



VENTILATORS

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LVCS VENTILATION CONTROL SYSTEM

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS FOR HEALTHY CLIMATE® LVCS VENTILATION CONTROL SYSTEM FOR USE WITH FURNACES /AIR HANDLERS

Shipping & Packing List

Package 1 of 1 contains the following:

- 1 – Ventilation controller
(includes outdoor temperature sensor, time only resistor and (4) mounting screws)
- 1 – Motorized damper (spring closed, power open)
- 1 – 24VAC transformer

Application

Healthy Climate LVCS Ventilation Control System provides fresh air intake which can be used with any furnace or air handler. Fresh air is brought into the return air system, where it can be filtered. The controller allows fresh air intake using a motorized damper when outdoor conditions are appropriate. In very cold climates, balanced ventilation is recommended. LVCS Ventilation Control System can be used with an exhaust fan to provide balanced ventilation. Per ASHRAE 62.2-2003, very cold climates are those that have more than 9000 annual heating degree-days based on 65°F day.

Operation Principles

Working in conjunction with a normally closed motorized damper, the Ventilation Controller makes decisions regarding when – and how long – to ventilate. It does this through continuous monitoring of indoor relative humidity, outdoor temperature, and user-adjusted timer settings. Ventilation time may be satisfied by a heating, cooling, or fan call initiated by the thermostat, or from a fan call initiated by the Ventilation Controller itself.

Indoor relative humidity is monitored to help prevent high humidity conditions inside your home. The Ventilation Controller will not allow ventilation when indoor relative humidity rises above 55% RH.

If the outdoor air temperature is below 0°F or above 100°F, the normally closed motorized damper to the outside will not be opened. This feature can be disabled at installation if the installer chooses not to use outdoor air temperature as a parameter.

Outdoor Temperature and Indoor Humidity Control Limits

In a standard application, your Ventilation Controller uses measurements of Outdoor Temperature and Indoor Humidity, along with the user-adjustable timer settings, to determine when to ventilate. Outdoor Temperature is measured with a sensor placed at the

inlet of the fresh air intake duct. Indoor Humidity is measured in the return duct with a sensor built into the Controller. In conjunction with the timer settings, the Controller then operates according to the temperature and humidity control limits shown in Figure 1.

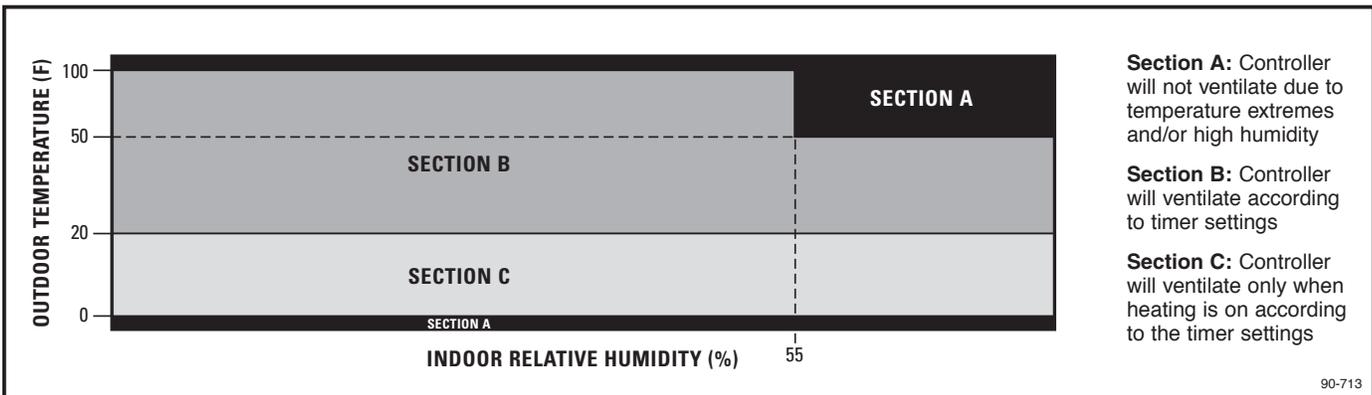


FIGURE 1 – OPERATING LIMITS

Safety Information

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a qualified installer or service agency.

⚠ WARNING



Electric shock hazard. Can cause injury, death or product or property damage. Turn off electrical power to unit at disconnect switch(es) before performing any maintenance or service operations on the unit. Unit may have multiple power supplies. Follow instructions attached to unit when putting unit back into operation after service or maintenance.

⚠ WARNING

Danger of sharp metallic edges. Can cause injury. Take care when servicing unit to avoid accidental contact with sharp edges.

⚠ CAUTION

1. Do not mount the Ventilation Controller on the supply plenum or duct. The unit will not withstand the supply temperatures.
2. When installing the Ventilation Controller on downflow furnaces, ensure blower continues to run after a heat call is satisfied to eliminate high temperatures from damaging the Ventilation Controller.
3. Do not mount the Ventilation Controller downstream of a fresh air intake, humidifier or bypass outlet. False humidity conditions will cause the Ventilation Controller to operate incorrectly.
4. UVC light may damage ventilation control system components. Do not install ventilation control system components where they may be exposed to UVC light.

Installation

LVCS Ventilation Control system requires installation of a motorized damper, fresh air intake (such as wall-mounted hood), fresh air intake duct, ventilation controller, and 24 VAC transformer.

