

# Installation Guide

## ZP4-ESP UNIVERSAL 2-POSITION FORCED AIR ZONING SYSTEM



**HVAC Controls**  
Indianapolis, IN 46237

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## **OVERVIEW**

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The ZP4-ESP is a 4 zone universal zone control panel that includes integrated ESP static pressure control logic designed to eliminate the need for a conventional bypass damper when used with 3-wire zone dampers. The panel is capable of handling up to 2 stages of conventional heating and cooling or 3 stages of heating and 2 stages of cooling for heat pump and fossil fuel applications.

## **SEQUENCE OF OPERATION**

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The panel allows a single HVAC unit to have up to four separate zones. Each zone is controlled by its own thermostat. When a zone thermostat calls for heating or cooling, the zones not calling will have their dampers powered closed, and the zones calling will have their dampers powered opened. The heating or cooling equipment will also be brought on.

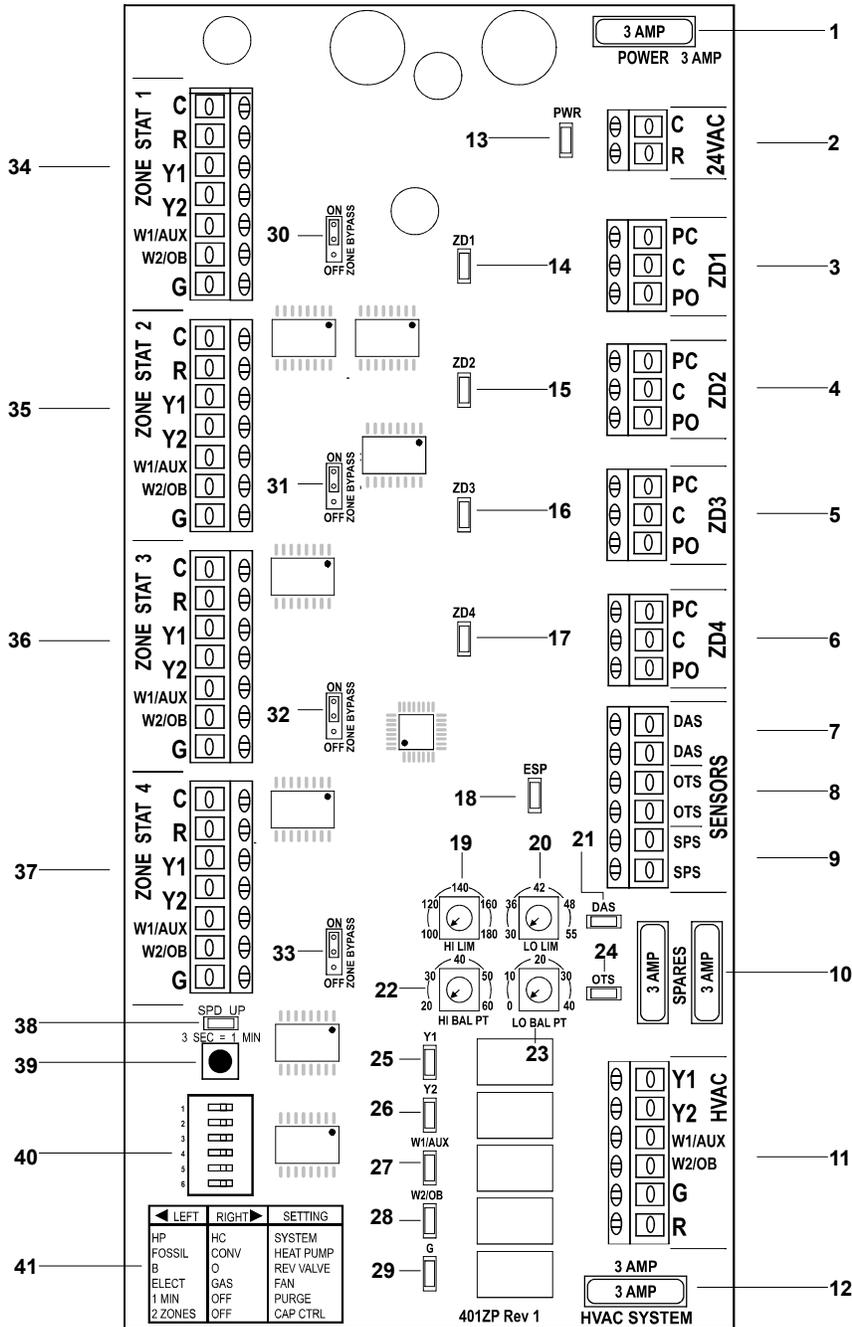
As zone dampers open and close, the ZPA-SPS Static Pressure Sensor continuously monitors the system static pressure. If the static pressure goes above the static pressure setpoint, the panel will send a signal to all selected non-calling zone dampers to start to open to a point where the static pressure setpoint is maintained. The ESP LED will come on with the non-calling zone LEDs until the static pressure reaches setpoint. The small amount of air allowed to bleed into non-calling zones eliminates air noise and assures proper airflow through the HVAC system. This also prevents coil freeze up and high temperature issues.

## **DESIGN AND INSTALLATION GUIDELINES**

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- [ ] Zone control begins with good HVAC design.
- [ ] Proper load calculations used to determine duct and equipment sizing are essential in achieving optimum performance.
- [ ] Install zone thermostats in their respective zones.
- [ ] System wires should be tagged to match the panel terminal designations and zone identification.
- [ ] Zone dampers should be installed at least 10' back from discharge air grills whenever possible.
- [ ] Zone dampers need to be located where they can be accessed for trouble shooting.
- [ ] Flex or lined duct is recommended on the last 5' of each branch run.
- [ ] Thermostats and zone dampers can typically be located up to 300' from the control panel when 18AWG copper thermostat wire is used.
- [ ] Always use a separate 24VAC transformer rated at the proper VA to power the panel, zone dampers and thermostats.
- [ ] Never use the equipment transformer regardless of its VA rating.
- [ ] When using forced air zoning with a variable speed HVAC system, high speed fan should be set at 400 CFM per ton of cooling.

