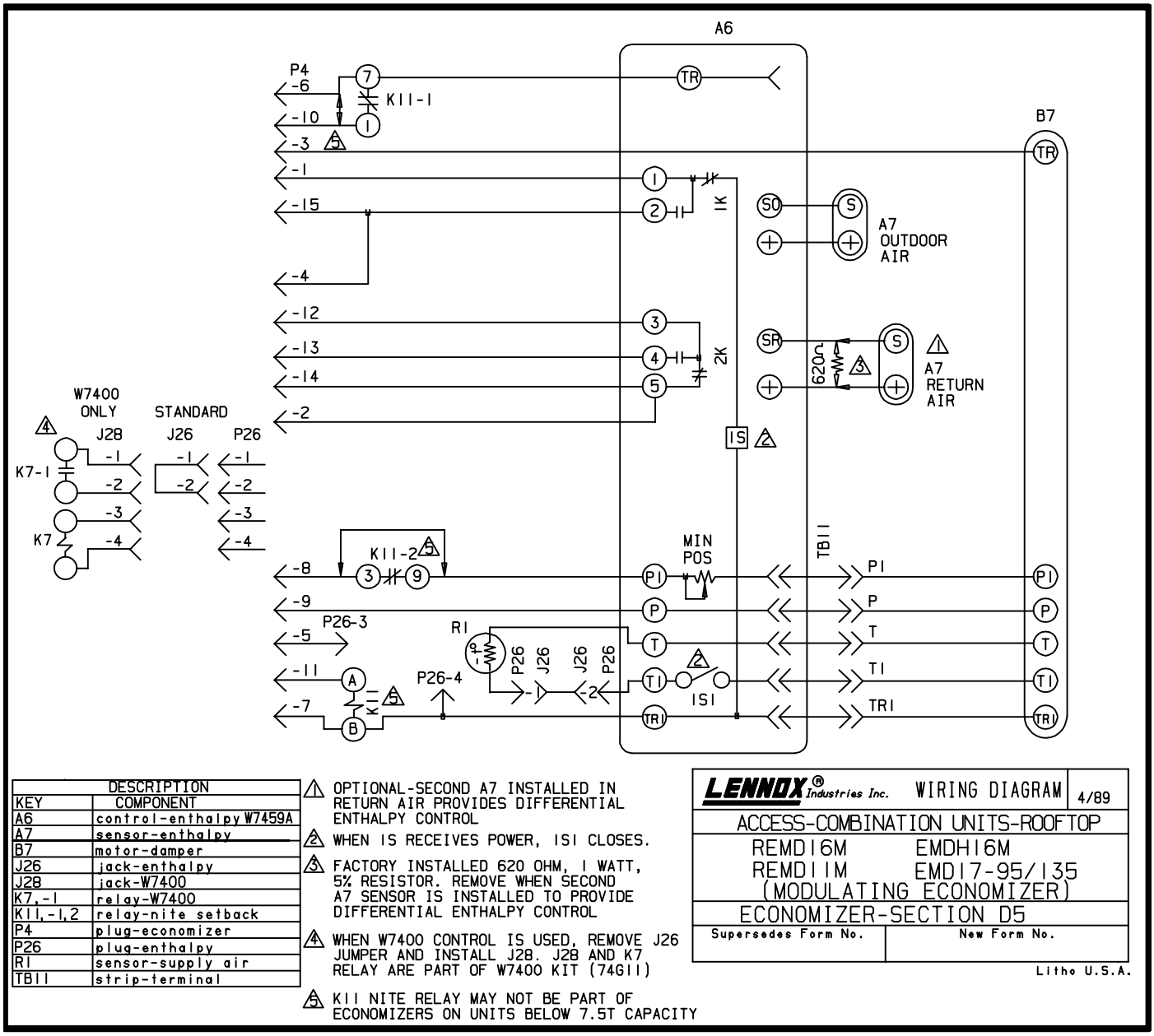
| DESCRIPTION | |
|---|---|
| KEY | COMPONENT |
| A6 | control-enthalpy (W7459C) |
| A7 | sensor-enthalpy |
| B7 | motor-damper |
| J26 | jack-enthalpy |
| J28 | jack-W7400 |
| K11,-1,2 | relay-nite setback |
| P4 | plug-economizer |
| P26 | plug-enthalpy |
| S13 | thermostat-discharge air |

