



Safety & Installation Instructions

Model 6404

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SAFETY INSTRUCTIONS

Read this Installation Manual before beginning installation of the Aprilaire Zoned Comfort Control System.
For questions call Research Products Corporation at (800) 334-6011.

WARNING

1. 120 Volts may cause serious injury from electrical shock. Sudden operation may cause serious injury from moving parts. Leave power disconnected until installation is complete.
2. Sharp edges may cause serious injury from cuts. Use care when making duct openings and handling ductwork.
3. The Aprilaire Zoned Comfort Control System is designed for indoor use only. Do not expose any component of the zone control system to moisture. Do not mount any Aprilaire Zone Control equipment where it may be accessible to children.

CAUTION

1. Turn off the system power before removing or installing any wires into the terminals of any component on the system. Wiring with a live circuit can lead to electrical shorts that can damage components.
2. Installation must be done in accordance with all applicable codes.
3. Installer should touch a grounded metal object before handling the Aprilaire control panel to avoid potential loss of internal computer programs due to static discharge.
4. A Zoned Comfort Control system may not control temperature properly unless the heating and cooling system is properly sized and balanced.
5. Insufficient air flow or excessive temperatures through the heating and cooling system could result in equipment damage. Refer to the manufacturer's recommendations for minimum safe airflow and temperature requirements.
6. Excessive pressure across a bypass evaporative type humidifier may cause high air velocity in the humidifier, resulting in water being blown into the ductwork. Refer to Design Guide (form 5001) for humidifier installation considerations.
7. Install an outdoor thermostat to prevent non-seasonal equipment starts if using auto changeover thermostats.
8. Do not mount the control panel on any part of the heating/cooling equipment or ductwork.
9. Do not install control panel where temperatures exceed 158°F (70°C) or are below 32°F (0°C).
10. Improper system installation could cause water damage from frozen pipes. Check system operation after installation.

SPECIFICATIONS

ELECTRICAL

Input Voltage	20-30 VAC
Power Requirement for control panels and thermostats only	40 VA
Damper Voltage	18-30 VAC
Power Requirement for dampers	10 VA per damper
Max. Current through EAC/HUM terminals	1 amp @ 24 VAC
Max. Current through equipment control terminals	1 amp each or 3 amp total @ 24 VAC
Fuse Size	3 amp

ENVIRONMENTAL

Operating Temperature	32°F (0°C) to 158°F (70°C)
Operating Humidity	up to 90% non-condensing
Shipping Temperature	-40°F (-40°C) to 180°F (82°C)
Plenum Temperature Sensor	RPC Model 8052

CONTROL PANEL LAYOUT

(1) DAMPERS

- Separate 24 VAC power input for 2 or 3-wire dampers.
- Damper LEDs light when the NO contact is closed.
- Damper output terminals for 2 or 3-wire dampers.

(2) CONTROL PANEL POWER

- 24 VAC power input serves the main 6404 panel, up to four expansion panels and thermostats.
- The POWER LED light blinks approximately once per second with power applied.

(3) HUMIDIFIER

- Dry contact relay that closes during heat calls, allowing for control of a humidifier.
- HUM LED lights when the relay is closed.

(4) ELECTRONIC AIR CLEANER

- Dry contact relay that closes during heating, cooling and fan calls.
- EAC LED lights when relay is closed.

(5) EQUIPMENT LEDES

- LEDs visible through the cover that indicate when the system is Heating, Cooling or operating the Fan.
- LEDs adjacent to Equipment output terminals that allow technician to determine which equipment outputs are currently energized.

(6) CONFIGURATION SETTINGS

Dip switch settings to configure HVAC outputs, set plenum sensor temperature limits and control equipment stage timing.

(7) TIME DELAY OVERRIDE

Time Delay Override button accelerates timing (6 seconds = 1 minute) for quicker testing of control panel. The POWER LED blinks approximately twice per second when the TDO button is pressed.

(8) PLENUM SENSOR

Plenum temperature sensor (8052) inputs.

(9) THERMOSTATS

Thermostat inputs.

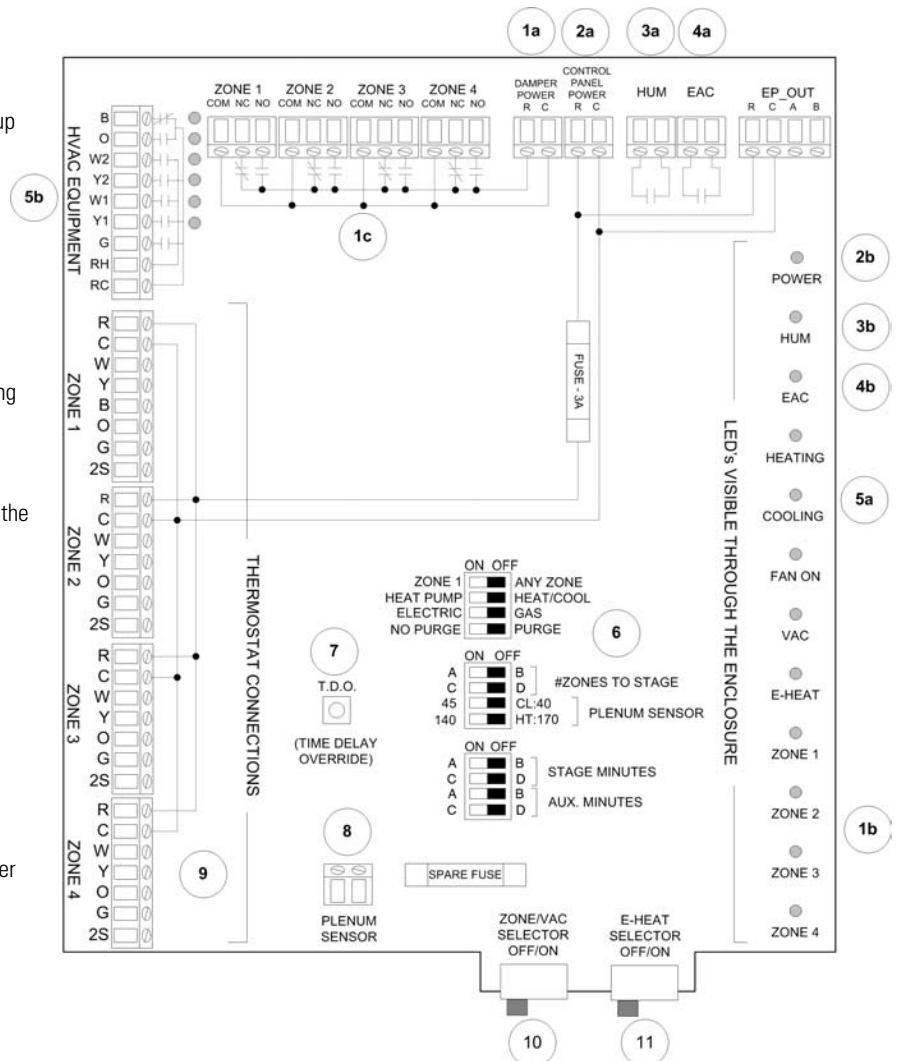
(10) ZONE/VAC SELECTOR SWITCH

When on, zone panel responds only to the Zone 1 thermostat and damper terminals do not energize.

(11) E-HEAT SELECTOR SWITCH

Use to put panel in Emergency Heat mode if controlling a heat pump with standard heat/cool thermostats.

FIGURE 1 – Control Panel Layout



CONTROL PANEL INSTALLATION

CAUTION

Installer must touch a grounded metal object before handling the Aprilaire control panel to avoid potential loss of programs due to static discharge.

