

ECONOMIZERS

507231-02
6/2017
Supersedes 507231-01

ECONOMIZERS

INSTALLATION INSTRUCTIONS FOR ECONOMIZER AND OUTDOOR AIR HOOD USED WITH LGH/LCH242-360 UNITS

Shipping and Packing List

Economizer Package 1 of 1 contains:

Damper Assembly

- 1- Economizer damper assembly
- 1 Economizer end plate (secured to packaging)
- 1- Bag assembly containing:
 - #10-32 X 1/2 Thread forming screws
 - # 6-32 X 1 Machine screws
 - #10-16 X 5/8 Self-drilling screws
 - Wiring diagram

Hood Assembly

- 1- Hood top
- 1- Hood top seal
- 2- Hood sides
- 2- Front filter brackets
- 1- Back filter bracket
- 2- Filter side seals
- 5- Filters
- 1- Filler panel
- 1- Hood top stiffener

Note - Gravity exhaust dampers are required with economizers. Refer to installation instructions provided with gravity exhaust dampers.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional HVAC installer or equivalent, service agency, or the gas supplier

⚠ CAUTION

As with any mechanical equipment, contact with sharp sheet metal edges can result in personal injury. Take care while handling this equipment and wear gloves and protective clothing.

Application

The economizer is used with LG/LC 242-360 units in downflow air discharge applications. See table 1. The economizer uses outdoor air for free cooling when temperature and/or humidity is suitable. LG/LC units are equipped with the following factory-installed, CEC Title 24 approved sensors:

- RT17 - Outside Air Temperature
- RT16 - Return Air Temperature
- RT6 - Discharge Air Temperature

See figure 13 in the *Start-Up* section for sensor location.

Optional field-provided sensors may be used instead of unit sensors to determine whether outdoor air is suitable for free cooling. Refer to table 13 in the *Start-Up* section.

**TABLE 1
Economizer**

Kit Description	Part No.	
Standard	74W43	606207-01
High Performance	10U62	606207-04

Install Economizer

- 1- Disconnect all power to unit.
- 2- Release latches and open filter access panel.
- 3- Remove corner tabs from both ends of the economizer support bracket when the upper bracket is secured to the lower bracket with screws. Leave the tabs in place when brackets are spot-welded together. See figure 1 detail A and B.
- 4- Align bottom of economizer with economizer support bracket and slide economizer into unit. See figure 1.
- 5- Fit economizer end plate over end of economizer and secure end plate with sheet metal screws.
- 6- Connect economizer plug P3 to unit jack J3 as shown in figure 2.

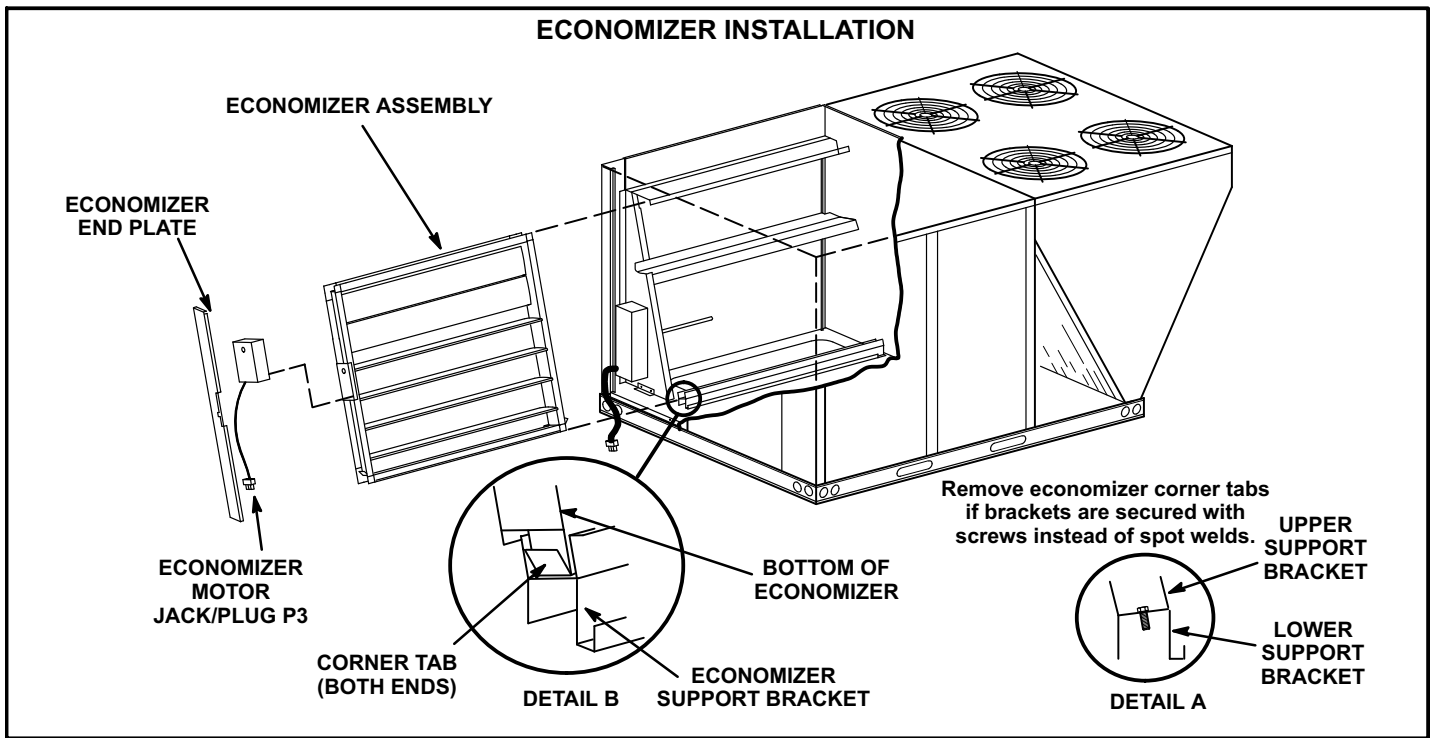


FIGURE 1

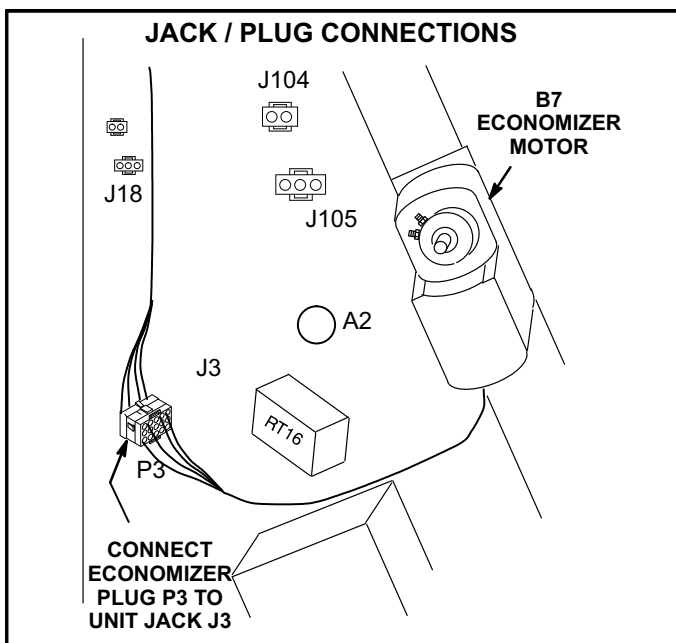


FIGURE 2

Outdoor Air Hood

The outdoor air hood is packaged separately but attached to the damper assembly crate. Assemble hood and install as follows:

- 1- Remove screws securing back panels and discard.
- 2- Secure filler panel to header. See figure 3.
- 3- Slide hood top seal under unit cabinet top; remove and retain screws securing top as needed. Secure top seal using retained screws. See figure 4 and 5.

- 4- Position filter side seals on hood sides; make sure brackets are on the INSIDE of the hood. Secure with screws provide. See figure 6.
- 5- Secure intake hood sides to hood top using four sheet metal screws on each side.
- 6- Align back filter bracket with holes in unit division panel. See figure 5. Secure with sheet metal screws.
- 7- Align hood stiffener screw holes with hood top screw holes. Secure with sheet metal screws.
- 8- Position hood top lip under top seal and slide hood assembly into place. See detail in figure 5. Secure intake hood sides to unit using screws provided.
- 9- Secure the longer front filter bracket flush with the left end of the hood top. Install all but last filter. See figures 4 and 7.
- 10- Slide last filter into the right corner of the back filter bracket. Slide the remaining (shorter) top filter bracket over the other end of the filter. Align the holes on the hood top with the holes on the shorter top filter bracket. Secure the the top filter bracket using sheet metal screws.