**FIGURE 6**




| DESCRIPTION | |
|---|---|
| KEY | COMPONENT |
| A6 | control-enthalpy W7459A |
| A7 | sensor-enthalpy |
| B7 | motor-damper |
| J26 | jack-enthalpy |
| J28 | jack-W7400 |
| K7,-1 | relay-W7400 |
| K11,-1,2 | relay-nite setback |
| P4 | plug-economizer |
| P26 | plug-enthalpy |
| R1 | sensor-supply air |
| TBII | strip-terminal |

1. OPTIONAL-SECOND A7 INSTALLED IN RETURN AIR PROVIDES DIFFERENTIAL ENTHALPY CONTROL
2. WHEN IS RECEIVES POWER, ISI CLOSES.
3. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR. REMOVE WHEN SECOND A7 SENSOR IS INSTALLED TO PROVIDE DIFFERENTIAL ENTHALPY CONTROL
4. WHEN W7400 CONTROL IS USED, REMOVE J26 JUMPER AND INSTALL J28. J28 AND K7 RELAY ARE PART OF W7400 KIT (74G11)
5. K11 NITE RELAY MAY NOT BE PART OF ECONOMIZERS ON UNITS BELOW 7.5T CAPACITY

LENNOX® Industries Inc. WIRING DIAGRAM 4/89

ACCESS-COMBINATION UNITS-ROOFTOP

REMDI6M EMDHI6M
REMDIIM EMDI7-95/135
(MODULATING ECONOMIZER)

ECONOMIZER-SECTION D5

Supersedes Form No. | New Form No.

Litho U.S.A.

**FIGURE 7**

## IV-CHECKOUT AND TROUBLESHOOTING

### A-Modulating Economizer (Figure 7)

The economizer must be prepared for checkout. You will need the following tools: wire jumpers, 620 ohm resistor, 1.2K ohm resistor and a DC milliammeter.

Checkout should be performed with economizer installed.

1- Turn off power to unit.

2- Locate enthalpy control A6 (see figure 1).

3- Carefully mark and disconnect wires from terminals P and P1.

*NOTE—Wires from terminals P and P1 must be re-connected before minimum position can be tested.*

4- Install jumper across terminals TR and 1. Install jumper across terminals T1 and T.

5- Carefully mark and disconnect wires from terminals $S_O$ and +.

6- Factory installed 620 ohm resistor should be connected to terminals $S_R$ and +. If optional differential enthalpy sensor is connected to these terminals, disconnect it and install a 620 ohm resistor in its place. See figure 8.

7- Turn on power to unit.

LED on enthalpy control should remain off and damper motor should remain in closed position.

8- Disconnect factory installed 620 ohm resistor from terminals $S_R$ and +.

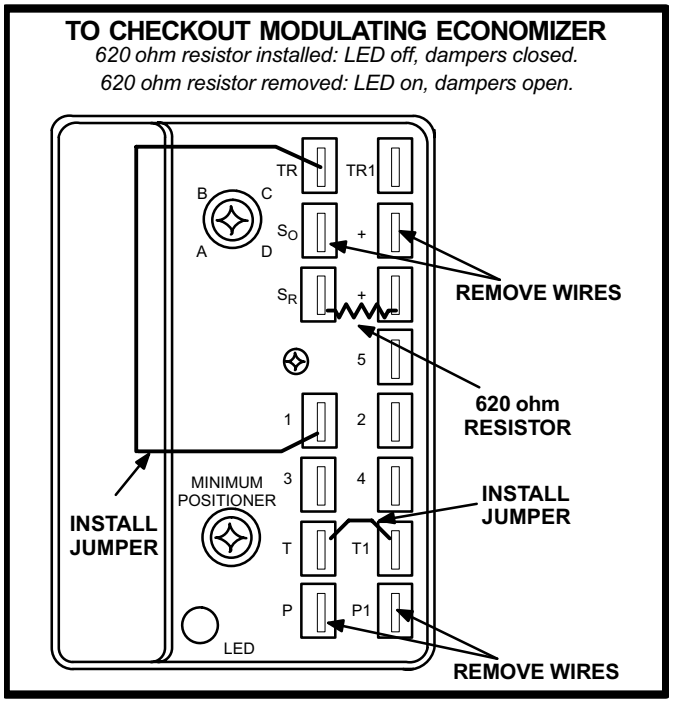



**FIGURE 8**

LED on enthalpy control should turn on and damper motor should drive toward open position.

