

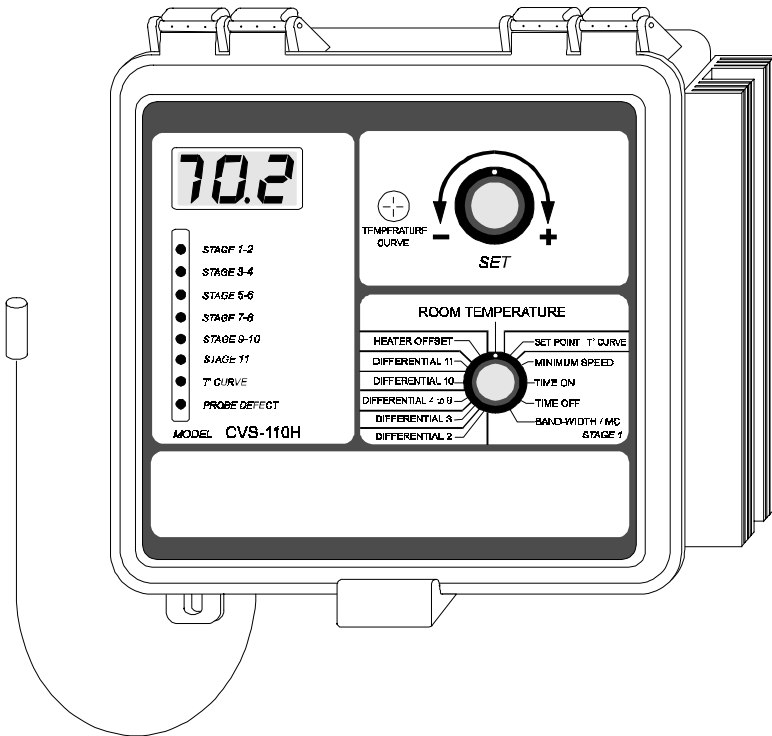
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# Temperature Controller

# CVS-110H

## User's Guide

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Read this guide carefully before using the controller.

# TABLE OF CONTENTS

FEATURES .....	3
PRECAUTIONS .....	5
INSTALLATION .....	6
LOCATION OF THE CONTROLS .....	11
USING THE CONTROLLER .....	14
The Meaning of a Flashing Display .....	14
Temperature Units .....	14
Viewing Temperatures .....	15
Room Temperature Display .....	15
Probe Temperature Display .....	15
Minimum and Maximum Temperature Recall .....	16
Minimum and Maximum Temperature Reset .....	17
Room Set Point / Temperature Curve .....	18
Stage 1 Parameters .....	22
Stage 2-9 Parameters .....	30
Stage 10 Parameters .....	32
Stage 11 Parameters .....	33
Locking the Parameters .....	35
HOW THE CONTROLLER OPERATES .....	36
TROUBLESHOOTING GUIDE .....	39
TECHNICAL SPECIFICATIONS .....	43
FACTORY SETTINGS .....	45

## FOR CUSTOMER USE

Enter below the serial number located on the side of the controller and retain this information for future reference.

Model number CVS-110H  
Serial number \_\_\_\_\_

# FEATURES

The CVS-110H is an electronic device used for environmental control in livestock buildings. It allows the user to maintain a specified target temperature by controlling the operation of ventilation and heating equipment. One stage of variable speed cooling fans can be connected to the controller, as well as eight stages of constant-speed fans and two stages of either constant-speed fans or heating units.

The main features of the controller are as follows:

## ▶ **THREE-DIGIT DISPLAY**

A three-digit display provides a high level of accuracy, allowing the user to specify a temperature to within one tenth of a degree (Fahrenheit or Celsius).

## ▶ **PILOT LIGHTS INDICATING STATE OF OUTPUTS**

Pilot lights indicating the status of outputs allow the user to monitor the operation of the system from a distance.

