# INSTALLATION INSTRUCTIONS

## Harmony III™ Zoning System

ZONING
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Supersedes 2/2014

Technical Publications
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**THIS MANUAL MUST BE LEFT WITH THE HOMEOWNER FOR FUTURE REFERENCE**

**⚠ WARNING**

Improper installation, adjustment, alteration, service or maintenance can cause personal injury, loss of life, or damage to property.

Installation and service must be performed by a licensed professional installer (or equivalent) or a service agency.

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# GENERAL

## Shipping and Packing List

Items shipped with the Harmony III™ zoning system include:

1 - Harmony III™ zoning system unit
1 - Discharge Air Sensor

**Additional items**—ordered separately; include (see System Components on Page 4):

- Transformer
- Dampers
- Thermostats
- Balance Point Sensor kit (56A87)
- Pressure switch (For Heat Pump Option): HFC-22 (27W12); HFC-410A (27W13)
- Tee for vapor line High Pressure Switch (87071)
- Defrost Tempering Kit (67M41)
- Humiditrol® Enhanced Dehumidification Accessory (EDA), EDA-024B (94M41), EDA-036C (94M42), EDA-060D (94M43)
- Humiditrol® Zoning Accessory (HZA) Kit (39W67) (required if Humiditrol® EDA, above, is used)

## Introduction

**⚠ IMPORTANT**

Variable Speed Blower Motor (VSM) technology is required for use with Harmony III™ zoning system.

The Lennox Harmony III™ zoning system manages the distribution of conditioned air to specific areas or zones in a house or small commercial building by directing heated or cooled air to occupied areas without conditioning unused areas. This improves economy while providing a balanced and comfortable environment. The system can be used in the following Lennox HVAC system applications:

**Option 1**. Variable speed gas furnace used with a 2-stage condensing unit.*

**Option 2**. Variable speed air handler unit (with or without electric heat) used with a 2-stage condensing unit or heat pump.*

**Option 3**. Variable speed gas furnace used with a 2-stage heat pump.*

*A 1 stage condensing unit (heat pump) may be used under specific circumstances as listed in Table 3 (see Page 5).

Variations on the options described above and included in this document are: cooling-only, hot water coil, and cooling system with electric heat applications.

The Harmony III™ zoning system uses off-the-shelf, single-stage, non-heat pump, non-power-robbing electronic thermostats and motorized dampers in any of the applications to control distribution of conditioned air to different zones. This control allows conditioning of different zones within a residence while using a single HVAC system.

The zone control system operates in two modes: **central control** (vacation mode) or **zone control**. LEDs on the zone control panel indicate the current operating mode.

When the system is in the **central control mode**, a demand from the central control thermostat results in conditioned air being directed to all of the zones. In this mode, zone 1 thermostat is designated as the controlling thermostat; other thermostats are not used.

When the system is in the **zone control mode**, a zone is conditioned only upon demand from that zone's thermostat.

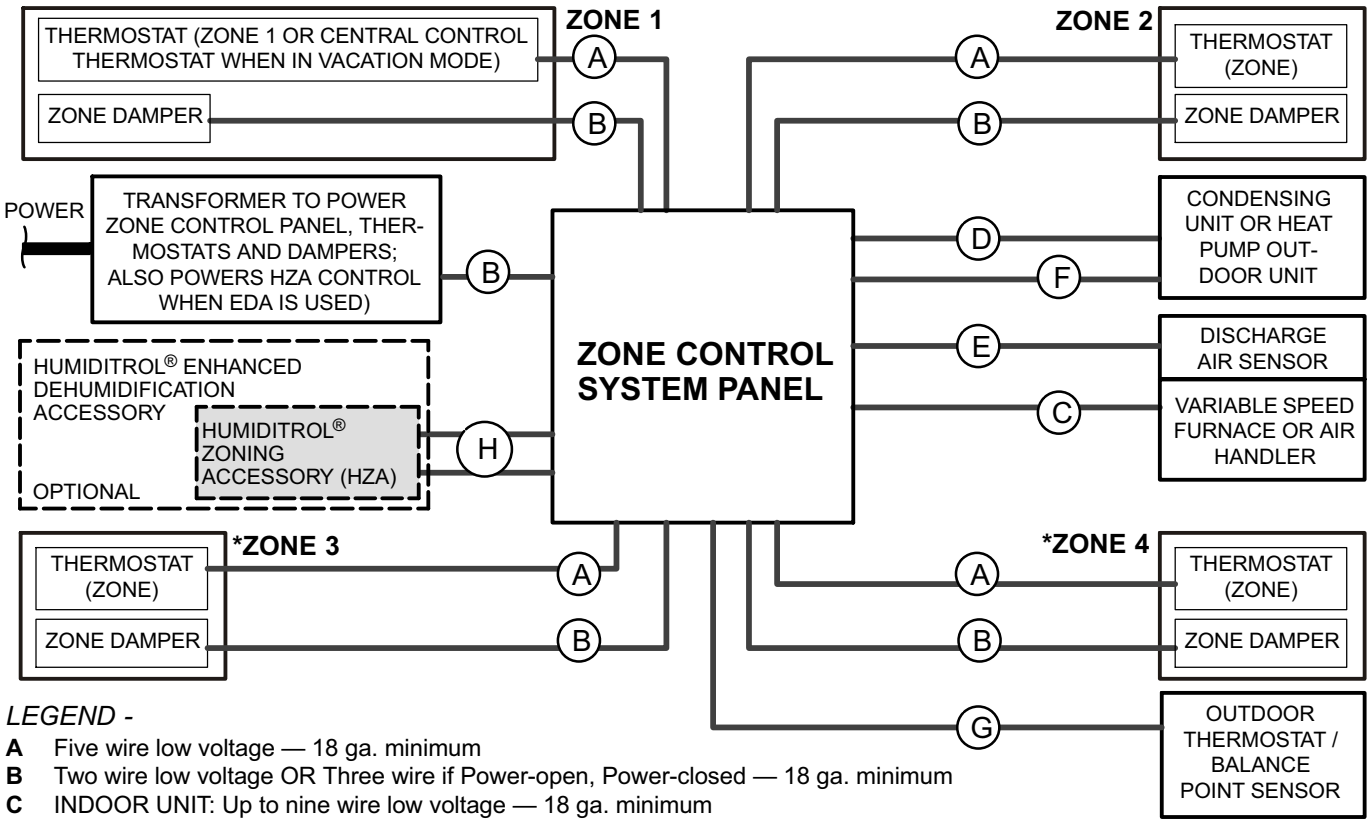
The zone control system is ideal for retrofit applications as well as new construction. The system controls the air volume, eliminating the need for bypass dampers in most applications. The homeowner controls the system using zone thermostats to make comfort settings for each zone.

A programmable thermostat should be used to provide a specialized heating and cooling sequence. While the system is in the zone mode, a programmable thermostat controls the temperature for its particular zone.

## Optional Dehumidification Accessories

The Harmony III™ zoning system may be used in conjunction with a Humiditrol® Enhanced Dehumidification Accessory (EDA) and which also requires a Humiditrol® Zoning Accessory (HZA). This document reflects the control which is outfitted for connection to, and control of, the EDA in a zone control system using the HZA. See *Humiditrol® Zoning Accessory Installation Instructions* for more information.

## Residential Zone Control System - Overview of Field Wiring




*LEGEND -*

**A** Five wire low voltage — 18 ga. minimum

**B** Two wire low voltage OR Three wire if Power-open, Power-closed — 18 ga. minimum

**C** INDOOR UNIT: Up to nine wire low voltage — 18 ga. minimum

**D** OUTDOOR UNIT:
- Two (3, if LSOM equipped unit) wire low voltage (single-stage condensing unit or EDA) 18 ga. minimum
- Three (4, if LSOM equipped unit) wire low voltage (two-stage condensing unit) 18 ga. minimum
- Up to seven wire low voltage (single-stage heat pump outdoor unit) 18 ga. minimum
- Up to eight wire low voltage (two-stage heat pump outdoor unit) 18 ga. minimum

**E** Two wire low voltage (discharge air sensor) 18 ga. minimum

**F** Two wire low voltage (pressure switch, heat pump only) — 18 ga. minimum

**G** Two wire — 18 ga. minimum

**H** Refer to the Humiditrol® Zoning Accessory (HZA) for wiring requirements.

**NOTE - Zone 3 and zone 4 not available with single-stage outdoor unit.*

## System Components

The Harmony III™ zoning system consists of the following (v - required):

- v Harmony Harmony III™ zoning system zone control panel (included)
- v Discharge Air sensor (included)
- v Thermostats (1 for each zone; ordered separately)
- v 24VAC Power Transformer(s) (ordered separately)
- v Dampers (ordered separately)
- v Pressure Switch and Tee w/Schrader valve (for Heat Pump systems; ordered separately)
- • Balance Point Sensor (Optional for Dual Fuel systems)
- • Defrost Tempering Kit (Optional for Dual Fuel systems)
- • Remote Vacation Switch (optional; ordered separately)

### Zone Control System

The Harmony III™ zoning system monitors electrical signals and directs control signals between thermostats, dampers, and HVAC equipment (see figure 1).

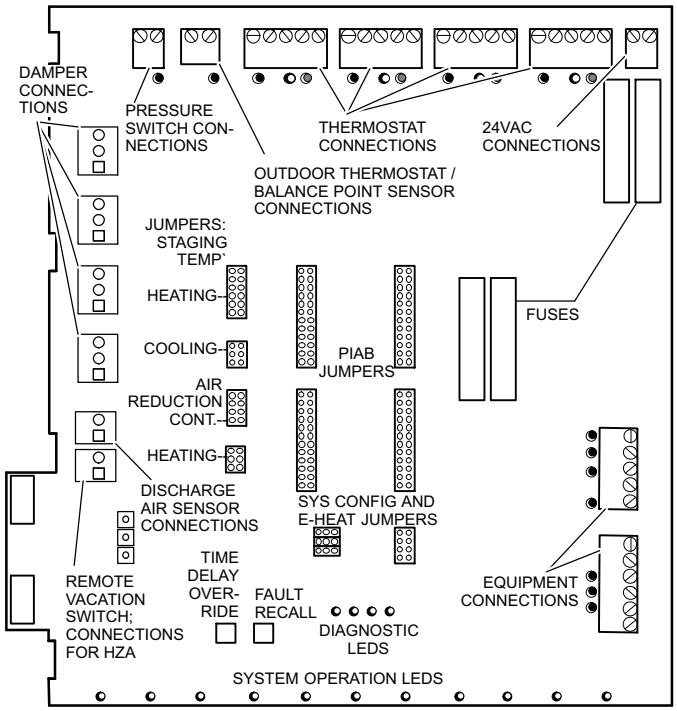



**Figure 1. Harmony III™ zoning system Zone Control Panel**

### Discharge Air Sensor (DAS)

A discharge air temperature sensor (88K38) monitors the supply air. This electronic sensor's probe is inserted into the discharge air plenum to gather air temperature data for the zone control panel. Figure 2 shows the kit; see figure 3 (Page 6) for location of the sensor.

TEMPERATURE/RESISTANCE CHART

| TEMP °F | RESISTANCE (OHMS) |
|---|---|
| 30 | 34,566 |
| 40 | 26,106 |
| 50 | 19,904 |
| 60 | 15,313 |
| 70 | 11.884 |
| 80 | 9,298 |
| 90 | 7,332 |
| 100 | 5,826 |

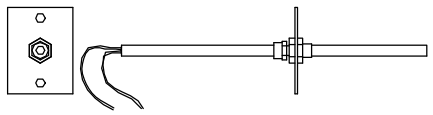


**Figure 2. Discharge Air Sensor**

### Thermostats

**⚠ IMPORTANT**

Room thermostat MUST BE configured Heat/Cool thermostat only.

For all zones, use thermostats that are of this type:

- electronic thermostat
- single-stage
- non-heat pump
- non-power robbing
- autochangeover or non-autochangeover
- Lennox recommends that zone 1 thermostat (central [vacation] mode controller) be programmable.
- Each thermostat must have a deadband between HEAT and COOL.

Recommended thermostats include:

**⚠ IMPORTANT**

Use only Electronic thermostats. Mechanical or electro-mechanical thermostats will not work with the Harmony III™ zoning system.

- ComfortSense® 7500 (13H14) 7-Day Programmable Touch Screen Thermostat - 4 Heat / 2 Cool.

  ***IMPORTANT!*** *When using this thermostat, only Precision Mode dehumidification can be used wherein 2°F of over-cooling is allowed. Also, it cannot reduce the blower speed because the zone control* ***DS*** *signal controls the blower. Thermostat* ***D*** *terminal is not used.*
- ComfortSense® 5500 (13H13) 7-Day Programmable Touch Screen Thermostat - 1 heat / 1 cool

### Transformer

The dampers, zone control panel, zone thermostats and Humiditrol® Zoning Accessory (if EDA is used) are powered by a single, field-provided 24VAC transformer. Together, the zone control panel and thermostats require 10VA; dampers require 10VA each. The transformer must have an adequate VA rating to serve all components (see recommendations in table 1).

## ⚠ IMPORTANT

Up to 5 dampers per zone may be connected in parallel to the zone control panel —not to exceed a total of six dampers for entire system.

Also, if more than 6 dampers are used, another transformer and isolation relay will be necessary.

**Table 1. 24VAC Transformer selection chart**

| Catalog Number | Size | Description | VA LOAD = Panel plus- |
|---|---|---|---|
| 10P17 | 40VA | 120/208/240VAC, 24VAC | 3 dampers |
| 10P87 | 50VA | 120/208/240VAC, 24VAC | 4 dampers |
| 12P61 | 75VA | 120/208/240VAC, 24VAC | 6 dampers |
| 83P74 | _ | Electrical Box (4-in. square) | |

### Dampers

Motorized 24VAC powered closed/spring return open dampers are standard for the Harmony III™ zoning system. However, “power-open/spring-close” and “power-open/power-close” dampers can be accommodated.

### Remote Vacation Switch

The Harmony III™ zone control panel includes connections for an optional remote vacation switch (see figure 1). The same connections are also used for connecting an optional Humiditrol® Zoning Accessory controller (see *Humiditrol® Zoning Accessory Installation Instructions* for details).

***NOTE - If a remote vacation switch is connected for routing to a convenient location for end user operation, be sure the switch (field-provided) is properly labeled and instructions provided for proper operation.***

***DO NOT LOCATE THE REMOTE VACATION SWITCH NEXT TO OTHER HOUSE SWITCHES! THE RECOMMENDED LOCATION IS NEXT TO ZONE 1 THERMOSTAT.***

## Installation Planning and Selecting Heating and Cooling Equipment

### Installation Considerations

The total HVAC system must be properly sized to provide the best comfort. Also, for best performance, zones should be similar in size so that each zone would require about the same CFM. Each zone's ducting lengths should be similar in length whenever possible. Always attempt to keep CFM requirements per zone within 25% of the average CFM (see table 2).

If a “small” zone cannot be avoided, give consideration to increasing the CFM of the small zone and linking a damper in a nearby zone that will open along with the small zone's damper(s). The procedure for zone linking is described on Page 7.

**Table 2. Adjusting for average CFM Example**

| Required CFM | | | | CFM adjusted to within average | | | |
|---|---|---|---|---|---|---|---|
| Zn | CFM | Avg | %CFM | Adj | Avg | %CFM | |
| 1 | **500** | 713 | **0.70** | **600** | 738 | **0.81** | Damper linked with Zn 2 |
| 2 | 825 | | 1.16 | 825 | | 1.12 | |
| 3 | 775 | | 1.09 | 775 | | 1.05 | |
| 4 | 750 | | 1.05 | 750 | | 1.02 | |

### Variable Speed Blower Motor (VSM)

Indoor units with variable speed blower motors (VSM) are required to allow the zone control system to distribute adequate air to each zone. **Use only units recommended in the following 3 options** as only those will work with the Harmony III™ zoning system; other types of units will not allow the Harmony III™ zoning system to proportion the amount of air going to each zone.

### Selecting/Installing Indoor and Outdoor Units

Outdoor units may be single or two-stage; use table 3 to determine which to use, based on the number of zones being implemented, and whether the air conditioned zones are of equal or unequal size.

**Option 1—**

- Lennox Gas Furnace with VSM only (G60UHV, G61MPV, G71MPP, SLP98, SL280V, E296V).
- Lennox Condensing Unit—as described in table 3.

**Option 2—**

- Lennox Air Handler Unit with VSM only (CBX25UHV, CBX32MV, CBX40UHV, CB31MV, CBWMV).
- Lennox Heat Pump Unit—as described in table 3.

**Option 3—**

- Lennox Gas Furnace with VSM only (G60UHV, G61MPV G71MPP, SLP98, SL280V, E296V).
- Lennox Heat Pump Unit —as described in table 3.

*NOTE - Limited variations to condensing units described herein are detailed on Page 39.*

**Table 3. Condensing units / Heat Pump units**

| No. of zones | Comparative Zone sizes | Lennox Condensing Unit or Heat Pump |
|---|---|---|
| 2 | *Equal | Single or Two-stage |
| 2 | *Unequal | Two-stage only |
| 3 or 4 | Equal or Unequal | Two-stage only |

*Equal zones would have very similar total ducting lengths with CFM requirements within 10% of average CFM per zone. Unequal would have less similar ducting length and greater variances from average CFM (see table 2 example).

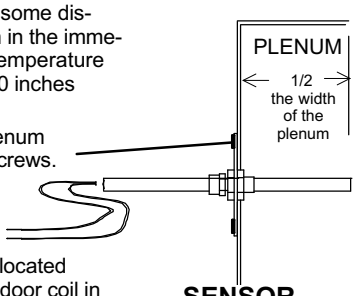
## Installing Zone Control Components

When possible, position the sensor some distance away from the coil rather than in the immediate coil area. The Discharge Air Temperature Sensor should be located at least 10 inches above the coil.

Fasten the sensor bracket to the plenum with two self- tapping sheet metal screws.

Connect wires to DAS on zone control panel, NOT on the AHC or IFC (see figures 17 through 27).

Be sure that the tip of the sensor is located approximately 10 inches from the indoor coil in the discharge plenum, and 1/2 the depth of the plenum, and centered over the discharge airflow, side-to-side.




**SENSOR MOUNTING DETAIL**

NOTE 1 - FOR UNITS WITH HUMIDITROL—Discharge air sensor (DAS) MUST be located on the output side of the EDA (if used; see Humiditrol Zoning Accessory Installation 505,337M)

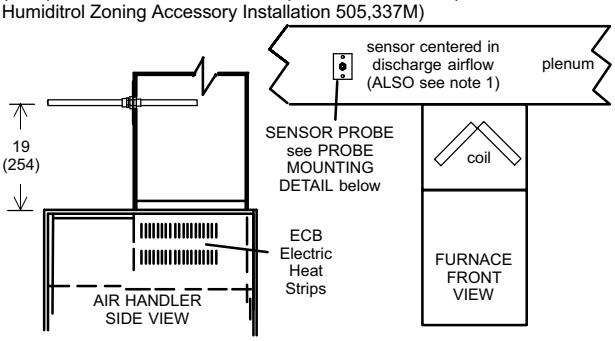



**Figure 3. Discharge Air Temperature Sensor installation (Typical Upflow Furnace)**

### Zone Control Panel

**⚠ IMPORTANT**

The electrical power source for the zone control system, i.e. the transformer primary, and furnace or air handler unit must be the same source. In addition, the zone control system power-up must occur at the same time or before the furnace or air handler unit is powered up.

Select an installation site for the Harmony III™ zoning system control considering the following location parameters:

- Is conveniently accessible and centrally located to facilitate wiring from thermostats, dampers, pressure switch (if used), and HVAC equipment.
- Is in a non-condensing area (such as a closet).
- Is NOT in a laundry room (nor other room in the house where the humidity would typically be much higher than the rest of the house).
- Is NOT in any part of the building where the temperature may exceed 150°F.

### Discharge Air Sensor

**⚠ CAUTION**

This device is manufactured using unpainted and prepainted metal. Sharp sheet metal edges can cause injury. When installing the device, avoid accidental contact with sharp edges.

Install the discharge air sensor in the discharge plenum downstream from the cooling coil. Be sure that the discharge air will pass over the sensor before the air is distributed into the duct system. Typical upflow sensor applications are shown in figure 3; the sensor dimensions shown (distance from heat strips, coil, and position in plenum) also apply to other applications.

**Thermostats**

Identify the best location for a thermostat in each zone. If two or more rooms are within a single zone, place the thermostat in a location that is central to all rooms. For example, if a zone contains two bedrooms, try to place the thermostat in a hallway near both bedrooms.

Do not install thermostats in drafty areas, behind doors, in corners, near radiant heat sources (appliances), near sunny windows, near concealed pipes and chimneys, nor in unconditioned spaces such as closets or exterior walls.

**Transformer**

Obtain an appropriately-rated transformer (see table 1, Page 5). Install the transformer in either the indoor unit or in an electrical junction box near the zone control panel.

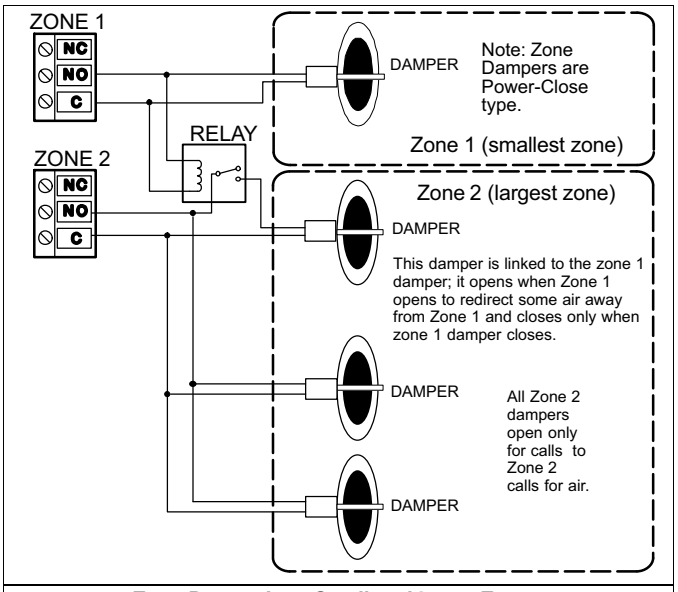
**Dampers**

*NOTE - The power source for the transformer must be the same power source as the indoor unit's transformer.*

Motorized dampers in the supply duct system regulate air to the zones. Some applications will be unique and require more than one damper per zone. If additional dampers are required, refer to the the wiring diagram in the Common System Component Wiring section (page 12). Also, if more than 6 dampers are used, another transformer and isolation relay will be necessary.

For more effective zone isolation, the return duct system may also be dampered by zone. Dampers for each zone must be wired in parallel. Install dampers in the desired locations; then run thermostat wire from the damper to the zone control panel and damper relays as needed.

**Zone Linking**—Zone link a small zone to a large zone by wiring dampers in a manner similar to figure 4. Effectively, this distributes some of the small zone's air to another zone to reduce the chance of overheating or overcooling the smaller zone. Table 2 (Page 5) shows an example of an unequal zone and how to adjust to bring it within 25% of the average CFM. Figure 4 shows how the dampers may be linked to distribute some of the air from a small zone into another zone.




**Zone Demands to Small and Large Zones**

| Zone Dampers | Zone with Demand | | | |
|---|---|---|---|---|
| | **None** | **Small** | **Sm.& Lg.** | **Large** |
| **Sm.Zone** | Closed (24V) | Open (0V) | Open (0V) | Closed (24V) |
| **Lg.Zone** | Closed (24V) | Open (0V) | Open (0V) | Open (0V) |
| | Closed (24V) | Closed (24V) | Open (0V) | Open (0V) |
| | Closed (24V) | Closed (24V) | Open (0V) | Open (0V) |

Note: Zone Dampers are Power-Close type.

**Figure 4. Zone Linking**

## Zone Control Panel Jumpers (General Information)

**Setup for controlling equipment staging and volume of air to zones**

This section provides information for installing jumpers on the zone control panel jumper banks (see figure 5). These jumpers define how the zone control system functions to control equipment staging and to deliver the proper amount of CFM to the zones.

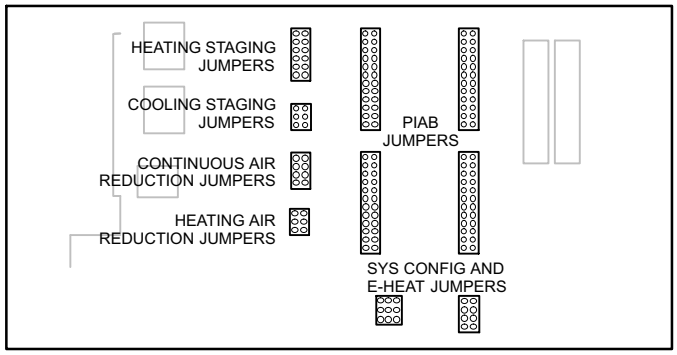



**Figure 5. Zone Control Panel Jumper Banks**

**⚠ CAUTION**

Static electrical discharge will damage electronics.

Discharge static electricity before touching the zone control panel. Touch a grounded metal object before touching the circuit board.

**How PIAB Jumpers affect blower operation**

A variable-speed motor will operate at its minimum speed or at any increment faster up to its maximum speed. The *Percentage Into Adjustment Band* (PIAB) jumpers control the speed variance of the motor.

When the zone control's PIAB jumpers are set to **0%**, the blower operates at the minimum air volume produced by the air handler and when set to **100%**, the blower operates at maximum air volume produced by the air handler (see your air handler installation instructions for specific CFMs).

**For example**: if an air handler has a minimum air volume of 800 CFM, and a maximum of 1500 CFM, and the jumper is set to **0%**, the air delivered to the zone will be 800 CFM. Similarly, if the jumper is set to **100%**, the air delivered to the zone is 1500 CFM. By placing a jumper in the **50%** position, you will direct airflow midway between the blower's minimum and maximum CFM capacities.

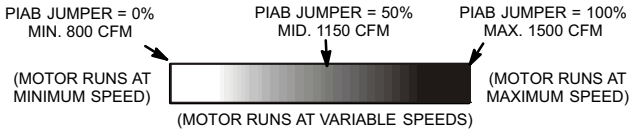



**Figure 6. VSM Adjustment Band Example**

By installing jumpers at different **%** on each PIAB bank, you can direct different amounts of air volume to each zone. You must jumper a **%** on zone 1 and at least one other zone, and you must jumper **OFF** on unused zones as shown in figure 7.

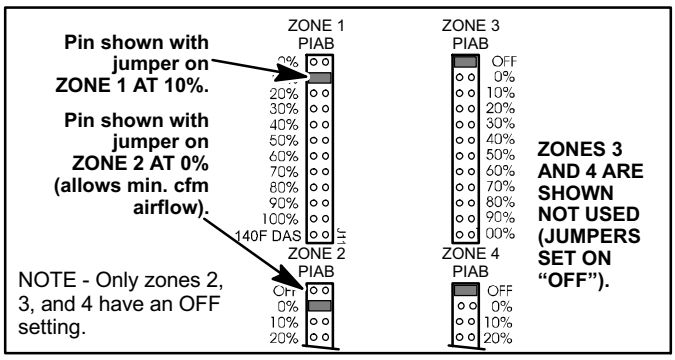



**Figure 7. PIAB Jumper Settings (typical)**

*NOTE - The blower speed may be affected by the reduction jumpers, if installed. See Page 9.*

**Upgrading from Harmony II®?**

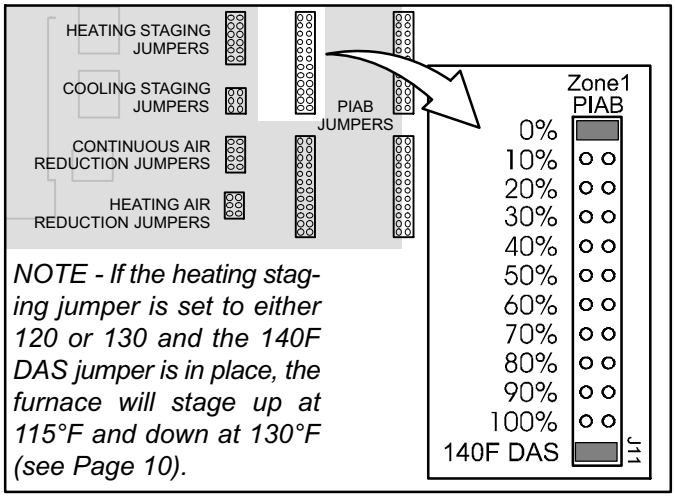
*NOTE - If replacing a Harmony II® system, use conversion values in table 4 to maintain equivalent air settings when setting up the Harmony III™ zoning system system.*

**Table 4. Air jumper positions conversion chart**

| Model | Equivalent Positions (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harmony II® | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 |
| Harmony III™ zoning system | 0 | 10 | 30 | 40 | 50 | 70 | 80 | 90 |

**Zone 1 PIAB Jumpers – 140ºF DAS**

Zone 1 PIAB terminal strip has an additional jumper setting (labeled 140F DAS) that may be used for added operational flexibility (see figure 8). When the supplied jumper is in place across both pins, the discharge air sensor (DAS) upper limit will be 140°F instead of 160°F (default) to provide added operational flexibility.




*NOTE - If the heating staging jumper is set to either 120 or 130 and the 140F DAS jumper is in place, the furnace will stage up at 115°F and down at 130°F (see Page 10).*

**Figure 8. 140F DAS Jumper**

## Zone Control Panel Jumpers (Determining PIAB Jumper Settings)

### Determining PIAB Jumper Settings

*NOTE - Use the PIAB Calculation Worksheet on Page 63 (also see example below) to help calculate the zone control system PIAB settings.*

1. From a cooling load analysis, determine what CFM is required for each zone. Also, from the air handler, determine its minimum and maximum CFM ratings.
2. Using the **PIAB formula**, found in Table 5 and reflected in the worksheet below, calculate the Percent Into Adjustment Band (PIAB) using the values from step 1 for each zone. Table 5 also gives **example CFM values** to illustrates how to determine the correct jumper for the PIAB for Zone 1 using those values.
3. Set the air selection jumper for the zone using the percent air determined in step 2. If the percent air falls between available jumper settings, select the nearest unit of ten.
4. For each zone, repeat steps 1 through 3.

*Note - See page 8 for information on 140F DAS (discharge air sensor) jumper used on Zone 1 PIAB.*

**Table 5. Determine PIAB jumper setting**

| example CFM values | | | | | |
|---|---|---|---|---|---|
| **Required CFM** | | | | **CFM** | |
| **Zone 1** | **Zone 2** | **Zone 3** | **Zone 4** | **Min.** | **Max.** |
| 1020 | 1500 | 720 | OFF | 720 | 2200* |
| *High cool jumper setting | | | | | |

**PIAB formula**

$$\frac{\text{(Req'd CFM – min. CFM)}}{\text{(Max. CFM – min. CFM)}} \times 100$$

**Using example values above, find PIAB for Zone 1:**

PIAB . . . . . (1020 - 720) = 300 . . . . . =.20
. . . . . (2220 - 720) =1500
PIAB Jumper setting % .20 x 100 . . . . . **20%**

**SETUP TIP!**

PIAB calculations should provide a good starting point for setting jumpers. It may also be beneficial to set jumpers at a higher percentage of airflow such that the sound of air rushing is objectionable, and then reduce it incrementally by 10% until: 1) the sound of air rushing is not objectionable, and 2) ample, but not excessive, air volume is being provided to adequately heat or cool the zone.