9- Turn off power to unit.

10- To simulate high and low enthalpy, re-connect factory installed resistor across terminals $S_R$ and +. Connect 1.2K ohm resistor across terminals $S_O$ and +.

Turn enthalpy setpoint to A.

11- Turn on power to unit. (See figure 9).

LED on enthalpy control should turn on (indicating low enthalpy) and damper motor should drive toward open position.

12- Turn enthalpy setpoint to D.

LED on enthalpy control should turn off (indicating high enthalpy) and damper motor should drive toward minimum position.

13- Turn off power to unit. Disconnect 1.2K ohm resistor.

14- To verify sensor operation, re-connect the + lead of outdoor air enthalpy sensor A7 to the + terminal (adjacent to terminal $S_O$).

15- Connect a DC milliammeter between terminal $S_O$ on the enthalpy control and terminal S on the enthalpy sensor (positive meter lead to terminal S of enthalpy sensor.)

16- Turn on power to unit. (See figure 10).

Milliammeter should indicate between 3 and 25 mA if sensor is operating properly (if milliammeter reads 0, the sensor may be wired backwards).

17- Turn off power to unit.

18- If using differential enthalpy, the return air enthalpy sensor can be checked by connecting the DC milliammeter between terminal $S_R$ of the control and terminal S of the return air enthalpy sensor (positive meter lead toward terminal S of enthalpy sensor).

