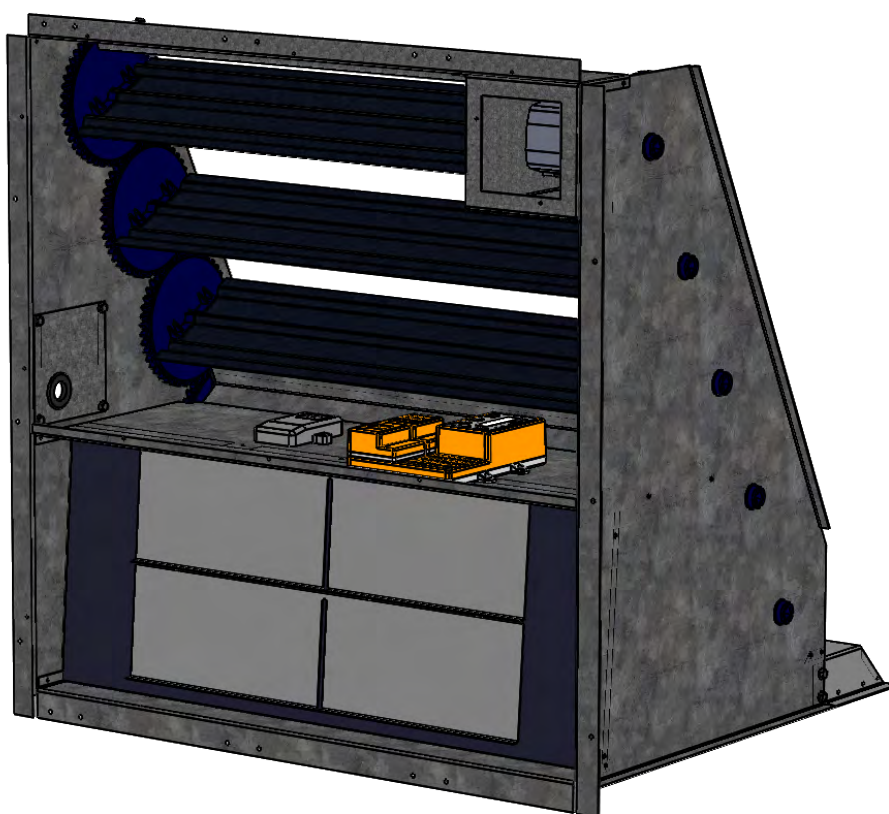


# INSTALLATION INSTRUCTIONS FOR

## 3-12.5 TON YORK PREDATOR GEN 6 OR OLDER ECONOMIZER

### DOWNSHOT CONFIGURATION



CAS PART NUMBER 1025869

**READ COMPLETELY BEFORE INSTALLING!!!**

CAMBRIDGEPORT IS NOT RESPONSIBLE FOR IMPROPERLY INSTALLED EQUIPMENT

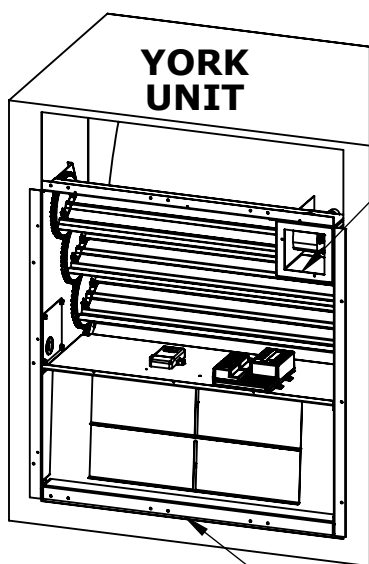
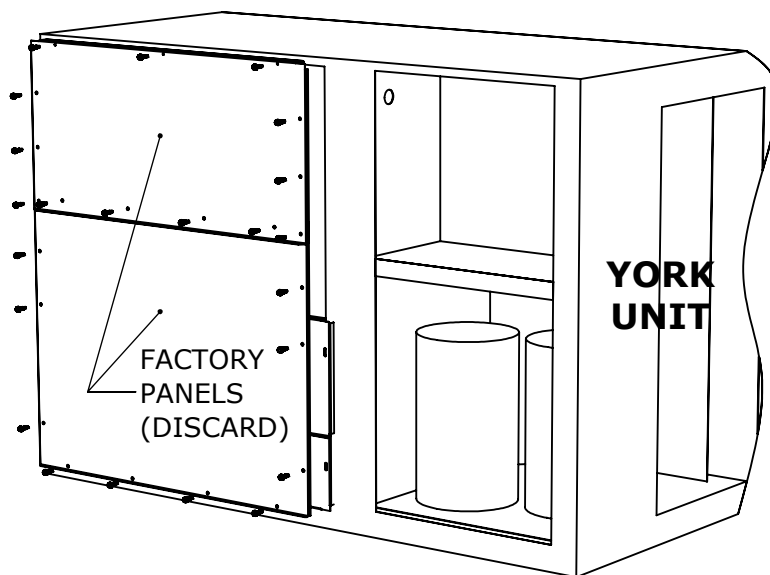
**PAGE 1**

**BEFORE BEGINNING VERIFY DOWNSHOT ECONOMIZER CONFIGURATION  
IF ECONOMIZER IS IN SIDESHOT CONFIGURATION SKIP AHEAD TO PAGE 6**

## STEP 1: PANEL REMOVAL

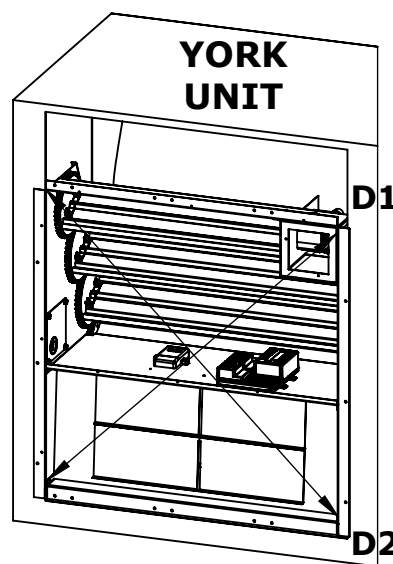
REMOVE TWO (2) FACTORY BLOCK OFF PANELS ON SIDE OF UNIT.

DISCARD PANELS AS THEY WILL NOT BE NECESSARY ONCE ECONOMIZER IS INSTALLED.



ACTUATOR ACCESS COVER (REMOVE AND SAVE)

3-12.5 TON ECONOMIZER



$D1 = D2 \pm .125"$

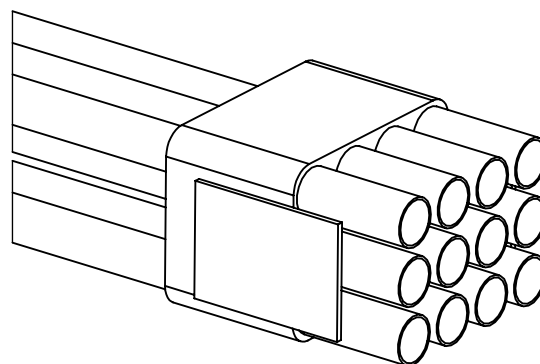
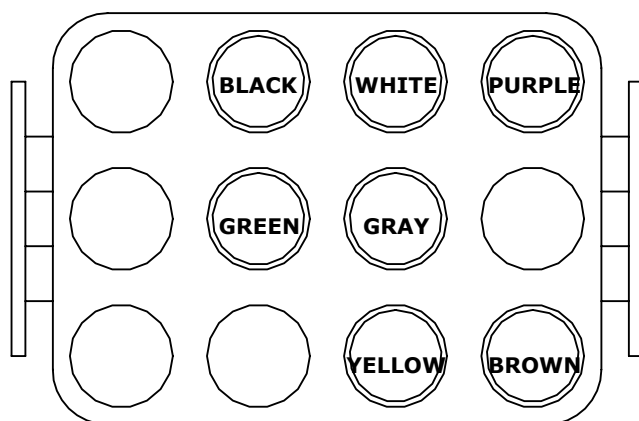
## STEP 2: ECONOMIZER INSTALL

PLACE ECONOMIZER DAMPER ASSEMBLY INTO YORK UNIT POSITIONED AS SHOWN. USING PRE-PUNCHED HOLES IN DAMPER SIDE AND BOTTOM FLANGES, SECURE ECONOMIZER TO UNIT WITH SCREWS PROVIDED IN HARDWARE BAG.

**WARNING: ECONOMIZER MUST BE INSTALLED "SQUARE" OR COMPONENT DAMAGE WILL RESULT! CAMBRIDGEPORT WILL NOT ACCEPT RESPONSIBILITY FOR DAMAGED PARTS DUE TO IMPROPER INSTALLATION/OPERATION!**

REMOVE ACTUATOR ACCESS COVER (SEE ABOVE) AND SAVE FOR LATER.

**PAGE 2**



### **12-PIN ECONOMIZER HARNESS (SUPPLIED BY CAMBRIDGEPORT)**

## **STEP 5**

PLUG ECONOMIZER HARNESS (SHOWN ABOVE) INTO THE UNIT WIRING HARNESS. ECONOMIZER IS PRE-WIRED AT CAMBRIDGEPORT FACTORY.

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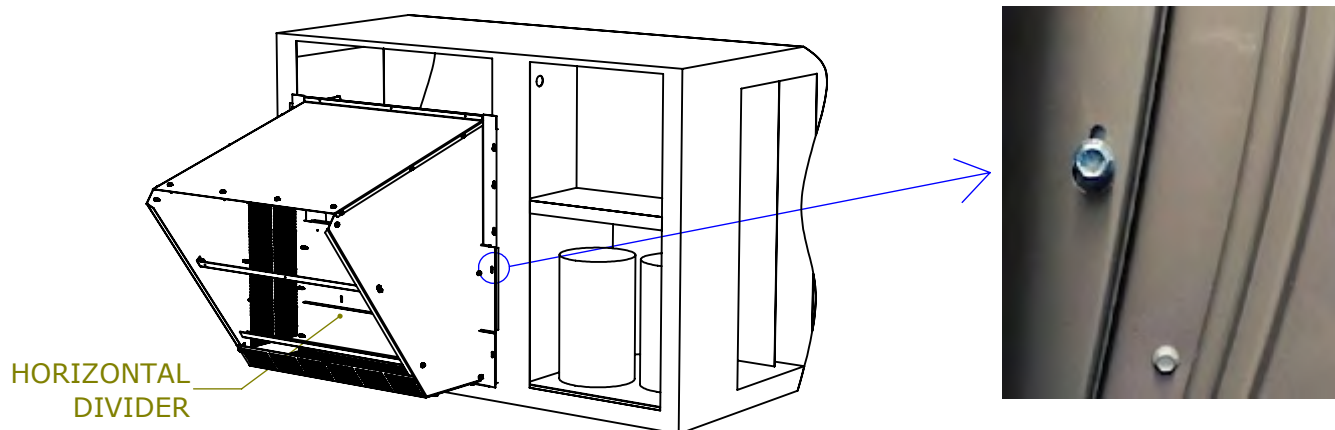
## **STEP 6**

MIXED AIR SENSOR INSTALLATION (**NOTE: A MIXED AIR SENSOR IS REQUIRED IN ALL APPLICATIONS**).

REMOVE MIXED AIR SENSOR FROM HARDWARE BAG AND INSTALL IT IN BLOWER COMPARTMENT OF UNIT. MOUNT SENSOR DIRECTLY TO THE SHEET METAL USING SELF TAPPING SCREWS OR ZIP-TIE TO HARNESS. PLUG PINK AND VIOLET WIRES FROM MIXED AIR SENSOR INTO TWO BLACK INSULATED CONNECTORS LOCATED ON LEFT HAND SIDE OF BLOWER COMPARTMENT. REFER TO INCLUDED BELIMO LITERATURE FOR INITIAL SET-UP AND CHECK-OUT PROCEDURES.

