

Installation Instructions

DNECOMZR052A00 and DNECOMZR053A00 Vertical and Horizontal Economizer IV Accessory Medium Rooftop Units – 15 to 25 Tons

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IMPORTANT: Read these instructions completely before attempting to install the accessory Economizer IV.

PACKAGE USAGE

UNIT SIZE	PART NUMBER
15, 17.5, 20 Ton	DNECOMZR052A00
25 Ton	DNECOMZR053A00

SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Have a fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes, the current editions of the National Fuel Gas Code (NFGC) NFPA 54/ANSI Z223.1, and the National Electrical Code (NEC) NFPA 70.

In Canada refer to the current editions of the National Standards of Canada CAN/CSA-B149.1 and .2 Natural Gas and Propane Installation Codes, and Canadian Electrical Code CSA C22.1.

Recognize safety information. This is the safety-alert symbol . When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand the signal words DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which will result in severe personal injury or death. WARNING signifies hazards which could result in personal injury or death. CAUTION is used to identify unsafe practices which may result in minor personal injury or product and property damage. NOTE is used

to highlight suggestions which will result in enhanced installation, reliability, or operation.

 **WARNING**

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Before performing service and maintenance operations on unit, turn off main power switch to unit. If gas unit, shut off gas supply before shutting off main power.

TAG DISCONNECT SWITCH WITH A SUITABLE LOCK AND WARNING LABEL.

UNIT	QTY	CONTENTS
DNECOMZR052A00	1	Damper Assembly
	1	Upper End Economizer Panel
	1	Bottom Panel w/Relief Damper (for vertical only)
	1	Bottom Panel #2 (for horizontal only)
	1	Side Replacement Panel (for horizontal only)
	4	Hood Angles
	2	Hood Side Plates
	1	Hood Top
	2	Side Filter Supports
	2	Side Drip Angles
	2	Top Hood Diverter
	1	Supply Air Temperature Sensor (SAT)
	60	Screws
	1	Seal Strip
DNECOMZR053A00	1	Damper Assembly
	1	Upper End Economizer Panel
	1	Bottom Panel w/Relief Damper (for vertical only)
	1	Bottom Panel #2 (for horizontal only)
	1	Hood Angles
	4	Hood Side Panels
	2	Hood Top
	1	Outdoor Air Screens
	4	Side Filter Supports
	2	Side Drip Angles
	2	Top Hood Diverter
	1	Supply Air Temperature Sensor (SAT)
	60	Screws
	1	Seal Strip

Table 1	Economizer IV Sensor Usage	
APPLICATION	Economizer IV WITH OUTDOOR AIR DRY BULB SENSOR	
	Accessories Required	
Outdoor Air Dry Bulb	None. The outdoor air dry bulb sensor is factory installed.	
Single Enthalpy	AXB078ENT	
Differential Enthalpy	AXB078ENT and DNENTDIF004A00*	
CO ₂ for DCV Control using a Duct-Mounted CO ₂ Sensor	DNCBDIOX005A00	

* DNENTDIF004A00 and DNTEMPNS002A00 accessories are used on many different base units. As such, these kits may contain parts that will not be needed for installation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury and/or death.

Disconnect power supply and install lockout tag before attempting to install the accessory.

GENERAL

The Economizer IV system utilizes the latest technology available for integrating the use of free cooling with mechanical cooling for packaged rooftop units. The solid-state control system optimizes energy consumption, zone comfort, and equipment cycling by operating the compressors when the outdoor-air temperature is too warm, integrating the compressor with outdoor air when free cooling is available, and locking out the compressor when outdoor-air temperature is too cold. Demand ventilation is supported.

The Economizer IV system utilizes gear-drive technology with a direct-mount spring return actuator that will close upon loss of power. The Economizer IV system comes standard with an outdoor air temperature sensor, supply air temperature sensor, and low temperature compressor lockout switch. indoor enthalpy and outdoor enthalpy sensors are available for field installation. Field-installed CO₂ sensors are available.

Barometric relief dampers provide natural building pressurization control. Barometric relief dampers are built into the design and are standard. An optional power exhaust system is available for applications requiring even greater exhaust capabilities. The power exhaust set point is adjustable at the Economizer IV controller.

See Package Contents and Package Usage tables for more information. See Table 1 for sensor usage.

ACCESSORIES LIST

The Economizer IV has several field-installed accessories available to optimize performance. Refer to Table 2 for authorized parts.

Table 2	Economizer IV Field-Installed Accessories	
	DESCRIPTION	PART NUMBER
	Power Exhaust 208–230 v 3 Ph	DNPWREXH068A00
	Power Exhaust 460 v 3 Ph	DNPWREXH069A00
	Power Exhaust 575 v 3 Ph	DNPWREXH070A00
	Outdoor Air Enthalpy Sensor	AXB078ENT
	Indoor Air Enthalpy Sensor	DNENTDIF004A00
	Return Air CO ₂ Sensor (4 to 20 mA)	DNCBDIOX005A00

VERTICAL INSTALLATION

These economizers are designed to work in both a vertical and horizontal applications. These instructions are for a vertical installation.

1. Turn off unit power supply and install lockout tag.
2. Prepare the unit for economizer installation:

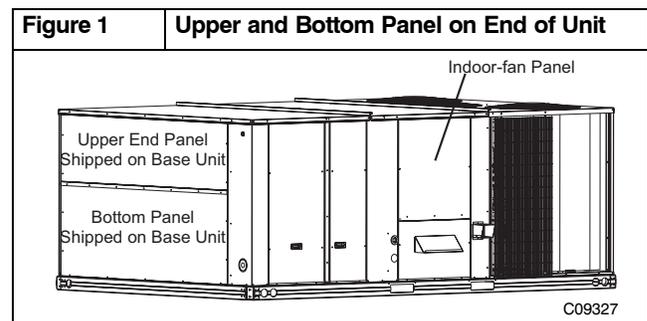
- a. For units with two position damper installed, remove the outside air hood. Unplug the damper actuator and remove assembly from unit.
 - b. For units with manual damper installed, remove the manual damper and hood.
3. Remove the upper panel and bottom panel (provided with the HVAC unit) on the end of the unit to expose the return section. (See Figure 1) Save the screws for use later when replacing the panel. The panels can be discarded.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

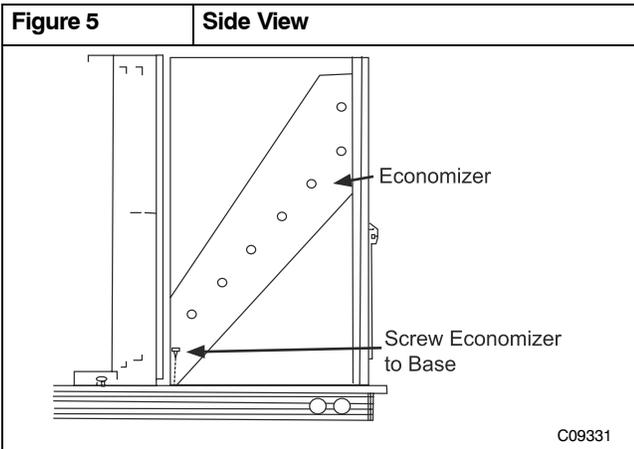
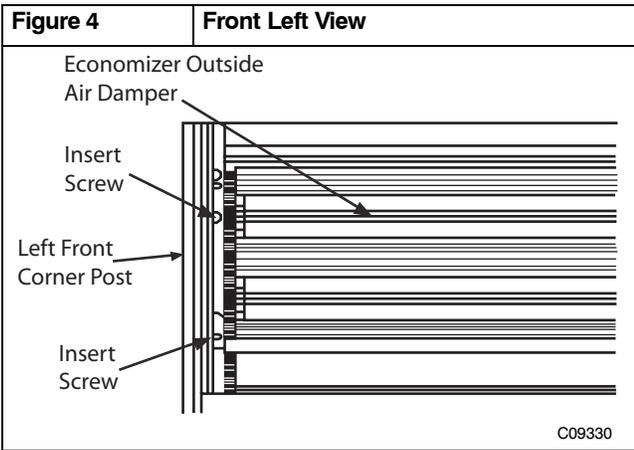
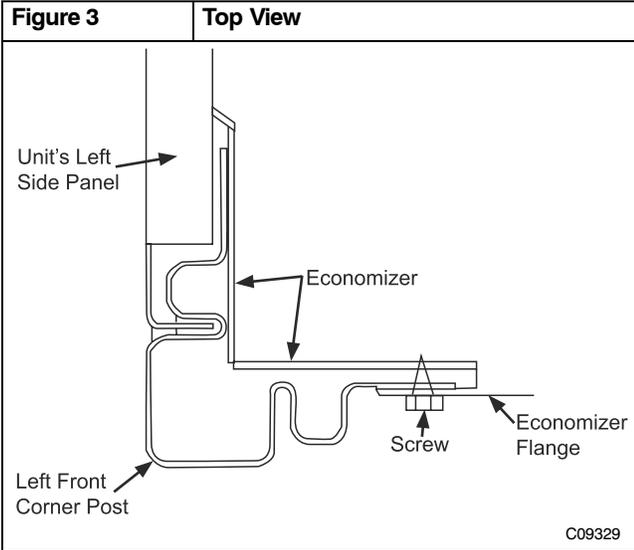
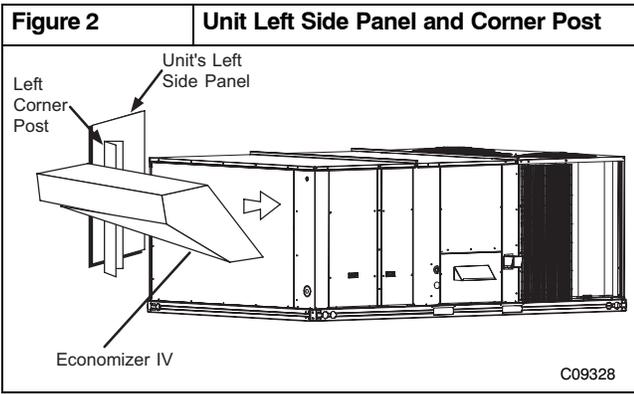
Failure to follow this caution may result in personal injury and damage to unit.