# ZP4-ESP PANEL LAYOUT



1. 3 AMP FUSE PROTECTS PRINTED CIRCUIT BOARD
2. 24 VOLT TRANSFORMER TERMINALS
3. ZONE 1 DAMPER TERMINALS
4. ZONE 2 DAMPER TERMINALS
5. ZONE 3 DAMPER TERMINALS
6. ZONE 4 DAMPER TERMINALS
7. DISCHARGE AIR SENSOR TERMINALS
8. OUTDOOR TEMPERATURE SENSOR TERMINALS
9. STATIC PRESSURE SENSOR TERMINALS
10. SPARE 3 AMP FUSES
11. HVAC EQUIPMENT TERMINALS
12. 3 AMP FUSE PROTECTS THE RELAY CONTACTS
13. PANEL POWER LED
14. ZONE 1 LED
15. ZONE 2 LED
16. ZONE 3 LED
17. ZONE 4 LED
18. ESP LED
19. HIGH LIMIT POTENTIOMETER
20. LOW LIMIT POTENTIOMETER
21. DISCHARGE AIR SENSOR LED

22. HIGH BALANCE POINT POTENTIOMETER
23. LOW BALANCE POINT POTENTIOMETER
24. OUTDOOR TEMPERATURE SENSOR LED
25. Y1 RELAY LED
26. Y2 RELAY LED
27. W1/AUX LED
28. W2/OB LED
29. G LED
30. ZONE 1 BYPASS JUMPER
31. ZONE 2 BYPASS JUMPER
32. ZONE 3 BYPASS JUMPER
33. ZONE 4 BYPASS JUMPER
34. ZONE 1 THERMOSTAT TERMINALS
35. ZONE 2 THERMOSTAT TERMINALS
36. ZONE 3 THERMOSTAT TERMINALS
37. ZONE 4 THERMOSTAT TERMINALS
38. TIME DELAY SPEED UP LED
39. TIME DELAY SPEED UP BUTTON
40. SYSTEM CONFIGURATION SELECTOR SWITCHES
41. SYSTEM CONFIGURATION SWITCH DEFINITIONS

# INSTALLING AND WIRING THE ZP4-ESP PANEL

## WARNING!

1. Turn power off to HVAC equipment and control panel during installation to prevent serious injury from electrical shock and/or damage to the system.
2. Use extreme care when making duct openings and handling sheet metal to avoid injury.
3. Install all components in a manner that provides easy access for test, check, and startup.

## CAUTION!

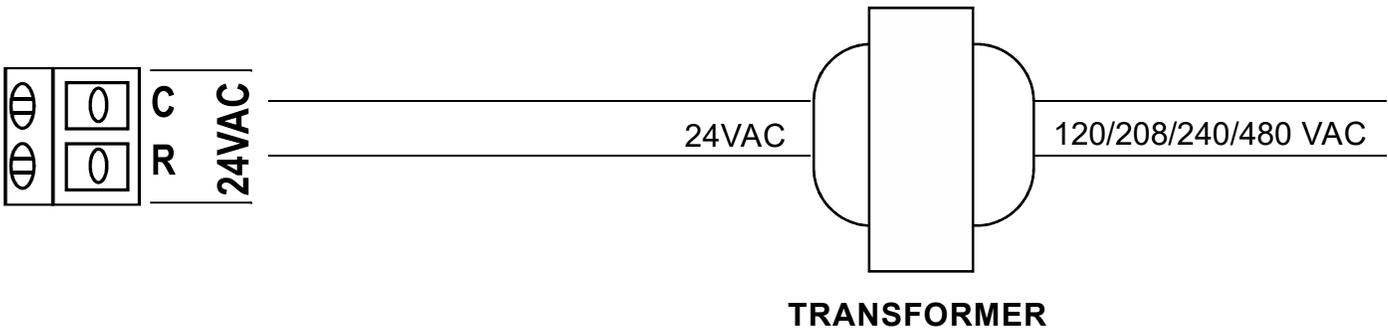
1. Installation of this system must be in compliance with all applicable codes.
2. HVAC system must be properly sized and balanced to assure optimum system performance.
3. All low voltage cable must be 18 gauge solid (not stranded) wire.
4. All wiring should be color coded and tagged for proper identification.

## Mounting the Panel

Carefully remove the panel from the shipping carton. Remove the cover and any packing material. Position the panel on a flat, non-condensating, vertical surface near the indoor unit that will facilitate ease of wiring and service access. Use appropriate anchors and screws to secure the panel to the surface.