### PIAB Calculation Example (see worksheet on Page 63 )

**PIAB = [(Required CFM - Minimum CFM) / (Maximum CFM - Minimum CFM)] * 100**

**Sample CFM ➧ Required Minimum Maximum Minimum**

**Sample PIAB = ([___920____ -____450___] / [__2000___ -____450____]) x 100**

**=** **=**

**Sample PIAB = ([_____470_____] / [_____1550_____]) x 100**

**=**

**Sample PIAB = [_____0.303_____] x 100 = _____30_____%**

## Zone Control Panel Jumpers (Air Reduction)

### Continuous Air Reduction Jumpers

During continuous fan mode without either a heating or cooling demand, the blower runs at the total percentage of the CFM jumper settings of the zones calling for continuous fan (not to exceed 100% of blower capacity). A continuous air reduction jumper allows the blower speed to be reduced by a percentage during continuous fan mode.

The selections are 75%, 50%, 25% and 0%. At the factory, the jumper is set on 0%. Set the jumper to the position equal to the amount of continuous air reduction desired. See figure 9.

*NOTE - If the calculations using a reduction percentage indicated a resulting CFM lower than the blower's minimum CFM rating, the blower will deliver its minimum CFM (see figure 6 on Page 8).*

### Heating Air Reduction Jumpers

*NOTE - For heat pump applications, **ALWAYS** set the jumper on **0%**. High head pressures may result if air is reduced during heating mode.*

*NOTE - For use in warm-climate areas where units have high cooling capacity with low heat capacity, ALWAYS set the jumper on **0%**.*

The heating air reduction jumper enables the blower speed, during heating only, to run at a reduced rate compared to the cooling blower speed.

The selections are 40%, 20% and 0%. Jumpers are set to 0% from the factory. Set the jumper to the position equal to the amount of heating air reduction desired. See figure 9.

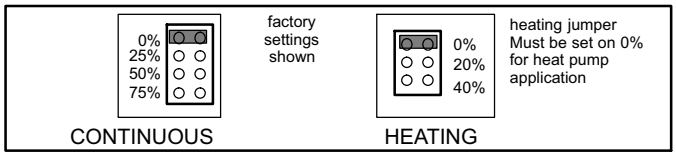



**Figure 9. Air Reduction Jumper Settings**

## Zone Control Panel Jumpers (Heat/Cool Staging)

Heating/Cooling staging jumpers prevent any rapid staging of the equipment. This section shows the recommendedsettingsforheating/coolingstagingtemperatures and explains the temperature differentials for different equipment configurations. In the diagrams, sine waves indicate which stage operates during the rise and fall of discharge air temperature for the different heating/cooling staging jumpers. Recommended jumper settings are shown in **bold type.**

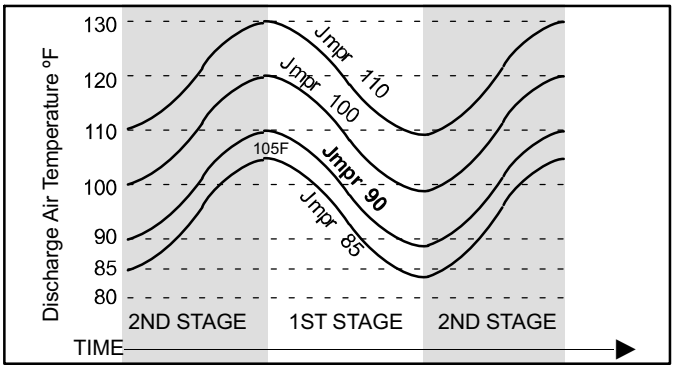
### Heating Staging Temperature Jumper

Heating Staging temperature jumpers are used to set the temperature at which the 2nd-stage heating equipment comes ON. Its selections range from 85 - 130 (°F). The setting has a built-in differential of 20°F (except as described when 140DAS jumper is used).

During operation, when the discharge air temperature falls below the jumper setpoint, 2nd-stage heating begins. If the discharge air temperature reaches the differential temperature, 2nd-stage operation ceases and 1st-stage heating resumes until the temperature again falls below the jumper set point.

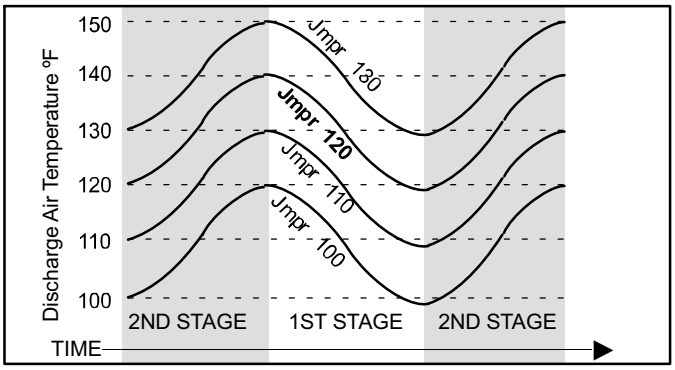
*NOTE - For G71MPP and SLP98 furnaces only, the furnace ignition control will automatically adjust firing rate without a 2nd stage heat demand to match the blower airflow (CFM) requested by the Harmony III™ zoning system. See "Operation with G71MPP and SLP98" on page 26 for additional information.*

**Heat Pump** (range: 85 - 110°F, recommended: **90**). The maximum discharge air temperature at which the heat pump/electric heat is allowed to run is fixed at 135°F.

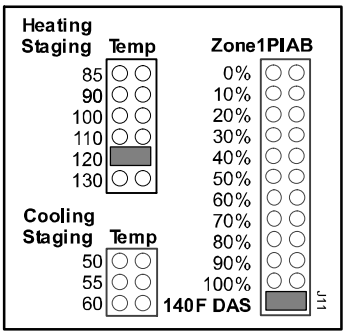


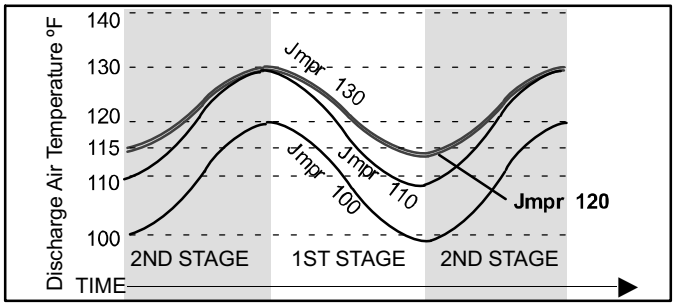

When the zone control system is applied to a heat pump with electric heat, the electric heat will be staged ON to maintain the discharge air temperature set by the heating staging jumper position.

**Gas Furnace with 160°F upper limit** (range: 100 - 130; recommended:**120**). The maximum discharge air temperature at which the furnace may run is fixed at 160°F.




**Gas Furnace w/140F DAS jumper** (range: 100 - 130; recommended:**120**). When the 140F DAS jumper is in place (as shown to the right), the maximum discharge air temperature at which the furnace may run is fixed at 140°F. *(Note the 140F DAS jumper's impact on the differential at 120 and 130 settings):*

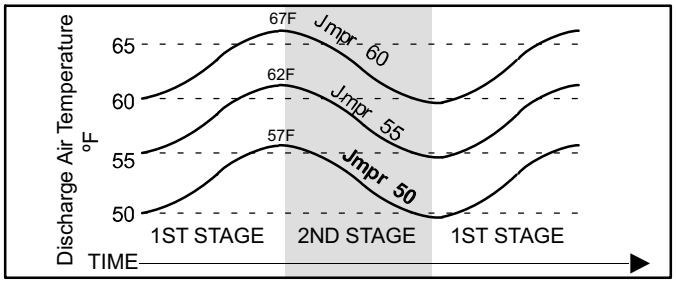



### Cooling Staging Temperature Jumper

Cooling Staging temperature jumpers are used to set the discharge air temperature at which 2nd-stage cooling comes on. It is selectable between 50°, 55° and 60°F. A 7 degree total differential is associated with this staging temperature, beginning at the jumper setpoint, and extending to 7 degrees above the setpoint.

For any jumper setting, if the discharge air should fall to 45°F and any zone still demands cooling, the compressor will not run leaving only the blower to operate until the discharge air once again rises to 50°F and the 5 minute compressor OFF delay has been satisfied. For this reason, and to better satisfy latent loads, the jumper recommended setting is 50.



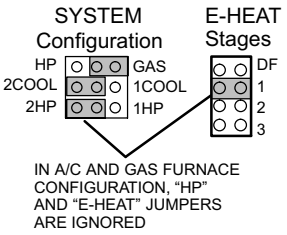
## Zone Control Panel Jumpers (SYSTEM Configuration/E-Heat Stages)

### SYSTEM Configuration/E-HEAT Stages Jumpers

The SYSTEM configuration jumpers must be inserted to select the type of cooling and heating system that has been installed and the E-HEAT Stages jumper defines if the system is dual fuel or defines the number of electric heating stages used.

#### Gas Furnace and Air Conditioning

For a gas furnace and air conditioning combinations, put the jumper on GAS (as shown) and select the number of equipment cooling stages by placing the cooling jumper to the appropriate site (place on 1COOL for 1stage cooling or 2COOL for 2-stage cooling).

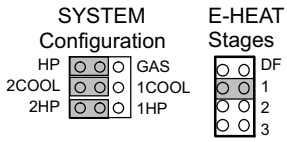



In this configuration, the maximum discharge temperature (upper temperature limit) at which the furnace is allowed to run is 160°F (except when 140FDAS jumper [as described on Page 10] is in place). At the upper limit, the zone control system removes any heat demand from the furnace for a minimum of 5 minutes and until the temperature comes back within normal operating temperatures.

While at or above the upper temperature limit, the control unit signals for continuous blower operation to those zones from which a thermostat heat demand is received. When setting up the furnace control board options, be sure to set the BLOWER-OFF DELAY to no greater than 210 SECONDS.

#### Heat Pump with Electric Backup Heat

For heat pump with electric backup heat, select HP position as shown in this diagram.



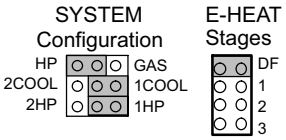

In this configuration, the maximum discharge temperature the electric heat or heat pump is allowed to run is 135°F. At that temperature, the zone control system removes demand from the heating unit for a minimum of 5 minutes and until the temperature returns to the normal operating temperature range. While at or above 135°F, the control unit signals for continuous blower operation to those zones from which a thermostat heat demand is received.

Select the number of equipment cooling stages by placing the COOL stages jumper to the appropriate side (1COOL or 2COOL). Similarly, set the number of Heat Pump stages (1HP or 2HP). Jumper settings on the above diagram illustrate the proper settings for a 2-stage heat pump and two-stage air conditioning system.

When using a heat pump with electric backup heat, insert an E-HEAT jumper to select the total number of available electric heat stages. The diagram above shows a single heat-strip configuration.

#### Heat Pump- Dual Fuel heating, 1-stage or 2 Stage Heat Pump and Gas Furnace

This diagram shows a dual-fuel configuration (heat pump for heat and cool with gas backup heat).




HP position must be jumpered for Dual Fuel applications and the E-Heat Stages jumper must be set to "DF" for dual fuel operation.

Select the number of equipment cooling stages by placing the COOL stages jumper to the appropriate side (1COOL or 2COOL). Similarly, set the number of Heat Pump stages (1HP or 2HP). Jumper settings on the above diagram illustrate the proper settings for a 1-stage heat pump and 1-Stage of Cooling.

*NOTE - See figure 23 (Page 39), Variations on Common Applications for other jumper configurations and electrical wiring variations.*

## Common System Component Wiring

Use thermostat wire to connect dampers, damper transformers, and the DAS probe with the zone control system.

**⚠ IMPORTANT**

Avoid running any control wiring close to AC house wiring. If this cannot be avoided, limit close parallel of power and control wiring to a few feet.

### Dampers and Damper Transformer Wiring

Connect dampers to the zone control panel as shown in figure 10. A total of six dampers may be connected at the damper output terminals on the zone control panel. If additional dampers are used, additional transformers and relays will be needed.

Fuse F1 will protect the damper outputs from a short circuit or overload in the damper wiring.

If dampers are applied to the return duct system, the dampers for each zone must be wired in parallel. Connect damper transformer to zone control panel terminal block. Refer to the Extended Damper Wiring section in figure 10 for wiring connections.

### Discharge Air Sensor (DAS) Probe Wiring

Wire discharge air sensor probe to zone control panel. The variable immersion-temperature probe is not polarity sensitive.

*NOTE - The extended damper transformer rating should be sized to adequately handle zone dampers (1-4) plus relays (K1-K4) not to exceed class II wiring limit of 75 VA.*

*Combined load of zone dampers and zone relays not to exceed 60VA.*

*Use Lennox Part 56L68 for Zone Relays 1 through 4.*

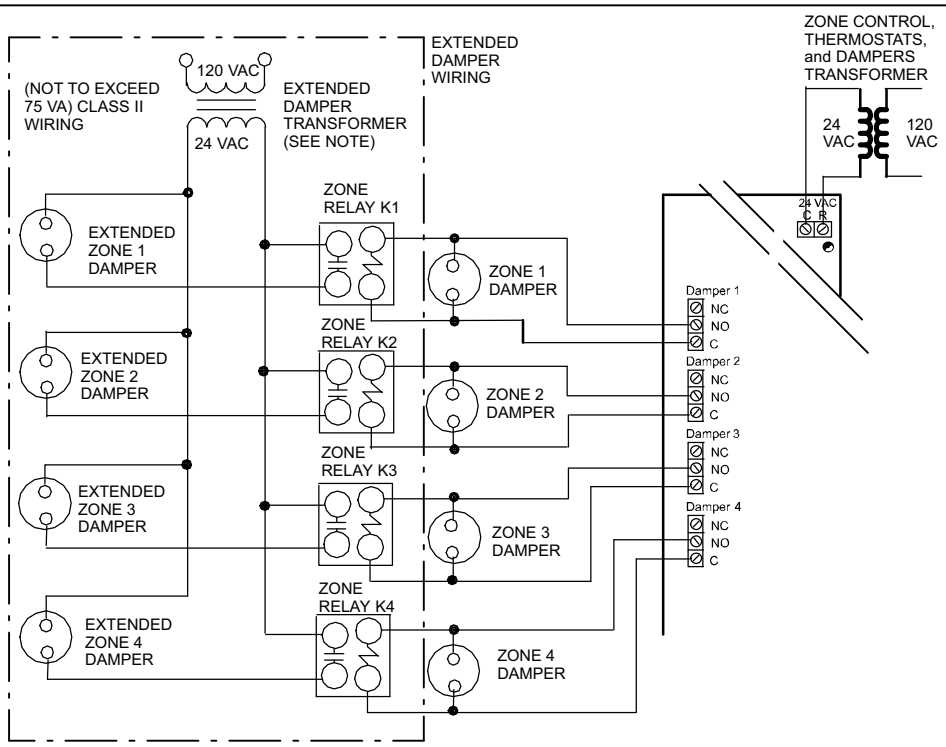



**Figure 10. Damper and Extended Damper Wiring Diagram**

## Component Specific Wiring

CHECK VOLTAGE BEFORE CONNECTING ZONE CONTROL TRANSFORMER (ZONE CTRL XFMR) LEADS TO THE ZONE CONTROL PANEL CONNECTIONS

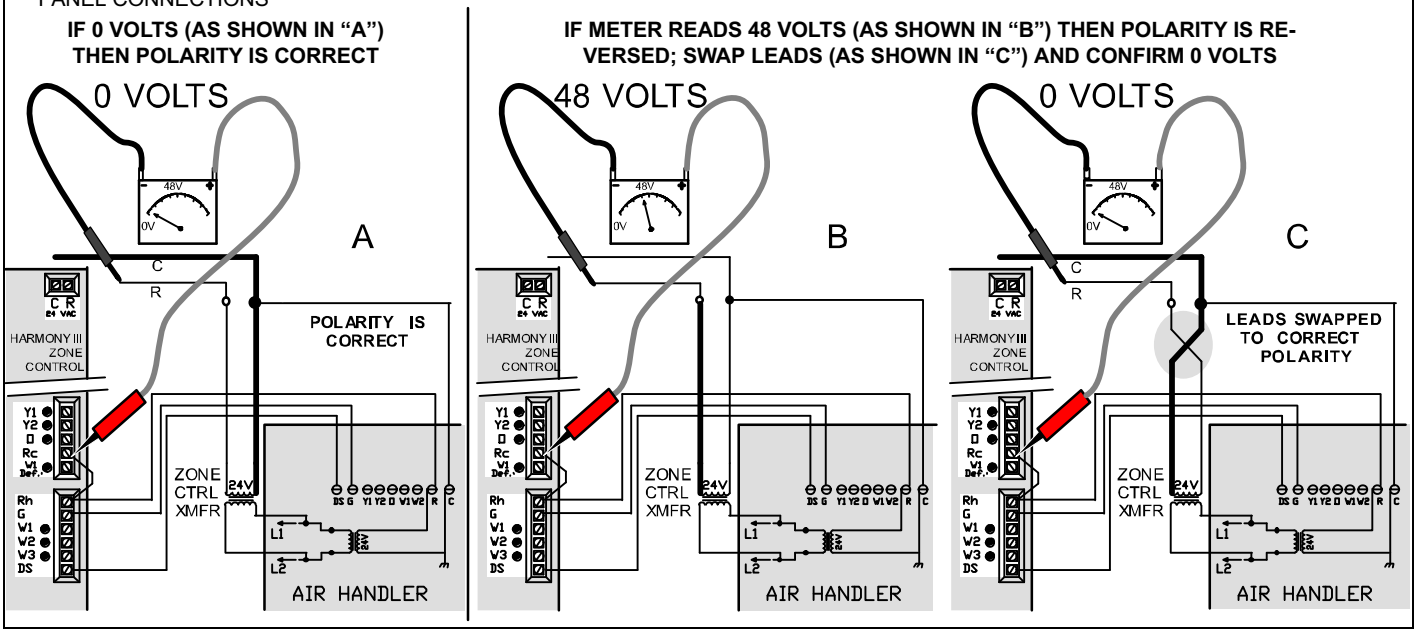



**Figure 11. Confirming Transformer Phasing (polarity) is Correct**

### Zone Control Transformer Phasing

**Using two transformers on a single system**—When the Harmony III™ zone control panel is connected to a system that has its own transformer, the *phasing* (or polarity) of the air handler transformer to the zone control's add-on transformer is extremely **IMPORTANT** because the zone control transformer powers the "DS" circuit within the zone control and then connects to the air handler "DS" circuit.

The only two transformers that need correct phasing with their commons connected are the zone control and air handler transformers. Check the phasing prior to connecting the zone control transformer zone control panel's connections. The zone control transformer primary should be the same source as the air handler to keep it uncomplicated. Use a 230 volt primary transformer with air handlers (CBX25UHV / CBX32MV / CB31MV / CBX40UHV) and use a 115 volt transformer with furnaces (G61MPV / G71MPP / SLP98 / SL280V / EL296V) and with CBWMV.

1. Connect the zone control transformer primary to the air handler voltage source (see figure 11).
2. Do not connect the zone control transformer secondary to the zone control panel at this time.
3. Connect air handler secondary common to the assumed zone control transformer common.
4. Measure voltage between air handler **R** and unconnected zone control transformer secondary lead (see figure 11):
   - if 0 volts (A, figure 11) then polarity is correct; connect the leads to zone control **C** and **R** as shown.
   - if 48 volts (B, figure 11) then polarity is reversed; swap leads as shown and confirm 0 volts (C, figure 11); connect the leads to zone control **C** and **R** as shown.
5. With the correct polarity determined, connect **C** wire to zone control 24VAC **C** terminal and **R** wire to **R** terminal.

### Thermostat Wiring

Using standard electronic 1-heat /1-cool non-heat pump, non-power robbing thermostats, and five-wire thermostat cable, wire units as follows:

1. Wire each thermostat to terminals **Y**, **W**, **G**, **R**, and **C**.
2. Run cable from each of the thermostats to the zone control panel. Mark each cable according to the zone thermostat from where it originates.
3. Strip the cables and attach each of the 5 wires to the zone control panel (see figures 17 [Page 24], 15 [Page 17], 27 [Page 45]).

### Gas Furnace Wiring

**⚠ IMPORTANT**

The common "C" terminal of the Harmony III™ zoning system zone control panel MUST be connected to the common terminal of the integrated control, or if using a air handler, MUST be connected to the common terminal of the air handler terminal strip.

If not connected, blower may operate only at the minimum CFM or will not ramp to zone air volume.

After the furnace is installed, field wire the unit as described in the installation instructions provided with the furnace. Use thermostat wire to connect the furnace and the zone control panel and to connect the zone control panel 24VAC **C** to the integrated control terminal strip **C** (see wiring diagram in figure 17).

### Condensing Unit Wiring

After the condensing unit is installed, field wire the unit as shown in the installation instructions provided with the unit. Use thermostat wire to connect the condensing unit to the zone control panel (see figure 17).

## Minimum CFM in Variable Speed Furnace and Air Handlers

Harmony III™ Zone Control system minimum CFM values for variable speed furnaces are listed in table 6. These apply to furnaces and air handlers with serial numbers indicating they were built in 2004 or later. With furnaces built before 2004, use the Harmony II® Zone Control system minimum air note in the installation instructions or engineering handbook for that furnace or air handler's air handling data.

**⚠ CAUTION**

This unit is manufactured using unpainted metal. Sharp sheet metal edges can cause injury. When installing the unit, avoid accidental contact with sharp edges.

**⚠ CAUTION**

The control's surfaces may be hot! Take care when making wiring connections. Failure to do so may result in personal injury.

**Table 6. Minimum CFM for Harmony III™ zoning system with Variable Speed Blower Motors**

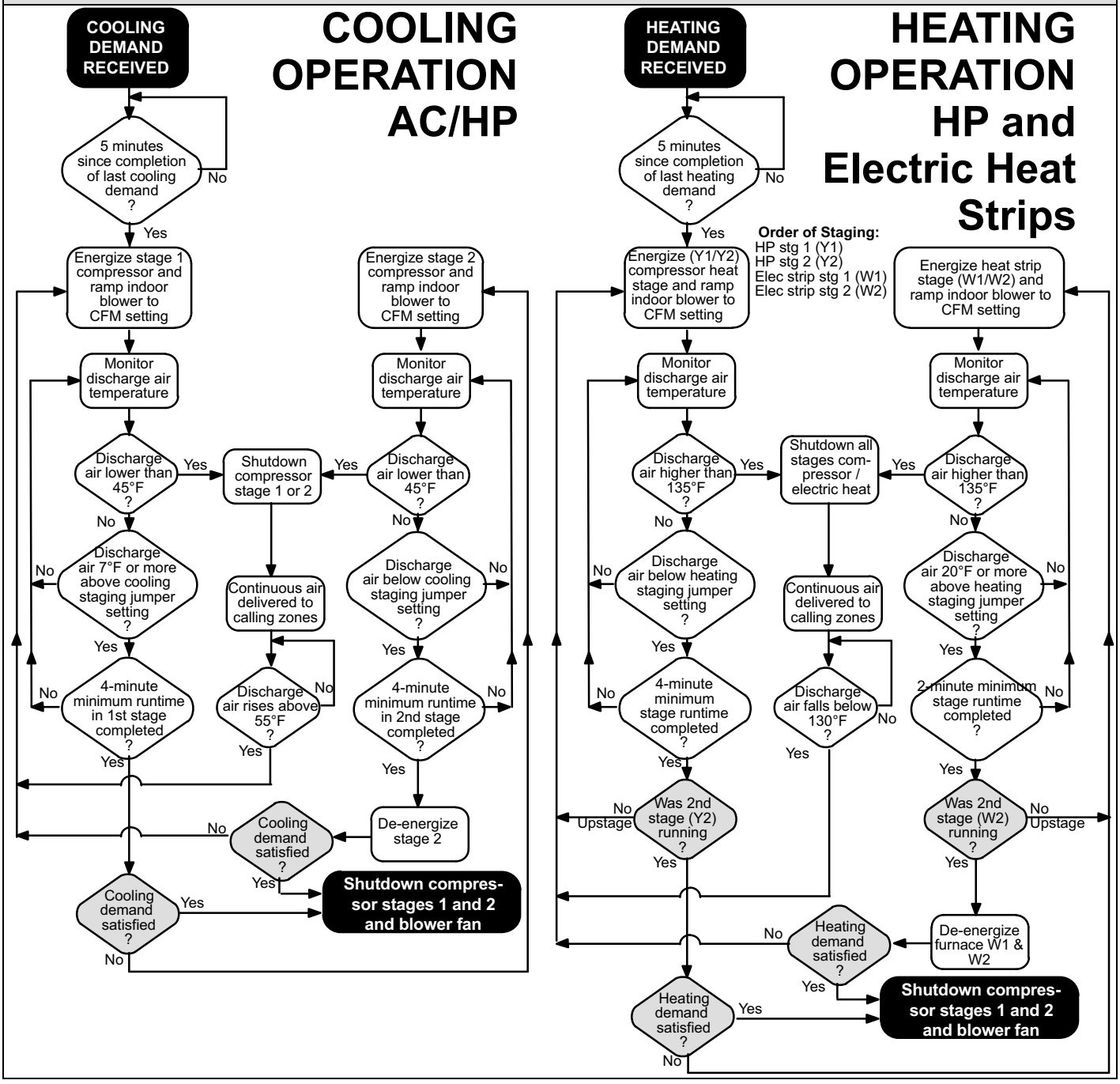
| Unit Model Number | CFM (min) | Unit Model Number | CFM (min) |
|---|---|---|---|
| G60DFV-36A-070 | 426 | **SLP98xx070V36B 1/2HP motor | 300 |
| G60DFV-36B-090 | 523 | **SLP98xx090V36C 1/2HP motor | 250 |
| G60DFV-60C-090 | 520 | **SLP98xx090V48C 3/4HP motor | 380 |
| G60DFV-60C-110 | 475 | **SLP98xx090V60C 1HP motor | 450 |
| G60DFV-60D-135 | 477 | **SLP98xx110V60C 1HP motor | 450 |
| G60UHV-36A-070 | 426 | **SLP98UH135V60D 1HP motor | 450 |
| G60UHV-36B-090 | 453 | SL280xxV 3-ton | 250 |
| G60UHV-60C-090 | 478 | SL280xxV 4- and 5-ton | 450 |
| G60UHV-60C-110 | 483 | EL296xxV 2 and 3-ton | 250 |
| G60UHV-60D-135 | 495 | EL296xxV 4-ton | 380 |
| G61MPV-36B-045 | 442 | EL296xxV 5-ton | 450 |
| G61MPV-36B-070 | 458 | CB31MV-41 | 380 |
| G61MPV-36B-071 | 458 | CB31MV-51, -65 | 399 |
| G61MPV-36C-045 | 442 | CBX25UHV-018, -024, -030, and -036 | 250 |
| G61MPV-36C-090 | 479 | CBX25UHV-042, -048 and -060 | 450 |
| G61MPV-60C-090 | 449 | CBX32MV-018/024, CBX32MV-024/030 Rev 06 | 300 |
| G61MPV-60C-091 | 458 | CBX32MV-036 Rev 06 | 300 |
| G61MPV-60C-110 | 463 | CBX32MV-048, -060, -068 Rev 06 | 300 |
| G61MPV-60C-111 | 458 | **CBX40UHV-024, -030 | 250 |
| G61MPV-60D-135 | 470 | **CBX40UHV-036 | 380 |
| **G71MPP-36B-070 | 250 | **CBX40UHV-042, -048, -060 | 450 |
| **G71MPP-36C-090 | 250 | CBWMV (all models) | 400 |
| **G71MPP-60C-090 | 450 | | |
| **G71MPP-60C-110 | 450 | | |
| **G71MPP-60D-135 | 450 | | |

* A 3% duty cycle corresponds to the minimum CFM, and a 97% duty cycle corresponds to the maximum CFM.

** On G71MPP and SLP98 Furnaces and CBX40UHV and CBX32MV revision 06 Air Handlers, listed values in the table correspond to 0% duty cycle of the Harmony III™ Zone Control system control signal. Since the Harmony III™ Zone Control system puts 3% at minimum, actual value may be 10-30 CFM higher.

xx: UH = up/horizontal flow; DF = down flow

## System Flow Diagrams



# HEAT PUMP

## Installing Heat Pump and accessories

### Equipment Installation

Follow all equipment installation instructions provided with each unit.

### Pressure Switch

A pressure switch (HFC-22 [27W12]; HFC-410A [27W13]) is required for applications with a Lennox heat pump (Options 2 and 3). This switch acts as a guard in case of high head pressures during 1st- and 2nd-stage heating. The switch's cut out and cut in points are shown in table 7.

**Table 7. Cut-out and Cut-in (Reset) Points**

| Refrigerant | Cut-Out | Cut-in (Reset) |
|---|---|---|
| HCFC-22 | 375 psig (2551 kPa) | 275 psig (1862 kPa) |
| HFC-410A | 550 psig (3965 kPa) | 425 psig (3102 kPa) |

*NOTE - If a pressure switch is factory installed in the unit, do not remove the switch or switch wires.*

The switch may also be fastened directly to the vapor valve service port which becomes the discharge line in heat pump heating mode (see figure 12).

### Pressure Switch Wiring

Pull a two-wire thermostat cable from the field-installed pressure switch to the zone control panel and connect at the pressure switch, and at the zone control panel as shown in the connection location diagram (see figure 15).

### Tee (High Pressure Switch; Heat Pumps only)

A tee (Lennox #87071) is needed to install the pressure switch along with a valve core (Schrader) for checking pressure in the vapor line during heat pump heating mode (see figure 12).

The switch may also be fastened directly to the vapor valve service port which becomes the discharge line in heat pump mode.

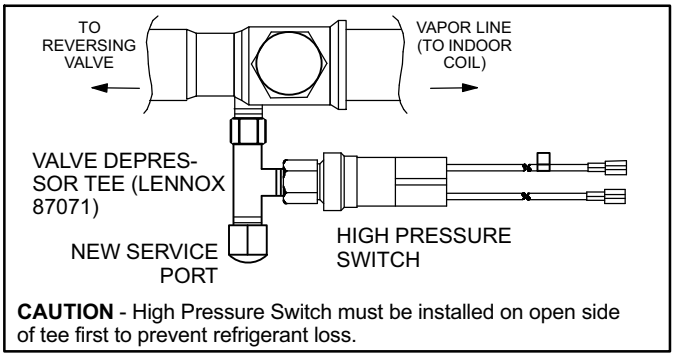



**Figure 12. Tee and Vapor Line High Pressure Switch**

### Balance Point Sensor (Outdoor Thermostat)

A balance point sensor (kit 56A87, figure 13) may be implemented in a dual-fuel (Option 3) system. This thermostat monitors the outdoor temperature, compares it to the balance point setting, and signals the zone control if the reading is below the set point. The zone control then instructs the gas furnace to provide all the heating and prohibits the heat pump from attempting to fill a demand for heat.

