Installation Instructions

DNECOMZR046A00 & DNECOMZR047A00

Economizer Accessory for Rooftop Units

18 to 25 Tons

TABLE OF CONTENTS

PACKAGE USAGE

UNIT	PART NUMBER
PAH/PGH210 & 240	DNECOMZR046A00
PAH/PGH300	DNECOMZR047A00

GENERAL

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

The accessory economizer package uses solid-state controls to sequence mechanical cooling with cool outdoor air (free cooling) to satisfy the cooling load and minimize energy consumption. Free cooling can be used alone or in conjunction with mechanical cooling.

The standard economizer uses an outdoor-air temperature sensor to sense outdoor-air temperature. The economizer will provide cooling when the outdoor temperature is suitable and if there is a cooling demand. In addition, if an outdoor enthalpy sensor accessory has been installed, then the enthalpy reading must also be “low” before economizer cooling can occur.

When free cooling is available, the economizer sequences free cooling with mechanical cooling to maintain comfort in the space. When free cooling is not available, the economizer modulates to an adjustable minimum position to maintain a supply of fresh air entering the building.

Optional barometric relief dampers provide natural building pressurization control when the building pressure rises high enough to overcome the weight of the damper. An optional power exhaust system is available for jobs requiring greater relief.

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.

IMPORTANT: Do not adjust the economizer damper assembly. The actuator and damper have been pre−set and adjusted for proper 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.

PACKAGE CONTENTS

PART NO.	QTY	CONTENTS
DNECOMZR046A00	1	Damper Assy
	1	Blockoff Panel (Insulated)
	1	Lower Hood Top Panel
	1	Hood Side
	1	Hood Side
	2	Side Filter Guide
	1	Upper Hood Top Panel
	1	Filter Bracket
	1	Filter Retainer Track
	3	Filter
	1	Economizer Controller
	2	No. 6 Screw x 1-in.
	10	1/4-in. Screw x 5/8-in.
	25	1/4-in. Screw x 3/4-in.
	3	Speed Nut
	9	Wire Tie (snap-in)
	5	Wire Tie
	1	Harness Assy
	1	Seal Strip
	1	Supply Air Temperature Sensor (3 K ohm)
	1	Low Temperature, Compressor Lockout Switch
	1	Low Temperature, Compressor, Lockout Bracket
	1	Outdoor, Temperature Sensor
	4	No. 6 Screw x 1/2-in.
	2	Wire
	1	Snap Bushing
	1	Wire Tie Screw
	3	No. 10 Screw x 5/8-in.

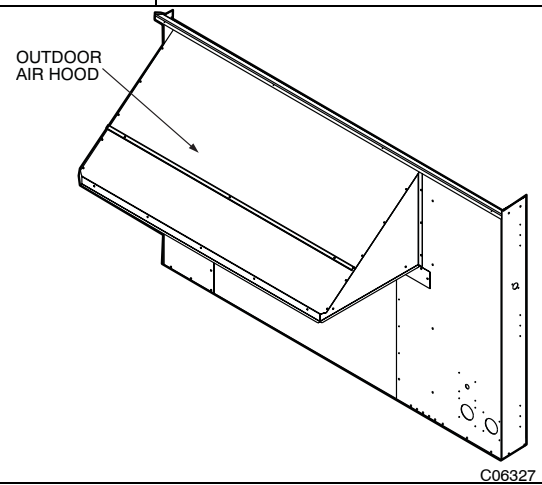
PART NO.	QTY	CONTENTS
DNECOMZR047A00	1	Damper Assy
	1	Blockoff Panel (Insulated)
	1	Lower Hood Top Panel
	1	Hood Side
	1	Hood Side
	2	Side Filter Guide
	1	Upper Hood Top Panel
	1	Filter Bracket
	1	Filter Retainer Track
	3	Filter
	1	Economizer Controller
	2	No. 6 Screw x 1-in.
	10	1/4-in. Screw x 5/8-in.
	22	1/4-in. Screw x 3/4-in.
	3	Speed Nut
	9	Wire Tie (snap-in)
	5	Wire Tie
	1	Harness Assy
	1	Seal Strip
	1	Supply Air Temperature Sensor (3 K ohm)
	1	Low Temperature, Compressor, Lockout Switch
	1	Low Temperature, Compressor, Lockout Bracket
	1	Outdoor Temperature Sensor
	4	No. 6 Screw x 1/2-in.
	2	Wire
	1	Snap Bushing
	1	Wire Tie Screw
	3	No. 10 Screw x 5/8-in.

NOTE: If unit is already equipped with an outdoor air hood, hood parts in the accessory will not be used and may be discarded.

INSTALLATION

1. Prepare the unit for installation:
   a. For units with two-position damper installed, remove the outdoor air hood. (See Figure 1) Unplug the two-position damper and remove the assembly from the outdoor air opening.
   b. For units with manual damper installed, remove manual damper and filter.
   c. For units with no outdoor air option installed, remove the outdoor air intake cover. (See Figure 2)

Figure 1 Outdoor Air Hood



⚠ WARNING

ELECTRICAL OPERATION HAZARD

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

Before installing or servicing unit, always turn off all power to unit. There may be more than one disconnect switch.