Fresh air intake duct and damper should be installed between the outdoor wall and the return side of the HVAC equipment. The ventilation controller should be mounted in the return/mixing plenum and wired to the thermostat and the HVAC equipment.

Installation of Fresh Air Intake

NOTE: Fresh air intake should be located in accordance with local codes. Refer to installation guidelines below:

- At least 6' (2 m) away from dryer vents and air handler exhaust (medium or high efficiency furnaces)*
- A minimum of at least 6' (2 m) from sources of contaminated air (including driveways, oil fill pipes, gas meters, garbage containers or swimming pools)*
- At least 18" (457mm) above the ground, or the depth of expected snow accumulation, whichever is higher*
- At least 3' (1 m) from the inside/outside corner of the building*
- Do not locate in any indoor space
- Provide 1/4" mesh screen or similar in the fresh air intake

* Local code may require greater distances.

Refer to Figure 2 for typical attic and basement installations.

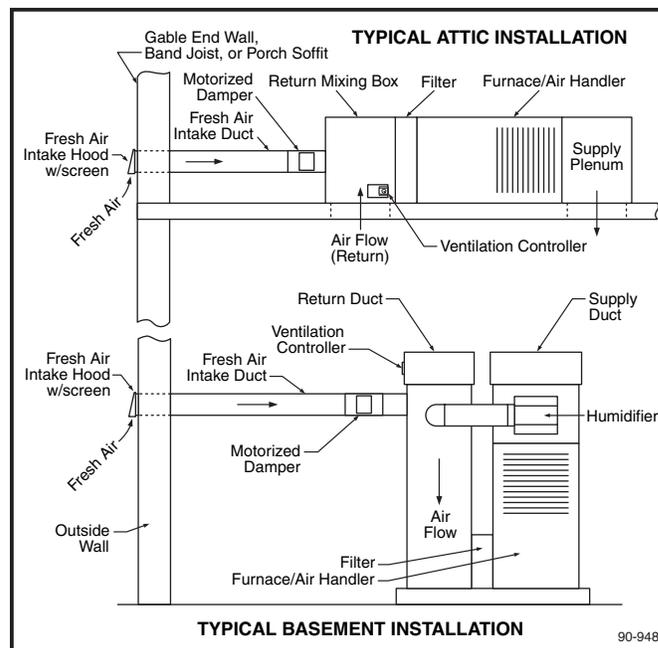


FIGURE 2 - TYPICAL FRESH AIR INTAKE FOR ATTIC AND BASEMENT INSTALLATION

Installation of Damper and Fresh Air Intake Duct

NOTE: Support all duct in accordance with local code or SMACNA standards.

⚠ CAUTION

Damper should be installed in fresh air duct only, and should be installed as close to the return duct as possible.

⚠ CAUTION

Do not force damper blades by hand, as damage may occur.

Step 1: The motorized damper must be installed on a rigid return air duct or plenum. If flexible duct has been used rather than rigid duct for the return air, a field-provided return air mixing box must be installed. Position damper so that crimped end is downstream and attach damper to a return air duct, plenum, or mixing box. Refer to Figure 5.

Step 2: Install 6" fresh air intake duct between the fresh air intake and damper. If metal fresh air duct is used, secure duct using 1/2" sheet metal screws (not included) and duct tape. If flexible fresh air duct is used, use proper strapping material to attach the duct to damper. Fresh air intake duct run should be as short as possible.

Step 3: The fresh air intake duct and damper must be fully insulated and all seams must be sealed to prevent condensation from forming. Refer to Figure 3.

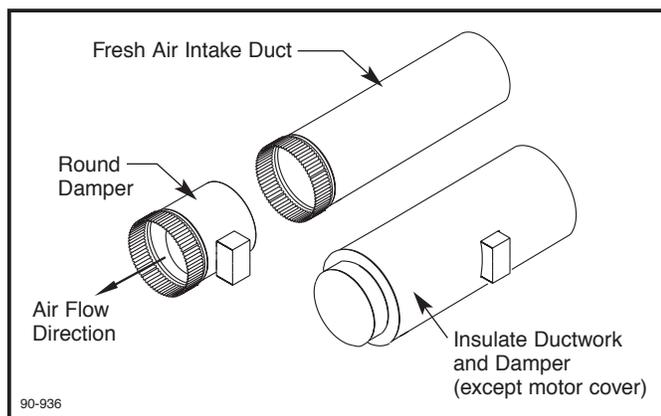


FIGURE 3 – DAMPER AND FRESH AIR DUCT INSTALLATION

Installation of Ventilation Controller

The Controller must be mounted in the return duct. For proper operation, the Controller must be at least 6 inches upstream from the following:

- Fresh Air Intake Ductwork
- Humidifier
- Humidifier Bypass Ductwork

In installations where it is difficult to mount the Controller 6" upstream from the fresh air intake duct (when using a mixing box with flex duct returns for example), then mount the Controller as close to the main return duct as possible. Refer to Figure 5.

After the location for the Controller is selected, use the 'Ventilation Controller Template' (on the last page of the manual) to mark the duct opening, and then cut it. The cutout size is 4-11/16" x 2-15/16". Mount the Controller in the duct opening (using 4 screws included) and make sure the Controller is sealed tightly to the duct. Do not install the Controller on the bottom side of duct. Also, do not install the Controller within 6 ft. of direct UVC light exposure or within 3 ft. of indirect UVC light exposure.