RUN WIRE FOR SYSTEM

TABLE 1 – WIRES REQUIRED BETWEEN HVAC EQUIPMENT AND CONTROL PANEL

System Type	Single-Stage Furnace & A/C	Two-Stage Furnace & A/C	Boiler w/AC (2-xformer)	Radiant 1st Stage Heat, Furnace 2nd Stage Heat & A/C	Single-Stage Heat Pump	Two-Stage Heat Pump
Wires	4	6	5	5	5	7

TABLE 2 – WIRES REQUIRED BETWEEN THERMOSTATS AND CONTROL PANEL

Aprilaire Thermostat Model Number	Number of Wires
8570	5 - 8
8363	4
8365	6
8366	6
8344	4
8346	6
8348	6

WIRE TYPE

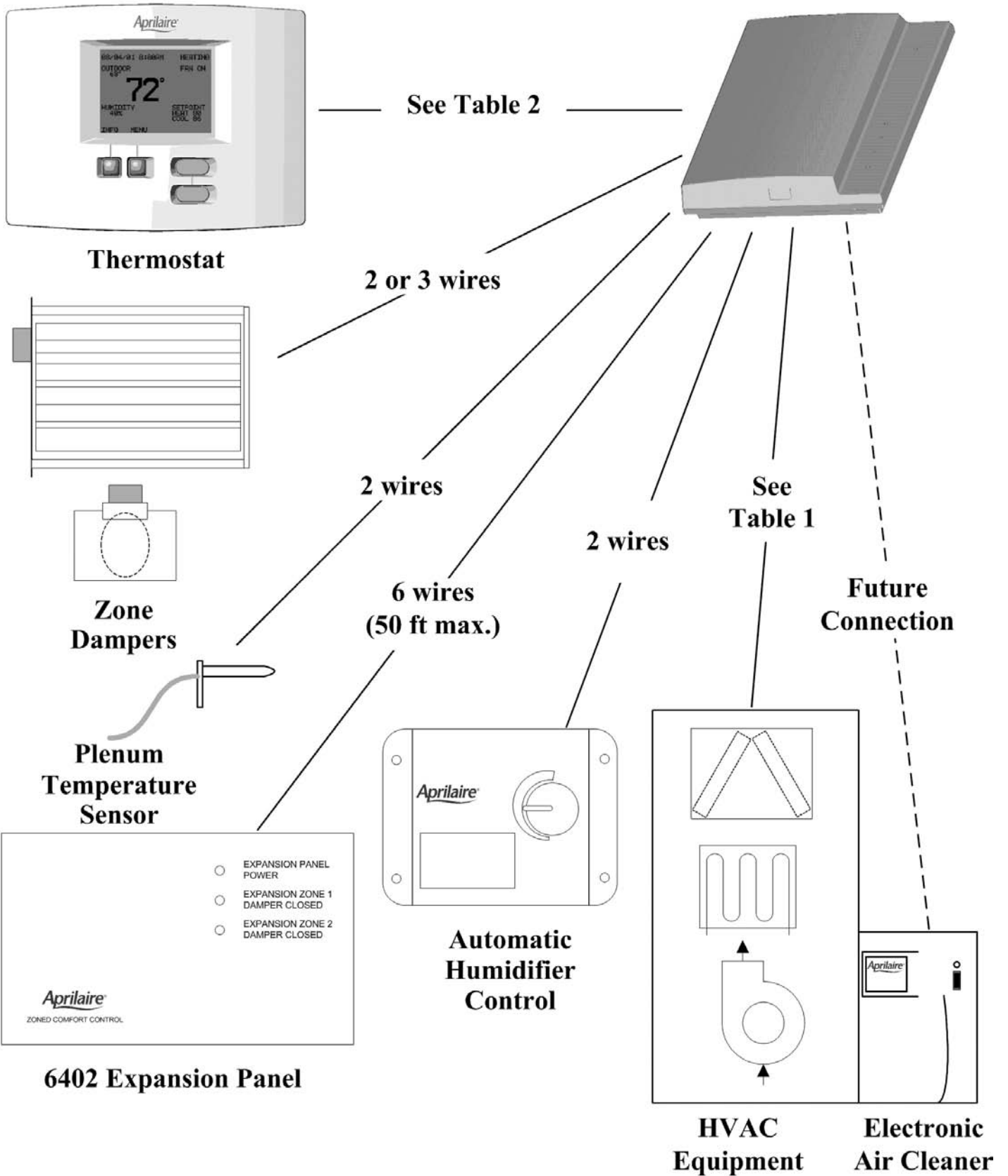
Standard 18-24 gauge stranded or solid thermostat wire can be used for all wire runs.

IMPORTANT

Avoid running thermostat and sensor wire alongside line voltage and high current carrying conductors (motors). This will prevent potential interference and ensure proper operation of the Zoned Comfort Control system.

FIGURE 2

MODEL 6404 CONTROL PANEL



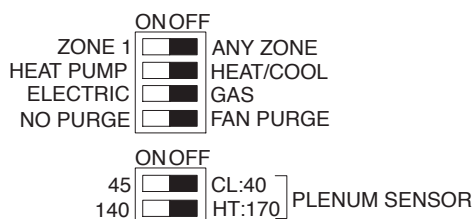
MOUNT THE CONTROL PANEL

NOTE: Mount in location where the temperature will not exceed 158°F and will not drop below freezing (32°F). Do not mount on foundation walls, or on the HVAC equipment or ductwork. These locations can cause the enclosure to become cooler than the surrounding air, which can cause moisture to condense on the enclosure.

1. Press in the latch on the left side of the enclosure and pull open the cover.
2. Use #8 screws (field supplied) to mount the base.

SET CONTROL PANEL FOR APPLICATION

There are six setup switches that must be set to meet your particular zoning application.



- **ZONE 1/ANY ZONE** determines how the control panel will control the mode of operation. In the ZONE 1 configuration, Zone 1 sets the mode of operation through the use of the O and B thermostat inputs. When the Zone 1 O terminal is energized, the system is in the cool mode and only cool and fan calls will be satisfied. When the Zone 1 B terminal is energized, the system is in heat mode and only heat and fan calls will be satisfied. If neither the Zone 1 O nor B terminal is energized, the system will not respond to cool or heat calls, but fan operation is unaffected. This configuration offers restricted control and is likely to be used in commercial applications where control from Zone 1 is desired (i.e. restaurants, churches, etc.). In the ANY ZONE configuration, the control panel responds to each individual thermostat equally. This allows thermostats to call for heating or cooling as required. If opposite calls (heating and cooling) occur at the same time, the zone panel will alternate between the heating and cooling call in 20 minute intervals. This offers control flexibility and is likely to be used in most residential applications and office or retail type commercial applications where the heating and cooling needs of the zones are completely independent. **TALK WITH THE CUSTOMER TO DETERMINE WHICH CONTROL CONFIGURATION SHOULD BE USED.** Refer to the sequence of operation sections on the following pages for additional details.
- **HEAT PUMP or HEAT/COOL** refers to the type of heating and cooling system. If a heat pump is to be used, set the switch to the ON position. If different equipment is used for heating and cooling (i.e. furnace and air conditioner, or boiler and air conditioner), set the switch to the OFF position.
- **ELECTRIC/GAS** refers to the heat source. If electric heat is to be used, set the switch to the ON position. This will turn on the fan (G output terminal) with a heat call (W1 output terminal). If the switch is left in the OFF position, it is assumed that the heating equipment will control the fan. For Dual Fuel Heat Pump systems, leave this switch in the GAS position.
- **NO PURGE / PURGE** determines whether the zone control panel or the equipment will control the compressor fan purge. If the NO PURGE/PURGE switch is set to PURGE, the G terminal will remain energized for a one minute purge delay following the completion of a compressor call. If set for NO PURGE, the G terminal will de-energize immediately following the completion of a compressor call. The NO PURGE setting is designed for use with systems where the equipment has a built in fan purge.
- **CL-45/40:** If using a plenum temperature sensor, this switch controls the temperature at which the cooling equipment will cut out to prevent freezing the indoor coil. For a low limit temperature of 45°F, move the switch to the ON position (45). For a low limit temperature of 40°F, leave the switch in the OFF position (CL-40).
- **HT-140/170:** If using a plenum temperature sensor, this switch controls the temperature at which the heating equipment will cut out to prevent overheating. For a high limit temperature of 140°F, move the switch to the ON position (140). For a high limit temperature of 170°F, leave the switch in the OFF position (HT-170).

SET THE STAGE TIME

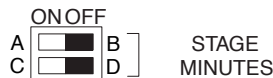
For systems with two-stage equipment (for heat pump applications, this does not include Auxiliary Heat), you have three options for controlling the second stage. The control panel will stage up the equipment outputs based on the number of zones calling for conditioning (# Zones to Stage), the time length of a call (Stage Minutes), or by staging thermostats.

	# ZONES TO STAGE
	1 (Staging by thermostat input or time)
	2
	3
	4



► **# ZONES TO STAGE** If staging thermostats are not installed with the system, second stage (does not apply to auxiliary heat on heat pump applications) operation can be initiated when more than one zone is calling for conditioning. Four selections are available: one, two, three and four zones. Set to one, thermostat inputs or timed length of call control staging, for all other settings only the specified number of calling zones can trigger staging.