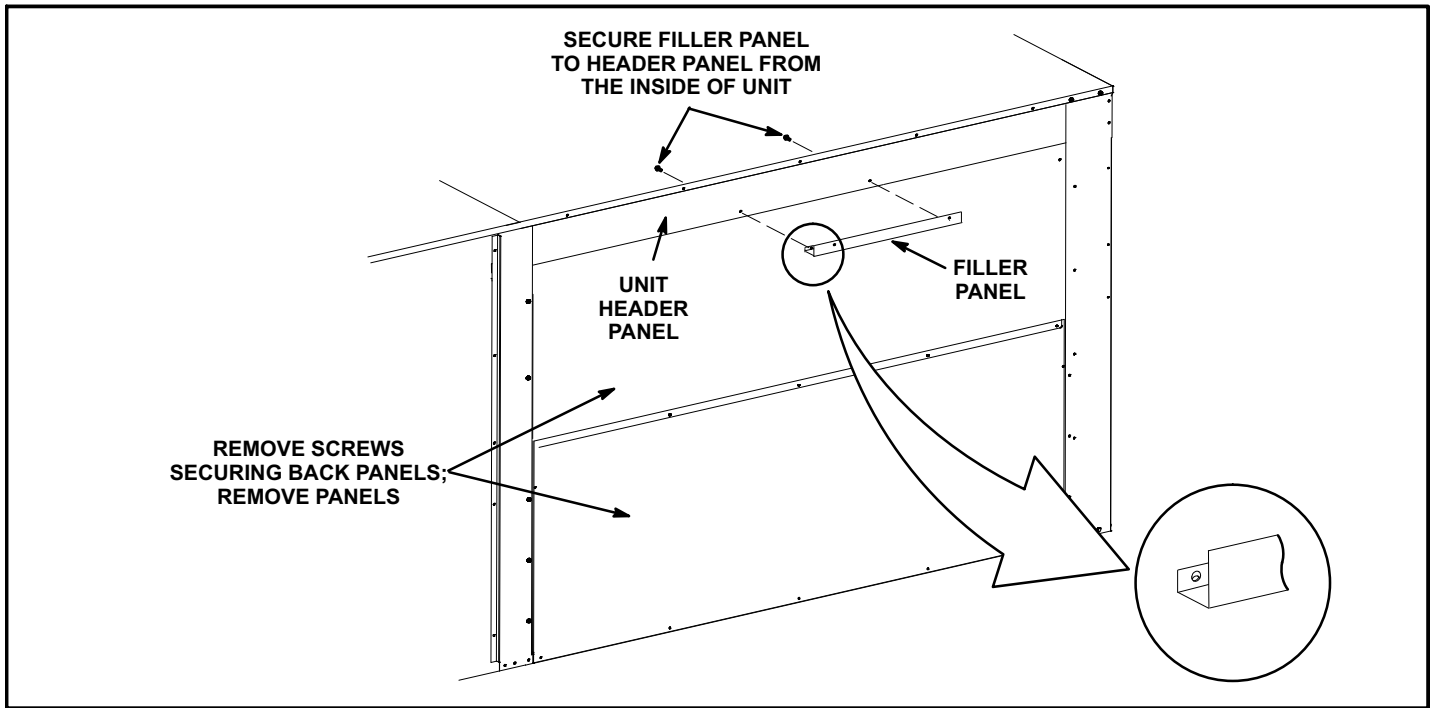


FIGURE 3

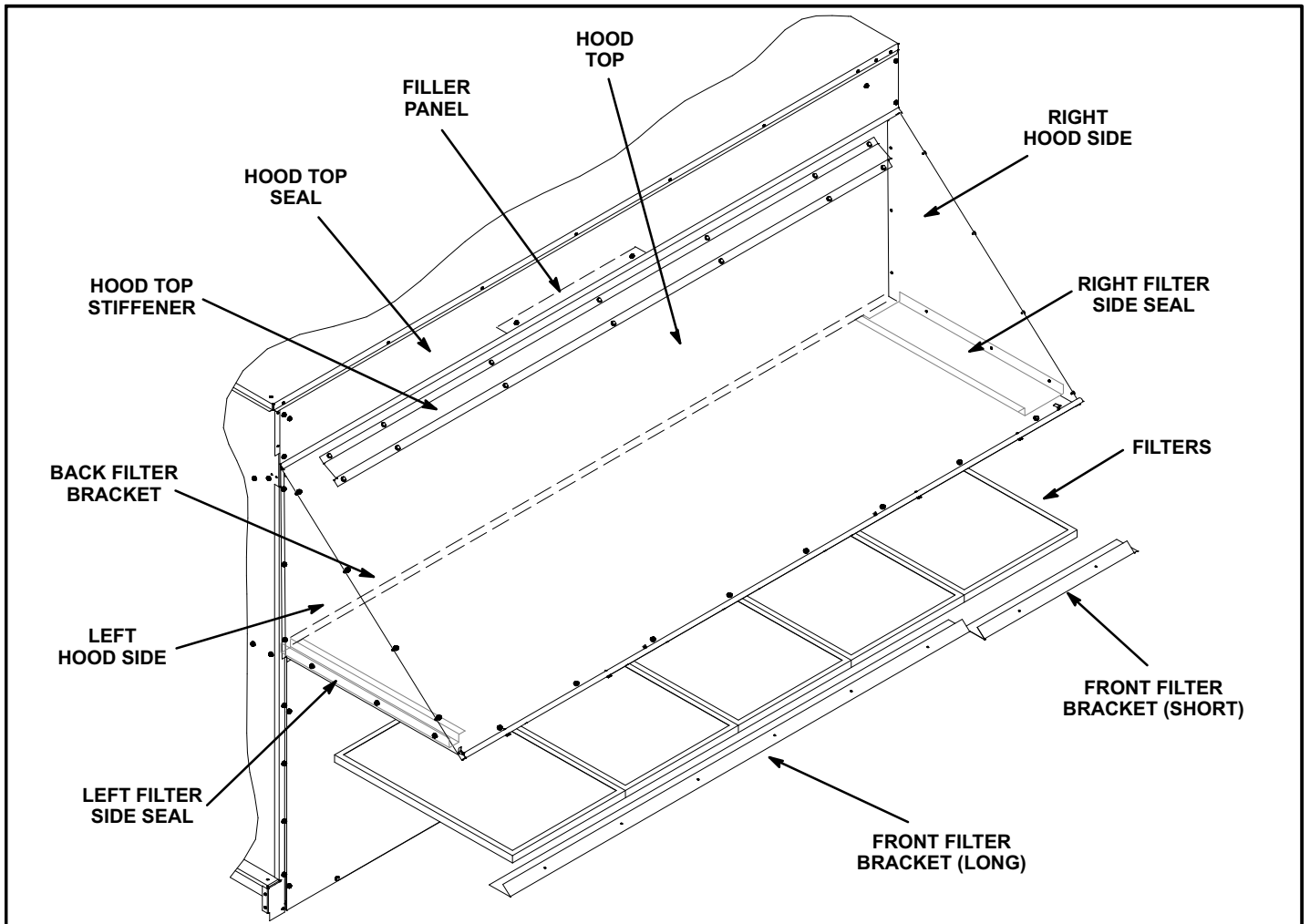


FIGURE 4

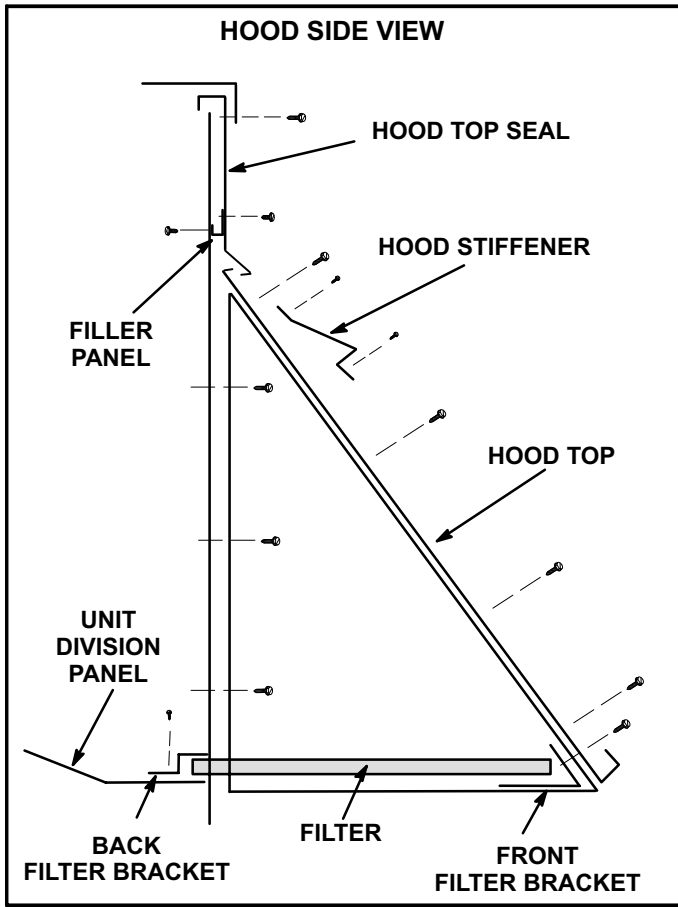


FIGURE 5

If the economizer is operating in the free cooling mode and the IAQ sensor demands more fresh air, the IAQ demand will override the free cooling demand to open the dampers further or to keep them open. A flashing OAS LED on the Unit Controller indicates an IAQ override condition.

The IAQ function is not energized during the unoccupied or night time period.

Economizer Operation

NOTE - Use indicating lights on Unit Controller to determine thermostat demand.

See table 2 for economizer operation with a standard two-stage thermostat

Table 3 shows economizer operation with an energy management system which uses a global sensor.

Both tables show the occupied and unoccupied time period. The occupied time period is determined by the thermostat or energy management system.

Table 4 shows economizer operation in zone sensor mode.

IAQ DAMPER OPERATION

The Unit Controller has a 0-10VDC IAQ input for a standard 0-2000ppm CO₂ sensor. The economizer starts opening at a CO₂ level of 500 ppm (default) and reaches full open at a CO₂ level of 1000ppm. These levels are adjustable as outlined in the Unit Controller manual under the menu *Settings>Setpoints>IAQ*.

