Commercial Zoning Guide

eControls

The commercial zoning solutions use the eWD3P Zoning Panel, eWD3X Expansion Panel and our rugged CRDA250 dampers. These products provide a cost effective solution for 3 to 12-zone installations for multi-stage gas/electric, conventional heat pumps and dual fuel heat pumps.

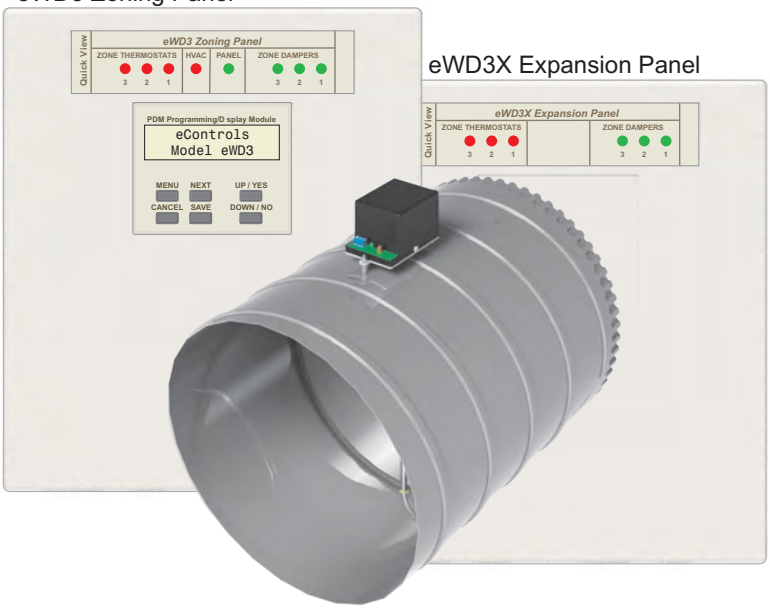
The CRDA250 dampers use a powerful, 24VAC modulating actuator that provides efficient airflow and can eliminate constructing bypass duct work.

The panels's PDM tutors the installer through the selection of thermostat, equipment and damper options as well as advanced options for controlling staging by demand, bypass control and numerous other options.

The contractor can enter their name and telephone number for display by the user. Multiple installations can be cloned to save time and insure consistent option selection.

eWD3 Zoning Panel

eWD3X Expansion Panel



Benefits of Zoning

Dividing a facility into separate zones provides the same comfort and energy efficiency as if each zone had its own HVAC system. Each zone has its own thermostat that controls the amount of conditioned air provided to that zone. And when zones are not used or set to more energy efficient settings, the thermostat reduces or terminates the airflow to those zones.

Why Spaces in a Building Vary in Comfort

When a building is commissioned, the airflow is balanced based on the CFM needs of each space. Unfortunately these demands vary dynamically with season, weather, occupancy, orientation, windows and the comfort level of the occupants.

This is illustrated using the example shown in Figure 1. The example is the administration offices of a small manufacturing company. The offices are located in the front of the building and manufacturing and warehousing is in the back.

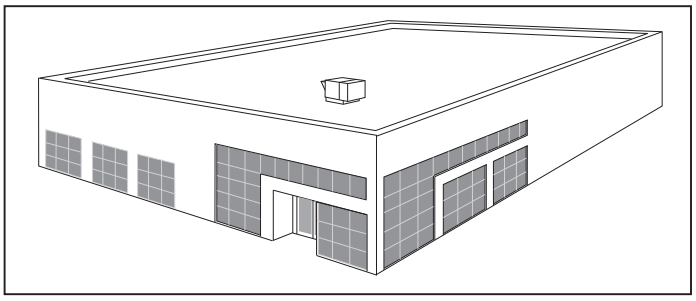


Figure 1. Manufacturing facility with offices in the front and manufacturing and warehousing in the back.

The perimeter and interior zones are shown in the floor plan in figure 2. The perimeter zones have the greatest variation in demand due to the effect of weather on the window areas and to a lessor extent, the walls. Figure 3 illustrates the effect of windows on the heat load for the perimeter spaces. It is important to define the perimeter areas as different zones than the interior space. And it is important to break the perimeter spaces into different zones based on their orientation.

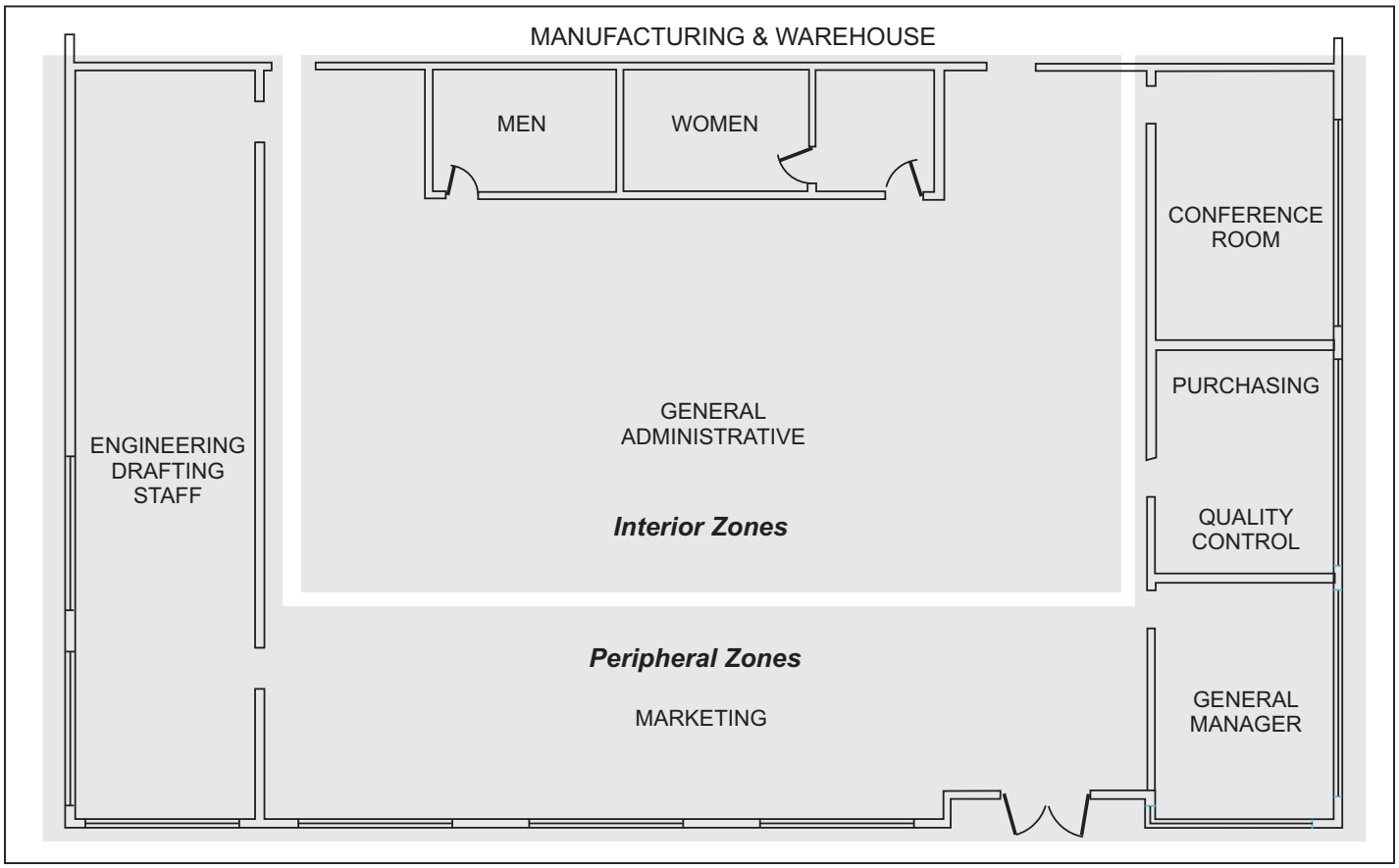


Figure 2. Floor plan of manufacturing facility.

Figure 3 shows the effect of solar and transmitted heat loads are significantly greater in perimeter zones than internal zones. And the effect of these loads changing dynamically with weather, orientation and time of day will have a significant effect on comfort. Zoning solves this problem.

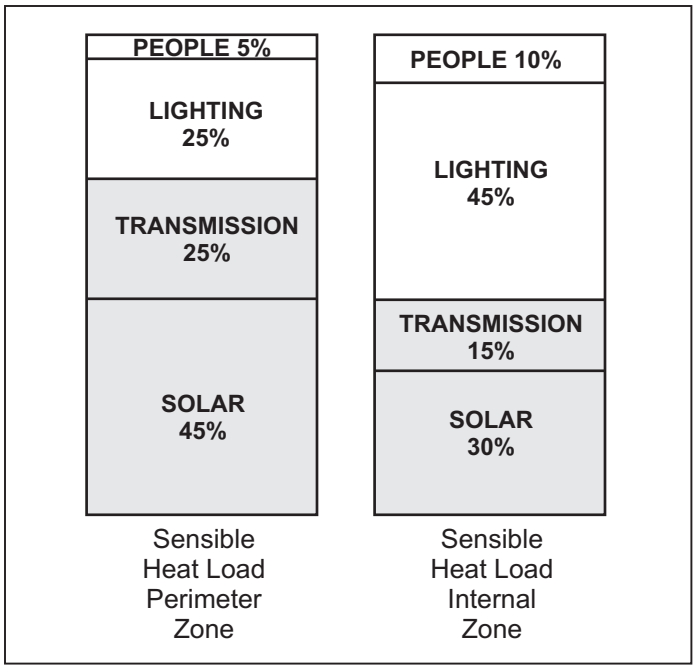


Figure 3. Sensible heat load for perimeter and internal zones.

Defining the Zones

Figure 4 shows how the offices in the example might be divided into zones. The perimeter areas and the internal areas are divided into different zones. The perimeter areas have been further divided into different zones. The conference room is a separate zone because it is only used intermittently. Other offices have been divided into different zones to provide more personal comfort.

Check for Comfort Problems

Discuss the discomfort problems being experienced by the staff. Here are some problems to look for.

- If an area is too warm during the cooling season and too cold during the heating season, it may indicate the ducts servicing the area are not large enough.
- If most areas are too warm during peak cooling season or too cold during peak heating season, it may indicate the heating or cooling equipment is not large enough.
- If areas are too warm during heating calls or too cold during cooling calls, zoning will improve this problem.

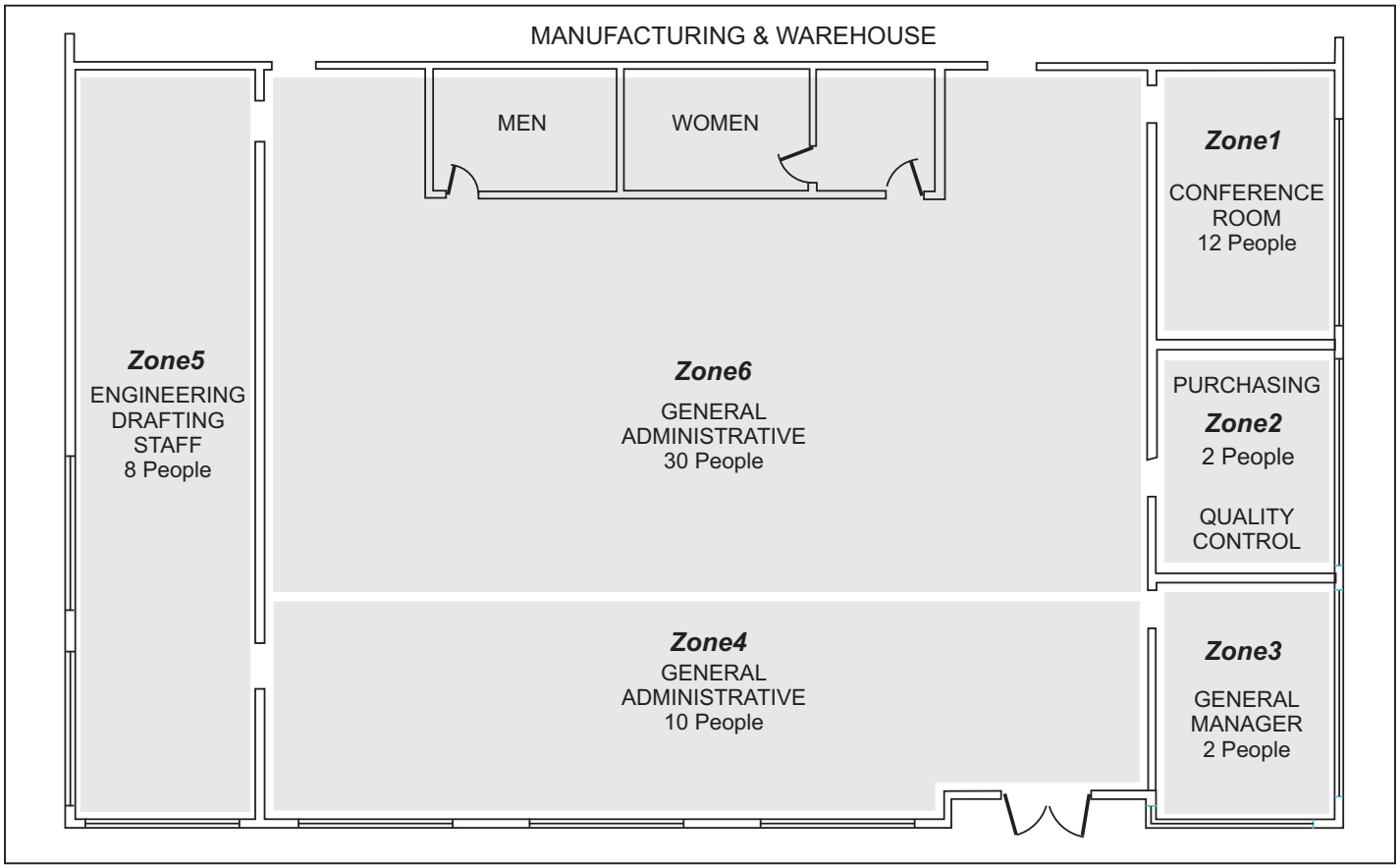


Figure 4. Zoning plan for manufacturing facility.

Defining the Zones

Figure 4 shows how the offices in the example might be divided into zones. Figure 5 shows the air distribution. The perimeter areas consist of Zones 1 through 5 and the internal area is Zone6. The demand for each of these zones can be calculated using ACCA Manual N. Shown in Table 1 is the peak cooling CFM demand calculated by Carrier for the example building.

Zone#	Description	Calculated CFM	Area Sq. Ft.	CFM Per Sq. Ft.
1	Conference Room	681	375	1.82
2	QC/Purchasing	317	225	1.41
3	General Manager	509	300	1.70
4	Marketing	1461	1050	1.39
5	Engineering	1540	900	1.71
6	General Administration	2043	3150	.65

Table 1. Zone CFM requirements.

A calculation of CFM requirements using ACCA Manual N is the most accurate method of determining CFM requirements. From Table 1, the average CFM per square foot for perimeter zones is 1.58 whereas interior zones require only .65 CFM per square foot. And the size of the zones vary greatly.