**STEP 3: HOOD**

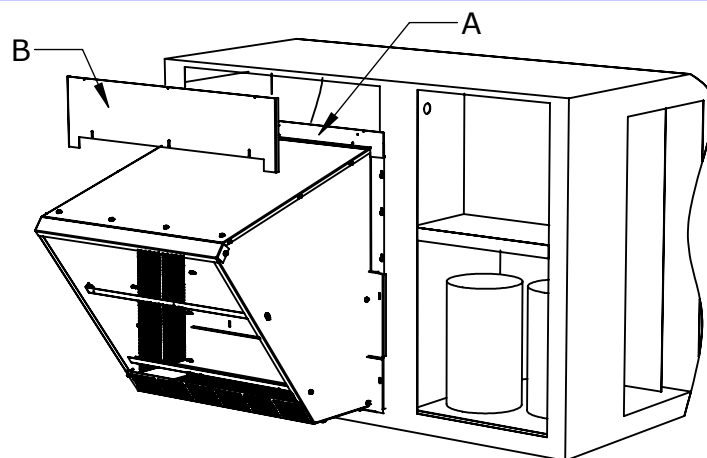
INSTALL HOOD AS SHOWN USING TEARDROP SLOTS ON LEFT AND RIGHT HAND SIDES. SIDE FLANGES OF ECONO HOOD SHOULD REST ON UNIT BASE RAIL ONCE INSTALLED. ENSURE HORIZONTAL DIVIDER IS INSTALLED IN HOOD FOR DOWNSHOT ORIENTATION ECONOMIZING

**STEP 4: BLOCK OFFS**

i) SMALL CABINET - INSTALL PANEL "A" FOLLOWED BY PANEL "B" ON ABOVE HOOD AS SHOWN.

**SMALL CABINET UNITS**

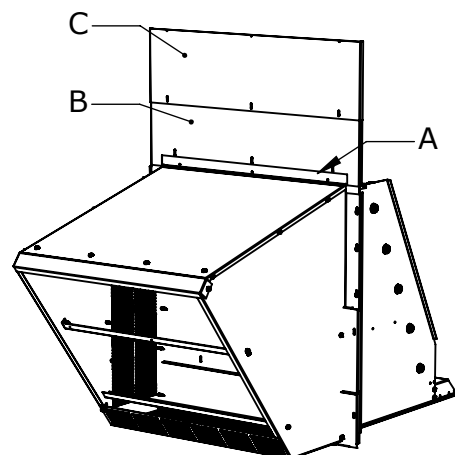
**ZF 078-090**  
**ZH 037-090**  
**ZJ 037-061**  
**ZR 037-090**

**SMALL CABINET**

ii) LARGE CABINET - INSTALL PANEL "A" FOLLOWED BY PANEL "B" AND FINALLY PANEL "C" ABOVE HOOD AS SHOWN.

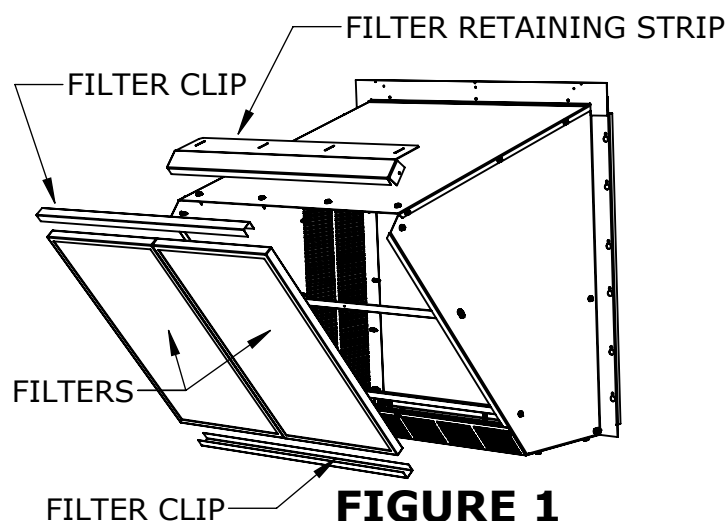
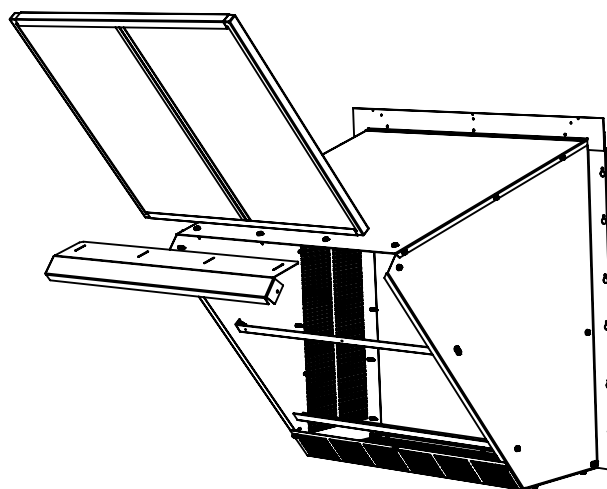
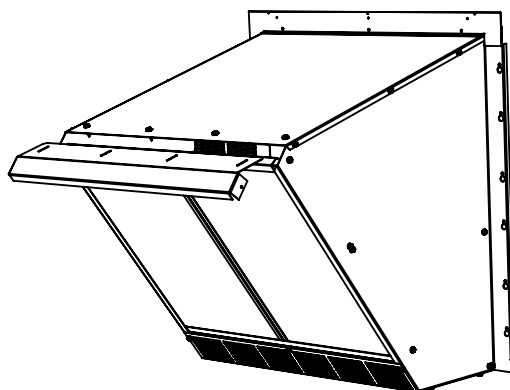
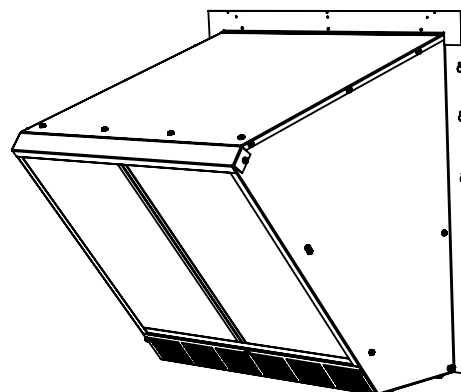
**LARGE CABINET UNITS**

**ZF 102-150**  
**ZH 102-150**  
**ZJ 078-150**  
**ZR 102-150**

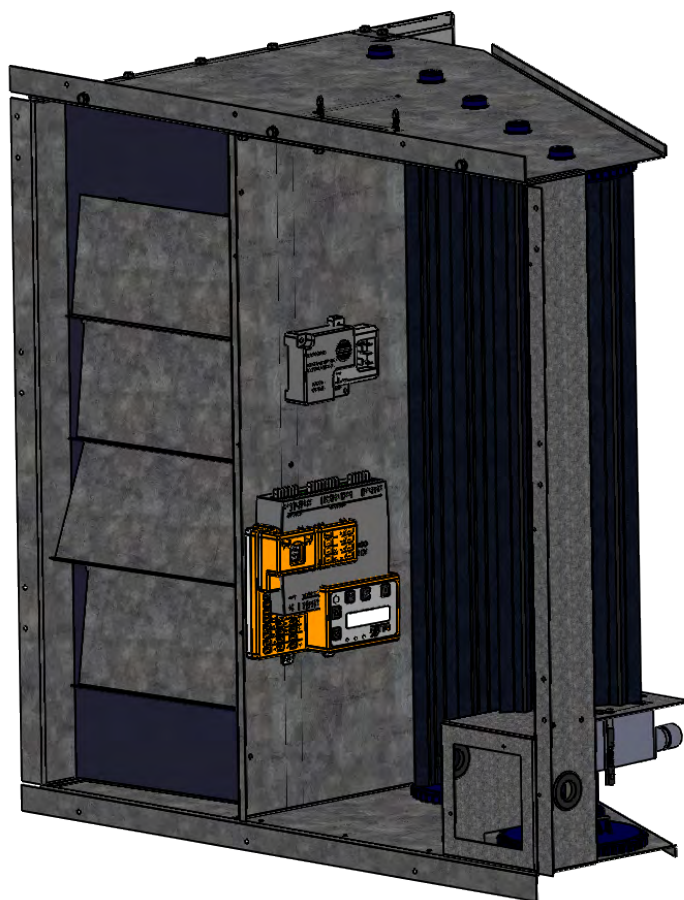
**LARGE CABINET  
(UNIT NOT SHOWN)**

**STEP 7: HOOD FILTERS**

LOOSEN SCREWS HOLDING FILTER RETAINING STRIP AND REMOVE. NOTE: FILTER RETAINING STRIP MAY SHIP PRE-REMOVED FROM THE FACTORY. ATTACH FILTER CLIPS TO TOP AND BOTTOM OF FILTERS TO HOLD IN PLACE [SEE FIGURES 1 & 2]. SLIDE FILTERS INTO HOOD AS SHOWN IN FIGURE 2. RE-INSTALL FILTER RETAINING STRIP TO HOLD FILTERS IN PLACE [SEE FIGURES 3 & 4].

**FIGURE 1****FIGURE 2****FIGURE 3****FIGURE 4**

# INSTALLATION INSTRUCTIONS FOR 3-12.5 TON YORK PREDATOR GEN 6 OR OLDER ECONOMIZER SIDESHOT CONFIGURATION



CAS PART NUMBER 1025869

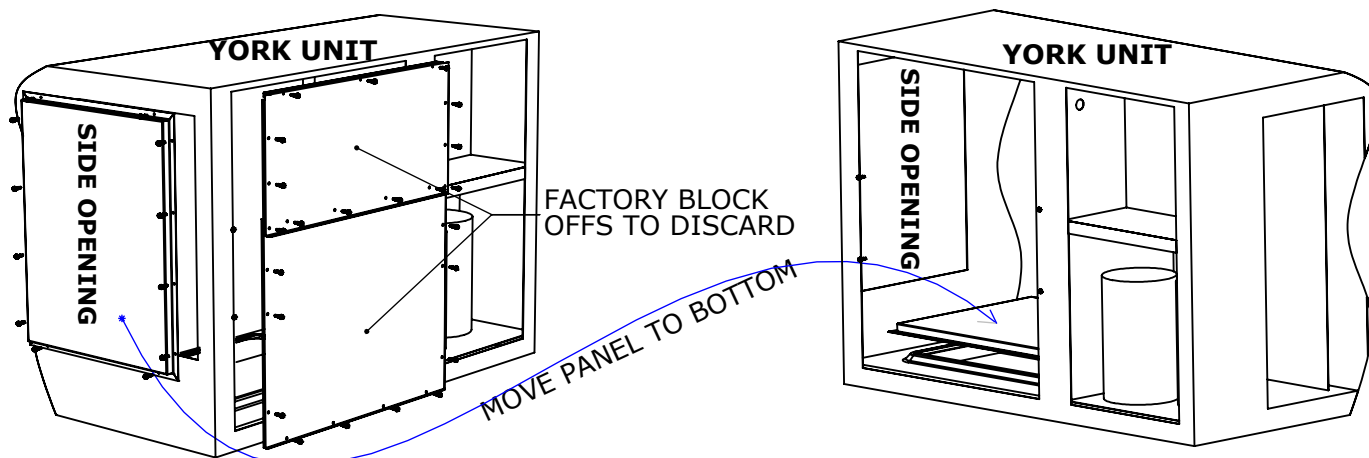
**READ COMPLETELY BEFORE INSTALLING!!!**

CAMBRIDGEPORT IS NOT RESPONSIBLE FOR IMPROPERLY INSTALLED EQUIPMENT

**PAGE 6**



**BEFORE BEGINNING VERIFY SIDESHOT ECONOMIZER CONFIGURATION  
IF ECONOMIZER IS IN DOWNSHOT CONFIGURATION REFER BACK TO PAGE 1**

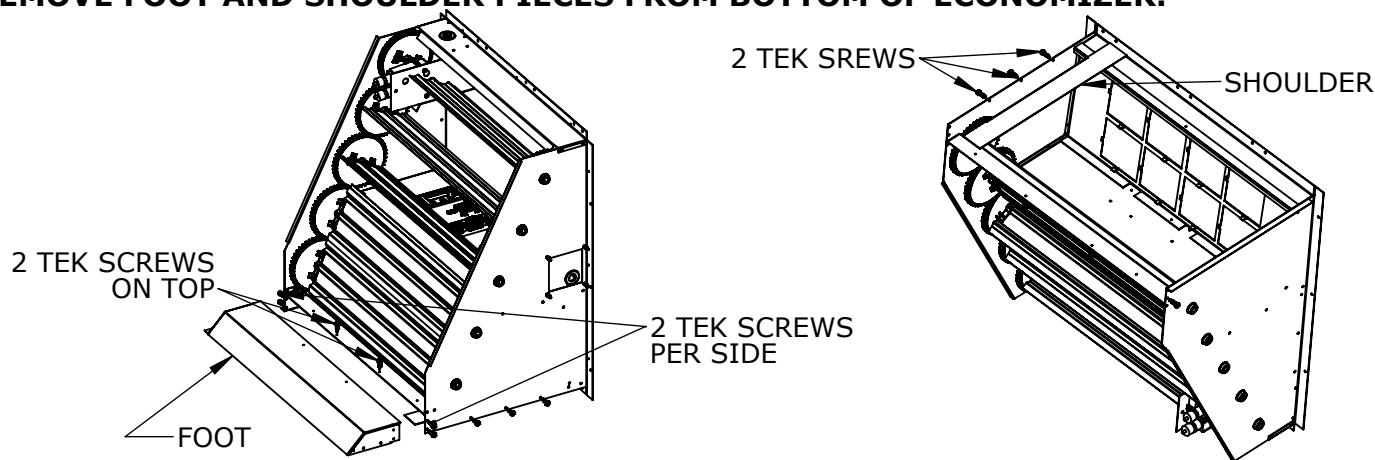


### STEP 1: PANEL REMOVAL

REMOVE TWO (2) FACTORY BLOCK OFF PANELS ON SIDE OF UNIT AND DISCARD. REMOVE SIDE RETURN AIR OPENING PANEL (SEE ABOVE) AND INSTALL ON UNUSED BOTTOM OPENING.