Cover the duct opening as a precaution so objects cannot fall into the return duct opening. Be sure to remove the cover when installation is complete.

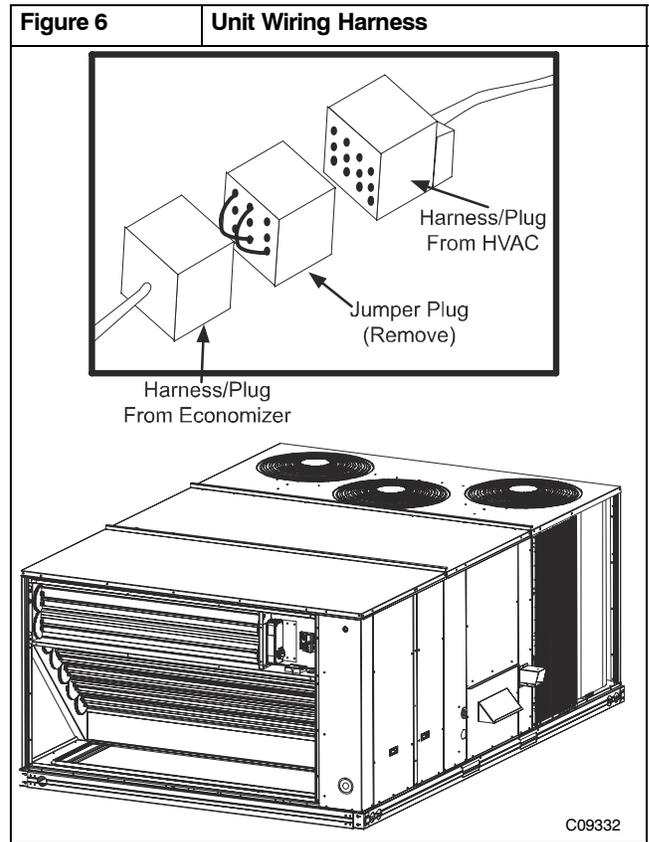


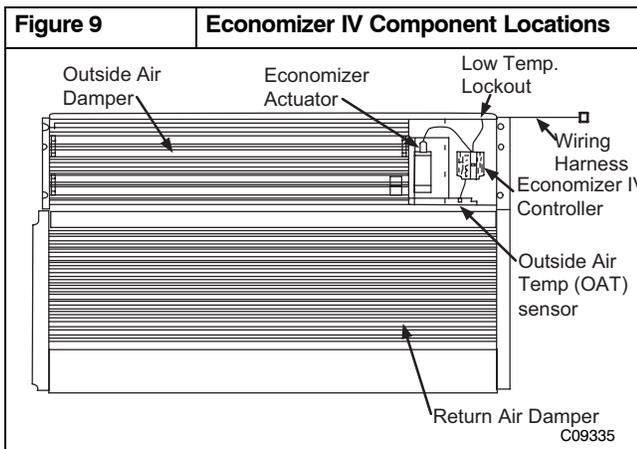
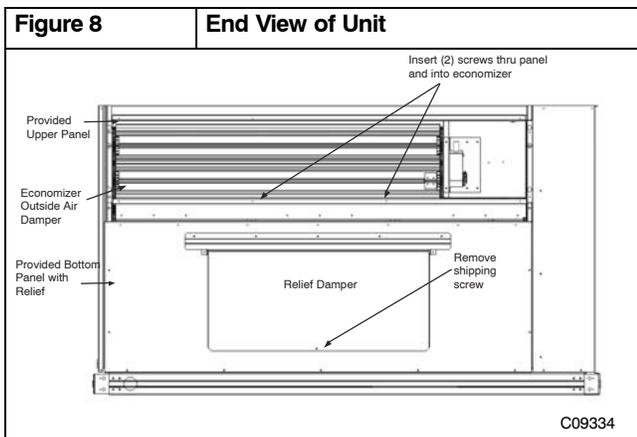
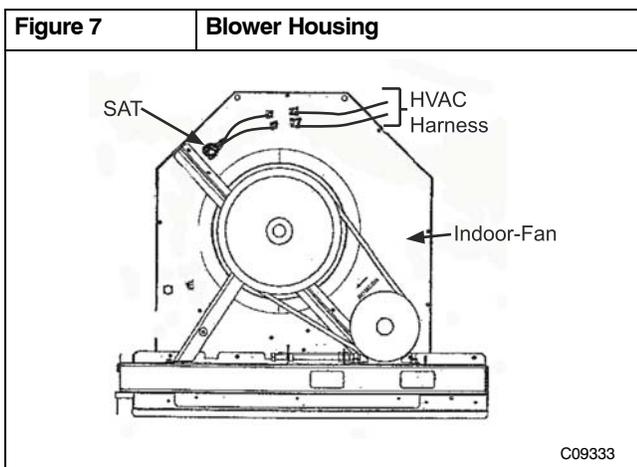
4. Remove the unit's left side corner post and left side panel from the unit to allow for easy economizer installation. (See Figure 2)
5. Install economizer, as shown in Figure 2, into the return air section of the unit. Be careful not to pinch the wires during installation. Bottom of economizer will rest on the base of the unit. (See Figure 5)
6. Reinstall the left side corner post on to the unit. Note the corner post will sit behind the economizer flange. (See Figure 3) Screw through the corner post and through the economizer. (See Figure 3 and Figure 4)
7. Insert provided screw through the bottom left rear of the economizer and into the unit base. (See Figure 5) Reinstall the unit's left side panel.
8. Before the economizer is secured in place on the right hand side, remove and save the 12-pin jumper plug from the unit wiring harness. (See Figure 6) Insert the economizer plug into the unit wiring harness plug.

NOTE: The 12-pin jumper plug should be saved for future use in the event that the Economizer IV is removed from the unit. The jumper plug is not needed as long as the Economizer IV is installed.