FIGURE 4 VENTILATION CONTROLLER

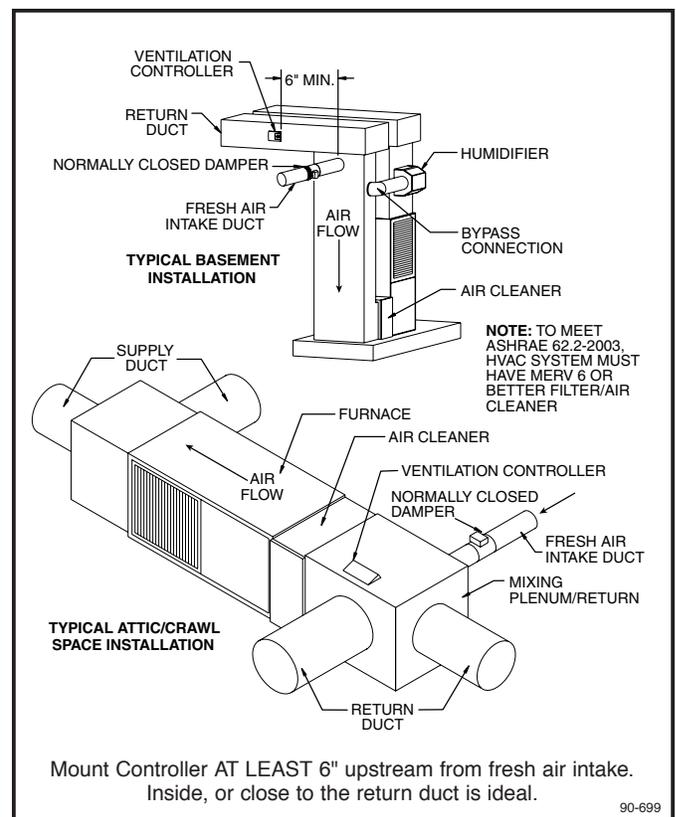


FIGURE 5 – TYPICAL INSTALLATIONS

Field Wiring

Field Wiring of Ventilation Controller

NOTE – When installing the Ventilation Controller in a system with a power-robbing thermostat, it is recommended that 300 ohm/5-watt load resistors be placed across Y and C terminals as well as W and C terminals.

NOTE – 18-22 AWG thermostat wire should be used.

⚠ CAUTION

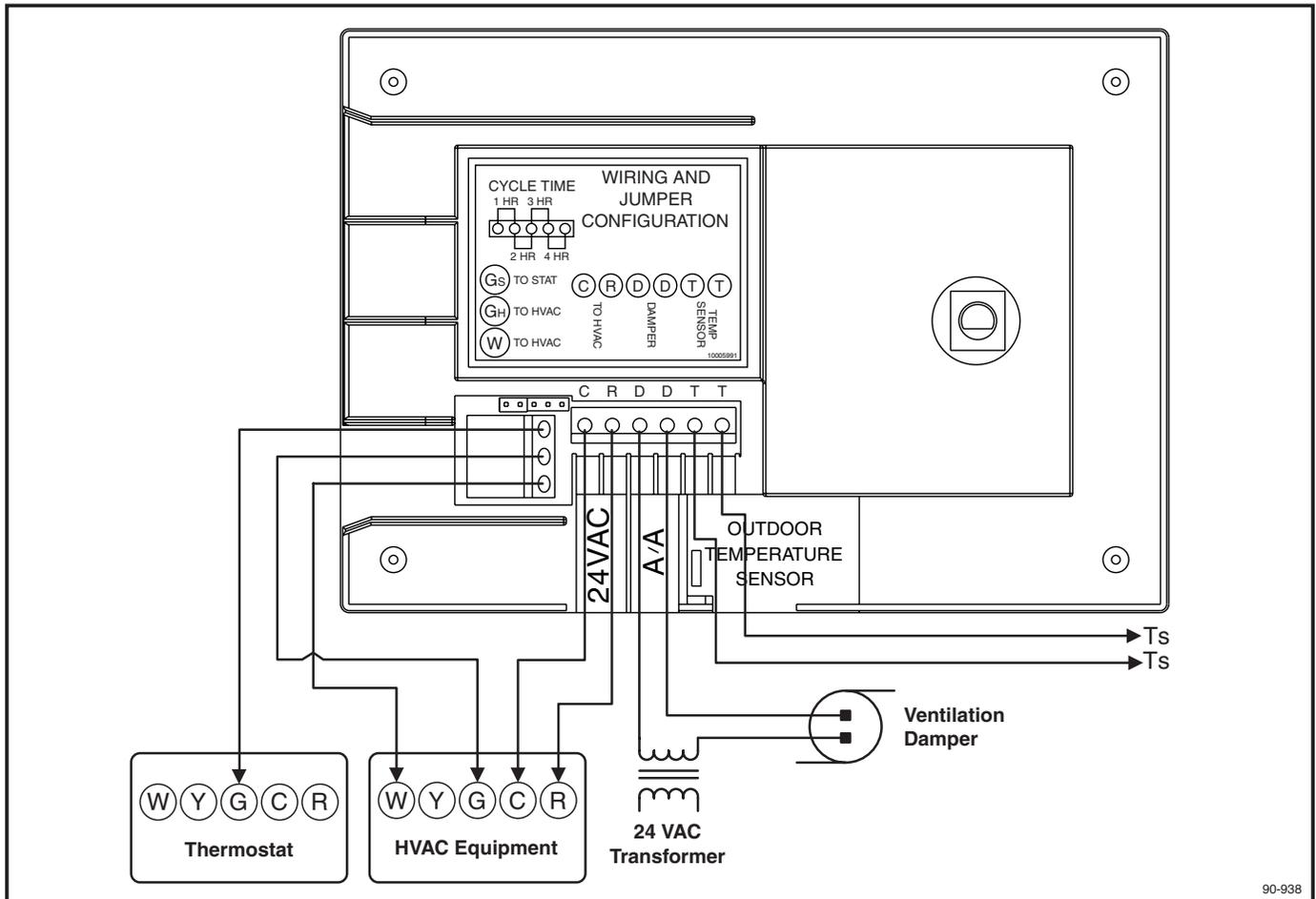
Improper wiring to the HVAC equipment could cause damage to the Ventilation Controller and/or the HVAC equipment.