Although many zoning panels assume equal sized zones when operating the HVAC equipment, our panels allow the contractor to enter the CFM or %Demand for each zone for intelligent staging of the equipment. This will be explained further when the zoning panel options are described.

Placing the Zone Dampers

The dampers are placed in the duct work to control the airflow to each zone. Some zones may require two or more dampers to control the airflow because of the duct work layout. Zones 5 and 6 in the example shown in Figure 6 require two dampers. The CRDA250 dampers are commercial quality and can be operated open/close or modulating.

Modulating dampers can be used to eliminate constructing bypass duct work with a barometric damper. The non-calling zone dampers can be used to bypass excess airflow. The zoning panel calculates the amount of bypass required based on the demand and opens the non-calling zone dampers just enough to maintain the minimum airflow. This method of bypass is preferred by the CEC rather than bypass excess airflow to the return duct.

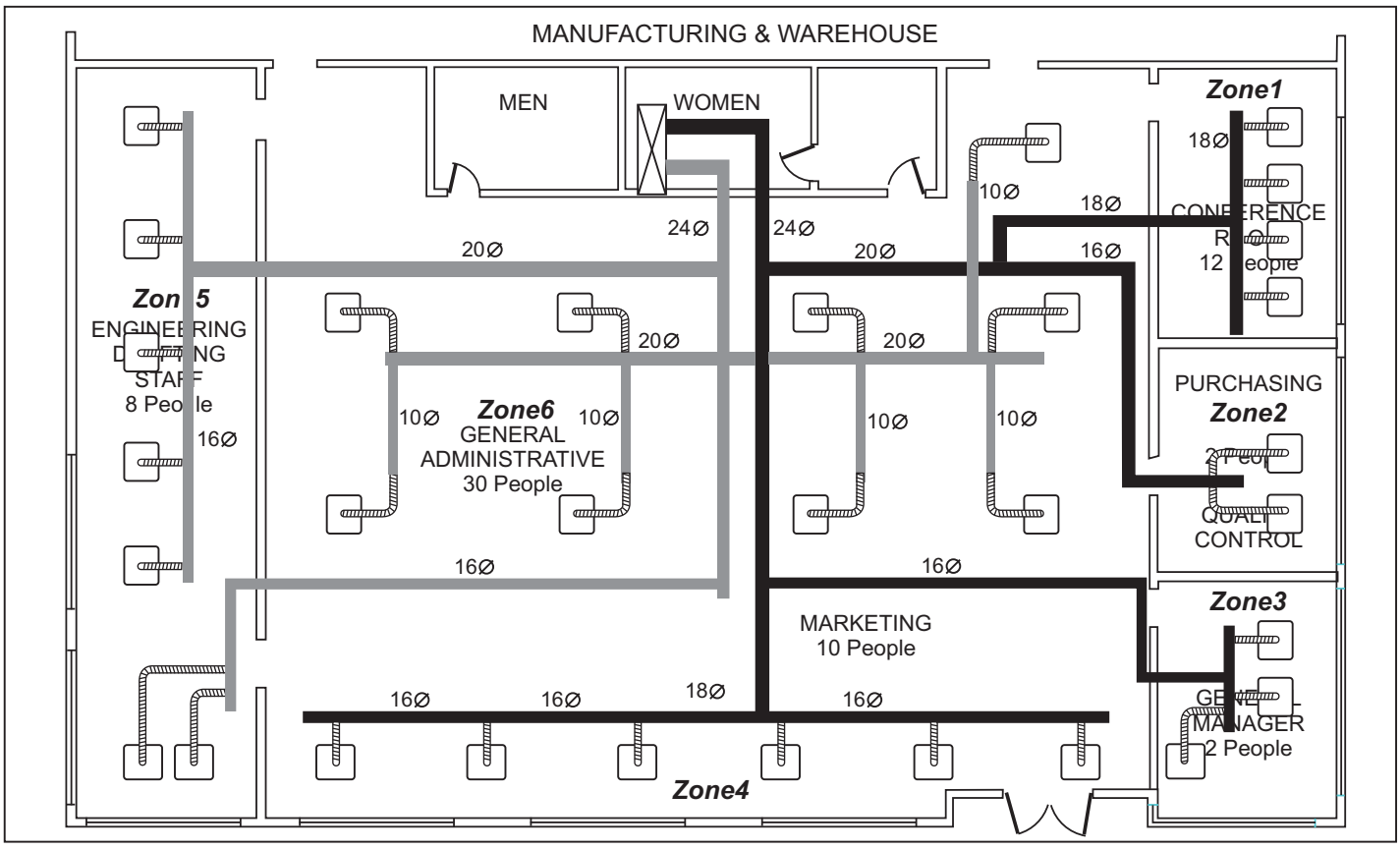


Figure 5. Duct work layout.

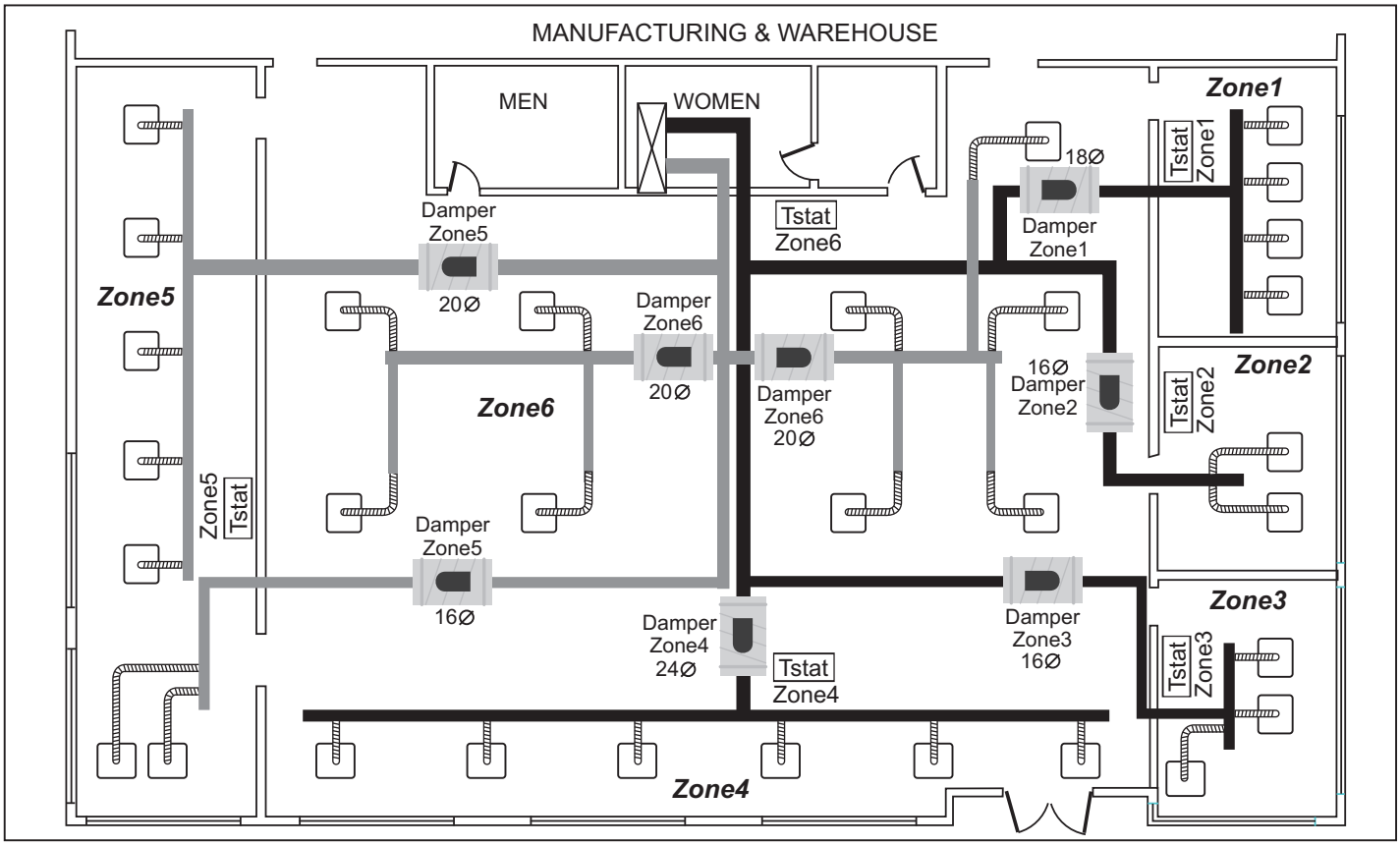


Figure 6. Damper and thermostat placement.

eWD3 Zoning Panel

The eWD3P Zoning Panel is shown in figure 7. This panel uses the PDM on the panel to select and program a wide range of options, display the status of each zone thermostat, the equipment, dampers and the sensors. It can also perform installation tests to insure the installation is operating properly and can even display the contractor's name and telephone number.

Zones — Up to 3 zones on the eWD3P and up to 12 zones using the eWD3X expansion panels.

Compatible Equipment — Gas/Electric systems, conventional and dual fuel Heat Pumps.

Gas/Electric Stages — Up to three-stage heating and two-stage cooling.

Heat Pump Stages — Up to four-stage heating (two compressors and auxiliary heat) and two-stage cooling.

Compatible Zone Thermostats — Any combination of heat/cool or heat pump thermostats. 24VAC or battery powered or power robbing.

Compatible Zone Dampers — Any 24VAC open/close damper or eControls commercial, modulating CRDA250 series.

Bypass Control — External using a bypass duct with a barometric damper or by automatically modulating the non-calling zone dampers.

Optional Sensors — Discharge and outdoor temperature sensors and duct pressure sensor.

LED Display — Multi-color LEDs indicate the call status of each zone thermostat, equipment call status, panel status and status of each damper. Viewable with the cover installed or removed.

PDM Display — The PDM display is a 2 line by 16 character display that tutors the installer through the selection of options or the display of information. The user can display information and even the contractor info.

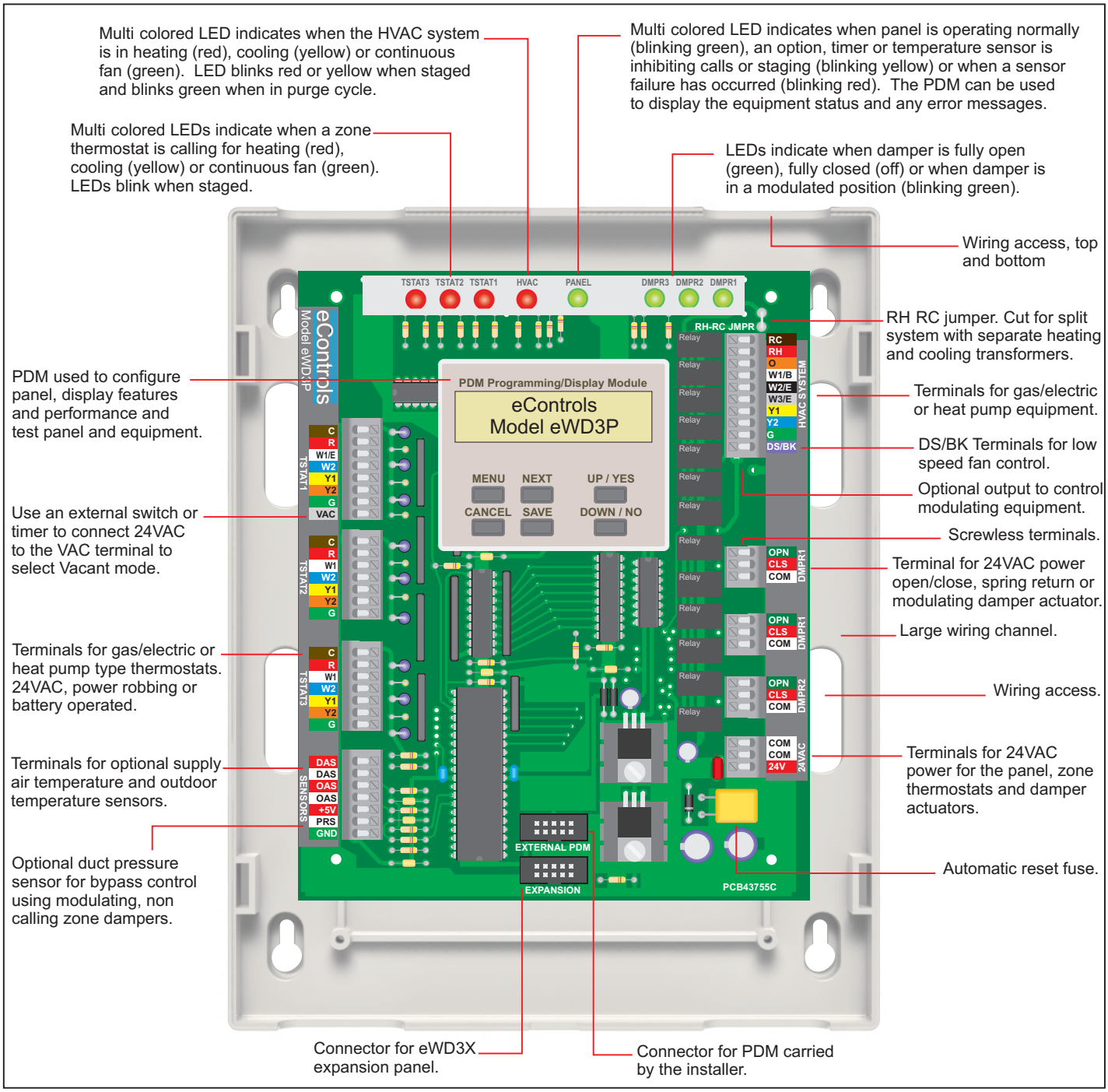


Figure 7. eWD3P Zoning Panel features.

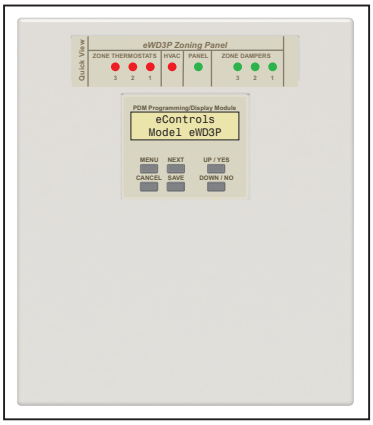


Figure 8. eWD3P Zoning Panel with cover installed.

Power Wiring

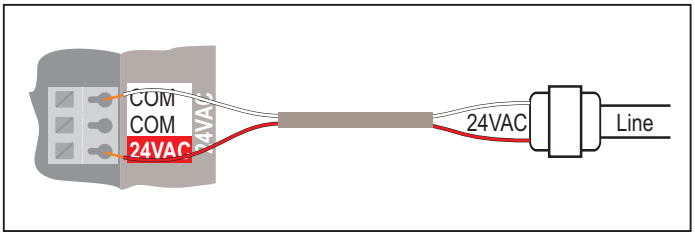


Figure 8. 24VAC power wiring for panel and dampers.

	Maximum VA	Typical VA
eWD3 Panel	10VA	10VA
eWD3XExpansion	10VA	10VA
Zone Thermostat	1.8VA	1.0VA
Zone Damper	4.0VA	0.7VA

Table 2. VA rating for zoning components.