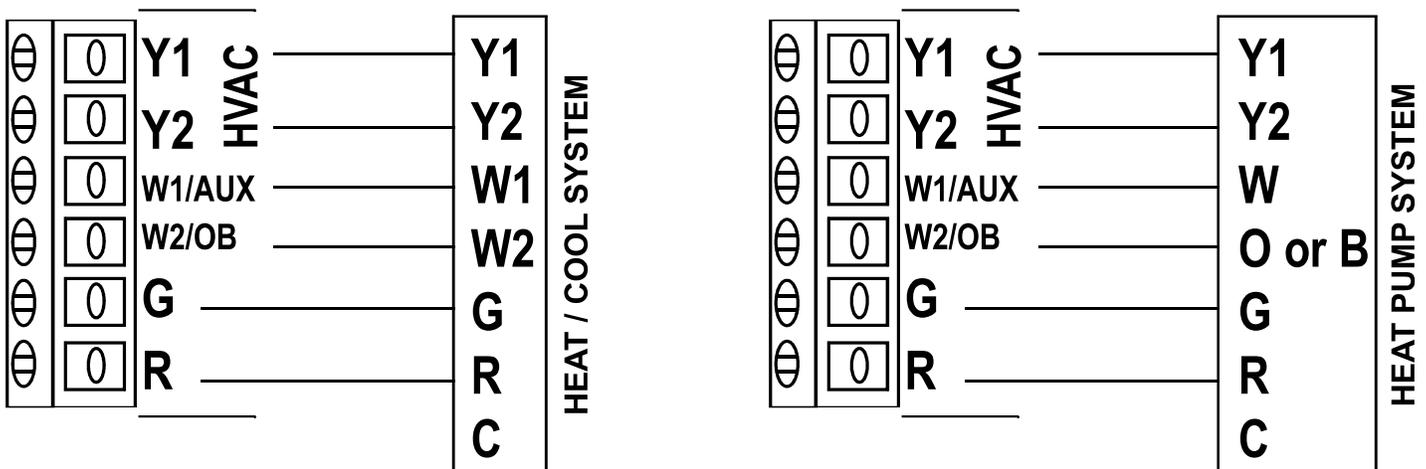
## System Power

1. Wire a 24VAC, 40VA transformer to the 24VAC 'R' and 'C' terminals on the ZP4-ESP panel.



## HVAC System

2. Wire the HVAC equipment to the HVAC SYSTEM terminals on the ZP4-ESP panel.

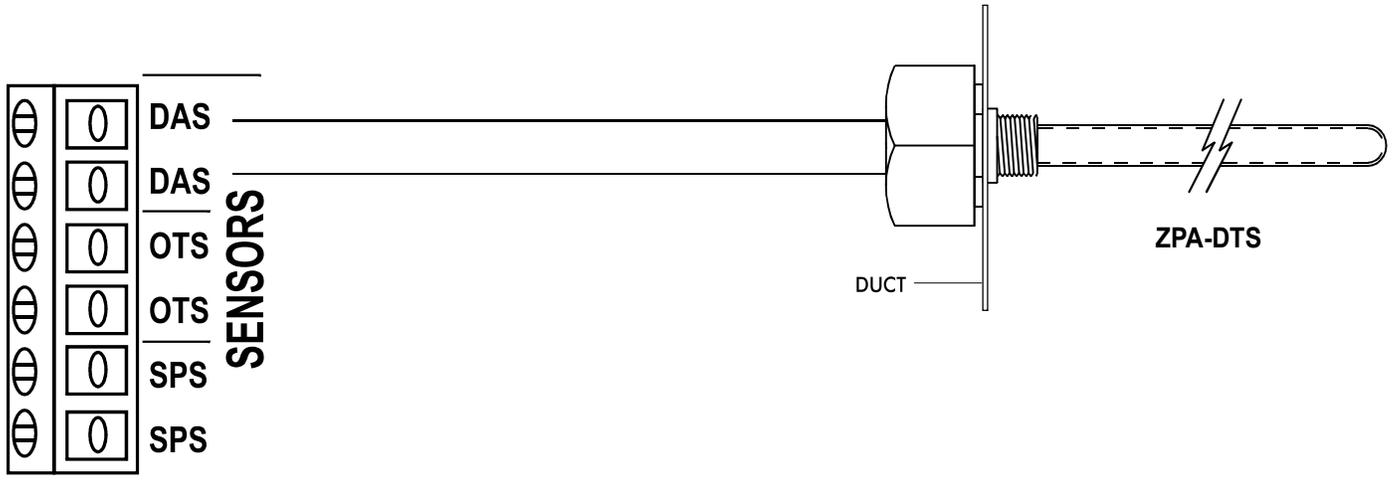


## Sensors

The SENSORS terminals provide inputs for Discharge Air Sensor (DAS), and Outdoor Temperature Sensor (OTS) and Static Pressure Sensor (SPS). The DAS and OTS sensors are NTC Type III thermistors rated at 10K Ohms @ 77° F.

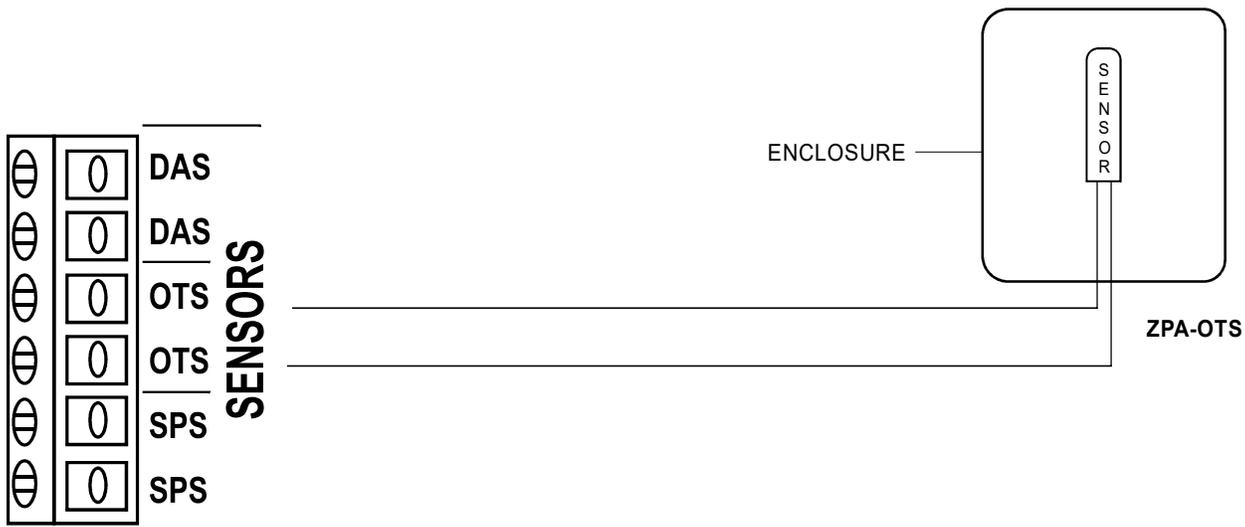
### Discharge Air Sensor

Mount the discharge air sensor in the main supply duct out of the line of sight of the heat exchanger or cooling coil and upstream of any duct transitions or zone dampers. Wire the sensor to the DAS and DAS terminals on the panel. The sensor is used for High and Low Limit protection.