- Route wire from the R, C, W, and G_H (TO HVAC) terminals on the Ventilation Controller to the corresponding terminals on the furnace/air handler/heat pump control board. See Figure 6 for the terminal locations.
- Route a wire from the G_S (TO STAT) terminal on the Ventilation Controller to nearby the furnace/air handler/heat pump control board but do not connect it.

Instead, on the furnace/heat pump control board, disconnect the G wire that comes from the thermostat, and use a wire nut (not provided) to connect the G wire from the thermostat to the G_S (TO STAT) wire from the Ventilation Controller. **Note: the only wire connected to the G terminal on the furnace/heat pump control board should be the G_H (TO HVAC) wire from the Ventilation Controller.**

Field Wiring of Motorized Damper and 24 VAC Transformer

- The Normally Closed Damper should be wired in series with a continuously energized 24 VAC transformer (provided) and connected to the terminals labeled “D/D” of the Ventilation Controller. (See Figure 6.)
- The 24 VAC transformer will require 110 VAC power supply and should be installed according to the local codes. Wire 24VAC transformer to power source other than furnace fan motor circuit. The transformer can be powered off the 120 VAC line at the junction box before it enters the furnace or from 120 VAC furnace accessory terminals. See furnace manufacturer's recommendations for wiring. 24 VAC transformer is rated for use with one fresh air damper only and no additional components.



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FIGURE 6 – WIRING DIAGRAM

Field Wiring of Outdoor Temperature Sensor

Wiring across the outdoor temperature sensor terminals T-T (see Figure 7) can be done in three different ways depending upon the mode of operation for the ventilation controller.

Choose Mode of Operation

There are three modes of operation:

1. If the Outdoor Temperature Sensor (see Figure 7) is connected, the Controller will use Outdoor Temperature and Indoor Humidity, along with the user-adjustable timer settings, to determine when to ventilate. **This is the recommended installation** as the Controller will prevent extreme hot, humid, or cold air from entering the home, all of which could have negative effects on comfort and energy costs. For this installation, go to the following section "Location & Wiring of Outdoor Temperature Sensor".
2. If the two Outdoor Temperature Sensor terminals are shorted with a standard 20-gauge wire (not provided), the Controller will disregard the temperature setting. Ventilation decisions will be based on the indoor relative humidity and the user-adjustable timer settings. This mode would be used if there is a desire to prevent ventilation only when the indoor humidity rises above 55% RH, regardless of outdoor temperature.
3. If the 'TIME ONLY' resistor (provided) is connected across the Outdoor Temperature Sensor terminals, the Controller will ignore outdoor temperature and indoor relative humidity and base ventilation simply on the time set by the installer/homeowner. This mode would be used where local codes require time-based ventilation regardless of temperature and humidity conditions.

NOTE: The Controller can operate in only one of the three modes. Install ONLY one of the following components: "outdoor temperature sensor" OR "wire jumper" OR "time only resistor".

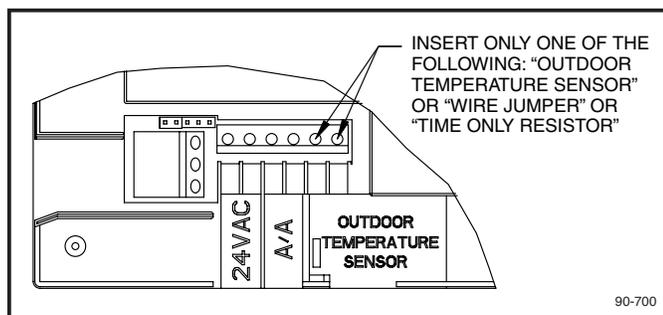


FIGURE 7 – OUTDOOR TEMPERATURE SENSOR TERMINAL

Location & Wiring of Outdoor Temperature Sensor

- The temperature sensor should be installed in the Fresh Air Intake Hood (not provided) or in the Fresh Air Intake Duct. **Note: The outdoor temperature sensor should be within 3 feet of the outside wall.**
- Use standard 18-22 AWG thermostat wire to field wire outdoor temperature sensor to the ventilation controller.
- The Outdoor Temperature Sensor is not affected by field wire length between the sensor and controller. Do not route the wire alongside wires carrying high voltage (120 VAC or greater) as interference may occur.
- Strip wire 1/4 inches, and insert the field wires from the sensor into the terminals labeled "Outdoor Temperature Sensor" on the Ventilation Controller. See Figure 6 for terminal locations.