Table 2 shows the transformer VA required for a 3-zone installation with 3 to 12 dampers to construct the zones. In zoning operation at least one zone is not operating when the other zones are operating and thermostats only use the 1.8VA power when they are calling for heating, cooling or fan. This combined with the 6.25-second operating time for a damper reduces the real VA required. The transformer VA ratings shown in the Tables 4, 5 and 6 conservatively reflect the real VA required.

	Max VA	Total VA	Transformer VA
eWD3P Panel	10 VA	10VA	
Zone Thermostats	3 @1.8VA	5.4VA	
Zone Dampers	3@4.0VA	12VA	40VA
Zone Dampers	6@4.0VA	24VA	40VA
Zone Dampers	9@4.0VA	36VA	50VA
Zone Dampers	12@4.0VA	48VA	60VA

Table 3. Transformer required for a 3-zone installation.

When an eWD3P Zoning Panel is used with one or more eWD3X Expansion Panels, a single transformer can be used to power the eWD3P and the eWD3X. When one transformer is used it is important that the wiring of the 24VAC and COM terminals be consistent as shown in Figure 9.

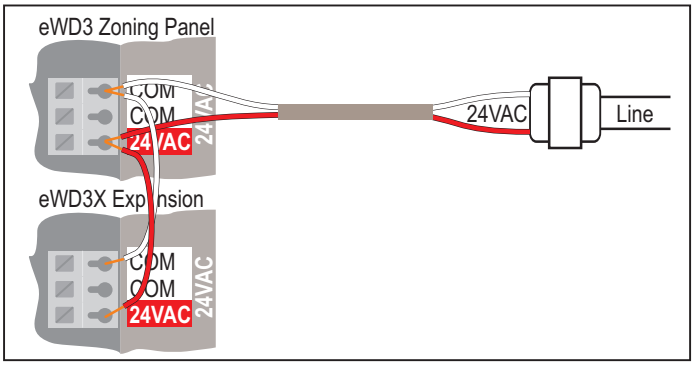


Figure 9. One transformer powering eWD3P and eWD3X.

	Max VA	Total VA	Transformer VA
eWD3 Panel	10VA	10VA	
eWD3X Expansion	10VA	10VA	
Zone Thermostats	6 @1.8VA	10.8VA	
Zone Dampers	6@4.0VA	24VA	50VA or 40VA/40VA
Zone Dampers	9@4.0VA	36VA	60VA or 40VA/40VA
Zone Dampers	12@4.0VA	48VA	75VA or 40VA/40VA
Zone Dampers	15@4.0VA	60VA	80VA or 40VA/4oVA

Table 4. Transformer required for a 6-zone installation.

	Max VA	Total VA	Transformer VA
eWD3 Panel	10VA	10VA	
eWD3X Expansion	2@10VA	20VA	
Zone Thermostats	9@1.8VA	16.2VA	
Zone Dampers	9@4.0VA	36VA	80VA or 40VA/40VA
Zone Dampers	12@4.0VA	48VA	50VA/40VA
Zone Dampers	15@4.0VA	60VA	50VA/50VA
Zone Dampers	18@4.0VA	72VA	80VA/40VA

Table 5. Transformer required for a 9-zone installation.

	Max VA	Total VA	Transformer VA
eWD3P Panel	10VA	10VA	
eWD3X Expansion	3@10VA	20VA	
Zone Thermostats	12@1.8VA	21.6VA	
Zone Dampers	12@4.0VA	48VA	50VA/50VA
Zone Dampers	15@4.0VA	48VA	60VA/60VA
Zone Dampers	18@4.0VA	60VA	60VA/60VA
Zone Dampers	21@4.0VA	72VA	80VA/60VA

Table 6. Transformer required for a 12-zone installation.

CRDA250 Zone Dampers

The CRDA250 damper series are heavy duty dampers for commercial applications. They use the A250 modulating, 24VAC actuator for positioning a damper up to 24 inches in diameter with 2-inch H_2O pressure.

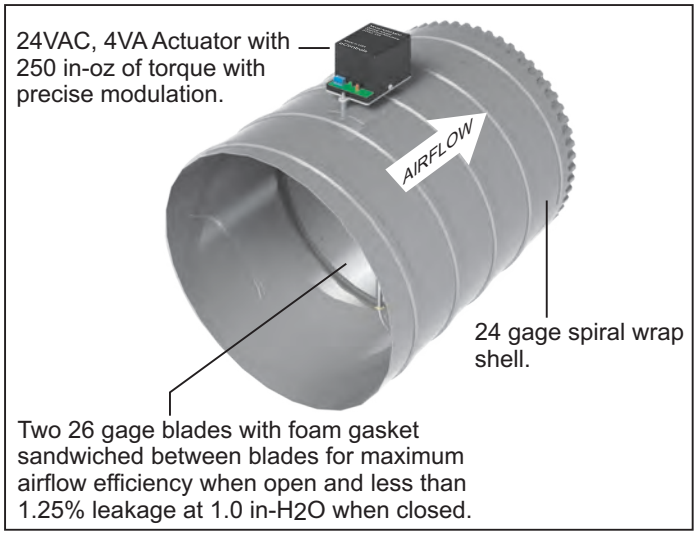


Figure 9. CRDA250 Series damper.

Operation Open/close or modulating.

Operation Time 6.25 seconds from fully open to fully closed.

Output Torque 250 inch-ounces.

Control 24VAC applied to Open or Close terminal.

LED Indicators Red LED on when fully closed and green LED On when fully open.

Electrical Power 24VAC, 4VA operating and .7VA holding.

Damper Shell Spiral wrapped, 22 to 26 gage galv steel.

Damper Blade Dual V-grooved, 26 gage, galvanized steel with neoprene gasket sandwiched between blades for efficient airflow..

Air Leakage Less than 1.25% air leakage within the damper when closed and less than .25% external air leakage.

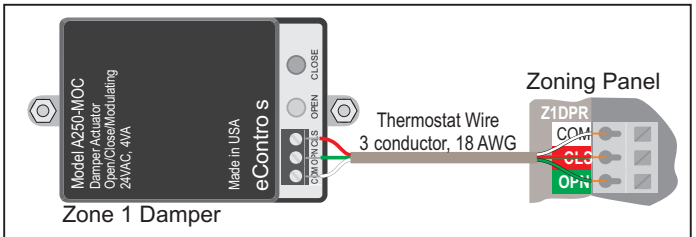
Maximum Static Pressure 2 inches H2O.

Model No.	Diameter	Shell Length
CRDA250-006	6 inches	10 inches
CRDA250-008	8 inches	10 inches
CRDA250-009	9 inches	10 inches
CRDA250-010	10 inches	12 inches
CRDA250-012	12 inches	14 inches
CRDA250-014	14 inches	16 inches
CRDA250-016	16 inches	18 inches
CRDA250-018	18 inches	20 inches
CRDA250-020	20 inches	22 inches
CRDA250-022	22 inches	24 inches
CRDA250-024	24 inches	26 inches

Table 7. Damper Model number, diameter and length.

Zone Damper Wiring

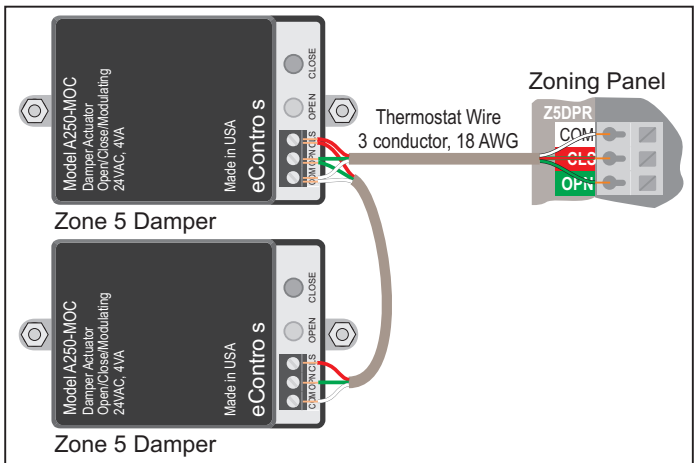
The three terminals on the zone damper actuator are wired to the corresponding zone damper terminals on the zoning panel.



Zoning Panel	Damper	Terminal Function
COM	COM	24VAC common
OPN	OPN	Opens damper
CLS	CLS	Closes Damper

Figure 10. Wiring CRDA250 actuator.

When 2 or more dampers are used for a zone, the dampers can be wired in parallel. Up to 6 dampers can be wired in parallel to form a zone.



Zoning Panel	Damper1	Damper6	Terminal Function
COM	COM	COM	24VAC common
OPN	OPN	OPN	Opens damper
CLS	CLS	CLS	Closes Damper

Figure 11. Wiring CRDA250 actuators when multiple dampers are used to form a zone.

Placing the Zone Thermostats

A thermostat is installed in each zone. It should be located on an interior wall and out of sunlight so it sensors the zone temperature. Figure 6 illustrates the location of the thermostats in the example. Each zone thermostat is wired to the corresponding terminals on the zoning panel.

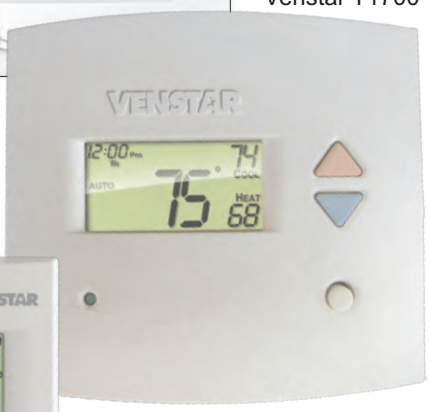
Compatible Zone Thermostats

Any 24VAC, battery powered or power robbing thermostat can be used with the eWD3 Zoning Panel. The type of thermostat (Heat/Cool or Heat Pump) can be selected for each zone.

When the panel controls a conventional or dual fuel heat pump, a heat pump thermostat should be used in Zone1 to have access to select emergency heating. The other zones can use Heat/Cool thermostats. The Zone1 Heat Pump thermostat is the master control emergency heating. Zoning panels used with Gas/Electric systems should use Heat/Cool thermostats. Some examples of compatible thermostats are shown below.

Venstar T5800

Venstar T1700

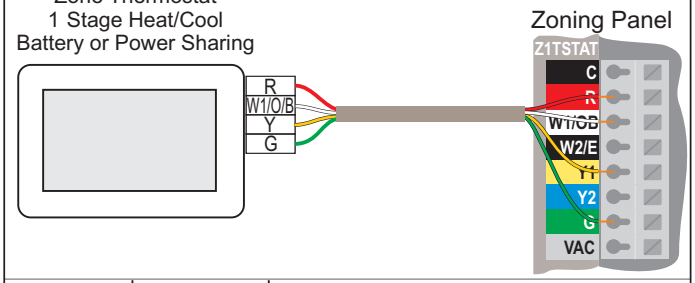


Venstar T2300FS

Zone Thermostat Wiring, Gas/Electric Equipment

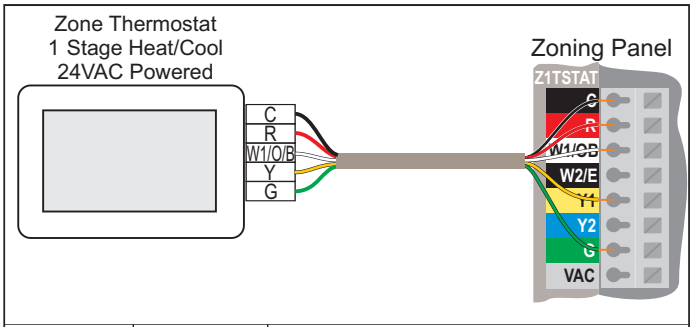
Zone thermostats used with gas/electric equipment are either single or two-stage Heat/Cool thermostats and thermostat terminals are wired to corresponding terminals on the zoning panel.

Figure 7 shows the connections for a single-stage Heat/Cool, battery powered or power sharing thermostat and Figure 12 shows a 24VAC powered Heat/Cool thermostat.



Thermostat	Zoning Panel	Terminal Function
R	R	Provides 24VAC to other terminals
W1/O/B	W1/OB	Activates heating when 24VAC
Y1	Y1	Activates cooling when 24VAC
G	G	Activates fan when 24VAC

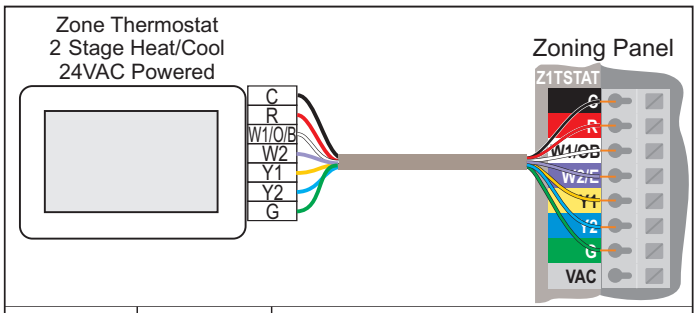
Figure 12. Wiring 1-stage, Heat/Cool, battery powered or power robbing zone thermostat.



Thermostat	Zoning Panel	Terminal Function
R	R	24VAC for Thermostat and Terminals
C	C	24VAC Common
W1/O/B	W1/OB	Activates heating when 24VAC
Y1	Y1	Activates cooling when 24VAC
G	G	Activates fan when 24VAC

Figure 13. Wiring 1-stage, Heat/Cool, 24VAC zone thermostat.

Two-stage thermostats can be used when 2-stage equipment is controlled by the zoning panel. The use of 2-stage thermostats or call demand to control equipment staging is discussed when options are selected.



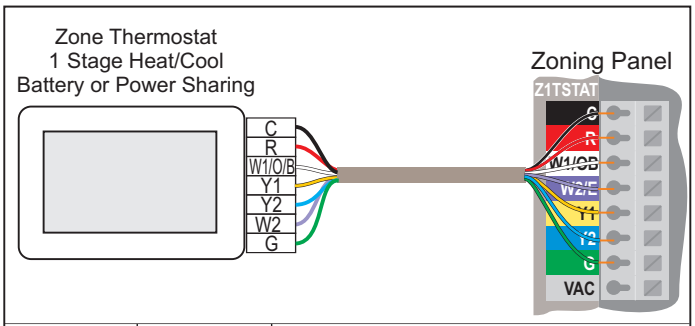
Thermostat	Zoning Panel	Terminal Function
R	R	24VAC for Thermostat and Terminals
C	C	24VAC Common
W1/O/B	W1/OB	Activates Stage1 Heating when 24VAC
W2	W2/E1	Activates Stage2 Heating when 24VAC
Y1	Y1	Activates Stage1 Cooling when 24VAC
Y2	Y2	Activates Stage2 Cooling when 24VAC
G	G	Activates Fan when 24VAC

Figure 14. Wiring 2-stage, Heat/Cool, 24VAC zone thermostat

Zone Thermostat Wiring, Heat Pump Equipment

Zone thermostats used with heat pump equipment have either single or two-stage compressor outputs, an O or B output for selecting heating or cooling and an output for controlling auxiliary electric strip heating or fossil fuel heating in a dual fuel heat pump.