Figure 2 Outdoor Air Intake Cover

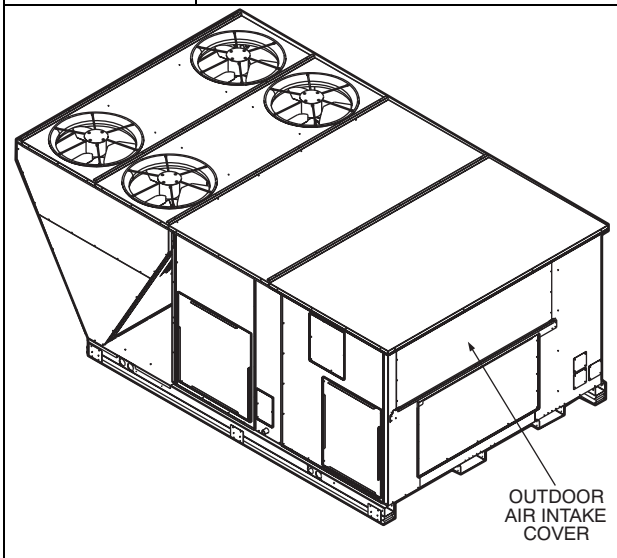
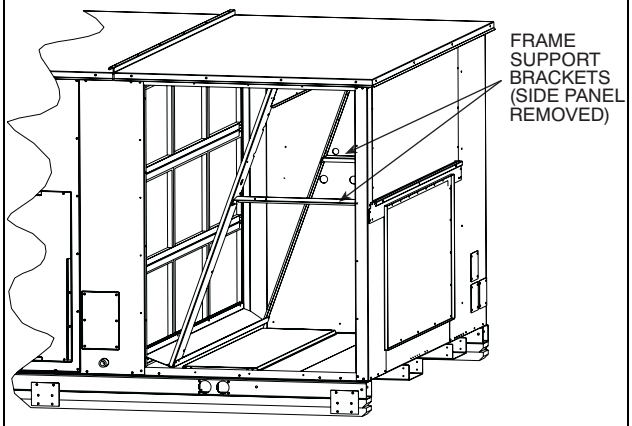


Figure 3 Frame Support Brackets



2. Remove the side panel on the return end of the unit to expose the return section of the unit. Save the screws for use later when replacing the panel. The inside of the unit will contain a frame for installing the economizer as shown in Figure 3.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment or property damage.

Cover the duct opening as a precaution so objects cannot fall into the return duct opening.

3. Remove the frame support brackets from both sides of the frame inside the unit. (See Figure 3) Save the screws for use later.
4. Uncrate the economizer assembly. Position the damper assembly so that it will rest on the angle bracket support at the bottom of the economizer frame inside the unit. Slide the economizer into the unit. (See Figure 4) Secure the damper assembly to the frame using the $^1/_4$-in. x $^5/_8$-in. screws provided.
5. Open the hinged control box compartment on the unit and remove the control box cover. Save the screws for use later. Be sure not to place sharp objects on any surface that could be damaged.
6. Install the economizer controller into the control box using the two no. 6 x 1-in. screws provided. The economizer controller will mount into the pre-drilled holes on the back of the control box as shown in Figure 5.
7. Connect the wiring harness to the Economizer controller. (See Figure 6 and Figure 7) Be sure to connect all quick connects except SR and SR+.
8. Unplug the existing jumper (used with manual damper) or harness (used with two-position damper) from PL1. Discard the jumper or harness. Connect PL1 from the Economizer harness to PL1 on the main control harness.
9. Route PL18 through the large hole on the right side of the bottom of the control box. Secure to the bottom of the control box using snap-in wire ties.

Figure 4 — **Slide Economizer Assembly into Unit**

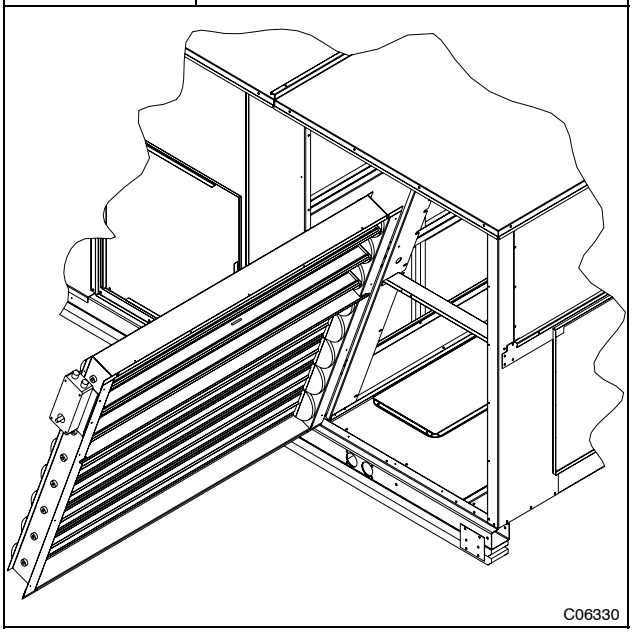


Figure 5 — **Unit Control Box**

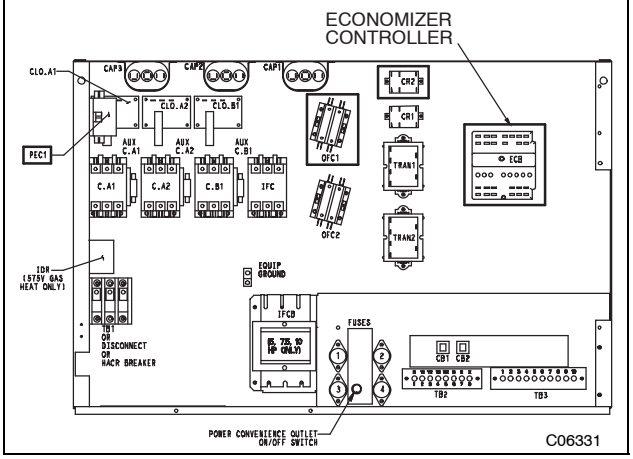
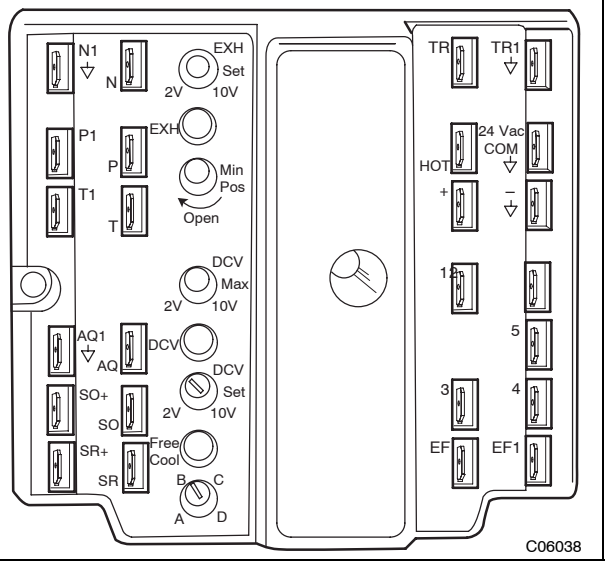