Setting the Cycle Time Interval

1-Hour Cycle Time (factory default) is the recommended setting as it closely matches run times of HVAC equipment with a digital thermostat. For a mechanical thermostat or a digital thermostat with longer run times, the Cycle Time interval can be set at 2, 3, or 4 hours. Note: 4-hour setting will not meet ASHRAE 62.2-2003 standard. To set Cycle Time interval, follow steps below:

- Remove the knob by pulling it straight out from the controller. Remove the cover by grabbing along the top and bottom edges of the cover and pulling straight out from the base. Refer to Figure 8 to locate the cycle time header & jumper.
- The jumper on the 5-pin header determines the cycle time interval. The interval can be set at 1, 2, 3 or 4 hours. (The default setting is 1 hour.)
- Move the jumper to the desired setting. The jumper can be removed by pulling it straight out from the header pins.
- Snap the cover back on the controller and slide the knob onto the shaft.

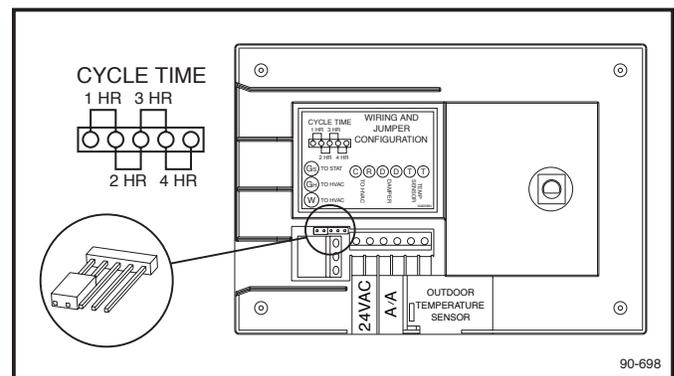
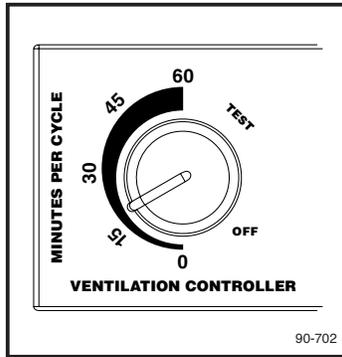


FIGURE 8 – CYCLE TIME

Setting the Ventilation Time

- The knob on the exterior of the Controller (see Figure 9) is used to set the ventilation time within the cycle time interval you set.
- The knob settings range from “OFF” which is all the way counter-clockwise, to “TEST” which is all the way clockwise. Within those two extreme settings the ventilation can be set from 0 to 60 minutes of ventilation time. For example: if you set the cycle time to 1 hour and the ventilation time knob to 30 minutes, you will get 30 minutes of ventilation every hour.



**FIGURE 9
VENTILATION TIME**

Setting the Ventilation Controller

Ventilation Time Setting (min./hr.)				
House Size (square feet)	Bedrooms			
	2	3	4	5
1000-1500	20	25	30	35
1501-2000	25	30	30	35
2001-2500	25	30	35	40
2501-3000	30	35	40	40
3001-3500	30	35	40	45

As an example, for a 2,500 square foot home with 3 bedrooms set the controller to 30 minutes of ventilation per one-hour cycle.

Notes:

1. Based on proposed ASHRAE 62.2–2003 ventilation requirement.
2. Based on fresh air duct of 20' long flex duct, 0.15 in. w.c. static pressure at fresh air duct.
3. Based on the default setting of one hour Cycle Time. Use Cycle Time settings of 2, 3 or 4 hours where longer run times or less frequent operation is preferred. Adjust Ventilation Time accordingly. (In the “Ventilation Time Setting” example, set the Ventilation Time to 60 minutes and the Cycle Time to 2 hours.)

A longer fresh air intake duct or lower return static will increase the Ventilation Time required. Additionally, local codes may affect the Ventilation Controller setting. For more detailed guidelines, see “Ventilation Worksheet” at the end of this manual.

System Checkout

1. For system test, be sure that 24 VAC is applied in series with the Normally Closed Damper and connected to the “D/D” terminals on the Ventilation Controller.
2. Check the wiring to the Furnace / Heat Pump described in the “Field Wiring” section.
3. Rotate the control knob clockwise to the “TEST” position.
4. If all is set up properly, the blower will turn on and the damper will open. Blower should be audible to the installer. To check opening of the damper, remove damper motor plastic cover and look for an orange lever arm move across the slot towards the stop screw (see Figure 10). The blower will remain on and the damper will remain open for 1 minute or until the knob is removed from the test position, whichever happens first.
5. If the damper or blower does not activate in TEST Mode, refer to the Troubleshooting Guide.
6. Rotate the knob to the desired ventilation setting.
Note: Do not leave the knob in the “TEST” position. The Controller will not operate after the 1-minute test sequence is over. Turn knob to off position for several seconds before setting it back to desired ventilation time.