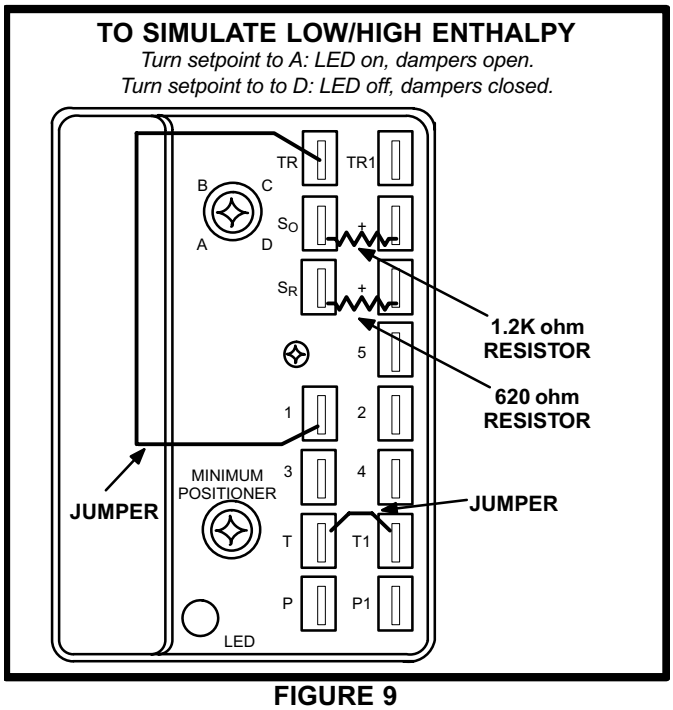



**FIGURE 9**

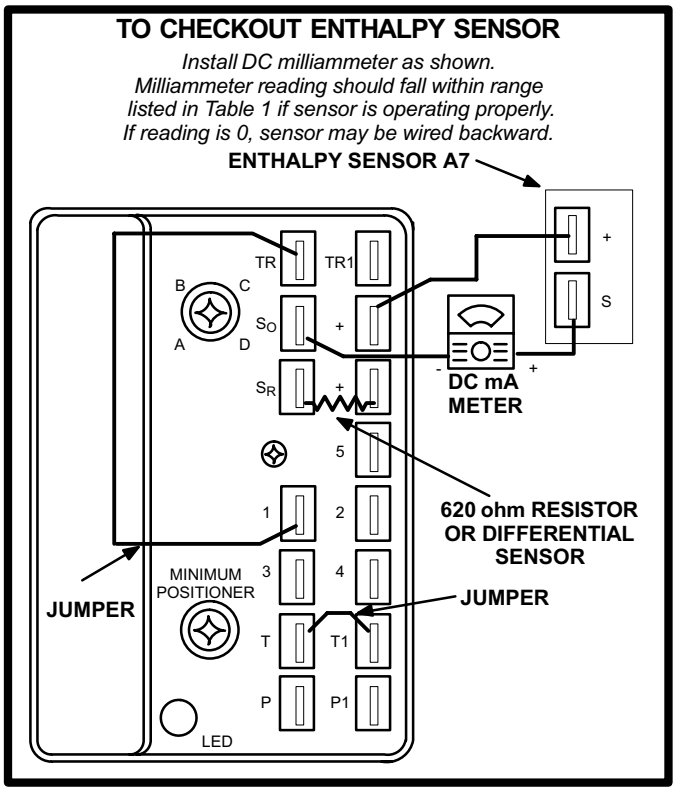
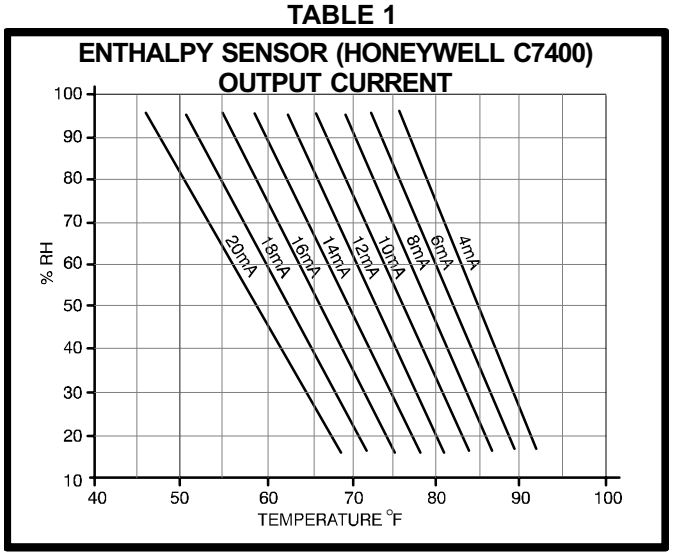



**FIGURE 10**

**TABLE 1**




19- Turn on power to unit.

Milliammeter reading should fall within range listed in Table 1 if sensor is operating properly (if milliammeter reads 0, the sensor may be wired backwards).

20- To test mixed air sensor, measure resistance (ohms) through the sensor. Resistance should match values in figure 11.

21- When tests are complete, turn off power to unit, remove all jumpers, re-connect all wires securely and replace all panels. Turn on power to unit.

## B-Three-Position Economizer (Figure 6)

The economizer must be prepared for checkout. You will need the following tools: wire jumpers, 620 ohm resistor, 1.2K ohm resistor and a DC milliammeter.

Checkout should be performed with economizer installed.

1- Turn off power to unit.

2- Locate enthalpy control A6 (see figure 1).

3- Carefully mark and disconnect wires from terminals 6, X and D.

4- Install jumper across terminals TR1 and 1. Install jumper across terminals 6 and D.

5- Carefully mark and disconnect wires from terminals $S_O$ and +.

6- Factory installed 620 ohm resistor should be connected to terminals $S_R$ and +. If differential enthalpy sensor is connected to these terminals, disconnect it and install 620 ohm resistor in its place. See figure 12.

7- Turn on power to unit.

LED on enthalpy control should remain off and damper motor should remain in closed position.