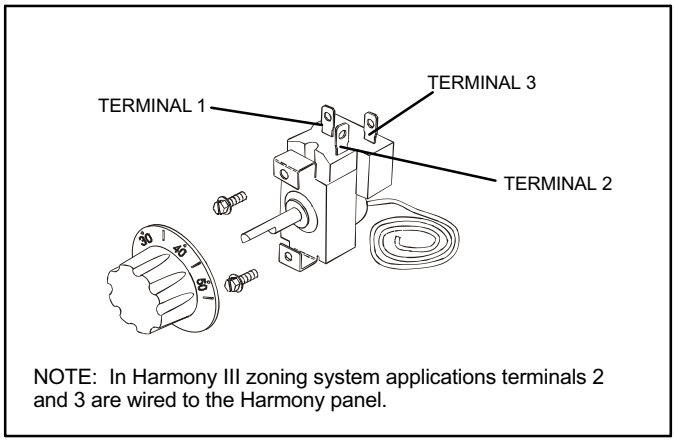



**Figure 13. Balance Point Sensor (56A87)**

### Defrost Tempering Kit

A defrost tempering kit (67M41) may be implemented in a dual-fuel (Option 3) system. This kit consists of a thermostat probe/switch which is installed between the furnace and the evaporator coil to turn the furnace on (at 80°F) and off (at 90°F) during a defrost cycle. This tempers the discharge air and protects the compressor from high refrigeration pressures during defrost. Figure 14 shows the kit; see figure 3 (Page 6) for location of the probe.

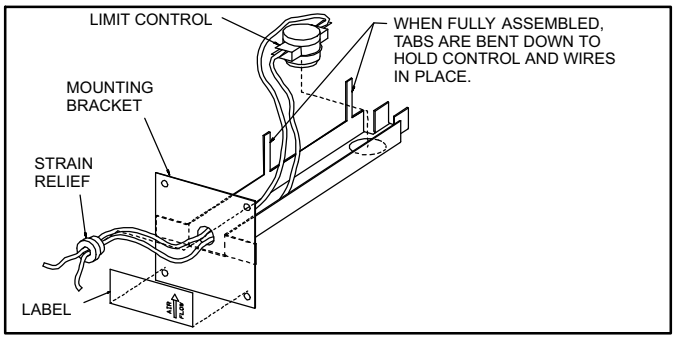



**Figure 14. Defrost Tempering Limit Control**

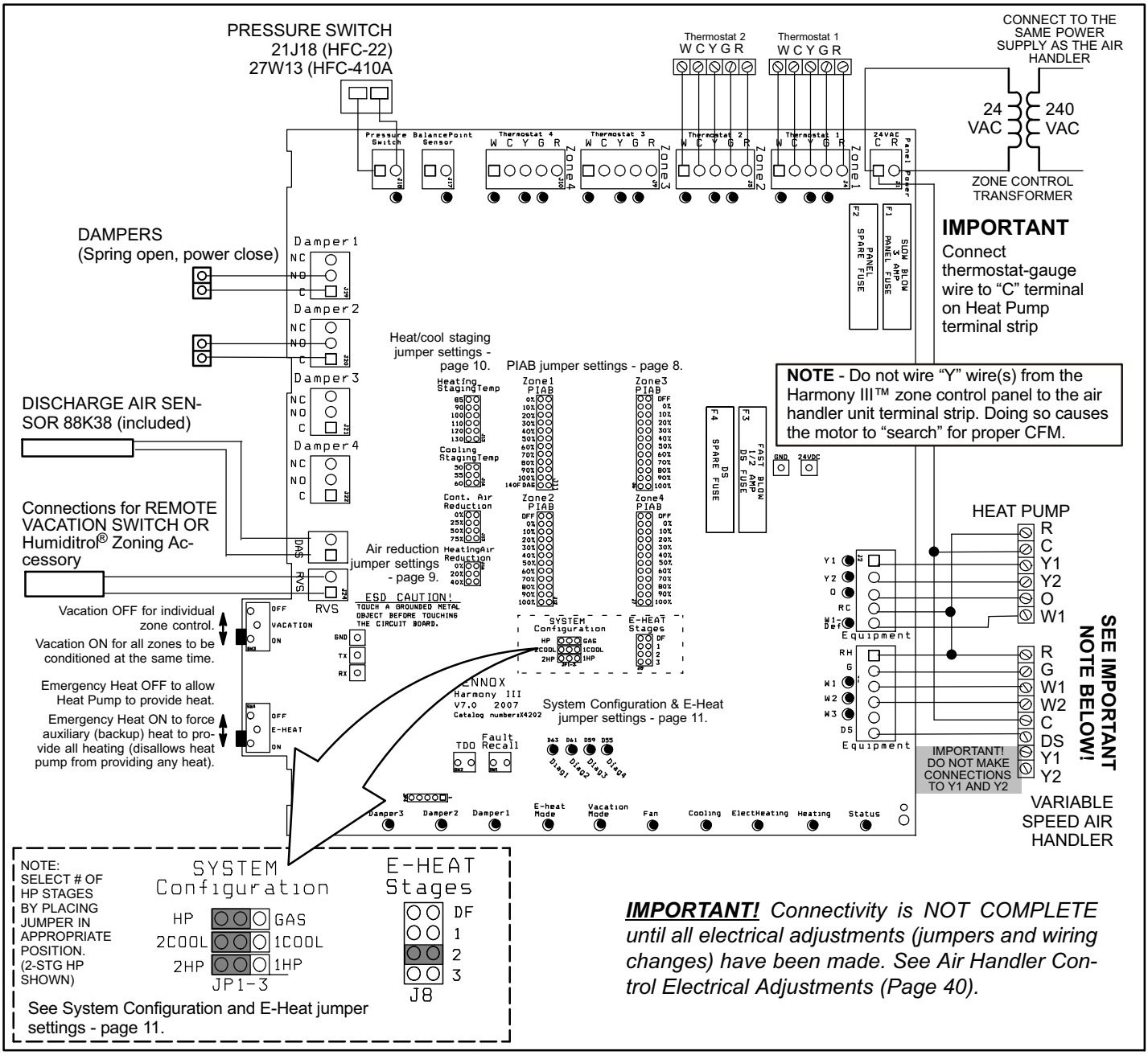



**Figure 15. Harmony III™ zoning system Option 2 - Lennox Heat Pump and Lennox Variable-Speed Air Handler**

## Heat Pump System Start-Up and Checkout

**⚠ IMPORTANT**

The zone control system power-up must occur at the same time or before the furnace or air handler unit is powered up.

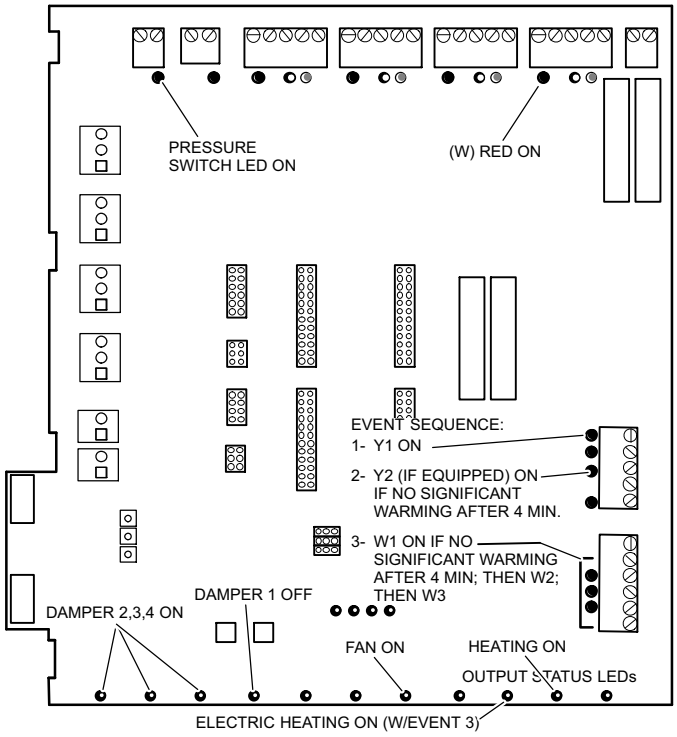
**Powering the System (All Systems)**

1. Adjust all thermostat settings so that no demand will occur.
2. Apply power to the zone panel transformer and to the air handler and observe the following: all four diagnostic LEDs will light; then each individual diagnostic LED will light in sequence; then all four diagnostic LEDs will light and extinguish.
3. Finally, the status light will begin to flash, indicating proper operation. Perform heat pump heating checkouts on pages 18 through 19.

## Heat Pump Heating Checkout (Single Zone)

**Prerequisites:**

- Zone 1 thermostat set to Heat




1. Set zone 1 thermostat for a heat demand; check:
   - Zone 1 thermostat W LED on (heating demand).
   - Damper LED 1 off (damper open).
   - Damper LEDs 2, 3, and 4 on (dampers closed).
   - Output Heat Y1 LED on (compressor on).
   - Heating LED on.
   - Fan LED on.
   - Pressure Switch LED on.

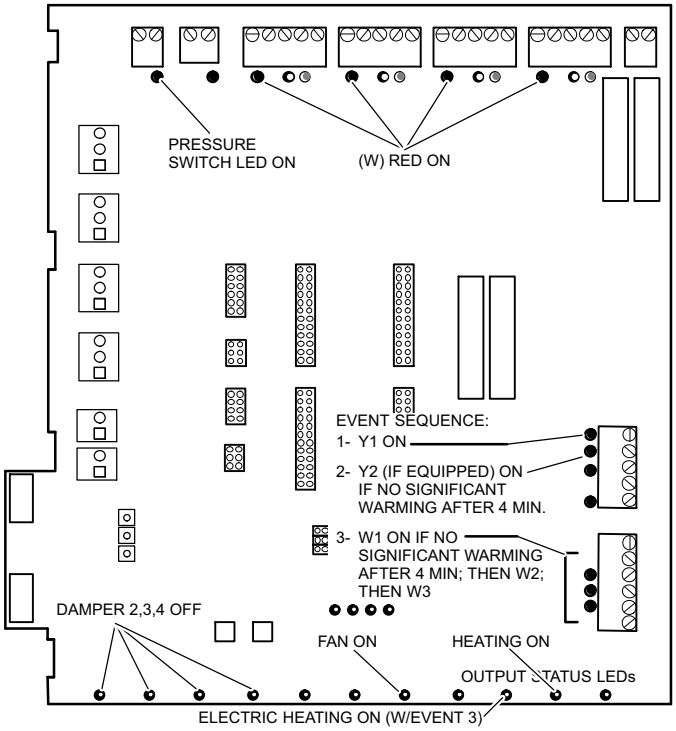
   The compressor in the outdoor unit begins operating in the heating mode. At approximately the same time, the indoor blower starts, operating at a speed according to the setting of the PIAB jumper for zone 1. It may take the blower 60 to 90 seconds to reach this speed.
2. **If Single-Stage Heat Pump - Skip to step 3**. The discharge air sensor continually samples air temperature. If, after 4 minutes, air temperature is not warming significantly, the high speed compressor energizes.
   - Output Heat Y2 LED on (high speed compressor).
3. The discharge air sensor continually samples air temperature. If, after (another) 4 minutes, air is not warming significantly, auxiliary heat sequence begins:
   - Electric Heating (E-Heating) LED on.
   - Output Heat W1 on, followed by (if available, and if necessary) W2, and then W3.
4. Remove heat demand from zone 1.
   - All LEDs off, except:
   - Damper LEDs 2, 3, 4 on.

   To check the amount of air being delivered to each zone and to confirm that each individual zone damper functions properly, repeat these steps for zones 2 - 4.

## Heat Pump Heating Checkout (Multiple Zone)

**Prerequisites:**

- All zone thermostats set to Heat



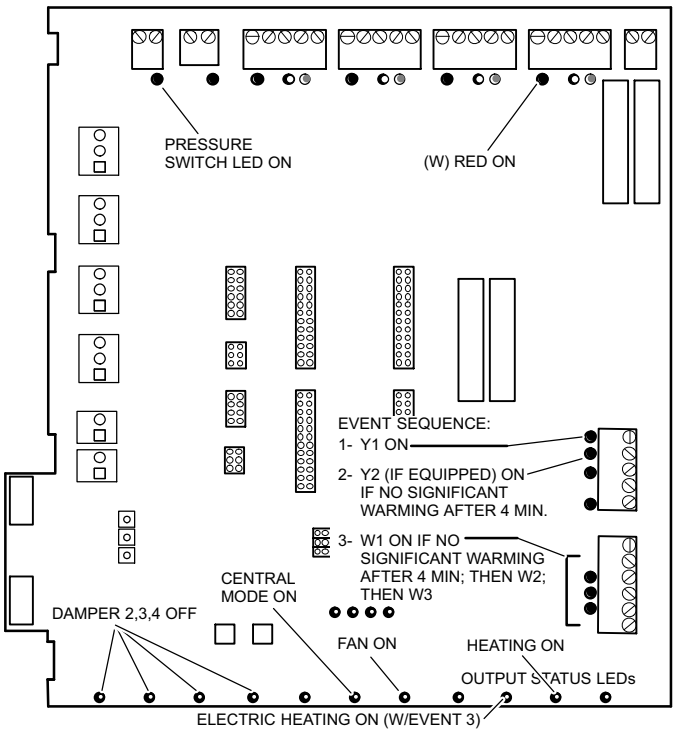

1. Apply heating demand to all thermostats.
   - All zone thermostat W LEDs on (heat demands).
   - Output Heat LED Y1 on (compressor).
   - Heating and Fan LEDs on.
   - LEDs dampers 1 - 4 off (all dampers open).
   - Pressure Switch LED on.

   The compressor in the outdoor unit begins operating in the heating mode. At approximately the same time, the indoor blower starts, operating at a speed according to the PIAB jumper settings for all zones. It may take the blower 60 to 90 seconds to reach this speed.
2. **If Single-Stage Heat Pump - Skip to step 3**. The discharge air sensor continually samples air temperature. If, after 4 minutes, air temperature is not warming significantly, the high speed compressor energizes.
   - Output Heat Y2 LED on (high speed compressor).
3. The discharge air sensor continually samples air temperature. If, after (another) 4 minutes, air is not warming significantly, auxiliary heat sequence begins:
   - Electric Heating (E-Heating) LED on.
   - Output Heat W1 on, followed by (if available, and if necessary) W2, and then W3.
4. Remove the heat demand from all zones.
   - Input LEDs off.
   - Fan LED off (Blower off).
   - Heating LEDs off.
   - Damper LEDs - Last zone thermostat demand removed: LED is off (this zone's damper remains open during 3-1/2 minute purge); Other zones damper LEDs are on during the 3-1/2 minute purge (dampers closed). After 3-1/2 minute delay, all dampers LEDs go off (dampers open).

## Heat Pump Heating Checkout (Central Control)

**Prerequisites:**

- Central mode switch on
- Red LED on the central mode fan switch on




1. Set zone 1 thermostat for a heat demand; check:
   - Zone 1 thermostat W LED on (heating demand).
   - Output Heat Y1 LED on (compressor on).
   - Heating LED on.
   - All damper LEDs off (dampers open).
   - Pressure Switch LED on.

   The outdoor-unit compressor begins operating in the heating mode (low-speed if 2-stage compressor). At approximately the same time, the indoor blower starts, operating at a speed according to the PIAB jumper settings for all zones. It may take the blower 60 to 90 seconds to reach this speed.
2. **If Single-Stage Heat Pump - Skip to step 3**. The discharge air sensor continually samples air temperature. If, after 4 minutes, air temperature is not warming significantly, the high speed compressor energizes.
   - Output Heat Y2 LED on (high speed compressor).
3. The discharge air sensor continually samples air temperature. If, after (another) 4 minutes, air is not warming significantly, auxiliary heat sequence begins:
   - Electric Heating (E-Heating) LED on.
   - Output Heat W1 LED on, followed by (if available, and if necessary) W2, and then W3.
4. Remove the heat demand from zone 1. Upon removal of the demand from zone 1, check:
   - Zone 1 thermostat W LED off (no heat demand).
   - Output Heat Y1, (Y2) LED(s) off.
   - Fan and Heating LEDs off.

**Pressure Switch Checkout**

The high pressure switch is a normally closed (N.C.) auto-reset high pressure switch located in the compressor discharge line or on the suction valve service port. The switch is factory set to open when operating pressures rise and close when the pressure drops (see table 8). The intent of the switch is to protect the outdoor unit from abnormally high operating pressures during mild weather heating days. The green pressure LED comes on when the HP pressure switch is closed indicated normal condensing pressures.

**Table 8. High Pressure Switch Operation**

| Refrigerant | Open on pressure rise (psig) | Close on pressure fall (psig) |
|---|---|---|
| HFC-22 | 375 | 275 |
| HFC-410A | 550 | 425 |

1. Connect refrigerant gauges to the outdoor unit vapor line.
2. Establish a compressor heating demand and allow system to begin operating (see heat pump heating checkout section for details). Note that the green pressure switch LED comes on.
3. Allow system to operate several minutes so refrigerant pressures can balance.
4. Momentarily block the return air opening and observe the high pressure gauge. When hot gas line pressure reaches the “open on” pressure (see table 8) and the green pressure switch LED turns off, an error code will be set in the zone control system, DIAGs 1 and 4 will turn on, and outdoor unit will stage down and turn off if the switch does not close within 90 seconds. Afterwards, backup heat will be used to satisfy the demand.
5. Remove the restriction. When hot gas pressure drops below the “close on” pressure, the green pressure switch LED will turn **on** and all DIAGs should turn off.

## Troubleshooting—Zoning system with Heat Pump

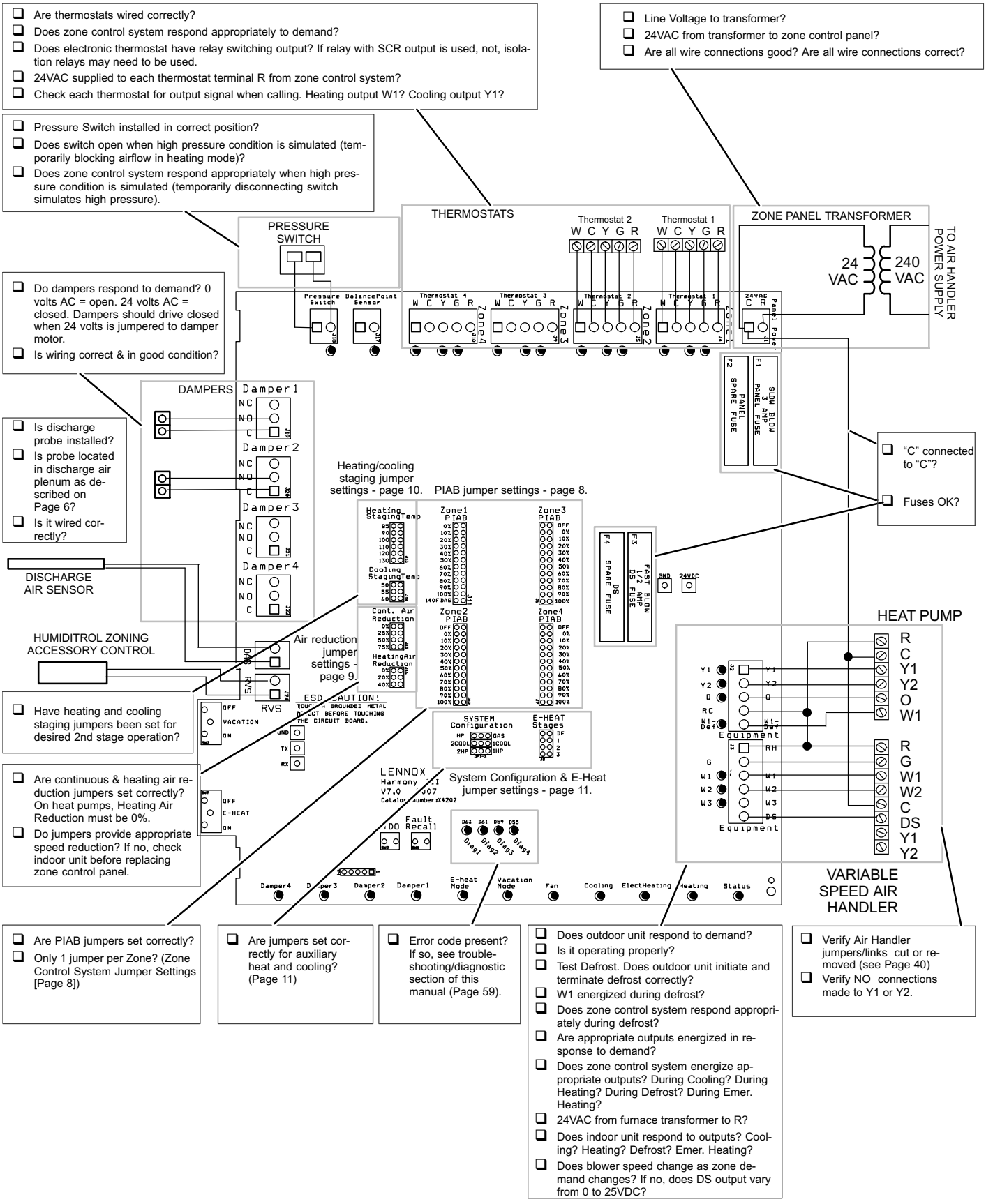
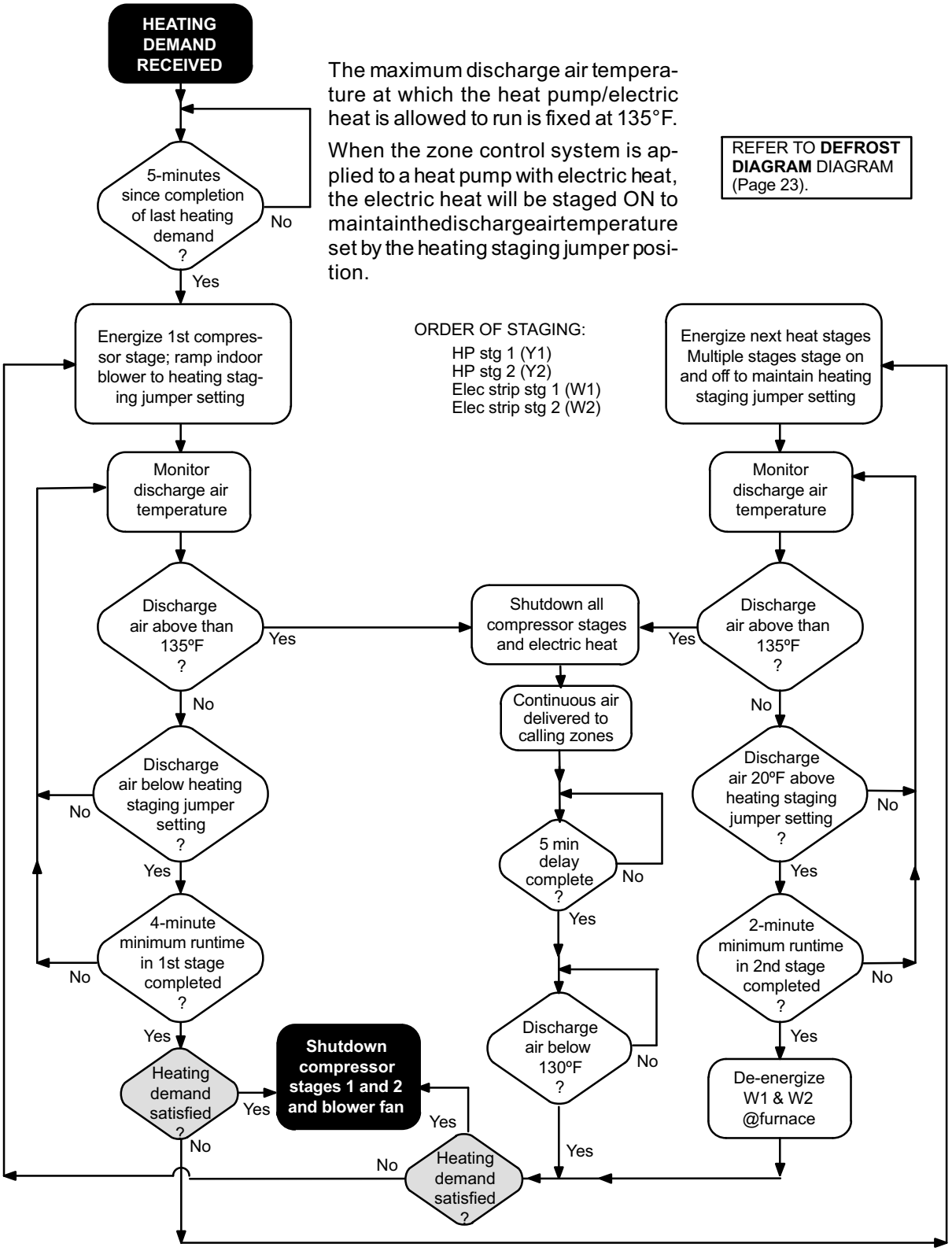



**Figure 16. Lennox Heat Pump and Lennox Variable-Speed Air Handler**

## Troubleshooting—Heat Pump Heating Operation




The maximum discharge air temperature at which the heat pump/electric heat is allowed to run is fixed at 135°F.

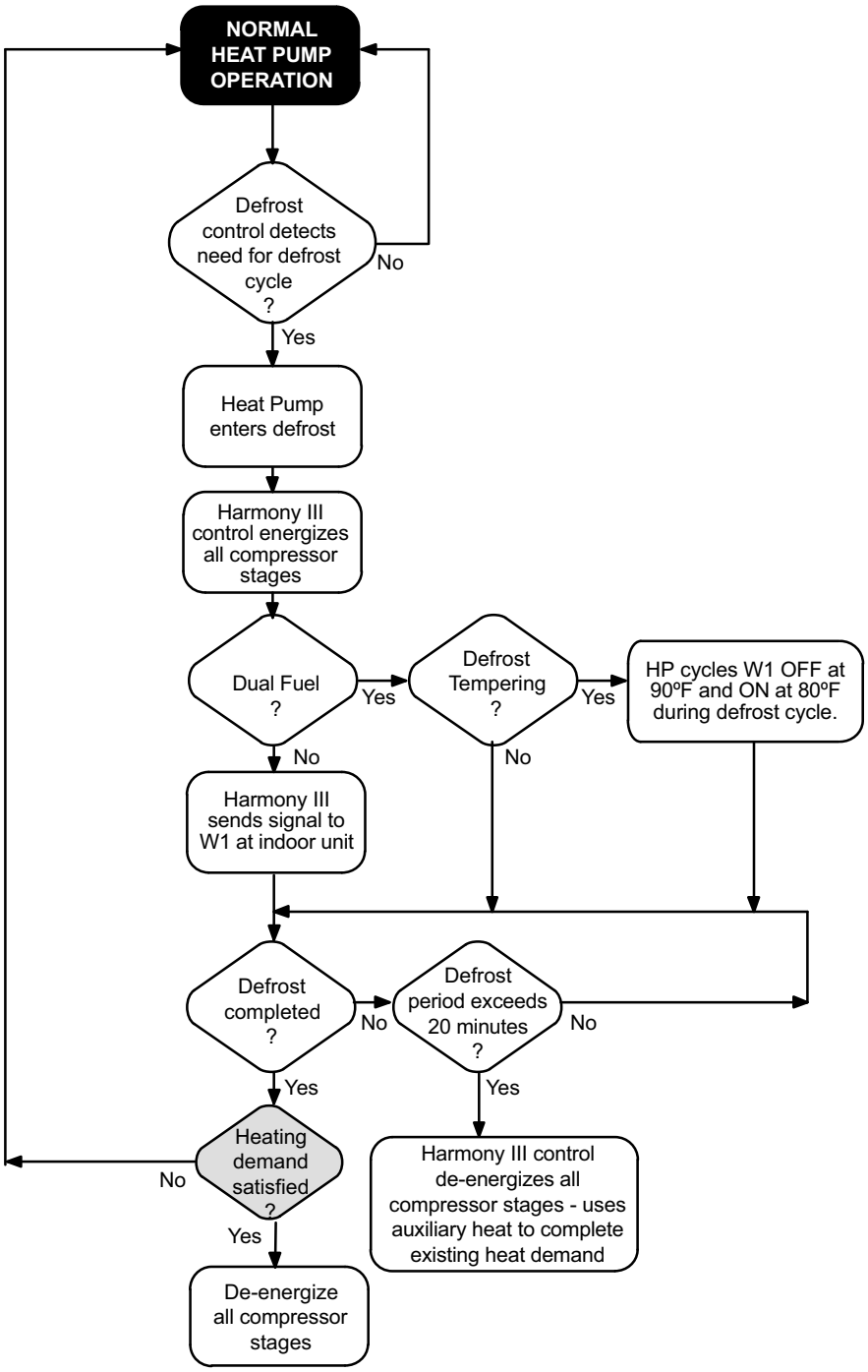
When the zone control system is applied to a heat pump with electric heat, the electric heat will be staged ON to maintainthedischargeairtemperature set by the heating staging jumper position.

REFER TO **DEFROST DIAGRAM** DIAGRAM (Page 23).