Figure 15 shows the connections for a 2-stage Heat/Cool, 24VAC heat pump thermostat and the function of each terminal.



Thermostat	Zoning Panel	Terminal Function
R	R	24VAC for Thermostat and Terminals
C	C	24VAC Common
W1/O/B	W1/OB	Controls the reversing valve.
W2	W2/E1	Activates Auxiliary Heating when 24VAC
Y1	Y1	Activates Stage1 Compressor when 24VAC
Y2	Y2	Activates Stage2 Compressor when 24VAC
G	G	Activates Fan when 24VAC

Figure 15. Wiring 1-stage, Heat/Cool, battery powered or power sharing zone thermostat.

Emergency Heat Control

Although a Heat/Cool thermostat could be used in Zone1, a Heat Pump is required for emergency heat control. When Zone1 makes a call for emergency heating, the zoning panel will activate emergency heating when making a heating call.

The W/E terminal acts as a call for auxiliary heating or emergency heating. In emergency heating the Y1 and Y2 terminals will be 0VAC.

When using Heat/Cool thermostats with zoning panels controlling a heat pump, they are wired the same as with a gas/electric system as shown in Figure 14.

Vacant Terminal at Zone1

The VAC terminal can be used with a switch or timer to activate the VAC terminal and initiate the Vacant operation. In the Vacant mode the equipment and all the zone dampers are controlled by the Zone1 thermostat. The Zone1 thermostat can be a 7-day programmable and can be set to energy saving temperatures for periods when the building is not occupied. This allows manual thermostats to be used in all other zones and they will be automatically over-ridden when the VAC terminal is activated.

Vacant Operation Using a Switch

Figure 16 shows a switch being used to activate the Vacant mode, Program the Zone1 thermostat for energy saving nighttime temperatures. Set the Vacant/Occupied switch to Vacant and all the zones will use the Zone1 temperature settings.

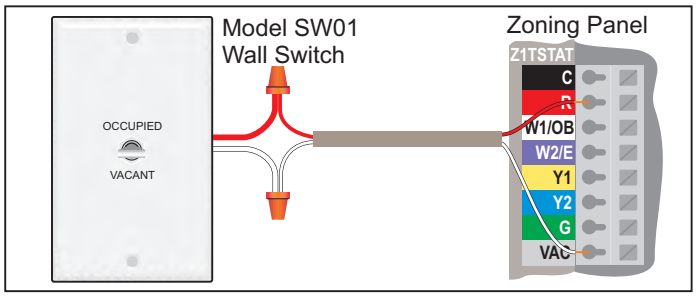


Figure 16. Wall switch used to control Vacant mode.

Figure 17 shows a timer with dry relay contacts controlling Vacant mode.

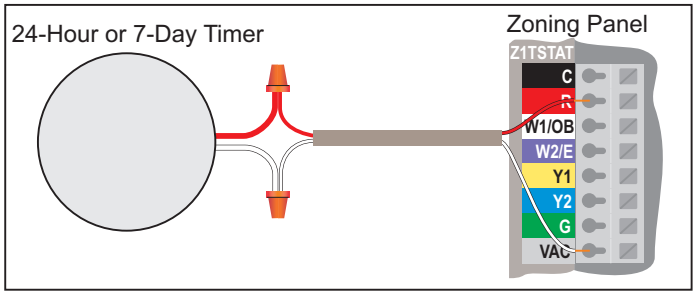


Figure 17. Timer used to control Vacant mode.

Optional Outdoor Temperature Sensor

A Model TS03 outdoor temperature sensor is required for dual fuel heat pump control. It is used to switch the heat pump from compressor heating to fossil fuel heating. The changeover temperature is set using the PDM.

An outdoor temperature sensor can also be used to limit the use of secondary heating in moderate weather.

The zoning panel automatically detects if an outdoor temperature sensor is installed. If an open or short occurs in the sensor or wiring, the panel detects it and will blink the Panel Status LED red until it is corrected.

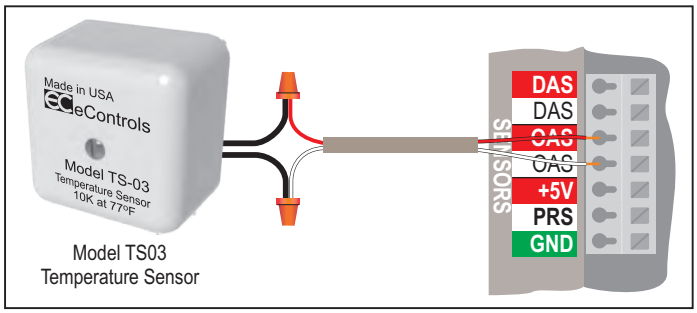


Figure 18. Outdoor temperature sensor connection.

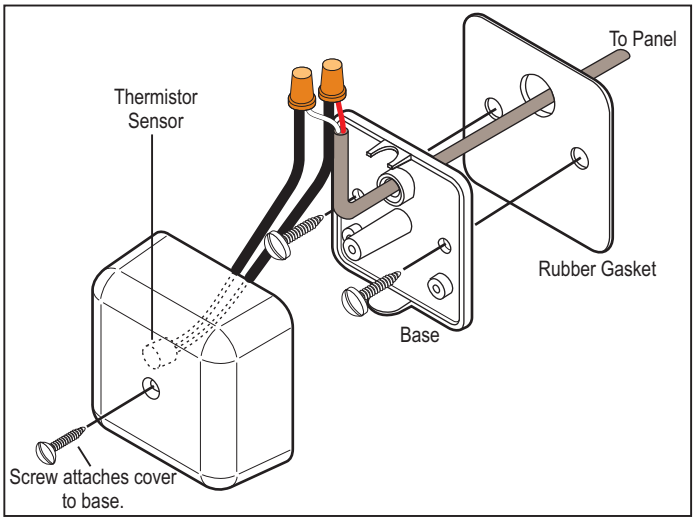


Figure 19. Outdoor temperature sensor wiring.

Installing the Outdoor Temperature Sensor

Find a suitable location that is not in direct sunlight and protected from rain or snow such as under the eves. Drill a 3/8 inch access hole and pass the thermostat cable through the drilled hole, gasket and the access hole in the base of the sensor. Use the wire nuts supplied to connect the sensor wires to the thermostat cable wires. Either sensor wire can be connected to the red or white thermostat wire. Secure the sensor base using the two screws and attach the sensor cover to the base as shown in figure 19.

Optional Discharge Air Temperature Sensor

A Model TS02 temperature sensor can be used to monitor the discharge air temperature to insure it does not exceed high and low temperature limits set using the PDM. The sensor is automatically detected by the panel. If an open or short occurs in the sensor or wiring, the Panel Status LED will blink red.

If either the heating or cooling discharge air temperature exceeds the limits set on the panel, the heating or cooling will downstage until the temperature is within limits. The fan is kept running.

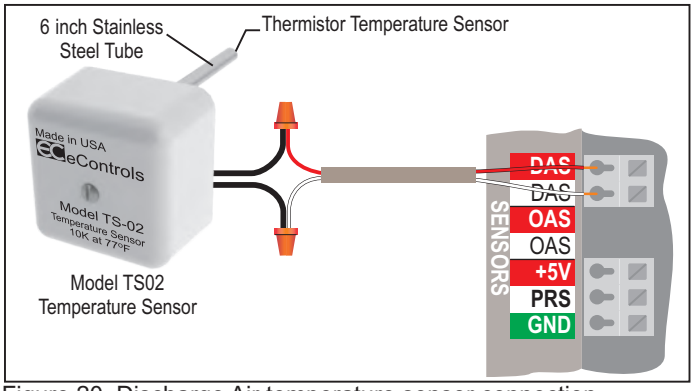


Figure 20. Discharge Air temperature sensor connection.

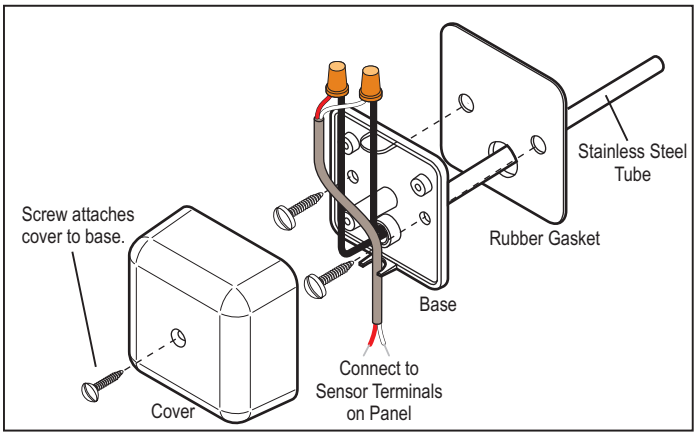


Figure 21. Discharge Air temperature sensor wiring.

Installing the Discharge Temperature Sensor

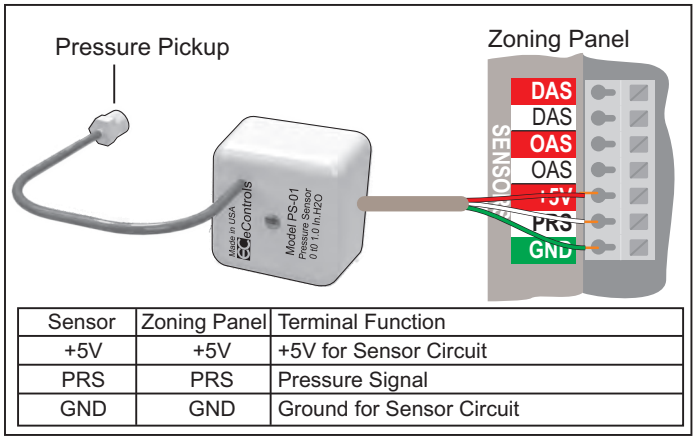
The Discharge Air temperature sensor should be installed in the supply duct or plenum at least 12 inches from any coils or heating elements. Drill a 3/8 inch access hole and pass the stainless steel tube through the gasket and the hole. Secure the sensor base with the two screws. Connect the sensor wires to the thermostat cable using the wire nuts. Replace the sensor cover with the thermostat cable passing through the wire retainer.

Warning!

Be careful when drilling into the plenum not to damage any coils or heating elements in the plenum.

Optional Duct Pressure Sensor

A Model PS01 pressure sensor can be used to monitor the pressure in the ducts to control bypass using the non-calling zone dampers. If the pressure rises above the pressure limit set, the non-calling zone dampers open just enough to keep the pressure from exceeding the limit.



Sensor	Zoning Panel	Terminal Function
+5V	+5V	+5V for Sensor Circuit
PRS	PRS	Pressure Signal
GND	GND	Ground for Sensor Circuit

Figure 22. Duct Pressure sensor connection.

Installing the Duct Pressure Sensor

The Duct Pressure sensor pickup should be installed in the main duct run about 6-feet before it splits into duct runs to service specific zones. Drill a 3/8 inch diameter hole and thread the sensor into the hole. Seal the sensor and duct. Remove the sensor cover and attach the sensor to the duct using the two screws. Attach the wires as shown in figure 23. Replace the cover.

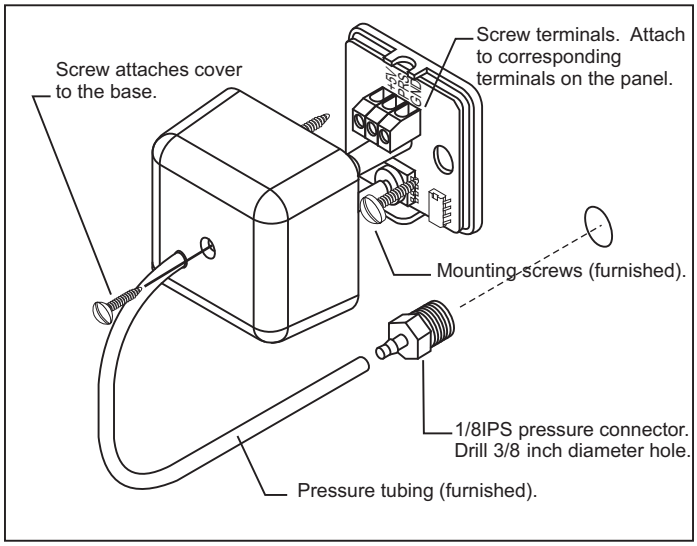


Figure 23. Duct Pressure installation.

HVAC Equipment Wiring

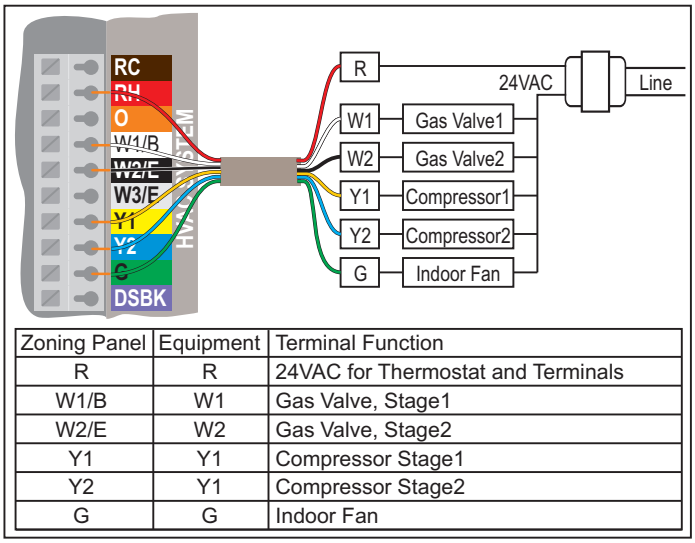
The zoning panel can control gas/electric, conventional heat pumps and dual fuel heat pumps. The function of the equipment control terminals on the zoning panel are shown in Table 7.

Terminal	Gas/Electric System	Heat Pump
RC	24VAC from cooling equipment	24VAC from heat pump
RH	24VAC from heating equipment	24VAC from heat pump
	RC and RH are jumpered on the zoning panel. Cut jumper for separate heating and cooling 24VAC	
O	Not used	O reversing valve control
W1/B	Stage1 Heating	B reversing valve control
W2/E	Stage2 Heating	Stage1 auxiliary heating
W3/E	Stage3 Heating	Stage2 auxiliary heating
Y1	Stage1 Compressor	Stage1 Compressor
Y2	Stage2 Compressor	Stage2 Compressor
G	Indoor Fan Control	Indoor Fan Control
DS/BK	Low Speed Fan Control	Low Speed Fan Control

Table 7. Equipment control terminal functions.

Gas Electric Equipment Wiring

Wiring for a typical gas/electric system with two-stage heating and two-stage cooling is shown in Figure 24.