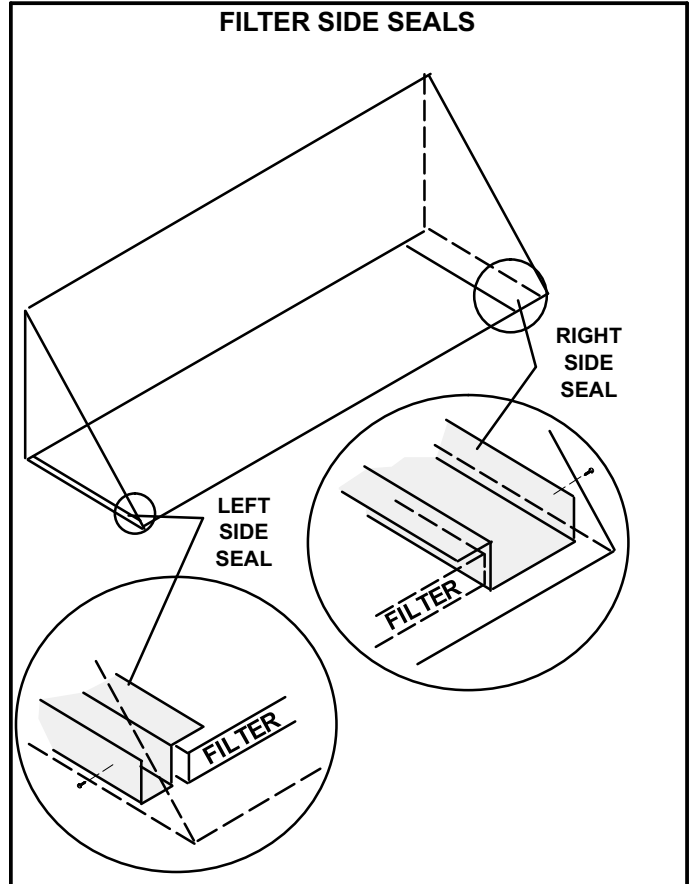


FIGURE 6

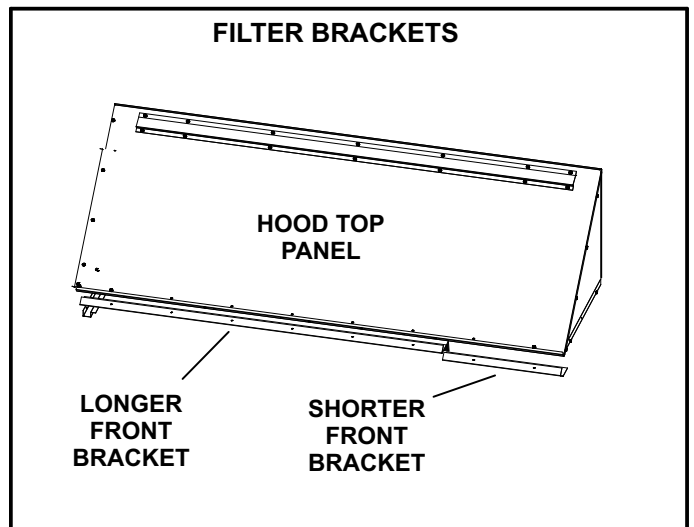
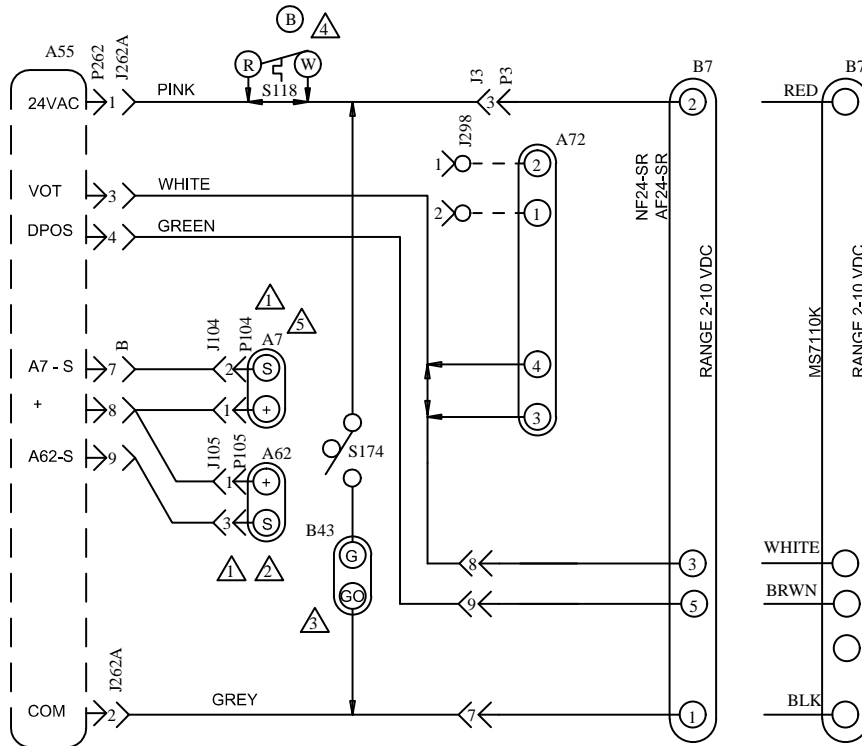
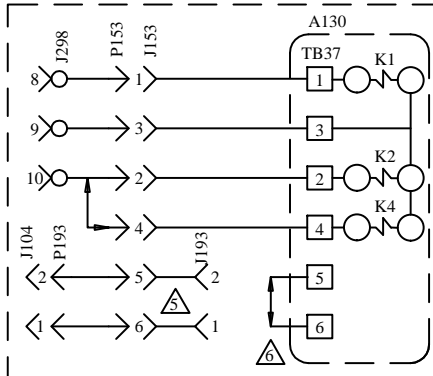


FIGURE 7



DESCRIPTION	
KEY	COMPONENT
A7	SENSOR, SOLID STATE ENTHALPY
A130	CONTROL, ERS
A55	CONTROL, MAIN PANEL LENNOX
A62	SENSOR, ENTHALPY INDOOR
A72	CONTROL, REMOTE MIN POS (OPT)
B7	MOTOR, DAMPER ECONOMIZER
B43	MOTOR, EXHAUST DAMPER
J3	JACK, UNIT ECONOMIZER
J104	JACK, SENSOR OUTDOOR ENTHALPY
J105	JACK, SENSOR RETURN AIR ENTHALPY
J153	JACK, ENTHALPY / DAMPER MOTOR
J193	JACK, ENTHALPY SENSOR
J298A	JACK, IAQ INTERFACE
J262A	JACK, DAMPER MOTOR
J262B	JACK, ENTHALPY SENSORS
P3	PLUG, ECONOMIZER BYPASS
P153	PLUG, ENTHALPY / DAMPER MOTOR
P193	PLUG, ENTHALPY SENSOR
P262	PLUG, ECONOMIZER OUTPUT
S118	THERMOSTAT, DESICANT DEFROST
S174	SWITCH, EXHAUST DAMPER



ENERGY RECOVERY WHEEL HOOK UP

- ⚠ DELETE A7 AND A62 (IF USED) FOR EITHER GLOBAL ENTHALPY OR SENSIBLE TEMPERATURE CONTROL
- ⚠ FOR UNIT DIFFERENTIAL ENTHALPY CONTROL, ADD A62 RETURN AIR ENTHALPY SENSOR
- ⚠ OPTIONAL EXHAUST DAMPER ACTUATOR TO HOLD EXHAUST DAMPER CLOSED WHEN OUTSIDE AIR DAMPER IS CLOSED
- ⚠ S118 USED ON 35 TO 50 TON ENERGECE UNITS WITH ENERGY RECOVERY WHEEL (ERW)
- ⚠ REPOSITION A7 ENTHALPY SENSOR FROM ROOFTOP UNIT ECONOMIZER INTO INTAKE HOOD OF THE ERW ROOFTOP UNIT
- ⚠ REMOVE JUMPER WHEN INSTALLING OPTIONAL LOW AMBIENT SWITCH

NOTE- THIS DIAGRAM USED ONLY WHEN ECONOMIZER OR MOTORIZED OUTDOOR AIR DAMPERS ARE INSTALLED.

————— DESIGNATES OPTIONAL WIRING
 - - - - - CLASS II FIELD WIRING

WIRING DIAGRAM		09/09
ACCESSORIES		
ENERGENCE™ SERIES ECONOMIZER AND MOTORIZED OAD PIVOTING WHEEL ENERGY RECOVERY SYSTEM OPTION		
SECTION D		
Supersedes	New Form No.	
	537189-01	

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**TABLE 2
ECONOMIZER OPERATION - Standard Two-Stage Thermostat (Default Option)**

THERMOSTAT DEMAND	DAMPER POSITION UNOCC.	DAMPER POSITION OCCUPIED	MECHANICAL COOLING
OUTDOOR AIR IS NOT SUITABLE FOR FREE COOLING--OAS LED "OFF"			
OFF	CLOSED	CLOSED	NO
G	CLOSED	MINIMUM	NO
Y1	CLOSED	MINIMUM	STAGE 1
Y2	CLOSED	MINIMUM	STAGES 1 AND 2
OUTDOOR AIR IS SUITABLE FOR FREE COOLING--OAS LED "ON"			
OFF	CLOSED	CLOSED	NO
G	CLOSED	MINIMUM	NO
Y1	MODULATING	MODULATING	NO
Y2	MODULATING	MODULATING (1)	STAGE 1

NOTE - Modulating dampers adjust to control supply air (RT6) to 55°F (13°C). (1) The Unit Controller goes into a "cool down" or "warm-up" mode when the occupied time period starts. (2) Units with two-stage compressor operation will operate only stage 1 with a Y2 demand.