9. Remove the indoor-fan motor access panel. (See Figure 1)
 10. Install the supply air temperature sensor (SAT). The sensor looks like an eyelet terminal with 2 attached wires, and is shipped in the economizer hardware bag. The sensor is located on the "crimped" end and is sealed for moisture. Mount the SAT to the indoor blower housing. (See Figure 7) Use the provided screw to secure in place. Attach the PINK and VIOLET wires in the unit to the sensor.
 11. Replace the indoor-fan motor access panel.
 12. Install the bottom panel with the relief damper attached on the unit. (See Figure 8) Screw panel in place.
- NOTE:** Remove the bottom screw holding the relief blade closed.
13. Install the upper end economizer panel over the economizer's outside air damper, and above the bottom panel. Screw panel in place and screw panel into economizer in two places. (See Figure 8)





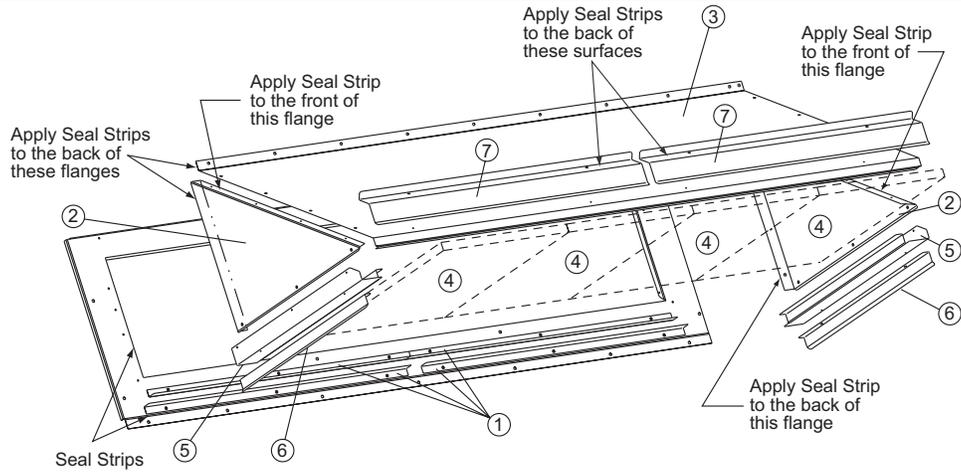
14. Assemble the outside air hood per Figure 10 and Figure 11.
 - a. Install four hood angles to the upper end panel using the screws provided.
 - b. Apply seal strip to mating flanges on the side plates of the hood and the hood top.
 - c. Secure the hood side plates to the panel using screws provided.
 - d. On 44 inch chassis, remove screws across top cover. Attach hood top to hood side plates (on 44 inch chassis, flange will slide behind flange of top cover).
 - e. On 44 inch chassis, reinstall the screws previously removed. On the 52 inch chassis, secure top flange using screws provided in kit.
 - f. Install the front outdoor air screens by sliding them into the channel formed by the four angles installed previously. Make sure the screens extend across the entire length of the hood.

NOTE: Screens may be left out at this time to allow for Economizer IV adjustments.

- g. Install the side filter supports using the screws provided.
 - h. Install the side drip edge angles using the screws provided.
 - i. Run a continuous length of seal strip across the hood covering the engagement hole in the lower hood.
 - j. Install top diverter using screws provided.
15. Install the hood assembly on to the unit. (See Figure 11 and Figure 12)
 16. Through the outdoor air hood, review and adjust the Economizer IV controller settings. See "Operation" section of this manual for details.
 - a. The standard Economizer IV controller has a factory setting of 63° F for the outdoor air temperature changeover and 55° F (fixed) for the supply air temperature sensor. The outdoor air temperature changeover setting is adjusted on the sensor by setting the dip switches on the sensor. See Fig 19. The ABCD potentiometer on the controller should be set to the "D" position.
 - b. The low temperature compressor lockout switch is fixed at 42° F.
 - c. The minimum position for the outdoor air damper can be configured for specific job requirements at the controller. When not using with a CO₂ sensor, the DCV Max potentiometer on the controller must be fully closed (CCW) for the Minimum Position potentiometer to function correctly.
 - d. Settings for the optional outdoor enthalpy sensor, indoor enthalpy sensor, power exhaust, and CO₂ sensor can be configured at the controller.

17. Install the hood screens and other approved Economizer IV accessories.

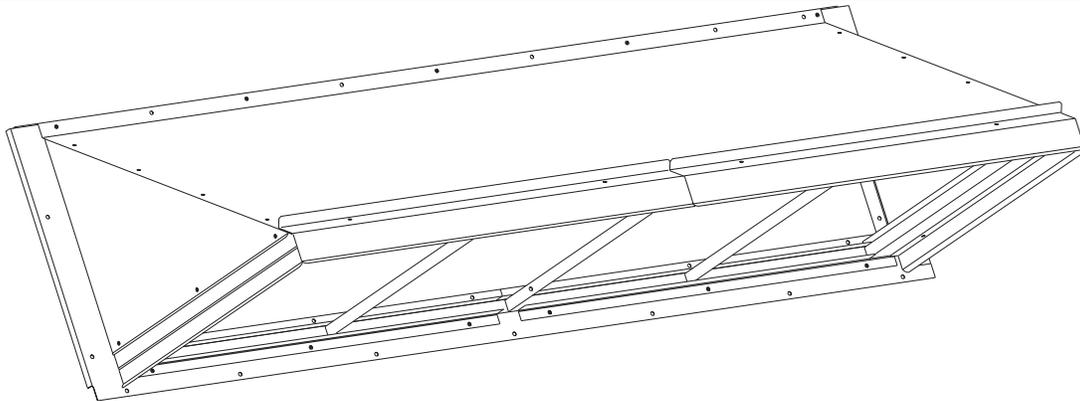
Figure 10 Hood Assembly



Item #	Description	Qty
1	Angles	4
2	Side Plates	2
3	Hood	1
4	Outdoor Air Screens	4
5	Side Filter Supports	2
6	Side Drip Angles	2
7	Top Diverters	2

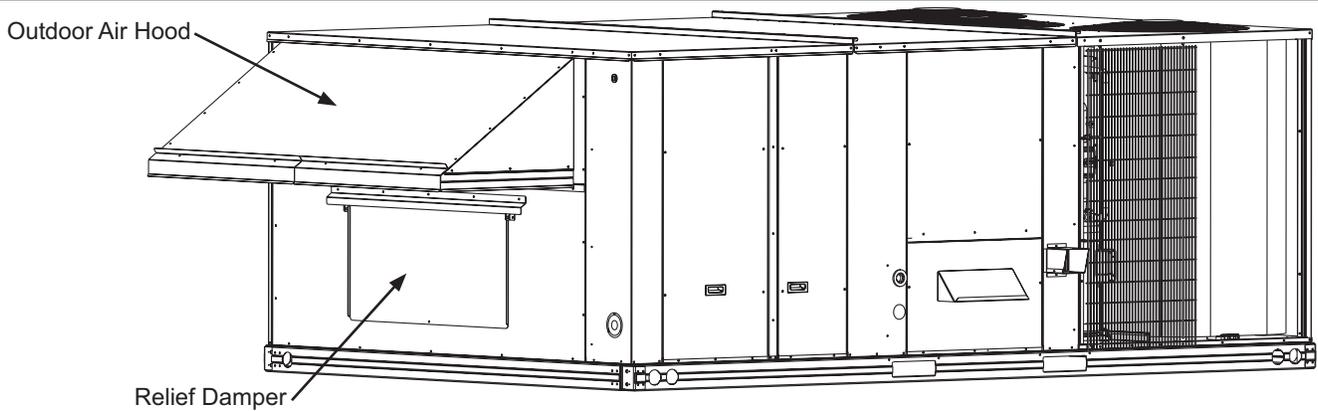
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Figure 11 Hood Assembly