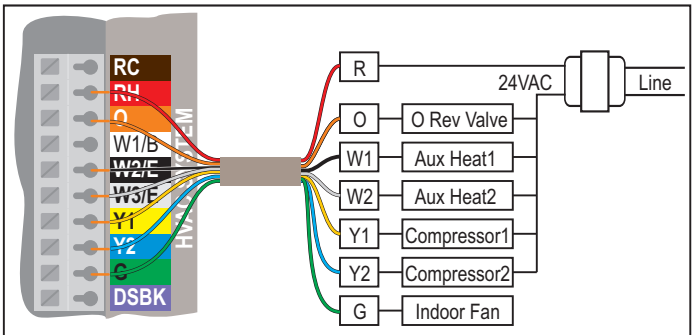
Zoning Panel	Equipment	Terminal Function
R	R	24VAC for Thermostat and Terminals
W1/B	W1	Gas Valve, Stage1
W2/E	W2	Gas Valve, Stage2
Y1	Y1	Compressor Stage1
Y2	Y1	Compressor Stage2
G	G	Indoor Fan

Figure 24. Wiring a Gas/Electric system with 2 heating and 2 cooling stages.

Heat Pump Equipment Wiring

Wiring for a typical heat pump system with two compressors or a 2-stage compressor and 2 stages of auxiliary heating is shown in figure 25.

The O and the W1/B terminals are the O and B terminals controlling the heat pump reversing valve. The W2/E and W3/E terminals control the auxiliary heating electric strip heating in a conventional heat pump or the fossil fuel heating in a dual fuel heat pump.



Zoning Panel	Equipment	Terminal Function
R	R	24VAC
O	O	O Reversing Valve
W2/E	W1	Auxiliary Heat, Stage1
W3/E	W2	Auxiliary Heat, Stage2
Y1	Y1	Stage1 Compressor
Y2	Y2	Stage2 Compressor
G	G	Indoor Fan

Figure 25. Wiring a Heat Pump system with a 2-stage compressor and 2 auxiliary heating stages.

Staging in Gas/Electric Equipment

The zoning panel reads the heating and cooling demand from each zone thermostat. The panel initiates, upstages, down-stages or terminates a heating, cooling or fan call. Table 8 shows the panel outputs during staging of heating and cooling for a Gas/Electric system. If the Electric Fan option is selected, the G terminal will be On (24VAC) during heating calls. If the Gas Fan option is selected, the equipment plenum sensor controls the fan in heating and the G terminal is Off (0VAC).

Terminal	No Call	Fan	Heat1	Heat2	Heat3	Cool1	Cool2
O	NU	NU	NU	NU	NU	NU	NU
W1/B	0VAC	0VAC	24VAC	24VAC	24VAC	0VAC	0VAC
W2/E	0VAC	0VAC	0VAC	24VAC	24VAC	0VAC	0VAC
W3/E	0VAC	0VAC	0VAC	0VAC	24VAC	0VAC	0VAC
Y1	0VAC	0VAC	0VAC	0VAC	0VAC	24VAC	24VAC
Y2	0VAC	0VAC	0VAC	0VAC	0VAC	0VAC	24VAC
G	0VAC	24VAC	0VAC	0VAC	0VAC	24VAC	24VAC

Table 8. Output terminal states in a Gas/Electric system.

Staging in Heat Pump Equipment

In a heat pump configuration, the W1/B terminal is the B reversing valve terminal, W2/E is the first stage of auxiliary heat and W3/E is the second stage of auxiliary heating.

Tables 9 and 10 show the panel outputs during staging of heating and cooling for a Heat Pump system. The O and B reversing valve terminals do not change state between calls. They only change state when switch between heating and cooling. Dual fuel heat pump do not down-stage from fossil fuel heating to compressor heating to prevent damage from over heating the indoor coil. The panel will stay in fossil fuel heating until the call is terminated. LS is the last state.

Terminal	No Call	Heat1	Heat2	Heat3	Heat4	EmHt1	EmHt1
O	LS	0VAC	0VAC	0VAC	0VAC	OVAC	0VAC
W1/B	LS	24VAC	24VAC	24VAC	24VAC	24VAC	24VAC
W2/E	0VAC	0VAC	0VAC	24VAC	24VAC	24VAC	0VAC
W3/E	0VAC	0VAC	0VAC	0VAC	24VAC	24VAC	24VAC
Y1	0VAC	24VAC	24VAC	24VAC	24VAC	0VAC	0VAC
Y2	0VAC	0VAC	24VAC	24VAC	24VAC	0VAC	0VAC
G	0VAC	24VAC	24VAC	24VAC	24VAC	24VAC	24VAC

Table 9. Output terminal states in heating calls in a Heat Pump.

Terminal	No Call	Fan	Cool1	Cool2	
O	LS	LS	24VAC	24VAC	
W1/B	LS	LS	0VAC	0VAC	
W2/E	0VAC	0VAC	0VAC	0VAC	
W3/E	0VAC	0VAC	0VAC	0VAC	
Y1	0VAC	0VAC	24VAC	24VAC	
Y2	0VAC	0VAC	0VAC	24VAC	
G	0VAC	24VAC	24VAC	24VAC	

Table 10. Terminal states in fan and cooling calls in a Heat Pump.

DSBK Terminal Used to Control Low Speed Fan Operation

If the equipment has controls for low speed fan operation, the DSBK terminal can be used. Low speed fan operation is used during de-humidification using cooling and when a limited number of zones are calling for heating or cooling.

The PDM can select whether DSBK is On or OFF to control low speed fan operation. Table 11 shows the G and DSBK terminals for both the On and Off option.

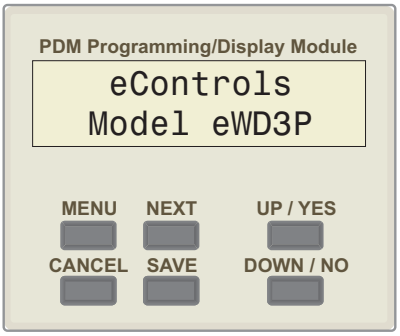
Fan Option	ON for Low Speed Fan			OFF for Low Speed Fan		
Fan Speed	OFF	LOW	HIGH	OFF	LOW	HIGH
G	0VAC	24VAC	24VAC	0VAC	24VAC	24VAC
DSBK	0VAC	24VAC	0VAC	24VAC	0VAC	24VAC

Table 11. DSBK terminal states for high and low speed fan operation.

PDM Programming and Display Module

The PDM provides the installer with a tutorial method of Selecting Equipment options, Selecting Damper options, Selecting Tstat options, Selecting Advanced options, Enter and Display Contractor info, Display Data and Selections and Testing a zoning installation.

The installer menu is accessed by pressing and holding the Menu key fo 7 seconds. The acceptable key strokes are shown in the lower right corner of the LCD display. The Cancel key can be used almost anytime to return to the main menu without saving any changes. Play with the PDM and explore the menus. Use the Restore Defaults to return the panel to the factory settings.

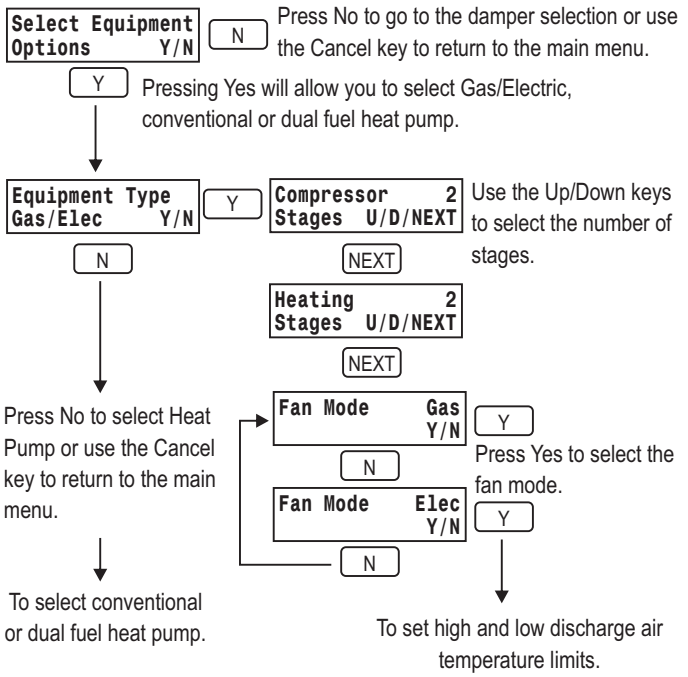


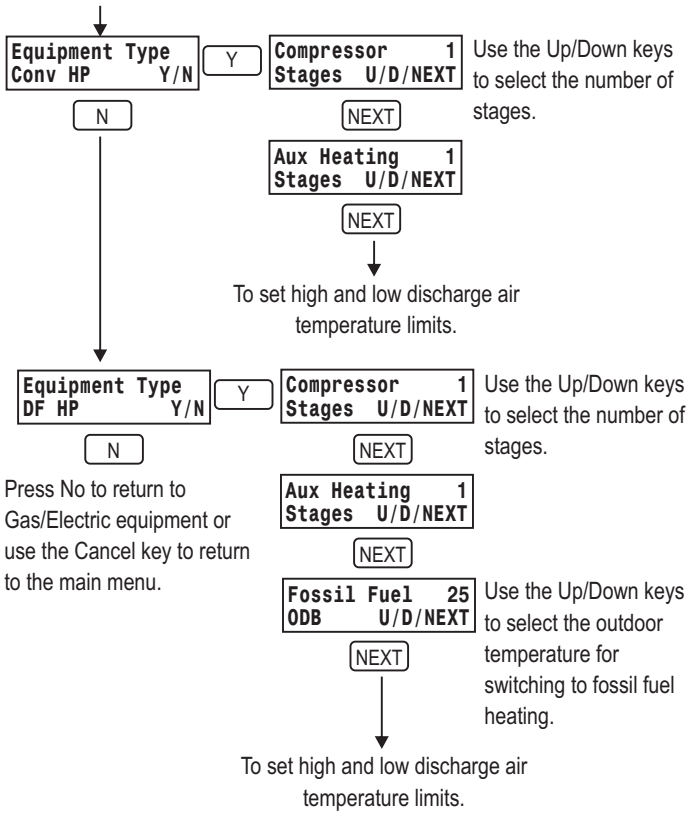
When accessing the Installer menu, the PDM will read a description of the panel and only those options compatible with the panel can be set.

Select Equipment Options

Select Type of Equipment

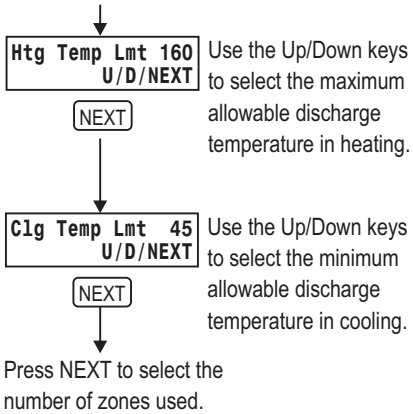
Access the Installer menu and use the Yes/No key display the Select Equipment Options menu.





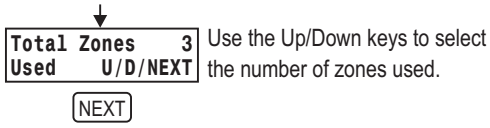
Setting High and Low Discharge Air Temperature Limits

The High DAT Limit is the highest temperature before the zoning panel down stages the heating and, if necessary, turns the heating off. The Low DAT Limit is the lowest before the zoning panel down stages the cooling and, if necessary, turns the cooling off. The indoor fan continues to operate during temperature limit down staging.



Setting the Number of Zones Used

Set the number of zones being used in the installation.

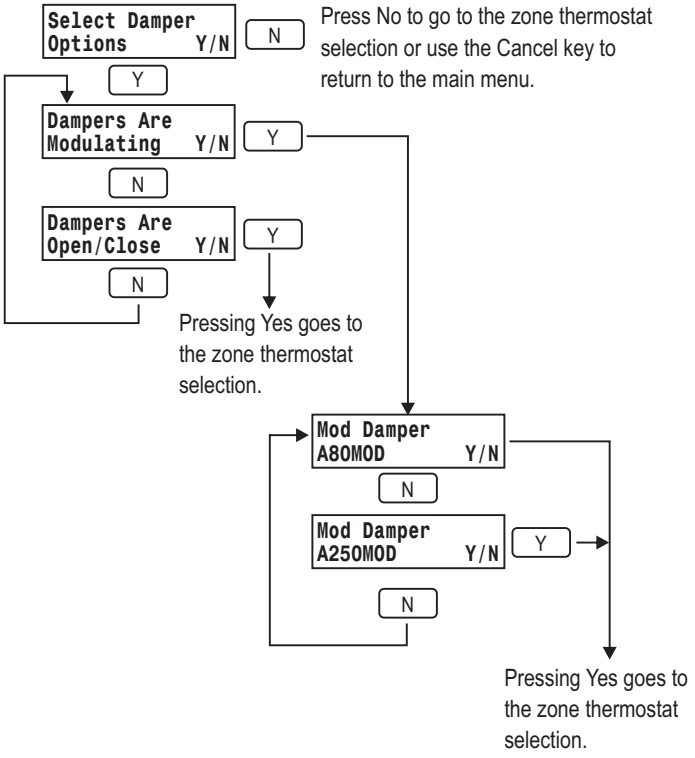


Pressing the Next key allows the option selections to be saved or continue to select other options.

Select Damper Options

Select Type of Damper

The eWD3P and eWD3X can use power open/close, spring open/power close or modulating dampers. Modulating dampers eliminate installing a bypass duct and barometric damper. All zones must use the same type damper/actuator.

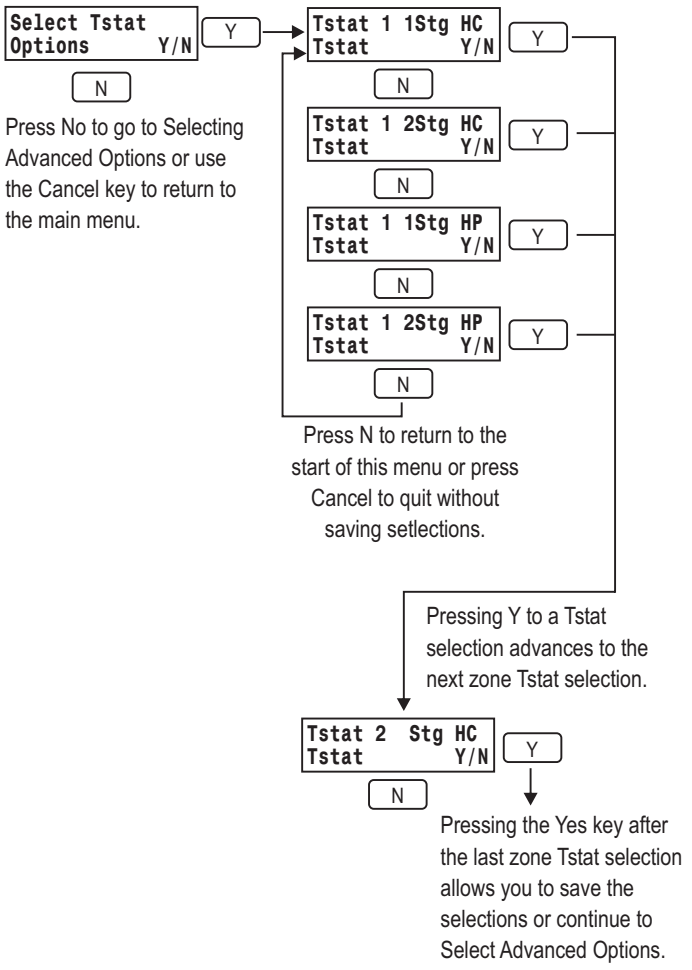


Select Thermostat Options

Select Type of Damper

The eWD3P and eWD3X can use Heat/Cool or Heat Pump thermostats. Heat pump thermostats can be either O type where the O terminal is 24VAC during cooling calls or the B type where the B terminal is 24VAC during heating calls.