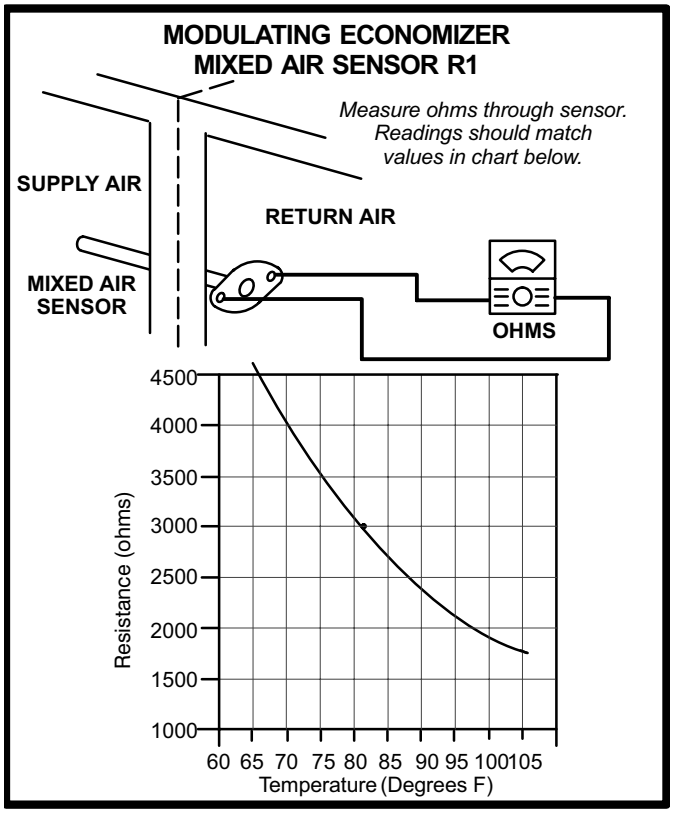



**FIGURE 11**

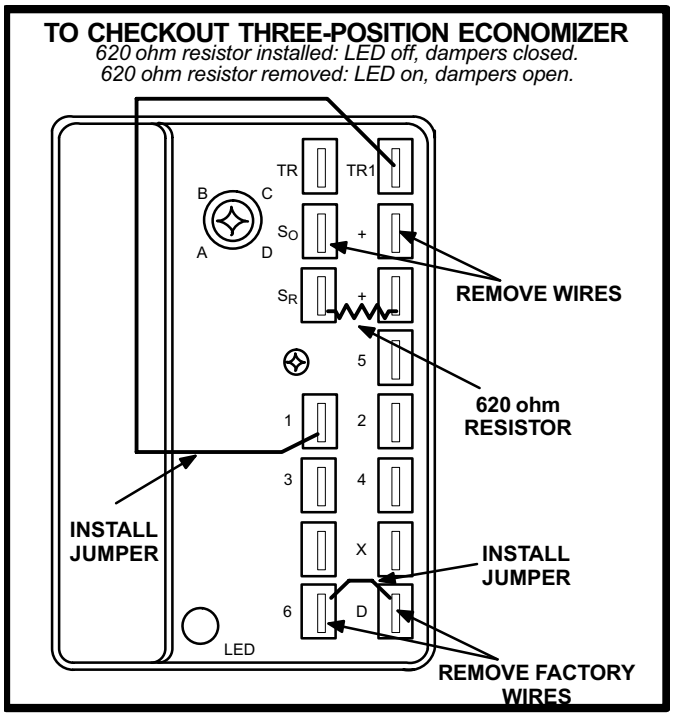



**FIGURE 12**

8- Disconnect factory installed 620 ohm resistor from terminals $S_R$ and +.

LED on enthalpy control should turn on and damper motor should drive toward open position.

9- Turn off power to unit.

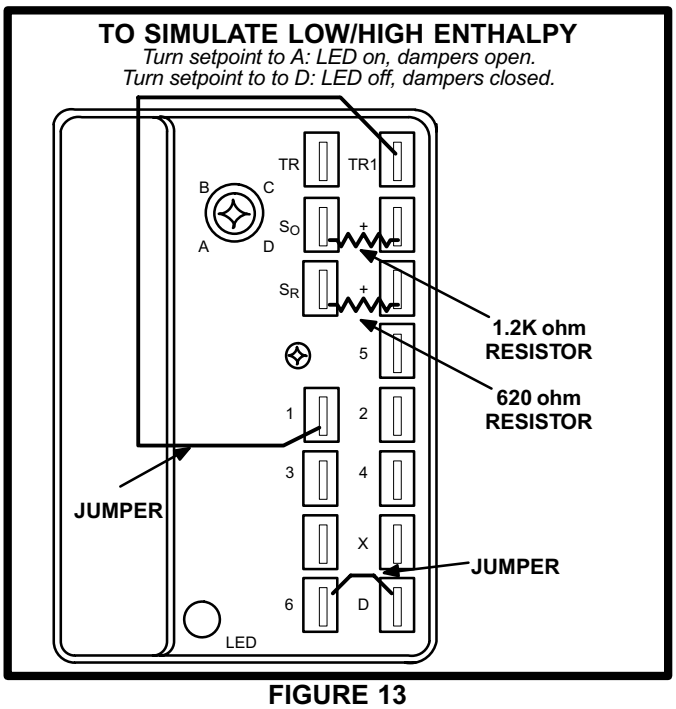



**FIGURE 13**

10- To simulate high and low enthalpy, re-connect factory installed resistor across terminals $S_R$ and +. Connect 1.2K ohm resistor across terminals $S_O$ and +.

Turn enthalpy setpoint to A.

11- Turn on power to unit. (See figure 13).