### STEP 2: ECONOMIZER PREPARATION

REMOVE FOOT AND SHOULDER PIECES FROM BOTTOM OF ECONOMIZER.

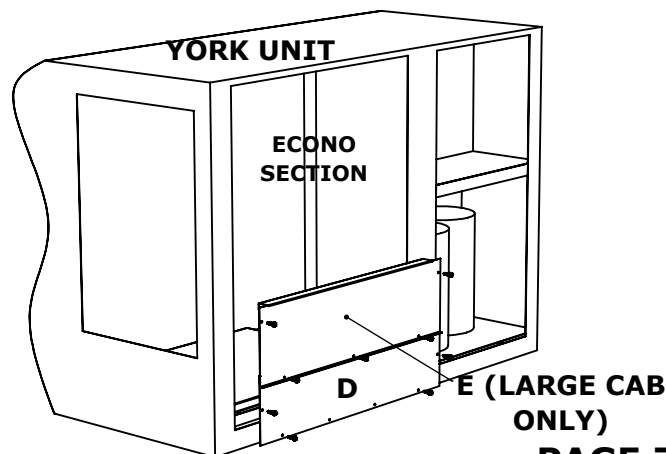


### STEP 3: BOTTOM BLOCK OFFS

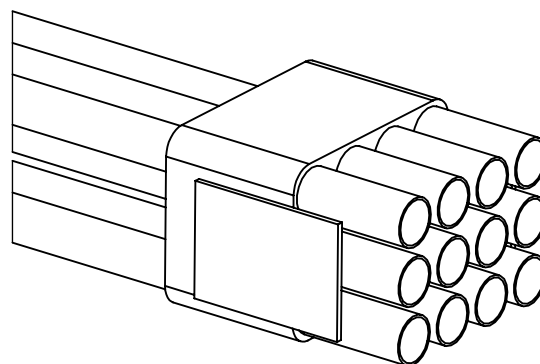
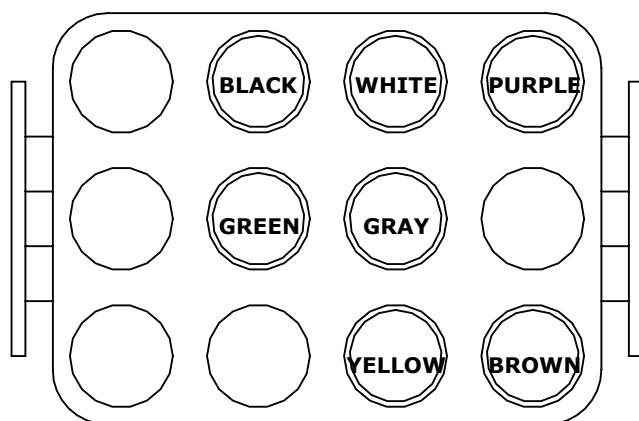
INSTALL PANEL "D" AT BOTTOM OF ECONOMIZER OPENING. IF LARGE CABINET YORK UNIT IS INSTALLED, ALSO ADD PANEL "E" ABOVE "D" (SEE BELOW)

#### LARGE CABINET UNITS

ZF 102-150  
ZH 102-150  
ZJ 078-150  
ZR 102-150



**PAGE 7**



### **12-PIN ECONOMIZER HARNESS (SUPPLIED BY CAMBRIDGEPORT)**

## **STEP 4**

PLUG ECONOMIZER HARNESS (SHOWN ABOVE) INTO THE UNIT WIRING HARNESS. ECONOMIZER IS PRE-WIRED AT CAMBRIDGEPORT FACTORY.

## **STEP 5**

MIXED AIR SENSOR INSTALLATION (**NOTE: A MIXED AIR SENSOR IS REQUIRED IN ALL APPLICATIONS**).

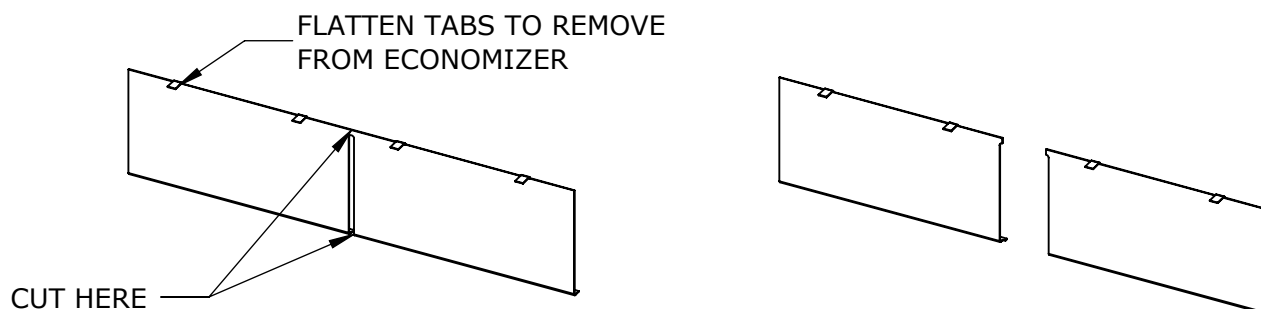
REMOVE MIXED AIR SENSOR FROM HARDWARE BAG AND INSTALL IT IN BLOWER COMPARTMENT OF UNIT. MOUNT SENSOR DIRECTLY TO THE SHEET METAL USING SELF TAPPING SCREWS OR ZIP-TIE TO HARNESS. PLUG PINK AND VIOLET WIRES FROM MIXED AIR SENSOR INTO TWO BLACK INSULATED CONNECTORS LOCATED ON LEFT HAND SIDE OF BLOWER COMPARTMENT. REFER TO INCLUDED BELIMO LITERATURE FOR INITIAL SET-UP AND CHECK-OUT PROCEDURES.



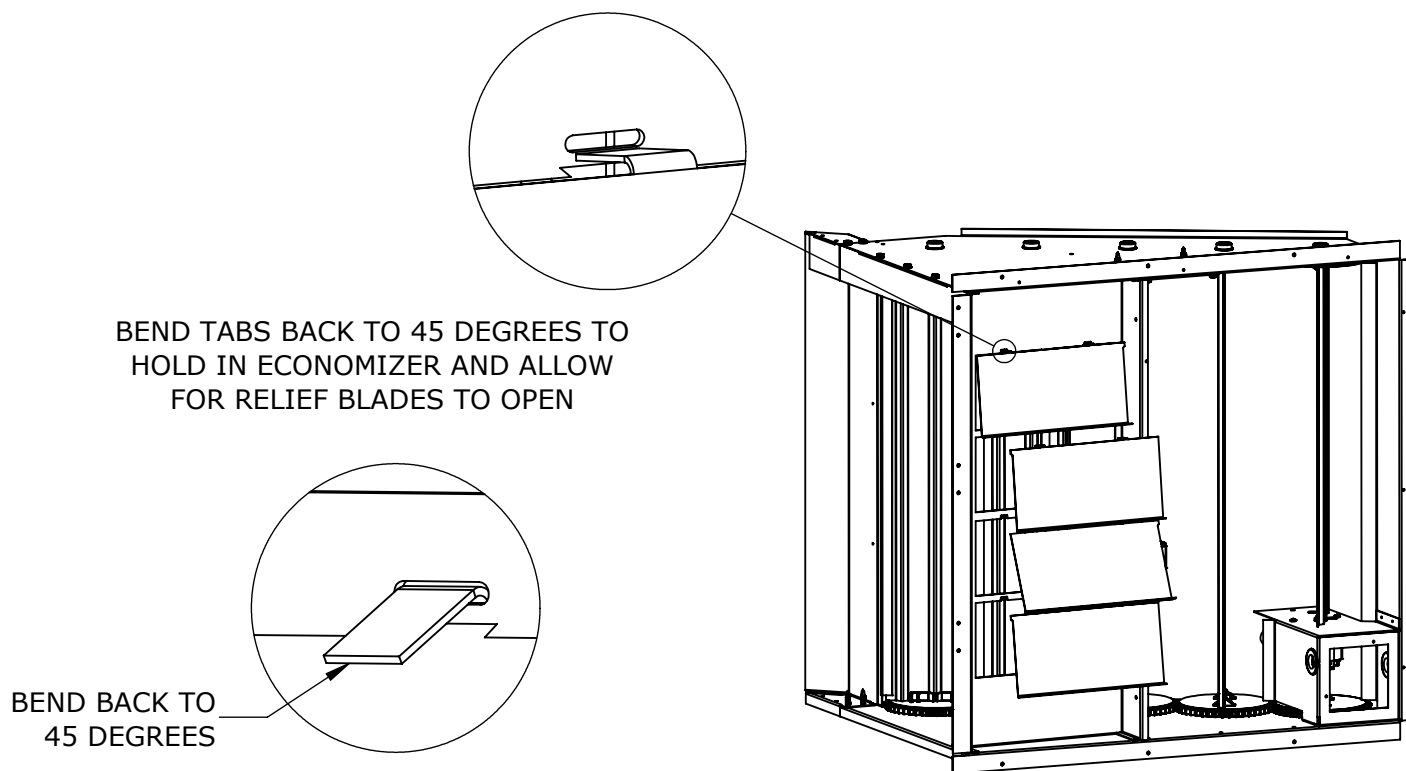
**STEP 6: BAROMETRIC RELIEF BLADES**

*NOTE: BAROMETRIC RELIEF BLADES ARE SHIPPED CONFIGURED FOR DOWNSHOT ECONOMIZERS. REPOSITION BLADES FOR HORIZONTAL APPLICATION*

FLATTEN TABS, REMOVE BLADES FROM ECONOMIZER, THEN CUT AT SLOTS



ROTATE BLADES 90 DEGREES AND PLACE IN ECONOMIZER AT FOUR LOCATIONS

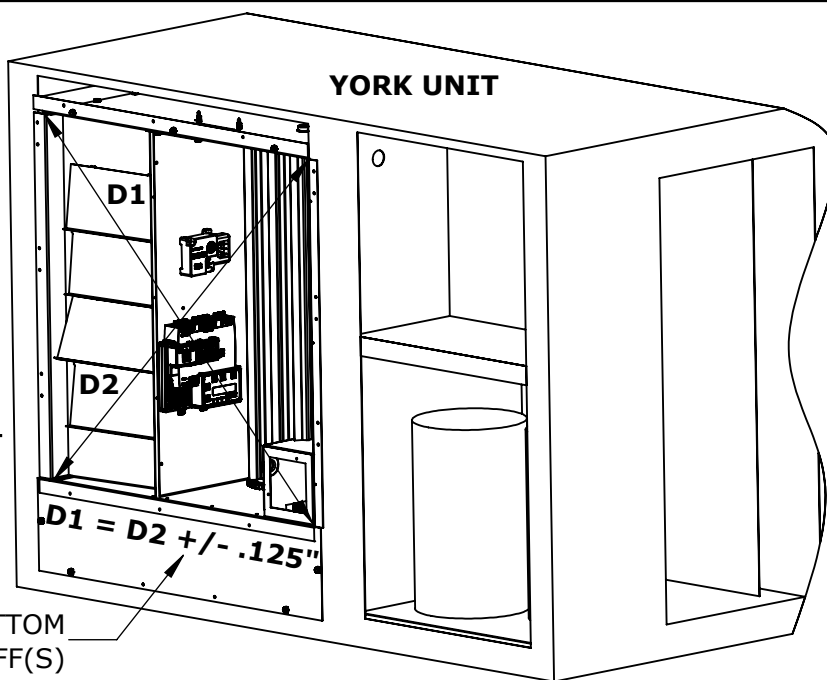


**STEP 7: ECONOMIZER INSTALL**

PLACE ECONOMIZER DAMPER ASSEMBLY INTO YORK UNIT POSITIONED AS SHOWN. USING PRE-PUNCHED HOLES IN DAMPER SIDE AND BOTTOM FLANGES, SECURE ECONOMIZER TO UNIT WITH SCREWS PROVIDED IN HARDWARE BAG.