ORDER OF STAGING:
HP stg 1 (Y1)
HP stg 2 (Y2)
Elec strip stg 1 (W1)
Elec strip stg 2 (W2)

5

## Troubleshooting—Defrost Operation



# GAS FURNACE

## Wiring for Gas Furnace and Outdoor AC Unit

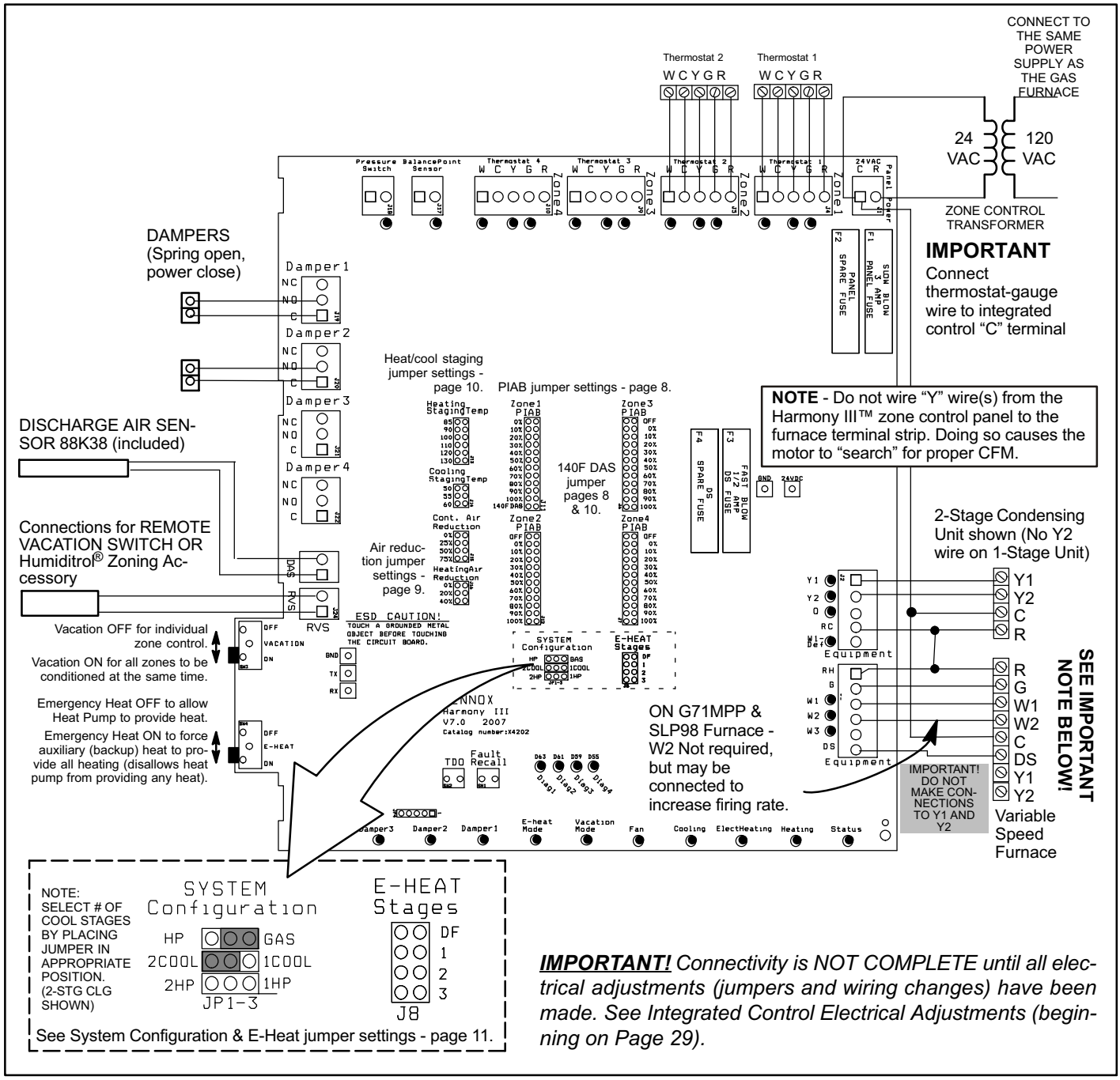



**Figure 17. Harmony III™ zoning system Option 1 - Lennox Variable-Speed Gas Furnace and 1- or 2-Stage Air Conditioner**

## VSM Furnace IFC Electrical Adjustments (G71MPP, SLP98, SL280V, EL296V)

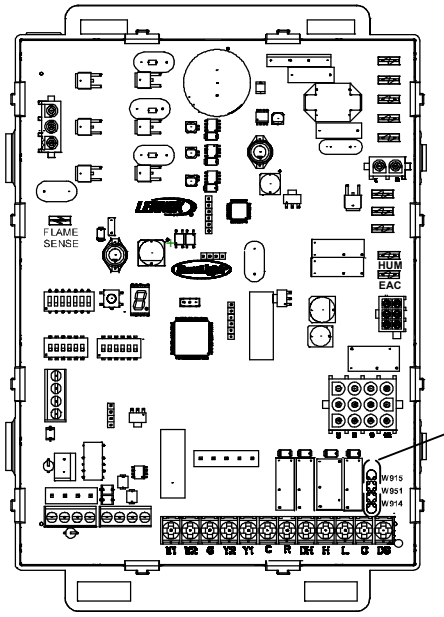
*NOTE - Follow all equipment installation instructions provided with each unit.*

The variable-speed motor (VSM) in the furnace is controlled by the integrated furnace control (IFC). Adjustment of these drive controls is made by cutting the clippable on-board links and selecting DIP switch settings. This is described in the following paragraphs.

The G71MPP, SLP98, SL280V, and EL296V blower motor speed must be adjusted to produce the zoning CFM requirements managed by the zone control system.

The Harmony III™ zone control's pulse width modulated (PWM) output signal is connected to the DS terminal on the furnace control. The PWM signal, along with any other thermostat request (G, W1, or W1+W2), controls fan speed linearly between the minimum and maximum CFM for the furnace as determined by the cool speed DIP switches (see G71MPP and SLP98 Installation Instructions for settings).

Locate the integrated control in the furnace control box area. Before connecting the zone control panel to the integrated control, complete the applicable electrical adjustments shown in figures 18 or 19.

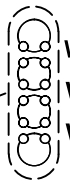



### Electrical Adjustments

1. **In all cases**—cut the clippable on-board link W914 Dehum - Harmony (between R and DS, see figure 18); if not cut, the zone control panel DS fuse will blow.
2. DO NOT CUT the clippable on-board link W915 2 Stage Compr (between Y1 and Y2).

**Do NOT cut any wires in the variable speed motor harness.**

**ON-BOARD LINKS:**

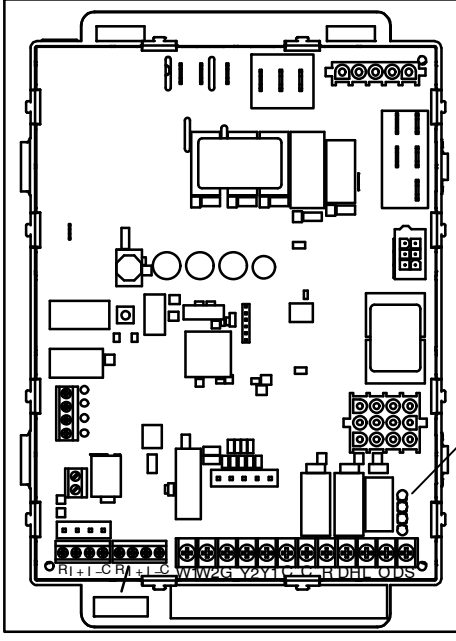


**W915** W915 2 Stage Compr (Y1 to Y2)—DO NOT CUT

**W951** W951 Heat Pump (R to O)—DO NOT CUT

**W914** W914 Dehum - Harmony (R to DS)—CUT IN ALL CASES

**Figure 18. G71MPP and SLP98 Integrated Furnace Control (IFC) Electrical Adjustments**




### Electrical Adjustments

1. **In all cases**—cut the clippable on-board link W914 Dehum - Harmony (between R and DS, see figure 18); if not cut, the zone control panel DS fuse will blow.
2. DO NOT CUT the clippable on-board link W915 2 Stage Compr (between Y1 and Y2).

**Do NOT cut any wires in the variable speed motor harness.**

**ON-BOARD LINKS:**

**W915** W915 2 Stage Compr (Y1 to Y2)—DO NOT CUT

**W951** W951 Heat Pump (R to O)—DO NOT CUT

**W914** W914 Dehum - Harmony (R to DS)—CUT IN ALL CASES

**Figure 19. SL280V and EL296V Integrated Furnace Control (IFC) Electrical Adjustments**

**Set the upper limit of blower CFM as follows:**

1. Determine the maximum system CFM requirements (sum of all the individual zones).
2. From the Blower Motor Performance tables (see *G71MPP, SLP98, SL280V, EL296V Furnace Installation Instructions*) determine the HIGH speed cool DIP switch setting that corresponds to this CFM.
3. Set the HIGH speed cool DIP switch setting on the integrated control to this value.

*NOTE - The lower limit of blower CFM is factory set. It is not field adjustable.*

The minimum airflow achieved by the G71MPP, SLP98, SL280V, EL296V when connected to a Harmony III™ zone control is listed in the table 6 (see page 14).

A 3% duty cycle corres

ponds to the minimum CFM, and a 97% duty cycle corresponds to the maximum CFM.

*NOTE - Any on/off delays present for a heating or cooling sequence are still present with Harmony III™ zone control operation.*

## VSM Furnace System Operation (G71MPP, SLP98, SL280V, EL296V)

The dehumidification on-board clippable link W914 Dehum - Harmony (R to DS) on the G71MPP, SLP98, SL280V, and EL29V integrated control must be cut for operation with the Harmony III™ zone control (see figure 18). Once the link is cut, the presence of the Harmony III™ zone control system, versus a standard dehumidification control, is automatically detected by the integrated control.

*IMPORTANT - DO NOT alter blower harness!*

When the integrated control is properly connected to a Harmony III™ zone control, operation is as follows:

- Integrated control DIP switches 1 and 2, which configure the control for operation with various types of thermostats, are ignored.
- The zone control sends a W1 Signal to the furnace which goes through its normal ignition sequence as described in the G71MPP, SLP98, SL280V, and EL29V installation instructions.
- The blower will start and operate at the minimum blower speed after a 45 second delay.
- After the temperature of the DAS rises above 100ºF the zone control will provide a PWM signal to the furnace on terminal DS based upon the Zone PIAB Jumper selections (and the heating air reduction jumper).
- The blower speed (CFM) is set according to the pulse width modulated (PWM) signal from the Harmony III™ zone control.
- The blower speed adjusts immediately with PWM adjustments.
- The furnace firing rate is based on current operating CFM and internal lookup table for midpoint temperature rise. If resulting firing rate is below minimum firing rate, it will operate at minimum fire rate. Accordingly, if resulting firing rate is above maximum firing rate, it will operate at maximum firing rate.
- Firing rate adjusts anytime the PWM deviates by more than 5% (e.g. 60% $\geq$ 65%).

  *NOTE - Integrated control DIP switches 14 thru 19 are not disabled, and can be used in conjunction with Harmony III to increase or decrease airflow volume during heating operation.*

  *NOTE - DIP switches 14-19 adjust firing rate when Harmony is detected. Air volume is controlled by Harmony. The furnace looks at air volume and determines proper firing rate based on DIP switch 14-19 settings. See* G71MPP and SLP98 Installation Instructions *for adjustment options.*

- **Integrated Control W2 terminal to Harmony III™ zone control:**

  Since the furnace automatically adjusts firing rate to match CFM to achieve a target temperature rise, connection of Harmony III™ zone control to W2 terminal on the integrated control is not required.

  With W2 connected, lower firing rates can be used for W1 demand usually resulting in greater comfort levels per zone. If temperature cannot be maintained, then W2 will quickly increase firing rates to satisfy demand.

  If discharge air temperature is too low, the integrated control W2 ***can be*** connected to Harmony III™ zone control to cause the furnace to increase firing rate. Every two minutes, the integrated control looks at W2. If W2 is ON, the firing rate increases by 5%. This 5% increase is added to the desired firing rate as determined by the PWM. Therefore, if a 50% duty cycle corresponds to a 70% firing rate, after 2 minutes of W2, that same 50% duty cycle will correspond to a 75% firing rate. This will last for the remainder of the heat cycle.

  When W2 goes from ON to OFF, the integrated control decreases the firing rate by 5%.

## Harmony III™ Installation Setup Worksheets

## G71MPP and SLP98—Cooling/Heating; (Non-Heat Pump Applications)

**Job Name:**_____ **Indoor Unit Model:**_____ **Outdoor Unit Model:**_____

### Indoor Unit setup:

√ Cut on-board link W914 DEHUM OR HARMONY (R to DS) on furnace IFC control (if not cut, fuse will blow in Harmony III zone control board)

√ W2 connection from Harmony III to SLP98 or G71MPP is optional – see Harmony III / furnace installation instructions for details

√ DIP switch settings (ON or OFF):

**1**_____OFF_____(DIP switch **1** – leave at factory setting – **ignored by Harmony III**)
**2**_____OFF_____(DIP switch **2** – leave at factory setting – **ignored by Harmony III**)
**3**_____OFF_____(DIP switch **3** – leave at factory setting – **ignored by Harmony III**)
**4**_____ON_____(DIP switches **4** and **5** determine heating blower "off" delay – **recommended 180 seconds**)
**5**_____ON_____ ~
**6**_____OFF_____(DIP switches **6** and **7** – leave at factory setting – **ignored by Harmony III**)
**7**_____OFF_____ ~
**8**_____(DIP switches **8** and **9** – cooling blower speed – determines maximum system cfm – see G71MPP blower tables)
**9**_____ ~
**10**_____(DIP switches **10** and **11**–cooling blower adjust–determines maximum system cfm – see G71MPP blower tables)
**11**_____ ~
**12**_____OFF_____(DIP switches **12** and **13** – leave at factory setting – **ignored by Harmony III**)
**13**_____OFF_____ ~
**14**_____OFF_____(DIP switches **14**,**15**,and**16** – sets low fire, minimum capacity, firing rate - DEFAULT SETTING SHOWN and IS RECOMMNEDED STARTING POINT– see Harmony III/furnace install instruction)
**15**_____OFF_____ ~
**16**_____OFF_____ ~
**17**_____OFF_____(DIP switches **17**,**18**,and**19** – sets high fire, 100% capacity, firing rate - DEFAULT SETTING SHOWN and IS RECOMMNEDED STARTING POINT– see Harmony III/furnace install instruction)
**18**_____OFF_____ ~
**19**_____OFF_____ ~

### Harmony III™ Panel setup:

√ Heating staging jumper (circle one): **85 90 100 110 120 130** (Recommended 120 deg-F)

√ Zone 1 PIAB 140F DAS jumper in place (circle one): **Yes No** (see Harmony III install instructions for info)

√ Cooling staging jumper (circle one): **50 55 60** (select desired discharge air temp during cooling)

√ Cont. Air Reduction jumper (circle one): **0 25 50 75** (% airflow reduction for continuous fan operation)

√ Heating Air Reduction jumper (circle one): **0 20 40** (% air flow reduction for heating mode)

√ System Configuration jumpers (circle one): **HP GAS** (Set to GAS)

√ Stages (circle one): **2COOL 1COOL** (Set to match condenser, 1 or 2 stage)

√ Stages (circle one): **2HP 1HP** (ignored for gas heat, non-heat pump application)

√ E-HEAT Stages (circle one): **DF 1 2 3** (ignored for gas heat, non-heat pump application)

√ Desired total system cfm with all zones calling- _____ Total system cfm per tables- _____ Minimum cfm- _____

√ Zone 1 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 2 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 3 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 4 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

*NOTE—All of the above are recommended "starting" positions for the SLP98 or G71MPP DIP switches and Harmony III jumpers. Slight variations may be required during system start up and operation checks.*

### Field Wiring Checklist:

√ Indoor Unit Wiring Completed:
- ❒ "DS" on Harmony III to "DS" on indoor unit connected,
- ❒ "C" on indoor unit connected to Harmony III transformer "C",
- ❒ No connection to "Y1" or "Y2" on indoor unit.

√ Outdoor Unit Wiring Completed.

√ Thermostat and Damper Wiring Completed.

√ Discharge Sensor wired to Harmony III.

## Harmony III™ Installation Setup Worksheets (continued)

## SL280V and EL296V—Cooling/Heating; (Non-Heat Pump Applications)

**Job Name:**_____ **Indoor Unit Model:**_____ **Outdoor Unit Model:**_____

### Indoor Unit setup:

√ Cut on-board link W914 DEHUM OR HARMONY (R to DS) on furnace IFC control (if not cut, fuse will blow in Harmony III zone control board)

√ DIP switch settings (ON or OFF):

**1**_____OFF_____(DIP switch **1** – leave at factory setting – **ignored by Harmony III**)
**2**_____OFF_____(DIP switch **2** – leave at factory setting – **ignored by Harmony III**)
**3**_____ON_____(DIP switches **3** and **4** – Blower Off Delay Switch Settings, set DIP switches 3 and 4 to ON (180 seconds).
**4**_____ON_____
**5**_____OFF_____DIP switches **5** and **6 -** Cooling Mode Blower Speed, set DIP switches 5 and 6 to OFF (High - Factory).
**6**_____OFF_____
**7**_____OFF_____DIP Switches **7** and **8** - Cooling Blower Speed Adjustment, set DIP switches 7 and 8 to OFF (Factory Default).
**8**_____OFF_____
**9**_____OFF_____DIP Switches **9** and **10** - Cooling Mode Blower Speed Ramping, set DIP switches 9 and 10 to OFF (A - Factory).
**10**_____OFF_____
**11**_____OFF_____DIP Switches **11, 12** and **13** - Heating Mode Blower Speed, set DIP switches 11, 12 and 13 to OFF (Factory Default).
**12**_____OFF_____
**13**_____OFF_____
**14**_____OFF_____DIP Switches **14** and **15** - Continuous Blower Speed, set DIP switches 14 and 15 to OFF (38% of High Cool Speed - Factory Default).
**15**_____OFF_____

### Harmony III™ Panel setup:

√ Heating staging jumper (circle one): **85 90 100 110 120 130** (Recommended 120 deg-F)

√ Zone 1 PIAB 140F DAS jumper in place (circle one): **Yes No** (see Harmony III install instructions for info)

√ Cooling staging jumper (circle one): **50 55 60** (select desired discharge air temp during cooling)

√ Cont. Air Reduction jumper (circle one): **0 25 50 75** (% airflow reduction for continuous fan operation)

√ Heating Air Reduction jumper (circle one): **0 20 40** (% air flow reduction for heating mode)

√ System Configuration jumpers (circle one): **HP GAS** (Set to GAS)

√ Stages (circle one): **2COOL 1COOL** (Set to match condenser, 1 or 2 stage)

√ Stages (circle one): **2HP 1HP** (ignored for gas heat, non-heat pump application)

√ E-HEAT Stages (circle one): **DF 1 2 3** (ignored for gas heat, non-heat pump application)

√ Desired total system cfm with all zones calling- _____ Total system cfm per tables- _____ Minimum cfm- _____

√ Zone 1 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 2 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 3 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 4 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

*NOTE—All of the above are recommended "starting" positions for the SLP98 or G71MPP DIP switches and Harmony III jumpers. Slight variations may be required during system start up and operation checks.*

### Field Wiring Checklist:

√ Indoor Unit Wiring Completed:

- ❒ "DS" on Harmony III to "DS" on indoor unit connected,
- ❒ "C" on indoor unit connected to Harmony III transformer "C",
- ❒ No connection to "Y1" or "Y2" on indoor unit.

√ Outdoor Unit Wiring Completed.

√ Thermostat and Damper Wiring Completed.

√ Discharge Sensor wired to Harmony III.

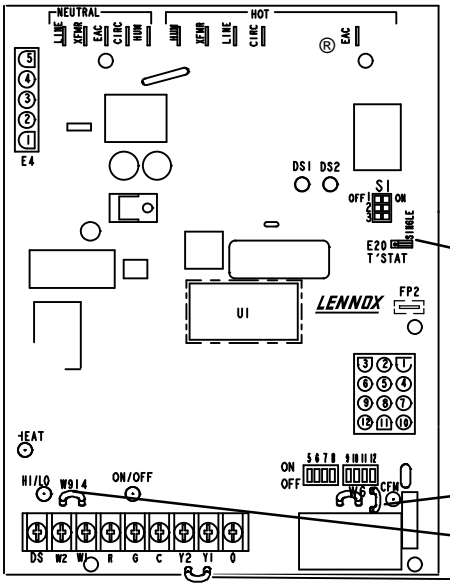
## VSM Furnace IFC Electrical Adjustments (G61MPV and G60UHV)

*NOTE - Follow all equipment installation instructions provided with each unit.*

Variable-speed furnaces are equipped with an integrated furnace control (IFC). The blower motor speed must be adjusted, by DIP switch setting selection, to produce the cfm required when all the zones are demanding heating or cooling which is managed by the zone control system.

Locate the integrated control in the furnace control box area. Switch settings on the control affect blower CFM. Before connecting the zone control panel to the integrated control, complete the applicable electrical adjustments as shown in figure 20.

A




**Electrical Adjustments**

1. **In all cases**—cut the clippable on-board link W914 Dehum - Harmony (between R and DS, shown left).
2. **DO NOT CUT** clippable on-board link W951 Heat Pump (between R and O).
3. **DO NOT CUT** clippable on-board link W915 2 Stage Compr (between Y1 and Y2).
4. Be sure T'STAT jumper is on “TWO”.
5. **In all cases**—cut and tape wires 2 and 13 on the motor end of the VSM harness connecting the integrated control to the motor (see figure 21).

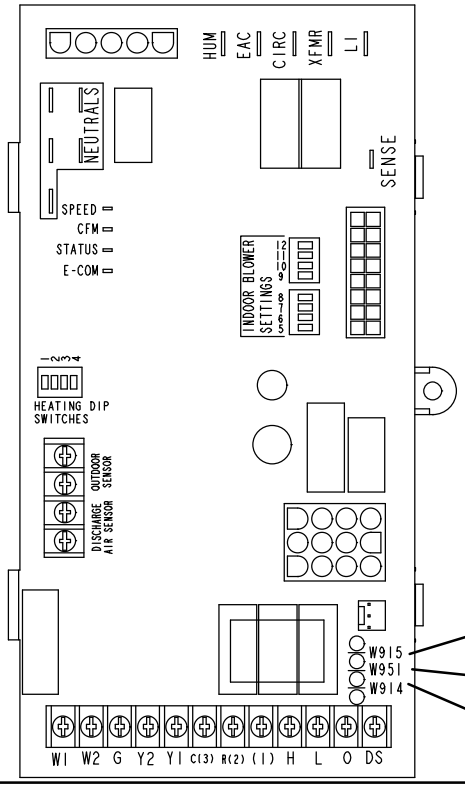
**ON-BOARD LINKS:**

W951 HEAT PUMP—DO NOT CUT

W914 DEHUM - HARMONY—CUT IN ALL CASES

W915 2 STAGE COMPR—DO NOT CUT

B




**IMPORTANT**

Be sure to cut jumper W914; if not cut, the zone control panel DS fuse will blow.

**Electrical Adjustments**

1. **In all cases**—cut the clippable on-board link W914 Dehum - Harmony (between R and DS, shown left).
2. **DO NOT CUT** clippable on-board link W951 Heat Pump (between R and O).
3. **DO NOT CUT** clippable on-board link W915 2 Stage Compr (between Y1 and Y2).
4. Be sure to set ”T'STAT Heat Stages” to ”ON” (2-stage).
5. **In all cases**—cut and tape wires 2 and 13 on the motor end of the VSM harness connecting the integrated control to the motor (see figure 21).

**ON-BOARD LINKS:**

W915 2 STAGE COMPR—DO NOT CUT

W951 HEAT PUMP—DO NOT CUT

W914 DEHUM - HARMONY—CUT IN ALL CASES

**Figure 20. G61MPV and G60UHV Integrated Furnace Control Electrical Adjustments**

## VSM Furnaces IFC Electrical Adjustments (G61MPV and G60UHV [cont'd])

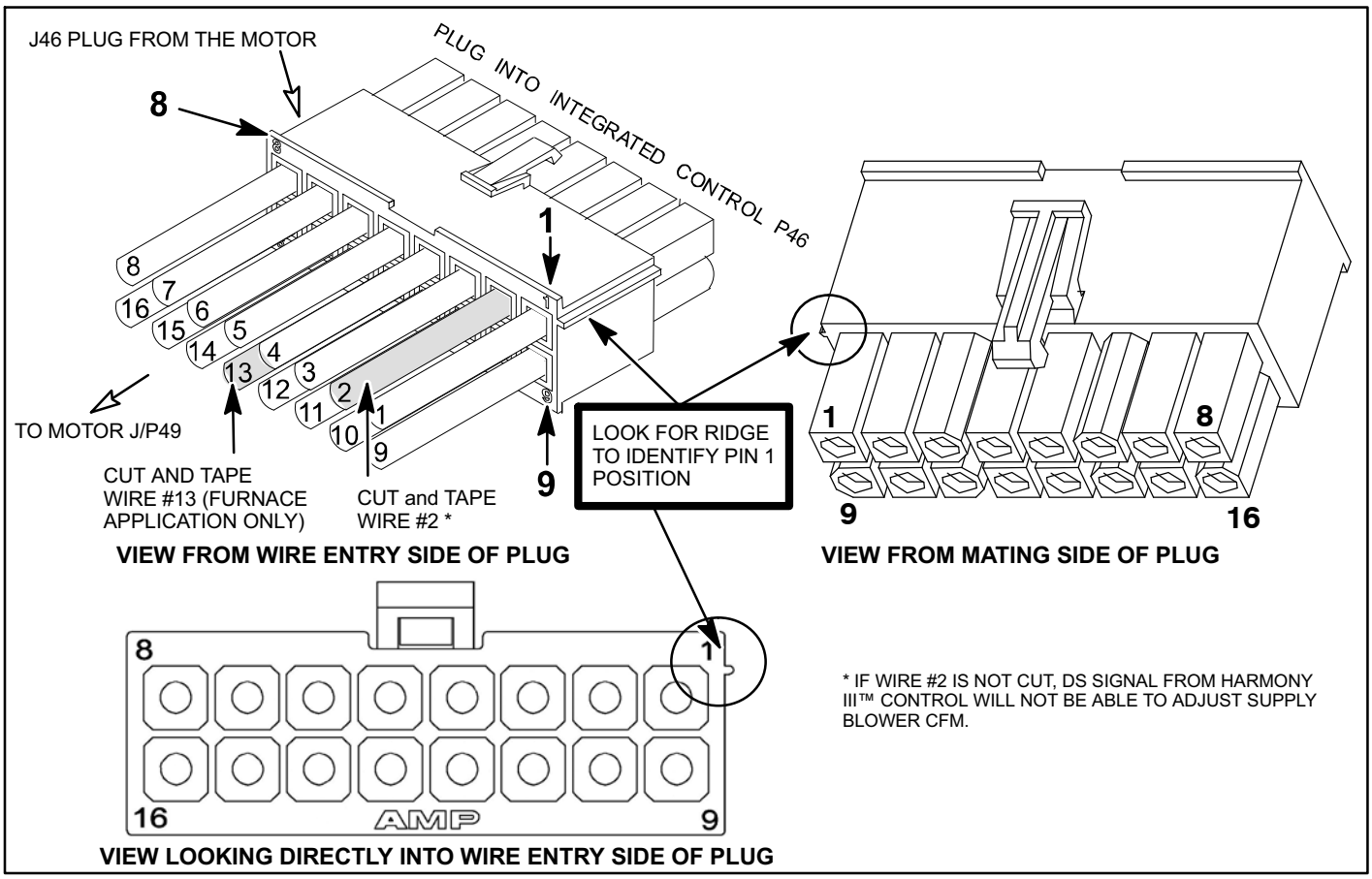



**Figure 21. Integrated Control Cable Modifications for G61MPV/G60UHV Furnaces**

**Set the upper limit of blower CFM as follows:**

1. Determine the maximum system CFM requirements (sum of all the individual zones).
2. From the Blower Motor Performance table (see unit installation instructions) determine the HIGH Speed cool DIP switch setting that corresponds to this CFM.
3. Set the HIGH Speed cool DIP switch setting on the control to this value.

*NOTE - The lower limit of blower CFM is factory set. It is not field adjustable. See table 6 on page 14 for minimum airflow values for specific furnace models.*

## VSM Furnace System Operation (G61MPV and G60UHV)

This section describes the operation of the zone control in a system that uses a gas furnace.

**Zone Thermostats**

Only electronic thermostats with a “C” terminal may be used with the zone control system. The zone control system distinguishes between heat pump and heat/cool applications via the SYSTEM jumper placement on the zone control panel.

1. Cool / Heat / Auto-Changeover Modes—Zone thermostats send a heating or cooling signal to the zone control panel. Thermostat servicing zone 1 is the central control thermostat. Zones 2, 3 and 4 each have their own thermostat. Thermostats may be standard or autochangeover type.

   Heat and cool demands present at the same time from different zones (opposing demands) are satisfied on a first come first served basis. If a heating demand and a cooling demand reach the zone control panel at the same time, the heating demand is satisfied first. If opposing demands persist, the system will work to satisfy the current demand for a maximum of 20 minutes, then switch over and try to satisfy the opposing demand for a maximum of 20 minutes. When either demand is satisfied, the system works to satisfy the other demand.

   *NOTE - Allowing opposing demands to persist may consume excess energy. If this condition continues, check the installation (i.e. zone arrangement, supply registers, return registers, zone loads etc.) and make adjustments as necessary. Table 9 shows the time delays that may be expected when opposing demands are received from the zone thermostats.*

   The zone control system acknowledges a new or opposing demand as soon as it is received by illuminating that zone's thermostat input lights. If the first demand is not satisfied by the time the delays elapse, the system switches over and begins satisfying the opposing demand. During the switch-over, a delay may be imposed before the system begins satisfying the new demand.
2. Fan On / Auto Mode—Zone thermostats can send a continuous fan signal to the zone control system. The zone control system will signal the blower to supply air to zones calling for continuous fan while no other conditioning calls exist. When the zone control system receives a conditioning call while satisfying a demand for continuous fan, it signals the damper controlling the continuous-fan zone to close. After the conditioning demand is satisfied, the continuous-fan zone damper is signaled to reopen.

**Balance Point Setting**

(Dual Fuel Systems) Balance Point Sensor (kit 56A87) communicates with the zone control panel whether or not to force the Gas Furnace to satisfy heating demands, based on a comparison of the Balance Point setting with the outdoor temperature. Terminals 2-3 close on temperature fall to lock out heat pump.

**Zone Mode**

The zone control mode (Vacation switch OFF) utilizes the zone control system's full potential. While in this mode, the zone control system will respond to demands from any zone, controlling dampers and regulating blower CFM to maintain comfort. When the system is in zone mode, the zone control system responds to demands from any zone thermostat. (Switch settings are shown in figures 17 through 27.)

The only OPEN supply-air dampers are those zones from which a demand was received; all other dampers are CLOSED. The blower operates at a speed based on the position of the Zone PIAB selection jumpers (and the heating air reduction jumper, if a call for heat is present).

*NOTE - To ensure that the zone control performs optimally, avoid mixing air between the zones.*

**Central (Vacation) Mode**

When in central mode (Vacation switch ON), the system responds only to heating or cooling demands from the central control (Zone 1) thermostat; all zones will receive conditioned air. All dampers remain open and the blower operates at full speed (minus the amount selected by the heating air reduction jumper). (Switch settings are shown in figures 17 through 27.)

In Fan-Auto mode, the blower will cycle on and off with each demand. During gas or electric-strip heating, the blower may continue after the end of a demand until the heater is cooled sufficiently.