**TABLE 3
ECONOMIZER OPERATION WITH GLOBAL SENSING - Energy Management System (Default Option)**

THERMOSTAT DEMAND	DAMPER POSITION UNOCC.	DAMPER POSITION OCCUPIED	MECHANICAL COOLING
GLOBAL INPUT OFF --OAS LED "OFF"			
OFF	CLOSED	CLOSED	NO
G	CLOSED	MINIMUM	NO
Y1	CLOSED	MINIMUM	STAGE 1
Y2	CLOSED	MINIMUM	STAGES 1 AND 2
GLOBAL INPUT ON --OAS LED "ON "			
OFF	MODULATING	MODULATING	NO
G	MODULATING	MODULATING	NO
Y1	MODULATING	MODULATING	STAGE 1
Y2	MODULATING	MODULATING (1)	STAGES 1 AND 2 (2)

NOTE - Modulating dampers adjust to control supply air (RT6) to 55°F (13°C). (1) The Unit Controller goes into a "cool down" or "warm-up" mode when the occupied time period starts. (2) Units with two-stage compressor operation will operate only stage 1 with a Y2 demand (default).

**TABLE 4
ECONOMIZER OPERATION - Zone Sensor Mode**

DEMAND	DAMPER POSITION UNOCC.	DAMPER POSITION OCCUPIED	MECHANICAL COOLING
OUTDOOR AIR IS NOT SUITABLE FOR FREE COOLING--OAS LED "OFF"			
OFF	CLOSED	CLOSED	NO
G	CLOSED	MINIMUM	NO
Cooling Stage 1	CLOSED	MINIMUM	COMPRESSOR 1
Cooling Stage 2	CLOSED	MINIMUM	COMPRESSOR 1 & 2
Cooling Stage 3	CLOSED	MINIMUM	COMPRESSOR 1, 2, & 3
Cooling Stage 4	CLOSED	MINIMUM	COMPRESSOR 1, 2, 3, & 4
OUTDOOR AIR IS SUITABLE FOR FREE COOLING--OAS LED "ON"			
OFF	CLOSED	CLOSED	NO
G	CLOSED	MINIMUM	NO
Cooling Stage 1	MODULATING	MODULATING	NO
Cooling Stage 2	FULL OPEN*	FULL OPEN*	COMPRESSOR 1
Cooling Stage 3	FULL OPEN*	FULL OPEN*	COMPRESSORS 1 & 2
Cooling Stage 4	FULL OPEN*	FULL OPEN*	COMPRESSORS 1, 2, 3, & 4

*Damper will modulate to maintain 55°F supply air when ECTO 6.27 is changed to setting "0". NOTE - Modulating dampers adjust to control supply air (RT6) to 55°F (13°C).

Free Cooling Differential Enthalpy - DIFF OFFSET

The Unit Controller allows damper modulation when outdoor air is lower than return air by a differential or offset temperature and humidity range. To set an offset range of 7°F at a constant relative humidity, enter “4” at the DIFF OFFSET menu prompt. If return air is 76°F, the Unit Controller will allow damper to modulate open at approximately 69°F outdoor air. See table 5. If the space temperature is too cool or dry, change the DIFF OFFSET to “3” and the Unit Controller will allow dampers to modulate open at approximately 71°F outdoor air.

**TABLE 5
FREE COOLING SETPOINT - DIFF OFFSET MODE**

*Temperature Offset °F	**Relative Humidity Offset %	Menu Entry mA	Counts
2	6	1	13

3.5	12	2	26
5.3	18	3	39
7	24	4	53

*At a constant relative humidity. **At a constant temperature.

E-Damper Minimum Position Setting

Use the menu path in figure 12 to set the minimum % open damper position when outdoor air is not suitable for free cooling. The minimum setpoint range is 0% open (dampers closed) to 100% (dampers fully open). On units with staged supply air blowers, refer to the unit installation instructions.

Economizer Start-Up 2.0 M3 Unit Controller

The economizer, when configured, controls:

- Damper position, which determines how much outdoor air is used to meet free cooling or indoor air quality requirements, and
- Optional power exhaust fans.

On a cooling demand, outdoor air is used for free cooling instead of first-stage compressor(s) when outdoor air is suitable.

1.1. Enabling Economizer and Settings

To enable the economizer, if installed, go to **SETUP >**

INSTALL and go through the wizard. When reaching **Configuration ID 1**, position **2** will need to be set to the applicable type of economizer. Valid types are as indicated below:

- **M** = Motorized Outdoor Air Damper Only
- **T** = Economizer - Temperature (*Note: Used for both set point and offset temperature control.*)
- **G** = Economizer - Global
- **S** = Economizer - Single Enthalpy
- **D** = Economizer - Dual Enthalpy

The following options are available depending on economizer setting above. These settings are available through the main menu at **SETUP > TEST & BALANCE > DAMPER**.

TABLE 6					
MENU INTERFACE (LEVEL 1 - SETTINGS) - M (MOTORIZED OUTDOOR AIR DAMPER ONLY)					
Level 2	Level 3	Level 4	Level 5	USE THE ADJUST AND SET VALUES ARROWS TO SCROLL UP OR DOWN FOR SELECTION OPTIONS.	
RTU OPTION	DAMPER	MIN DAMPER POSITION BLOWER ON HIGH = X.X %			
		MIN DAMPER POSITION BLOWER ON LOW = X.X %			
		DEMAND CONTROL VENT DAMPER START OPEN = XXXX.X PPM			
		DEMAND CONTROL VENT DAMPER FULL OPEN = XXXX.X PPM			
		DEMAND CONTROL VENT DAMPER MAX OPENING = XXX.X%			
		FRESH AIR HEATING ENABLE FAH = YES OR NO		FRESH AIR HEATING FAH SETPOINT = XX F	
		FRESH AIR COOLING ENABLE AFC = YES OR NO		FRESH AIR COOLING AFC SETPOINT = XX F	

TABLE 7					
MENU INTERFACE (LEVEL 1 - SETTINGS) - T (TEMPERATURE ECONOMIZER)					
Level 2	Level 3	Level 4	Level 5	USE THE ADJUST AND SET VALUES ARROWS TO SCROLL UP OR DOWN FOR SELECTION OPTIONS.	
RTU OPTION	DAMPER	ECONOMIZER TEMP ECON TYPE = TEMPERATURE OFFSET OR TEMPERATURE SETPT			
		ECONOMIZER OAT SETPOINT = XX.X F			
		FREE COOLING SUPPLY AIR SETPOINT = XX F			
		MIN DAMPER POSITION BLOWER ON HIGH = X.X %			
		MIN DAMPER POSITION BLOWER ON LOW = X.X %			
		DEMAND CONTROL VENT DAMPER START OPEN = XXXX.X PPM			
		DEMAND CONTROL VENT DAMPER FULL OPEN = XXXX.X PPM			
		DEMAND CONTROL VENT DAMPER MAX OPENING = XXX.X%			
		FRESH AIR HEATING ENABLE FAH = YES OR NO		FRESH AIR HEATING FAH SETPOINT = XX F	
		FRESH AIR COOLING ENABLE AFC = YES OR NO		FRESH AIR COOLING AFC SETPOINT = XX F	

**TABLE 8
MENU INTERFACE (LEVEL 1 - SETTINGS) - G (GLOBAL ECONOMIZER)**

Level 2	Level 3	Level 4	Level 5	USE THE ADJUST AND SET VALUES ARROWS TO SCROLL UP OR DOWN FOR SELECTION OPTIONS.
RTU OPTION	DAMPER	FREE COOLING SUPPLY AIR SETPOINT = XX F		
		MIN DAMPER POSITION BLOWER ON HIGH = X.X %		
		MIN DAMPER POSITION BLOWER ON LOW = X.X %		
		DEMAND CONTROL VENT DAMPER START OPEN = XXXX.X PPM		
		DEMAND CONTROL VENT DAMPER FULL OPEN = XXXX.X PPM		
		DEMAND CONTROL VENT DAMPER MAX OPENING = XXX.X%		
		FRESH AIR HEATING ENABLE FAH = YES OR NO	FRESH AIR HEATING FAH SETPOINT = XX F	
		FRESH AIR COOLING ENABLE AFC = YES OR NO	FRESH AIR COOLING AFC SETPOINT = XX F	

1.2. Damper Operation During Free Cooling

These are operating profile options for the economizer damper (Parameter 164 - ECONOMIZER PROFILE) during free cooling when any compressor is on and can be selected as follows:

Option 0: Damper continues to modulate while compressors are on, but the effect of mechanical cooling may force the damper closed to its minimum position. After compressor starts, the free cooling set point is lowered to fixed temperature setting of 45°F.

Option 1: Damper opens to its max-open position (Parameter 131 - FREE CL MAX DAMPER) when any of the compressors start.

NOTE - When using Option 1 and after the compressor is stopped, the M3 shall resume damper modulation.

Option 2: Is as follows:

- Holds-off compressor on Y2 call until damper has modulated to maximum position (Parameter 131 - FREE CL MAX DAMPER) for three minutes.
- After three minutes, the compressor starts and the free cooling set point is lowered to 45°F. Damper is not locked at maximum open while compressor is on, but modulates to maintain 45°F discharge air temperature.
- When Y2 is satisfied, compressor goes off and free cooling set point is restored to 55°F (Parameter 159 - FREE COOL SUPPLY SP).