**WARNING: ECONOMIZER MUST BE INSTALLED SQUARE OR COMPONENT DAMAGE WILL RESULT!**  
**CAMBRIDGEPORT WILL NOT ACCEPT RESPONSIBILITY FOR DAMAGED PARTS DUE TO IMPROPER INSTALLATION/OPERATION!**

BOTTOM  
BLOCK-OFF(S)

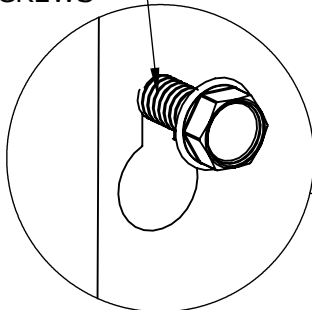
**STEP 8: HOOD INSTALL**

LOOSEN SCREWS PREVIOUSLY USED TO INSTALL ECONOMIZER. SLIDE TEARDROP SLOTS ON SIDE FLANGES OF WEATHER HOOD OVER SCREWS AND TIGHTEN TO SECURE WEATHER HOOD IN PLACE (SEE DETAIL "B" BELOW).

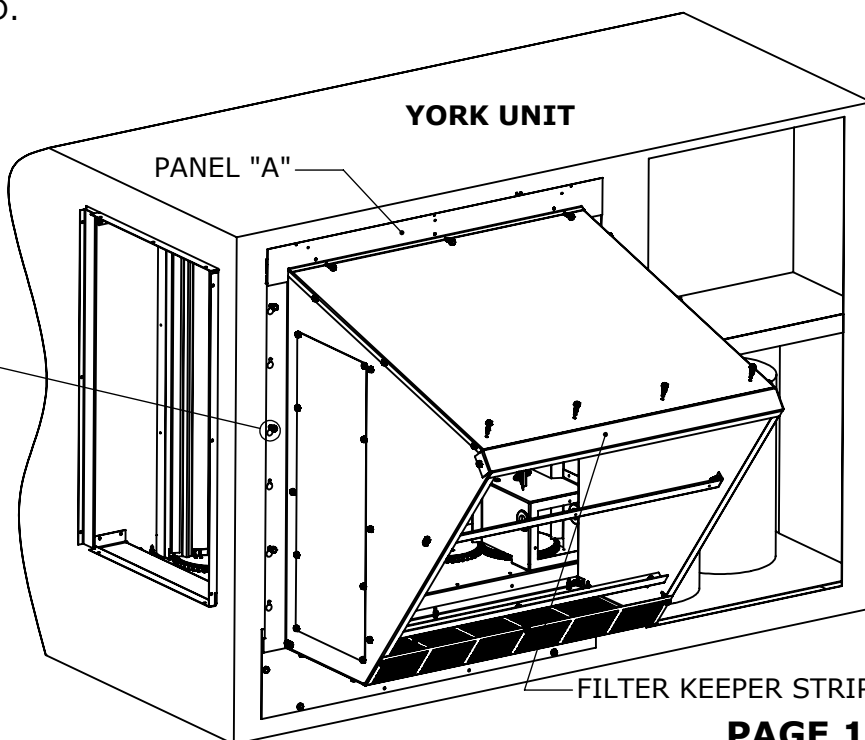
INSTALL TRIM RING PANEL "A" ABOVE WEATHERHOOD. PANEL SHOULD REST UNDERNEATH TOP CAP OF YORK UNIT.

REMOVE FILTER KEEPER STRIP (SEE BELOW). NOTE: FILTER KEEPER STRIP MAY BE REMOVED AT FACTORY AND SHIPPED UNASSEMBLED.

LOOSEN SCREWS



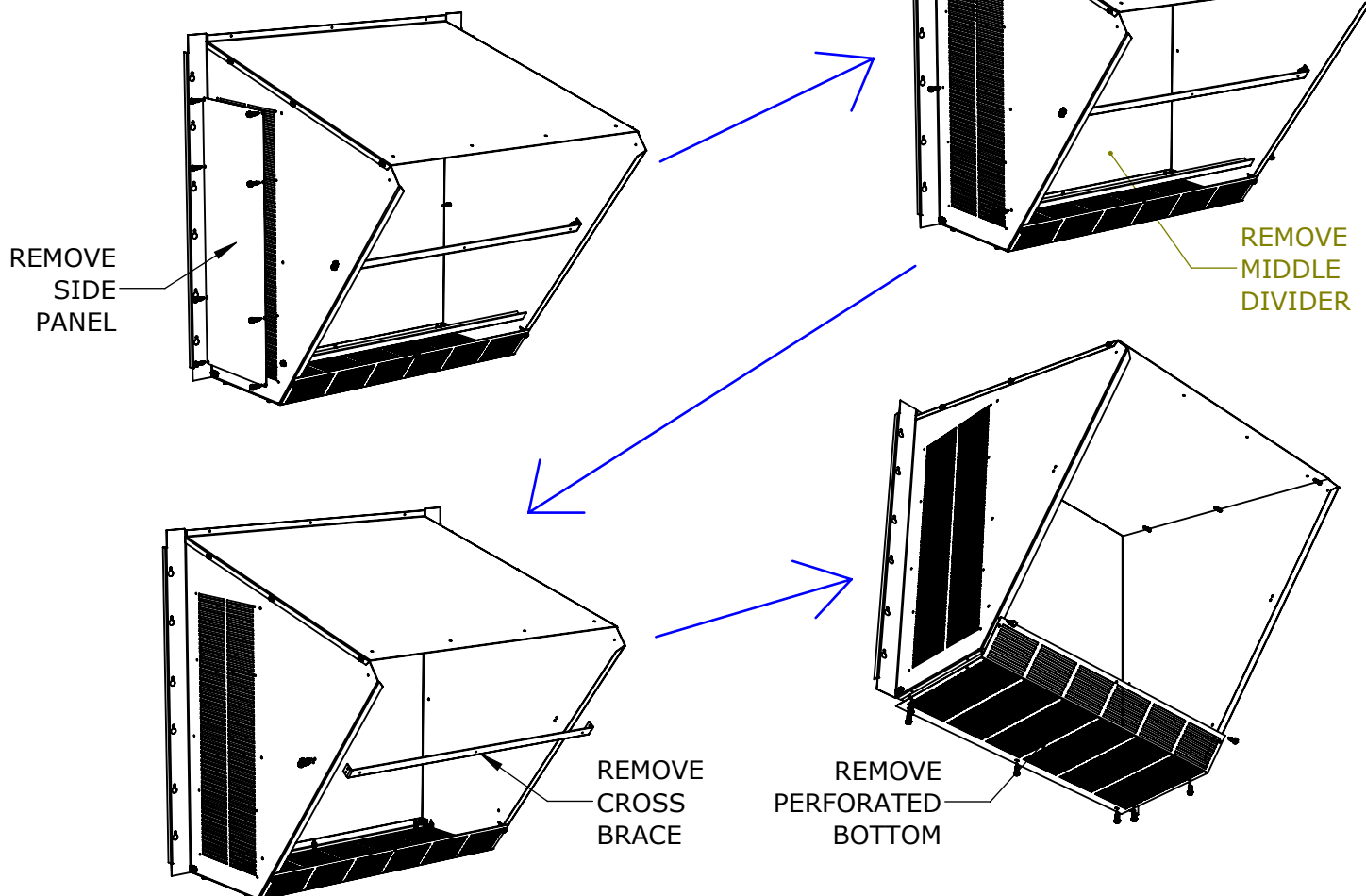
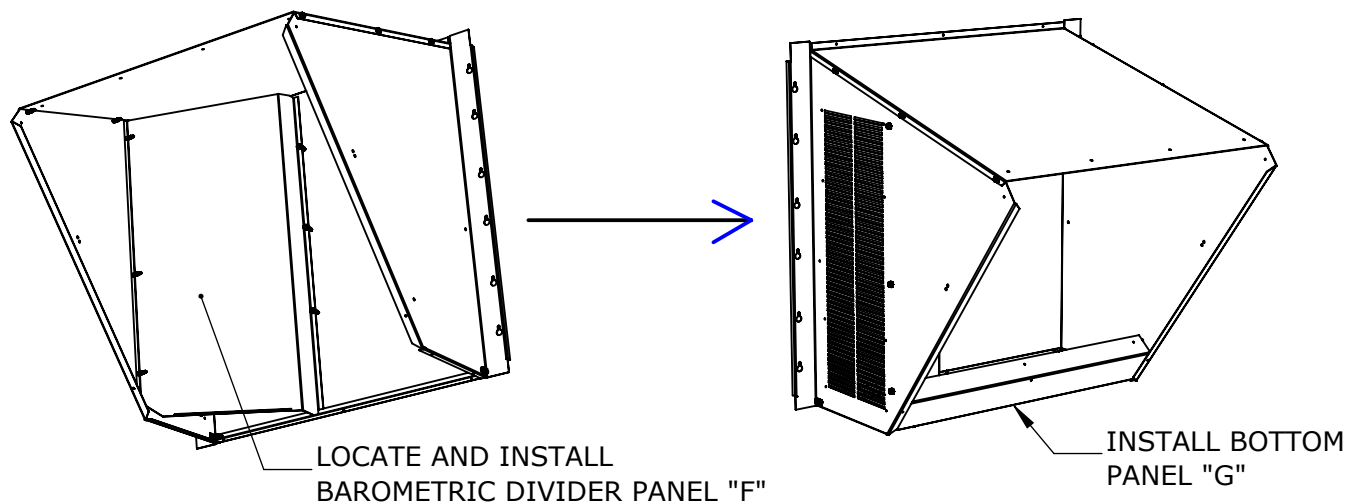
DETAIL B

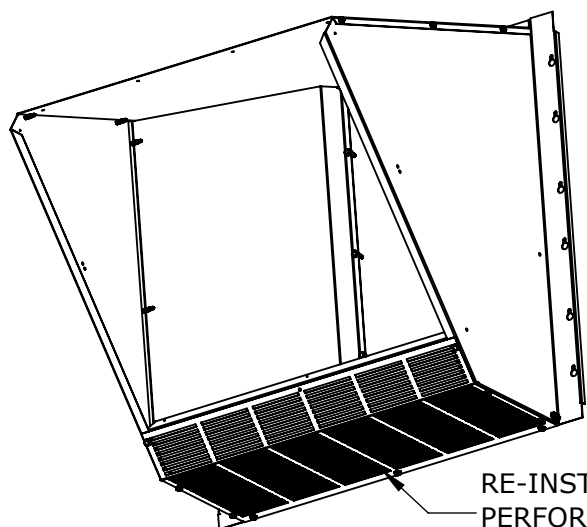


**PAGE 10**

**STEP 9: SIDESHOT HOOD PREPARATION**

*NOTE: HOOD IS SHIPPED FOR DOWNSHOT ORIENTATION*

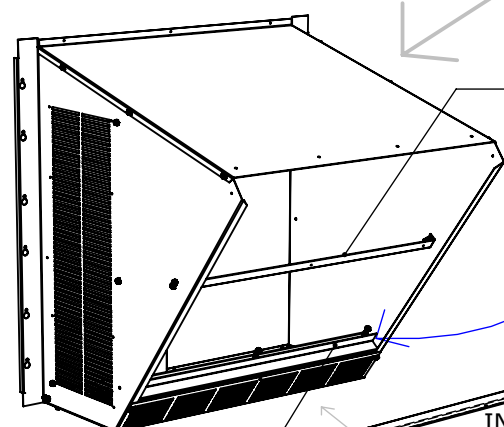
**PART ONE: REMOVAL OF EXISTING PARTS****PART TWO: INSTALL PARTS FOR SIDESHOT AIR FLOW**