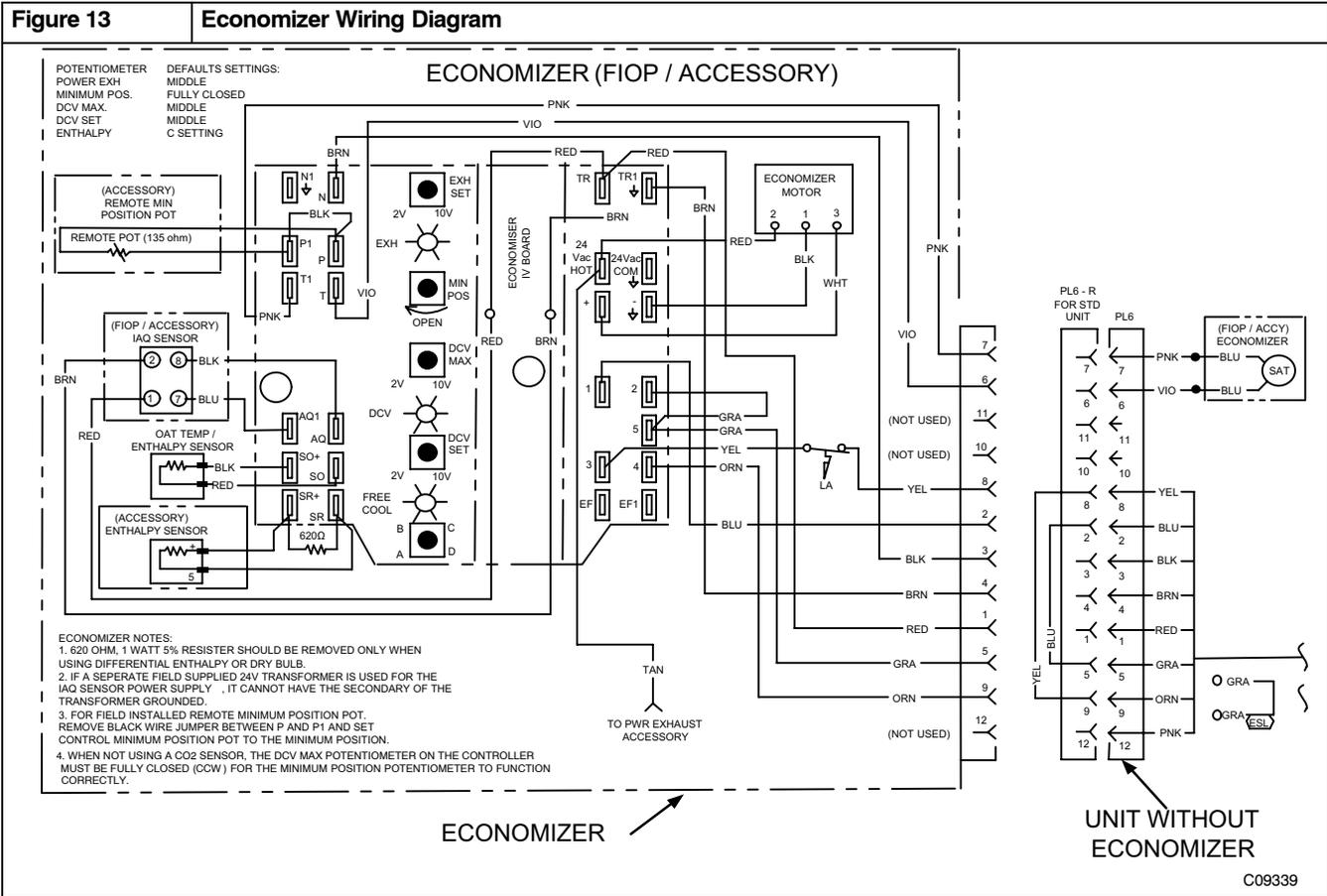


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Figure 12 Hood Assembly Installed on Unit



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HORIZONTAL INSTALLATION

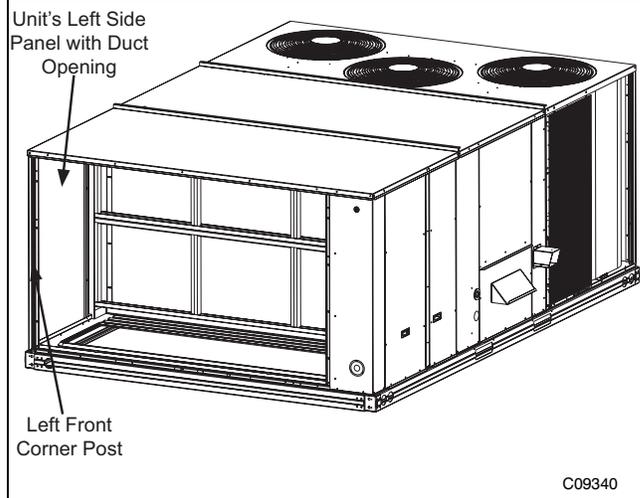
These economizers are designed to work in both vertical and horizontal applications. These instructions are for a horizontal application.

The unit has a horizontal duct opening next to the horizontal supply duct opening. However, in this application, with an economizer, the horizontal duct will actually come into the unit underneath the outdoor air hood. (See Figure 17)

1. Turn off unit power supply and install lockout tag.
2. Prepare the unit for economizer installation:
 - a. For units with 2 position damper installed, remove the outside air hood. Unplug the damper actuator and remove assembly from unit.
 - b. For units with manual damper installed, remove the manual damper and hood.
3. Remove the upper panel and bottom panel (provided with the HVAC unit). On the end of the unit to expose the return section. (See Figure 1) Save the screws for use later when replacing the panel. The panels can be discarded.
4. Remove the unit's left side corner post and left side panel from the unit to allow for easy economizer installation. (See Figure 14)

NOTE: The unit's left side panel has a duct opening in it, but this panel / duct opening will not be used in this application and can be discarded.

Figure 14 Remove Unit Corner Post and Side Panel

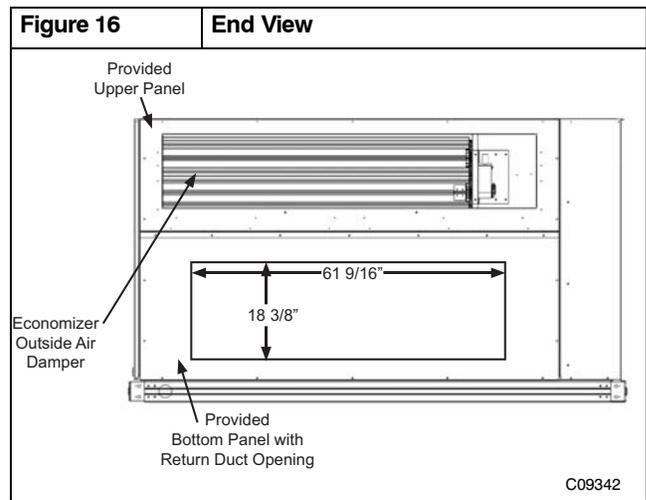
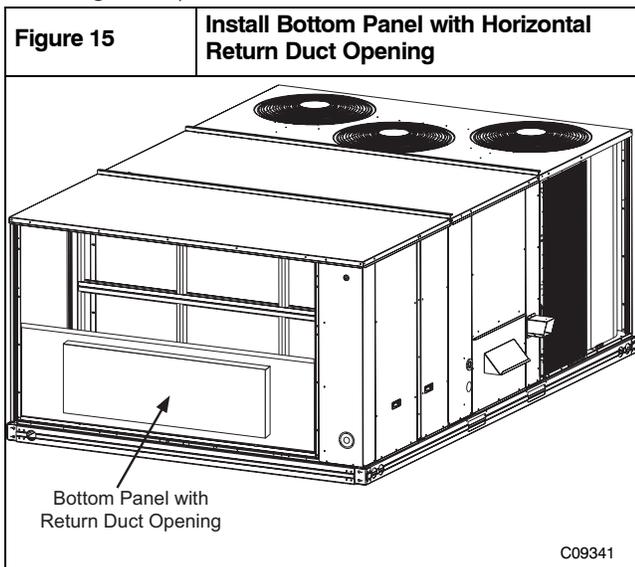


5. Install economizer, as shown in Figure 2, into the return air section of the unit. Be careful not to pinch the wires during installation. Bottom of economizer will rest on the base of the unit. (See Figure 5)
6. Reinstall the left side corner post on to the unit. Note the corner post will sit behind the economizer flange. (See Figure 3) Screw through the corner post and through the economizer. (See Figure 3 and Figure 4)

7. Insert provided screw through the bottom left rear of the economizer and into the unit base. (See Figure 5) Install the new (provided) left side panel - without the duct opening on the unit.
8. Before the economizer is secured in place on the right hand side, remove and save the 12-pin jumper plug from the unit wiring harness. Insert the Economizer IV plug into the unit wiring harness plug. (See Figure 6)

NOTE: The 12-pin jumper plug should be saved for future use in the event that the Economizer IV is removed from the unit. The jumper plug is not needed as long as the Economizer IV is installed.

9. Remove the indoor-fan motor access panel. (See Figure 1)
10. Install the supply air temperature sensor (SAT). The sensor looks like an eyelet terminal with 2 attached wires, and is shipped in the economizer hardware bag. The sensor is located on the "crimped" end and is sealed for moisture. Mount the SAT to the indoor blower housing. (See Figure 7) Use the provided screw to secure in place. Attach the PINK and VIOLET wires in the unit to the sensor.
11. Replace the indoor-fan motor access panel.
12. Install the (provided) bottom panel with the horizontal return duct opening on the unit. (See Figure 15) Screw panel in place.
13. Install the upper end economizer panel in place over the economizer's outside air damper, and above the bottom panel. Screw panel in place and screw panel into economizer in two places. (See Figure 16)



14. Assemble the outside air hood per Figure 10 and 11.
 - a. Install four hood angles to the upper end panel using the screws provided.
 - b. Apply seal strip to mating flanges on the side plates of the hood and the hood top.
 - c. Secure the hood side plates to the panel using screws provided.
 - d. On 44 inch chassis, remove screws across top cover. Attach hood top to hood side plates (on 44 inch chassis, flange will slide behind flange of top cover).
 - e. On 44 inch chassis, reinstall the screws previously removed. On the 52 inch chassis, secure top flange using screws provided in kit.
 - f. Install the four outdoor air screens by sliding them into the channel formed by the four angles installed previously. Make sure the screens extend across the entire length of the hood.
- NOTE:** Screens may be left out at this time to allow for Economizer IV adjustments.
- g. Install the side filter supports using the screws provided.
 - h. Install the side drip edge angles using the screws provided.
 - i. Run a continuous length of seal strip across the hood covering the engagement hole in the lower hood.
 - j. Install top diverter using screws provided.
15. Install the hood assembly on to the unit. Figure 11 and Figure 12.
 16. Through the outdoor air hood, review and adjust the Economizer IV controller settings. See "Operation" section of this manual for details.
 - a. The standard Economizer IV controller has a factory setting of 63° F for the outdoor air temperature changeover and 55° F (fixed) for the supply air temperature sensor. The outdoor air temperature changeover setting is adjusted on sensor. See Fig 19. The ABCD potentiometer on the controller should be set to the "D" position.
 - b. The low temperature compressor lockout switch is fixed at 42° F.
 - c. The minimum position for the outdoor air damper can be configured for specific job requirements at the controller. When not using a CO2 sensor, the DCV Max potentiometer must

be fully closed (CCW) for the Minimum Position potentiometer to function correctly.