Option 3: Same as Option 2, but with a ten-minute delay instead of a three-minute delay.

1.3. Free Cooling Compressor Lockout Mode and Low Ambient Set Point

Go to **SETTINGS > RTU OPTION > EDIT PARAMETER = 285 (FRCL COMP LCKOUT MD)**. Default value is 2. Range is 0 to 2.

- 0** = Disable Compressor Lockout
- 1** = Lockout Compressor if outdoor air is suitable regardless of outdoor air temperature.
- 2** = Lockout Compressor if outdoor air temperature is below Parameter 108 setting and Outdoor Air is Suitable (Default).

Go to **SETTINGS > RTU OPTION > EDIT PARAMETER = 108 (FREE LO AMB LCKT SP)**. Default value is 55.0°F. Range is 45.0 to 80.0°F.

1.4. Outdoor Air Suitable for Free Cooling

The M3 Unit Controller displays the outdoor air suitability information on the status screen.

The appropriate sensors are provided when the economizer is factory-configured. When the economizer is field-installed and configured, the single or dual enthalpy modes require additional field-provided sensor(s).

1.5. Enthalpy Set Point

This setting pertains to the single enthalpy free cooling mode only. The M3 Unit Controller will enable free cooling when outdoor air enthalpy (A7) is less than the enthalpy set point (Parameter 162 - ECON FREECL ENTH SP). Figure 8 shows the approximate enthalpy sensor output at various temperatures and percentage of relative humidity.

ENTHALPY SENSOR OUTPUT CURRENT HONEYWELL C7400

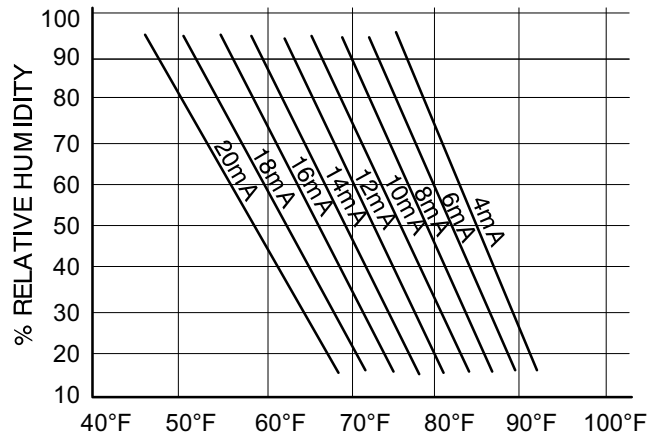


FIGURE 8

**TABLE 9
MENU INTERFACE (LEVEL 1 - SETTINGS) - SINGLE ENTHALPY**

The following settings are available when **Configuration ID 1**, position **2** is set to **S** (Single Enthalpy)

Level 2	Level 3	Level 4	USE THE ADJUST AND SET VALUES ARROWS TO SCROLL UP OR DOWN FOR SELECTION OPTIONS.
RTU OPTION	DAMPER	ECONOMIZER ENTHALPY SETPOINT = XX.X MA	ENTHALPY SET POINT 73°F 70°F 67°F 63°F
		FREE COOLING SUPPLY AIR SETPOINT = XX.X F	MA SETTING 12.0 13.6 15.5 17.6
		MIN DAMPER POSITION BLOWER ON HIGH = X.X %	CLIMATE ZONE 1, 3, 5, 11-16
		MIN DAMPER POSITION BLOWER ON LOW = X.X %	7
		DEMAND CONTROL VENT DAMPER START OPEN = XXXX.X PPM	SINGLE SENSIBLE 75.0°F
		DEMAND CONTROL VENT DAMPER FULL OPEN = XXXX.X PPM	73.0°F
		DEMAND CONTROL VENT DAMPER MAX OPENING = XXX.X%	71.0°F
		FRESH AIR HEATING ENABLE FAH = YES OR NO	69.0°F
		FRESH AIR HEATING ENABLE FAH = YES OR NO	FRESH AIR HEATING FAH SETPOINT = XX F
		FRESH AIR COOLING ENABLE AFC = YES OR NO	FRESH AIR COOLING AFC SETPOINT = XX F

TABLE 10
MENU INTERFACE (LEVEL 1 - SETTINGS) - DUAL ENTHALPY

The following settings are available when **Configuration ID 1**, position **2** is set to **D** (Dual Enthalpy)

Level 2	Level 3	Level 4	USE THE ADJUST AND SET VALUES ARROWS TO SCROLL UP OR DOWN FOR SELECTION OPTIONS.			
RTU OPTION	DAMPER	ECONOMIZER ENTHALPY OFFSET = X.XX MA	TEMP OFFSET* °F	RELATIVE HUMIDITY OFFSET %**	MA SETTING	
			2	6	1.0	
			3.5	12	2.0	
			5.3	18	3.0	
			7	24	4.0	
			* AT A CONSTANT RELATIVE HUMIDITY.			
			** AT A CONSTANT TEMPERATURE			
			FREE COOLING SUPPLY AIR SETPOINT = XX F	CLIMATE ZONE 1, 3, 5, 11-16	SINGLE SENSIBLE 75°F	
				2, 4, 10	73°F	
				6, 8, 9	71°F	
	7	69°F				
	MIN DAMPER POSITION BLOWER ON HIGH = X.X %					
	MIN DAMPER POSITION BLOWER ON LOW = X.X %					
	DEMAND CONTROL VENT DAMPER START OPEN = XXXX.X PPM					
	DEMAND CONTROL VENT DAMPER FULL OPEN = XXXX.X PPM					
	DEMAND CONTROL VENT DAMPER MAX OPENING = XXX.X%					
	FRESH AIR HEATING ENABLE FAH = YES OR NO	FRESH AIR HEATING FAH SETPOINT = XX F				
	FRESH AIR COOLING ENABLE AFC = YES OR NO	FRESH AIR COOLING AFC SETPOINT = XX F				

1.6. Free Cooling Damper Maximum Position

Damper Maximum position for free cooling is by default set to 100%. To modify this settings, use the following path:

SETTINGS > RTU OPTION > EDIT PARAMETER - 131 (FREE CL MAX DAMPER)

1.7. Minimum Damper Position

Use the following menu path to modified the minimum damper positions for both high and low operations.

SETUP > TEST & BALANCE > DAMPER > MIN DAMPER POSITION BLOWER ON HIGH = .%

SETUP > TEST & BALANCE > DAMPER > MIN DAMPER POSITION BLOWER ON LOW = .%

1.8. Motorized Outdoor Air Damper

Set damper position according to “Minimum Damper Position” section 1.7. For normal operation, make sure the motorized outdoor air damper is set correctly in **Configuration ID 1**, position **2** needs to be set to **M**. The damper will open to the specified position during the occupied time period and close during the unoccupied time period.

NOTE - When equipped with Motorized Outdoor damper Air Damper, Prodigy 2.0 provides only Demand Control Ventilation. Free Cooling/Economizer function is not available.

1.9. Economizer Checkout

The following checkout procedures are completed with unit energized. Step 1 will determine whether the economizer is allowing full damper travel. Use step 2 when the damper does not respond to step 1.

Steps 3, 4, 5, and 6 checkout the operating modes; checkout only the mode that applies to the unit being worked on.

⚠ CAUTION

Power exhaust fans will be functional. To prevent operation of power exhaust fans, disconnect power to unit and then PED jack/plug P/J18.:

Step 1. ECONOMIZER OUTPUT VOLTAGE

The M3 Unit Controller monitors P262 (DPOS) and operates as reference in Section *Damper Diagnostics in the Prodigy 2.0 (M3 Unit Controller) Application Guide (Advance Features)*.

- A** Go to **SERVICE > TEST > DAMPER>POSITION > DAMPER POSITION ACTUAL: 0.0%** The motor will slowly modulate to the closed position.

- B Change DAMPER POSITION ACTUAL to 100.0%.The motor will slowly modulate to the fully opened position.
- C If the motor does not respond, go to step 2. If the motor does respond properly, go to the appropriate mode of operation checkout.

Step 2. OUTPUT VOLTAGE CHECK

- A Go to **SERVICE > TEST > DAMPER > POSITION > DAMPER POSITION ACTUAL: 0.0%**
- B Adjust the DAMPER POSITION ACTUAL: to 0.0% position.
- C Measure the voltage on P262 between pin 3 (VOT damper control) and pin 2 (GND) **using pin 1 as common**. Voltage should read approximately 2 VDC.
- D Adjust the DAMPER POSITION ACTUAL: to 100.0% position.

***NOTE** - Allow approximately 90 seconds for actuator to react.*
- E Measure the voltage between P262 between pin 3 (VOT damper control) and pin 2 (GND) **using pin 1 as common**. Voltage should read approximately **10 volts DC**. If not, check wiring and trouble shoot system.

Step 3. SINGLE ENTHALPY OPERATION (ODE)

In the single enthalpy mode, dampers open for free cooling when the outdoor enthalpy is less than the enthalpy set point (Parameter 162 - ECON FREECL ENTH SP); dampers will try to modulate discharge air temperature (RT6) to (Parameter 159 - FREE COOL SUPPLY SP) which has a default setting of 55.0°F (13°C).

- A Go to **SETUP > INSTALL > press SAVE** until you get to the **Configuration ID 1**, position **2** needs to be set to **S** for Economizer - Single Enthalpy and press **SAVE**.
- B To simulate low outdoor enthalpy. Disconnect A7 outdoor enthalpy sensor jack/plugs J/P104. Connect a 750 ohm resistor across plug J104-1 and J104-2. J104 is located in the filter access area.
- C Check all connections and wiring between J104 and the control.