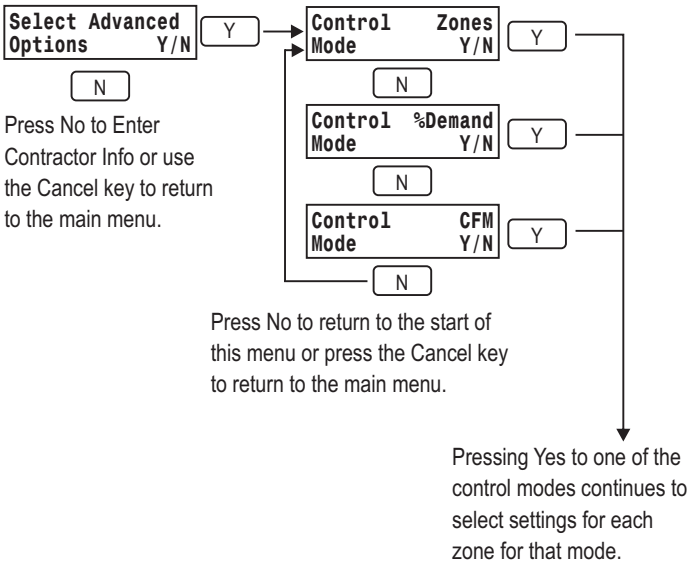
Only heat/cool thermostats can be used on gas/electric systems. Heat/cool or heat pump thermostats can be selected when a heat pump is being used. Only single stage thermostats can be used when the selected equipment is single stage. A thermostat type can be selected for each zone thermostat.



Select Advanced Options

Selecting the Control Mode

The panel controls bypass and staging based on zones, CFM or %Demand calling. If no selection is made, equal sized zones are used.

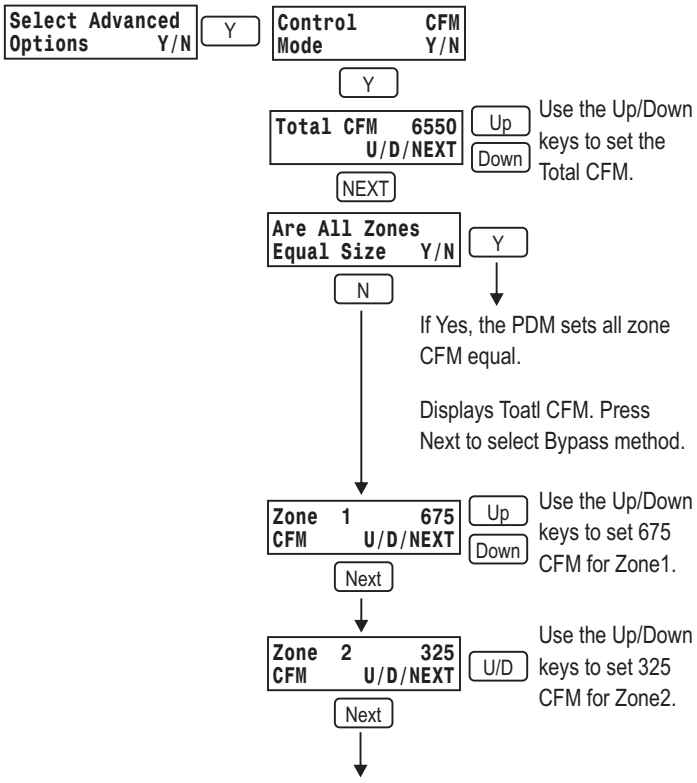


Selecting Control Mode Using CFM.

If the CFM required for each zone is known or is calculated, it should be used for control. Table1 from page 4 showed the CFM required for each zone. Table X below shows the CFM rounded to 25 CFM.

Zone#	Description	Calculated CFM	Rounded CFM
1	Conference Room	681	675
2	QC/Purchasing	317	325
3	General Manager	509	500
4	Marketing	1461	1450
5	Engineering	1540	1550
6	General Administration	2043	2050
		Total CFM	6550

Table X. CFM required for each zone.



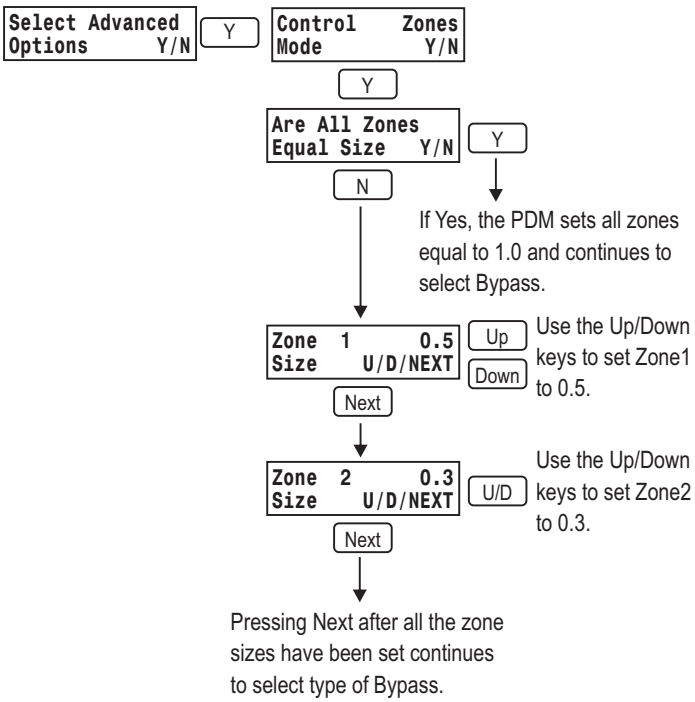
Selecting Control Mode Using Zones.

The eWD3P allows for different zone sizes for more intelligent bypass and staging. Each zone can be set to a weighted value. A small zone might be 0.3 and a large zone could be 1.9. The zone areas and the load factor in table 1 on page 4 can be used to define the zones.

Zone6 is an interior zone and its load is 40% of and exterior zone and is reduced by 40%x3150=1260 effective area. The average zone size is the Total Effective Area divided by the number of zones or 685. The relative size of each zone can be calculated by the Effective Area of the zone divided by 685. The calculations and results are shown in table X.

Zone#	Description	Area Sq. Ft.	Effective Area	Calculated Zone Size
1	Conference Room	375	375	375/685=.55
2	QC/Purchasing	225	225	225/685=.33
3	General Manager	300	300	300/685=.44
4	Marketing	1050	1050	1050/685=1.53
5	Engineering	900	900	900/685=1.31
6	Gen Adm	3150	1260	1260/685=1.83
			Total Effective Area 4110	
			Average Zone Effective Area 4110/6=685	

Table X. Calculating the relative zone value.



Selecting Control Mode Using % Demand.

The demand for each zone can be calculated and entered as a percent of the total demand(100%).

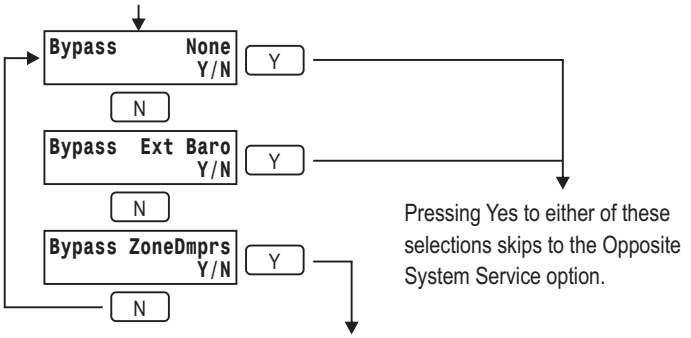
Zone6 is an interior zone and its load is 40% of and exterior zone and is reduced by 40%x3150=1260 effective area. The %Demand for each zone is the Effective Area of the zone divided by the Total Effective Area as shown in table X.

Zone#	Description	Area Sq. Ft.	Effective Area	Calculated Demand Size
1	Conference Room	375	375	375/4110=9%
2	QC/Purchasing	225	225	225/4110=5%
3	General Manager	300	300	300/4110=7%
4	Marketing	1050	1050	1050/4110=25%
5	Engineering	900	900	900/4110=22%
6	Gen Adm	3150	1260	1260/4110=31%
Total Effective Area 4110				

Table X. Calculating the %Demand of each Zone.

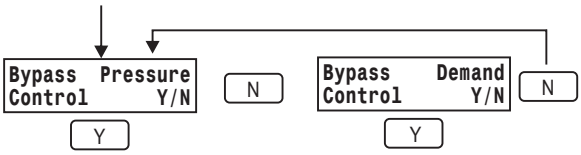
Select Type of Bypass

There are three bypass options– None, External duct work with a barometric damper or using the non-calling zone dampers with modulating actuators. If None or External Barometric is chosen, the zoning panel does not control bypass. The CEC is considering prohibiting using external bypass that returns the excess dis-charge air to the return air duct. The PDM can perform a bypass test that closes dampers and monitors the dis-charge air temperature to help define a setting for the bypass limit.



Select Bypass Control

Bypass using the non-calling zone dampers can be controlled by the Duct Pressure sensor or by the calling demand in Zones, CFM or %Demand.



Press Yes to select using the Duct Pressure sensor to control Bypass using the non-calling zone dampers and continue to set the H20 Bypass Limit.

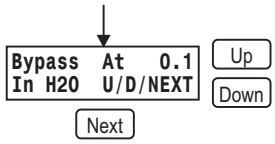
Press Yes to select using the calculated calling demand in CFM, Zones or %Demand to control Bypass using the non-calling zone dampers and continue to set the demand limit.

Setting the Duct Pressure Bypass Limit

The Duct Pressure sensor monitors the static duct pressure and as zones are satisfied and the zone dampers close, the duct pressure rises.

A test can be performed that sequentially closes dampers while monitoring and displaying the duct pressure. Note the pressure where the noise or the discharge air temperature could interfere with performance.

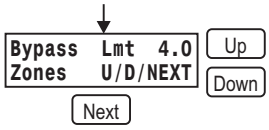
This is the limit set for bypass. Whenever the pressure reaches the limit, the panel will open the non-calling zone dampers about 6% and check the pressure. If the pressure is still above the limit, the panel opens the non-calling zone dampers another 6%. When the duct pressure drops below the limit, the panel will begin to close the non-calling zone dampers.



Pressing Next skips to the Opposite System Service option.

Setting the Bypass Limit Using Zones

If bypass control using Zones was selected, set the number of Zones at which bypass is required as shown below. If during the bypass test, the system operation was acceptable down to 4.0 zones in a 6-zone installation, set 4.0 as the limit. When the number of zones calling drops below 4.0 zones, the zoning panel will open the non-calling zone dampers just enough to meet the Zone limit or minimum airflow.

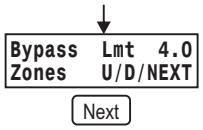


Use the Up and Down keys to set the Zone limit.

Pressing Next skips to the Opposite System Service option.

Setting the Bypass Limit Using CFM

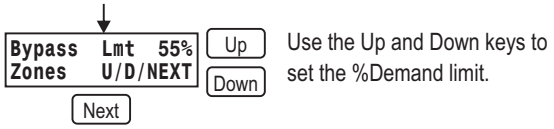
If bypass control using CFM was selected, set the CFM at which bypass is required as shown below. If during the bypass test, the system operation was acceptable down to 2000 CFM, set 2000 as the limit. When the CFM calling drops below 2000 CFM, the zoning panel will open the non-calling zone dampers just enough to meet the CFM limit or minimum airflow.



Pressing Next skips to the Opposite System Service option.

Setting the Bypass Limit Using %Demand

If bypass control using %Demand was selected, set the %Demand at which bypass is required as shown below. If during the bypass test, the system operation was acceptable down to 55% Demand, set 55 as the limit. When the %Demand calling drops below 55%, the zoning panel will open the non-calling zone dampers just enough to meet the 55% limit or minimum airflow.

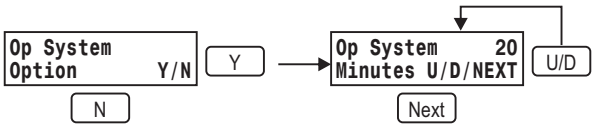


Use the Up and Down keys to set the %Demand limit.

Pressing Next skips to the Opposite System Service option.

Select Opposite System Service Option

When the opposite system option is On, the panel will switch from the calling system to the opposite system even though there may be fewer zones calling for the opposite system. The panel will not switch until the call time on the active system is equal to the Opposite System Time you select.



Pressing No skips to the next advanced option selection.

Pressing Next skips to the next advanced option selection.

Select Purge After a Call Option

When the purge option is On, the panel will keep the non-calling dampers open, turn the heating or cooling off and activate the indoor fan for the selected Purge Time.

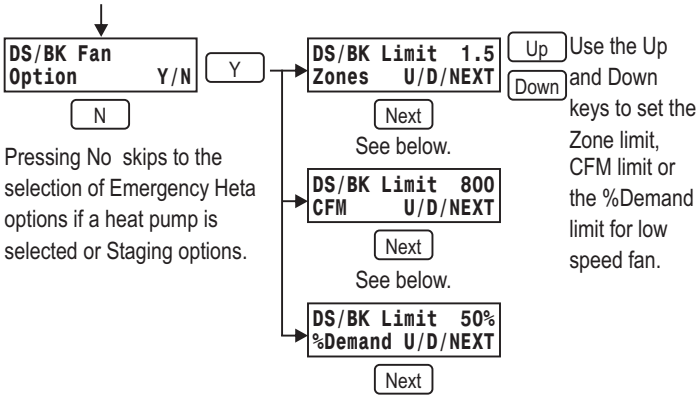
Use the Up and Down keys to set the Purge time in seconds.

Pressing No skips to select Low Speed Fan option.

Pressing Next skips to select Low Speed Fan option.

Select DS/BK Low Speed Fan Option

Some equipment have a terminal (DS or BK) for activating the low speed fan during a call. The DS/BK output is normally set to 24VAC for normal or high speed fan operation. The DS/BK option activates the low speed fan when the Zones, CFM or %Demand is below the limit set. The G terminal is set to 24VAC and the DSBK terminal is set to 0VAC for low speed fan operation.



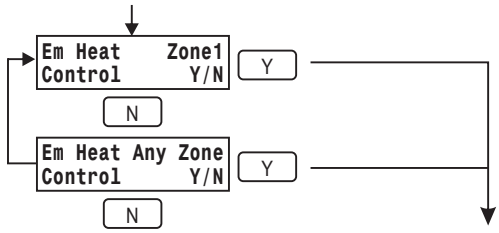
Use the Up and Down keys to set the Zone limit, CFM limit or the %Demand limit for low speed fan.

Pressing No skips to the selection of Emergency Heta options if a heat pump is selected or Staging options.