	STAGE MINUTES
	0 (Staging not time controlled)
	10
	60
	120



► **STAGE MINUTES** If staging thermostats are not installed and the # Zones to Stage is set to 1, staging can be controlled by the amount of time that any one zone must be calling for conditioning before initiating a second stage (does not apply to auxiliary heat on heat pump applications). Four selections are available: 0, 10, 60 and 120 minutes. Set to zero, thermostat inputs or "# of Zones to Stage" control staging.

► **THERMOSTAT CONTROL** The 2S terminal available at each zone thermostat input can be used to control staging by the thermostat. For single-stage equipment or to control staging through thermostat input only (2S), set the "# ZONES TO STAGE" and "STAGE MINUTES" dip switches to the OFF position.

- **For two-stage heat pump systems**, the 2nd stage compressor thermostat output (usually denoted Y2) is wired to the 2S terminal.
- **For two-stage heat, one-stage cool systems** (not heat pump systems), the 2nd stage heat thermostat output (usually denoted W2) is wired to the 2S terminal.
- **For two-stage cool, one-stage heat systems**, the 2nd stage cool thermostat output (usually denoted Y2) is wired to the 2S terminal.
- **For systems with two stages of heat and two stages of cooling**, wire both the Y2 and W2 thermostat output terminals to the 2S terminal.

The control panel will stage up immediately (following the minimum on-time for first stage) when the 2S terminal in any calling zone has been activated. Set the "# ZONES TO STAGE" and "STAGE MINUTES" dip switches to the OFF position when controlling staging by the thermostats.

SET AUXILIARY HEAT STAGE UP TIME (HEAT PUMP SYSTEMS ONLY)



For thermostat control of auxiliary heat, set all AUX. MINUTES switches to the OFF position and refer to the sequence of operations sections on the following pages for details. For timed control, set the AUX. MINUTES switches to the amount of time the first and second stage (where applicable) compressors are allowed to try and satisfy a call for heating before auxiliary heat will be activated. There are four selections available: 0, 10, 60 and 120 minutes. Set to zero, auxiliary heat will be controlled by the thermostat.

	AUX. MINUTES
	0 (Aux. heat not time controlled)
	10
	60
	120

IMPORTANT

Thermostat control of auxiliary heat is only available when heat pump thermostats are used in all zones.

WIRE THE SYSTEM

SELECT AND WIRE THE TRANSFORMER TO THE CONTROL PANEL

WARNING

120-volts may cause serious injury from electrical shock. Sudden operation may cause serious injury from moving parts. Leave power disconnected until installation is complete.

- Two separate 24-volt transformers may be required for the system. The HVAC Equipment transformer cannot be used for power. Transformer #1 is used to power the control panels and thermostats. Transformer #2 is used to power the zone dampers. Optionally, a single transformer may be used to power both the zone board and dampers provided it has a sufficient VA rating. This can be accomplished by using a jumper wire to connect the R Terminal on the Control Power to the R Terminal on the Damper Power and a jumper wire to connect the C Terminal on the Control Power to the C Terminal on the Damper Power.

Component	Component VA Required	Refer to Wiring Schematic
Main Control Panel (6404), up to 4 Expansion Panels (6402) and up to 12 Thermostats	40 VA*	Diagram 1
Zone Damper	10 VA each	Diagram 8 (page 12)

* 24V thermostats (i.e. 8570) require a 75 VA transformer when using 12 thermostats.

- Install Transformer #1 (see Diagram 1). The 24-volt side of Transformer #1 is wired to the "Control Power" terminals on the control panel.
- Size Transformer #2
 - Add up all the zone dampers that are in the system.
 - Subtract the number of dampers in the zone with the least number of dampers.
 - This is the most number of dampers that **could be** energized at one time. Multiply this number by 10 to determine the Transformer #2 size.

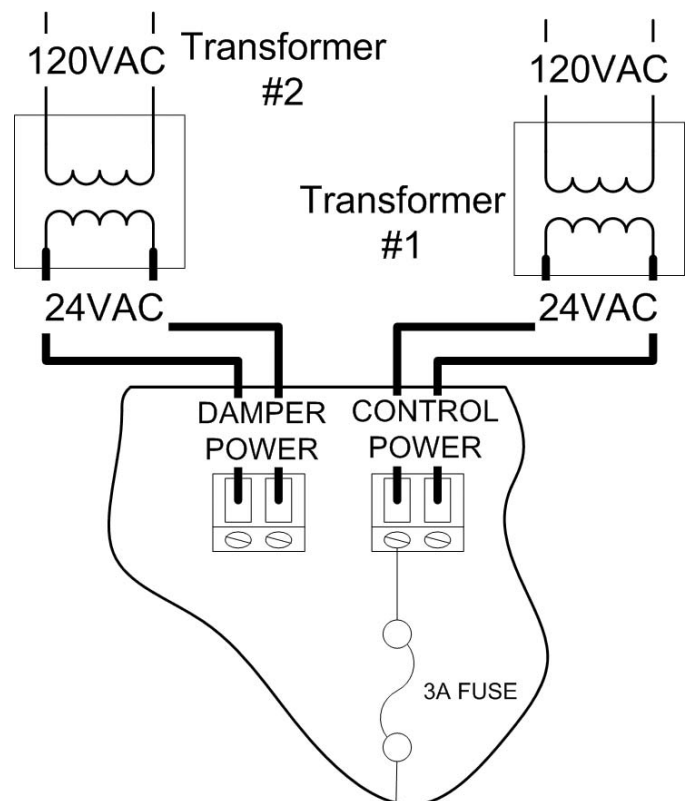
Example: If you have a 4-zone system, and there are two dampers per zone, then the total number of dampers that could be energized at one time is

8 - 2 = 6 dampers.

6 x 10 = 60 VA

- Install Transformer #2 (see Diagram 1). The load side (24-volt side) of Transformer #2 is wired to the DAMPER POWER terminals of the control panel.
- If multiple transformers are required for damper power, refer to Diagram 8.

DIAGRAM 1



SELECT AND WIRE THERMOSTATS

How the ZONE 1/ANY ZONE switch, HEAT PUMP/ HEAT/COOL switch and AUX. MINUTES switches are set will determine the thermostat requirements for each zone. Use the following table to determine which thermostat is required.

CONTROL PANEL DIP SWITCH POSITIONS	THERMOSTAT REQUIREMENTS					
	ZONE 1			OTHER ZONES		
	TYPE	THERMOSTAT TERMINALS (See Note)	RECOMMENDED THERMOSTATS	TYPE	THERMOSTAT TERMINALS (See Note)	RECOMMENDED THERMOSTATS
	HEAT/COOL	R, W, Y, G	Aprilaire® 8570, 8344, 8348, 8363, 8366	HEAT/COOL	R, W, Y, G	Aprilaire® 8570, 8344, 8348, 8363, 8366
	HEAT/COOL	R, W, Y, G, O, B (See Note)	Aprilaire® 8570	HEAT/ COOL	R, W, Y, G	Aprilaire® 8570, 8344, 8348, 8363, 8366
	HEAT/COOL	R, W, Y, G	Aprilaire® 8570, 8344, 8348, 8363, 8366	HEAT/COOL	R, W, Y, G	Aprilaire® 8570, 8344, 8348, 8363, 8366
	HEAT/COOL	R, W, Y, G, O, B (See Note)	Aprilaire® 8570	HEAT/COOL	R, W, Y, G	Aprilaire® 8570, 8344, 8348, 8363, 8366
	HEAT PUMP	R, W1, Y1, G, O (See Note)	Aprilaire® 8570 8346, 8365	HEAT PUMP	R, W1, Y1, G, O (See Note)	Aprilaire® 8570, 8346, 8365

NOTE: A common terminal (labeled “C”) is provided at the control panel thermostat terminal strip for use with 24-volt thermostats. **The B terminal listed in the required terminals is not a 24V-com terminal** (Trane/ American Standard or GE thermostat users).

THERMOSTAT TERMINAL DEFINITIONS

(refer to thermostat manufacturer’s literature for matching terminals)

R = 24V-hot

C = 24V-common

W / W1 = 1st-stage heat or 1st-stage auxiliary heat

W2 = 2nd-stage heat

Y / Y1 = 1st-stage cool or 1st-stage compressor

Y2 = 2nd-stage cool or compressor

B = Reversing valve – heating

O = Reversing valve – cooling

G = Fan

CONTROL PANEL TERMINAL DEFINITIONS

R = 24V-hot

C = 24V-common

W = 1st-stage heat or auxiliary heat

Y = 1st-stage cool or compressor

B = Reversing valve – heating

O = Reversing valve – cooling

G = Fan

2S = 2nd-stage heat, cool or compressor

WIRE THE HVAC EQUIPMENT TO THE CONTROL PANEL

WARNING

120-volts may cause serious injury from electrical shock. Sudden operation may cause serious injury from moving parts. Turn off power to HVAC System and leave power disconnected until installation is complete.