Step 4. DUAL ENTHALPY MODE OF OPERATION

In dual enthalpy mode, dampers open for free cooling when the outdoor air enthalpy is lower than the return air enthalpy by difference value of (Parameter 163 - ECN FRCL ENTH OFFST); dampers will modulate discharge air temperature (RT6) to (Parameter 159 - FREE COOL SUPPLY SP) which has a default setting of 55.0°F (13°C).

- A Go to **SETUP > INSTALL > press SAVE** until you get to the **Configuration ID 1** position **2** needs to be set to **D** for Economizer - Dual Enthalpy and press **SAVE** if performing an economizer field-install.
- B Use two resistors to simulate outdoor air enthalpy suitable.

- Disconnect A62 return air enthalpy sensor jack/plug J/P105. Place a 1500 ohm resistor between J105-1 and J105-3. J/P105 is located in the filter access area.
- Disconnect A7 outdoor enthalpy sensor jack/plugs J/P104. Connect a 750 ohm resistor across J104-1 and J104-2.

Step 5. ALL TEMPERATURE MODES OF OPERATION

In the Economizer – Temperature mode, the damper opens for free cooling when the outdoor air temperature is:

- Less than return air temperature by at least a difference of (Parameter 161 - ECON FRCL TMP OFFST) if Temperature Offset mode is selected
- Less than (Parameter 160 - ECON FREECL TEMP SP)

In all modes, dampers will try to modulate discharge air temperature (RT6) to (Parameter 159 - FREE COOL SUPPLY SP) which has a default setting of 55.0°F (13°C).

Refer to the “Displaying Sensor Inputs” section to read return air (RT16) and outdoor air (RT17) temperatures. If outdoor air is not cooler than return air, simulate a colder outdoor air temperature with a resistor. Select a resistor value that corresponds to a temperature (see table 11):

- A Locate RT17 sensor in unit. Disconnect 1/4" quick connect terminals on wires leading from sensor.
- B Jumper RT17 wires leading back to control with the appropriate resistor.
- C Check all connections and wiring between RT17 and the M3 Unit Controller, and between RT16 and the M3 Unit Controller.

TABLE 11 TMP MODE RESISTOR VALUES							
Temp. °F (°C)	Size Resist or	Temp . °F (°C)	Size Resist or	Temp . °F (°C)	Size Resist or	Temp . °F (°C)	Size Resist or
30 (-1)	34,56 6	50 (10)	19,90 4	70 (21)	11,88 4	90 (32)	7,332
40 (4)	26,10 6	60 (16)	15,31 3	80 (27)	9,298	100 (38)	5,826

Step 6. GLOBAL MODULATING (GLO) MODE OF OPERATION

In the GLO (modulating) mode, dampers modulate open for free cooling when the global input is energized; dampers will try to modulate discharge air temperature (RT6) to (Parameter 159 - FREE COOL SUPPLY SP) which has a default setting of 55.0°F (13°C).

***NOTE** - The global input turns on the blower.*

- A Set **global** mode using the **Configuration ID 1**, position **2**, and set to character **G**.

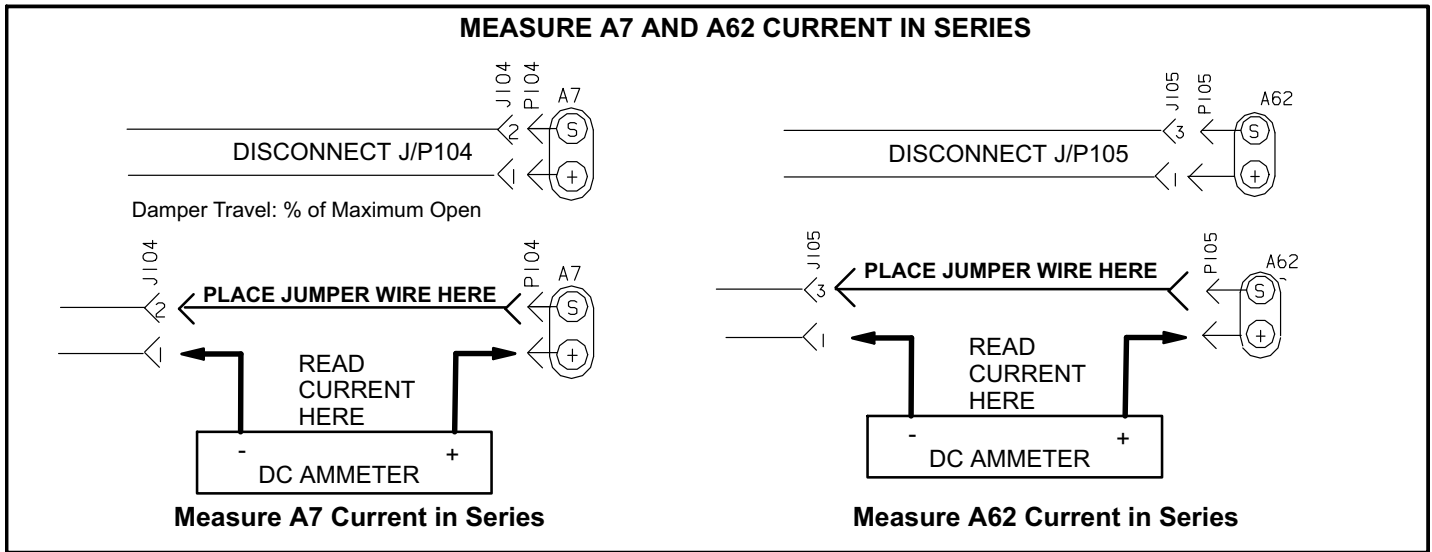


FIGURE 9

- B** Connect a jumper between A55_P297-1 (24VAC) and A55_P297-9 (global). The blower will be energized and the damper will slowly open if discharge air temperature (RT6) is greater than (Parameter 159 - FREE COOL SUPPLY SP) which has a default setting of 55.0°F (13°C).
- C** Disconnect 24VAC to A55_P297-9. The blower will turn off and the damper will close.
- D** If the damper does not actuate check all connections and wiring between P262A and B.

Step 7. ENTHALPY SENSOR OPERATION (A7 and A62)

- A** Connect a direct current ammeter as shown in figure 9 to measure current output of A7 or A62.

NOTE - If Enthalpy Sensors are configured, current sensor reading by M3 controller can be verified on User interface:

- B** The reading will be between 4 and 20 ma. depending on outdoor temperature and humidity. Refer to figure 8 to approximate reading.

Go to **DATA > IN/OUTPUTS > SENSORS > LOCAL** (scroll down to **IE: x.x mA** and **OE: x.x mA**)

- C** If the meter reads zero, check sensor wiring harness for continuity and/or check polarity of sensor wiring.

1.10. Demand Control Ventilation

1.10.1. General

A field-provided and installed indoor air quality (IAQ) sensor can be used with the modulating economizer or OADM to control carbon dioxide levels in the conditioned space. The carbon dioxide level in a space is an indicator of the number of people occupying a room. As the carbon dioxide level rises (indicating the occupancy of a room has increased), dampers modulate open - regardless of outdoor air suitability. Likewise, as the carbon dioxide level falls (indicating the occupancy has decreased), dampers modulate further closed.

Standard economizer installations have a minimum fresh air ventilation requirement based on maximum room occupancy. With standard economizer use, the amount of air required for maximum room occupancy is heated or cooled with each heating or cooling cycle. IAQ installations use the maximum amount of required ventilation air only with maximum room occupancy; less outdoor air needs to be heated or cooled when fewer people are in the conditioned space.

If the economizer is operating in the free cooling mode and the indoor air quality control requires the damper to open further, the indoor air quality demand will override the free cooling demand.

The IAQ function is not energized during the unoccupied or night time period.

NOTE - The IAQ sensor may also be used with systems containing a motorized outdoor air damper.

1.10.2. Default Operation

The M3 Unit Controller has a 0-10VDC indoor air quality input for a standard 0 - 2000ppm carbon dioxide sensor. The economizer starts opening at a carbon dioxide level of 500 ppm (default) (start open set point) and reaches full open at a carbon dioxide level of 1000ppm (default) (full open set point).

The damper opens to a default position of 100% (see Parameter 117). Determine damper travel position using the following formula.

$$\% \text{ Damper Travel} = \frac{\text{carbon dioxide ppm} - \text{Start Open ppm}}{5}$$

Example: At a carbon dioxide level of 750ppm, the damper will be approximately 50% open:

$$\% \text{ Damper Travel} = \frac{750-500}{5} = 50\%$$

Use the menu interface to read carbon dioxide ppm. **DATA > IN/OUTPUTS > SENSORS > C02**. Figure 10 shows default or proportional operation.

1.10.3. Maximum and Minimum Demand Control Ventilation Damper Settings

Maximum position is set using the following menu path:

Go to **SETUP > TEST & BALANCE > DAMPER > DAMPER MAX OPENING = .%**

Use the following menu path to modify the minimum damper positions for both high and low blower operations.

Go to **SETUP > TEST & BALANCE > DAMPER > MIN DAMPER POSITION BLOWER ON HIGH = .%**

Go to **SETUP > TEST & BALANCE > DAMPER > MIN DAMPER POSITION BLOWER ON LOW = .%**

1.10.4. Parameter Adjustments

Default indoor air quality economizer operation is based on common or average applications. Adjustments may be made to the indoor air quality parameters to alter operation or meet required specifications. Use the user interface to change Parameter 117 through 119. Go to **SETTINGS > RTU OPTIONS > EDIT PARAMETER**

Select a demand control ventilation mode with Parameter 134. Modes 3 and 4 will bring on the unit blower when demand control ventilation calls for maximum damper open, and returns to auto-blower when demand control ventilation damper returns to 0. The other modes only operate when the unit blower is on, but will not bring it on themselves.