**Cooling Operation**

When the Harmony III™ zoning system receives a thermostat cooling call, the following events occur:

- The zone control checks to make sure it has been at least 5 minutes since the last cooling call ended to prevent starting against high head pressures.
- When timed-off delay is satisfied, the zone control starts the outdoor unit with 1st-stage compressor and slowly increases the indoor blower speed to achieve proper CFM. Four minutes must elapse at this state to allow the system to reach steady-state operation before staging again.
- The zone control checks the discharge air sensor for proper temperature. If measured temperature is 7ºF or more above the cooling staging jumper setting, then Y2 energizes (if available). If both stages of cooling are energized and 4 minutes has elapsed since the last staging event, and the discharge air sensor (DAS) detects a temperature less than the cooling staging jumper, then Y2 is staged off.
- If, at any time, the discharge air sensor measures a temperature of 45ºF or below, the zone control de-energizes the Y1 and/or Y2 output, stopping the compressor and preventing the indoor coil from freezing up. The compressor will not be energized again until the temperature at the DAS rises by 10ºF and the timed-off delay expires. During this time, continuous fan is supplied to the zones calling for cooling.

## VSM Furnace System Operation (G61MPV and G60UHV [cont'd})

### Heating Operation

**Gas furnace**—In this system, when the zone control receives a thermostat heating demand, the following events occur:

- The zone control sends a W1 signal to the furnace, which goes through its normal ignition sequence, except that while the temperature at the DAS is below 100ºF, the zone control instructs the blower to run at minimum speed.
- After the temperature at the DAS rises above 100ºF, the zone control slowly increases the CFM delivered until it reaches the correct setting. During a call for heat, the zone control stages the furnace up and down to maintain the discharge air temperature between the heating staging jumper setting and 20ºF above this jumper setting. There is a minimum 3 minute delay between staging events.

*NOTE - See page 26 for additional notes on operation with G71MPP and SLP98 furnace.*

**Heat Pump with Electric Heat**—In this system, when the zone control receives a thermostat heating call, the following events occur:

- The zone control starts the heat pump on 1st-stage.
- If after 4 minutes, the temperature at the DAS is not within the proper range (heating staging jumper setting and heating staging jumper setting +20) the unit stages up or down, accordingly.
- If the air temperature cannot be maintained using the heat pump alone, the zone control starts the electric heating stages. Should the discharge temperature exceed 135ºF, the compressor (and any electric heat that may be on) is turned off and continuous fan runs (if the demand for heat remains) until the air temperature falls below 130ºF and the minimum timed-off delay expires.
- If the heat pump goes into defrost mode, the zone control energizes all stages of compressor and the 1st-stage of electric heat. If the defrost process lasts longer than 20 minutes, the zone control, presuming a defrost board failure, de-energizes the heat pump and instructs electric heat to service the remainder of the current heating call. (The heat pump will be tried again on the next heating call.)

**Dual Fuel-Heat Pump with Gas Furnace**—In this system, when it receives a thermostat heating call, the zone control responds in one of two ways:

1. **Outdoor temperature below balance point** (balance point sensor **closed**, red Balance Point Sensor LED **on**): the zone control sends a W1 signal to the furnace to satisfy heat demands, staging the furnace to maintain discharge air temperatures between 110ºF and 130ºF.
2. **Outdoor temperature above balance point** (balance point sensor **open**, red Balance Point Sensor LED **off**): the heat pump is first used to satisfy the demand. If, after 20 minutes, the heat pump fails to maintain the required discharge air temperature, the zone control will discontinue using the heat pump and initiate furnace heating. (A five-minute delay exists between stopping the heat pump and starting the furnace.) In this mode, all heating calls for the next three hours are serviced with the gas furnace. Also, diagnostic lights 2, 3, and 4 blink to indicate that the zone control is operating within this 3-hour furnace lock-in time. During this time, the zone control stages the furnace to maintain discharge air temperatures between 110ºF and 130ºF. After the 3-hour delay expires, the heat pump will again be tried on the next heating call.

   **Defrost Tempering (Optional)**—If installed, refer to Defrost Operation on Page 23 for Defrost Tempering operation.

### Emergency heat mode

When the unit is setup for heat pump and the emergency heat switch is turned on, the unit will satisfy all heating demands with electric backup heat or, in a dual fuel system, the heat demand is satisfied by the gas furnace.

### Humiditrol® mode (Enhanced Dehumidification Accessory)

*When the unit is equipped for dehumidification (Enhanced Dehumidification Accessory and Humiditrol® Zoning Accessory installed), the unit will satisfy all demands for dehumidification. Refer to supplemental kit information Dehumidification Interface Kit for Harmony III™ Zone Control.*

## Harmony III™ Installation Setup Worksheets

## G61MPV/G60UHV—Cooling/Heating; with Honeywell 2-stage IFC control (non-Heat Pump applications)

**Job Name:**_____ **Indoor Unit Model:**_____ **Outdoor Unit Model:**_____

### Indoor Unit setup:

√ Cut on-board link W914 DEHUM OR HARMONY (R to DS) on furnace IFC control (if not cut, fuse will blow in zone control board)

√ Cut and tape wires from pin # 2 and pin #13 on plug J46 of the VSM wiring harness routed from the motor to the Furnace Integrated control.

√ Furnace IFC Control DIP switch settings (ON or OFF):

**1**_____OFF_____(DIP switch **1** must be set to **Off** for 2-stage heating operation)

**2**_____OFF_____(DIP switch **2** determines 2nd stage heat time delay and is **ignored by Harmony III**)

**3**_____ON_____(DIP switches **3** and **4** determines heating blower off delay, **recommended is 180 sec**)

**4**_____ON_____ „

**5** _____DIP switches **5** and **6** determines 2nd stage cooling blower speed or **maximum system air vol**.)

**6**_____ „

**7**_____(DIP switches **7** and **8** determine blower "adjust" setting for **maximum system air volume**)

**8**_____ „

**9**_____OFF_____(DIP switches **9** and **10** determines cooling blower ramping profile and is **ignored by Harmony III**)

**10**_____OFF_____ „

**11**_____OFF_____(DIP switches **11**and**12** determines heating blower speed and is **ignored by Harmony III**)

**12**_____ON_____ „

### Harmony III™ Panel setup:

√ Heating staging jumper (circle one): **85 90 100 110 120 130** (Recommended 120 deg-F)

√ Zone 1 PIAB 140F DAS jumper in place (circle one): **Yes No** (see install instructions for info)

√ Cooling staging jumper (circle one): **50 55 60** (select desired discharge air temp during cooling)

√ Cont. Air Reduction jumper (circle one): **0 25 50 75** (% airflow reduction for continuous fan operation)

√ Heating Air Reduction jumper (circle one): **0 20 40** (% air flow reduction for heating mode)

√ System Configuration jumpers (circle one): **HP GAS** (Set to GAS)

√ Stages (circle one): **2COOL 1COOL** (Set to match condenser, 1 or 2 stage)

√ Stages (circle one): **2HP 1HP** (ignored for gas heat, non-heat pump application)

√ E-HEAT Stages (circle one): **DF 1 2 3** (ignored for gas heat, non-heat pump application)

√ Desired total system cfm with all zones calling- _____ Total system cfm per tables- _____ Minimum cfm- _____

√ Zone 1 – Name:_____ Desired cfm:_____ PIAB Setting: _____% Actual cfm: _____

√ Zone 2 – Name:_____ Desired cfm:_____ PIAB Setting: _____% Actual cfm: _____

√ Zone 3 – Name:_____ Desired cfm:_____ PIAB Setting: _____% Actual cfm: _____

√ Zone 4 – Name:_____ Desired cfm:_____ PIAB Setting: _____% Actual cfm: _____

*NOTE—All of the above are recommended starting positions for DIP switches and Harmony III jumpers. Slight variations may be required during system start up and operation checks.*

### Field Wiring Checklist:

√ Indoor Unit Wiring Completed:

- ❒ "DS" on Harmony III to "DS" on indoor unit connected,
- ❒ "C" on indoor unit connected to Harmony III transformer "C",
- ❒ No connection to "Y1" or "Y2" on indoor unit.

√ Outdoor Unit Wiring Completed.

√ Thermostat and Damper Wiring Completed.

√ Discharge Sensor wired to Harmony III.

## Furnace System Start-Up and Checkout

**⚠ IMPORTANT**

The zone control system power-up must occur at the same time or before the furnace or air handler unit is powered up.

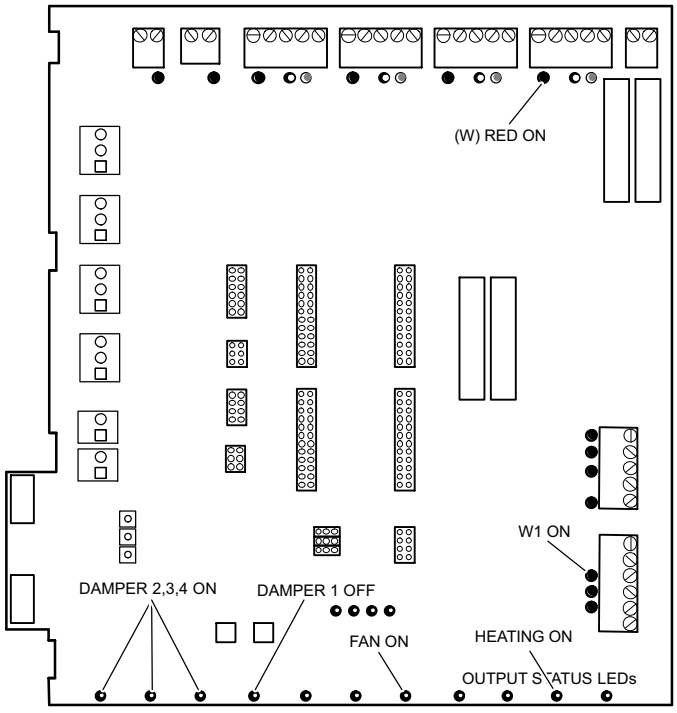
**Powering the System (All Systems)**

1. Adjust all thermostat settings so that no demand will occur.
2. Apply power to the zone panel transformer and to the furnace and observe the following: all four diagnostic LEDs will light; then each individual diagnostic LED will light in sequence; then all four diagnostic LEDs will light and extinguish.
3. Finally, the status light will begin to flash, indicating proper operation. Perform the gas heating checks on pages 34 through 35.

## Gas Heating Checkout (Single Zone)

**Prerequisites:**

- Zone 1 thermostat set to Heat




1. Set zone 1 thermostat for a heat demand; check:
   - Zone 1 thermostat W LED on (heating demand).
   - Damper 1 LED off (damper open).
   - Damper 2, 3, and 4 LEDs on (dampers closed).
   - Output Heat W1 LED on (furnace on).
   - Heating LED on.

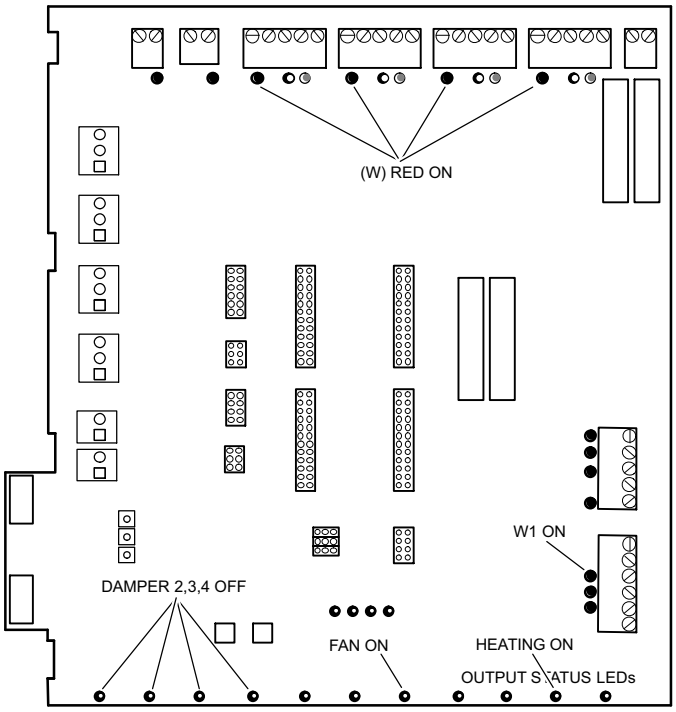
   The furnace begins ignition sequence after zone 1 has demanded heat. The zone control system will start the furnace blower on low speed (0 PIAB) 45 seconds after the combustion cycle has begun.
2. When 100ºF warm air is sensed by the discharge air sensor, the fan LED will light and the blower will slowly increase to speed required by the zone calling. The blower operates at speed setting of PIAB jumper for zone 1 and the jumper for heating air reduction. It may require 60 - 90 seconds to reach this speed.
3. Set zone 1 thermostat for NO heat demand; check:
   - Zone 1 thermostat W LED off (no heat demand).
   - Output Heat W1 LED off.
   - Fan LED off.
   - Heating LED off.
   - Damper LEDs 2-4 remain on until after 3-1/2 minute purge; then off.

   To check the amount of air being delivered to each zone and to confirm that each individual zone damper functions properly, repeat these steps for zones 2 - 4.

## Gas Heating Checkout (Multiple Zone)

**Prerequisites:**

- All zone thermostats set to Heat



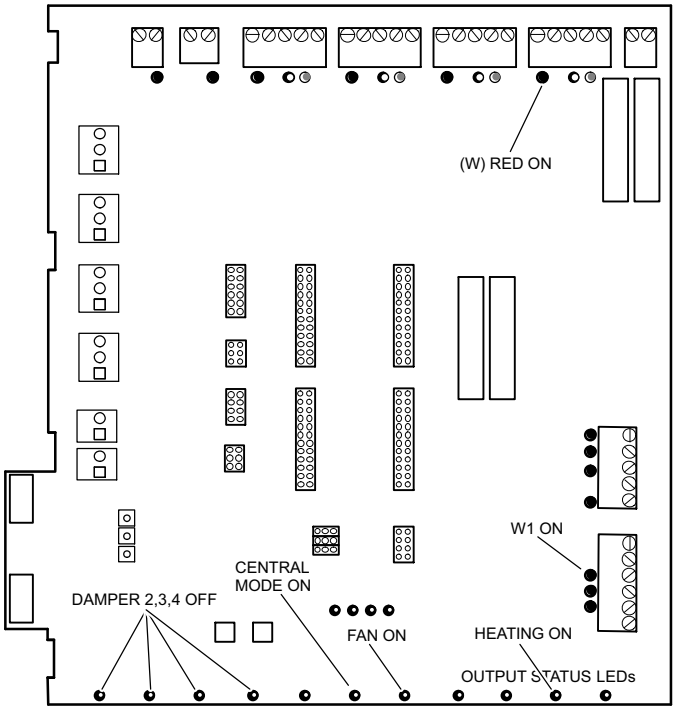

1. Set all zone thermostats for a heat demand; check for the following:
   - All zone thermostat W LEDs on (heat demands).
   - LEDs dampers 1 - 4 off (all dampers open).
   - Output Heat W1 LED on (furnace on).
   - Heating LED on.

   The furnace begins ignition sequence after a heat demand is detected. The zone control system will start the furnace blower on low speed (0 PIAB) 45 seconds after the combustion cycle has begun.
2. When 100ºF warm air is sensed by the discharge air sensor, the fan LED comes on and the blower will slowly increase to speed required by the zones calling. The blower operates at a speed equivalent to the sum of all zone PIAB jumpers but at a maximum not to exceed the setting of the heating air reduction jumper. It may take the blower 60 to 90 seconds to reach this speed.
3. Set all zone thermostats for NO heat demands; check:
   - Output Heat W1 LED off.
   - Heating LED off.
   - Fan LED off (blower turns off after delay).
   - All zone thermostat W LEDs off.
   - Damper LEDs - Last zone thermostat demand removed: LED is off (this zone's damper remains open during 3-1/2 minute purge); other zones damper LEDs are on during the 3-1/2 minute purge (dampers closed). After 3-1/2 minute delay, all dampers LEDs go off (dampers open).

## Gas Heating Checkout (Central Control)

**Prerequisites:**

- Central mode switch on
- Red LED on the central mode fan switch on




1. Set zone 1 thermostat for a heat demand; check:
   - Zone 1 thermostat W LED on (heating demand).
   - Output Heat W1 LED on (furnace on).
   - Heating LED on.
   - All damper LEDs off (damper open).
2. The furnace will begin its ignition sequence after Zone 1 has demanded heat. The zone control system will start the furnace blower on low speed (0 PIAB air) 45 seconds after the combustion cycle has begun.
3. When 100ºF warm air is sensed by the discharge air sensor, the fan LED will light and the blower will slowly increase to speed. The blower will operate at a speed equivalent to the PIAB calculated for all zones calling, taking into account the heating air reduction jumper position. It may take the blower 60 to 90 seconds to reach this speed.
4. Remove the heat demand from zone 1 (no heat input or output and no blower demand). Upon removal of the demand from zone 1, check:
   - Zone 1 thermostat W LED off (no heat demand).
   - Output Heat W1 LED off.
   - Fan LED off.
   - Heating LED off.

   After 3-1/2 minute purge time, furnace blower turns off.

## Troubleshooting Diagram—Zone system with Gas Furnace

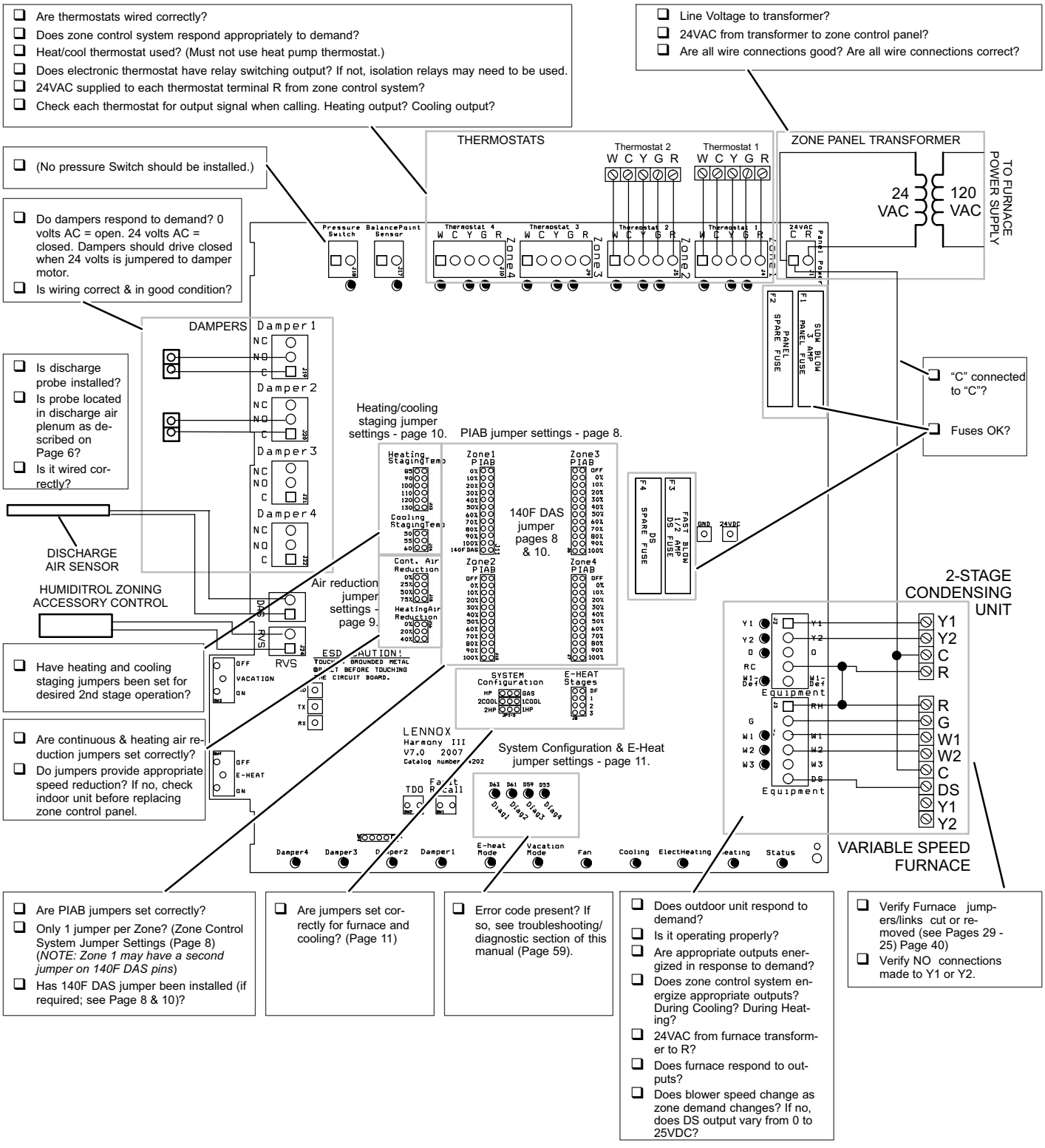
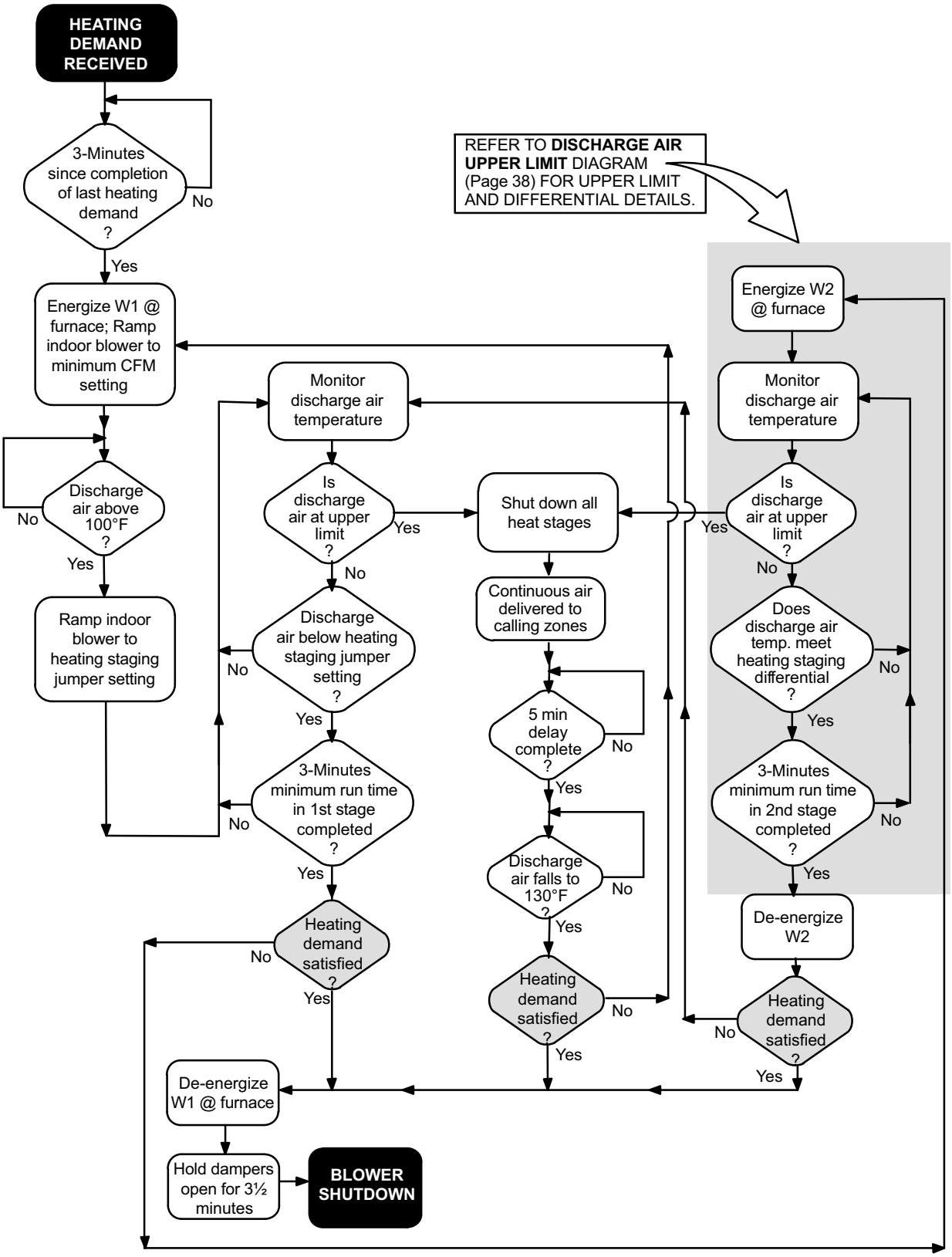
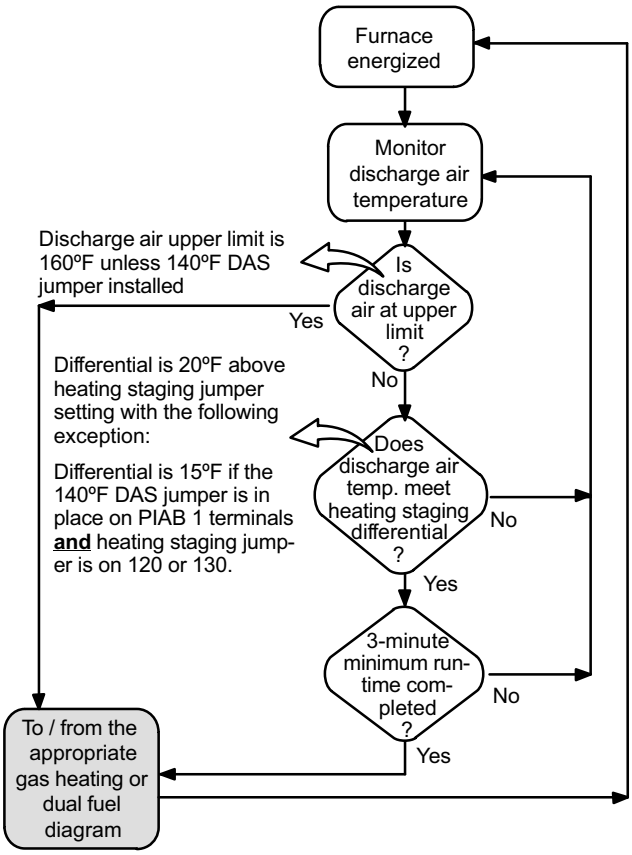



**Figure 22. Option 1 - Lennox Variable-Speed Gas Furnace and Lennox Condensing Unit**

## Troubleshooting—Gas Heating Operation



## Troubleshooting—Discharge Air Upper Limit and Differential Temperatures



# AIR HANDLERS

## Variations on Common Condensing Unit Applications

### Heating/Cooling Equipment Installation

Follow all equipment installation instructions provided with each unit.

### Air Handler Wiring

After the air handler unit is installed, field wire the line voltage as shown in the installation instructions provided with the unit. Use thermostat wire to connect the air handler to the zone control panel (see figure 15) and to connect wire from zone control panel 24V “C” to air handler terminal strip “C” (24VAC common) blue wire in CBX25UHV air handler..

*NOTE - Be sure to remove the factory installed jumper bar between W1 to W2 and W2 to W3 (CBX40 or CBX32MV rev 06) or remove the jumper wires between R to W1 and R to W2 (CBX32MV prior to rev 06). CBX25UHV does not have any factory jumpers.*

### Variations

Several variations may be required for specific applications. Figure 23 shows alternate wiring and describes specific jumper configurations and other special modifications required for each variation. Aside from the variations described in figure 23, the connectivity is the same as shown in figure 17 (Page 24).

**COOLING WITH ELECTRIC HEAT**

- System configuration jumpers:
  HP;
  1COOL or 2COOL.
- E-Heat stage jumper set on # agreeing with # of available heat stages.
- E-HEAT Selector Switch always ON.
- As applicable, cut jumpers and harness wires (see Blower Control Adjustments - Air Handlers on Page 40).

**HOT WATER COIL (CBX25UHV, CBWMV, CBX32MV or CBX40UHV)**

- System configuration jumpers:
  GAS;
  1COOL or 2COOL;
  Others do not matter.
- AHC (prior to revision 06): Cut or remove 24 volt jumper Y1 to DS.
- AHC (revision 06): Cut R to DS clippable link on air handler control.
- CBWMV has no K20 relay, therefore wiring harness modification (shown in figure 25, Page 40) is not required.
  - Cut or remove 24v jumper Jumper Y1 to DS
  - Remove Pink wire from TB1-W1 to J46-2 on CBWMV
- CBX25UHV does not have factory jumper between R to DS.

*NOTE - K212 field hookup relay must be field provided on the CBX25UHV, CBX32MV and CBX40UHV*

*NOTE - DAS must be located downstream of the cooling coil and*

**COOLING ONLY**

- System configuration jumpers:
  GAS;
  1COOL or 2COOL;
  Others do not matter.
- As applicable, cut jumpers and harness wires (see Blower Control Adjustments - Air Handlers on Page 40).

**HEATING ONLY**

*NOTE - JUMPER between RC and RH must be in place on the control!*

For any option or variation, connect thermostat wire between “C” on terminal strip(s) of controlled equipment and zone control panel 24VAC “C” terminal.