REMOVE TRACK FROM MIDDLE DIVIDER  
TAKEN OUT AT BEGINNING OF STEP 9



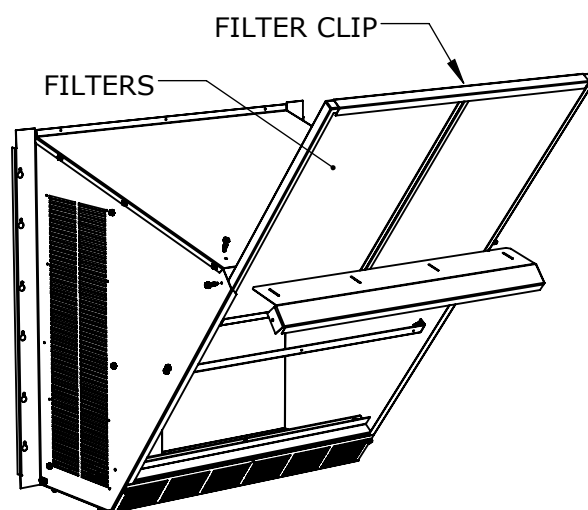
RE-INSTALL  
PERFORATED  
BOTTOM



RE-INSTALL  
CROSS  
BRACE

INSTALL TRACK

INSTALL IN THIS  
ORIENTATION



FILTER CLIP

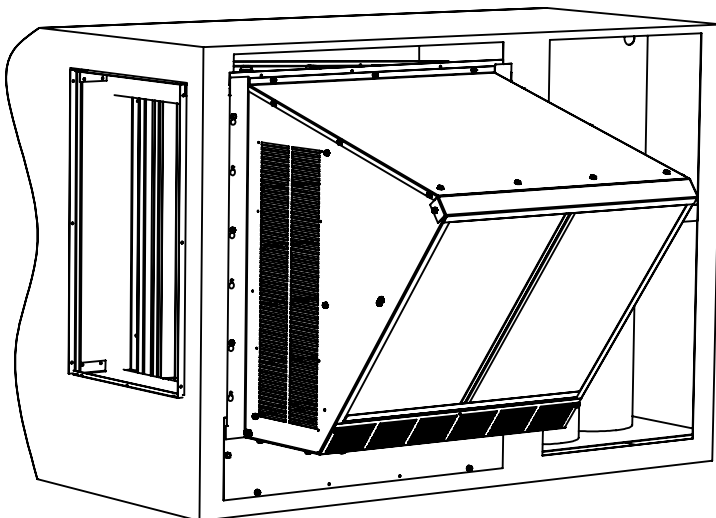
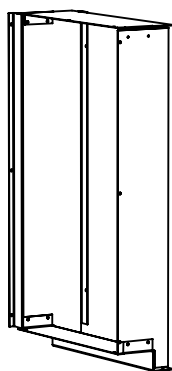
FILTERS

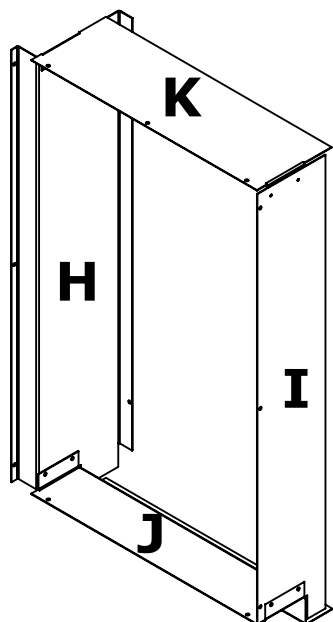
SLIDE FILTER CLIP OVER TOP AND BOTTOM OF FILTERS AND SLIDE FILTERS INTO HOOD.  
RE-INSTALL FILTER KEEPER STRIP AND WEATHER HOOD INSTALL IS COMPLETE.

## STEP 10: SAFING INSTALL

**FOR ALL UNITS! INSTALL SAFING PIECES IN SIDE RETURN OPENING BETWEEN UNIT SIDE PANEL AND ECONOMIZER DAMPER ASSEMBLY. ENSURE ALL GAPS ARE COVERED AND SAFING IS SECURED BETWEEN UNIT AND DAMPER. INSTALL PIECES IN THE FOLLOWING ORDER:**

- 1) LEFT SAFING WALL
- 2) RIGHT SAFING WALL
- 3) BOTTOM SAFING FLOOR
- 4) TOP SAFING CEILING

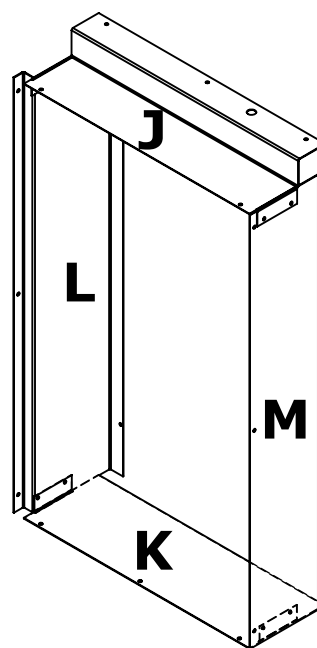


**SMALL CABINET UNITS**

**ZF 078,090**  
**ZH 037-090**  
**ZJ 037-061**  
**ZR 037-090**

**IN ORDER INSTALL:**

1. PANEL H
2. PANEL I
3. PANEL J
4. PANEL K

**LARGE CABINET UNITS**

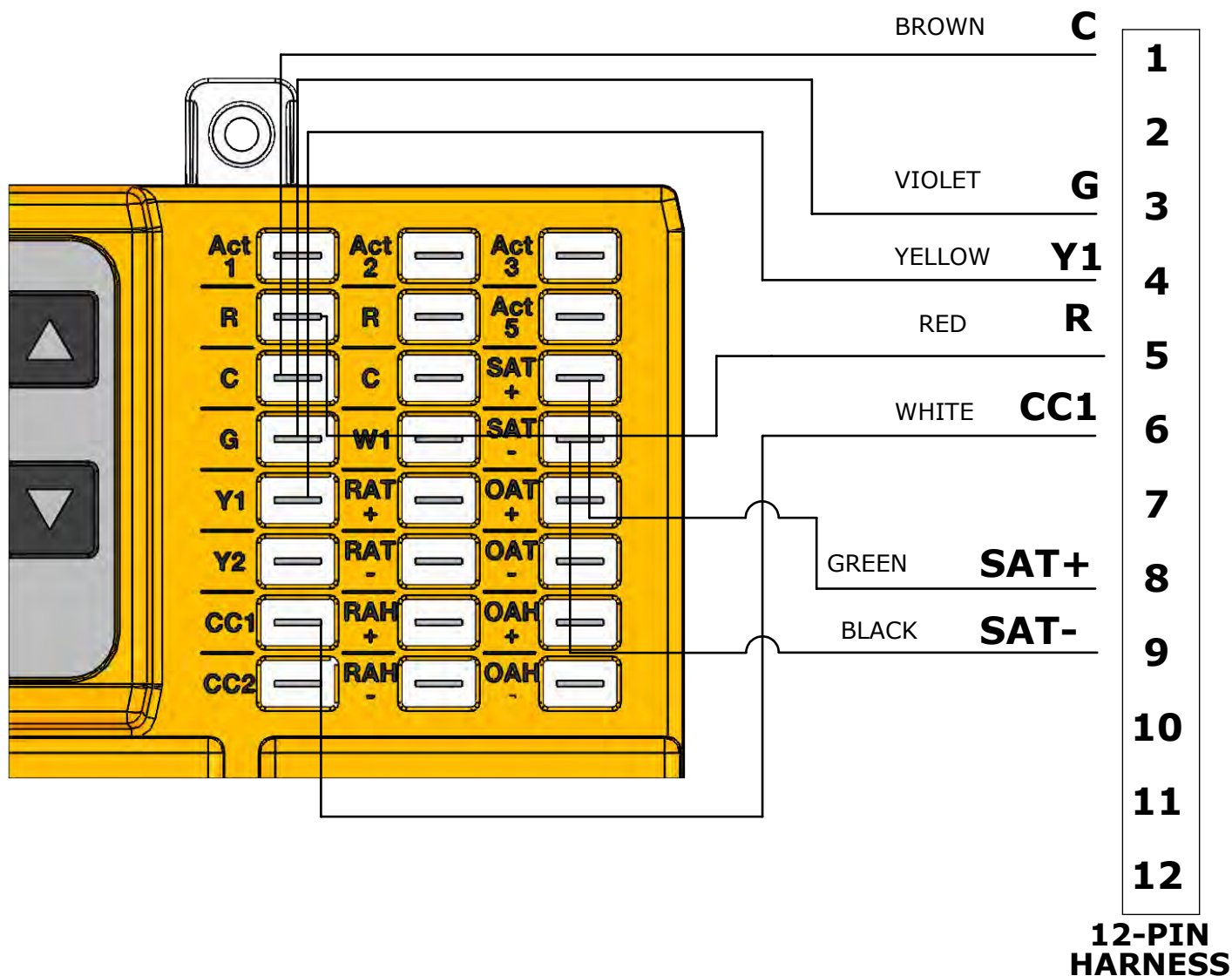
**ZF 102-150**  
**ZH 102-150**  
**ZJ 078-150**  
**ZR 102-150**

**IN ORDER INSTALL:**

1. PANEL L
2. PANEL M
3. PANEL K
4. PANEL J

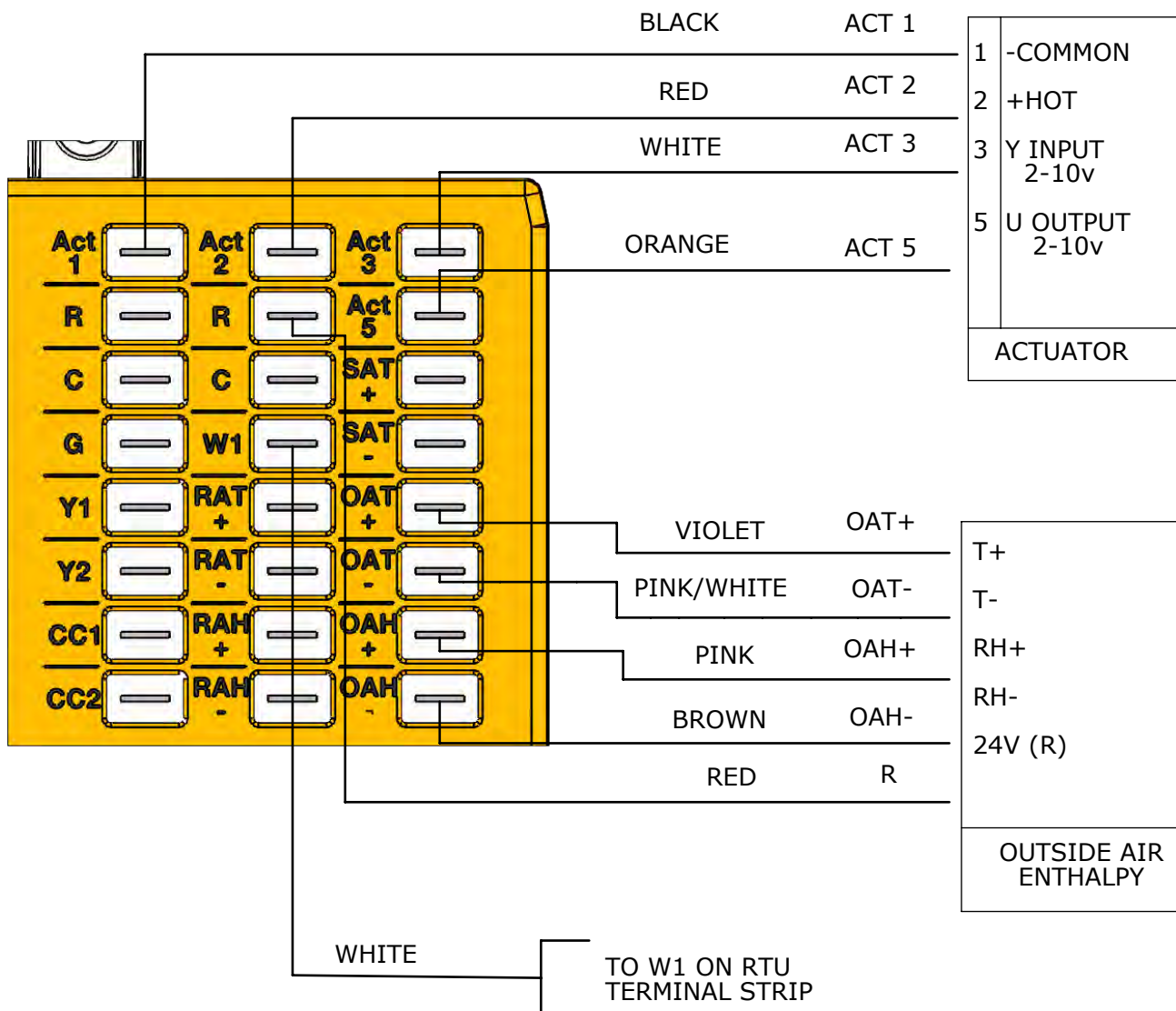
# CAS PART NUMBER 9800467

## 12-Pin Wire Harness



CONNECTS  
TO UNIT  
PLUG



**CAS PART NUMBER 9800467  
HARNESS (PAGE 2)**

**SETUP IS REQUIRED FOR ECONOMIZER OPERATION****STEP 7: BELIMO ZIP CONTROLLER SETUP**

**ENTER YOUR ZIP CODE TO AUTOMATICALLY SET YOUR  
CHANGEOVER SET POINT BASED ON ASHRAE  
RECOMMENDATIONS**



PRESS OK



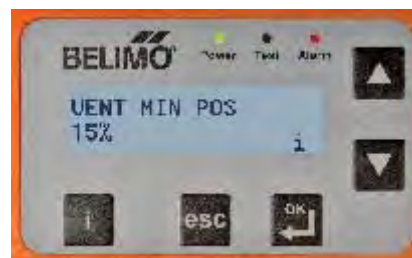
PRESS OK



PRESS "OK" AND FIRST NUMBER  
SHOULD START TO FLASH.  
USE UP/DN TO CHANGE NUMBER  
PRESS "OK" TO SELECT NUMBER



MAKE SURE ZIP CODE IS  
NOT FLASHING. IF IT IS,  
PRESS OK ONE MORE TIME  
TO MAKE NUMBERS SOLID.  
NOW PRESS ESC ONCE



PRESS THE DOWN ARROW  
UNTIL YOU GET TO THE  
VENT MIN POS MENU. NOW  
PRESS OK AND THE % WILL  
BEGIN TO FLASH. USE UP  
ARROW AND SET YOUR MIN.  
O/A % THEN PRESS OK