1. Disconnect power to the HVAC system.
2. Run wire between the HVAC equipment and the control panel.
3. Set the HVAC equipment configuration switches to match your application (see "Set Control Panel for Application" on page 6).
4. Use the diagram appropriate for your application to terminate the wires (refer to Diagrams 2 – 7).

DIAGRAM 2 – Single-Stage Furnace and A/C

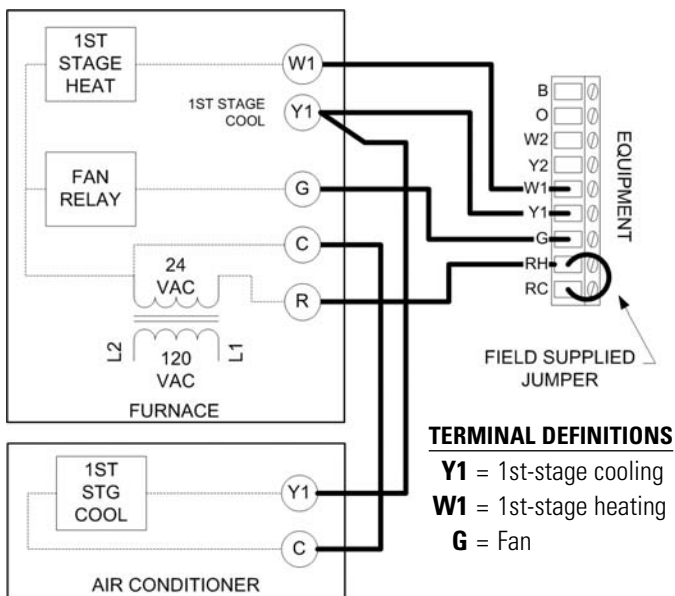


DIAGRAM 3 – Two-Stage Furnace and A/C

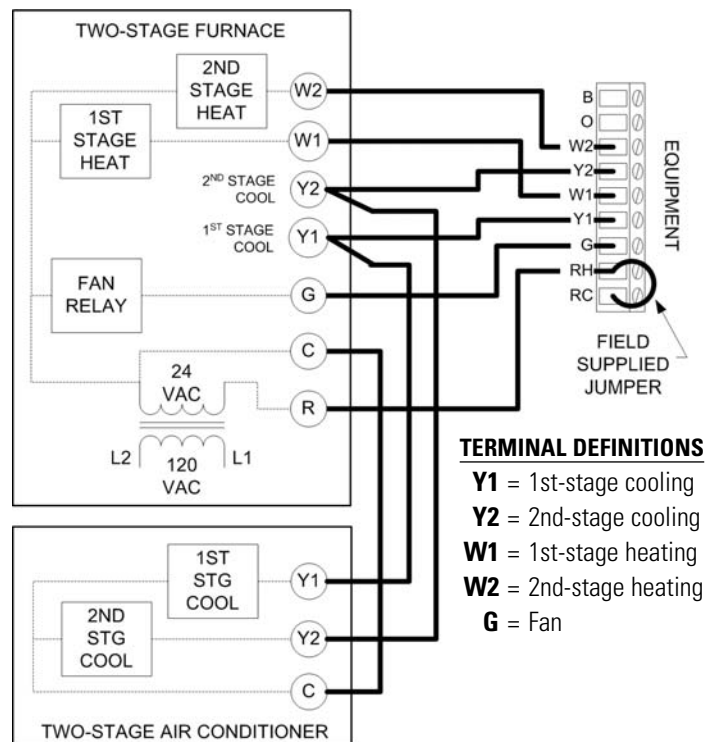


DIAGRAM 4 – Boiler and A/C

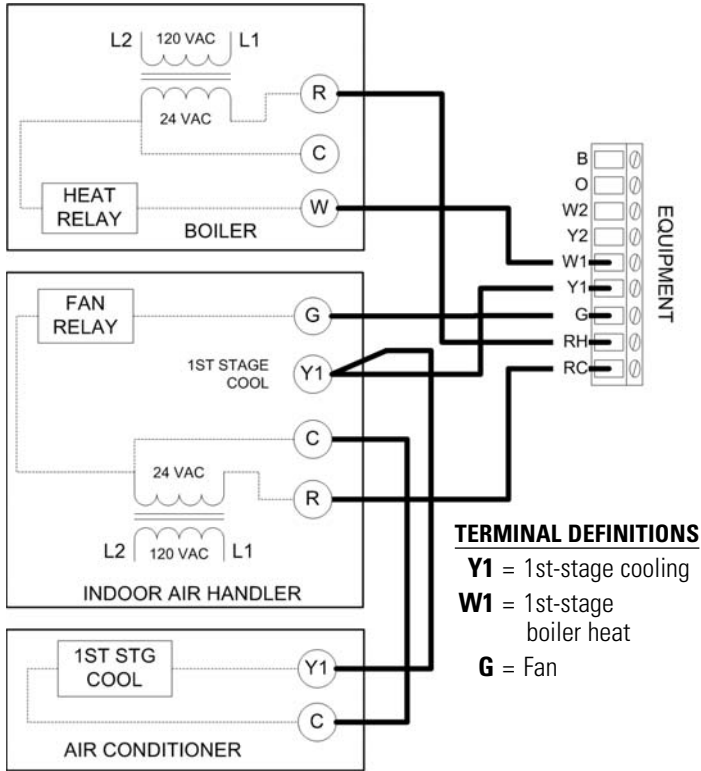


DIAGRAM 5 – Radiant Floor First-Stage Heat, Furnace 2nd-Stage Heat and A/C

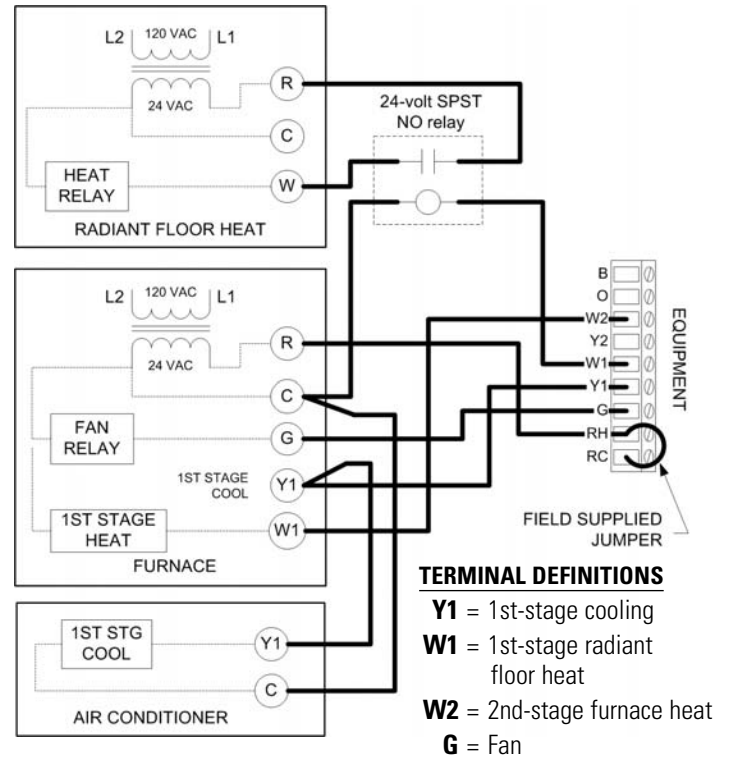


DIAGRAM 6 – Single-Stage Heat Pump

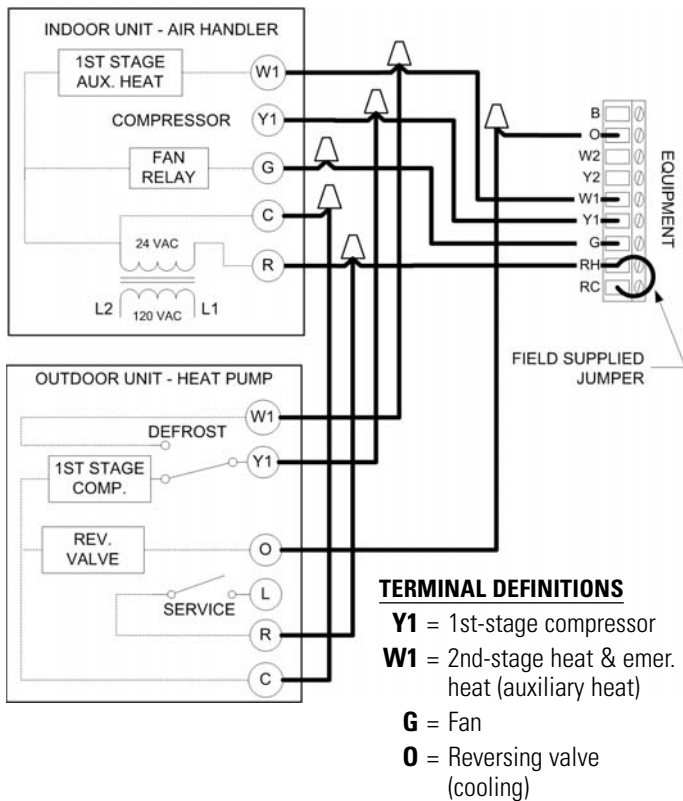
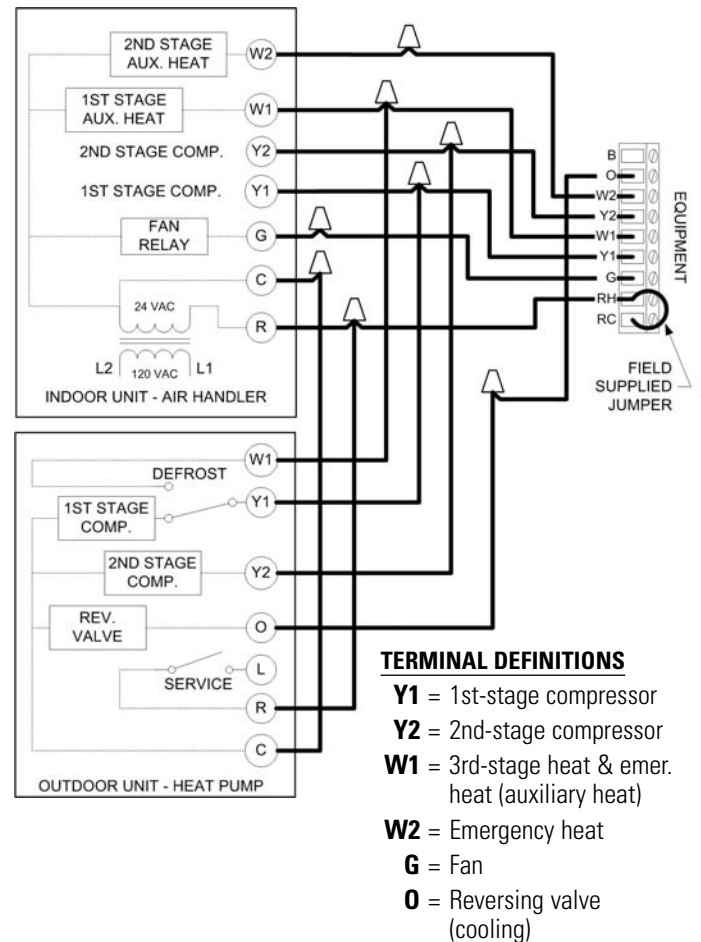


DIAGRAM 7 – Two-Stage Heat Pump



WIRE ZONE DAMPERS TO THE CONTROL PANEL

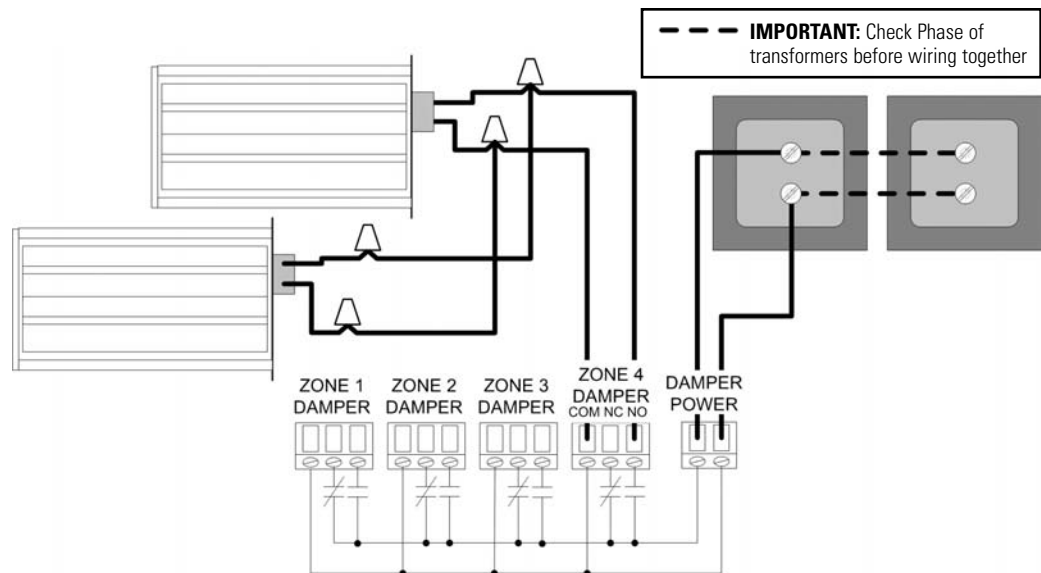
1. Run 2-wire thermostat cable for spring return dampers (normally open or normally closed). Run 3-wire cable for power open/power close dampers. Multiple dampers for the same zone can be paralleled together as shown.
2. Wire the dampers to the Zone Damper output terminals on the control panel:

NC – This terminal remains energized when that zone thermostat is calling for heating/cooling/fan or when no zone is calling. This terminal is used to power a damper open.