Figure 6 — **Economizer Controller**



10. Remove the foam grommet shown in Figure 8. Pass the wires through the hole in the control box and route into the return air section. Secure harness inside control box with 2 wires ties. Re-install the foam grommet.
11. Route the wire harness across the frame support as shown in Figure 8. The motor plug (PL7) should be located at the actuator side of the unit and snaps into the frame support bracket. Be careful not to damage the wires. Route the harness across the back of the top member of the frame as shown and attach to the frame using the snap-in wire ties provided.
12. Connect the motor plug to the plug provided with the harness.
13. Attach the low temperature compressor lockout switch to the low temperature compressor lockout bracket using two no. 6 x $^1/_2$-in. screws as shown in Figure 9. Mount bracket to economizer damper frame as shown in Figure 9 using two no. 10 x $^5/_8$-in. screws. Connect the gray wires from the harness to the low temperature compressor lockout switch. Use a wire tie to keep the wires away from sharp edges.
14. Attach outdoor air temperature sensor to the economizer damper frame using two no. 6 x $^1/_2$-in. screws as shown in Figure 9. Connect the pink wire to the "+" terminal on the outdoor air temperature

sensor. Connect the yellow wire to the S terminal on the outdoor air temperature sensor.

15. Examine plug PL1. If plug positions 14 and 15 have black wires installed, skip to Step 16. If black wires are not installed, insert two black wires provided into plug positions 14 and 15. Route the wires through the control box and into the indoor air section. Insert the wires in the wire track and route wires to the blower housing. Screw the wires to the center post using one no. 10 x $^{5}/_{8}$-in. screw and the wire tie screw. Secure the wires to the fan housing using a snap-in wire tie.
16. Remove the foil tape covering the supply air temperature sensor mounting hole. Insert the supply air temperature sensor in the mounting hole. Connect the sensor to the black wires. Secure wires using wires ties provided. Be sure wires cannot touch moving parts.

Figure 7 **Economizer Wiring**

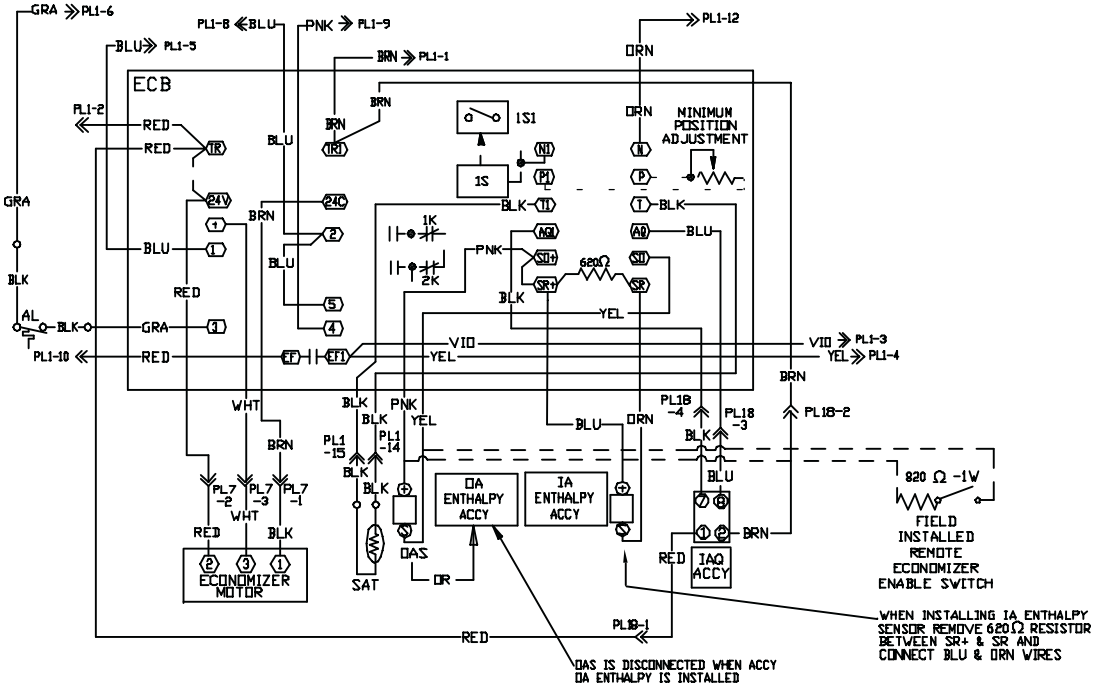
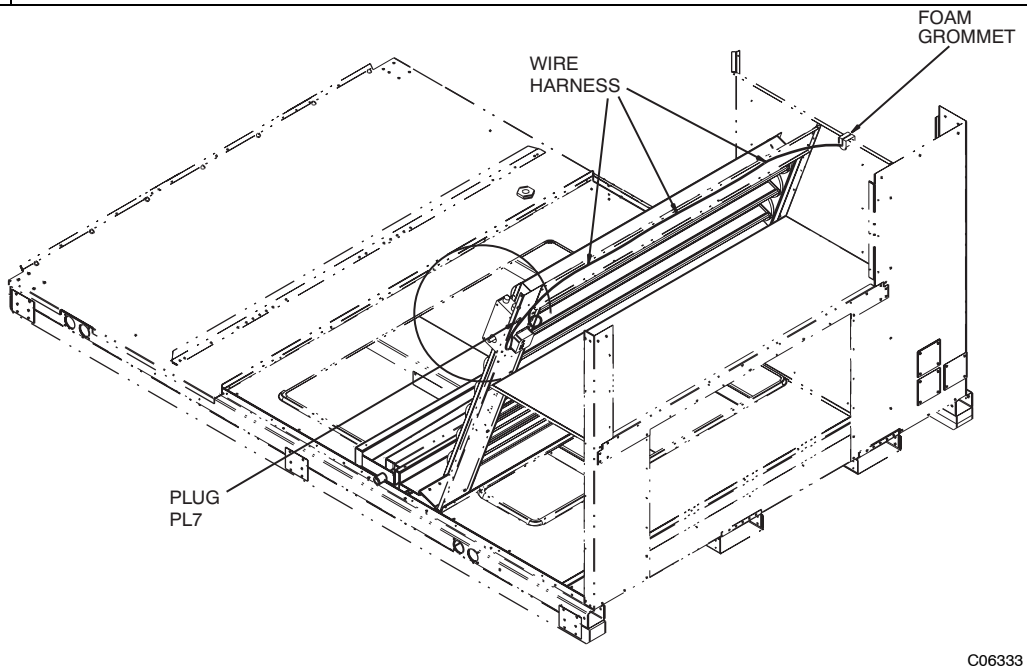