YOU SHOULD SEE A SETUP COMPLETE MESSAGE AT THIS POINT.  
THEN DAMPER SCALING. IF YOU DID NOT SEE SETUP COMPLETE THE  
CONTROL IS NOT READY FOR OPERATION AND SOMETHING ELSE IS  
HOLDING YOU OUT. PLEASE CONTACT CAMBRIDGEPORT FOR MORE  
INFO OR SEE BELOW.

**POSSIBLE ISSUES PREVENTING SETUP COMPLETION**

- 1) DO YOU HAVE A CO2 SENSOR OR POWER EXHAUST THAT NEEDS TO BE SET UP?
- 2) IS A PRESSURE SWITCH OR OTHER SAFETY ON YOUR COMPRESSOR OPEN?
- 3) IF YOU HAVE A HEAT PUMP ADDITIONAL SET UP IS REQUIRED
- 4) YOU MUST HAVE A COMPRESSOR, A SUPPLY AIR SENSOR, AND AN OUTSIDE AIR SENSOR INSTALLED

## B) HEAT PUMP SETUP

NOTE: AFTER SETTING MINIMUM DAMPER POSITION ALARM LIGHT WILL BE ON



RETURN TO SETTINGS MENU  
SCROLL UP TO "HEAT PUMP OP"  
PRESS "OK"



USING "UP" AND "DN" ARROWS  
SET EITHER [B], [O], OR [W1]  
PRESS "OK"



PRESS "DN" ONCE TO "NO  
COMPRESSOR DETECTED"  
SCREEN. PRESS "OK"



CHOOSE APPROPRIATE  
COMPRESSOR QTY AND  
SELECT "OK"

## C) CO2 (DCV) SETUP



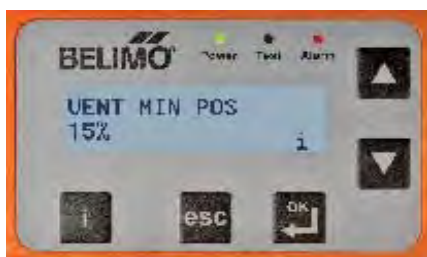
ENTER SETTINGS MENU  
UNIT WILL DETECT CO2  
SENSOR. SELECT "OK"



SET MINIMUM O/A %  
WHEN CO2 LEVELS  
ARE BELOW  
SETPOINT (EX. 5%)



SET CO2 SETPOINT FOR THE  
SPACE (EX. 1000 PPM)



**OPERATION: OUTSIDE AIR DAMPER WILL  
MODULATE BETWEEN DCV MIN (MINIMUM)  
AND VENT MIN(MAXIMUM) TO KEEP SPACE  
CO2 LEVELS BELOW SETPOINT**

GO BACK TO VENT MIN POS FROM EARLIER IN THE  
SETUP. THIS WILL BE YOUR O/A MAX % WHEN CO2  
LEVELS ARE ABOVE SET POINT (EX. 45%)

FOR MORE INFORMATION ON DCV SETUP SEE PAGE 34 OF APPENDIX

PAGE 17

**D) 2-SPEED FAN ADDITION**

IF A 2-SPEED FAN/VFD IS BEING USED:



RETURN TO "SETTINGS" MAIN MENU SCREEN

SCROLL "UP"/"DN" TO ARRIVE AT "2 SPEED FAN"

PRESS "OK"

PRESS "OK" AGAIN AND SELECT "UP"/"DN" FOLLOWED BY "OK"  
TO TURN 2 SPEED FAN SETTINGS ON

**I) LOW SPEED VENT MIN**

SCROLL "DN" TO "LOW SP VENT MIN" SCREEN AND PRESS "OK" TO ENTER LOW SPEED VENT MINIMUM POSITION. THIS VALUE WILL BE GREATER THAN THE VENT MINIMUM POS, HOWEVER EQUAL THE SAME AIRFLOW RATE VALUE.

**II) LOW SPEED DCV MIN (C02 SENSOR INSTALLED)**

SCROLL "DN" TO "LOW SP DCV MIN POS". PRESS "OK" AND ENTER LOW SPEED DCV MINIMUM POSITION. THIS POSITION WILL BE GREATER THAN DCV MIN POS, HOWEVER EQUAL THE SAME MEASURED AIRFLOW RATE VALUE.

**III) LOW EXHAUST FAN POSITION (POWER EXHAUST INSTALLED)**

SCROLL "DN" TO "LOW EXH FAN POS". PRESS "OK" AND ENTER LOW EXHAUST FAN ON POSITION. THIS POSITION WILL BE GREATER THAN EXHAUST FAN ON POS, HOWEVER EQUAL THE SAME AIRFLOW RATE VALUE.

**THESE VALUES SHOULD BE SET TO PROVIDE THE SAME AIRFLOW OF OUTSIDE AIR (OA) AND EXHAUST AS WHEN FAN IS OPERATING AT FULL SPEED. DUE TO LESS PRESSURE GENERATED BY THE FAN, THIS VALUE IS TYPICALLY A HIGHER PERCENTAGE OPEN VALUE.**



**SERVICE AND COMMISSIONING MUST BE PERFORMED AFTER INITIAL ECONOMIZER SET-UP IS COMPLETED. THIS ACCEPTANCE TEST IS MANDATED TO VALIDATE ECONOMIZER FUNCTIONALITY AND COMPONENT WARRANTY**

**\*\*\*IMPORTANT\*\*\***

**UNIT INDOOR FAN MUST BE RUNNING DURING THIS TEST TO PREVENT COMPRESSOR DAMAGE! EITHER JUMP OUT FAN AT UNIT TERMINAL STRIP OR SET FAN TO "ON" VIA THERMOSTAT**



PRESS DN TILL AT THIS SCREEN AND PRESS "OK"



PRESS DN AT MANUAL MODE TO GET TO THIS SCREEN



PRESS "OK" HERE THEN "OK" AGAIN TO START

FOLLOW PROMPTS TO COMPLETE TEST...YOU MUST CONFIRM AS PROMPTED BY PRESSING "OK" WHEN:

- 1) THE ECONOMIZER DAMPER FULLY OPENS
- 2) DAMPER STAYS OPEN AND 1ST STAGE COMPRESSOR STARTS AND RUNS IN INTEGRATED MODE
- 3) DAMPER FULLY CLOSES
- 4) DAMPER GOES TO MINIMUM



PRESS "OK"



PRESS "OK"

Sequence of Operation

States

Virgin State

The ZIP Economizer comes shipped from the factory in this state. "Setup Incomplete" will be displayed. No control will occur until setup is completed.

**Automatic State** – all of the following strategies and operational modes are available in this state.

A minimum of two pieces of information (in level 2 Settings menu) must be entered before the ZIP Economizer will go into Automatic State:

- The appropriate ZIP code must be entered.
- The minimum damper position setpoint (Vent Min Pos) percentage must be entered.

When in Automatic State, the G input terminal is used to monitor a remote occupancy contact, time clock and/or indoor fan signal. When the G terminal is energized, the ZIP Economizer will operate in Occupied (damper will move to the proper ventilation position). Otherwise, the ZIP Economizer will operate in Unoccupied.

Strategies

Compressor Protection and Energy Savings

**DXLL** (Supply Air Low Temperature Protection in Mechanical Cooling)

This strategy is activated automatically when in Mechanical Cooling Mode depending on supply air temperature. Timers, temperature dead bands and SAT Y2 Limit setting all interact with this strategy.

SAT < 45°F	All compressor stages disabled.
45 °F ≤ SAT < 47°F	Compressor stages may or may not be enabled based on whether or not SAT is rising or falling.
SAT ≥ 47°F and SAT Y2 Limit=Off	Both compressor stages enabled.
47°F ≤ SAT < 56.5°F and SAT Y2 Limit=On	1st stage compressor enabled. 2nd stage compressor disabled.
SAT ≥ 56.5°F	Both compressor stages enabled.

**SAT Y2 Limit**

This strategy inhibits the 2nd stage compressor from coming on prematurely based on SAT temperature and time.

- IF Y2 is energized  
AND Compressor 1 has been running for less than 4 minutes  
AND Supply Air Temp is less than or equal to its required setpoint + 1.5° (56.5°F)  
THEN Compressor 2 will not be allowed to come on

**LCLO (Low Ambient Compressor Lockout)**

This strategy inhibits compressor operation at low outdoor air temperatures.

- IF OAT falls below the low limit (50°F)  
AND not in Heat Pump Mode  
THEN Compressor 1 and Compressor 2 will be disabled.
- IF OAT rises 2°F above the low limit (52°F)  
OR in Heat Pump Mode  
THEN Compressor 1 and Compressor 2 will be enabled.

**Minimum On and Minimum Off Time**

This strategy prevents the compressors from "short-cycling".

- IF any Compressor is energized  
THEN run it at least 180 seconds EXCEPT when entering Brownout Mode when compressors will be shut off immediately.
- IF any Compressor is de-energized  
THEN keep it off for at least 180 seconds

**Not Simultaneous ON/Not Simultaneous OFF**

On RTUs with 2 compressors this strategy is used to prevent both compressors from coming on at the same instant to keep electrical demand down.

- Compressors 1, 2 are kept from switching on together by a 10 second time delay.
- If SAT Y2 Limit is set to "On" compressor 2 is delayed by 240 seconds to evaluate if the single compressor already operating can bring SAT less than or equal to setpoint +1.5 °F (56.5°F).
- Compressors 1, 2 are kept from switching off together by a 5 second time delay EXCEPT when entering Brownout when compressors will be shut off immediately.

**Brownout Protection**

Input power (24 VAC) is monitored.

- IF input voltage drops to 75%  
AND it stays below there for 30 seconds  
THEN Brownout will be enabled.
- IF input voltage rises to 85%  
AND it stays there for 300 seconds  
THEN Brownout will be disabled.

Under Brownout conditions the current operating mode will be maintained EXCEPT Mechanical Cooling and Integrated Cooling (where compressors are utilized).

Instead of Mechanical Cooling it will go to Ventilation, DCV or Unoccupied. Instead of Integrated Cooling it will go to Free Cooling.

This strategy prevents compressor operation during brownout conditions. Compressors will be turned off immediately (bypassing minimum on/off timers).

**Random On Delay after Power Up**

After a power blackout or any power restore, compressors will go through a random time delay before allowing them to operate. This random timer is between 30-180 seconds. This helps the electrical network to come back up without excessive demand from multiple RTUs and compressors coming back on after the blackout.

**Freeze Protection**

See Freeze Protection Mode of Operation below.



### High Limit Changeover

(Four possibilities depending on installed sensors)

Note: Economizing is enabled based on one of the following and becomes active in Free Cooling and Integrated Cooling.

#### Single Dry Bulb Changeover

- If only an OAT sensor is connected, it will be analyzed against the reference Outdoor Air changeover temperature value (based on entered ZIP code).
  - IF OAT is 2°F below the reference value  
THEN economizing will be enabled.
  - IF OAT is above the reference value  
THEN economizing will be disabled.