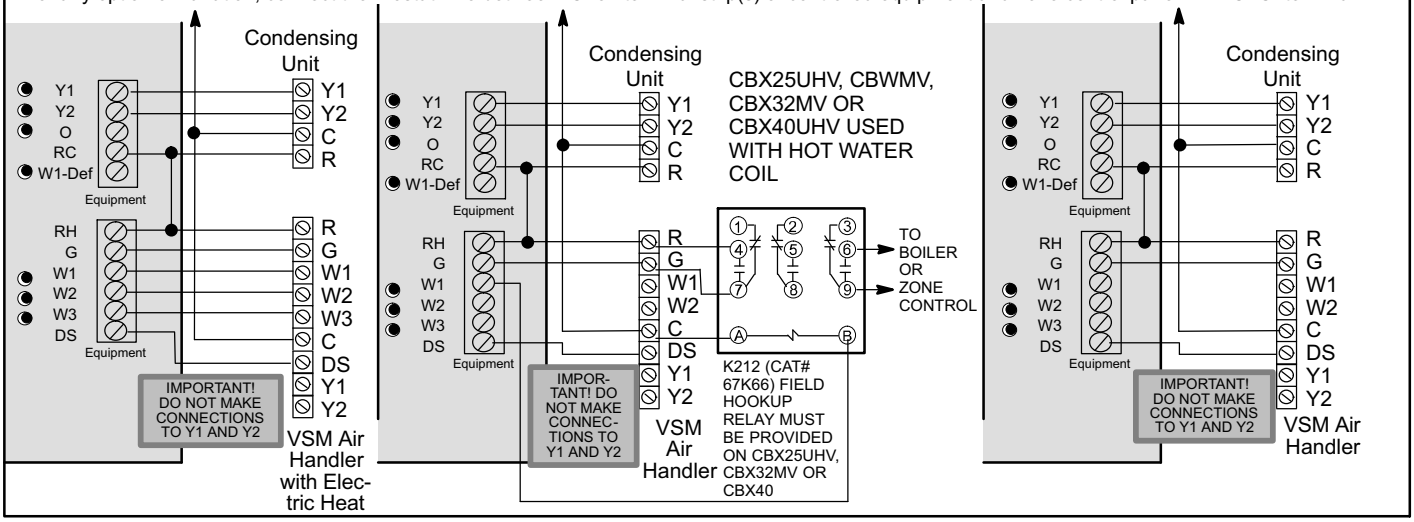



**Figure 23. Harmony III™ zoning system - Variations on Common Applications**

## Air Handler Control Electrical Adjustments (All model VSM Air Handlers)

**Electrical Adjustments—Communicating CBX32MV (revision 06) and CBX40UHV (all)**

**Electrical Adjustments**

As shown in this diagram, make the following adjustments:

1. Cut on board link R to DS (Dehum or Harmony).
2. Remove Jumper Bars from W1 to W2 and W2 to W3.
3. DO NOT CUT on board links Y1-Y2 2 STAGE COMPR and R-O HEAT PUMP

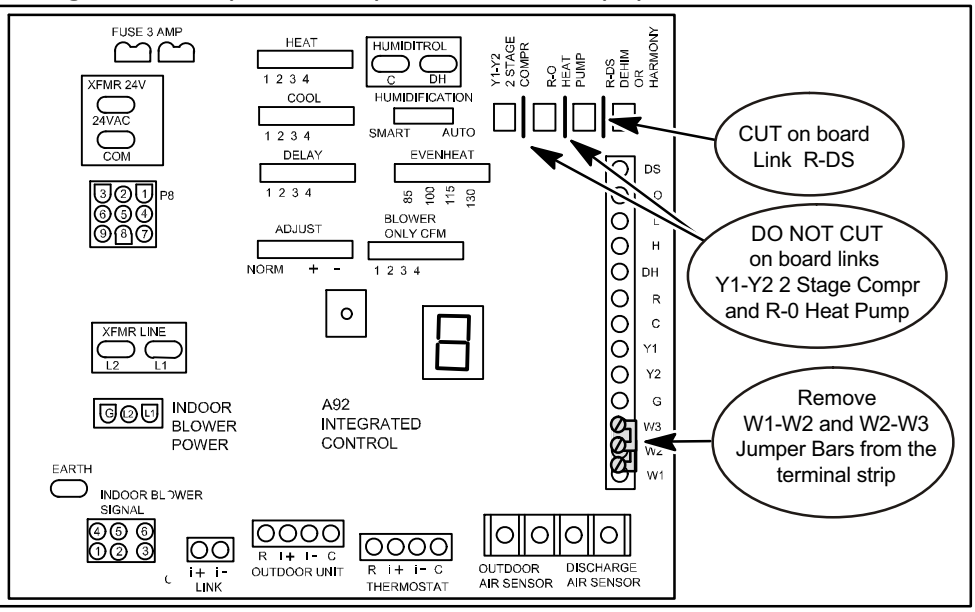



**Figure 24. Electrical Adjustments for Air Handler Control CBX32MV (revision 06) and CBX40UHV (all)**

**Electrical Adjustments—Non-communicating CBX32MV (prior to revision 06), CB31MV and CBWMV**

These air handler blower motors are controlled by the BDC3 drive control; CFM adjustment Is by jumper setting selection.

Locate the BDC3 board in the blower control box. Before connecting the zone control panel to the BDC3 board, complete all of the applicable electrical adjustments as shown in figure 25.

***NOTE - Before cutting wires or jumpers, be sure your installation is not affected by "Variations on Common Condensing Unit Applications" figure 23 (Page 39).***

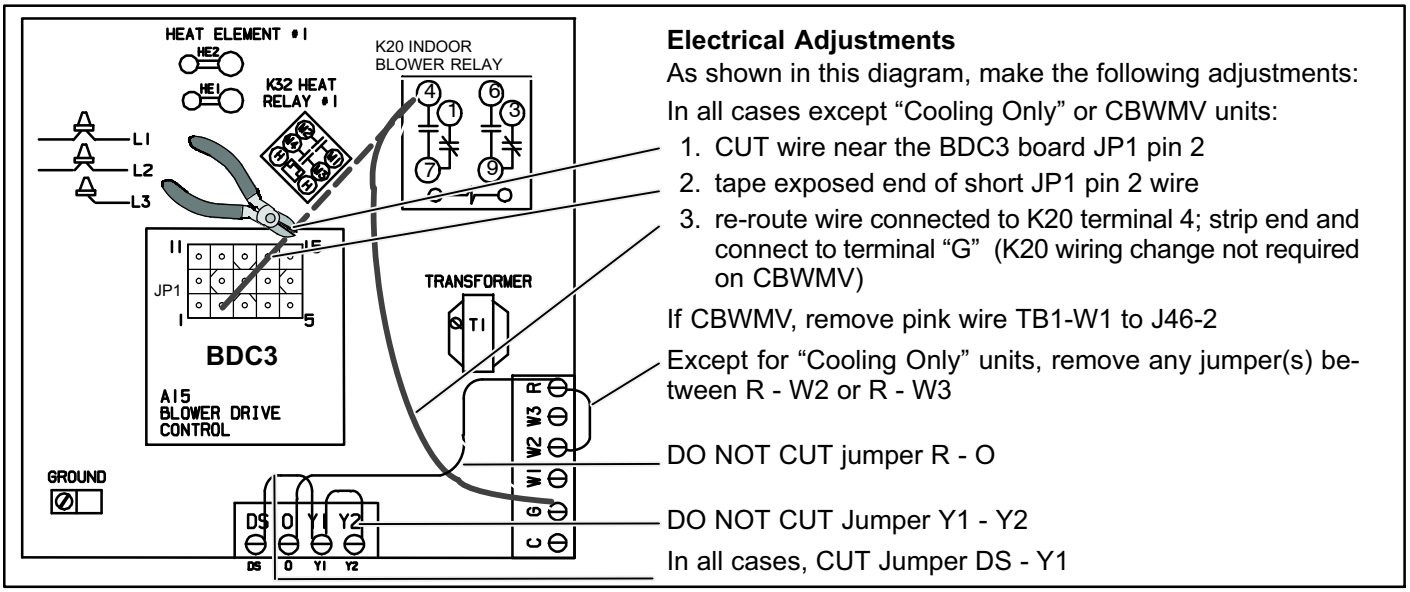



**Figure 25. Electrical Adjustments for Air Handler Control CBX32MV (pre-rev. 06), CB31MV and CBWMV**

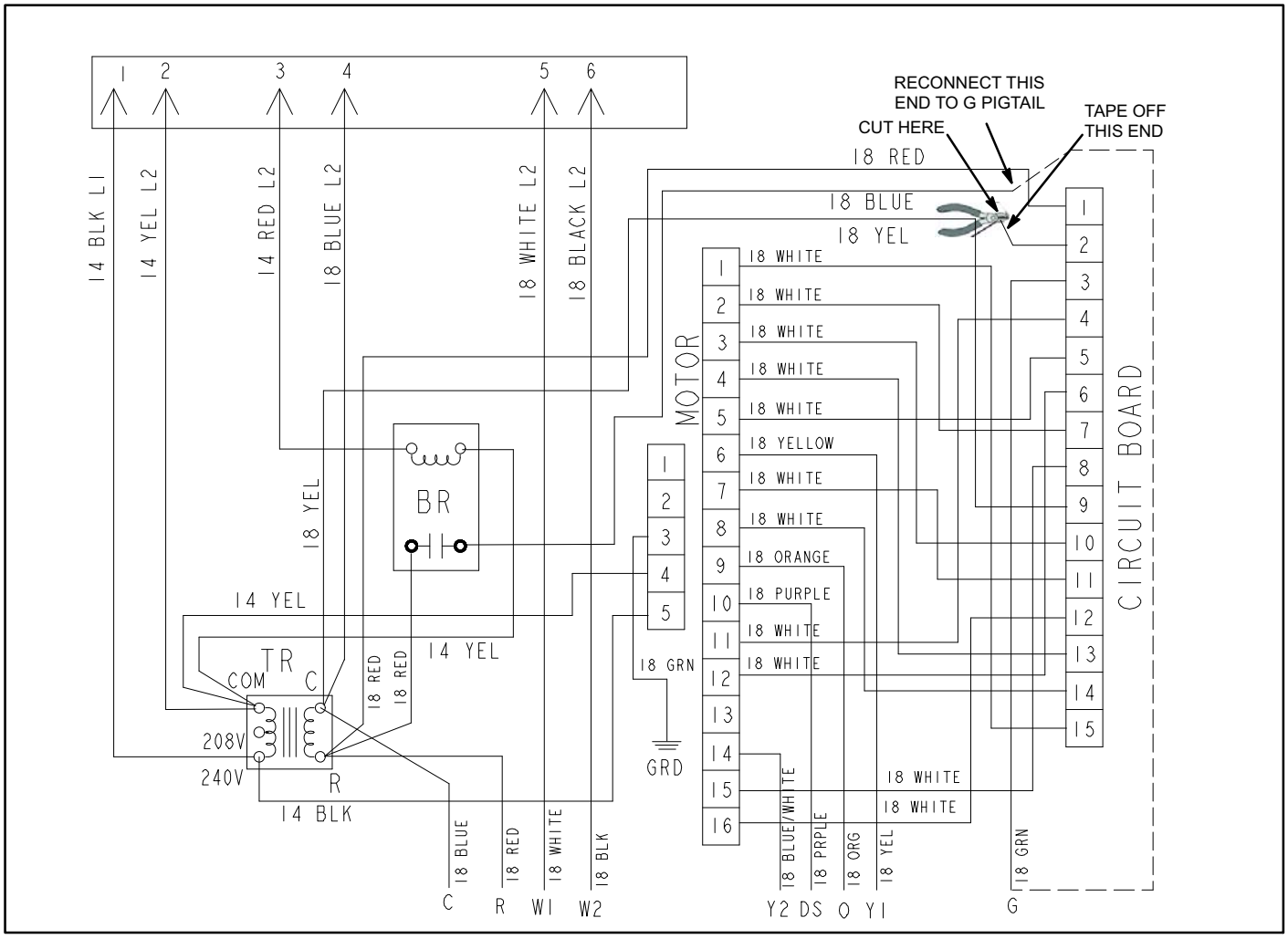



**Figure 26. Electrical Adjustments for Air Handler Control CBX25UHV**

**As shown in figure 26, make the following adjustments:**

Blue wire that goes between plug # 2 of the circuit board and one side of the contacts on the BR relay must be removed and connected to the G pigtail. Tape off end of wiring going to the circuit board jack plug. If this wire is not removed, the DS signal from the Harmony III control will not be able to vary the speed of the indoor blower motor.

Connection from BR relay to G required to provide blower operation during electric heat sequencer shutoff time period after demand ends. Otherwise electric heat can remain on for a period without blower operation and trip one shot thermal limits on elements.

## Harmony III™ Installation Setup Worksheets

### CBX25UHV/CBX32MV/CBX40UHV—Cooling/Heating; Electric Strip Heat (non-Heat Pump applications)

**Job Name:**_____ **Indoor Unit Model:**_____ **Outdoor Unit Model:**_____

### CBX40UHV and CBX32MV Revision 06 Indoor Unit setup:

√ Cut on-board link R to DS "DEHUM or HARMONY"

√ Remove any factory-installed jumpers bars from W1 to W2 or W2 to W3.

√ Air Handler Control jumper settings:

**COOL:**_____ This setting, along w/ ADJUST setting, determines maximum system CFM (See blower tables)

**ADJUST:**_____ Setting affects both heating and cooling blower speeds (see blower tables to determine setting)

**HEAT:**_____**HIGH**_____ Heating blower speed selection – Ignored by Harmony III

**DELAY:**_____4_____ Cooling blower ramping – Ignored by Harmony III

**BLOWER ONLY CFM:**_____ Continuous fan speed – Ignored by Harmony III

**EVENHEAT:**_____ EVENHEAT is not used with Harmony III

### CBX25UHV (all units) and CBX32MV units prior to Revision 06 — Indoor Unit Setup:

√ Remove DS to Y1 jumper

√ No jumper between DS and Y1 on CBX25UHV

√ On the CBX32MV the wire from K20 terminal 4 to BDC3 board JP1 pin 2 must be re-routed to establish an electrical connection between K20 terminal 4 and terminal G. Cut the wire near JP1 pin 2. Using the wire still connected to K20 terminal 4, strip the cut end and connect it to terminal G. Tape the exposed end of the short JP1pin 2 wire.

√ On the CBX25UHV Blue wire that goes between plug # 2 of the circuit board and one side of the contacts on the BR relay must be removed and connected to the G pigtail. Tape off end of wire going to the circuit board jack plug.

√ Remove any factory-installed jumpers between terminal R and W1, W2, or W3. No jumper between R and W1 or W2 on CBX25UHV.

√ BDC3 control clip jumper settings (CBX25UHV and CBX32MV):

**COOL:**_____ This setting, along w/ ADJUST setting, determines maximum system CFM (See blower tables)

**ADJUST:**_____ Setting affects both heating and cooling blower speeds (see blower tables to determine setting)

**HEAT:**_____**4**_____ Heating blower speed selection – Ignored by Harmony III

**DELAY:**_____4_____ Cooling blower ramping – Ignored by Harmony III

### Harmony III™ Panel setup:

√ Heating staging jumper (circle one): **85 90 100 110 120 130** (Recommended 120 deg-F)

√ Zone 1 PIAB 140F DAS jumper in place (circle one): **Yes No**

√ Cooling staging jumper (circle one): **50 55 60** (select desired discharge air temp during cooling to stage compressor)

√ Cont. Air Reduction jumper (circle one): **0 25 50 75** (% airflow reduction for continuous fan operation)

√ Heating Air Reduction jumper (circle one): **0 20 40** (% air flow reduction for heating mode)

√ System Configuration jumpers (circle one): **HP GAS** (Set to HP)

√ Stages (circle one): **2COOL 1COOL** (Set to match condenser, 1 or 2 stage)

√ Stages (circle one): **2HP 1HP** (Ignored for non-heat pump – w/ strip heat applications – setting does not matter)

√ E-HEAT Stages (circle one): **DF 1 2 3** (Set to # of strip ht stages (<8KW=1)(>8KW and <30KW=2)( 30KW=3)

√ Emergency Heat switch on Harmony III zone panel must be set to ON.

√ Desired total system cfm with all zones calling- _____ cfm, Actual total system cfm- _____

√ CB unit "minimum" cfm _____ (determined by unit spec as listed below unit blower table)

√ Zone 1 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 2 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 3 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 4 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

*NOTE—All of the above are recommended starting positions for DIP switches and Harmony III jumpers. Slight variations may be required during system start up and operation checks.*

### Field Wiring Checklist:

√ Indoor Unit Wiring Completed:

- ❑ "DS" on Harmony III to "DS" on indoor unit connected,
- ❑ "C" on indoor unit connected to Harmony III transformer "C",
- ❑ No connection to "Y1" or "Y2" on indoor unit.

√ Outdoor Unit Wiring Completed.

√ Thermostat and Damper Wiring Completed.

√ Discharge Sensor wired to Harmony III.

## Harmony III™ Installation Setup Worksheets (continued)

### CBX25UHV/CBX32MV/CBX40UHV—Heat Pump; Electric Strip Heat

**Job Name:**_____ **Indoor Unit Model:**_____ **Outdoor Unit Model:**_____

#### CBX40UHV and CBX32MV Revision 06 Indoor Unit setup:

√ Cut on-board link R to DS "DEHUM or HARMONY"

√ Remove any factory-installed jumpers bars from W1 to W2 or W2 to W3.

√ Air Handler Control jumper settings:

**COOL:**_____ This setting, along w/ ADJUST setting, determines maximum system CFM (See blower tables)

**ADJUST:**_____ Setting affects both heating and cooling blower speeds (see blower tables to determine setting)

**HEAT:**_____**HIGH**_____ Heating blower speed selection – Ignored by Harmony III

**DELAY:**_____4_____ Cooling blower ramping – Ignored by Harmony III

**BLOWER ONLY CFM:**_____ Continuous fan speed – Ignored by Harmony III

**EVENHEAT:**_____ EVENHEAT is not used with Harmony III

#### CBX25UHV (all units) and CBX32MV units prior to Revision 06 — Indoor Unit Setup:

√ Remove DS to Y1 jumper

√ No jumper between DS and Y1 on CBX25UHV

√ On the CBX32MV the wire from K20 terminal 4 to BDC3 board JP1 pin 2 must be re-routed to establish an electrical connection between K20 terminal 4 and terminal G. Cut the wire near JP1 pin 2. Using the wire still connected to K20 terminal 4, strip the cut end and connect it to terminal G. Tape the exposed end of the short JP1pin 2 wire.

√ On the CBX25UHV Blue wire that goes between plug # 2 of the circuit board and one side of the contacts on the BR relay must be removed and connected to the G pigtail. Tape off end of wire going to the circuit board jack plug.

√ Remove any factory-installed jumpers between terminal R and W1, W2, or W3. No jumper between R and W1 or W2 on CBX25UHV.

√ BDC3 control clip jumper settings (CBX25UHV and CBX32MV):

**COOL:**_____ This setting, along w/ ADJUST setting, determines maximum system CFM (See blower tables)

**ADJUST:**_____ Setting affects both heating and cooling blower speeds (see blower tables to determine setting)

**HEAT:**_____**4**_____ Heating blower speed selection – Ignored by Harmony III

**DELAY:**_____4_____ Cooling blower ramping – Ignored by Harmony III

#### Harmony III™ Panel setup:

√ Heating staging jumper (circle one): **85 90 100 110 120 130** (Recommended 90 deg-F)

√ Zone 1 PIAB 140F DAS jumper in place (circle one): **Yes No**

√ Cooling staging jumper (circle one): **50 55 60** (select desired discharge air temp during cooling to stage compressor)

√ Cont. Air Reduction jumper (circle one): **0 25 50 75** (% airflow reduction for continuous fan operation)

√ Heating Air Reduction jumper (circle one): **0 20 40** (Must be set to 0% on heat pump systems)

√ System Configuration jumpers (circle one): **HP GAS** (Set to HP)

√ Stages (circle one): **2COOL 1COOL** (Set to match condenser, 1 or 2 stage)

√ Stages (circle one): **2HP 1HP** (Set to heat pump stages, 1 or 2 stage)

√ E-HEAT Stages (circle one): **DF 1 2 3** (Set to # of strip ht stages (<8KW=1)(>8KW and <30KW=2)( 30KW=3)

√ Desired total system cfm with all zones calling- _____ cfm, Actual total system cfm- _____

√ CB unit "minimum" cfm _____ (determined by unit spec as listed below unit blower table)

√ Zone 1 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 2 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 3 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 4 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

*NOTE—All of the above are recommended starting positions for DIP switches and Harmony III jumpers. Slight variations may be required during system start up and operation checks.*

#### Field Wiring Checklist:

√ Indoor Unit Wiring Completed:

- ❑ "DS" on Harmony III to "DS" on indoor unit connected,
- ❑ "C" on indoor unit connected to Harmony III transformer "C",
- ❑ No connection to "Y1" or "Y2" on indoor unit.

√ Outdoor Unit Wiring Completed.

√ Thermostat and Damper Wiring Completed.

√ Discharge Sensor wired to Harmony III.

√ Heat Pump Pressure Switch wired to Harmony III.

## Harmony III™ Installation Setup Worksheets (continued)

## CBX25UHV/CBX32MV/CBX40UHV – Cooling Only or Cooling with Hot Water Coil (non-Heat Pump)

**Job Name:**_____ **Indoor Unit Model:**_____ **Outdoor Unit Model:**_____

### CBX40UHV and CBX32MV Revision 06 Indoor Unit setup:

√ Cut on-board link R to DS "DEHUM or HARMONY"

√ For Hot Water Coil Only—Add K212 Relay and wire per Harmony III wiring detail.
NOTE - Discharge air sensor must be located down stream of cooling coil and hot water coil.

√ Air Handler Control jumper settings:

**COOL:**_____ This setting, along w/ ADJUST setting, determines maximum system CFM (See blower tables)

**ADJUST:**_____ Setting affects both heating and cooling blower speeds (see blower tables to determine setting)

**HEAT:**_____**HIGH**_____ Heating blower speed selection – Ignored by Harmony III

**DELAY:**_____4_____ Cooling blower ramping – Ignored by Harmony III

**BLOWER ONLY CFM:**_____ Continuous fan speed – Ignored by Harmony III

**EVENHEAT:**_____ EVENHEAT is not used with Harmony III

### CBX25UHV (all units) and CBX32MV units prior to Revision 06 — Indoor Unit Setup:

√ Remove DS to Y1 jumper

√ No jumper between DS and Y1 on CBX25UHV

√ On the CBX32MV the wire from K20 terminal 4 to BDC3 board JP1 pin 2 must be re-routed to establish an electrical connection between K20 terminal 4 and terminal G. Cut the wire near JP1 pin 2. Using the wire still connected to K20 terminal 4, strip the cut end and connect it to terminal G. Tape the exposed end of the short JP1pin 2 wire.

√ On the CBX25UHV Blue wire that goes between plug # 2 of the circuit board and one side of the contacts on the BR relay must be removed and connected to the G pigtail. Tape off end of wire going to the circuit board jack plug.

√ Remove any factory-installed jumpers between terminal R and W1, W2, or W3. No jumper between R and W1 or W2 on CBX25UHV.

√ BDC3 control clip jumper settings (CBX25UHV and CBX32MV):

**COOL:**_____ This setting, along w/ ADJUST setting, determines maximum system CFM (See blower tables)

**ADJUST:**_____ Setting affects both heating and cooling blower speeds (see blower tables to determine setting)

**HEAT:**_____**4**_____ Heating blower speed selection – Ignored by Harmony III

**DELAY:**_____4_____ Cooling blower ramping – Ignored by Harmony III

### Harmony III™ Panel setup:

√ Heating staging jumper (circle one): **85 90 100 110 120 130** (Cooling only – setting does not matter; Hot water - set at 120)

√ Zone 1 PIAB 140F DAS jumper in place (circle one): **Yes No** (Cooling only – setting does not matter)

√ Cooling staging jumper (circle one): **50 55 60** (select desired discharge air temp during cooling–50 deg-F suggested)

√ Cont. Air Reduction jumper (circle one): **0 25 50 75** (% airflow reduction for continuous fan operation)

√ Heating Air Reduction jumper (circle one): **0 20 40** ( Cooling only – setting does not matter; Hot Water set at % reduction for Heating mode)

√ System Configuration jumpers (circle one): **HP GAS** (Set to GAS)

√ Stages (circle one): **2COOL 1COOL** (Set to match condenser, 1 or 2 stage)

√ Stages (circle one): **2HP 1HP** (ignored; non-heat pump application – setting does not matter)

√ E-HEAT Stages (circle one): **DF 1 2 3** (non-heat pump – setting does not matter )

√ Desired total system cfm with all zones calling _____ cfm, Actual total system cfm- _____

√ CB unit "minimum" cfm _____ (determined by unit spec listed below unit blower table)

√ Zone 1 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 2 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 3 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 4 – Desired cfm _____ PIAB Setting _____% Actual cfm _____

*NOTE—All of the above are recommended starting positions for DIP switches and Harmony III jumpers. Slight variations may be required during system start up and operation checks.*

### Field Wiring Checklist:

√ Indoor Unit Wiring Completed:
- ❑ "DS" on Harmony III to "DS" on indoor unit connected,
- ❑ "C" on indoor unit connected to Harmony III transformer "C",
- ❑ No connection to "Y1" or "Y2" on indoor unit.

√ Outdoor Unit Wiring Completed.

√ Thermostat and Damper Wiring Completed.

√ Discharge Sensor wired to Harmony III and if a hot water coil is used, the sensor must be located down stream of the hot water coil.

# DUAL FUEL

## Zone control system wiring—Dual Fuel Application

### Heating/Cooling Equipment Installation

Follow all equipment installation instructions provided with each unit.

### Heat Pump Unit Wiring

After the heat pump unit is installed, field wire the line voltage as shown in the installation instructions provided with the unit. Use thermostat wire to connect the heat pump to the zone control panel (see figure 27).

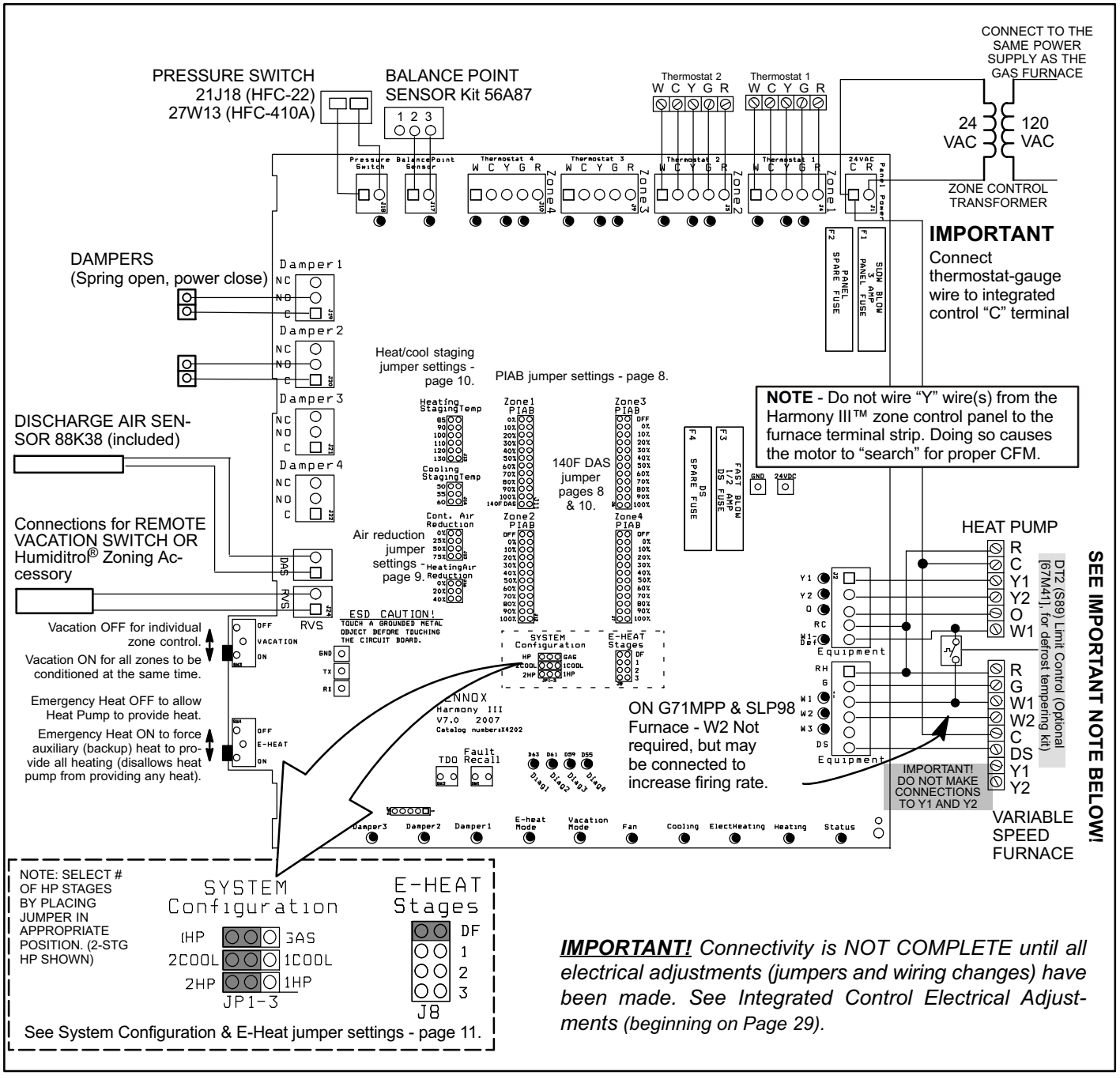



**Figure 27. Harmony III™ zoning system Option 3 - Lennox Heat Pump and Lennox Variable-Speed Gas Furnace (Dual Fuel)**

## Dual Fuel System Start-Up and Checkout

**⚠ IMPORTANT**

The zone control system power-up must occur at the same time or before the furnace or air handler unit is powered up.

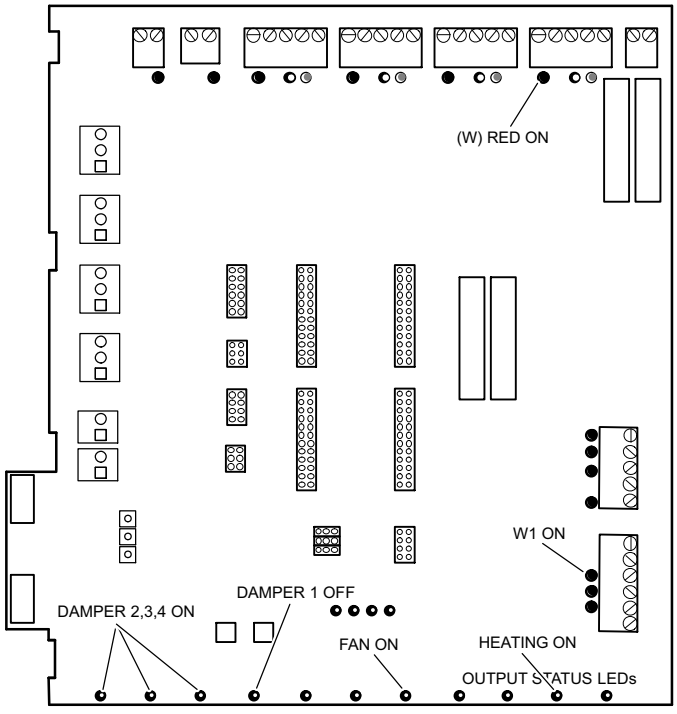
**Powering the System (All Systems)**

1. Adjust all thermostat settings so that no demand will occur.
2. Apply power to the zone panel transformer and to the furnace and observe the following: all four diagnostic LEDs will light; then each individual diagnostic LED will light in sequence; then all four diagnostic LEDs will light and extinguish.
3. Finally, the status light will begin to flash, indicating proper operation. Perform the dual fuel gas heating checks on pages 46 through 48.

## Dual Fuel Gas Heating Checkout (Single Zone)

**Prerequisites:**

- Zone 1 thermostat set to Heat.
- Balance Point Sensor set at higher temperature than outdoor BPS-sensed temperature (red balance point sensor LED on).
  **OR**
- Balance Point Sensor inputs jumpered to simulate cold outdoor temperature below balance point (red balance point sensor LED on).




1. Set zone 1 thermostat for a heat demand; check:
   - Zone 1 thermostat W LED on (heating demand).
   - Damper 1 LED off (damper open).
   - Damper 2, 3, and 4 LEDs on (dampers closed).
   - Output Heat W1 LED on (furnace on).
   - Heating LED on.