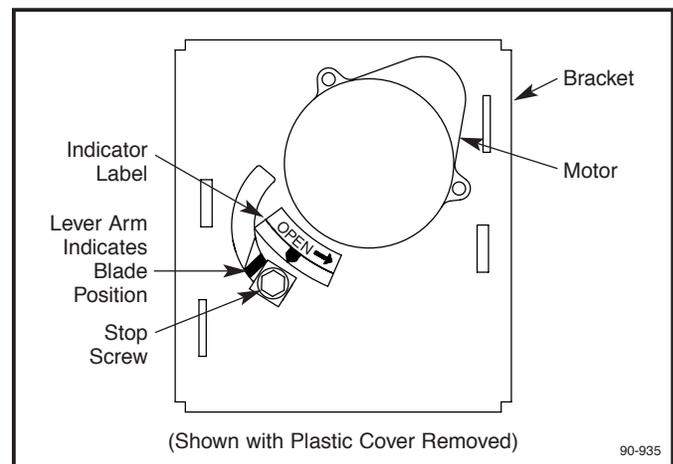


FIGURE 10 – DAMPER MOTOR AND BRACKET

Troubleshooting

Symptom	Troubleshooting Procedure
HVAC Blower does not turn on in "TEST" Mode.	<ul style="list-style-type: none"> • Make sure there is power to the HVAC Equipment. • Check the wiring diagram for the R, C, W, G_s (TO STAT) and G_H (TO HVAC) at both the HVAC Equipment and the Ventilation Controller. • Make sure the supplied Temperature Sensor, or the supplied time only resistor, or a jumper wire is connected to the Outdoor Temperature Sensor terminals. If nothing is connected to these terminals, the Ventilation Controller will not function. • Check the voltage across the R and C terminals at the Ventilation Controller. Voltage should be 18 VAC minimum – 30 VAC maximum. • In "TEST" Mode, the blower will activate for 1 minute. IF THE KNOB IS LEFT IN TEST MODE FOR MORE THAN ONE MINUTE, THE VENTILATION CONTROLLER WILL NOT OPERATE. TURN KNOB TO OFF POSITION FOR SEVERAL SECONDS BEFORE SETTING IT BACK TO DESIRED VENTILATION TIME.
The Damper does not open in "TEST" Mode.	<ul style="list-style-type: none"> • Follow all of the above procedures. • Check the wiring diagram for the damper and 24 VAC transformer.
The Ventilation Controller operates continuously after the knob is taken off "TEST" Mode.	<ul style="list-style-type: none"> • If the HVAC equipment is making a Heat or Cool call, or the Fan is in Continuous Operation, the Ventilation Controller will remain on until the ventilation requirement set by the interval jumper and knob is met. • If the interval is set at 1 HOUR and the Ventilation Time is set at 60 minutes, the Ventilation Controller will be on always. Change the ventilation setting to a lower amount if this is not desired.
The Damper does not open when the fan is active.	<ul style="list-style-type: none"> • The damper will not open if the ventilation time within the current interval has already been met. For instance if the ventilation knob is set to 5 MINUTES and the Ventilation Controller has already ventilated for 5 minutes in that interval, the damper will remain closed. • If the Indoor Relative Humidity is above 60% and the Outdoor Temperature is above 50°F, the damper will not open due to High Humidity conditions inside the house, or the potential thereof. • If the Outdoor Temperature is below 0°F or above 100°F, the damper will remain closed for energy efficiency. • If using the Outdoor Temperature Sensor, check that it is installed within 3 feet from the outside wall in the Fresh Air Intake or on the North, East or West Side of the house. (Not in direct sunlight) • Make sure the Ventilation Controller is at least 6 inches upstream of the Fresh Air Intake Duct, in the return duct.
The Fan turns on unexpectedly.	<ul style="list-style-type: none"> • The Ventilation Controller will turn on the fan as needed to meet the ventilation requirements determined by the Cycle Time and Ventilation knob setting.
HVAC blower runs all the time.	<ul style="list-style-type: none"> • Ventilation time may be set for 60 minutes and cycle time set for 1 hour. Recheck ventilation time requirements. • Check the wiring diagram for the R, C, W, G_s (TO STAT) and G_H (TO HVAC) at both the HVAC Equipment and the Ventilation Controller. • If outdoor temperature sensor is used, sensor maybe out of specifications. Compare sensor resistance to Temperature/Resistance chart (see Table 1).

Troubleshooting (continued)

Symptom	Troubleshooting Procedure
Indoor humidity is too high	<ul style="list-style-type: none"> • If the “TIME ONLY” resistor is wired across the outdoor temperature sensor terminals T-T (see figure 6), then the ventilation controller ignores indoor humidity and may continue to bring in very humid outside air. Consider wiring outdoor temperature sensor or a jumper across the outdoor temperature sensor terminals. • Check the wiring diagram for the R, C, W, G_s (TO STAT) and G_H (TO HVAC) at both the HVAC Equipment and the Ventilation Controller.
Home is too hot or too cold	<ul style="list-style-type: none"> • Check if ventilation time is set too high. Verify ventilation time requirements. • Check the wiring diagram for the R, C, W, G_s (TO STAT) and G_H (TO HVAC) at both the HVAC Equipment and the Ventilation Controller. • If outdoor temperature sensor is used, sensor maybe out of specifications. Compare sensor resistance to Temperature/Resistance chart (see Table 1).
No fresh air in home	<ul style="list-style-type: none"> • Check if ventilation time is set too low. Verify ventilation time requirements. • Check the wiring diagram for the R, C, W, G_s (TO STAT) and G_H (TO HVAC) at both the HVAC Equipment and the Ventilation Controller. • Check fresh air intake duct for blockage • Check if the motorized damper opens in the test mode. • If the “outdoor temperature sensor” is wired across the outdoor temperature sensor terminals T-T (see Figure 6), the indoor air humidity is above 55%RH and outdoor air temperature is above 50°F, then the ventilation controller keeps the fresh air damper closed so as not to increase the indoor humidity. When the indoor humidity drops below 55%RH or outdoor air temperature is below 50°F, the fresh air damper will open to bring in fresh air.