Some applications require a different carbon dioxide set point range than default settings. Damper “start open” (Parameter 118 and “full open” (Parameter 119) carbon dioxide set points may be adjusted from 0 to 2000 ppm. Use the following formula to determine damper travel.

NOTE - When changing carbon dioxide set point range, “start open” set point should be less than “full-open” set point.

$$\% \text{ Damper Travel} = \frac{\text{carbon dioxide ppm} - \text{Start Open ppm} \times \text{Max Open (Parameter 117)}}{\text{Full Open} - \text{Start Open}}$$

Example: An application requires the dampers open at 800 CO₂ ppm and reach full open at 1200. If the carbon dioxide level in the space reads 1000 ppm, calculate the damper percent open as follows.

$$\% \text{ Damper Travel} = \frac{1000 - 800}{1200 - 800} \text{ or } \frac{200}{400} \text{ or } .5 = 0.5 \times 100 = 50\%$$

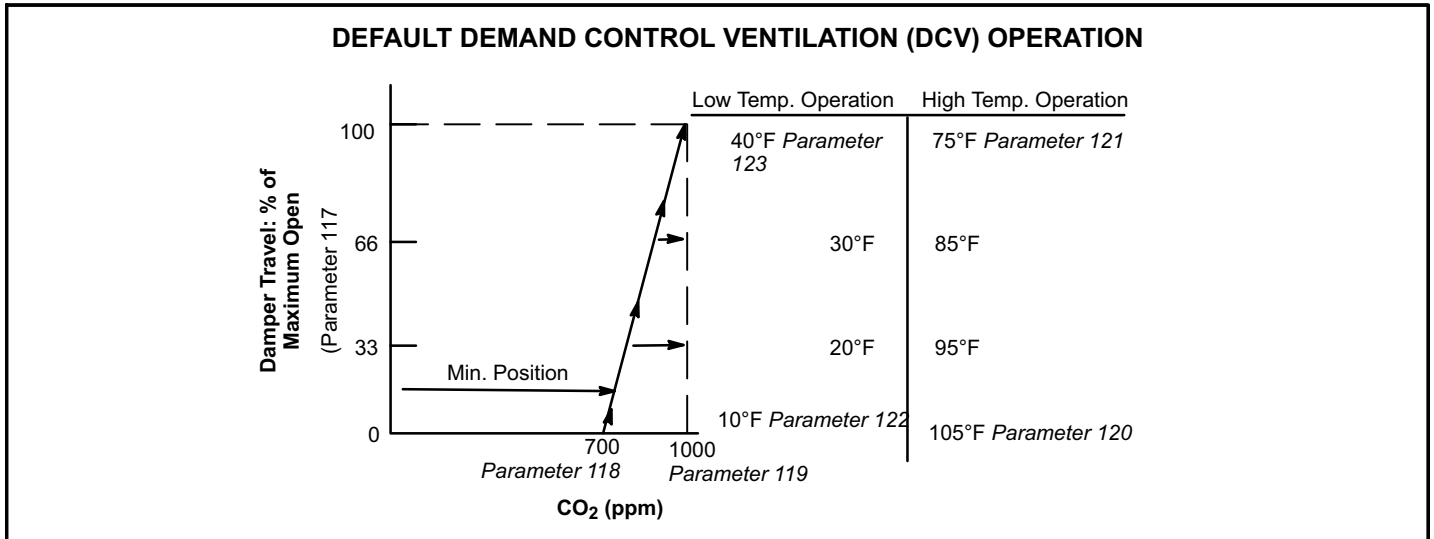


FIGURE 10

**TABLE 12
DEMAND CONTROL VENTILATION PARAMETERS**

Control Parameter			Control Value			Units	Description
No	Screen Name	Parameter Short Description	Min.	Default	Max.		
117	DCV MAX DAMPER OPEN	Demand Control Ventilation Maximum Damper Open	0	100	100	%	Maximum allowed demand control ventilation damper open position.
118	DCV DAMP START OPEN	Demand Control Ventilation Damper Start Open	0	700	2000	PPM	<ul style="list-style-type: none"> • Damper "start open" CO₂ set point for Demand Control Ventilation. • Level where fresh air damper begins to open.
119	DCV DAMP FULL OPEN	Demand Control Ventilation Maximum Damper Full Open Set Point	0	1200	2000	PPM	<ul style="list-style-type: none"> • Damper "full open" CO₂ set point for Demand Control Ventilation. • Level where fresh air damper is opened to maximum.
120	DCV HI TMP OV FL CL	Demand Control Ventilation Outdoor Air Control Hi Temperature Override Full Closed	-31.0	105.0	132.0	°F	High outdoor air temp. where fresh air damper is closed to minimum position.
121	DCV HI TMP OV ST CL	Demand Control Ventilation Outdoor Air Control Hi Temperature Override Start Closing	-31.0	75.0	132.0	°F	High outdoor air temperature where fresh air damper begins to close.
122	DCV LO TMP OV FL CL	Demand Control Ventilation Outdoor Air Control Low Temperature Override Full Closed	-31.0	10.0	132.0	°F	Low outdoor air temperature where fresh air damper is closed to minimum position
123	DCV LO TMP OV ST CL	Demand Control Ventilation Outdoor Air Control Low Temperature Override Start Closing	-31.0	40.0	132.0	°F	Low outdoor air temp. where fresh air damper begins to close.
134	IAQ INPUT MODE	Indoor Air Quality Input Mode	0	1	6	Option	<p>IAQ input source and mode (0-3 operate only when blower is on).</p> <p>0- Demand Control Ventilation System Indoor Air Quality. Either P298-3 or network indoor air quality.</p> <p>1- Demand Control Ventilation System Indoor Air Quality. Either P298-3 or network Indoor Air Quality with no outdoor air temperature limits.</p> <p>2- Outdoor Air Control Sensor A24 (A133_P194-6) (TB22-6).</p> <p>3- Outdoor Air Control Sensor A24 (A133_P194-6) (TB22-6) with no outdoor air temperature limits.</p> <p>4- Demand Control Ventilation System Indoor Air Quality. Either P298-3 or network Indoor Air Quality with blower on/auto operation.</p> <p>5- Demand Control Ventilation System Indoor Air Quality. Either P298-3 or network Indoor Air Quality with blower on/auto operation with no outdoor air temperature limits.</p>

1.10.4.1. Set Point Control Option

Set point control mode is commonly used in areas with high occupancy and frequent change out such as classrooms or conference rooms.

In applications requiring this on/off damper response to carbon dioxide levels, set the start open (Parameter 118 - DCV DAMP START OPEN) set point higher than the full open (Parameter 119 - DCV DAMP FULL OPEN) set point. The dampers will drive to fully-open position immediately. Figure 11 shows the set point control option.

Change Parameters 122 and 123 to set the minimum outdoor temperature limits. Change Parameters 120 and 121 to set the maximum temperature limits.

⚠ IMPORTANT

Mixed air temperatures less than 45°F (7°C) on units with an aluminized heat exchanger or less than 30°F (-1°C) on stainless steel heat exchangers will void the manufacturer's warranty.

1.10.4.2. Determining Indoor Air Quality Inputs

Go to **DATA> IN/OUTPUTS > SENSORS** menu selection from the M3 Unit Controller menu display.

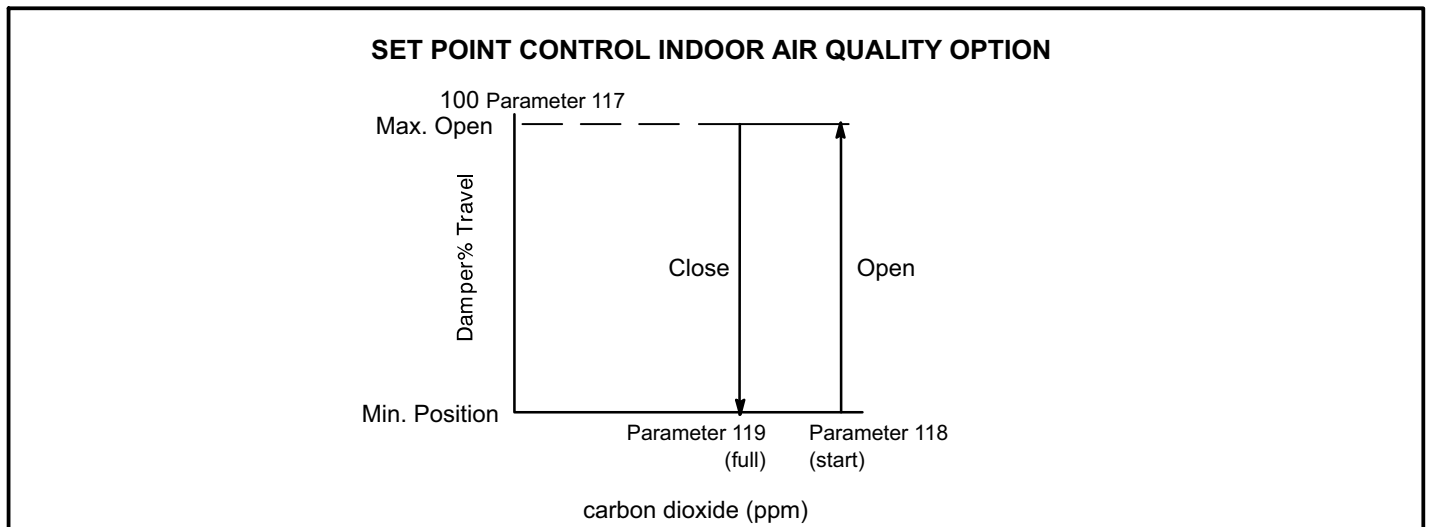


FIGURE 11

Economizer Start-Up M2 Unit Controller

The economizer is controlled by the Unit Controller which is located in the unit control panel. A detailed menu layout can be found in the Unit Controller manual provided with each unit.