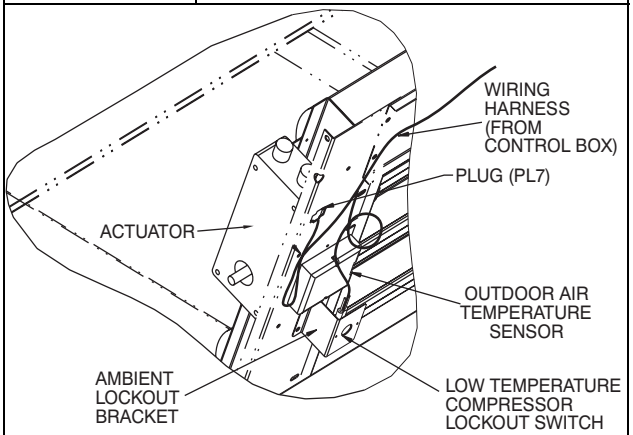
Figure 8 **Wire Harness Routing**



17. Install the insulated partition (block-off panel) by sliding the panel into the unit from the side. The damper side of the panel will slide along the top of the flange of the damper assembly, between the return and outdoor air damper blades. The panel should then be rotated upwards so that the mounting holes align with the holes in the panels at the end of the unit. Once in the correct position, the partition will be horizontal inside the unit as shown in Figure 10.

18. Secure the partition to the frame using the screws saved from Step 3, at the edges of the partition as shown in Figure 11.
19. The installation of the damper assembly is now complete.
    Units with Outdoor Air Hood:
    If the unit was equipped with an outdoor air hood, replace the outer unit panels and outdoor air hood (if necessary) using the screws saved from the earlier steps. Be sure to inspect all panel seals prior to start-up and replace any seals that appear damaged. Install filters.
    Units without Outdoor Air Hood:
    If the unit was not equipped with an outdoor air hood, perform the following procedure to install the hood:
    a. Make sure power supply is off.
    b. Apply seal strip provided to back flange of both hood sides where the hood side connects to the unit back panel. (See Figure 12)
    c. Apply seal strip provided to top flange of both hood sides where hood sides connect to the hood top panels. (See Figure 12)
    d. Install hood sides to the back panels using the screws provided. The sloped flanges point outward. The drip edges of the side panels should face outward as well. Attach side filter guides to the hood sides. The flanges should face inward to hold the filters in place. (See Figure 12)
    e. Apply seal strip along the entire length of the bottom flange of the hood top. (See Figure 12)
    f. Install the lower hood top panel using 4 screws provided. (See Figure 12)

Figure 9 — **Low Temperature Compressor Lockout Switch and Outdoor Air Sensor Installation**



    g. Install the upper hood top panel using the 6 screws removed in Step 2. (See Figure 12)
    h. Install the filter retainer track along the bottom edge of the outdoor air hood using 4 screws provided. For filter removal, remove the four screws holding the filter bracket. The filters can then be removed, cleaned, or replaced.
    i. Install filters.
    j. Re-install the outdoor panel with the screws saved from Step 2. Be sure to inspect all panels prior to unit start-up. Replace any seals that appear damaged.

Figure 10 — **Economizer Block−Off Panel Location**

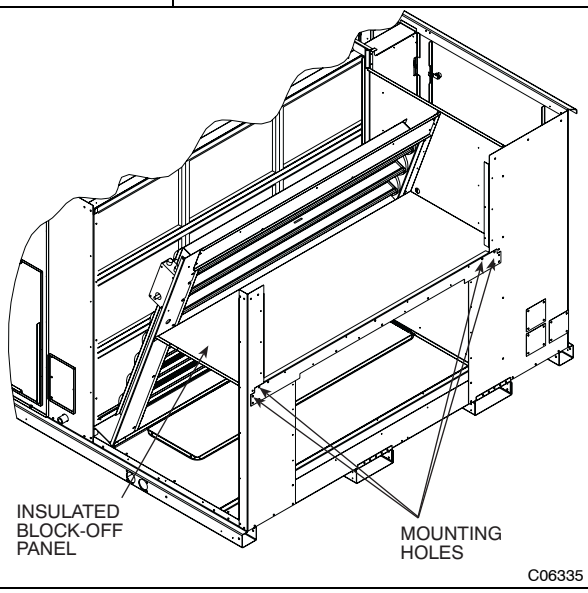
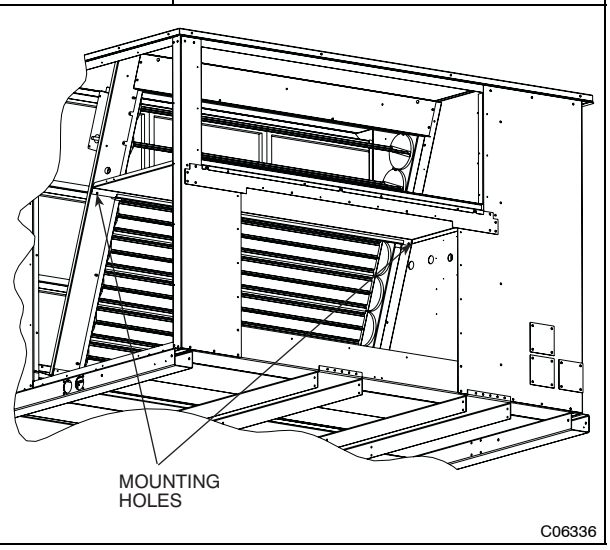


Figure 11 — **Secure Block−Off Panel to Frame**



IMPORTANT: If the return duct opening was covered prior to installation, remember to remove the covering so as not to block off the return air to the unit.