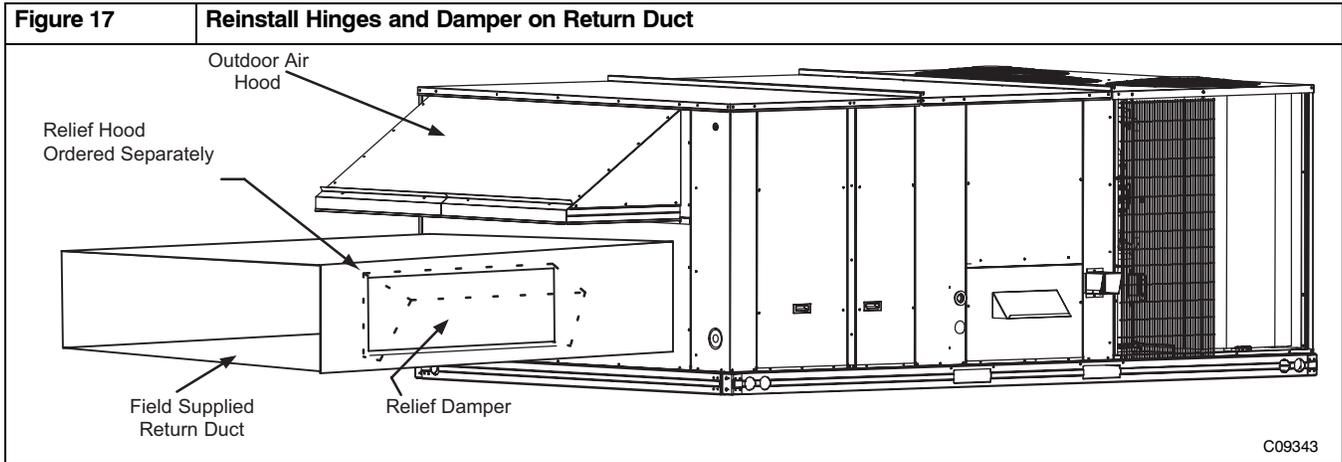
- d. Settings for the optional, outdoor enthalpy sensor, indoor enthalpy sensor, power exhaust, and CO₂ sensor can be configured at the controller.

17. If barometric relief is required remove the relief damper and hinges from the (provided) bottom

panel used on vertical applications. Reinstall the hinges and damper on the side of the field supplied return duct. (See Figure 17)

NOTE: A relief hood for the horizontal application can be ordered separately or can be field supplied.

18. Install the hood screens and other approved Economizer IV accessories.



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CONFIGURATION

Economizer IV Standard Sensors

Outdoor Air Temperature (OAT) Sensor

The outdoor air temperature sensor is a 10 to 20 mA device used to measure the outdoor-air temperature. The outdoor-air temperature is used to determine when the Economizer IV can be used for free cooling. The sensor is factory-installed on the Economizer IV in the outdoor airstream. (See Figure 9) The sensor has 8 selectable temperature changeover set points, ranging from 48° F to 78° F. The temperature changeover is set using the 3 dip switches on the sensor. The ABCD potentiometer on the controller should be set to the "D" position.

Supply Air Temperature (SAT) Sensor

The supply air temperature sensor is a 3K thermistor located at the inlet of the indoor fan. (See Figure 9) This sensor is field installed. The operating range of temperature measurement is 0° to 158°F. See Table 5 for sensor temperature/resistance values.

The temperature sensor looks like an eyelet terminal with wires running to it. The sensor is located in the "crimp end" and is sealed from moisture.

Table 3	Supply Air Sensor Temperature/Resistance Values
TEMPERATURE (F)	RESISTANCE (ohms)
-58	200,250
-40	100,680
-22	53,010
-4	29,091
14	16,590
32	9,795
50	5,970
68	3,747
77	3,000
86	2,416
104	1,597
122	1,080
140	746
158	525
176	376
185	321
194	274
212	203
230	153
248	116
257	102
266	89
284	70
302	55

Low Temperature Compressor Lockout Switch

The Economizer IV is equipped with a low ambient temperature lockout switch located in the outdoor airstream which is used to lock out the compressors below a 42°F ambient temperature. (See Figure 9)

Economizer IV Control Modes

Determine the Economizer IV control mode before set up of the control. Some modes of operation may require different sensors. (See Table 1) The Economizer IV is supplied from the factory with a supply air temperature sensor, a low temperature compressor lockout switch,

and an outdoor air temperature sensor. This allows for operation of the Economizer IV with outdoor air dry bulb changeover control. Additional accessories can be added to allow for different types of changeover control and operation of the Economizer IV and unit.

Outdoor Dry Bulb Changeover

The standard controller is shipped from the factory configured for outdoor dry bulb changeover control. The outdoor air and supply air temperature sensors are included as standard. For this control mode, the outdoor temperature is compared to a selectable set point sensor. See Fig 19. If the outdoor-air temperature is above the set point, the Economizer IV will adjust the outdoor air damper to minimum position. If the outdoor-air temperature is below the set point, the position of the outdoor-air dampers will be controlled to provide free cooling using outdoor air. When in this mode, the LED next to the free cooling set point potentiometer will be on. The changeover temperature set point is selected by the switches on the sensor. See Figure 19 for the corresponding temperature changeover values.

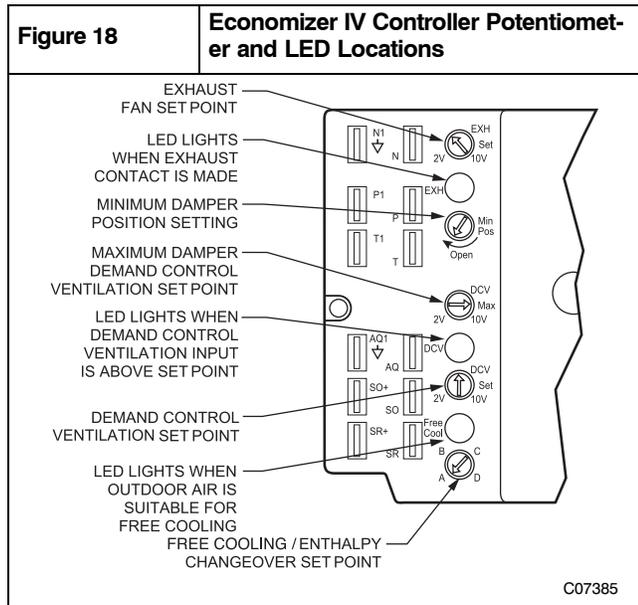


Figure 19 Selectable Temperature Options

DIP SWITCH POSITION	CHANGEOVER TEMPERATURE
ON OFF [] [] [] 1 2 3	48°F
ON OFF [] [] [] 1 2 3	53°F
ON OFF [] [] [] 1 2 3	55°F
ON OFF [] [] [] 1 2 3	58°F
ON OFF [] [] [] 1 2 3	63°F
ON OFF [] [] [] 1 2 3	68°F
ON OFF [] [] [] 1 2 3	73°F
ON OFF [] [] [] 1 2 3	78°F

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Outdoor Enthalpy Changeover

For enthalpy control, accessory enthalpy sensor (part number AXB078ENT) is required. Replace the standard outdoor dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. (See Figure 9) When the outdoor air enthalpy rises above the outdoor enthalpy changeover set point, the outdoor-air damper moves to its minimum position.