   The furnace begins ignition sequence after zone 1 has demanded heat. The zone control system will start the furnace blower on low speed (0 PIAB) 45 seconds after the combustion cycle has begun.
2. When 100ºF warm air is sensed by the discharge air sensor, the fan LED will light and the blower will slowly increase to speed required by the zone calling. The blower operates at speed setting of PIAB jumper for zone 1 and the jumper for heating air reduction. It may require 60 - 90 seconds to reach this speed.
3. Set zone 1 thermostat for NO heat demand; check:
   - Zone 1 thermostat W LED off (no heat demand).
   - Output Heat W1 LED off.
   - Fan LED off.
   - Heating LED off.
   - Damper LEDs 2-4 remain on until after 3-1/2 minute purge; then off.

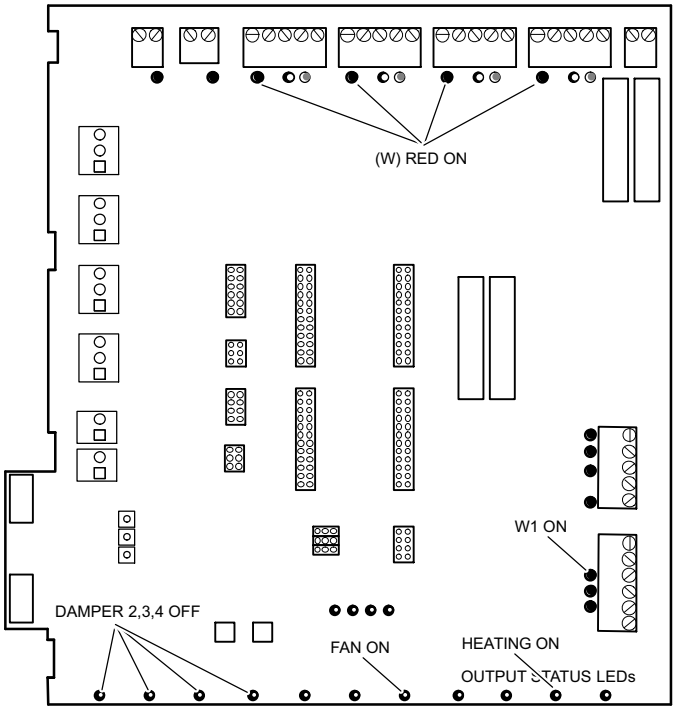
   To check the amount of air being delivered to each zone and to confirm that each individual zone damper functions properly, repeat these steps for zones 2 - 4.

## Dual Fuel Gas Heating Checkout (Multiple Zone)

**Prerequisites:**

- All zone thermostats set to Heat.
- Balance Point Sensor set at higher temperature than outdoor BPS-sensed temperature (red balance point sensor LED on).

  **OR**
- Balance Point Sensor inputs jumpered to simulate cold outdoor temperature below balance point (red balance point sensor LED on).




1. Set all zone thermostats for a heat demand; check for the following:
   - All zone thermostat **W** LEDs on (heat demands).
   - LEDs dampers 1 - 4 off (all dampers open).
   - Output Heat **W1** LED on (furnace on).
   - Heating LED on.

   The furnace begins ignition sequence after a heat demand is detected. The zone control system will start the furnace blower on low speed (0 PIAB) 45 seconds after the combustion cycle has begun.

2. When 100ºF warm air is sensed by the discharge air sensor, the fan LED comes on and the blower will slowly increase to speed required by the zones calling. The blower operates at a speed equivalent to the sum of all zone PIAB jumpers but at a maximum not to exceed the setting of the heating air reduction jumper. It may take the blower 60 to 90 seconds to reach this speed.

3. Set all zone thermostats for NO heat demands; check:
   - Output Heat W1 LED off.
   - Heating LED off.
   - Fan LED off (blower turns off after delay).
   - All zone thermostat W LEDs off.
   - Damper LEDs - Last zone thermostat demand removed: LED is off (this zone's damper remains open during 3-1/2 minute purge); other zones damper LEDs are on during the 3-1/2 minute purge (dampers closed). After 3-1/2 minute delay, all dampers LEDs go off (dampers open).

**Defrost Tempering (Kit 67M41)**

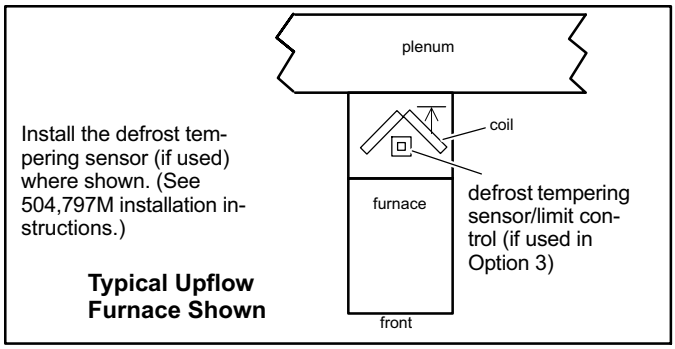


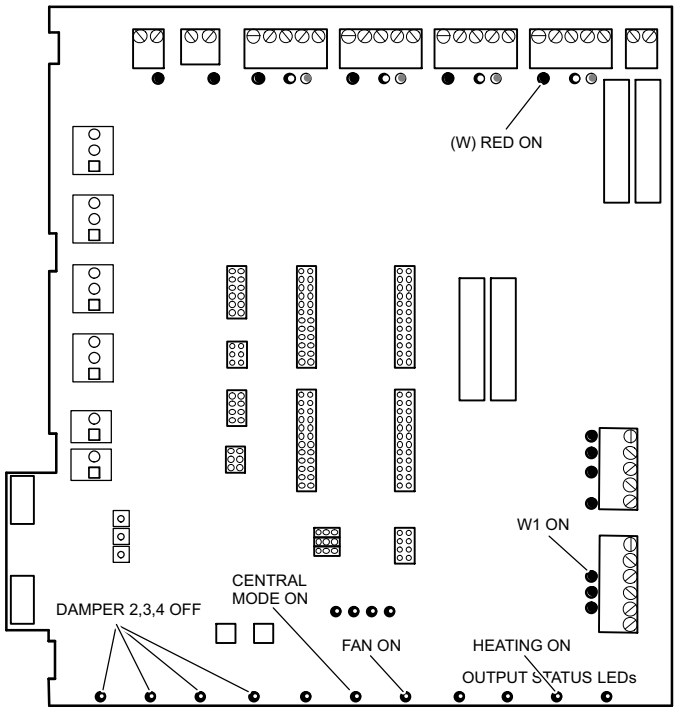

**Figure 28. Defrost Tempering Sensor Placement**

## Dual Fuel Gas Heating Checkout (Central Control)

**Prerequisites:**

- Central mode switch on.
- Red LED on the central mode fan switch on.
- Zone 1 thermostat set to Heat.
- Balance Point Sensor set at higher temperature than outdoor BPS-sensed temperature (red balance point sensor LED on).

  **OR**
- Balance Point Sensor inputs jumpered to simulate cold outdoor temperature below balance point (red balance point sensor LED on).




1. Set zone 1 thermostat for a heat demand; check:
   - Zone 1 thermostat **W** LED on (heating demand).
   - Output Heat **W1** LED on (furnace on).
   - Heating LED on.
   - All damper LEDs off (damper open).

2. The furnace will begin its ignition sequence after Zone 1 has demanded heat. The zone control system will start the furnace blower on low speed (0 PIAB air) 45 seconds after the combustion cycle has begun.

3. When 100ºF warm air is sensed by the discharge air sensor, the fan LED will light and the blower will slowly increase to speed. The blower will operate at a speed equivalent to the PIAB calculated for all zones calling, taking into account the heating air reduction jumper position. It may take the blower 60 to 90 seconds to reach this speed.

4. Remove the heat demand from zone 1 (no heat input or output and no blower demand). Upon removal of the demand from zone 1, check:
   - Zone 1 thermostat W LED off (no heat demand).
   - Output Heat W1 LED off.
   - Fan LED off.
   - Heating LED off.

   After 3-1/2 minute purge time, furnace blower turns off.

## Troubleshooting—Zoning system with Dual Fuel

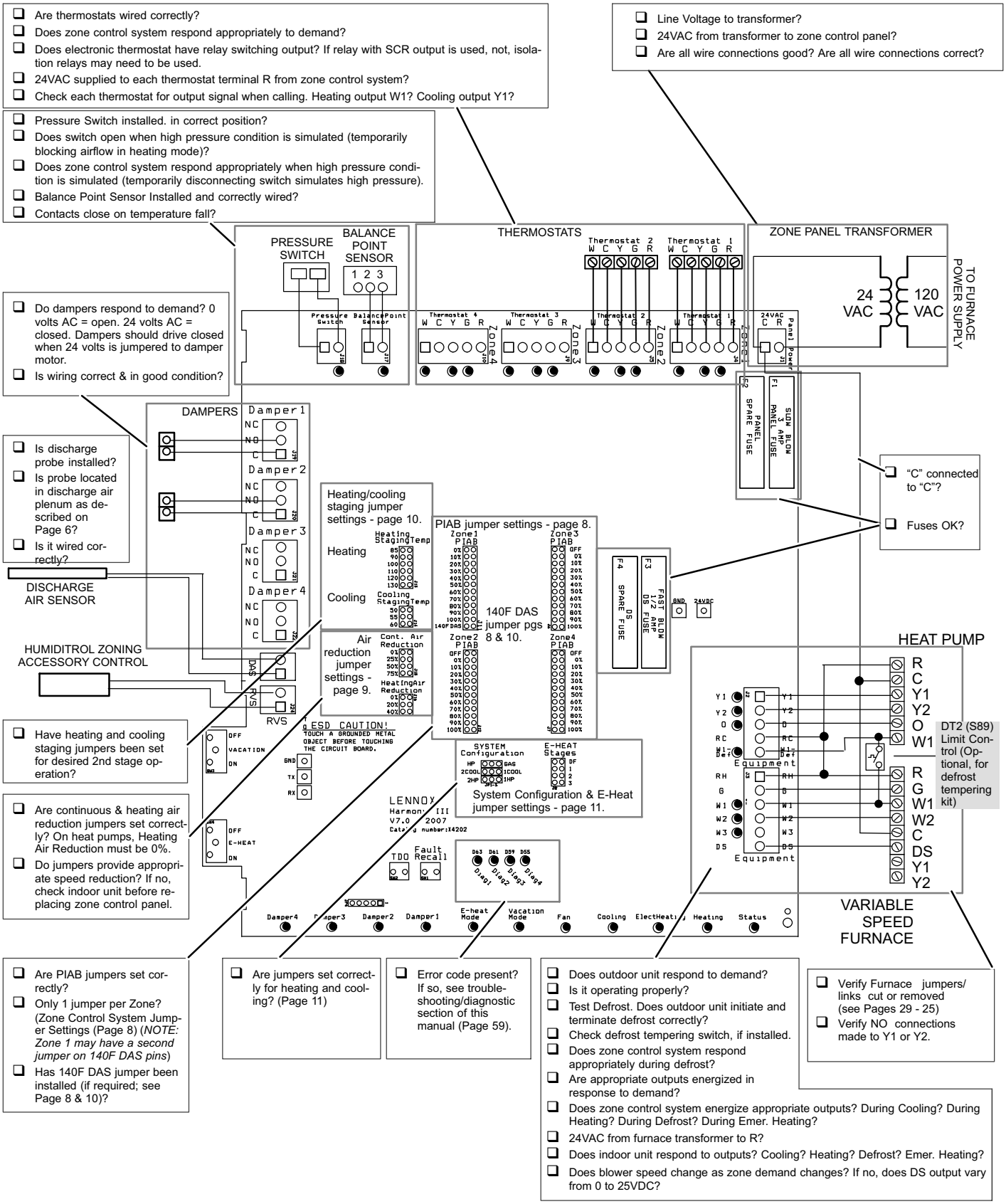
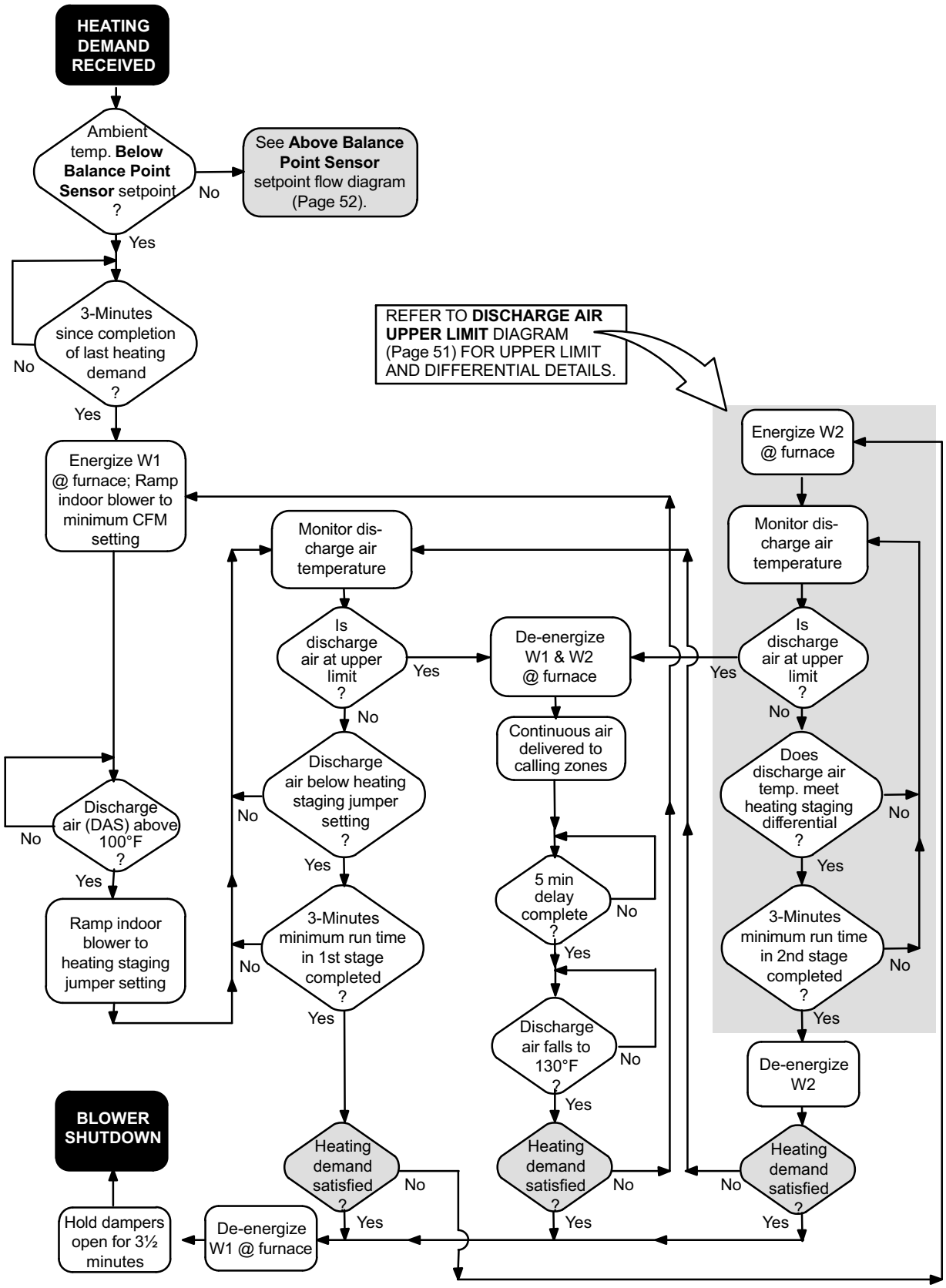
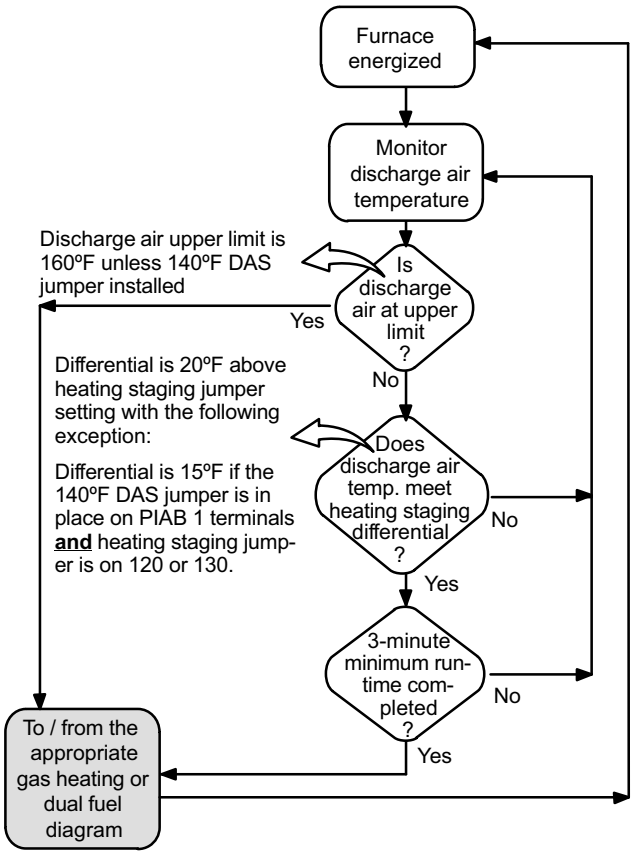



**Figure 29. Option 3 - Lennox Heat Pump and Lennox Variable-Speed Gas Furnace (Dual Fuel)**

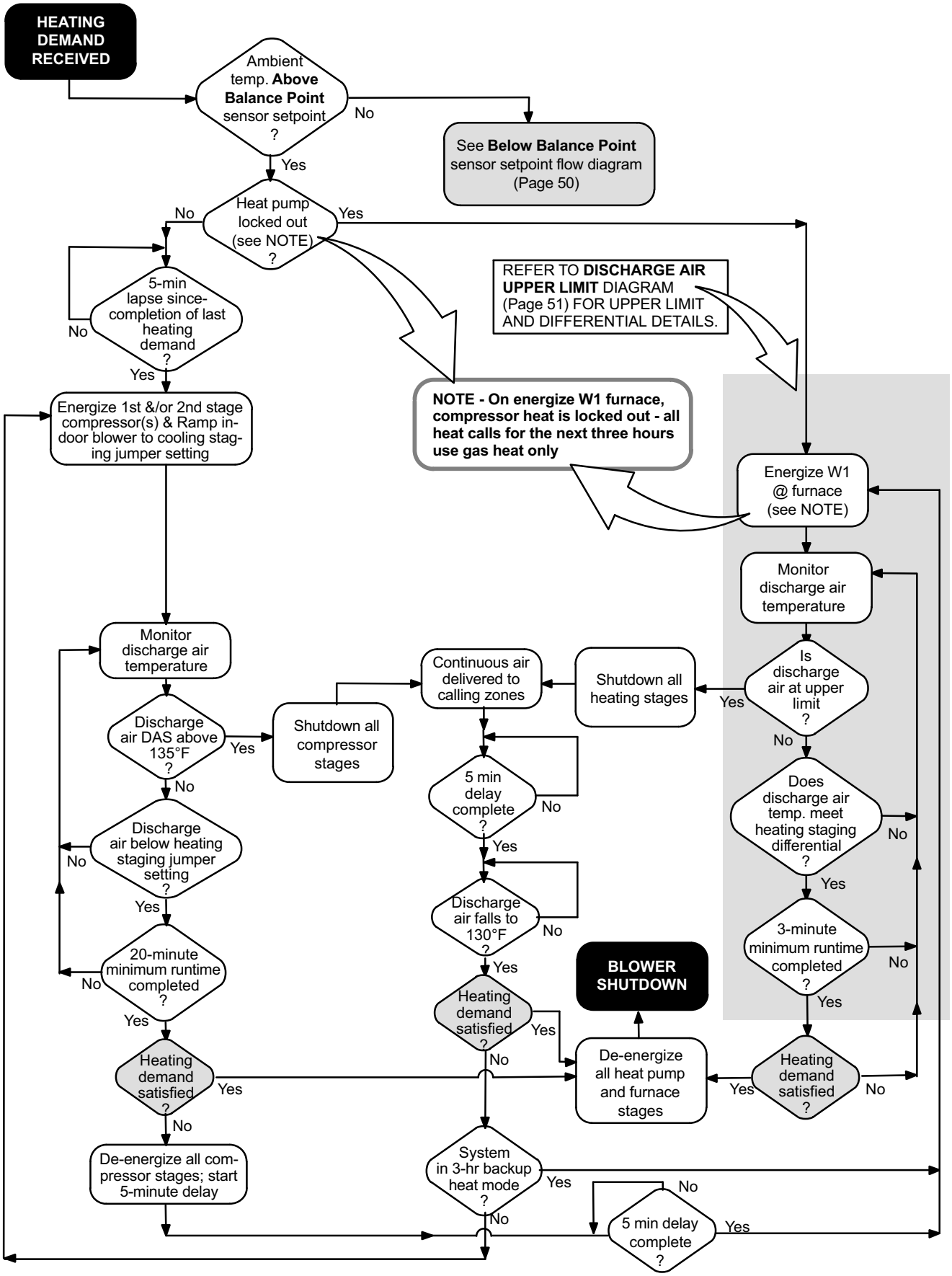
## Troubleshooting—Dual Fuel Operation (Below Balance Point)



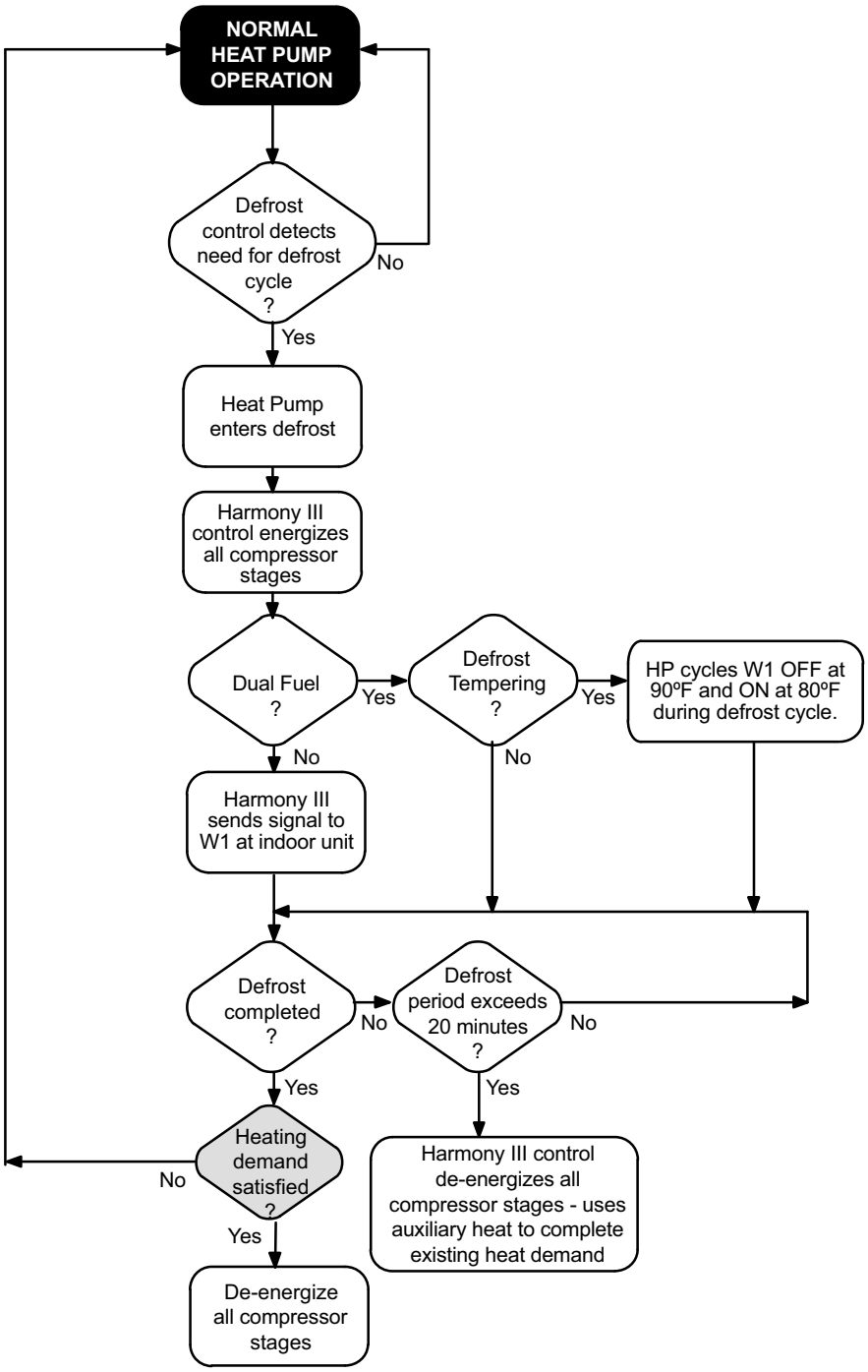
## Troubleshooting—Discharge Air Upper Limit and Differential Temperatures



## Troubleshooting—Dual Fuel Operation (Above Balance Point



## Troubleshooting—Defrost Operation



## Harmony III™ Installation Setup Worksheets

## G61MPV/G60UHV—Dual Fuel; with Honeywell 2-stage IFC control (Heat Pump applications)

**Job Name:**_____ **Indoor Unit Model:**_____ **Outdoor Unit Model:**_____

### Miscellaneous Items:

√ Install Pressure Switch in the outdoor unit per Harmony III installation instructions (27W13 for R410A or 21J18 for R22)

√ Install Balance Point Sensor (56A87) as per installation instructions. Set to desired outdoor lock out temperature for HP

√ Install Optional Defrost Tempering Sensor 67M41 (if used) per installation instructions. NOTE: MUST be located in coil delta plate between furnace and coil

√ Install Discharge Air Sensor per installation instructions. The location of the sensor is CRITICAL for proper system operation

### Indoor Unit setup:

√ Cut on-board link W914 DEHUM OR HARMONY (R to DS) on furnace IFC control (if not cut, fuse will blow in zone control board)

√ Cut and tape wires from pin # 2 and pin #13 on plug J46 of the VSM wiring harness routed from the motor to the Furnace Integrated control.

√ Furnace IFC Control DIP switch settings (ON or OFF):

**1**_____OFF_____(DIP switch **1** must be set to **Off** for 2-stage heating operation)

**2**_____OFF_____(DIP switch **2** determines 2nd stage heat time delay and is **ignored by Harmony III**)

**3**_____ON_____(DIP switches **3** and **4** determines heating blower off delay, **recommended is 180 sec**)

**4**_____ON_____ „

**5** _____DIP switches **5** and **6** determines 2nd stage cooling blower speed or **maximum system air vol**.)

**6**_____ „

**7**_____(DIP switches **7** and **8** determine blower “adjust” setting for **maximum system air volume**)

**8**_____ „

**9**_____OFF_____(DIP switches **9** and **10** determines cooling blower ramping profile and is **ignored by Harmony III**)

**10**_____OFF_____ „

**11**_____OFF_____(DIP switches **11**and**12** determines heating blower speed and is **ignored by Harmony III**)

**12**_____ON_____ „

### Harmony III™ Panel setup:

√ Heating staging jumper (circle one): **85 90 100 110 120 130** (Recommended 90 deg-F)

√ Zone 1 PIAB 140F DAS jumper in place (circle one): **Yes No** (see install instructions for info)

√ Cooling staging jumper (circle one): **50 55 60** (select desired discharge air temp during cooling)

√ Cont. Air Reduction jumper (circle one): **0 25 50 75** (% airflow reduction for continuous fan operation)

√ Heating Air Reduction jumper (circle one): **0 20 40** (must be set to 0% for heat pump systems)

√ System Configuration jumpers (circle one): **HP GAS** (Set to HP)

√ Stages (circle one): **2COOL 1COOL** (Set to match condenser, 1 or 2 stage)

√ Stages (circle one): **2HP 1HP** (Set to match heat pump stages, 1 or 2 stage)

√ E-HEAT Stages (circle one): **DF 1 2 3** (Must be set to DF for dual fuel application)

√ Desired total system cfm with all zones calling- _____ Total system cfm per tables- _____ Minimum cfm- _____

√ Zone 1 – Name:_____ Desired cfm:_____ PIAB Setting: _____% Actual cfm: _____

√ Zone 2 – Name:_____ Desired cfm:_____ PIAB Setting: _____% Actual cfm: _____

√ Zone 3 – Name:_____ Desired cfm:_____ PIAB Setting: _____% Actual cfm: _____

√ Zone 4 – Name:_____ Desired cfm:_____ PIAB Setting: _____% Actual cfm: _____

*NOTE—All of the above are recommended starting positions for DIP switches and Harmony III jumpers. Slight variations may be required during system start up and operation checks.*

### Field Wiring Checklist:

√ Indoor Unit Wiring Completed:

- ❑ “DS” on Harmony III to “DS” on indoor unit connected,
- ❑ ”C” on indoor unit connected to Harmony III transformer “C”,
- ❑ No connection to “Y1” or “Y2” on indoor unit.

√ Outdoor Unit Wiring Completed.

√ Thermostat and Damper Wiring Completed.

√ Discharge Sensor wired to Harmony III.

√ Heat Pump Pressure Switch wired to Harmony III.