A-Field-Installed Economizer

The Unit Controller must be set to identify an economizer has been installed.

1. Use the Unit Controller keypad to enter the following menu:
Setting / Install / Damper
2. Use the up/down arrows to display ECON and press the SELECT button (!SET! will display).
3. Press the left arrow returning up the menu path until the Unit Controller resets and saves the change.

The Unit Controller will now operate the economizer.

B-Free Cooling Mode and Setpoint

On start-up, the economizer mode defaults to TEMP OFFSET. In this mode, free cooling is energized when the outdoor air temperature (RT17) is less than return air temperature (RT16) by at least the offset value. The default offset value is 10°F. Use the following menu path on the Unit Controller to adjust the free cooling mode or setpoint. See figure 13 for sensor location.

Settings / Setpoints / Damper / Economizer Mode

Refer to table 13 and figure 12 for additional free cooling modes and setpoints. The Unit Controller has a restricted range of input values for each mode as shown in table 13.

Note - An energy management system may be used to provide the outdoor air suitable (OAS) signal via network connection. The free cooling mode must be set to one of the TEMP modes to allow this function.

C-California Title 24 Compliance

For California Title 24 compliance, adjust the free cooling setpoint based on:

- The climate zone where the unit is installed. See table 14.
- The setpoint requirement published by the California Energy Commission. See Section 140.4 - Prescriptive Requirements for Space Conditioning Systems of the 2013 Building Energy Efficiency Standards.

Note - Values in the referenced standard will supersede values listed in table 14.

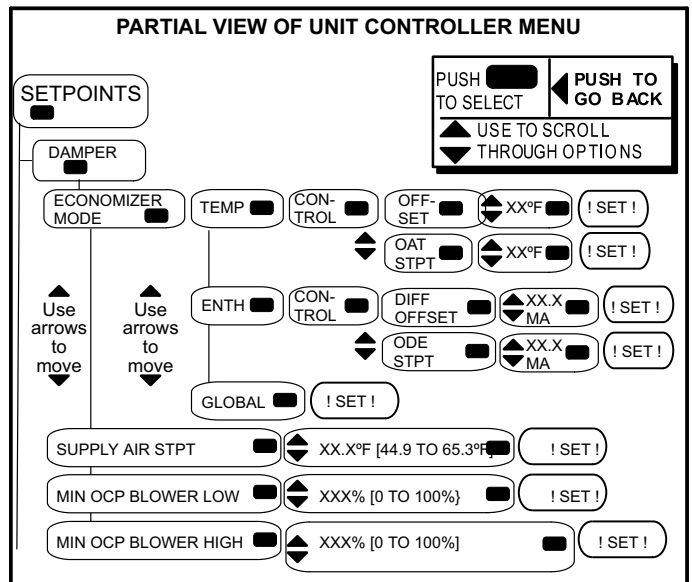


FIGURE 12

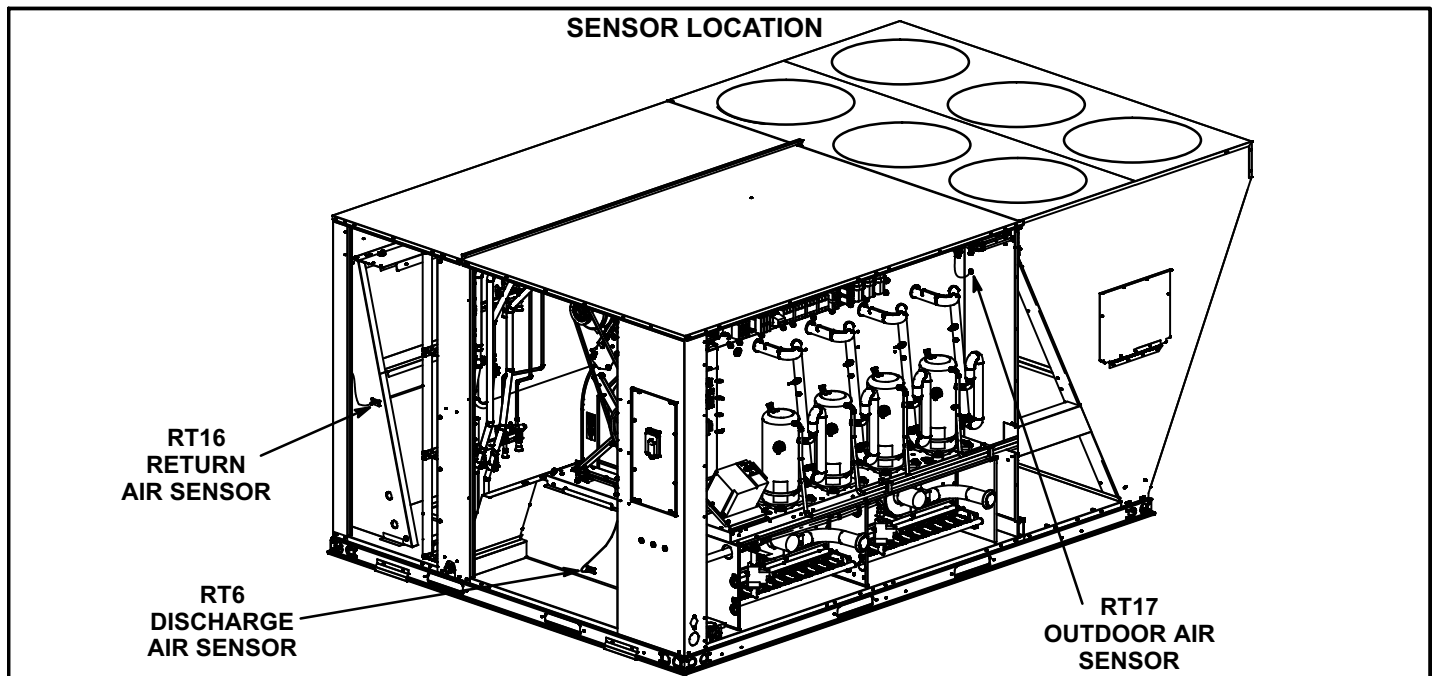


FIGURE 13

**TABLE 13
ECONOMIZER MODES AND SETPOINT**

Free Cooling Mode	Free Cooling Setpoint	Field-Provided Sensors	Dampers will modulate to 55°F discharge air (RT6) when outdoor air is suitable:	Permitted Inputs
TEMP	OFFSET	None Needed	Outdoor air temperature (RT17) is less than return air temperature (RT16) by at least the OFFSET value.	0-40°F
TEMP	OAT STPT	None Needed	Outdoor air temperature (RT17) is less than the OAT STPT value.	41-75°F
Remote	Remote	Energy Management System**	Either of the TEMP modes can be used when a network OAS signal is provided by an energy management or building control system, via BACnet, LonTalk, or L Connection. The network can command OAS, NOT OAS, or AUTO. AUTO returns to local control of OAS, which is the selected TEMP mode.	NA
ENTH	DIFF OFFSET	(Two) C7400	Outdoor air enthalpy* (A7) is less than return air enthalpy (A62) by at least the OFFSET value.	0mA-4mA
ENTH	ODE STPT	C7400	Outdoor air enthalpy (A7) is less than free cooling setpoint.	12-19mA
GLOBAL	GLOBAL	24VAC Input Signal	Global input is energized by (P297-9). This setting is also used for outdoor air damper applications. Global input also brings on the blower. (This mode is NOT used when OAS signal is provided via network connection. GLO is only used when a 24VAC signal is used to energize the P297-9 GLO input.)	NA

*Enthalpy includes effects of both temperature and humidity.

**Energy management system may require additional field-provided sensors; refer to manufacturer's instructions.

**TABLE 14
FREE COOLING SETPOINT**

Climate Zone	Setpoint (Single Sensible)	Setpoint (Differential Sensible)
1, 3, 5, 11-16	75°F	0°F
2, 4, 10	73°F	2°F
6, 8, 9	71°F	4°F
7	69°F	6°F

D-Setting Free Cooling Setpoint in Enthalpy Mode

Free Cooling Setpoint - ODE STPT

The enthalpy sensor (A7) provides a milliamp signal to the Unit Controller based on outdoor air temperature and humidity. See table 15. To set a free cooling setpoint of 73°F at 50% relative humidity, enter "12" at the ODE STPT menu

prompt. The Unit Controller will allow dampers to modulate open at approximately 73°F. If the space temperature is too warm, change the ODE STPT to "13.6" and the Unit Controller will allow dampers to modulate open at approximately 70°F.

**TABLE 15
FREE COOLING SETPOINT - ODE STPT MODE**

Enthalpy Setpoint °F (°C)*	Menu Entry - mA	Counts
73 (23)	12.0	150
70 (21)	13.6	173
67 (19)	15.5	199
63 (17)	17.6	224

*Approximate temperature at 50% relative humidity.