TABLE 1 – TEMPERATURE/RESISTANCE REF. TABLE FOR OUTDOOR TEMPERATURE SENSOR

Outdoor Temperature (°F)	Resistance (kΩ)
-30	230.6
-20	163.8
-10	117.6
0	85.4
10	62.6
20	46.3
30	34.6
40	26.1
50	19.9
60	15.3
70	11.9
80	9.4
90	7.4
100	5.9

Replacement Parts

Part #	Description
X4152	Ventilation Motorized Damper
X4153	H/C Ventilation Controller
22N03	24 VAC Transformer
79N66	Outdoor Temperature Sensor

Note to Homeowner

Refer to “Application” and “Operation Principles” sections on page 1 to better understand ventilation control system operation. Also see “Setting of Ventilation Time” section to adjust ventilation time if needed.

Ventilation Worksheet

Ventilation is essential for both new and existing homes. The Ventilation Control System provides control of the quantity and quality of ventilation for both new and retrofit applications.

Quantity of air is regulated by setting the Ventilation Time and Cycle Time. The CFM required and CFM delivered by the fresh air intake will determine the Ventilation Time and Cycle Time settings.

Quality of air is regulated by preventing ventilation when the air is too hot, too cold or could raise the relative humidity in the home above 55%.

- CFM required** will be based on:
- ASHRAE 62.2-2003 Ventilation Standard or Air Changes per Hour (ACH)
 - Area and occupancy

- CFM delivered** will be based on:
- Length of fresh air intake
 - Static pressure of the return
 - Type of duct

This section walks you through three simple steps to assure proper adjustment of the ventilation controller.

Step 1. How much ventilation is needed?

Step 1 determines ventilation required. For ASHRAE 62.2–2003 use CHART 1.

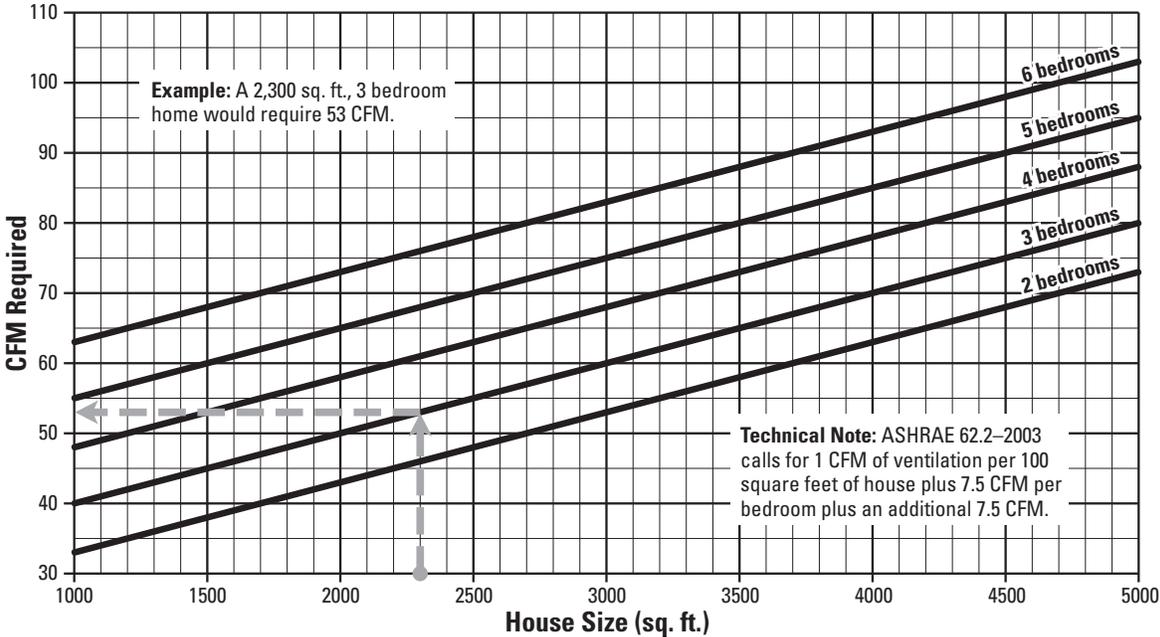
To use Chart 1:

- Locate the **house size** (sq. ft.) on the horizontal axis.
- Draw a vertical line up from the bottom to the point that intersects the line for the number of **bedrooms** in the house.

- From the point where the **house size** and **bedroom** lines intersect, draw a horizontal line to the left (vertical) axis to determine the how much ventilation air (CFM) is required.

Record the **CFM required** here: _____

Chart 1: Ventilation Air Required – per ASHRAE Standard 62.2–2003



Alternately, if using Air Changes per Hour (ACH), use the formula below.

ACH Formula	
House Size (sq. ft.) x Ceiling Height x ACH	= CFM Required
60	

Step 2. How much ventilation will the system deliver?