20. Secure all wires so that they do not rub any sharp edges or interfere with any moving parts.
21. Replace the control box cover using the screws saved from Step 5. Economizer wiring is shown in Figure 7.
22. Power can now safely be restored to the unit.
23. Inspect the unit to make sure all panels are properly replaced and secured to the unit.
24. Configure the unit for use with economizer.

CONFIGURATION

NOTE: The economizer static pressure drop must be accounted for after installation. (See Table 1) Refer to the base unit installation instructions for information on adjusting the fans.

Economizer 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 can be used for free cooling. The sensor is factory-installed on the Economizer in the outdoor airstream. 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 should be set to the “D” position. see Fig 13.

Supply−Air Temperature (SAT) Sensor

The supply-air temperature sensor is a 3 K thermistor located at the outlet of the indoor fan. This sensor is factory installed. The operating range of temperature measurement is 0° to 158°F.

The temperature sensor is a short probe with blue wires running to it.

Low Temperature Compressor Lockout Switch

The Economizer is equipped with an ambient temperature lockout switch located in the outdoor airstream which is used to lockout the compressors below a 42°F ambient temperature.

Figure 12 **Outdoor Air Hood Details**

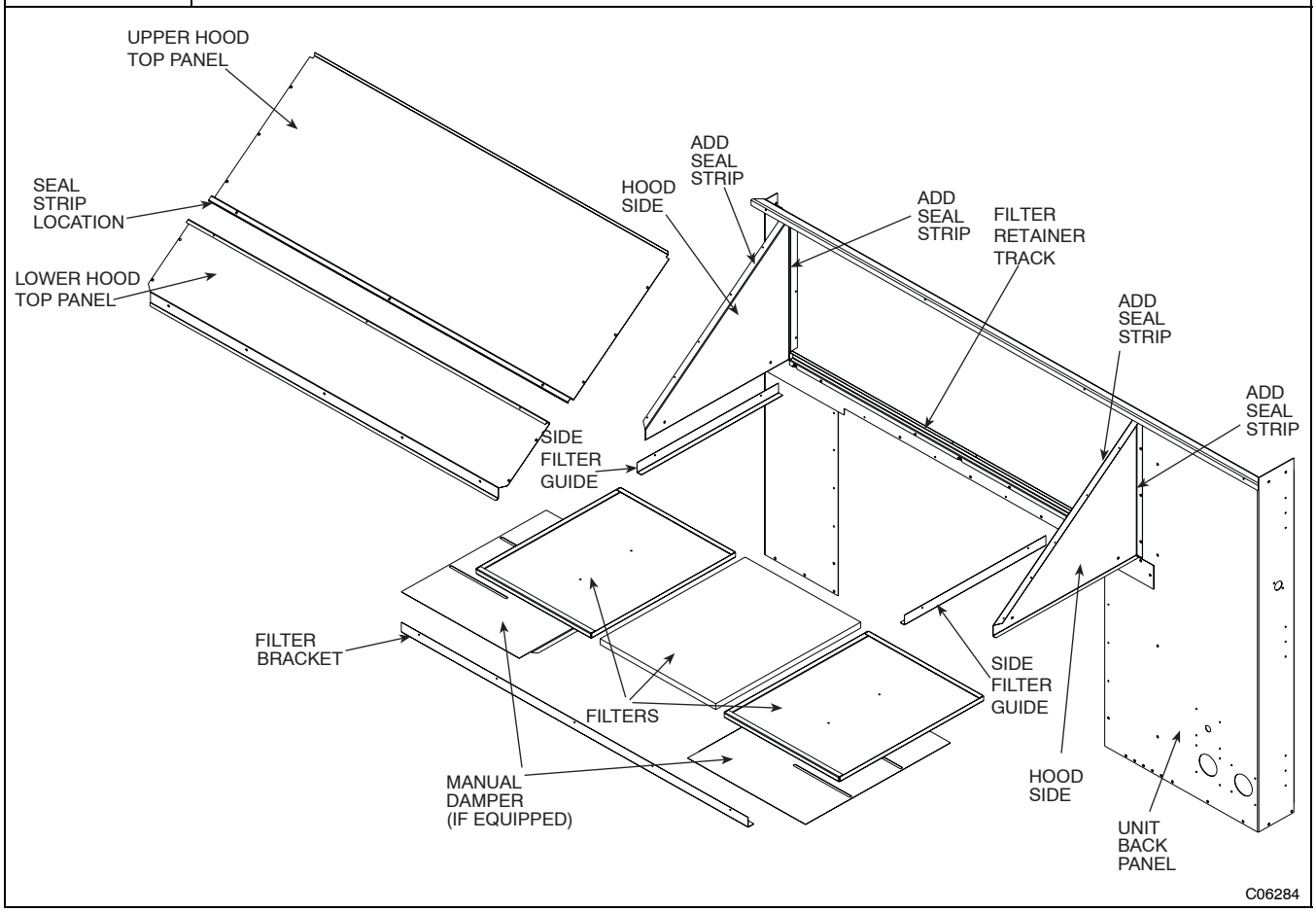


Table 1	Accessory Economizer Static Pressure (in wc)*								
COMPONENT	CFM								
	4,000	4,500	5,000	5,500	6,000	6,500	7,000	7,500	8,000
Economizer	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
COMPONENT	CFM								
	8,500	9,000	9,500	10,000	10,500	11,000	11,500	12,000	
Economizer	0.11	0.12	0.13	0.15	0.16	0.17	0.19	0.20	

*The static pressure must be added to the external static pressure. The sum and the evaporator entering-air cfm should then be used in conjunction with the Fan Performance tables to determine blower rpm and watts.

Economizer Controller Wiring and Operational Modes

Determine the Economizer control mode before set up of the control. Some modes of operation may require different sensors. Refer to Table 2. The Economizer 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 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 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 on the sensor see Fig 13. If the outdoor-air temperature is above the set point, the Economizer will adjust the outside- air dampers to minimum position. If the outdoor-air temperature is below the set point, the position of the outdoor-air dampers will be controlled to provided 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 controlled by the set point on the sensor. See Figure 13 for the corresponding temperature changeover values.