NO – This terminal energizes in a non-calling zone when another zone thermostat makes a call for heating/cooling/fan. This terminal is used to power a damper closed.

COM – This terminal provides a common connection for the NC and NO terminals.

DIAGRAM 8



3. If multiple transformers will be required, wire them in parallel as shown. Before wiring the transformers together, **ensure that they are connected in phase** by observing polarity marks or terminal orientation on each transformer.

WIRE AN 8052 PLENUM TEMPERATURE SENSOR (INCLUDED)

IMPORTANT

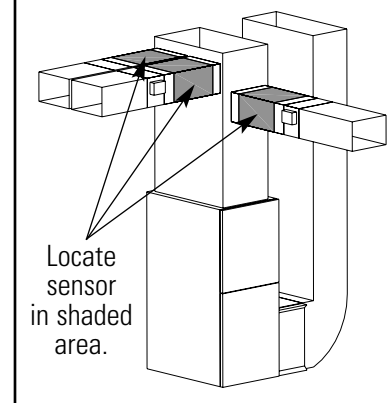
Do not mount the sensor in direct line-of-sight of the heat exchanger, cooling coils or UV lights as this may cause the sensor to report false temperature readings.

1. Locate the sensor in the supply trunk, downstream of the heat exchanger and cooling coils and before the zone dampers (see the shaded areas of Figure 3).
2. Mount the sensor according to the installation instructions provided with the sensor.
3. Before wiring to the control panel, measure the resistance across the sensor. The resistance corresponds (approximately) to the sensed temperature according to the following table:

Temperature (°F)	30	40	50	60	70	80	90	100
Resistance (kΩ)	34.6	26.1	19.9	15.3	11.9	9.4	7.4	5.9

4. Wire the sensor to the control panel PLENUM SENSOR terminals. **THIS MUST BE DONE BEFORE POWER IS APPLIED TO THE CONTROL PANEL** or the sensor will not be recognized by the control panel.