Pressing Next skips to the selection of Emergency Heta options if a heat pump is selected or Staging options.

Select Emergency Heat Control Option

When a heat pump is used, select if only the Zone1 thermostat can call for emergency heating or Any Zone can call for Emergency heating.

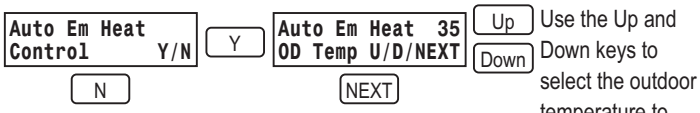


Pressing No returns to the start of this menu option.

Pressing Yes selects this option and skips to the Automatic Emergency Heat option.

Select Automatic Emergency Heat Option

When a heat pump is selected, this option can automatically activate emergency heat mode when the outdoor temperature drops below the selected temperature limit.



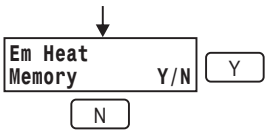
Pressing No skips to the Emergency Heat option selection.

Pressing Next skips to the Emergency Heat option selection.

Use the Up and Down keys to select the outdoor temperature to activate emergency heat.

Select Emergency Heat Memory Option

When selected, an emergency heat call from any zone thermostat will cause all non-emergency heating calls from the other zone thermostats to be treated as emergency heat calls until the zone thermostat that called for emergency heating calls for non-emergency heating or cooling. This option is automatically selected when emergency heat control from only the Zone1 thermostat is selected.



Pressing Yes selects this option and skips to the Staging options selection.

Pressing No skips to the Staging options selection.

Select Staging Options

There are a number of staging options that can improve comfort and energy usage.

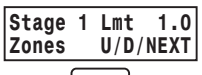
Pressing Yes skips to the option that limits staging based on calling demand.

Pressing No skips to selecting heating or cooling priority.

Select Limit Staging by Demand Option

When selected, this option will inhibit upstaging a heating or cooling call unless the minimum demand (Zones, CFM or %Demand) for that stage is calling.

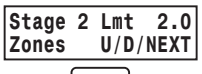
The Stage1 limit can be used to inhibit a small zone from calling for heating or cooling until another zone is calling. The following key sequence uses Zones to control staging although CFM or %Demand can also be used.



Use the Up and Down keys to set the minimum Zones, CFM or %Demand that must be calling to activate stage1 heating or cooling.

NEXT

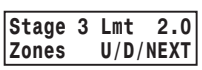
Pressing Next will set the Stage2 limit if 2 or more stages are used.



Use the Up and Down keys to set the minimum Zones, CFM or %Demand that must be calling to activate stage2 heating or cooling.

NEXT

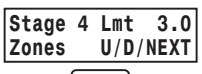
Pressing Next will set the Stage3 limit if 3 or more stages are used.



Use the Up and Down keys to set the minimum Zones, CFM or %Demand that must be calling to activate stage3 heating or cooling.

NEXT

Pressing Next will set the Stage3 limit if 3 or more stages are used.



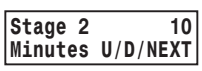
Use the Up and Down keys to set the minimum Zones, CFM or %Demand that must be calling to activate stage4 heating or cooling.

NEXT

Pressing Next after the last staging limit is set will skip to the selection of Timed Upstaging.

Select Timed UpStaging Option

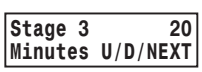
When selected, the panel will automatically upstage when the panel has been continuously calling for heating or cooling for a time equal to the time limit selected.



Use the Up and Down keys to set the time (minutes) the panel must be continuously calling to up-stage to Stage2 heating or cooling.

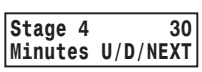
NEXT

Pressing Next will set the Stage3 time if 3 or more stages are used.



Use the Up and Down keys to set the time to up-stage to Stage3 heating or cooling.

NEXT



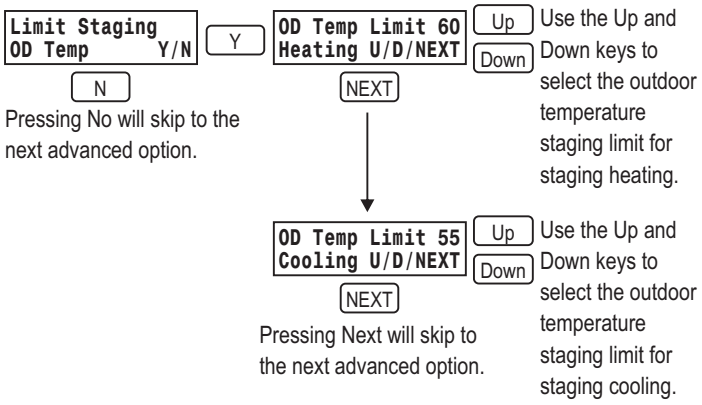
Use the Up and Down keys to set the time to up-stage to Stage4 heating or cooling.

NEXT

Pressing Next after the last staging time is set will skip to the Limiting Staging Moderate Weather option.

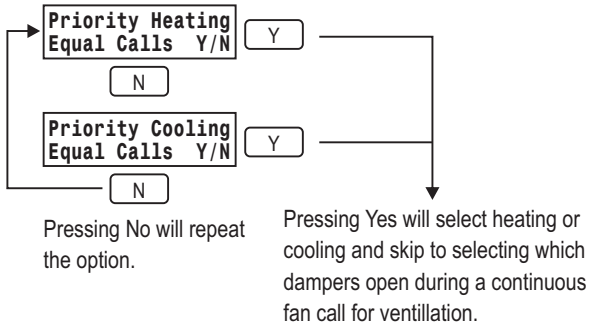
Select Staging in Moderate Weather Option

When selected, the panel will not up-stage heating if the outdoor temperature is above the heating limit or up-stage cooling if the temperature is below the cooling limit.



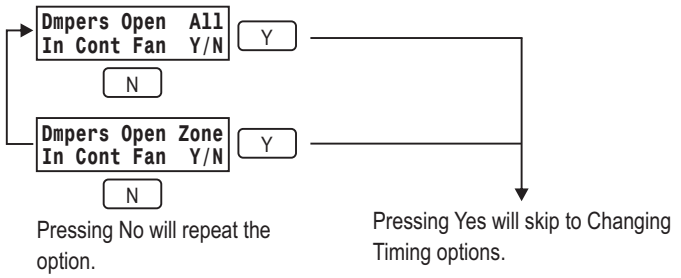
Select Heating or Cooling Priority

When there are equal demand (Zones, CFM or %Demand) calling for heating and cooling, the priority system is serviced first.



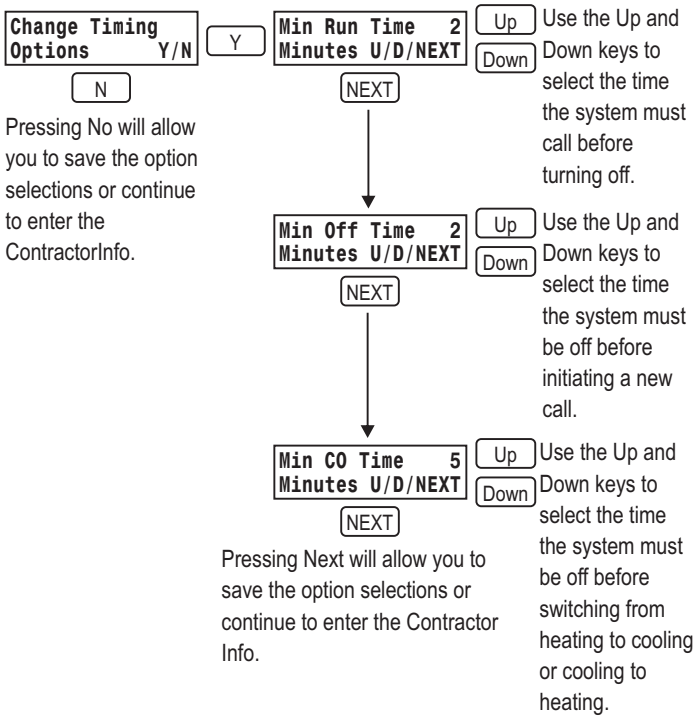
Select Dampers Open in Cont Fan Option

When there is a continuous fan call for ventilation, select whether all dampers open or only the zone dampers calling for continuous fan open.



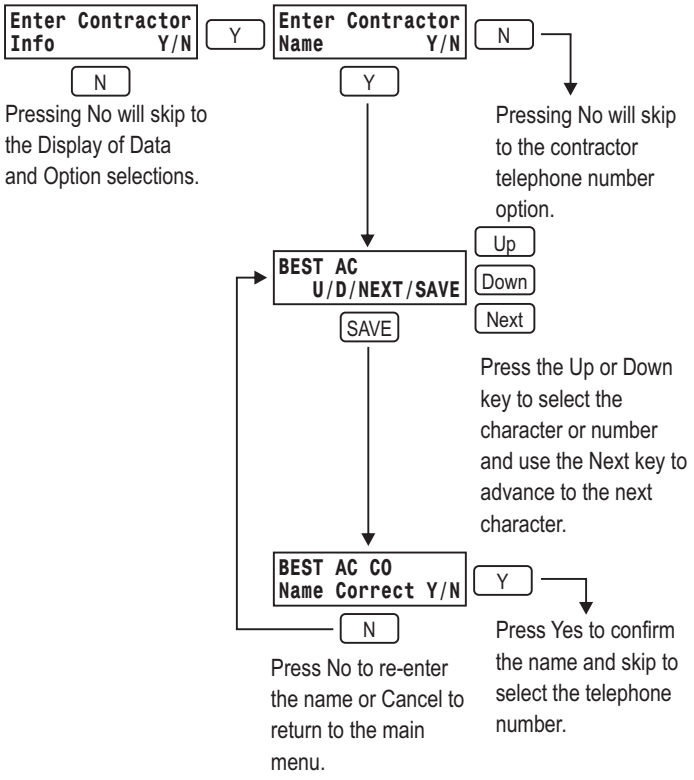
Select Timing Options

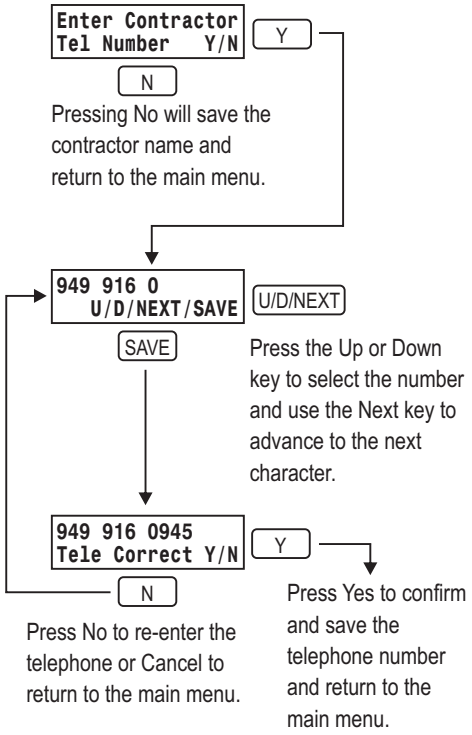
The minimum run time, minimum off time and the minimum heat/cool changeover time can be selected.



Enter Contractor Information

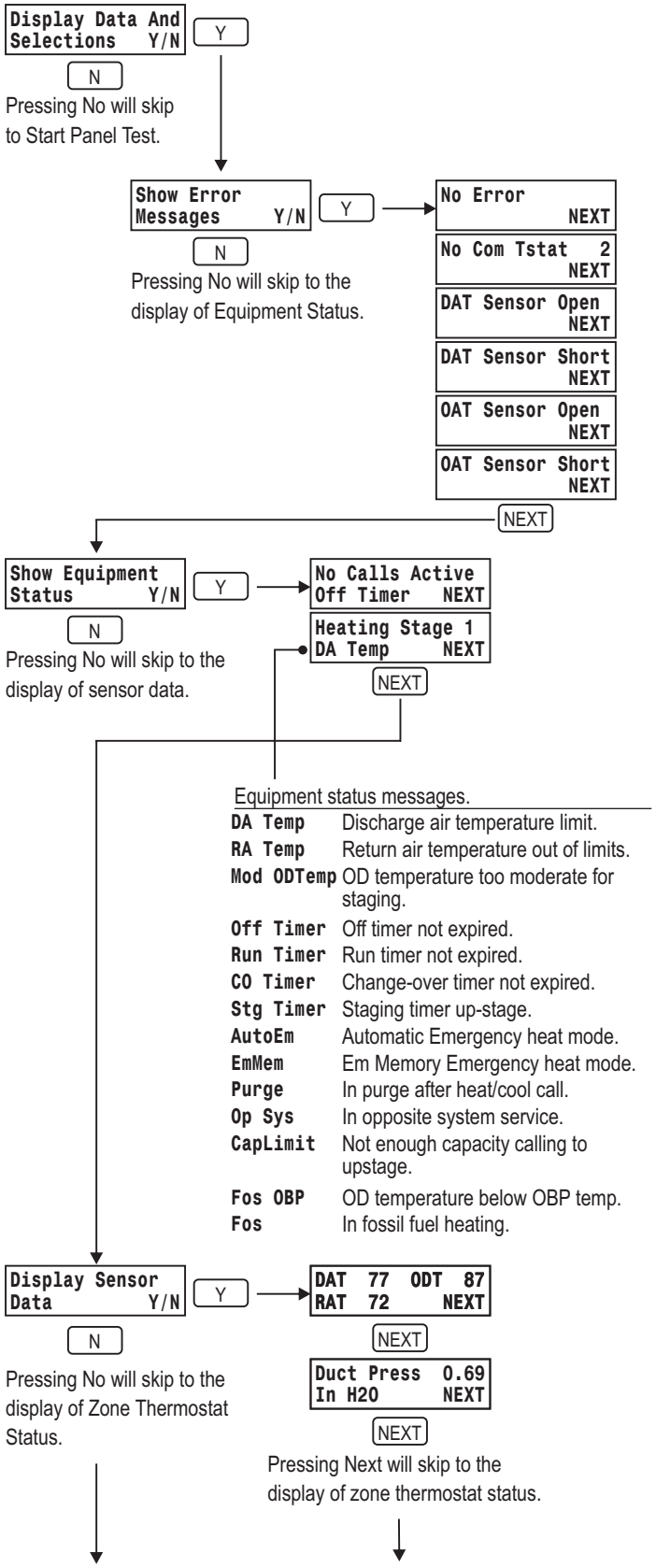
The contractor's name and telephone number can be entered and stored in the panel to be displayed by the user with the Menu key and will be displayed each year with the "Annual Service" message.