LED on enthalpy control should turn on (indicating low enthalpy). Damper should drive to open position.

12- Turn enthalpy setpoint to D.

LED on enthalpy control should turn off (indicating high enthalpy). Damper should drive to minimum position.

13- Turn off power to unit. Disconnect 1.2K ohm resistor.

14- To verify sensor operation, re-connect the + lead of outdoor air enthalpy sensor A7 to the + terminal (adjacent to terminal $S_O$).

15- Connect a DC milliammeter between terminal $S_O$ on the enthalpy control and terminal S on the enthalpy sensor (positive meter lead to terminal S.)

16- Turn on power to unit. (See figure 14).

Milliammeter should indicate between 3 and 25 mA if sensor is operating properly (if milliammeter reads 0, the sensor may be wired backwards).

17- Turn off power to unit.

18- If using differential enthalpy, the return air enthalpy sensor can be checked by connecting the DC milliammeter between terminal $S_R$ of the control and terminal S of the return air enthalpy sensor (positive meter lead toward terminal S of enthalpy sensor).

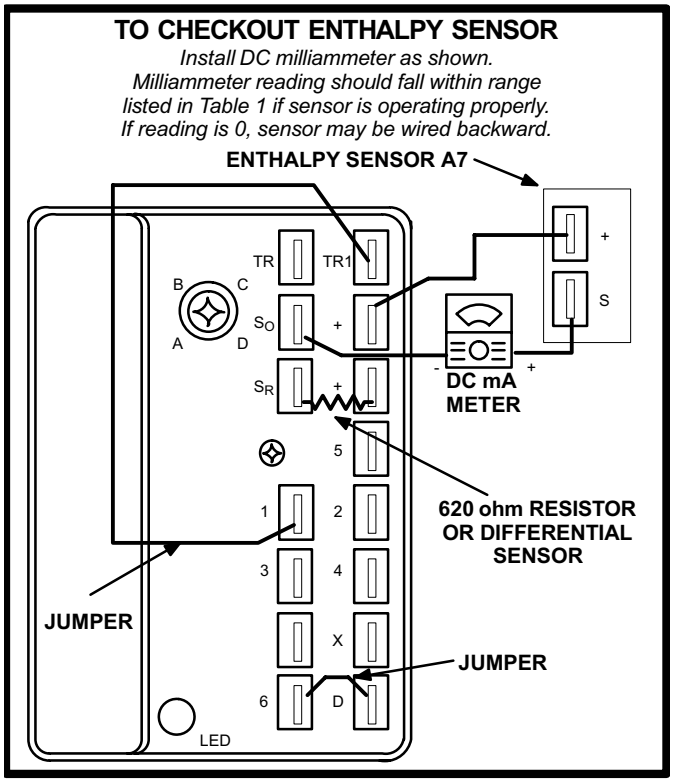



**FIGURE 14**

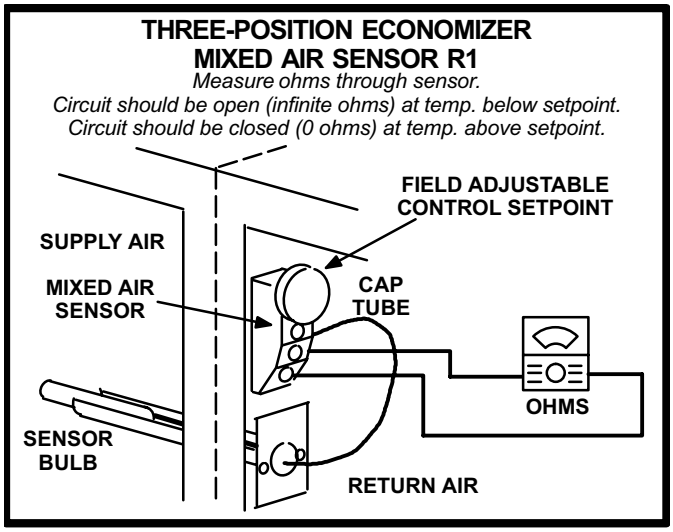



**FIGURE 15**

19-Turn on power to unit.

Meter reading falls within range listed in Table 1 if operating properly (if meter reads 0, sensor may be wired backward).

20-To test mixed air sensor, measure resistance (ohms) through the sensor. See figure 15.

21- When tests are complete, turn off power to unit, remove all jumpers, re-connect all wires securely and replace all panels. Turn on power to unit.