The outdoor enthalpy changeover set point is set with the outdoor enthalpy set point potentiometer on the Economizer IV controller. The set point are A, B, C and D. (See Figure 21) The factory-installed 620-ohm jumper must be in place across terminals SR and SR+ on the Economizer IV controller. (See Figure 13)

Differential Enthalpy Control

For differential enthalpy control, the Economizer IV controller uses two enthalpy sensors (AXB078ENT and DNENTDIF004A00), one in the outside air and one in the return airstream. The Economizer IV controller compares the outdoor air enthalpy to the return air enthalpy to determine Economizer IV use. The controller selects the lower enthalpy air (return or outdoor) for cooling. For example, when the outdoor air has a lower enthalpy than the return air and is below the set point, the Economizer IV opens to bring in outdoor air for free cooling.

Replace the standard outside air dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. (See Figure 9) Mount the return air enthalpy sensor in the return air duct. (See Figure 20) When using this mode of changeover control, turn the enthalpy set point potentiometer fully clockwise to the D setting.

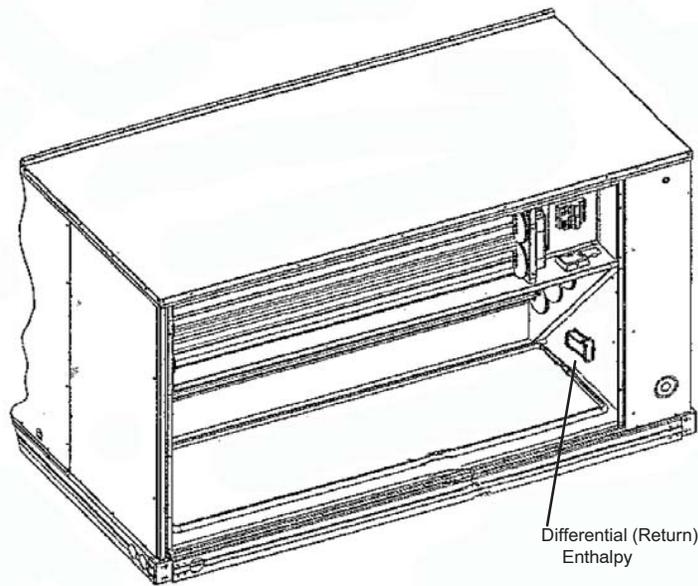
Indoor Air Quality (IAQ) Sensor Input

The IAQ input can be used for demand control ventilation control based on the level of CO₂ measured in the space or return air duct.

Mount the accessory IAQ sensor according to manufacturer specifications. The IAQ sensor should be wired to the AQ and AQ1 terminals of the controller. Adjust the DCV voltage output of the indoor air quality sensor at the user-determined set point. (See Figure 23) If a separate field-supplied transformer is used to power the IAQ sensor, the sensor must not be grounded or the Economizer IV control board will be damaged.

Figure 20

Return Air Temperature or Enthalpy Sensor Mounting Location

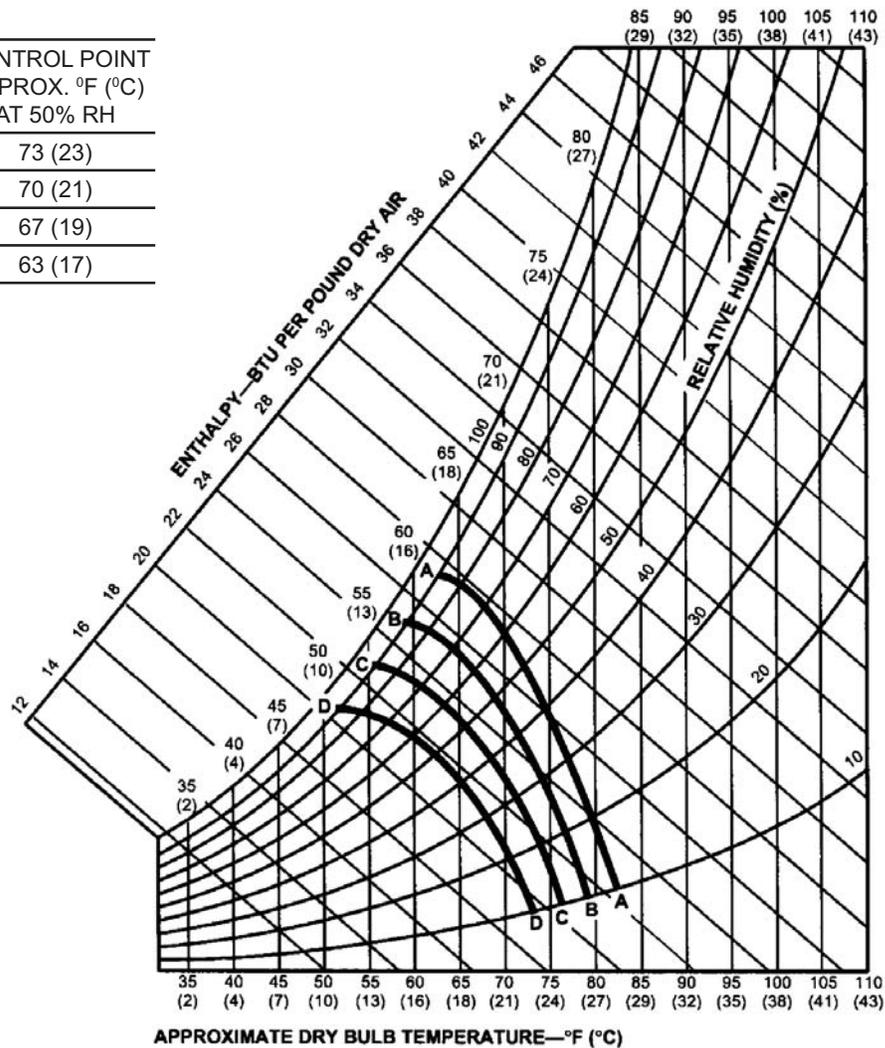


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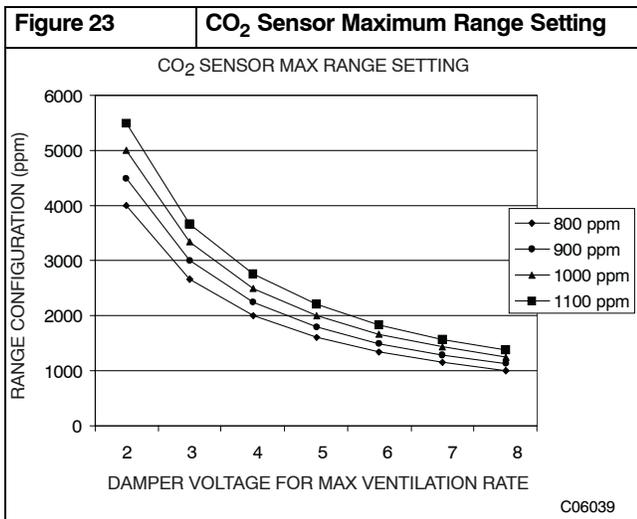
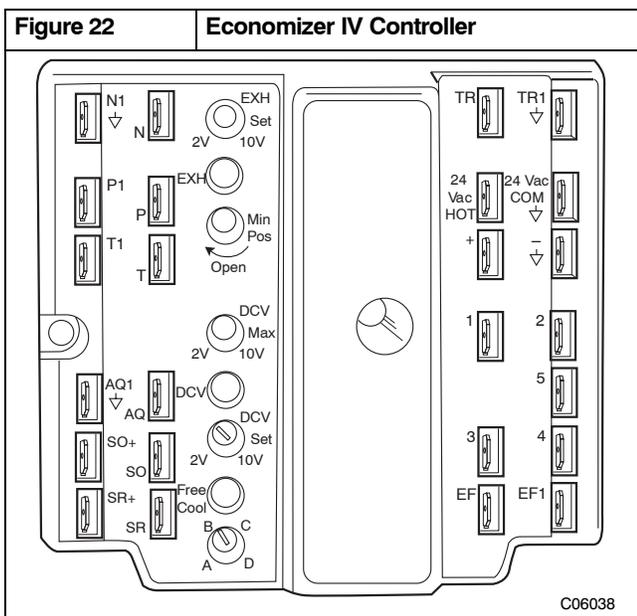
Figure 21

Enthalpy Changeover Setpoints

CONTROL CURVE	CONTROL POINT APPROX. °F (°C) AT 50% RH
A	73 (23)
B	70 (21)
C	67 (19)
D	63 (17)



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Exhaust Set Point Adjustment

The exhaust set point will determine when the exhaust fan runs based on damper position (if accessory power exhaust is installed). The set point is modified with the Exhaust Fan Set Point (EXH SET) potentiometer. (See Figure 18) The set point represents the damper position above which the exhaust fans will be turned on. When there is a call for exhaust, the Economizer IV controller provides a 45±15 second delay before exhaust fan activation to allow the dampers to open. This delay allows the damper to reach the appropriate position to avoid unnecessary fan overload.