### Outdoor Temperature Sensor (Optional)

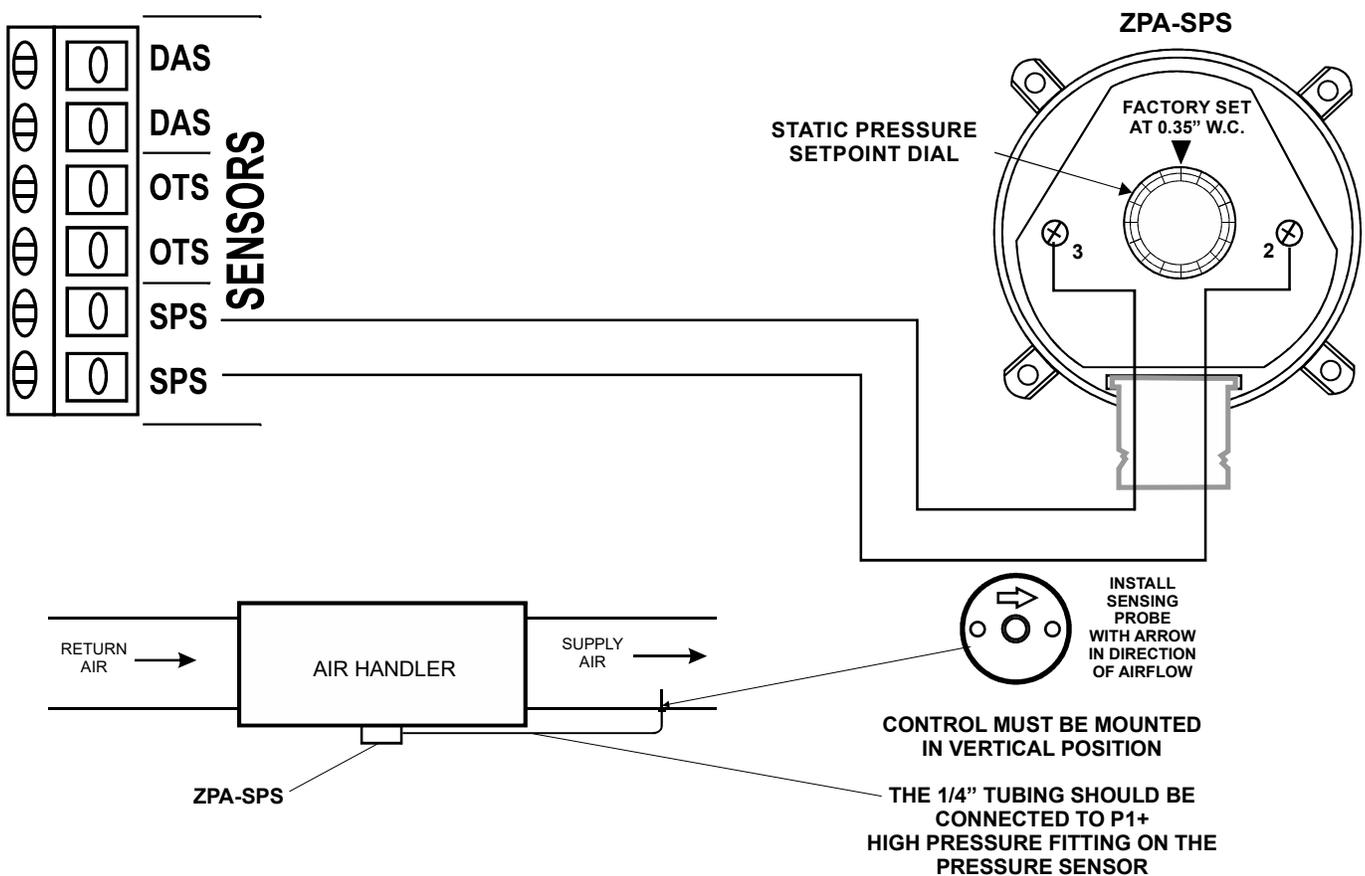
The outdoor temperature sensor is used for High and Low Balance Point control in heat pump and fossil fuel applications. Mount the sensor inside the outdoor unit where it will not be directly exposed to sunlight, water, snow or ice. Wire the sensor to the OTS and OTS terminals on the panel.



## SPS Terminals

The SPS terminals 2 and 3 wire to the ZPA-SPS Static Pressure sensor. The sensor should be installed on a flat surface so that the diaphragm is in the vertical position. Use the 1/4" x 36" tubing provided and connect one end to the (P1+) high pressure fitting on the sensor. The other end of the tubing should be connected to the plastic sensing probe mounted in the main discharge air plenum prior to any zone dampers or duct transitions. The sensing probe is 2-1/8" x 1/4" O.D. Install and mount the probe with the arrow in the direction of airflow. The pressure sensor is factory set for 0.35" W.C. but is fully adjustable from 0.08 to 1.2" W.C. The terminals are not polarity sensitive. Use 18-2 thermostat wire. After removing the outer jacket, strip approximately 1/8" insulation off of each wire. Land the wires to terminals 2 and 3 on the pressure sensor and repeat the process on the other end by landing the wires to the SPS terminals on the panel.

NOTE: The ESP function only works with 3-wire, power open / power close dampers.