Step 2 determines how much ventilation air can be brought into the house based on the length and type of fresh air duct used as well as the static pressure in the return duct.

Example: At 0.15" w.c. static pressure a 6" diameter, 20' long **flex** fresh air duct would deliver approximately 108 CFM.

Record the **CFM delivered** here: _____

CHART 2: Ventilation Air Delivered by 6" Fresh Air Intake (CFM)

Fresh Air Duct Length (ft.)	Static Pressure of Return Duct (in. w.c.)											
	0.05		0.10		0.15		0.20		0.25		0.30	
	Flex	Rigid	Flex	Rigid	Flex	Rigid	Flex	Rigid	Flex	Rigid	Flex	Rigid
10	70	77	98	108	120	132	139	153	156	172	172	189
15	66	73	93	102	114	125	132	145	148	163	163	179
20	63	69	88	97	108	118	125	137	140	154	153	169
25	59	64	83	91	102	112	118	129	131	145	144	158
30	55	60	78	86	96	105	110	121	123	135	135	148

Step 3. What should the Ventilation Controller be set to?

Step 3 takes the information from the first two steps and indicates where the 'Ventilation Time' knob on the Ventilation Controller should be set.

The point where the two lines intersect indicates where the 'Ventilation Time' knob should be set. It may be necessary to estimate the precise setting if the intersection point falls between two lines.

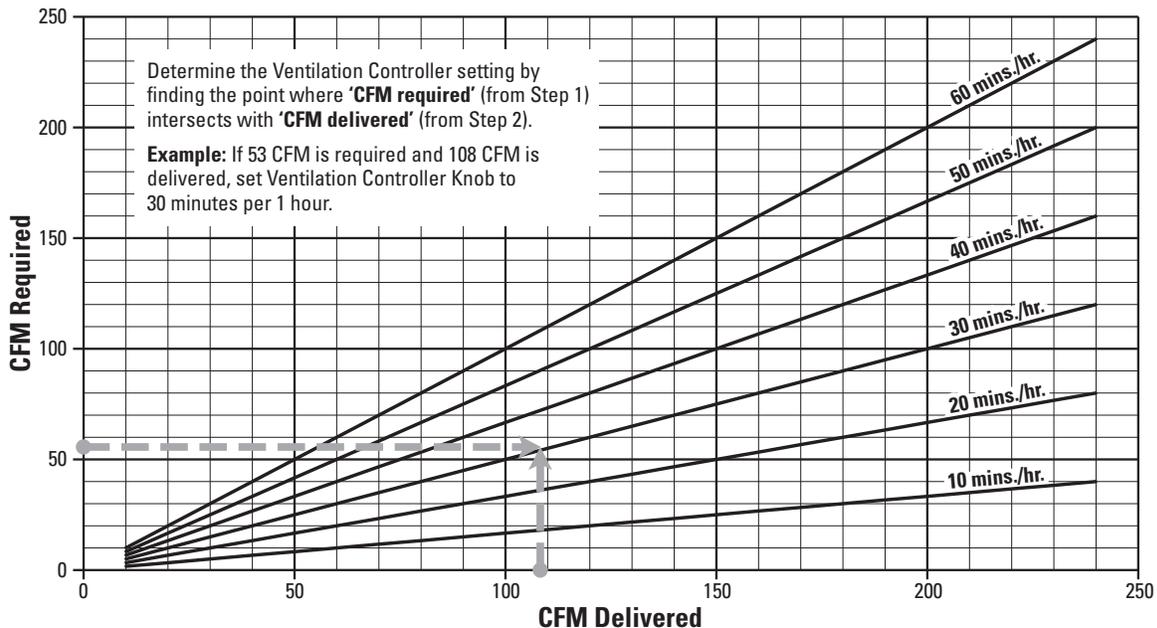
To use Chart 3:

- Using the value obtained in Step 1, locate the **CFM required** on the left (vertical) axis and draw a horizontal line to the end of the chart.
- Using the value obtained in Step 2, locate the **CFM delivered** on the horizontal axis and draw a vertical line up from the bottom to a point beyond the vertical **CFM required** line.

Record the 'Ventilation Time' setting here: _____

Note: the chart in Step 3 indicates the min./hr. setting for a 1 hour Cycle Time. For other Cycle Times, multiply the min./hr. setting in the chart by the Cycle Time length. For example, 15 min./hr. for a 1 hour Cycle Time is equal to 30 min./hr. (15 X 2) for a 2 hour Cycle Time.

Chart 3



Installation Template 4-11/16" x 2-15/16" cutout

⚠ WARNING

Danger of sharp metallic edges. Can cause injury. Take care when servicing unit to avoid accidental contact with sharp edges.

⚠ CAUTION

1. Do not mount the Ventilation Control on the supply plenum or duct. The unit will not withstand the supply temperatures.
2. When installing the Ventilation Control on downflow furnaces, ensure blower continues to run after a heat call is satisfied to eliminate high temperatures from damaging the Ventilation Control.
3. Do not mount the Ventilation Control downstream of a fresh air intake, humidifier or bypass outlet. False humidity conditions will cause the Ventilation Control to operate incorrectly.
4. UVC light may damage ventilation control system components. Do not install ventilation control system components where they may be exposed to UVC light.

Installation Template 4-11/16" x 2-15/16" cutout