#### Differential Dry Bulb Changeover

- Must have OAT and RAT sensors connected. OAT and RAT will be analyzed against each other and the OAT will be analyzed against the reference differential temperature high limit (based on entered ZIP code).
  - IF OAT is 2-8°F below the RAT (Value Climate Zone Dependent)  
AND OAT is 2°F below the reference differential temp high limit DTHL  
THEN economizing will be enabled.
  - IF OAT is greater than or equal to 0-6°F below the RAT (Value Climate Zone Dependent)  
OR the OAT is greater than the reference differential temp high limit DTHL  
THEN economizing will be disabled.

#### Single Enthalpy Changeover

- Must have OAH (RH) and OAT sensors connected. Outdoor air enthalpy (Outdoor Enth) will be calculated. They will be analyzed against the reference values as follows:
  - IF Outdoor Enth is 2 btu/lb less than the reference enthalpy high limit (default is 28 btu/lb – 2 btu/lb = 26 btu/lb)  
AND OAT is 2°F below the reference temperature high limit ETHL (based on entered ZIP code)  
THEN economizing will be enabled.
  - IF Outdoor Enth is greater than reference enthalpy high limit (default is 28 btu/lb)  
OR OAT is greater than the reference temperature high limit ETHL (based on entered ZIP code)  
THEN economizing will be disabled.

#### Differential Enthalpy Changeover

- Must have OAH, OAT, RAH and RAT sensors connected. Outdoor Air Enthalpy and Return Air Enthalpy will be calculated.
  - IF Outdoor Enth is 2.5 btu/lb less than Return Air Enth  
AND Outdoor Enth is 2 btu/lb less than the reference differential enthalpy high limit DEHL (30 btu/lb)  
AND OAT is 2°F below the reference differential temperature high limit DTHL (based on entered ZIP code)  
THEN economizing will be enabled.

- If Outdoor Air Enthalpy is 1 btu/lb less than Return Air Enthalpy  
OR Outdoor Air Enthalpy is greater than reference enthalpy high limit DEHL (30 btu/lb)  
OR OAT is greater than reference differential temperature high limit (based on entered ZIP code)  
THEN economizing will be disabled.

### Operational Modes

#### Free Cooling

- Outdoor air ambient conditions are analyzed by one of the 4 changeover strategies above (Single or Differential Dry Bulb; Single or Differential Enthalpy) and has been deemed suitable for “free” cooling.
- Y1 is energized indicating a call for stage 1 cooling.
- Y2 is de-energized.
- W1 is de-energized.
- G input could be energized or de-energized (occupied or unoccupied state).
- Compressor 1 is off<sup>2</sup>.
- Compressor 2 is off<sup>2</sup>.
- Fan Speed could be energized (low speed, when OAT is below 50°F) or de-energized (high speed) for indoor fan<sup>1</sup>.
- Exhaust Fan could be running or not based on % damper open position<sup>1</sup>.
- Damper Pos output is modulated between the respective current minimum damper position setpoint and 100% open to attempt to maintain SAT setpoint (55°F). When OAT is at 55°F the damper will be fully open to outside air. As outdoor air continues to rise above 55°F, SAT will rise with it.

#### Integrated Cooling

- Outdoor air ambient conditions are analyzed by one of the four changeover strategies above (Single or Differential Dry Bulb; Single or Differential Enthalpy) and has been deemed suitable for “free” cooling.
- Y1 is energized indicating a call for stage 1 cooling.
- Y2 is energized indicating a call for stage 2 cooling.
- W1 is de-energized.
- G input could be energized or de-energized (occupied or unoccupied state).
- Compressor 1 is on<sup>2</sup>.
- Compressor 2 is off<sup>2</sup>.
- Fan Speed is de-energized (indoor fan is operating on high speed)<sup>1</sup>.
- Exhaust Fan is on<sup>1</sup>.
- Damper Pos output is fixed at 100% (fully open to outdoor air).

**Note:** Outdoor Damper must be fully open for 60 seconds before mechanical cooling will be enabled.

### Mechanical Cooling

- Outdoor air ambient conditions are analyzed by one of the 4 changeover strategies above (Single or Differential Dry Bulb; Single or Differential Enthalpy) and has been deemed NOT suitable for "free" cooling.
- Y1 is energized indicating a call for stage 1 cooling.
- Y2 may or may not be energized depending on thermostat call for stage 2 cooling.
- W1 is de-energized.
- G input could be energized or de-energized (occupied or unoccupied state).
- Compressor 1 is on<sup>2</sup>.
- Compressor 2 may or may not be on based on thermostat call for stage 2 cooling<sup>2</sup>.
- Fan Speed may or may not be energized (indoor fan is operating on high or low speed). See Indoor 2 Speed Fan sequence under Energy Module Option Functions<sup>1</sup>.
- Exhaust Fan is off<sup>1</sup>.
- Damper Pos output is at Vent Min Pos if indoor fan is on high speed. Output is at Low SP Vent Min if indoor fan is on low speed.

### DCV<sup>1</sup>

- Outdoor air may or may not be suitable "for free cooling"; however still utilizing fresh air for cooling
- Y1 may or may not be energized depending on thermostat call for stage 1 cooling.
- Y2 may or may not be energized depending on thermostat call for stage 2 cooling.
- W1 may or may not be energized depending on thermostat call for heating.
- G input is energized indicating occupied state.
- Compressor 1 may or may not be on depending on thermostat call for stage 1 cooling<sup>2</sup>.
- Compressor 2 may or may not be on depending on thermostat call for stage 2 cooling<sup>2</sup>.
- Fan Speed may or may not be energized (indoor fan is operating on high or low speed). See Indoor 2 Speed Fan sequence under Energy Module Option Functions<sup>1</sup>.
- Exhaust Fan is off<sup>1</sup>.
- Damper Pos – Minimum outdoor damper position will be modulated based on CO2 levels. If indoor fan is on high speed and CO2 levels are high, minimum damper position will be at Vent Min Pos; if CO2 levels are low, minimum damper position will be at DCV Min Pos. As CO2 levels fluctuate, minimum damper position will modulate between these 2 minimum settings. If indoor fan is on low speed, the two minimum damper settings reference will change to Low SP Vent Min and Low SP DCV Min respectively.

### Possible Co-existing Modes of Operation<sup>3</sup>:

#### Mechanical Cooling, Heating.

### Ventilation

- Outdoor air may or may not be suitable "for free cooling".
- Y1 is de-energized.
- Y2 is de-energized.
- W1 is de-energized.
- G input is energized indicating occupied state of operation.
- Compressor 1 is off<sup>2</sup>.
- Compressor 2 is off<sup>2</sup>.
- Fan Speed will be energized (indoor fan is operating on low speed). See Indoor 2 Speed Fan sequence under Energy Module Option Functions<sup>1</sup>.
- Exhaust Fan is off<sup>1</sup>.
- Damper Pos output is at Low SP Vent Min<sup>1</sup>.

### Possible Co-existing Modes of Operation<sup>3</sup>: DCV, Heating.

### Heating

- Outdoor air may or may not be suitable "for free cooling".
- Y1 is off (unless RTU is a heat pump).
- Y2 is off (unless RTU is a heat pump).
- W1 is energized.
- G input may or may not be energized (occupied or unoccupied state).
- Compressor 1 is de-energized (unless Heat Pump Op in Settings menu is turned on)<sup>2</sup>.
- Compressor 2 is de-energized (unless Heat Pump Op in Settings menu is turned on)<sup>2</sup>.
- Fan Speed will be de-energized (indoor fan is operating on high speed). See Indoor 2 Speed Fan sequence under Energy Module Option Functions<sup>1</sup>.
- Exhaust Fan is off<sup>1</sup>.
- Damper Pos output is at Vent Min Pos or damper in DCV position. See DCV mode<sup>1</sup>.

### Unoccupied

- Outdoor air may or may not be suitable "for free cooling".
- Y1 may or may not be energized depending on thermostat call for stage 1 cooling.
- Y2 may or may not be energized depending on thermostat call for stage 2 cooling.
- W1 may or may not be energized depending on thermostat call for stage 1 heating.
- G input is de-energized (unoccupied state).
- Compressor 1 may or may not be on depending on thermostat call for stage 1 cooling<sup>2</sup>.
- Compressor 2 may or may not be on depending on thermostat call for stage 2 cooling<sup>2</sup>.
- Fan Speed may or may not be energized (indoor fan is operating on high or low speed or not at all). See Indoor 2 Speed Fan sequence under Energy Module Option Functions<sup>1</sup>.
- Exhaust Fan is off<sup>1</sup>.
- Damper Pos output is closed to Outdoor Air.

### Possible Co-existing Modes of Operation<sup>3</sup>: Free Cooling, Integrated Cooling, Mechanical Cooling, Heating, or Purge.

### Freeze Protection

- Outdoor air is suitable “for free cooling”.
- Y1 may or may not be energized depending on thermostat call for stage 1 cooling.
- Y2 may or may not be energized depending on thermostat call for stage 2 cooling.
- W1 may or may not be energized depending on thermostat call for stage 1 heating.
- G input is energized indicating occupied state of operation.
- Compressor 1 is de-energized<sup>2</sup>.
- Compressor 2 is de-energized<sup>2</sup>.
- Fan Speed may or may not be energized (indoor fan is operating on high or low speed). See Indoor 2 Speed Fan sequence under Energy Module Option Functions<sup>1</sup>.
- Exhaust Fan is off<sup>1</sup>.
- Damper Pos output is modulated from minimum to closed to maintain discharge air setpoint.

### Possible Modes of Operation<sup>3</sup>: Heating , Free Cooling and Ventilation.

#### Energy Module Option Functions<sup>1</sup>

##### Purge<sup>1</sup>

(Purge Control in Settings Menu must be turned on to enable and 24 VAC applied to AUX1)

- Outdoor air may or may not be suitable “for free cooling”.
- Y1 may or may not be energized depending on thermostat call for stage 1 cooling.
- Y2 may or may not be energized depending on thermostat call for stage 2 cooling.
- W1 may or may not be energized depending on thermostat call for stage 1 heating.
- G input may or may not be energized (occupied or unoccupied state).
- Compressor 1 may or may not be energized depending on thermostat call for stage 1 cooling<sup>2</sup>.
- Compressor 2 may or may not be energized depending on thermostat call for stage 2 cooling<sup>2</sup>.
- Fan Speed may or may not be energized (indoor fan is operating on high or low speed). See Indoor 2 Speed Fan sequence under Energy Module Option Functions<sup>1</sup>.
- Exhaust Fan is off<sup>1</sup>.
- Damper Pos output goes to value set in Purge Dmp Set.

### Possible Co-existing Modes of Operation<sup>3</sup>: Mechanical Cooling, Heating.

### Damper Override

- IF Remote Dmp Cntrl is turned on (enabled) in Settings menu  
AND G powered  
THEN Damper Pos will go to the value of the signal input (0-10 VDC) at AUX2.

**Note:** If outdoor air is suitable for “free cooling” and damper is override to closed position, there will be no cooling.

### Indoor 2 Speed Fan

Thermostat Signal	Economizing Available	OAT	Energy Module Fan Relay	Fan Speed	ZIP Econ / RTU Mode
G, Y1, not Y2	No	N/A	Closed	Low	1 Stage DX
G, Y1, not Y2	Yes	>50°F	Open	High	Economizing
G, Y1, not Y2	Yes	<50°F	Closed	Low	Economizing
G, Y1, Y2	No	N/A	Open	High	2 Stage DX
G, Y1, Y2	Yes	N/A	Open	High	Integrated Economizer
G, W1	No	N/A	Open	High	Heating
G, W1	Yes	N/A	Open	High	Heating
G, not Y1, not W1	No	N/A	Closed	Low	Ventilation
G, not Y1, not W1	Yes	N/A	Closed	Low	Ventilation
not G, not Y1, not W1	No	N/A	Open	Off	Unoccupied <sup>3</sup>
not G, not Y1, not W1	Yes	N/A	Open	Off	Unoccupied

When indoor fan is on high speed, the high speed fan minimum damper position setpoints Vent Min Pos and DCV Min Pos will be referenced as the minimums for damper control.

When indoor fan is on low speed, the low speed fan minimum damper position setpoints Low Sp Vent Min and Low Sp DCV Min will be referenced as the minimums for damper control.

**Note:** Indoor fan speed will operate according to the above table whether in Occupied or Unoccupied.

**Note:** If RTU equipped with fan speed switching relays from the factory, an Energy Module is not required to set up 2 Speed Fan. See 2 Speed Fan Op in settings menu for more information.