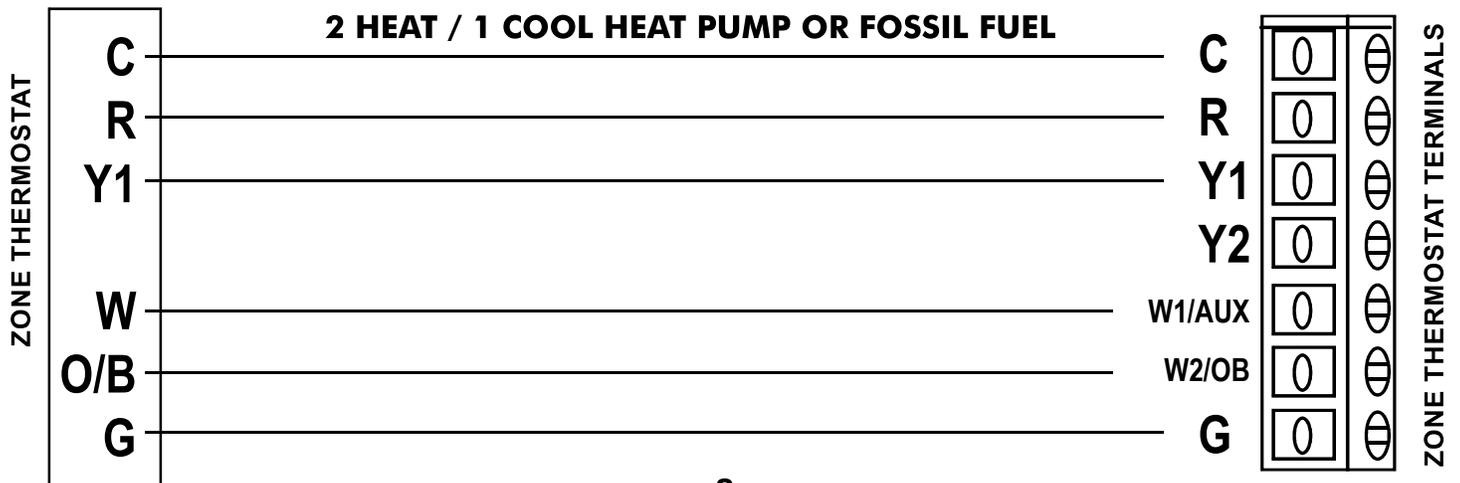
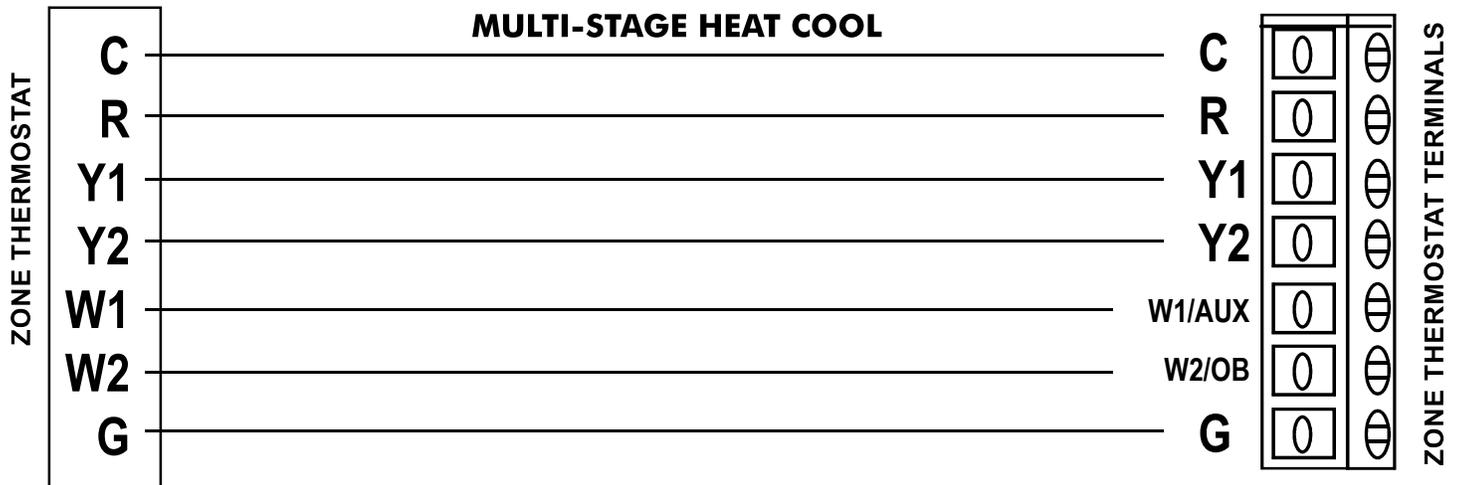
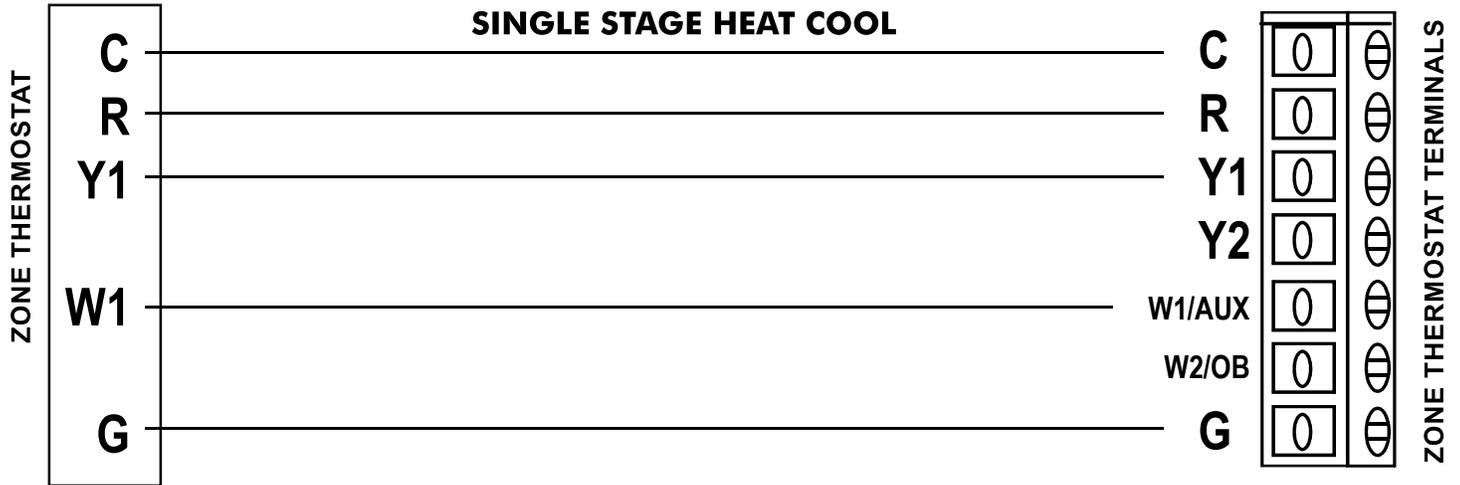