FIGURE 3 – Furnace Setup

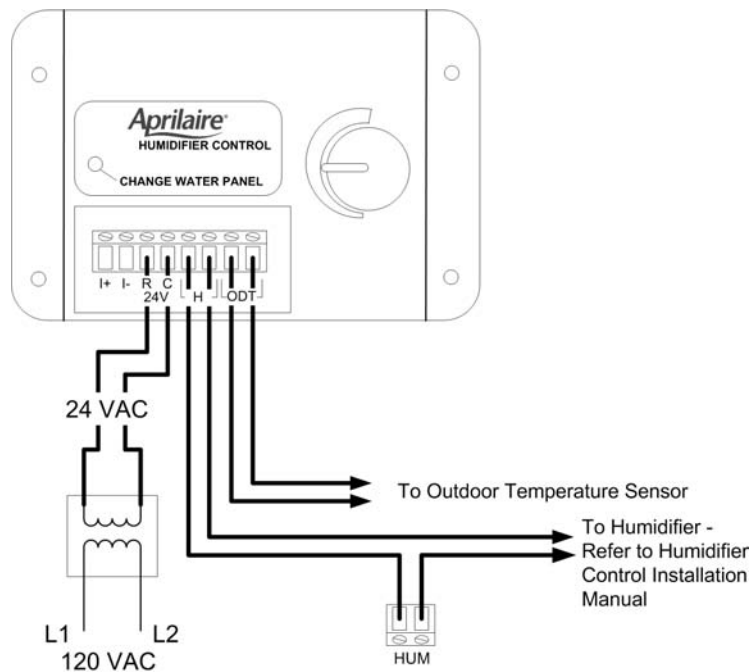


WIRE AN APRILAIRE HUMIDIFIER CONTROL OR ELECTRONIC AIR CLEANER TO THE CONTROL PANEL – OPTIONAL

The control panel closes a dry contact relay to complete a circuit between the HUM terminals on the control panel when the heat is on, eliminating the need for a Model 50 relay or use of equipment humidifier terminals.

1. Install the Humidifier Control and its outdoor temperature sensor:
 - Constant power must be applied to the Humidifier Control transformer. **DO NOT power the transformer through furnace accessory terminals.**
2. Run a 2-wire cable from the Humidifier Control to the control panel.
3. Wire the Humidifier Control to the control panel – see Diagram 9. Use wire color as a means to ensure the terminals are connected correctly.
 - Connect one of the H terminals on the Humidifier Control to one of the HUM terminals on the 6404 control panel.
 - Connect the remaining (open) HUM terminal on the 6404 control panel to the humidifier lead (refer to Humidifier Control Installation Manual).
 - Connect the remaining (open) humidifier lead back to the remaining (open) H terminal on the Humidifier Control.
4. After completing the Model 6404 installation, you will need to verify proper operation of the Humidifier Control – see Humidifier Control installation instructions for further details.

DIAGRAM 9



To control an electronic air cleaner (EAC), 24-volt control will be required. The EAC relay closes whenever the HVAC equipment is operating (heating, cooling or continuous fan – see sequence of operation for details).

EAC INSTALLATION REQUIRES 24-VOLT CONTROL:

1. Mount the EAC in accordance with the installation instructions provided with the unit.
2. Run a 2-wire cable from the 24-volt control of the device to the control panel.
3. Connect the wires to the 24-volt control of the device.
4. Connect the other end of the wires to the EAC terminals on the control panel.

TO 24-VOLT
ELECTRONIC AIR CLEANER
CONTROLLER



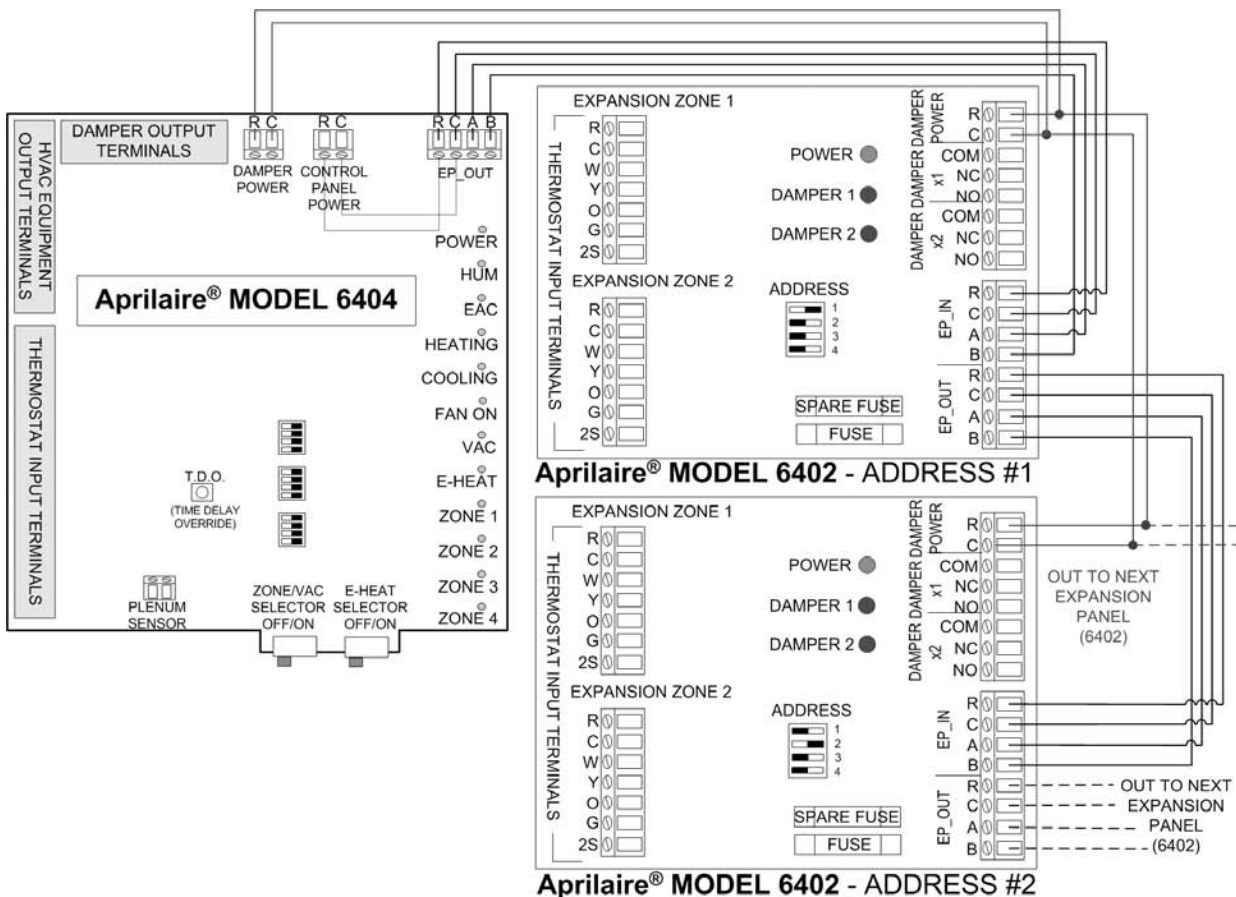
WIRE EXPANSION PANELS

Up to four expansion panels, each with 2 zones, can be added to the Model 6404 control panel if additional zones are required.

To add Model 6402 expansion panels, follow these guidelines:

1. Disconnect the Control Power and Damper Power on the 6404 control panel until installation is complete.
2. Mount the expansion panels using four #8 screws (field supplied) in location where the temperature will not exceed 140°F and will not drop below freezing (32°F). Do not mount on foundation walls, or on the HVAC equipment or ductwork. These locations can cause the enclosure to become cooler than the surrounding air, which can cause moisture to condense on the enclosure.
3. Connect the R, C, A and B terminals labeled "EP_OUT" on the 6404 panel to the R, C, A and B terminals labeled "EP_IN" on the first 6402 expansion panel. To wire additional 6402 expansion panels, connect the R, C, A and B terminals labeled "EP_OUT" on the first expansion panel to the R, C, A and B terminals labeled "EP_IN" on the next expansion panel. See Diagram 10. Polarity is important. If wired incorrectly control panel power and/or communications will be affected. Use wire color as a means to ensure the terminals are connected correctly.
4. Connect the Damper Power R and C terminals on the 6404 control panel to the Damper Power R and C terminals on the first 6402 expansion panel. For additional 6402 expansion panels, damper power can be daisy chained as shown in Diagram 10.
5. Wire dampers to 6402 expansion panel(s) as previously described in the "Wire Dampers to Control Panel Section".
6. Wire thermostats to 6402 expansion panel(s). Use the same thermostats as were selected for zones 2-4 on the 6404 control panel. Refer to "Select and Wire Thermostats" section for additional detail on terminal designations.
7. Address each 6402 expansion panel. Each expansion panel must have its own unique address, 1 through 4, or communications cannot be established between the 6404 panel and the expansion panel.