### Exhaust Fan

(Operates only in Free Cooling and Integrated Cooling.)

**Note:** In theory, if Exh Fan On Pos/Low Exh Fan Pos for damper % is set very low, then Exhaust Fan could also run in other modes (Ventilation, Mechanical, DCV).

- Control of the exhaust fan is damper position dependent. Damper setpoint for enable/disable of the exhaust fan is Indoor Fan Speed dependent (High Speed Damper Setpoint = Exh Fan On Pos; Low Speed Damper Setpoint = Low Exh Fan Pos).
  - IF Damper Pos is 10% greater than Exh Fan On Pos/ Low Exh Fan Pos  
OR Damper Pos is 100% open  
THEN Exhaust Fan will be energized.
  - IF Damper Pos is 10% less than Exh Fan On Pos/ Low Exh Fan Pos  
OR Damper Pos is less than 5% open  
THEN Exhaust Fan will be de-energized.

Example: If Exh Fan On Pos is set at 45%, when damper opens to 55%, exhaust fan will turn on. When damper closes to 35%, exhaust fan will turn off.

### Service and Commissioning

#### Manual Mode

This menu is available after Setup has been completed. This is selected in Level 2 menu Service and Commissioning. This supports the commissioning phase allowing all connected RTU components (except for the room thermostat) to be tested by manually commanding them through the keypad interface. **To prevent RTU safety lockout and possible equipment damage, ensure the RTU indoor fan is running!** Return to Automatic will occur automatically between 1-8 hours (adjustable) unless Return to Automatic is selected.

**Note:** Damper will move at high speed.

**Note:** Compressors, exhaust fan<sup>1</sup> and indoor 2 speed fan<sup>1</sup> minimum on or minimum off time does NOT apply in this test state. They will be turned on and off immediately based on the entered command. Also, exhaust fan<sup>1</sup> will not be turned on automatically based on damper position in this mode, but it can be manually commanded.

#### Damper Scaling

If there was a mechanical failure or adjustment that prevented proper damper scaling from virgin to automatic, it can be rescaled. "Damper scaling starts in 10secs" and will countdown to 0. A message will scroll saying "Damper scaling for better operation if obstruction is present rescale damper in commissioning menu". (For detailed instructions on this – please see the section "Service and Commissioning" below. This will open damper to 100% (re-scale control signal if needed). (Note: failure to identify obstructions or improper setup of damper assembly may result in an improper scaling and operation of the damper.)

Once scaling is complete, a message will appear saying "Damper scaling successful". The ZIP will then show "maximum at 80° = 100%" That message will show maximum rotation of the damper. This process ensures the damper is always operating and displayed from 0-100%.

#### Acceptance Test (Four possible options)

This menu is available after Setup has been completed. This complies with the California Title 24 Mechanical Testing and has four tests. **To prevent RTU safety lockout and possible equipment damage, ensure the RTU indoor fan is running!**

#### Economizer Test (NA7.5.4)

- This is an automatic functional and verification test that moves the damper 100% open/100% closed/and minimum position and switches on CC1 and EF<sup>1</sup> (if available). It leads one through the test step by step in accordance with California Title 24 test form.

**Note:** 1 minute minimum on time; 1 minute minimum off time for compressor applies in this test to prevent damage from short cycling. Exhaust fan<sup>1</sup> does turn on based on damper position in this test.

**Note:** Damper will move at high speed.

#### Ventilation Test (NA7.5.1.2)

- This is a manual test that allows adjustment to the damper minimum position (Vent Min Pos) in the Settings menu for verification of ventilation rates.

**Note:** Damper minimum position must be commanded to get damper to go to minimum position in this mode!

Example: Prior to going into this test, let's say Vent Min Pos is set for 20%. After going into this test you still must go into Settings/Vent Min Pos and change the value by at least 1%, then you can change back to 20%. If you don't create a change of value for Vent Min Pos the damper will not move off fully closed position in this test. The new Vent Min Pos setting you enter will be stored and used when you return to automatic.

#### RTU Test (NA7.5.2)

- This is a manual test used to test the following signals from the thermostat to the RTU:
  - G powered (Occupied) – damper is at minimum position (Vent Min Pos); otherwise the damper goes closed to outdoor air (Unoccupied).
  - Y1 powered – CC1 is energized; otherwise CC1 is de-energized.
  - Y2 powered – CC2 is energized; otherwise CC2 is de-energized.

**Note:** 1 minute minimum on time; 1 minute minimum off time applies in this test mode to prevent damage from short cycling compressors.

- W1 powered – Heating is enabled.

#### DCV<sup>1</sup> Test (NA7.5.5)<sup>6</sup>

- This is a manual test used for the following:
  - CO2 input will be used to modulate minimum damper position between DCV Min Pos and Vent Min Pos as CO2 levels vary below and above (respectively) the CO2 Setpoint.

All of the above tests can be aborted by selecting Return to Automatic in the Level 2 menu.

#### End of Sequences

<sup>1</sup> Only available with Energy Module Option. If no Energy Module exists associated menu options will not be displayed.

<sup>2</sup> Subject to Compressor Protection Strategies as noted earlier.

<sup>3</sup> The following modes listed below take display priority on the ZIP MMI when co-existing with this mode.

<sup>4</sup> This could possibly happen if W1 and Y1 are energized together calling for heating and cooling at the same time (provided that RTU is not configured as a Heat Pump.) An alarm will be generated.

<sup>5</sup> Minimum on/off times must be observed before compressor will be commanded.

<sup>6</sup> "G" must be energized to run test.

## Quick Setup

### Required "Settings" Parameters for All Configurations

**Note:** you may enter parameters in any order - eg: Vent min Pos before ZIP Code - If the RTU is a heat pump or uses a 2 speed indoor fan, these parameters should be enabled first, otherwise the logic may go to Setup Complete prematurely.

1. ZIP Code US or Canada (sets the free cooling changeover high limit and temperature units F/C)
  - a. When the Zip Code submenu is displayed enter "OK" to begin "US" Zip Code parameterization. If "Canada" Postal Code is desired press the up/down arrow to access.
    - i. Press OK to access digit 1 (flashing) then use the up/down arrow to parameterize; enter OK when complete. Repeat until all digits are complete. If a mistake is made press "esc" and repeat from beginning
  - ii. When all Zip Code or Postal Code digits are entered press "esc" to move up a level then press the up/down arrow to access next settings parameter.
2. Vent Min Pos (Outdoor Air Damper Ventilation Minimum Position)
  - a. When the "Vent Min Pos" submenu is displayed press "OK" to parameterize (flashing).




- b. Use the up/down arrow to parameterize, press "OK" when complete. The actuator will immediately drive the damper to the minimum position.
3. Additional Parameters may require setting. The ZIP Economizer will auto-detect added Devices such as a CO2 sensor etc. When the ZIP Economizer detects a new device, it will prompt the user in the Status level; navigate to Settings and parameterize blank fields. If the devices are connected upon first start up their settings will require parameterization then.
4. When all parameters have been set, the ZIP Economizer will show "Setup Complete" if there are still parameters to set, there will be no action. You can verify by pushing esc until status level is reached and it will display "Setup Incomplete". If this is the case, re-enter settings menu and use up down arrows to find the parameter with blank fields and parameterize as described above.

### Setup Complete - Initializing Automatic Mode

1. When all entries have been completed, the ZIP Economizer will switch to Status display and show "Setup Complete", and will immediately show a "Damper scaling starts in 10secs" and will countdown to 0 (**be aware, at 0 the damper will start to move at high speed**). A message will scroll saying "Damper scaling for better operation if obstruction is present rescale damper in commissioning menu". (For detailed instructions on this — please see the section "Service and Commissioning" below. This will open damper to 100% (re-scale control signal if needed). (Note: failure to identify obstructions or improper setup of damper assembly may result in an improper scaling and operation of the damper.)

Once scaling is complete, a message will appear saying "Damper scaling successful". The ZIP will then show "maximum at 80° = 100%" That message will show maximum rotation of the damper. This process ensures the damper is always operating and displayed from 0-100%.

2. Once the message has appeared, the actuator immediately closes the damper and a countdown begins, until the unit starts to operate in Automatic Mode (**be aware, when countdown complete, the RTU will respond to thermostat calls which may enable mechanical cooling**).

### Service and Commissioning (Acceptance Test & Manual Mode)

The ZIP Economizer has built in commissioning processes found in Acceptance Test.

1. **Economizer Test.** Use "Economizer Test" to verify RTU Integrated Economizer operation. Navigate to the "Service and Commissioning" menu, press "OK"; press the down arrow to access "Acceptance Test". Press OK again when "Economizer Test" appears. Press "OK" again to confirm running test. Follow prompts during test. This test will open damper to 100%, enable power exhaust fan (if connected), enable 1st stage of Mechanical Cooling, reverse this process and then drive to Vent Min Position. When used with a Belimo actuator, the actuator will speed up to reduce test time.
2. **Manual Mode** is used to override outputs after entering a "Timeout" duration.
3. **Damper Scaling.** The test will re-scale the control signal range to maximum resolution (0-100%) over the calibrated (reduced) angle. When using a Belimo actuator, the actuator will speed up to reduce test time.

**Note:** Failure to identify obstructions or improper setup of damper assembly may result in an improper scaling and operation of the damper.)

**Note:** Additional testing can be found on page 36 of this document.



## Demand Control Ventilation Setup

### Before Getting Started

ECON-ZIP-EM and CO<sub>2</sub> sensor can be added during or after initial set up.

1. A CO<sub>2</sub> sensor is needed with the following characteristics:
  - a. Output that is 0-10 VDC
  - b. Range of 0-2000ppm
2. Attach the Energy Module ECON-ZIP-EM to the ZIP Economizer ECON-ZIP-BASE.



3. Setting PPM range (only required if sensor is configurable for other ranges).

Type of Output	Ventilation Rate (cfm/Person)	Analog Output	CO <sub>2</sub> Control Range (ppm)
Proportional	Any	0-10V	0-2000

4. Power RTU and enter Settings Menu.

Note: When the CO<sub>2</sub> sensor is powered and 0-10 VDC is available at CO<sub>2</sub>+ and CO<sub>2</sub>-, the ZIP Economizer will recognize the CO<sub>2</sub> presence and the prompt to set up CO<sub>2</sub> settings.

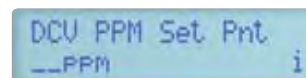
5. Setting DCV settings.

- a. With single speed indoor fan, only 2 DCV settings are required.

- i. DCV Min Pos – This is the minimum occupied or zero occupancy ventilation rate expressed in damper percent open (Title 24 2013 section 120.1(b)2; ASHRAE 62.1 Section 6.2.7).

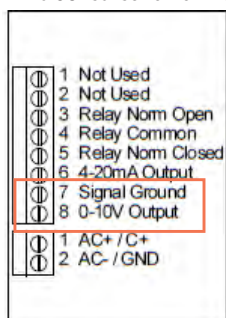


- ii. CO<sub>2</sub> PPM Set Pnt – This is the CO<sub>2</sub> concentration that is desired in the space (Title 24 2013 section 120.1(c)4. prescribed as 600ppm plus outdoor air CO<sub>2</sub> concentration assumed to be 400ppm = a set point of 1000ppm).



### Wiring CO<sub>2</sub> Sensor to ZIP Economizer

1. Wire CO<sub>2</sub> sensor 0-10 VDC output to ECON-ZIP-EM CO<sub>2</sub> sensor input.

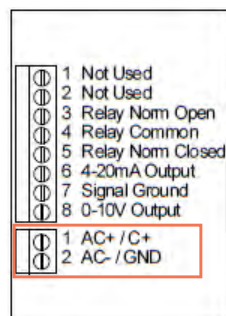


Example CO<sub>2</sub> Sensor Diagram



2. Wire CO<sub>2</sub> sensor power.

Note: If RTU transformer VA is sufficient R/C terminals may be used on ZIP Economizer.



Example CO<sub>2</sub> Sensor Diagram



### Operation

The ZIP Economizer logic will control the outside air damper position based on space CO<sub>2</sub> dilution needs. If the CO<sub>2</sub> value is low, the damper shall remain at DCV Min Pos when not in free cooling. When the CO<sub>2</sub> concentration rises above the CO<sub>2</sub> PPM Set Pnt (as the space becomes more populated), then the damper will start to modulate towards Vent Min Pos to maintain level at CO<sub>2</sub> PPM set Pnt. When the CO<sub>2</sub> concentration drops in the space (the space population decreases) the damper will start to modulate back towards DCV Min Pos.

### **WARNING** Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.