## ▶ **MINIMUM VENTILATION CYCLE**

When ventilation is not required for cooling, the fans can be operated either continuously or intermittently to reduce the level of humidity and supply oxygen to the room.

## ▶ **TEMPERATURE AND MINIMUM VENTILATION SPEED CURVES**

The controller can be set to automatically change the temperature set point and the minimum ventilation speed over a given period of time in accordance with the user's requirements by specifying a temperature curve and a minimum ventilation curve with up to six different set points.

## ▶ **CHOICE OF TEN MOTOR CURVES**

The variation in motor speed resulting from a change in voltage will depend on the make and capacity of the motor. In order to achieve a high degree of compatibility between controller and motor, the user can choose from among ten different motor curves, thus ensuring that the correct voltages are supplied

## ► **FULL-SPEED FAN START-UP**

In order to overcome the inertia of the ventilation system components, and de-ice the fan blades in cold weather conditions, the controller supplies maximum voltage to the variable speed fans during the 2 seconds immediately following each start-up.

## ► **FOUR INDEPENDENT TEMPERATURE SENSOR INPUTS**

Up to four temperature sensors can be connected to the controller in order to obtain a more accurate reading of the average ambient temperature and a faster reaction time.

## ► **OVERLOAD AND OVERVOLTAGE PROTECTION**

Fuses are located at the input and outputs of the controller to protect its circuitry in the case of an overload or overvoltage and a connector can be used to detect blown fuses.

## ► **COMPUTER CONTROL**

The controller can be connected to a computer, thus making possible the centralization of information management and a more diversified control strategy.

## PRECAUTIONS

**We strongly recommend the installation of supplementary natural ventilation, an independent failure alarm system as well as a back-up thermostat (refer to the wiring diagram enclosed with this user's manual to connect the thermostat).**

**Although fuses at the input and outputs of the controller protect its circuitry in the case of an overload or overvoltage, we recommend the installation of an additional protection device on the controller's supply circuit.**

**The room temperature where the controller is located MUST ALWAYS REMAIN BETWEEN 32° AND 104°F (0° AND 40°C).**

**To avoid exposing the controller to harmful gases or excessive humidity, it is preferable to install it in a corridor.**

**DO NOT SPRAY WATER ON THE CONTROLLER**

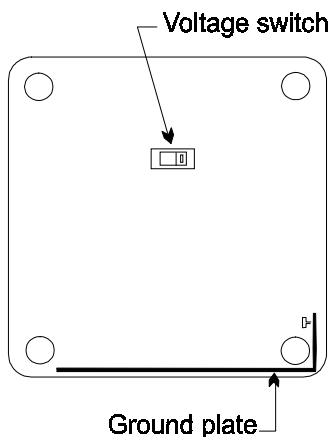
## Mounting Instructions

Remove the four screws in the front cover and lift the cover. Remove the black caps located on the three mounting holes. Mount the enclosure to the wall using three screws. Be sure the electrical knockouts are at the bottom of the enclosure in order to prevent water from entering the controller. Insert the screws into the mounting holes and tighten. **Fasten the black caps onto the mounting holes.**

## Connections

To connect the controller, refer to the wiring diagram enclosed with this user's manual.

- Set the voltage switch to the appropriate line voltage.
- Route the cables through the electrical knockouts provided at the bottom of the enclosure. Do not make additional holes in the enclosure, particularly on the side of the enclosure when using a computer communication module.
- If metallic cable holders are used to secure cables entering the enclosure, connect the ground wire to the ground plate.



**Inside of the enclosure**

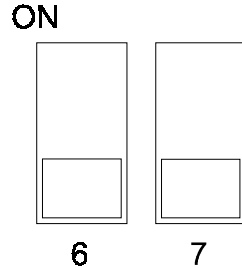
- It may be necessary to install a transformer on the heating stages in order to supply the correct voltage to the heater.