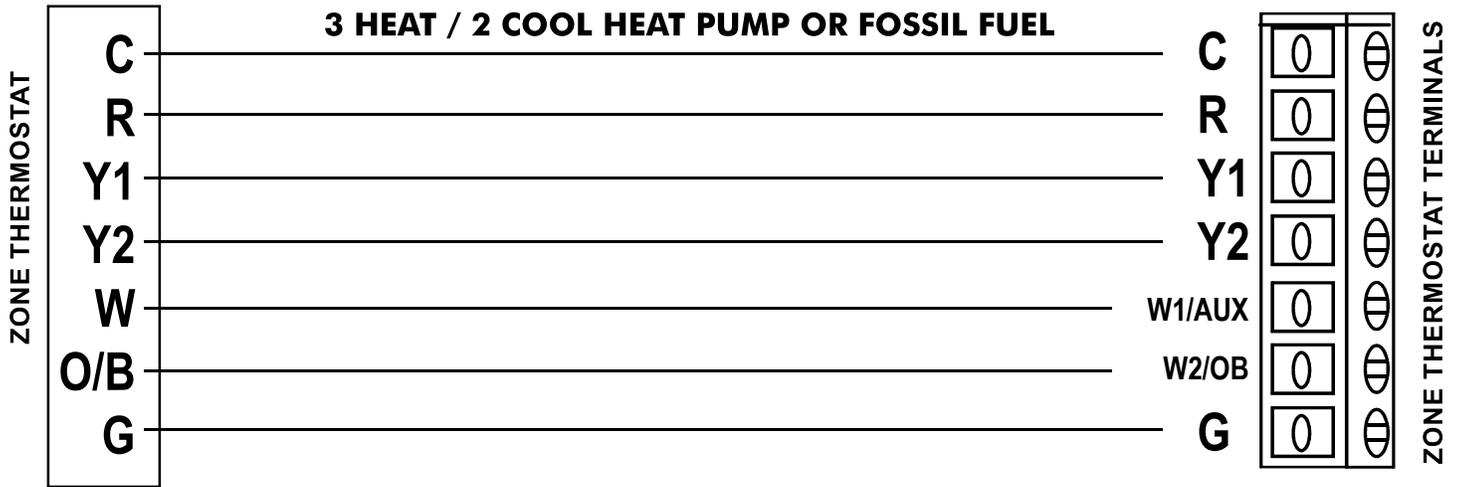
## How ESP Works

As zone dampers open and close, the ZPA-SPS Static Pressure Sensor continuously monitors the system static pressure. If the static pressure goes above the static pressure setpoint, the sensor will send a signal to the panel which will begin to open selected non-calling zone dampers until the static pressure setpoint is maintained. The SPS LED will come on until the static pressure reaches setpoint and then will turn off. Any zone with the bypass jumper in the OFF position will not be allowed to bleed air. The small amount of air allowed to bleed into selected non-calling zones eliminates air noise and ensures proper airflow through the HVAC system. This also prevents coil freeze up and high temperature issues. When all zones are satisfied, all zone dampers will go to the full open position provided no thermostat is calling for ventilation mode.

## Zone Thermostats

The Panel has inputs for four zone thermostats. Each zone thermostat must be equipment compatible.

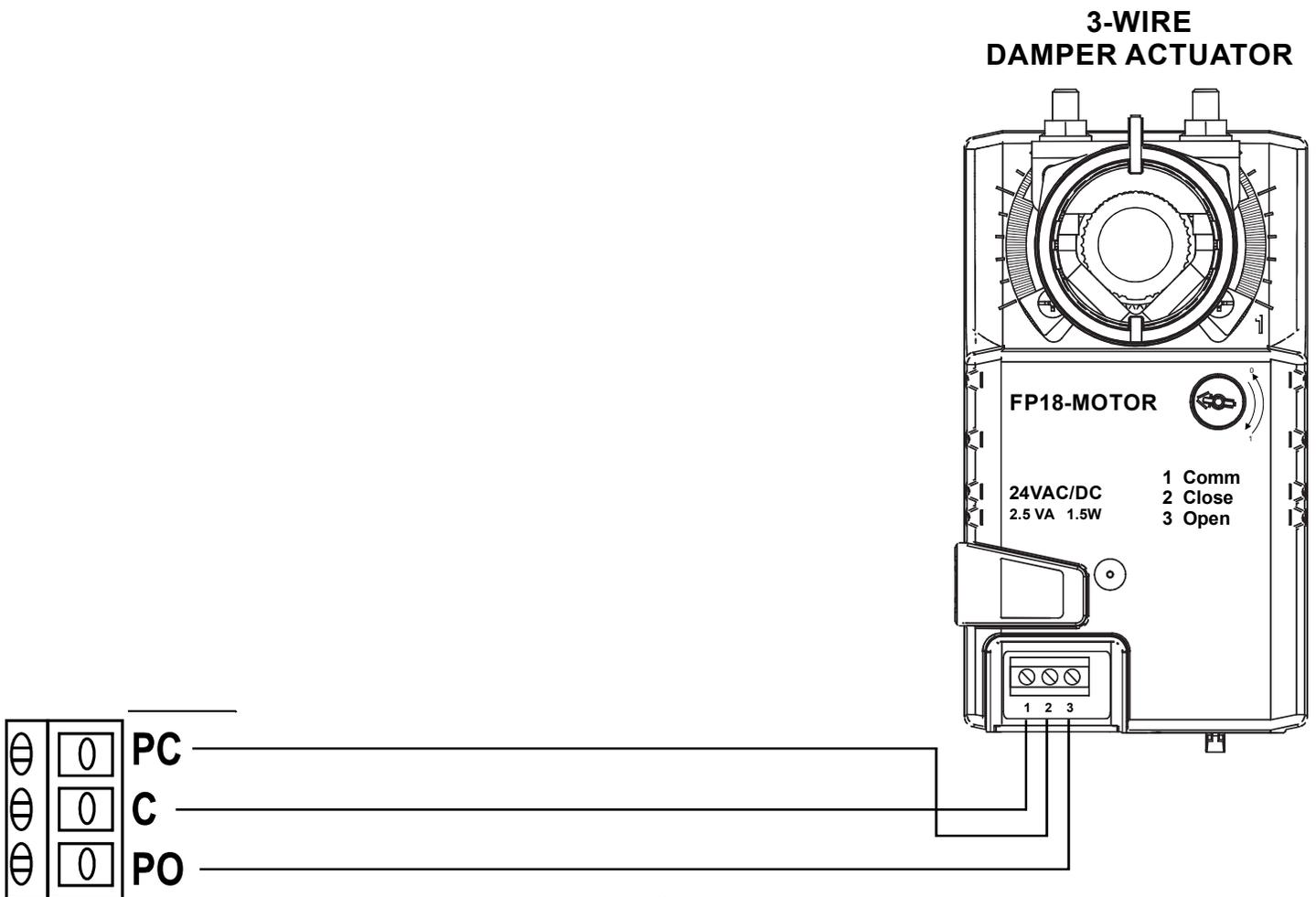




### Zone Dampers

The panel has dedicated terminals for each zone damper. Dampers have three-wire, floating point actuators rated at 2.5VA.

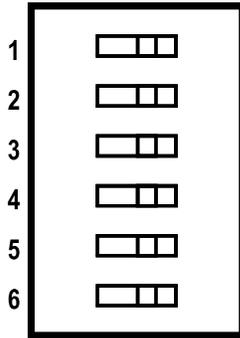
NOTE: 3-wire dampers must be used with the ESP function that eliminates the need for a traditional bypass damper.