Table 2	Economizer Sensor Usage		
APPLICATION	ECONOMIZER 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 Wall-Mounted CO_2 Sensor	33ZCSENCO2 or CGCDXSEN004A00		
CO_2 for DCV Control using a Duct-Mounted CO_2 Sensor	33ZCSENCO2 or CGCDXSEN004A00† and 33ZCASPCO2 or CGCDXASP001A00**	OR	DNCBDIOX005A00††

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

†33ZCSENCO2 and CGCDXSEN004A00 are accessory CO_2 sensors.

**33ZCASPCO2 and CGCDXASP001A00 are accessory aspirator boxes required for duct-mounted applications.

††DNCBDIOX005A00 is an accessory that contains both 33ZCSENCO2 and 33ZCASPCO2 accessories.

Outdoor Enthalpy Changeover

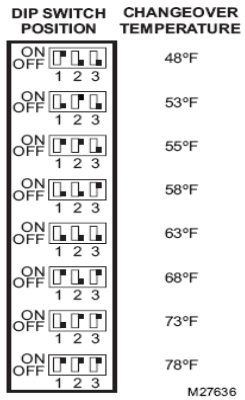
For enthalpy control, accessory enthalpy sensor (part number AXB078ENT) is required. Replace the standard outdoor dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. When the outdoor-air enthalpy rises above the outdoor enthalpy changeover set point, the outdoor-air damper moves to its minimum position. The outdoor enthalpy changeover set point is set with the outdoor enthalpy set point potentiometer on the Economizer controller. The set points are A, B, C, and D. (See Figure 14 and Figure 15) The factory-installed 620-ohm jumper must be in place across terminals S_R and S_R+ on the Economizer controller. (See Figure 7)

Differential Enthalpy Control

For differential enthalpy control, the Economizer controller uses two enthalpy sensors (AXB078ENT and DNENTDIF004A00), one in the outside air and one in the return air duct. The Economizer controller compares the outdoor air enthalpy to the return air enthalpy to determine Economizer 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 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. Mount the return air enthalpy sensor in the return air duct. Wiring is provided in the Economizer wiring harness. (See Figure 7) The outdoor enthalpy changeover set point is set with the outdoor enthalpy set point potentiometer on the Economizer controller. When using this mode of changeover control, turn the enthalpy setpoint potentiometer fully clockwise to the D setting.

Figure 13 Selectable Temperature Options



Indoor Air Quality (IAQ) Sensor Input

The IAQ input can be used for demand control ventilation control based on the level of CO_2 measured in the space or return air duct.

Mount the optional IAQ sensor according to manufacturer specifications. The IAQ sensor should be wired to the AQ and AQ1 terminals of the controller. Adjust the DCV potentiometers to correspond to the DCV voltage output of the indoor air quality sensor at the user-determined set point. (See Figure 15)

If a separate field-supplied transformer is used to power the IAQ sensor, the sensor must not be grounded or the Economizer control board will be damaged.

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 15) 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 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 controller. (See Figure 15) 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 compounds) 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. The maximum demand ventilation position should be turned fully clockwise.

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.

Figure 14 **Enthalpy Changeover Set Points**

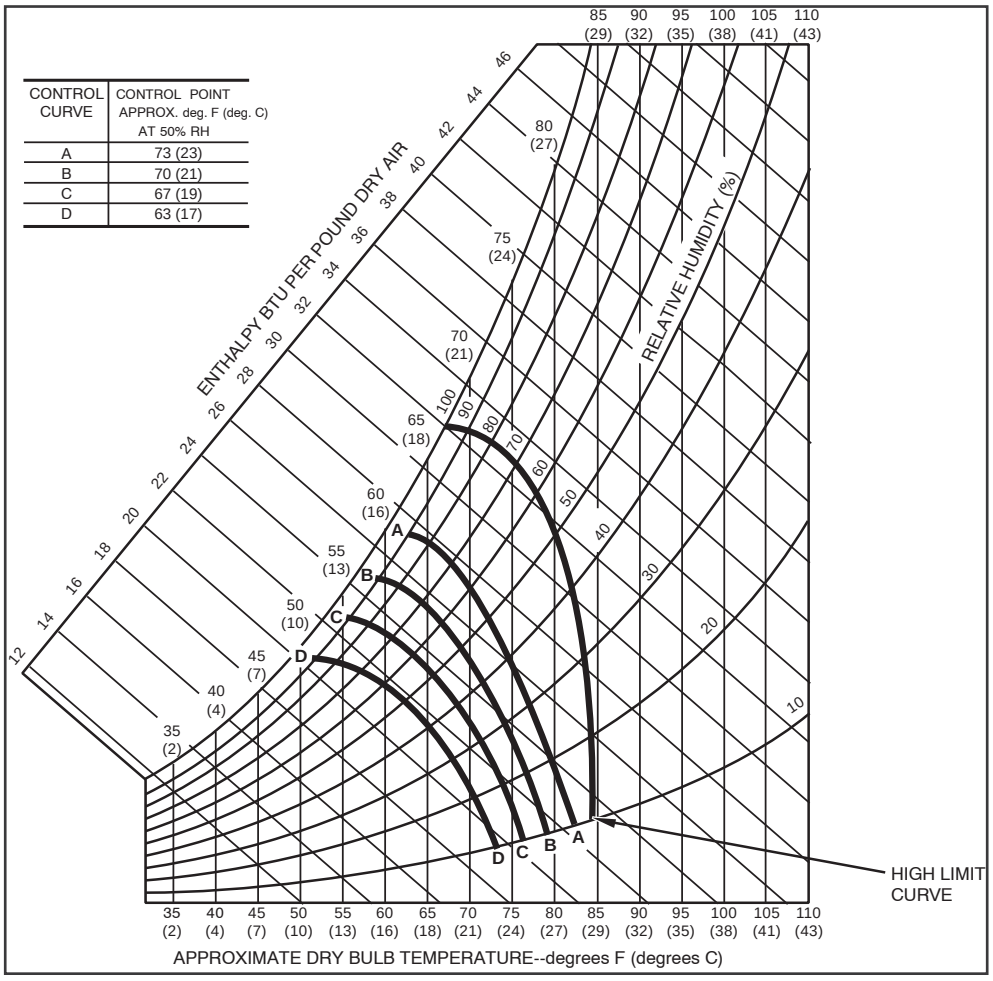
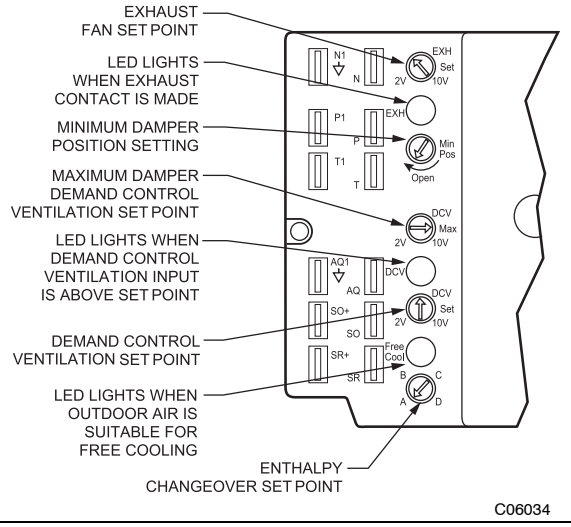