DIAGRAM 10



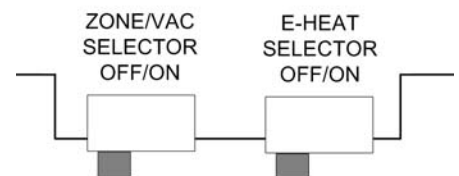
SEQUENCE OF OPERATION

The 6404 Control Panel is a heat call priority system with automatic mode changeover after 20 minutes of operation. If two calls for opposing mode exist while the system is idle, the Heat call will be satisfied first. The heating equipment will not stop operating until 1.) all heat calls have been satisfied, 2.) the minimum-on time lapses, 3.) the equipment has been on for 20 minutes **and** a cooling call exists or 4.) the call is interrupted by the plenum temperature sensor due to high limit settings. After the heating equipment has stopped, calls for cooling can be satisfied. Similarly, once the cooling equipment comes on it will not stop operating until 1.) all cool calls have been satisfied, 2.) the minimum-on time lapses, 3.) the equipment has been on for 20 minutes **and** a heat call exists or 4.) the call is interrupted by the plenum temperature sensor due to low limit settings. Equipment operation is only interrupted if an Emergency Heat call exists. The sequence of operation is dependent on the position of the ZONE 1/ANY ZONE switch and the HEAT PUMP or HEAT/COOL switch. A Time Delay Override (TDO) button is available on the control panel to speed up the internal timer for system checkout. Note that immediately after the board is powered, there is a four minute minimum off delay where only the fan output will respond.

Heat/Cool Changeover: When a call for heat/cool exists and an opposing call is made from another zone, a changeover time limit of 20 minutes begins at the time that the opposing call is made. If the original call is not satisfied within that 20-minute time period, the call will be interrupted, turning the equipment off and allowing for the normal fan purge cycle and minimum equipment off time. The opposing call will then be answered. After 20 minutes, if the original call still exists, the opposing call will be interrupted and the original call can once again be recognized.

High/Low Limit Temperature: The high/low limit temperature settings are designed to prevent the heat exchanger from overheating or the cooling coil from freezing. An 8052 Sensor mounted in the supply duct senses the plenum air temperature and interrupts the heating/cooling equipment (depending on the Heat and Cool temperatures set on the control panel) before overheating/freezing occurs. When a heating/cooling call is interrupted by the high/low temperature limit, the zone control panel turns the equipment off and energizes the G terminal (if not already energized). The Heating/Cooling LED on the control panel will flash during a high/low limit temperature interrupt. Once the temperature drops/rises 10°F, the equipment is turned back on if the call for conditioning still exists. The Heating/Cooling LED will then stop flashing.

Zone/Vac (Vacation) Selector: This switch allows the homeowner to switch from normal operation (ZONE) to a VACATION mode. In VACATION mode (switch in the ON position), Zone 1 becomes the only zone from which a call for heating or cooling is recognized. Additionally, when in VACATION mode, damper outputs do not change – they remain in the open position. The VACATION LED will illuminate when the switch is in the VACATION position.



E-Heat Selector: This feature can only be used with heat pump systems. When the EMERGENCY HEAT switch is in the ON position, any call for heat will be answered with auxiliary heat equipment outputs (W1 and W2). This feature enables the homeowner to activate EMERGENCY HEAT mode when heat/cool thermostats are installed in all zones.

HEAT/COOL SYSTEM WHERE ANY ZONE SETS THE MODE

THERMOSTAT INPUT DEFINITIONS

All Zones: Heat = W, Cool = Y, Fan = G, 2nd Stage Heat or Cool = 2S



FAN OPERATION

A call for Fan from any zone will initiate the G equipment output terminal. The damper terminal at all zones not calling for continuous fan will be energized.

HEATING OPERATION

When a zone makes a call for Heat, the W1 and B output terminals (and G terminal with the ELECTRIC/GAS switch in the ELECTRIC position) will energize. The NO contact of the damper terminals for any zone not calling for Heat also energizes, while the NC contact de-energizes. Following a 2-minute minimum on time, the W1 terminal de-energizes when (1) all zones stop calling for Heat, (2) the call has exceeded the heat/cool changeover time limit while a cooling call exists or (3) the call is interrupted by the high limit setting. The G terminal and any energized damper terminals remain energized for a one-minute purge delay if set to PURGE. If set to NO PURGE, the G terminal de-energizes immediately and the dampers remain energized for a 3.5 minute purge. When the W1 terminal is de-energized, a minimum off time delay of 4 minutes must elapse before it can be energized again. Should any call for Heat not be satisfied in the time that is set on the STAGE dip switch bank, or should the 2S terminal of any calling zone be energized, or the number of zones calling for conditioning matches or exceeds the # Zones to Stage setting, the W2 terminal will energize. If all the dip switches are OFF (zero stage time) the W2 terminal can only be energized if a 2S thermostat terminal is energized. When the zone that initiated the W2 terminal is no longer calling, the W2 terminal will de-energize unless a different zone has been calling for longer than the time set on the STAGE dip switch bank or unless another zone's 2S terminal has been energized. Following a 2 minute minimum on time (if set to GAS) or immediately (if set to ELECTRIC) the W2 terminal will de-energize at the end of a heat call. Once de-energized, the W2 terminal has a 4 minute minimum off time if set to GAS or no minimum off time if set to ELECTRIC. The B terminal remains energized until there is a Cool call.

COOLING OPERATION

When a zone makes a call for Cooling, the Y1, G and O terminals will energize. The NO contact of the damper terminals for any zone not calling for Cooling also energizes, while the NC contact de-energizes. Following a 4-minute minimum on time, the Y1 terminal de-energizes when (1) all zones stop calling for Cooling, (2) the call has exceeded the heat/cool changeover time limit while a heat call exists or (3) the call is interrupted by the low limit temperature setting. The G terminal and any energized damper terminals remains energized for a one-minute purge delay if set to PURGE. If set to NO PURGE, the G terminal de-energizes immediately and any energized damper terminals remain energized for a 3.5 minute purge delay. When the Y1 terminal is de-energized, a minimum off time delay of 4 minutes must elapse before it can be energized again. Should any call for Cooling not be satisfied in the time that is set on the STAGE dip switch bank, or should the 2S terminal of any calling zone be energized, or should the number of zones calling for conditioning be greater or equal to the # Zones to Stage setting, the Y2 terminal will energize. If all the dip switches are OFF (zero stage time) the Y2 terminal can only be energized if a 2S thermostat terminal is energized. When the zone that initiated the Y2 terminal is no longer calling, the Y2 terminal will de-energize unless a different zone has been calling for longer than the time set on the STAGE dip switch bank or unless another zone's 2S terminal has been energized. Once energized the Y2 terminal remains energized for a minimum on time of 4 minutes. Once de-energized, the Y2 terminal can not be energized again until a 4-minute minimum off time delay elapses. The O terminal remains energized until there is a Heat call.

HEAT/COOL SYSTEM WHERE ZONE 1 SETS THE MODE

THERMOSTAT INPUT DEFINITIONS

All Zones: Heat Call = Zone 1 B + W, **Cool Call** = Zone 1 O + Y, **Fan** = G,
2nd Stage Heat or Cool = 2S



FAN OPERATION - same as previous

HEATING OPERATION - same as previous with the following exception:

The Zone 1 B terminal must be continuously energized for the control panel to recognize a call for heat from any zone. When the Zone 1 B terminal is energized, cool calls will not be recognized.

COOLING OPERATION – same as above sequence with the following exception:

The Zone 1 O terminal must be continuously energized for the control panel to recognize a call for cooling from any zone. When the Zone 1 O terminal is energized, heat calls will not be recognized.

HEAT PUMP SYSTEMS WHERE ANY ZONE SETS THE MODE

THERMOSTAT INPUT DEFINITIONS

Aux Time ≠ 0 (Heat /Cool thermostats in all zones): Heat = W, **Cool** = Y, **Fan** = G,
2nd Stage Heat or Cool = 2S, **Emergency Heat** = See "Emergency Heat Operation" below



Aux. Time = 0 (Heat Pump thermostats in all zones): Heat = Y, **Cool** = Y+O, **Fan** = G, **2nd Stage Heat or Cool** = 2S,
Auxiliary Heat = Y+W, **Emergency Heat** = See "Emergency Heat Operation" below

FAN OPERATION

A call for Fan from any zone will initiate the G equipment output terminal. The damper terminal at all zones not calling for continuous fan will be energized.