## Harmony III™ Installation Setup Worksheets (continued)

## G71MPP and SLP98—Dual Fuel (Heat Pump Applications)

**Job Name:**_____ **Indoor Unit Model:**_____ **Outdoor Unit Model:**_____

### Miscellaneous Items:

√ Install Pressure Switch in the outdoor unit per Harmony III installation instructions (27W13 for R410A or 21J18 for R22)

√ Install Balance Point Sensor (56A87) as per installation instructions. Set to desired outdoor lock out temperature for HP

√ Install Optional Defrost Tempering Sensor 67M41 (if used) per installation instructions. NOTE: MUST be located in coil delta plate between furnace and coil

√ Install Discharge Air Sensor per installation instructions. The location of the sensor is CRITICAL for proper system operation

### Indoor Unit setup:

√ Cut on-board link W914 DEHUM OR HARMONY (R to DS) on furnace IFC control (if not cut, fuse will blow in Harmony III zone control board)

√ W2 connection from Harmony III to SLP98 or G71MPP is optional – see Harmony III / furnace installation instructions for details

√ DIP switch settings (ON or OFF):

**1**_____OFF_____(DIP switch **1** – leave at factory setting – **ignored by Harmony III**)
**2**_____OFF_____(DIP switch **2** – leave at factory setting – **ignored by Harmony III**)
**3**_____OFF_____(DIP switch **3** – leave at factory setting – **ignored by Harmony III**)
**4**_____ON_____(DIP switches **4** and **5** determine heating blower "off" delay – **recommended 180 seconds**)
**5**_____ON_____ „
**6**_____OFF_____(DIP switches **6** and **7** – continuous indoor blower speed – **ignored by Harmony III**)
**7**_____OFF_____ „
**8**_____(DIP switches **8** and **9** – cooling blower speed – determines maximum system cfm – see furnace blower tables)
**9** _____ „
**10**_____(DIP switches **10** and **11**–cooling blower adjust–determines maximum system cfm – see furnace blower tables)
**11**_____ „
**12**_____OFF_____(DIP switches **12** and **13** – cooling mode blower ramping – **ignored by Harmony III**)
**13**_____OFF_____ „
**14**_____OFF_____(DIP switches **14**,**15**,and**16** – sets low fire, minimum capacity, firing rate - DEFAULT SETTING SHOWN and IS RECOMMNEDED STARTING POINT– see Harmony III/furnace install instruction)
**15**_____OFF_____ „
**16**_____OFF_____ „
**17**_____OFF_____(DIP switches **17**,**18**,and**19** – sets high fire, 100% capacity, firing rate - DEFAULT SETTING SHOWN and IS RECOMMNEDED STARTING POINT– see Harmony III/furnace install instruction)
**18**_____OFF_____ „
**19**_____OFF_____ „

### Harmony III™ Panel setup:

√ Heating staging jumper (circle one): **85 90 100 110 120 130** (Recommended 90 deg-F)

√ Zone 1 PIAB 140F DAS jumper in place (circle one): **Yes No** (see Harmony III install instructions for info)

√ Cooling staging jumper (circle one): **50 55 60** (select desired discharge air temp during cooling – Recommended 50 deg-F)

√ Cont. Air Reduction jumper (circle one): **0 25 50 75** (% airflow reduction for continuous fan operation)

√ Heating Air Reduction jumper (circle one): **0 20 40** (Must be set to 0 for heat pump applications)

√ System Configuration jumpers (circle one): **HP GAS** (Set to HP)

√ Stages (circle one): **2COOL 1COOL** (Set to match type of heat pump, 1 or 2 stage compressor)

√ Stages (circle one): **2HP 1HP** (Set to match type of heat pump, 1 or 2 stage compressor)

√ E-HEAT Stages (circle one): **DF 1 2 3** (Must be set to DF for dual fuel application)

√ Desired total system cfm with all zones calling- _____ Total system cfm per tables- _____ Minimum cfm- _____

√ Zone 1 – Name:_____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 2 – Name:_____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 3 – Name:_____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 4 – Name:_____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

*NOTE—All of the above are recommended "starting" positions for the SLP98 or G71MPP DIP switches and Harmony III jumpers. Slight variations may be required during system start up and operation checks.*

### Field Wiring Checklist:

√ Indoor Unit Wiring Completed:
- ❑ "DS" on Harmony III to "DS" on indoor unit connected,
- ❑ "C" on indoor unit connected to Harmony III transformer "C",
- ❑ No connection to "Y1" or "Y2" on indoor unit.

√ Outdoor Unit Wiring Completed.

√ Thermostat and Damper Wiring Completed.

√ Discharge Sensor wired to Harmony III.

√ Heat Pump Pressure Switch wired to Harmony III.

## Harmony III™ Installation Setup Worksheets (continued)

## SL280V and EL296V—Cooling/Heating—Dual Fuel (Heat Pump Applications)

### Miscellaneous Items:

√ Install Pressure Switch in the outdoor unit per Harmony III installation instructions (27W13 for R410A or 21J18 for R22)

√ Install Balance Point Sensor (56A87) as per installation instructions. Set to desired outdoor lock out temperature for HP

√ Install Optional Defrost Tempering Sensor 67M41 (if used) per installation instructions. NOTE: MUST be located in coil delta plate between furnace and coil

√ Install Discharge Air Sensor per installation instructions. The location of the sensor is CRITICAL for proper system operation

**Job Name:**_____ **Indoor Unit Model:**_____ **Outdoor Unit Model:**_____

√ Cut on-board link W914 DEHUM OR HARMONY (R to DS) on furnace IFC control (if not cut, fuse will blow in Harmony III zone control board)

√ DIP switch settings (ON or OFF):

### Indoor Unit setup:

**1**_____OFF_____(DIP switch **1** – leave at factory setting – **ignored by Harmony III**)
**2**_____OFF_____(DIP switch **2** – leave at factory setting – **ignored by Harmony III**)
**3**_____ON_____(DIP switches **3** and **4** – Blower Off Delay Switch Settings, set DIP switches 3 and 4 to ON (180 seconds).
**4**_____ON_____
**5**_____OFF_____DIP switches **5** and **6 -** Cooling Mode Blower Speed, set DIP switches 5 and 6 to OFF (High - Factory).
**6**_____OFF_____
**7**_____OFF_____DIP Switches **7** and **8** - Cooling Blower Speed Adjustment, set DIP switches 7 and 8 to OFF (Factory Default).
**8**_____OFF_____
**9**_____OFF_____DIP Switches **9** and **10** - Cooling Mode Blower Speed Ramping, set DIP switches 9 and 10 to OFF (A - Factory).
**10**_____OFF_____
**11**_____OFF_____DIP Switches **11, 12** and **13** - Heating Mode Blower Speed, set DIP switches 11, 12 and 13 to OFF (Factory Default).
**12**_____OFF_____
**13**_____OFF_____
**14**_____OFF_____DIP Switches **14** and **15** - Continuous Blower Speed, set DIP switches 14 and 15 to OFF (38% of High Cool Speed - Factory Default).
**15**_____OFF_____

### Harmony III™ Panel setup:

√ Heating staging jumper (circle one): **85 90 100 110 120 130** (Recommended 120 deg-F)

√ Zone 1 PIAB 140F DAS jumper in place (circle one): **Yes No** (see Harmony III install instructions for info)

√ Cooling staging jumper (circle one): **50 55 60** (select desired discharge air temp during cooling)

√ Cont. Air Reduction jumper (circle one): **0 25 50 75** (% airflow reduction for continuous fan operation)

√ Heating Air Reduction jumper (circle one): **0 20 40** (% air flow reduction for heating mode)

√ System Configuration jumpers (circle one): **HP GAS** (Set to GAS)

√ Stages (circle one): **2COOL 1COOL** (Set to match condenser, 1 or 2 stage)

√ Stages (circle one): **2HP 1HP** (ignored for gas heat, non-heat pump application)

√ E-HEAT Stages (circle one): **DF 1 2 3** (ignored for gas heat, non-heat pump application)

√ Desired total system cfm with all zones calling- _____ Total system cfm per tables- _____ Minimum cfm- _____

√ Zone 1 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 2 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 3 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

√ Zone 4 – Name _____ Desired cfm _____ PIAB Setting _____% Actual cfm _____

*NOTE—All of the above are recommended "starting" positions for the SLP98 or G71MPP DIP switches and Harmony III jumpers. Slight variations may be required during system start up and operation checks.*

### Field Wiring Checklist:

√ Indoor Unit Wiring Completed:
- ❒ "DS" on Harmony III to "DS" on indoor unit connected,
- ❒ "C" on indoor unit connected to Harmony III transformer "C",
- ❒ No connection to "Y1" or "Y2" on indoor unit.

√ Outdoor Unit Wiring Completed.

√ Thermostat and Damper Wiring Completed.

√ Discharge Sensor wired to Harmony III.

# TROUBLESHOOTING

## Operation and Troubleshooting Indicators

### Zone Control Panel LEDs

The zone control system operation is indicated by light emitting diodes (LEDs) located on the zone control panel. In addition to operating condition, the LEDs provide valuable information system troubleshooting. The LEDs (shown in figure 30) are thermostat, diagnostic, and output status.

1. Thermostat LEDs—located along the upper edge of the zone control panel. Each zone has three LEDs to indicate a call for heating or cooling: green (indicates a Y / compressor demand), red (indicates a W / heating demand) and amber (indicates a G / indoor blower demand). These LEDs are labeled according to the zone and demand.
2. Diagnostic LEDs—Diags 1, 2, 3, 4—located near the bottom center of the the zone control panel. These LEDs aid the technician in troubleshooting problems. When an error is detected, LEDs illuminate in a pattern. See *Fault Recall and Time Delay Override* on page 58.
3. Output LEDs—located along the bottom of the zone control panel and near connection terminals. These red LEDs indicate the output status of dampers, furnace, outdoor unit, etc. When an output is powered or active, the corresponding LED is illuminated.
4. Pressure Switch LED—Located at the top left corner. Green LED illuminates when the heat pump pressure switch is closed indicated normal pressures. The LED will be off when the pressure switch opens under abnormal or excessive condensing pressure in the heat pump heating mode. Pressure switch is used only on heat pump systems.
5. Balance Point Sensor LED—Located at the top left corner. Red LED illuminates when the balance point sensor is closed indicating outdoor temperature is below the balance point sensor setting. Only used on dual fuel heat pump systems.

   The LEDs are labeled according to output and function. For example, if Damper 1 LED is illuminated, it's damper has been signaled to close; when the LED is extinguished, it's damper has been signaled to open, allowing air flow to that zone.

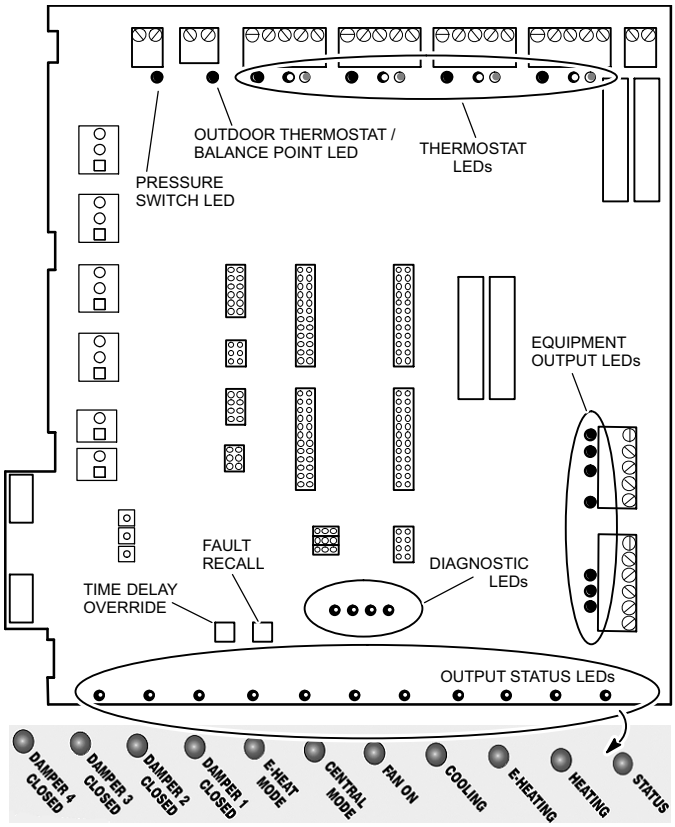



**Figure 30. System Indicators/Troubleshooting Devices**

### Fault Recall and Time Delay Override

When the Time Delay Override is pressed and held, the internal clock speeds up by a factor of 60. This overrides the current time delay and permits the next event to occur. Table 9 identifies the time delays used by the system.

When the Fault Recall button is pressed and released (clicked), the fault codes are displayed (10 most recent). When the fault recall button is pressed and held, the fault codes are erased. Each code will be displayed for 10 seconds starting with the most recent code, then the next most recent, and so on. Pressing the button while recalling fault codes will bypass the 10-second timer and go right to the next fault code.

Use the Fault Recall button to observe diagnostic codes that will indicate either correct operation, or help checkout and troubleshoot problems in the zone control system. Table 10 in the troubleshooting section (see page 59) identifies all diagnostic codes.

Press the button once while the system is operating. The system will respond by momentarily lighting all four DIAG LEDs then displaying the error code, if an error code is stored in memory. This allows a visual check to verify that all four LEDs are operational before displaying an error code.

### Time Delays

Timers used in the Harmony III™ zoning system system define delays which precede or follow a demand, depending on the type of function. The delays are used to control equipment connected to the system. Table 9 shows how the most noticeable delays are used.

**Table 9. Time Delays**

| Delay | Time | Function |
|---|---|---|
| Blower Off Delay (gas heat only) | 3-1/2 min. | Gas Furnace only. Delivers air into last zone called during cool down following heat demand. |
| Compressor Speed Change | 4 min. | Between low speed and high speed in order to make sure steady state is reached before staging. |
| Compressor Off Time | 5 min. | At end of demand. Equalizes pressure in refrigerant system and prevents short cycling. |
| Heat Staging (electric) | 2 min. | Between staging up or down (May stage faster to prevent overshoot/undershoot). |
| Heat Staging (gas) | 3 min. | Between staging up or down to achieve steady state. |
| Dual Fuel Furnace Lock-in Timer | 3 hrs. | Starts when system enters dual fuel furnace heating when the outdoor temperature is above balance point. When operating within this 3-hour time, only the furnace is used for heating. Heat pump will be tried again on the next call after this timer expires. Diagnostic LEDs 2, 3, and 4 will flash when this timer is active. |
| Damper Hold | 3-1/2 min. | This timer is defined as the amount of time to hold the last zone calling open past the thermostat call drop out. During this time, the panel will not energize the blower (except when a continuous fan call exists); the controlled equipment will provide this signal. This is a non-adjustable timer set at 210 seconds. |
| Autochangeover | 20 min. | When opposing demands are present, zone control system must work to satisfy current demand at least 20 min. If current demand is not satisfied after time has elapsed, system will changeover and satisfy opposing demand. On and Off delays above will also apply. |
| Dual Fuel Autochangeover | 20 min. | When temperature is above balance point, heat pump will operate for 20 minutes before allowing gas furnace to take over heating demand. |

### Discharge Air Probe Checkout (All Systems)

The discharge air sensor is a temperature-dependent resistor; the higher the temperature, the lower the resistance. To confirm the sensor is functioning, disconnect both sensor leads from the zone control panel. Using a digital voltmeter (DVM) set to read resistance, touch the leads from the sensor to the probes of the DVM.

Do not touch both probes with your fingers—doing so will produce a faulty reading. At 77°F, the resistance of the sensor will be 10K ohm; at lower probe temperatures, expect higher resistance; at warmer probe temperatures, expect lower resistance.

After reading the resistance at room temperature, warm the tip of the sensor by holding it in the palm of your hand, and take another resistance reading. The resistance should be noticeably lower than the previous reading.

| Temp. ºF (ºC) | Resistance (ohms) |
|---|---|
| 65 (18) | 13476 |
| 70 (21) | 11884 |
| 75 (24) | 10501 |
| 80 (27) | 9298 |
| 85 (29) | 8249 |
| 90 (32) | 7333 |

The zone control system will monitor the operation of the probe and determine if a failure has occurred. The probe is an integral (but replaceable) part of the zone control system. The zone control system will indicate if the probe is operating improperly and needs to be replaced. The discharge air temperature probe serves several purposes:

1. In cooling systems (and heat pump systems in cooling mode) the probe varies the speed of the compressor from high to low to off in order to maintain a constant discharge air temperature and prevent coil freezing.
2. In gas heating systems, it is responsible for increasing the speed of the blower to the setting of the CFM jumpers after the discharge air has warmed up to about 100ºF. Also stages equipment up and down to control discharge air temperature.
3. In heat pump systems operating in the heating mode, the probe varies compressor speed and stages of auxiliary heat in order to maintain a constant discharge air temperature.

**Blower Speed Checkout**

The indoor blower speed should vary as zone demand changes. The fan speed LED varies in brightness as the blower varies in speed. The brighter the LED, the more CFM being delivered. Blower speed can also be viewed by attaching an electronic voltmeter between DS and any C terminal on the zone control panel. While not a precise measurement, the voltmeter fluctuation indicates that the blower speed is changing.

1. Connect electronic voltmeter between DS and any C terminal on the zone control panel. Leave all field wiring in place.
2. Select DC volts scale.
3. Start zone heating or cooling checkout procedure.
4. Observe voltages:
   - 22 volts DC = high speed (varies depending on input voltage at primary transformer).
   - 11 volts DC (approx.) = medium speed 50% into adjustment band of blower.
   - 0 volts DC = low speed or off.

   All speeds in between are a percentage of 22VDC.
5. Also measure voltage at the indoor unit between DS and C. If the voltage is lower than the voltage measured at the Harmony zone panel and/or the blower runs at a minimum fan speed, check and make sure C on the indoor unit is connected to C on the zone panel transformer connection.

*NOTE - G71MPP and SLP98 furnace models are equipped with an LED on the integrated control which displays blower airflow in all modes of operation. See G71MPP and SLP98 installation instructions for additional information.*

*NOTE - CBX40UHV and CBX32MV Rev 06 have an LED display that will indicate the unit air volume. "A" followed by the number indicates the cfm. For example, "A-2-0-0-5" indicates 2005 cfm.*

*NOTE - If blower operates only at the minimum cfm or will not ramp to zone air volume, check and make sure terminal "C" on the indoor unit terminal strip is connected to Harmony 24 VAC terminal "C" (see figures 17 through 27).*

*NOTE - If blower "hunts", check and make sure there is no connections on Y1 or Y2 on the indoor unit terminals strip (see figures 17 through 27).*

*NOTE - Units without a 7-Segment LED will have a "cfm" LED to indicate blower airflow. One blink of the LED is equal to approximately 100 cfm; then it pauses and repeats. For example if the CFM indicator LED blinks 10 times this indicates approximately 1000 cfm.*

*NOTE - Make sure DS on the Harmony board is connected to DS on the furnace/air handler terminal strip.*

**Troubleshooting using the Diagnostic LED Error Codes**

When the zone control system finds a problem (error condition), it will turn on one or more of the diagnostic LEDs on the zone control. These LEDs can be lit in several different patterns, each pattern corresponding to a different error condition. Table 10 shows each possible display pattern, a description of the error, and ways to correct the error.

Some of the errors found in table will cause a fail-safe or shutdown condition. The system will shutdown after the error is present for about five seconds. During a shutdown condition, all dampers will open, there is no demand to the condensing unit or furnace. Normal operation will resume five seconds after the error has been corrected.

The blower may run during a fail-safe condition after a heating demand. This is due to the operation of the integrated control inside the furnace.

If a shutdown condition occurs while there is a call for cooling, a five-minute timer is initiated before cooling can be called for again. The timer begins at the time of the shutdown condition and does not affect the response to, nor is affected by, a heating demand.

Troubleshooting diagrams (figures 16, 22 and 29 respectively) identify common areas to check when troubleshooting specific equipment. The diagrams provide checkpoints related to connectivity and operation of system equipment. Use these diagrams, along with installation information contained throughout this manual, to identify and correct problems.

**Table 10. Diagnostics Codes**

| Code # | (0-off;1-on) Diag LED 1234 | Fault Indicated | Remedy | Fail-safe (System Shut Down) |
|---|---|---|---|---|
| 0 | 0000 | Normal operation | No remedial action required. | |
| 1 | 1000 | Insufficient cooling | Occurs when there is a call for cooling and the Discharge Air Sensor does not sense a decrease in supply air temperature indicating the cooling is not functioning properly. | No |
| 2 | 0100 | Defrost time > 20 minutes | The defrost board should never allow a defrost for greater than 20 minutes. If this error occurs, check the outdoor unit to see if it is stuck in defrost mode. The zone control system will use the backup heat during this error and not the heat pump. | No |

*table continued on next page*

| Code # | (0-off;1-on) Diag LED 1234 | Fault Indicated | Remedy | Fail-safe (System Shut Down) |
|---|---|---|---|---|
| 3 | 1100 | Unsteady thermostat input | This error occurs when a thermostat changes state repeatedly and rapidly, indicating that the thermostat is making intermittent contact and needs attention. The offending thermostat will be ignored for 4 minutes after the zone control system detects the problem. After 4 minutes if the signal from the thermostat is steady again, it will be recognized by the zone control system. Disconnect thermostats until error goes away. This will identify the source of bad input. If error remains after all inputs have been disconnected, replace zone control panel. | No |
| 4 | 0010 | Defrost while gas heat selected | System detected defrost signal at W1-Def terminal block while the jumper is selected for the furnace. May be caused by:<br>• Wrong selection for INDOOR UNIT jumper.<br>• OUTDOOR UNIT terminal block misfired.<br>• Zone control system failure.<br>Check unit installation instructions for correct wiring. If no signal is present at W1, then replace zone control panel. | Yes |
| 5 | 1010 | Discharge Air Sensor (DAS) detects high heating temperature | This condition may occur any time the discharge probe senses air warmer than 160ºF for furnace or 135ºF for heat pump. If system is in zone mode when this code is set, the system continues in zone mode, shuts off equipment, and runs continuous blower to satisfy demand. The heat pump or furnace will remain off for a minimum of 5 minutes and until the DAS senses 130ºF.<br>Add more air to zone or redistribute zones to divide air more evenly. | No |
| 6 | 0110 | Zone air jumper not selected | 1) Air selected for fewer than two zones or, 2) No air is selected for zone 1 or, 3) If a zone air selection jumper is left off of a zone that issues a heat or cool demand. In this case the system will assume that a PIAB of 100 is required to service the zone.<br>Make a zone air jumper selection. If jumpers are in place, replace the zone control panel. | No |
| 7 | 1110 | Open or shorted DAS | If system is operating, system will be forced into central mode. The compressor will cycle from high to off in cooling. The compressor will cycle from high to off in heating. The furnace will operate normally in gas heat.<br>Replace discharge probe. If error persists, replace zone control panel. | No |
| 8 | 0001 | Simultaneous heat and cool call from same thermostat | (Or inconsistent thermostat signals) Make sure the thermostats are correctly connected to the zone control panel. If error persists after you check the thermostats and jumper selections, try another thermostat model or brand. Demand will be ignored from the zone sending bad signals. See Table 9. | No |
| 9 | 1001 | Open pressure switch (**heat pump systems only**) | Displayed when the pressure switch opens and does not necessarily mean there is anything wrong. However, try increasing the air delivered to the smallest zone. An open pressure switch will stage the heat pump down to 1st stage only, if after 90 seconds the switch does not close, the heat pump is shut off and backup heat is used to satisfy the call. Green Pressure switch LED on zone panel will be off. | No |
| 10 | 0101 | Insufficient heating | Occurs when there is a call for heating and the Discharge Air Sensor does not sense a increase in supply air temperature indicating the heating is not functioning properly. | No |
| 11 | 1101 | DAS sensed frozen coil | Indicates discharge air temperature sensed by discharge air sensor drops below 45 degrees during the cooling mode. When sensed, the condensing unit will stop and as long as the cooling demand is present the ID blower will continue to run until the 5 minute timed off timer expires and the discharge air sensor senses 55ºF. | No |
| 12 | 0011 | Multiple jumper selection | Each jumper block on zone control panel is allowed only one jumper, except for the system setup block. Remove extra jumper. | No |
| 13 | 0111 | Dual-fuel furnace use lock-in | Heat pump was not able to maintain desired discharge air temperature; furnace will be used to satisfy heat calls for the next 3 hours. After 3 hours, the heat pump will be used again. | No |

## Troubleshooting Air Delivered By Blower

The actual CFM delivered to each zone will be determined by the zone control system settings, blower motor control board settings, zone thermostat demand status (calling for heating, cooling, continuous fan, or no demand [zone damper closed]), and the air distribution system's duct size.

When the zone control system is set for a particular zone, heating reduction jumper, and/or continuous air reduction settings determine the total CFM available from the unit as follows:

1. **Determine Total Unit PIAB**—Using the formula in Table 11, calculate the Total Percent into Adjustment Band. This illustrates the percentage into the adjustment band that the motor runs when more than one zone is calling for conditioning.

2. **Determine Total CFM Delivered**—Continuing from the previous example and assumptions, and using the formula in Table 11, calculate the total CFM delivered.

   The max. and min. CFM values used in the formula should correspond to the jumper settings on the blower control board. This value represents the volume of air received if all zones were calling for cooling.

3. **Determine heating PIAB and total heating air CFM delivered during a heating call**—Calculate these totals using the formulas and examples in Table 12.

4. Check ”CFM” LED or 7-Segment LED on indoor unit to obtain approximately CFM the indoor unit is operating at.

5. **Determine total air delivered during a continuous blower call**—Calculate these totals using the formulas and examples in Table 13.

**Table 11. Determine total PIAB and Total CFM Delivered**

Example values

| Jumpers | | | | | | CFM | |
|---|---|---|---|---|---|---|---|
| Zn1 | Zn2 | Zn3 | Zn4 | Cont. Air Reduction | Heating Air Red. | Min. | Max. |
| 30% | 10% | 20% | OFF | 25% | 20% | 720 | 2200 |

Gray zones are calling.

Total PIAB Formula

$$\text{(Sum of calling zones 1 to 4 jumper positions)} + \frac{\text{(\# of zones calling} - 1)}{3}$$

**1. Using example values above, find Total PIAB:**

| | |
|---|---|
| Jumper positions . . . . . .10 +.20 . . . . . | .30 |
| (# of Calling zones minus 1) divided by 3 . . . (2-1)/3 . . . . . | +.33 |
| Total (motor runs 63% into adjustment band of motor) . . . . . | 63 |

Total CFM Formula

Total PIAB **x** (CFM max. – CFM min.) **+** (min. CFM)

**2. Then find Total CFM:**

| | |
|---|---|
| Total PIAB from step 1. . . . . | .63 |
| CFM max. - CFM min. . . . . (2220-720) . . . . | x1500 |
| CFM into adjustment band . . . . . | 945 |
| Total CFM (CFM min + CFM into adjustment band) . . . . . | 1665 |

**⚠ IMPORTANT**

If any blower speed settings (furnace or air handler) are changed, the zone control PIAB calculations must be performed again to ensure proper airflow.

## Troubleshooting Air Delivered By Blower (continued)

### Table 12. Determine total heating CFM delivered

**Example values**

| Jumpers | | | | | | CFM | |
|---|---|---|---|---|---|---|---|
| Zn1 | Zn2 | Zn3 | Zn4 | Cont. Air Reduction | Heating Air Red. | Min. | Max. |
| 30% | 50% | 40% | OFF | 25% | 20% | 720 | 2200 |

Gray zones are calling.

**Total PIAB Formula**

(Sum of calling zones 1 to 4 jumper positions) + (# of zones calling – 1) / 3

**1. Using example values above, find Total PIAB:**

| | |
|---|---|
| Jumper positions . . . . . .30 +.40 . . . . . | .70 |
| (Calling zones minus 1) divided by 3 . . . . . (2-1)/3 . . . . . | +.33 |
| Total (use sum or 1.00, whichever is less) . . 1.03 . . . . . | *1.00 |

*Blower cannot support 103%; uses 100%

**Heating PIAB Formula**

Total PIAB **x** (1 **–** Heating air reduction setting)

**2. Then find Heating PIAB:**

| | |
|---|---|
| Total PIAB from step 1 . . . . . | 1.00 |
| (1-Heating air reduction setting) . . . . . (1.00-.20) . . . . . | x.80 |
| Total Heating PIAB . . . . . | **.80** |

**Total Heating CFM Formula**

Heating PIAB **x** (CFM Max. **–** Min.) **+** (Min. CFM)

**3. Then find Total Heating CFM:**

| | |
|---|---|
| Heating PIAB from step 2 . . . . . | .80 |
| CFM max. - CFM min. . . . . (2220-720) . . . . | x1500 |
| Subtotal . . . . . | 1200 |
| Min CFM . . . . . | +720 |
| Total Heating CFM . . . . . | **1920** |

### Table 13. Determine total continuous CFM delivered

**Example values**

| Jumpers | | | | | | CFM | |
|---|---|---|---|---|---|---|---|
| Zn1 | Zn2 | Zn3 | Zn4 | Cont. Air Reduction | Heating Air Red. | Min. | Max. |
| 30% | 50% | 40% | OFF | 25% | 20% | 720 | 2200 |

Gray zones are calling.

**Total PIAB Formula**

(Sum of calling zones 1 to 4 jumper positions) + (# of zones calling – 1) / 3

**1. Using example values above, find Total PIAB:**

| | |
|---|---|
| Jumper positions . . . . . (.30+.50+.40) . | 1.20 |
| (Calling zones minus 1) divided by 3 . . . . . (3-1)/3 . . . . . | +. 66 |
| Total (use sum or 1.00, whichever is less) . . 1.86 . . . . . | *1.00 |

*Blower cannot support 186%; uses 100%

**Continuous Air PIAB Formula**

Total PIAB **x** (1 – continuous air reduction setting)

**2. Then find Continuous Air PIAB:**

| | |
|---|---|
| Total PIAB from step 1. . . . . | 1 |
| x (1-Continuous air reduction setting) . . . . . (1.00-.25) . . . . . | x.75 |
| Total Continuous Air PIAB . . . . . | **.75** |

**Total Continuous CFM Formula**

Continuous air PIAB **x** (CFM max. – CFM min.) **+** (min. CFM)

**3. Then find Total Continuous Air CFM:**

| | |
|---|---|
| Continuous Air PIAB from step 2. . . . . | .75 |
| CFM max. - CFM min. . . . . (2220-720) . . . . | x1500 |
| Subtotal . . . . . | 1125 |
| Min CFM . . . . . | +720 |
| Total Continuous Air CFM . . . . . | **1845** |

# PIAB Calculation Worksheet

**PIAB = [(Required CFM - Minimum CFM) / (Maximum CFM - Minimum CFM)] * 100**

**Sample CFM ➧ Required Minimum Maximum Minimum**

**Sample PIAB = ([ 920 - 450 ] / [ 2000 - 450 ]) x 100**

=

=

**Sample PIAB = ([ 470 ] / [ 1550 ]) x 100**

=

**Sample PIAB = [ 0.303 ] x 100 = 30 %**

**Zone 1 CFM ➧ Required Minimum Maximum Minimum**

ZONE 1 PIAB = ([ - ] / [ - ]) x 100

=

=

ZONE 1 PIAB = ([ ] / [ ]) x 100

=

ZONE 1 PIAB = [ ] x 100 = %

**Zone 2 CFM ➧ Required Minimum Maximum Minimum**

ZONE 2 PIAB = ([ - ] / [ - ]) x 100

=

=

ZONE 2 PIAB = ([ ] / [ ]) x 100

=

ZONE 2 PIAB = [ ] x 100 = %

**Zone 3 CFM ➧ Required Minimum Maximum Minimum**

ZONE 3 PIAB = ([ - ] / [ - ]) x 100

=

=

ZONE 3 PIAB = ([ ] / [ ]) x 100

=

ZONE 3 PIAB = [ ] x 100 = %

**Zone 4 CFM ➧ Required Minimum Maximum Minimum**

ZONE 4 PIAB = ([ - ] / [ - ]) x 100

=

=

ZONE 4 PIAB = ([ ] / [ ]) x 100

=

ZONE 4 PIAB = ( ) x 100 = %

**REVISION HISTORY**

| Date | Revision description |
|---|---|
| 01-2011 | G71, SLP98 Furnace support added.<br>CBX32, CBX40 (non-iComfort®) support added.<br>Clarifications requested by Applications, Field, and Training groups.<br>Added installation worksheets<br>Clarification of zone control jumper usage. |
| 07-2011 | Add SL280V, EL296V Furnace support added. (reformatted) |