# PANEL SETUP

## CONFIGURING PANEL FOR EQUIPMENT APPLICATION:

Once all wiring is completed, the panel can be configured for the specific equipment application. The ZP4-ESP has a row of slide switches located on the printed circuit board along with a switch selection chart.



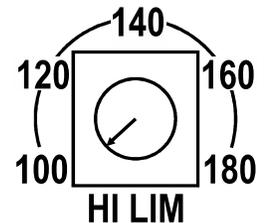
◀ LEFT	RIGHT ▶	SETTING
HP	HC	SYSTEM
FOSSIL	CONV	HEAT PUMP
B	O	REV VALVE
ELECT	GAS	FAN
1 MIN	OFF	PURGE
2 ZONES	OFF	CAP CTRL

## SWITCH DEFINITIONS:

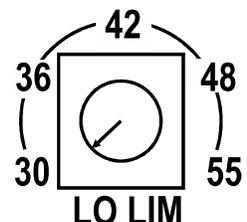
- SW-1** Selects type of HVAC equipment.  
Right = Conventional Heat/Cool  
Left = Heat Pump
- SW-2** Selects type of heat pump system.  
Right = Conventional heat pump  
Left = Heat pump with fossil fuel furnace
- SW-3** Selects heat pump reversing valve order.  
Right = O (energizes in cooling)  
Left = B (energizes in heating)
- SW-4** Selects fan operation.  
Right = Fan controlled by furnace  
Left = Fan energized on call for heat
- SW-5** Purge option  
Right = No purge after call  
Left = Purge after call is satisfied for 1 minute into last zone calling before all dampers go open
- SW-6** Capacity Control option  
Right = No Capacity Control  
Left = Only allow additional equipment staging if 2 or more zones are calling and at least one zone is calling for an additional stage

## LIMIT ADJUSTMENTS:

**High Limit** - The panel has a potentiometer marked HI LIM that is adjustable from 100° to 180° F. When used with the ZPA-DTS duct sensor, should the temperature rise above the high limit setting, the panel will shut off the heating system. The fan will continue to run until the temperature drops below the high limit setting. The high limit setpoint should always be below the internal safety limit setting of the heating system.



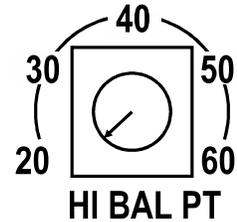
**Low Limit** - The panel has a potentiometer marked LO LIM that is adjustable from 30° to 55° F. When used with the ZPA-DTS duct sensor, should the temperature fall below the low limit setting, the panel will shut off the compressor. The fan will continue to run until the temperature rises above the low limit setting. A time delay will also be initiated to prevent short cycling of the equipment.



## BALANCE POINT ADJUSTMENTS:

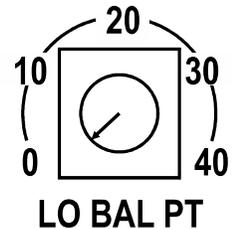
When used with a heat pump or dual fuel system and fitted with a ZPA-OTS outdoor sensor, the panel can provide both high and low balance point control.

**High Balance Point** - The panel has a potentiometer marked HI BAL PT that is adjustable from 20° to 60° F. If the outdoor temperature rises above the high balance point setting, the panel will prevent auxiliary heat from coming on.



**Note:** If a zone thermostat is set in the emergency heat mode, the panel will override the high balance point setting regardless of the outdoor temperature and the system will function in emergency heat until the thermostat is taken out of the emergency heat mode.

**Low Balance Point** - The panel has a potentiometer marked LO BAL PT that is adjustable from 0° - 40° F. If the outdoor temperature falls below the low balance point setting, the panel will lock out mechanical heating and change over to the auxiliary heat source.



## ZONE BYPASS

Each zone has a Zone Bypass jumper that can be used to remove the ESP function for that zone. This can be useful in applications where one zone out of three or four zones may represent a very small percentage of the total system CFM.



## PANEL LED DEFINITIONS AND FUNCTIONS

LED	COLOR	DEFINITION	FUNCTION
<b>PWR</b>	Red	Power	<b>ON</b> - 24VAC to panel <b>OFF</b> - No 24VAC to C and R terminals or 3 AMP POWER fuse is blown
<b>ESP</b>	Red	Static Pressure Control	<b>ON</b> - When system static pressure is above static pressure control setpoint <b>OFF</b> - When system static pressure is below static pressure control setpoint
<b>ZD1</b>	Green	Zone Damper 1	<b>ON</b> - Damper driving open or in the open position
<b>ZD2</b>	Green	Zone Damper 2	<b>OFF</b> - Damper in the closed position
<b>ZD3</b>	Green	Zone Damper 3	<b>BLINKING</b> - Damper in floating position to relieve static pressure as part of ESP function
<b>ZD4</b>	Green	Zone Damper 4	
<b>DAS</b>	Red	Discharge Air Sensor	<b>ON</b> - Confirms discharge air sensor is wired to panel <b>OFF</b> - No discharge air sensor wired to panel or wiring problem <b>BLINKING</b> - Panel out on High or Low Limit
<b>OTS</b>	Red	Outdoor Temp Sensor	<b>ON</b> - Confirms outdoor temperature sensor is wired to panel <b>OFF</b> - No outdoor temperature sensor wired to panel or wiring problem <b>BLINKING</b> - Panel out on High or Low Balance Point
<b>SPD UP</b>	Red	Speed Up Mode	<b>OFF</b> - Panel time delays in standard operating mode <b>BLINKING</b> - Panel time delays in speed up mode
<b>Y1</b>	Red	1st Stage Compressor	<b>ON</b> - Panel calling for 1st stage compressor <b>OFF</b> - No call for 1st stage compressor
<b>Y2</b>	Red	2nd Stage Compressor	<b>ON</b> - Panel calling for 2nd stage compressor <b>OFF</b> - No call for 2nd stage compressor
<b>W1/AUX</b>	Red	1st Stage Heat or Aux Heat	<b>ON</b> - Panel calling for 1st stage or auxiliary heat <b>OFF</b> - No call for 1st stage or auxiliary heat
<b>W2/OB</b>	Red	2nd Stage Heat-Reversing Valve	<b>ON</b> - Panel calling for 2nd stage heat or reversing valve is energized <b>OFF</b> - No call for 2nd stage heat or reversing valve is de-energized
<b>G</b>	Red	Fan	<b>ON</b> - Fan relay energized <b>OFF</b> - Fan relay de-energized