Minimum Position Control

There is a minimum damper position potentiometer on the Economizer IV controller. (See Figure 18) The minimum damper position maintains the minimum airflow into the building during the occupied period.

When using demand ventilation, the minimum damper position represents the minimum ventilation position for VOC (volatile organic compound) ventilation requirements. The maximum demand ventilation position is used for fully occupied ventilation.

When demand ventilation control is not being used, the minimum position potentiometer should be used to set the occupied ventilation position. When not using a CO₂ sensor, the DCV MAX potentiometer must be fully closed (CCW) for the Minimum Position potentiometer to function correctly.

Adjust the minimum position potentiometer to allow the minimum amount of outdoor air, as required by local

codes, to enter the building. Make minimum position adjustments with at least 10°F temperature difference between the outdoor and return-air temperatures.

To determine the minimum position setting perform the following procedure:

1. Calculate the appropriate mixed air temperature using the following formula:

$$T_O \times \frac{OA}{100} + (T_R \times \frac{RA}{100}) = T_M$$

T_O = Outdoor-Air Temperature

OA = Percent of Outdoor Air

T_R = Return-Air Temperature

RA = Percent of Return Air

T_M = Mixed-Air Temperature

2. Disconnect the supply air sensor from terminals T and T1.
3. Ensure that the factory-installed jumper is in place across terminals P and P1. If remote damper positioning is being used, make sure that the terminals are wired according to Figure 13 and that the minimum position potentiometer is turned fully clockwise.
4. Connect 24 vac across terminals TR and TR1.
5. Carefully adjust the minimum position potentiometer until the measured mixed-air temperature matches the calculated value.
6. Reconnect the supply air sensor to terminals T and T1.

Remote control of the Economizer IV damper is desirable when requiring additional temporary ventilation. If a field-supplied remote potentiometer is wired to the Economizer IV controller, the minimum position of the damper can be controlled from a remote location.

To control the minimum damper position remotely remove the factory-installed jumper on the P and P1 terminals on the Economizer IV controller. Wire the field-supplied potentiometer to the P and P1 terminals on the Economizer IV controller. (See Figure 13)

Damper Movement

Damper movement from full open to full closed (or vice versa) takes 2-1/2 minutes.

Thermostats

The Economizer IV control works with conventional thermostats that have a Y1 (cool stage 1), Y2 (cool stage 2), W1 (heat stage 1), W2 (heat stage 2), and G (fan). The Economizer IV control does not support space temperature sensors. Connections are made at the thermostat terminal connection board located in the main control box.

Occupancy Control

The factory default configuration for the economizer control is occupied mode. Occupied status is provided by the black wire from Pin 3. When unoccupied mode is desired, install a field-supplied time clock function in place of the jumper between TR and N. (See Figure 13) When the time clock contacts are closed, the Economizer IV control will be in occupied mode. When the time clock contacts are open (removing the 24-v signal from terminal N), the economizer will be in unoccupied mode.

Demand Control Ventilation

When using the Economizer IV for demand controlled ventilation, there are some equipment selection criteria which should be considered. When selecting the heat capacity and cool capacity of the equipment, the maximum ventilation rate must be evaluated for design conditions. The maximum damper position must be calculated to provide the desired fresh air.

Typically the maximum ventilation rate will be about 5 to 10% more than the typical cfm required per person, using normal outside air design criteria.

An exponential anticipatory strategy should be taken with the following conditions: a zone with a large area, varied occupancy, and equipment that cannot exceed the required ventilation rate design conditions. Exceeding the required ventilation rate means the equipment can condition air at a maximum ventilation rate that is greater than the required ventilation rate for maximum occupancy. An exponential-anticipatory strategy will cause the fresh air supplied to increase as the room CO₂ level increases even though the CO₂ set point has not been reached. By the time the CO₂ level reaches the set point, the damper will be at maximum ventilation and should maintain the set point.

In order to have the CO₂ sensor control the economizer damper in this manner, first determine the damper voltage output for minimum or base ventilation. Base ventilation is the ventilation required to remove contaminants during unoccupied periods. The following equation may be used to determine the percent of outside-air entering the building for a given damper position. For best results there should be at least a 10 degree difference in outside and return-air temperatures.

$$T_O \times \frac{OA}{100} + (T_R \times \frac{RA}{100}) = T_M$$

T_O = Outdoor-Air Temperature
 OA = Percent of Outdoor Air
 T_R = Return-Air Temperature
 RA = Percent of Return Air
 T_M = Mixed-Air Temperature

Once base ventilation has been determined, set the minimum damper position potentiometer to the correct position.

The same equation can be used to determine the occupied or maximum ventilation rate to the building. For example, an output of 3.6 volts to the actuator provides a base ventilation rate of 5% and an output of 6.7 volts provides the maximum ventilation rate of 20% (or base plus 15 cfm per person). Use Figure 23 to determine the maximum setting of the CO₂ sensor. For example, a 1100 ppm set point relates to a 15 cfm per person design. Use the 1100 ppm curve on Figure 23 to find the point when the CO₂ sensor output will be 6.7 volts. Line up the point on the graph with the left side of the chart to determine that the range configuration for the CO₂ sensor should be 1800 ppm. The Economizer IV controller will output the 6.7 volts from the CO₂ sensor to the actuator when the CO₂ concentration in the space is at 1100 ppm. The DCV set point may be left at 2 volts since the CO₂ sensor voltage will be ignored by the Economizer IV controller until it rises above the 3.6 volt setting of the minimum position potentiometer.

Once the fully occupied damper position has been determined, set the maximum damper demand control ventilation potentiometer to this position as this can result in over-ventilation to the space and potential high-humidity levels.

CO₂ Sensor Configuration

The CO₂ sensor has preset standard voltage setting that can be selected anytime after the sensor is powered up. (See Table 4)

Use setting 1 or 2 for this equipment. (See Table 4)

1. Press Clear and Mode buttons. Hold at least 5 seconds until the sensor enters the Edit mode.

2. Press Mode twice. The STDSET Menu will appear.
3. Use the Up/Down button to select the preset number. (See Table 4)
4. Press Enter to lock in the selection.
5. Press Mode to exit and resume normal operation.

The custom settings of the CO₂ sensor can be changed anytime after the sensor is energized. Follow the steps below to change the non-standard settings:

1. Press Clear and Mode buttons. Hold at least 5 seconds until the sensor enters the Edit mode.
2. Press Mode twice. The STDSET Menu will appear.
3. Use the Up/Down button to toggle to the NONSTD menu and press Enter.
4. Use the Up/Down button to toggle through each of the nine variables, starting with Altitude, until the desired setting is reached.
5. Press Mode to move through the variables.
6. Press Enter to lock in the selection, then press Mode to continue to the next variable.

Dehumidification of Fresh Air With DCV Control

Information from ASHRAE indicates that the largest humidity load on any zone is the fresh air introduced. For some application, an energy recovery unit can be added to reduce the moisture content of the fresh air being brought into the building when the enthalpy is high. In most cases, the normal heating and cooling processes are more than adequate to remove the humidity loads for most commercial applications.

If normal rooftop heating and cooling operation is not adequate for the outdoor humidity level, and energy recovery unit and/or a dehumidification option should be considered.

OPERATION

Sequence of Operation

When free cooling is not available, the compressors will be controlled by the zone thermostat. When free cooling is available, the outdoor-air damper is modulated by the Economizer IV control to provide a 50° to 55°F supply-air temperature into the zone. As the supply-air temperature fluctuates above 55° or below 50°F, the dampers will be modulated (open or close) to bring the Supply-air temperature back within the set points.

For Economizer IV operation, there must be a thermostat call for the fan (G). This will move the damper to its minimum position during the occupied mode.

Above 50°F supply-air temperature, the dampers will modulate from 100% open to the minimum open position. From 50°F to 45°F supply-air temperature, the dampers will maintain at the minimum open position. Below 45°F, the dampers will be completely shut. As the supply-air temperature rises, the dampers will come back open to the minimum open position once the supply-air temperature rises to 48°F.

If optional power exhaust is installed, as the outdoor-air damper opens and closes, the power exhaust fans will be energized and deenergized.