Figure 15 **Economizer Controller Potentiometer and LED Locations**



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

As an example, if local codes require 10% outdoor air during occupied conditions, outdoor-air temperature is 60°F, and return-air temperature is 75°F.

(60 x .10) + (75 x .90) = 73.5°F

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 7 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 damper is desirable when requiring additional temporary ventilation. If a field-supplied remote potentiometer (Honeywell part number S963B1128) is wired to the Economizer 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 controller. Wire the field-supplied potentiometer to the P and P1 terminals on the Economizer controller. (See Figure 7)

Damper Movement

Damper movement from full open to full closed (or vice versa) takes $2^1/_2$ minutes.

Thermostats

The Economizer 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 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 jumper from terminal TR to terminal N. When unoccupied mode is desired, install a field-supplied timeclock function in place of the jumper between TR and N. (See Figure 7) When the timeclock contacts are closed, the Economizer control will be in occupied mode. When the timeclock contacts are open (removing the 24-v signal from terminal N), the Economizer will be in unoccupied mode.

Demand Control Ventilation

The information in this section is applicable for the 33ZCSENCO2 and CGCDXSEN004A00 sensors only. When using the Economizer for demand control 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 at 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 CO_2 level increases even though the CO_2 set point has not been reached. By the time the CO_2 level reaches the set point, the damper will be at maximum ventilation and should maintain the set point.

In order to have the CO_2 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

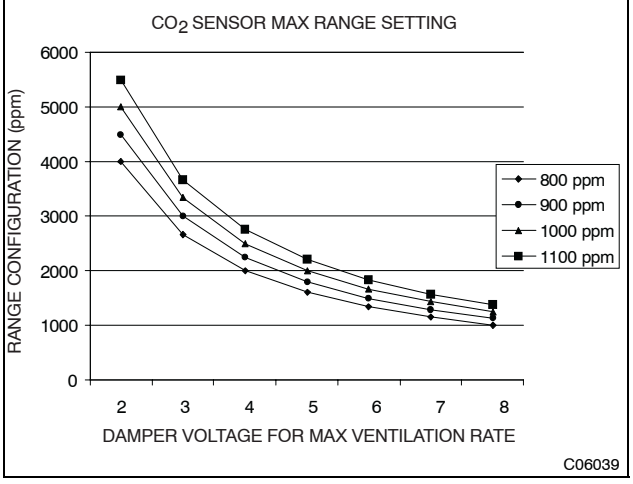
RA = Percent of Return Air

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 16 to determine the maximum setting of the CO_2 sensor. For example, a 1100 ppm set point relates to a 15 cfm per person design. Use the 1100 ppm curve on Figure 16 to find the point when the CO_2 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 CO_2 sensor should be 1800 ppm. The Economizer controller will output the 6.7 volts from the CO_2 sensor to the actuator when the CO_2 concentration in the space is at 1100 ppm. The DCV set point may be left at 2 volts since the CO_2 sensor voltage will be ignored by the Economizer controller until it rises above the 3.6 volt setting of the minimum position potentiometer.

Figure 16 | **CO_2 Sensor Maximum Range Setting**



The custom settings of the CO_2 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.
7. Press Enter to lock in the selection.
8. Press Mode to exit and resume normal operation.

Table 3	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 7-20 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

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 applications, 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.

Operating Sequence

Cooling, Units With Economizer

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 control to provide a 50° to 55°F mixed-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 control.

If mechanical cooling is utilized with free cooling, the outdoor-air damper will maintain its current position at the time the compressor is started. If the increase in cooling capacity causes the supply-air temperature to drop below 45°F, then the outdoor-air damper position will be decreased to the minimum position. If the supply-air temperature continues to fall, the outdoor-air damper will close. Control returns to normal once the supply-air temperature rises above 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.

If field-installed accessory CO_2 sensors are connected to the Economizer control, a demand controlled ventilation strategy will begin to operate. As the CO_2 level in the zone increases above the CO_2 set point, the minimum position of the damper will be increased proportionally. As the CO_2 level decreases because of the increase in fresh air, the outdoor-air damper will be proportionally closed.

For Economizer operation, there must be a thermostat call for the fan (G). If the unit is occupied and the fan is on, the damper will operate at minimum position. Otherwise, the damper will be closed.

When the Economizer control is in the occupied mode and a call for cooling exists (Y1 on the thermostat), the control will first check for indoor fan operation. If the fan is not on, then cooling will not be activated. If the fan is on, then the control will open the Economizer damper to the minimum position.

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 (switch, dry bulb, enthalpy curve, or differential enthalpy), then the control will modulate the dampers open to maintain the mixed-air temperature set point at 50 to 55°F.

If there is a further demand for cooling (cooling second stage — Y2 is energized), then the control will bring on compressor stage 1 to maintain the mixed-air temperature set point. The Economizer damper will be open at maximum position. Economizer operation is limited to a single compressor.

Heating, Gas Heat Units With Economizer

NOTE: The units have two−stages of heat.

When the thermostat calls for heating, power is sent to W1 on the IGC (integrated gas unit controller) board. An LED (light-emitting diode) on the IGC board will be on during normal operation. A check is made to ensure that the rollout switch and limit switch are closed and the induced-draft motor is running. The induced-draft motor is then energized, and when speed is proven with the hall effect sensor on the motor, the ignition activation period begins. The burners will ignite within 5 seconds.