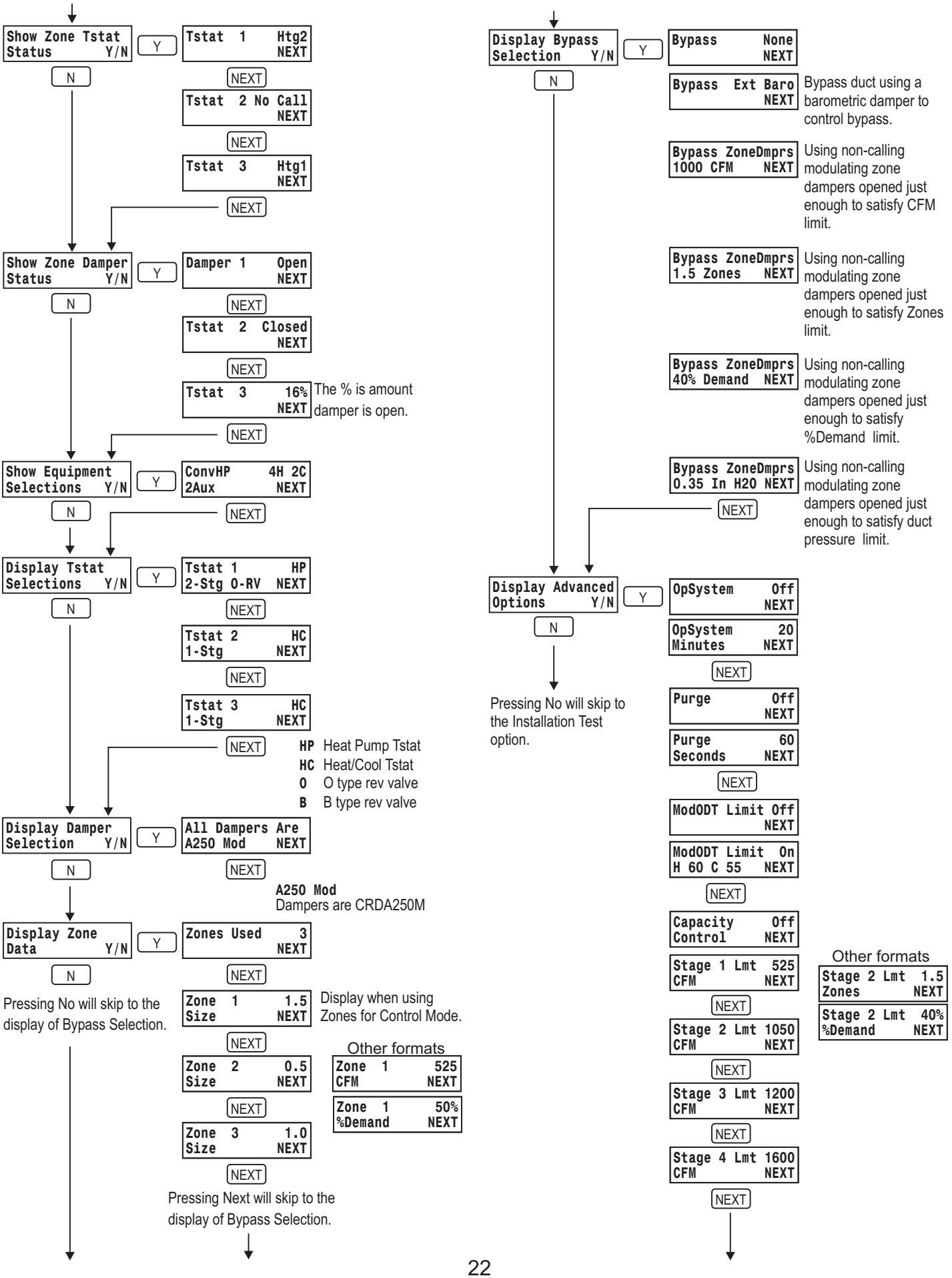


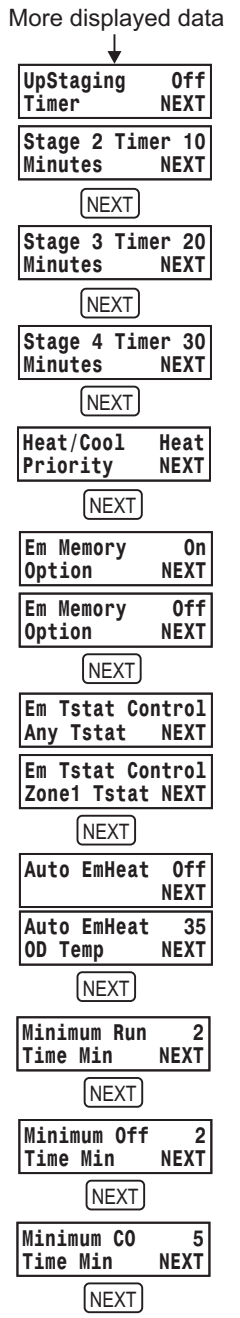


Display Data and Selections

The display menu allows the installer to display data and option selections, thermostat status, damper status, HVAC equipment status, sensor readings and error messages.

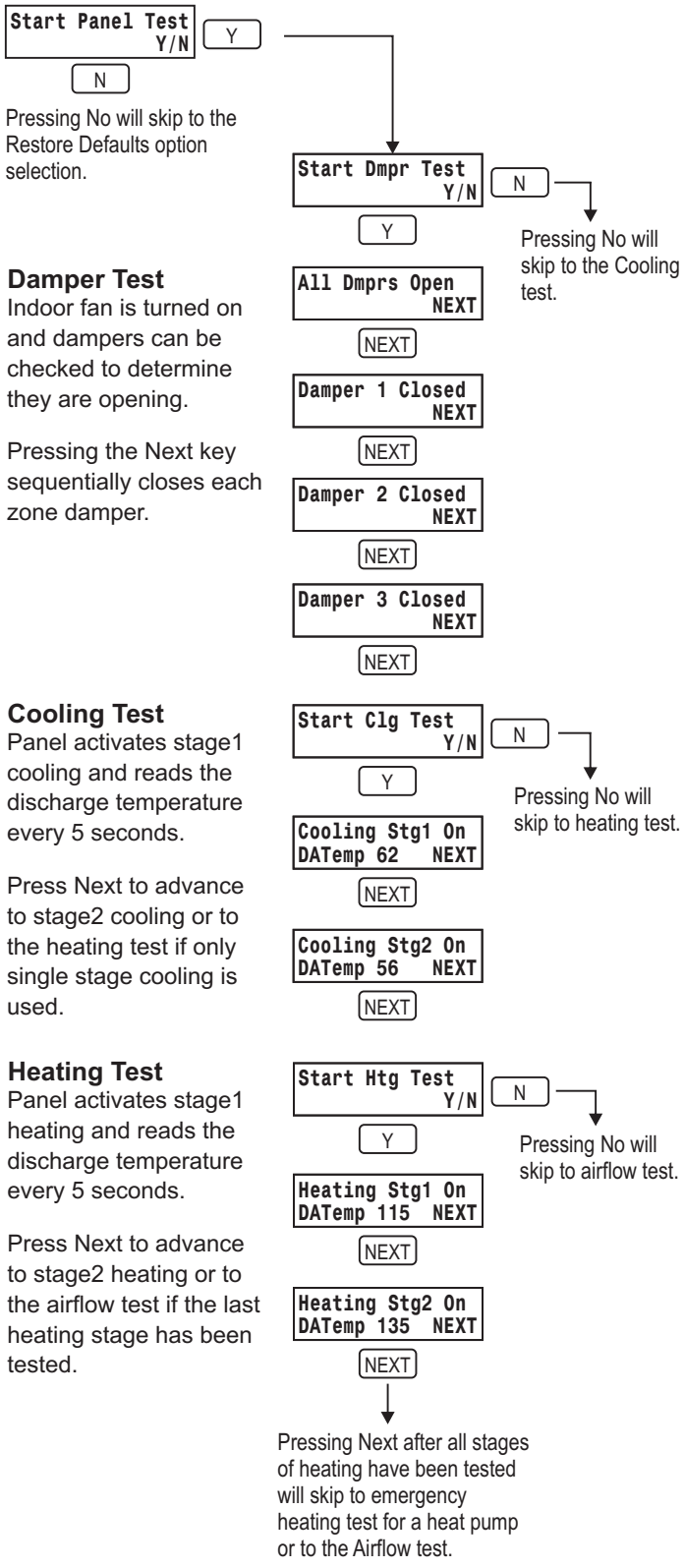



Show Zone Tstat Status Y/N
Y
Tstat 1 Htg2 NEXT
N
NEXT
Tstat 2 No Call NEXT
NEXT
Tstat 3 Htg1 NEXT
NEXT
Show Zone Damper Status Y/N
Y
Damper 1 Open NEXT
N
NEXT
Tstat 2 Closed NEXT
NEXT
Tstat 3 16% NEXT
The % is amount damper is open.
NEXT
Show Equipment Selections Y/N
Y
ConvHP 4H 2C
2Aux NEXT
N
NEXT
Display Tstat Selections Y/N
Y
Tstat 1 HP
2-Stg O-RV NEXT
N
NEXT
Tstat 2 HC
1-Stg NEXT
NEXT
Tstat 3 HC
1-Stg NEXT
NEXT
HP Heat Pump Tstat
HC Heat/Cool Tstat
O O type rev valve
B B type rev valve
Display Damper Selection Y/N
Y
All Dampers Are
A250 Mod NEXT
N
NEXT
A250 Mod
Dampers are CRDA250M
Display Zone Data Y/N
Y
Zones Used 3
NEXT
N
NEXT
Pressing No will skip to the display of Bypass Selection.
Zone 1 1.5
Size NEXT
Display when using Zones for Control Mode.
NEXT
Zone 2 0.5
Size NEXT
Other formats
Zone 1 525
CFM NEXT
Zone 1 50%
%Demand NEXT
NEXT
Zone 3 1.0
Size NEXT
NEXT
Pressing Next will skip to the display of Bypass Selection.
Display Bypass Selection Y/N
Y
Bypass None
NEXT
N
Bypass Ext Baro
NEXT
Bypass duct using a barometric damper to control bypass.
Bypass ZoneDmprs
1000 CFM NEXT
Using non-calling modulating zone dampers opened just enough to satisfy CFM limit.
Bypass ZoneDmprs
1.5 Zones NEXT
Using non-calling modulating zone dampers opened just enough to satisfy Zones limit.
Bypass ZoneDmprs
40% Demand NEXT
Using non-calling modulating zone dampers opened just enough to satisfy %Demand limit.
Bypass ZoneDmprs
0.35 In H2O NEXT
Using non-calling modulating zone dampers opened just enough to satisfy duct pressure limit.
NEXT
Display Advanced Options Y/N
Y
OpSystem Off
NEXT
N
OpSystem 20
Minutes NEXT
NEXT
Pressing No will skip to the Installation Test option.
Purge Off
NEXT
Purge 60
Seconds NEXT
NEXT
ModODT Limit Off
NEXT
ModODT Limit On
H 60 C 55 NEXT
NEXT
Capacity Off
Control NEXT
Stage 1 Lmt 525
CFM NEXT
Other formats
Stage 2 Lmt 1.5
Zones NEXT
Stage 2 Lmt 40%
%Demand NEXT
NEXT
Stage 2 Lmt 1050
CFM NEXT
NEXT
Stage 3 Lmt 1200
CFM NEXT
NEXT
Stage 4 Lmt 1600
CFM NEXT
NEXT



Testing the Installation

The installation test steps through the test of dampers, indoor fan, heating, cooling and tests the airflow as dampers close to determine the bypass requirements.



Damper Test

Indoor fan is turned on and dampers can be checked to determine they are opening.

Pressing the Next key sequentially closes each zone damper.

Cooling Test

Panel activates stage1 cooling and reads the discharge temperature every 5 seconds.

Press Next to advance to stage2 cooling or to the heating test if only single stage cooling is used.

Heating Test

Panel activates stage1 heating and reads the discharge temperature every 5 seconds.

Press Next to advance to stage2 heating or to the airflow test if the last heating stage has been tested.

Em Heating Test

If a heat pump is used, the panel activates stage1 emergency heating and reads the discharge temperature every 5 seconds.

Press Next to advance to stage2 emergency heating or to the airflow test if the last heating stage has been tested.

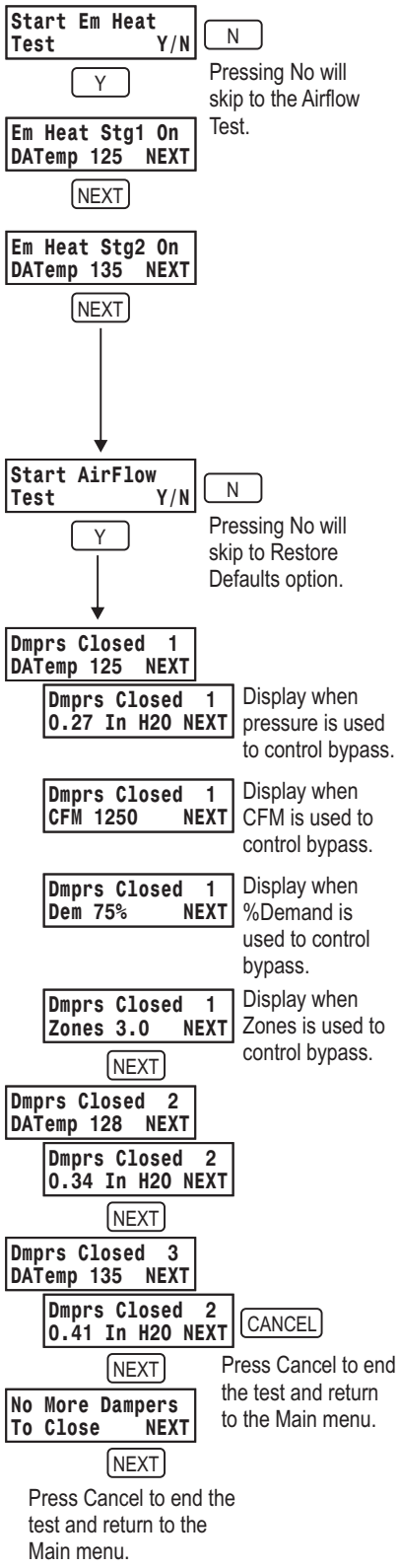
Airflow Test

The airflow test leaves all stages of heating On and sequentially (using Next key) closes dampers to determine the affect on the duct work, noise level and discharge air temperature. The last damper cannot be closed.

The calling demand (Zones, CFM or %Demand) or duct pressure is alternately displayed with discharge air temperature every few seconds.

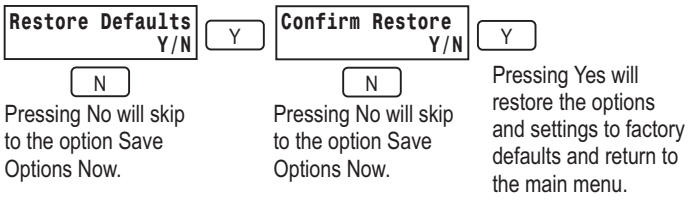
Pressing the Next key closes the next zone damper.

Use the demand or pressure to set the bypass limit when bypassing using non-calling zone dampers



Restore Defaults

This restores the factory defaults to the panel. Useful after demonstrating or testing a panel.



Air Balancing

Air balancing can be performed by setting the thermostats to Continuous Fan and heating and cooling Off. The default settings opens all dampers during a Continuous fan call.

eControls

eControls, Inc. 26945 Cabot Road #101 / Laguna Hills, CA 92653
949-916-0945 Fax 949-458-8502 www.eControlsUSA.com