HEATING OPERATION

When a zone makes a call for Heat, the Y1, G and B output terminals will energize. The NO contact of the damper terminals for any zone not calling for Heat also energizes, while the NC contact de-energizes. Following a 4-minute minimum on time, the Y1 terminal de-energizes when (1) all zones stop calling for Heat, (2) the call has exceeded the heat/cool changeover time limit while a cooling call exists or (3) the call is interrupted by the high limit setting. The G terminal and any energized damper terminals remain energized for a one-minute purge delay if set to PURGE. If set to NO PURGE, the G terminal de-energizes immediately and the dampers remain open for a 3.5 minute purge. When the Y1 terminal is de-energized, a minimum off time delay of 4 minutes must elapse before it can be energized again. Should any call for Heat not be satisfied in the time that is set on the STAGE dip switch bank, or should the 2S terminal of any calling zone be energized, or should the number of zones calling for conditioning match or exceed the # Zones to Stage setting, the Y2 terminal will energize. If all the dip switches are OFF (zero stage time) the Y2 terminal can only be energized if a 2S thermostat terminal is energized. When the zone that initiated the Y2 terminal is no longer calling, the Y2 terminal will de-energize unless a different zone has been calling for longer than the time set on the STAGE dip switch bank or unless another zone's 2S terminal has been energized. Once energized the Y2 terminal remains energized for a minimum on time of 4 minutes. Once de-energized, the Y2 terminal can not be energized again until a 4-minute minimum off time delay elapses. The B terminal remains energized until there is a Cool call.

AUXILIARY HEAT OPERATION

Auxiliary Heat can be controlled by time or by the thermostats.

Thermostat Control (Heat Pump thermostats in all zones): If the Y and W thermostat input terminals at any zone are energized concurrently (assuming the heat pump is on in the Heat mode of operation), the W1 output terminal will energize immediately. This is thermostat control.

Time Control (Heat/Cool thermostats in all zones): If it is desired to have the auxiliary heat come on after a specific amount of time, set the appropriate AUX switch(es) to ON. Should any call for Heat not be satisfied in the time that is set on the STAGE MINUTES plus the AUX MINUTES dip switch bank, the W1 equipment output terminal will energize.

Following a two minute minimum on time (if set to GAS) or immediately (if set to ELECTRIC), the W1 terminal immediately de-energizes when both of the above two conditions no longer exist.

DUAL FUEL

Your system acts as a dual fuel system when the HEAT PUMP/HEAT COOL switch is set to the HEAT PUMP position and the ELECTRIC/GAS switch is set to the GAS position. The dual fuel system is set up so that when the auxiliary heat comes on, whether initiated by time or zone input, the compressor outputs (Y1 and Y2) will turn off before the W1 output is turned on. The dual fuel mode effects auxiliary heat operation only.

COOLING OPERATION

When a zone makes a call for Cooling, the Y1, G and O terminals will energize. The NO contact of the damper terminals for any zone not calling for Cooling also energizes, while the NC contact de-energizes. Following a 4-minute minimum on time, the Y1 terminal de-energizes when (1) all zones stop calling for Cooling, (2) the call has exceeded the heat/cool changeover time limit while a heat call exists or (3) the call is interrupted by the low limit temperature setting. The G terminal and any energized damper terminals remains energized for a one-minute purge delay if set to PURGE. If set to NO PURGE, the G terminal de-energizes immediately and any energized damper terminals remain energized for a 3.5 minute purge delay. When the Y1 terminal is de-energized, a minimum off time delay of 4 minutes must elapse before it can be energized again. Should any call for Cooling not be satisfied in the time that is set on the STAGE dip switch bank, or should the 2S terminal of any calling zone be energized, or should the number of zones calling for conditioning be greater or equal to the # Zones to Stage setting, the Y2 terminal will energize. If all the dip switches are OFF (zero stage time) the Y2 terminal can only be energized if a 2S thermostat terminal is energized. When the zone that initiated the Y2 terminal is no longer calling, the Y2 terminal will de-energize unless a different zone has been calling for longer than the time set on the STAGE dip switch bank or unless another zone's 2S terminal has been energized. Once energized the Y2 terminal remains energized for a minimum on time of 4 minutes. Once de-energized, the Y2 terminal can not be energized again until a 4-minute minimum off time delay elapses. The O terminal remains energized until there is a Heat call.

EMERGENCY HEAT OPERATION

Thermostat Control of Emergency Heat: This only exists when heat pump thermostats are installed in all zones (and AUX. MINUTES = 0). In this case, the first call for Emergency Heat (only W thermostat input terminal energized) sets the system to the Emergency Heat mode. All subsequent calls for heat by other zones are recognized as Emergency Heat calls until the zone(s) that initiated the Emergency Heat mode call for regular heating.

E-Heat Switch Control: If heat/cool thermostats are installed in all zones (AUX. MINUTES not equal to zero), Emergency heat can only be initiated by turning the EMERGENCY HEAT switch on the zone control panel to the ON position. When the EMERGENCY HEAT switch is in the ON position, all calls for normal heating will be recognized as Emergency Heat calls. The system will remain in Emergency Heat mode until the EMERGENCY HEAT switch is moved to the OFF position, at which point calls for heat will once again be answered with normal heating.

When a call for Emergency Heat is recognized, the Y terminal will de-energize (if energized) after a 4 minute minimum on time, after which the B and W terminals (and G terminal if set to ELECTRIC) will energize. Following a 2-minute minimum on time (if set to GAS) or immediately (if set to ELECTRIC), the W terminal will de-energize when (1) all zones stop calling for heat, (2) the call has exceeded the heat/cool changeover time limit while a cooling call exists or (3) the call is interrupted by the high limit setting. Any energized damper terminals remain energized for a one-minute purge (if set to PURGE) or a 3.5 minute purge (if set to NO PURGE). When the W terminal is de-energized, it has a 4 minute minimum off time if set to GAS or no minimum off time if set to ELECTRIC.

HEAT PUMP SYSTEMS WHERE ZONE 1 SETS THE MODE

THERMOSTAT INPUT DEFINITIONS

All Zones: Heat Call = Zone 1 B + W, **Cool Call** = Zone 1 O + Y, **Fan** = G,
2nd Stage Heat or Cool = 2S, **Emergency Heat** = see Emergency Heat Operation below



FAN OPERATION - same as above sequence

HEATING OPERATION – same as above sequence with the following exception:

The Zone 1 B terminal must be continuously energized for the control panel to recognize a call for heat from any zone. When the Zone 1 B terminal is energized, cool calls will not be recognized.

AUXILIARY HEAT OPERATION

Auxiliary heat will come on after a specific amount of time set by the AUX dip switch(es). Should any call for Heat not be satisfied in the time that is set on the STAGE plus the AUX dip switch bank, the W1 terminal will energize. For single stage heat pumps, set the STAGE time to zero by setting all the switches to OFF. The W1 terminal immediately de-energizes when both of the above two conditions no longer exist.

DUAL FUEL

Your system acts as a dual fuel system when the HEAT PUMP/HEAT COOL switch is set to the HEAT PUMP position and the ELECTRIC/GAS switch is set to the GAS position. The dual fuel system is set up so that when the auxiliary heat comes on, whether initiated by time or zone input, the compressor outputs (Y1 and Y2) will turn off before the W1 output is turned on. The dual fuel mode effects auxiliary heat operation only.

COOLING OPERATION – same as above sequence with the following exception:

The Zone 1 O terminal must be continuously energized for the control panel to recognize a call for cooling from any zone. When the Zone 1 O terminal is energized, heat calls will not be recognized.

EMERGENCY HEAT OPERATION

Thermostat control of Emergency Heat only exists when heat pump thermostats are installed in all zones (and AUX. MINUTES = 0). In this case, a call for Emergency Heat (only W thermostat input terminal energized) from Zone 1 sets the system to the Emergency Heat mode. All subsequent calls for heat by other zones are recognized as Emergency Heat calls until Zone 1 calls for normal heating or cooling.

If heat/cool thermostats are installed in all zones (AUX. MINUTES not equal to zero), Emergency heat can only be initiated by turning the EMERGENCY HEAT switch on the zone control panel to the ON position. When the EMERGENCY HEAT switch is in the ON position, all calls for normal heating will be recognized as Emergency Heat calls. The system will remain in Emergency Heat mode until the EMERGENCY HEAT switch is moved to the OFF position, at which point calls for heat will once again be answered with normal heating.

When a call for Emergency Heat is recognized, the Y terminal will de-energize (if energized) after a 4 minute minimum on time, after which the B and W terminals (and G terminal if set to ELECTRIC) will energize. Following a 2-minute minimum on time (if set to GAS) or immediately (if set to ELECTRIC), the W terminal will de-energize when (1) all zones stop calling for heat, (2) the call has exceeded the heat/cool changeover time limit while a cooling call exists or (3) the call is interrupted by the high limit setting. Any energized damper terminals remain energized for a one-minute purge (if set to PURGE) or a 3.5 minute purge (if set to NO PURGE). When the W terminal is de-energized, it has a 4 minute minimum off time if set to GAS or no minimum off time if set to ELECTRIC.



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