If the burners do not light, there is a 22-second delay before another 5-second attempt. If the burners still do not light, this sequence is repeated for 15 minutes. After the 15 minutes have elapsed, if the burners still have not lit, heating is locked out. To reset the control, break 24-v power to the thermostat.

When ignition occurs the IGC board will continue to monitor the condition of the rollout and limit switches, the hall effect sensor, as well as the flame sensor. If the unit is controlled through a room thermostat set for fan auto., 45 seconds after ignition occurs, the indoor-fan motor will be energized (and the outdoor-air dampers will open to their minimum position). If for some reason the overtemperature limit opens prior to the start of the indoor fan blower, on the next attempt, the 45-second delay will be shortened to 5 seconds less than the time from initiation of heat to when the limit tripped. Gas will not be interrupted to the burners and heating will continue. Once modified, the fan on delay will not change back to 45 seconds unless power is reset to the control.

When additional heat is required, W2 closes and initiates power to the second stage of the main gas valve. When the thermostat is satisfied, W1 and W2 open and the gas valve closes, interrupting the flow of gas to the main burners. If the call for W1 lasted less than 1 minute, the heating cycle will not terminate until 1 minute after W1 became active. If the unit is controlled through a room thermostat set for fan auto., the indoor-fan motor will continue to operate for an additional 45 seconds then stop

(and the outdoor-air dampers will close). If the overtemperature limit opens after the indoor motor is stopped within 10 minutes of W1 becoming inactive, on the next cycle the time will be extended by 15 seconds. The maximum delay is 3 minutes. Once modified, the fan off delay will not change back to 45 seconds unless power is reset to the control.

When the thermostat is satisfied and W1 and W2 are deenergized, the IFM continues to run and the economizer damper then moves to the minimum position.

Heating, Electric Heat Units With Economizer

NOTE: The units have two−stages of electric heat.

When the thermostat calls for one stage of heating, W1 is energized. The thermostat must be configured such that the blower output (G) is energized when there is a W1 call for heating. The indoor fan contactor (IFC) and first stage electric heat contactor(s) are energized, and the indoor-fan motor and first stage electric heater are started. The Economizer damper modulates to the minimum position.

If additional heating is required, the thermostat will call for a second stage of heating, energizing W2. This will energize the second stage of electric heat. The Economizer damper modulates to the minimum position.

When the thermostat is satisfied, the Economizer damper modulates closed.

TROUBLESHOOTING

See Table 4 for Economizer logic.

A functional view of the Economizer is shown in Figure 17. Typical settings, sensor ranges, and jumper positions are also shown. An Economizer simulator program is available to help with Economizer training and troubleshooting.

Economizer Preparation

This procedure is used to prepare the Economizer 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.

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 contacts 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 S_O+. Connect 1.2 kilo-ohm 4074EJM checkout resistor across terminals S_O and S_O+.
8. Put 620-ohm resistor across terminals S_R and S_R+.
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 preparation procedure has been performed.
2. Place 620-ohm resistor across S_O and S_O+.
3. Place 1.2 kilo-ohm resistor across S_R and S_R+. The Free Cool LED should be lit.
4. Remove 620-ohm resistor across S_O and S_O+. The Free Cool LED should turn off.
5. Return Economizer settings and wiring to normal after completing troubleshooting.

Single Enthalpy

To check single enthalpy:

1. Make sure Economizer 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 settings and wiring to normal after completing troubleshooting.

DCV (Demand Control Ventilation) and Power Exhaust

To check DCV and Power Exhaust:

1. Make sure Economizer 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 Exhaust should turn on. The actuator should drive to between 90 and 95% open.
4. 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.
5. 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.
6. Turn the DCV and Exhaust potentiometers CCW until the Exhaust LED turns on. The exhaust contacts will close 30 to 120 seconds after the Exhaust LED turns on.
7. Return Economizer settings and wiring to normal after completing troubleshooting.

DCV Minimum and Maximum Position

To check the DCV minimum and maximum position:

1. Make sure Economizer preparation procedure has been performed.
2. 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.
3. Turn the DCV Maximum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
4. Turn the DCV Maximum Position potentiometer to fully CCW. The actuator should drive fully closed.
5. Turn the Minimum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
6. Turn the Minimum Position Potentiometer fully CW. The actuator should drive fully open.
7. Remove the jumper from TR and N. The actuator should drive fully closed.

8. Return Economizer settings and wiring to normal after completing troubleshooting.

Supply−Air Input

To check supply-air input:

1. Make sure Economizer preparation procedure has been performed.
2. Set the Enthalpy potentiometer to A. The Free Cool LED turns on. The actuator should drive to between 20 and 80% open.
3. Remove the 5.6 kilo-ohm resistor and jumper T to T1. The actuator should drive fully open.
4. Remove the jumper across T and T1. The actuator should drive fully closed.
5. Return Economizer settings and wiring to normal after completing troubleshooting.

Economizer Troubleshooting Completion

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

1. Disconnect power at TR and TR1.
2. Set enthalpy potentiometer to previous setting.
3. Set DCV maximum position potentiometer to previous setting.
4. Set minimum position, DCV set point, and exhaust\ potentiometers to previous settings.
5. Remove 620-ohm resistor from terminals S_R and S_R+.
6. Remove 1.2 kilo-ohm checkout resistor from terminals S_O and S_O+. If used, reconnect sensor from terminals S_O and S_O+.
7. Remove jumper from TR to N.
8. Remove jumper from TR to 1.
9. Remove 5.6 kilo-ohm resistor from T and T1. Reconnect wires at T and T1.
10. Remove jumper from P to P1. Reconnect device at P and P1.
11. Apply power (24 vac) to terminals TR and TR1.

Table 4 Economizer Input/Output Logic

INPUTS					OUTPUTS			
Demand Control Ventilation (DCV)	Enthalpy*		Y1	Y2	Compressor		N Terminal†	
	Outdoor	Return			Stage 1	Stage 2	Occupied	Unoccupied
							Damper	
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 N 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).

Figure 17 Economizer Functional View