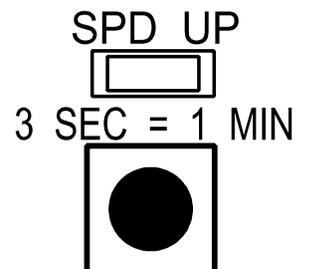
# PANEL TIME DELAY CHART

TIME DELAY	NORMAL MODE	SPEED UP MODE
Minimum OFF Time	3 Minutes	9 Seconds
Changeover	5 Minutes	15 Seconds
Time Share	20 Minutes	60 Seconds
Purge	1 Minute	3 Seconds

## TEST, CHECK AND START-UP

1. Verify that all component wires have been connected to the proper terminals and are secure.
2. Make sure that the selector switches on the panel are in their proper position for the specific equipment application.
3. Temporarily disconnect the R wire from the panel to the HVAC system.
4. Apply 24 Volt power to the panel.
5. Place all zone thermostats in the OFF mode with Auto Fan.
6. With no calls taking place, the following panel LEDs should be lit:
  - PWR
  - ZD1
  - ZD2
  - ZD3
  - ZD4
  - DAS (If Discharge Air Sensor is wired to panel)
  - OTS (If Outdoor Temperature Sensor is wired to panel)
7. Visually confirm that all zone dampers are in the open-position.
8. Place zone 1 thermostat in the continuous fan ON mode. The following LEDs should be lit:
  - PWR
  - ZD1
  - DAS (If Discharge Air Sensor is wired to panel)
  - OTS (If Outdoor Temperature Sensor is wired to panel)
  - G
9. Put zone 1 thermostat in Auto Fan and repeat the same steps for each zone thermostat in the system. The only change in LED status will be the ZD2 LED will light for zone 2, ZD3 LED will light for zone 3 and ZD4 LED will light for zone 4.
10. Once the ventilation test is completed, and the zone thermostat fan modes are set to Auto, place zone 1 thermostat in the cooling mode and adjust the setpoint above the space temperature until it calls for cooling. Keep in mind that the zone thermostat may have a time delay.

**NOTE:** The panel also has built-in time delays that can be put in speed up mode by pressing the SPD UP button on the panel. The SPD UP LED will start blinking confirming the time delays in the panel are in speed up mode. 3 seconds = 1 minute in speed up mode. Pushing the SPD Up button manually turns speed up on and off. If left on, speed up mode will automatically drop out in 10 minutes.



11. Once the cooling cycle is energized, the following panel LEDs should be lit:

PWR

ZD1

DAS (If Discharge Air Sensor is wired to panel)

OTS (If Outdoor Temperature Sensor is wired to panel)

Y1

Y2 (If two stage system and setpoint is low enough to energize second stage)

G

**NOTE:** If the panel has been configured for heat pump or fossil fuel, and the reversing valve is set to 'O' for cooling, the W2/OB LED would come on indicating that the reversing valve output is energized.

12. Leave zone 1 thermostat in the cooling mode and place zone 2 thermostat in the cooling mode.

Once the thermostat calls for cooling ZD2 LED will come on.

13. Repeat this step for each zone thermostat in the system and confirm that its zone LED comes on.

14. Turn each zone thermostat off until the panel no longer displays any cooling calls.

15. Place zone 1 thermostat in the heating mode and adjust the setpoint above the space temperature to force a heating call.

16. Once the heating cycle is energized, the following panel LEDs should be lit based on the following equipment configurations:

Conventional Heat/Cool

PWR

ZD1

DAS (If Discharge Air Sensor is wired to panel)

OTS (If Outdoor Temperature Sensor is wired to panel)

W1

W2 (If two stage system and setpoint is high enough to energize second stage)

G (If fan selector switch is set for electric)

Conventional Heat Pump or Fossil Fuel

PWR

ZD1

DAS (If Discharge Air Sensor is wired to panel)

OTS (If Outdoor Temperature Sensor is wired to panel)

Y1

Y2 (If two stages of compressor and setpoint is high enough to energize second stage)

W1/AUX (If setpoint is high enough to energize auxiliary heat)

G

**NOTE:** If the panel has been configured for heat pump or fossil fuel, and the reversing valve is set to 'B' for heating, the W2/OB LED would come on indicating that the reversing valve output is energized. In fossil fuel configuration, if the thermostat calls for auxiliary heat, all compressors will be dropped out.

17. Repeat this step for each zone thermostat in the system and confirm that its zone LED comes on.

18. Turn each zone thermostat off until the panel no longer displays any heating calls.

19. Turn off 24 volts to the panel and reconnect the R wire from the panel to the HVAC system.

20. Reapply 24 volts to the panel.

21. Place zone one thermostat in the continuous fan ON mode.

22. ZD1 and G LED should light and the system fan should come on.

23. If the system static pressure rises above the ESP static pressure sensor setting, the ESP LED will come on and the non-calling zone LEDs will come on confirming that they are opening.

24. When the system static pressure falls below the ESP static pressure sensor setting, the ESP LED will go out but the non-calling zone LEDs will blink confirming they are in a floating position.
25. After confirming the ESP function is working, place the zone one thermostat in the Auto fan mode.
26. The system fan should shut off and all zone LEDs will light confirming that the zone dampers are now in the full open position.
27. Place the zone thermostats in their normal operating mode and adjust setpoints and scheduling accordingly.

## ZP4-ESP SPECIFICATIONS:

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### Enclosure:

Aluminum

### Panel Dimensions:

Height: 8.75"

Width: 7.0"

Depth 1.5"

### PC Board Mounting:

Individual Snap Track mounted to enclosure base

### Operating Temperature Rating:

-40° F to 150° F

### Operating Humidity:

5% to 90% RH non-condensing

### Wiring:

18-gauge wire for all equipment and component connections.

### Time Delays:

5 minutes off between heating and cooling calls

3 minutes off on high or low limit

20 minute time share

Purge ON = 1 minute

### Thermostats:

Single or multi-stage

Programmable or non-programmable

Auto or manual changeover

### Sensors:

ZPA-DTS Discharge Temperature Sensor

NTC Type 3, 10KΩ @ 77° F, +/- 3% @ 77° F

ZPA-OTS Outdoor Temperature Sensor

NTC Type 3, 10KΩ @ 77° F, +/- 3% @ 77° F



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