Table 4		CO ₂ Sensor Standard Settings					
SETTING	EQUIPMENT	OUTPUT	VENTILATION RATE (cfm/Person)	ANALOG OUTPUT	CO ₂ CONTROL RANGE (ppm)	OPTIONAL RELAY SETPOINT (ppm)	RELAY HYSTERESIS (ppm)
1	Interface w/Standard Building Control System	Proportional	Any	0-10V 4-20 mA	0-2000	1000	50
2		Proportional	Any	2-10V 4-20 mA	0-2000	1000	50
3		Exponential	Any	0-10V 4-20 mA	0-2000	1100	50
4	Economizer	Proportional	15	0-10V 4-20 mA	0-1100	1100	50
5		Proportional	20	0-10V 4-20 mA	0-900	900	50
6		Exponential	15	0-10V 4-20 mA	0-1100	1100	50
7		Exponential	20	0-10V 4-20 mA	0-900	900	50
8	Health & Safety	Proportional	—	0-10V 4-20 mA	0-9999	5000	500
9	Parking/Air Intakes/Loading Docks	Proportional	—	0-10V 4-20 mA	0-2000	700	50

LEGEND

ppm — Parts Per Million

If field-installed accessory CO₂ sensors are connected to the Economizer IV control, a demand controlled ventilation strategy will begin to operate. As the CO₂ level in the zone increases above the CO₂ set point, the minimum position of the damper will be increased proportionally. As the CO₂ level decreases because of the increase in fresh air, the outdoor-air damper will be proportionally closed. Damper position will follow the higher demand condition from DCV mode or free cooling mode.

Damper movement from full closed to full open (or vice versa) will take between 1-1/2 and 2-1/2 minutes.

If free cooling can be used as determined from the appropriate changeover command (dry bulb, enthalpy curve, or differential enthalpy), a call for cooling (Y1 closes at the thermostat) will cause the control to modulate the dampers open to maintain the supply air temperature set point at 50° to 55°F.

As the supply air temperature drops below the set point range of 50° to 55°F, the control will modulate the outdoor-air dampers closed to maintain the proper supply-air temperature.

TROUBLESHOOTING

See Table 5 for Economizer IV logic.

Economizer IV Preparation

This procedure is used to prepare the Economizer IV for troubleshooting. No troubleshooting or testing is done by performing the following procedure.

NOTE: This procedure requires a 9-v battery, 1.2 kilo-ohm resistor, and a 5.6 kilo-ohm resistor which are not supplied with the Economizer IV.

IMPORTANT: Be sure to record the positions of all potentiometers before starting troubleshooting.

1. Disconnect power at TR and TR1. All LEDs should be off. Exhaust fan contact should be open.
2. Disconnect device at P and P1.
3. Jumper P to P1.
4. Disconnect wires at T and T1. Place 5.6 kilo-ohm resistor across T and T1.
5. Jumper TR to 1.
6. Jumper TR to N.
7. If connected, remove sensor from terminals S_O and +. Connect 1.2 kilo-ohm checkout resistor across terminals S_O and +.

8. Put 620-ohm resistor across terminals S_R and +.
9. Set minimum position, DCV set point, and exhaust potentiometers fully CCW (counterclockwise).
10. Set DCV maximum position potentiometer fully CW (clockwise).
11. Set enthalpy potentiometer to D.
12. Apply power (24 vac) to terminals TR and TR1.

Differential Enthalpy

To check differential enthalpy:

1. Make sure Economizer IV preparation procedure has been performed.
2. Place 620-ohm resistor across S_O and +.
3. Place 1.2 kilo-ohm resistor across S_R and +. The Free Cool LED should be lit.
4. Remove 620-ohm resistor across S_O and +. The Free Cool LED should turn off.
5. Return Economizer IV settings and wiring to normal after completing troubleshooting.

Single Enthalpy

To check single enthalpy:

1. Make sure the Economizer IV preparation procedure has been performed.
2. Set the enthalpy potentiometer to A (fully CCW). The Free Cool LED should be lit.
3. Set the enthalpy potentiometer to D (fully CW). The Free Cool LED should turn off.
4. Return Economizer IV settings and wiring to normal after completing troubleshooting.

DCV (Demand Control Ventilation) and Power Exhaust

1. Make sure Economizer IV preparation procedure has been performed.
2. Ensure terminals AQ and AQ1 are open. The LED for both DCV and Exhaust should be off. The actuator should be fully closed.
3. Connect a 9-v battery to AQ (positive node) and AQ1 (negative node). The LED for both DCV and
4. Exhaust should turn on. The actuator should drive to between 90 and 95% open.
5. Turn the Exhaust potentiometer CW until the Exhaust LED turns off. The LED should turn off when the potentiometer is approximately 90%. The actuator should remain in position.

- Turn the DCV set point potentiometer CW until the DCV LED turns off. The DCV LED should turn off when the potentiometer is approximately 9-v. The actuator should drive fully closed.
- Turn the DCV and Exhaust potentiometers CCW until the Exhaust LED turns on. The exhaust contact will close 30 to 120 seconds after the Exhaust LED turns on.
- Return Economizer IV settings and wiring to normal after completing troubleshooting.

ECV Minimum and Maximum Position

To check the DCV minimum and maximum position:

- Make sure Economizer IV preparation procedure has been performed.
- Connect a 9-v battery to AQ (positive node) and AQ1 (negative node). The DCV LED should turn on. The actuator should drive to between 90 and 95% open.
- Turn the DCV Maximum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
- Turn the DCV Maximum Position potentiometer to fully CCW. The actuator should drive fully closed.
- Turn the Minimum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
- Turn the Minimum Position potentiometer fully CW. The actuator should drive fully open.
- Remove the jumper from TR and N. The actuator should drive fully closed.
- Return Economizer IV settings and wiring to normal after completing troubleshooting.

Supply-Air Input

To check supply-air input:

- Make sure Economizer IV preparation procedure has been performed.

- Set the Enthalpy potentiometer to A. The Free Cool LED turns on. The actuator should drive to between 20 and 80% open.
- Remove the 5.6 kilo-ohm resistor and jumper T to T1. The actuator should drive fully open.
- Remove the jumper across T and T1. The actuator should drive fully closed.
- Return Economizer IV settings and wiring to normal after completing troubleshooting.

Economizer IV Troubleshooting Completion

This procedure is used to return the Economizer IV to operation. No troubleshooting or testing is done by performing the following procedure:

- Disconnect power at TR and TR1.
- Set enthalpy potentiometer to previous setting.
- Set DCV maximum position potentiometer to previous setting. Note: when not using a CO2 sensor the DCV Max potentiometer must be fully closed (CCW) for the Minimum Position potentiometer to function correctly.
- Set minimum position, DCV set point, and exhaust potentiometers to previous settings.
- Remove 620-ohm resistor from terminals S_R and +.
- Remove 1.2 kilo-ohm checkout resistor from terminals S_O and +. If used, reconnect sensor from terminals S_O and +.
- Remove jumper from TR to N.
- Remove jumper from TR to 1.
- Remove 5.6 kilo-ohm resistor from T and T1. Reconnect wires at T and T1.
- Remove jumper from P to P1. Reconnect device at P and P1.
- Apply power (24 vac) to terminals TR and TR1.

Demand Control Ventilation (DCV)	INPUTS		Y1	Y2	Compressor		OUTPUTS	
	Enthalpy*				Stage 1	Stage 2	N Terminal†	
	Outdoor	Return					Occupied	Unoccupied
Below set (DCV LED Off)	High (Free Cooling LED Off)	Low	On	On	On	On	Minimum position	Closed
			On	Off	On	Off		
			Off	Off	Off	Off		
	Low (Free Cooling LED On)	High	On	On	On	Off	Modulating** (between min. position and full-open)	Modulating** (between closed and full-open)
			On	Off	Off	Off		
			Off	Off	Off	Off	Minimum position	Closed
Above set (DCV LED On)	High (Free Cooling LED Off)	Low	On	On	On	On	Modulating†† (between min. position and DCV maximum)	Modulating†† (between closed and DCV maximum)
			On	Off	On	Off		
			Off	Off	Off	Off		
	Low (Free Cooling LED On)	High	On	On	On	Off	Modulating***	Modulating†††
			On	Off	Off	Off		
			Off	Off	Off	Off		

* For single enthalpy control, the module compares outdoor enthalpy to the ABCD set point.

† Power at B terminal determines Occupied/Unoccupied setting: 24 vac (Occupied), no power (Unoccupied).

** Modulation is based on the supply-air sensor signal.

†† Modulation is based on the DCV signal.

*** Modulation is based on the greater of DCV and supply-air sensor signals, between minimum position and either maximum position (DCV) or fully open (supply-air signal).

††† Modulation is based on the greater of DCV and supply-air sensor signals, between closed and either maximum position (DCV) or fully open (supply-air signal).