ALL WIRING MUST BE DONE BY AN AUTHORIZED ELECTRICIAN AND MUST COMPLY WITH APPLICABLE CODES, LAWS AND REGULATIONS. BE SURE POWER IS OFF BEFORE DOING ANY WIRING TO AVOID ELECTRICAL SHOCK AND EQUIPMENT DAMAGE.

## Heat/Cool Option

Stages 10 and 11 can both operate as a heating stage or a cooling stage. If one is used as a heating stage and the other as a cooling stage, the fans must be connected to stage 10 and the heating units to stage 11.



- Set switches # 6 and # 7 to the required position:
  - # 6 to OFF; # 7 to ON or OFF: stage 10 & 11 operate as cooling stages.
  - # 6 to ON; # 7 to ON: stage 10 & 11 operate as heating stages.
  - # 6 to ON; # 7 to OFF: stage 10 operates as a cooling stage and stage 11 as a heating stage.

**FACTORY SETTING:** When the controller is shipped from the factory, switch # 6 is set to ON and switch # 7 to OFF (stage 10 operates as a cooling stage and stage 11 as a heating stage).

## Temperature Probes

The controller is supplied with one room probe connected to terminal # 1. Up to three additional probes may be connected to the controller to improve accuracy and reaction times.

- Use terminals # 2, 3 and 4 to connect additional probes, as shown on the wiring diagram enclosed with this manual

**CAUTION:** The probes operate under low voltage and are isolated from the supply. Be sure the probe cables remain isolated from all high voltage sources. Do not route the probe cables and other power cables through the same electrical knockout. Do not run the probe cables next to other power cables. When crossing over other cables, cross at 90°.

## Extending the Probes

Each probe can be extended up to 500 feet (150 meters). To extend a probe:

- Use a shielded cable of outside diameter between 0.245 and 0.260 in (6.22 and 6.60 mm) to ensure the cable entry is liquid-tight (the cable dimension should not be under 18 AWG).
- It is preferable to weld the cable joint to ensure a proper contact between the two cables.
- **Do not ground the shielding.**

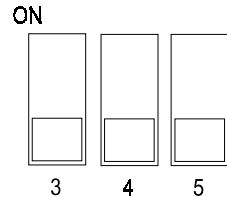
## Connecting Additional Room Probes

Up to three additional room probes may be connected to the controller in order to obtain a more accurate reading of the average room temperature and a faster reaction time.

- Connect each additional room probe using terminals # 2, # 3 and # 4, as shown on the wiring diagram enclosed with this user's manual.

Switches are used to activate or deactivate the additional room probes connected to the controller.

- Activate each additional room probe by setting the appropriate switch to ON:




- Switch # 3 activates the room probe connected to terminal # 2.
- Switch # 4 activates the room probe connected to terminal # 3
- Switch # 5 activates the room probe connected to terminal # 4.

**FACTORY SETTING:** When the controller is shipped from the factory, switches # 3, 4 and 5 are set to OFF (room probes are deactivated).

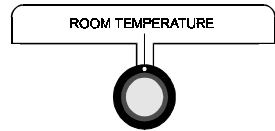
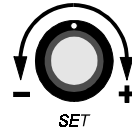


# Defective Probes

If one or many room probes are defective, the defective probe pilot light turns on. If all the room probes are defective, the display shows the letter "P" when the parameter selection knob is set to ROOM and the controller operates according to the minimum ventilation cycle (  refer to "Minimum ventilation cycle", page 22). Otherwise, the display shows the average value of all temperatures measured by the room probes remaining in proper condition and the controller operates according to this temperature.

To identify the defective probe:

- Set the selection knob to **ROOM**. The room temperature is displayed.
- Press the push-button. If the probe connected to terminal # 1 and supplied with the controller is not defective, the letters "**PR1**" are displayed, alternating with the temperature measured by the probe. Otherwise, the letters "**PR1**" are displayed, alternating with the letter "**P**".



For each additional probe connected to the controller:

- Press the push-button once again. If the probe is not defective, the letters "**PR#**" (where # is the number of the terminal the probe is connected to) are displayed, alternating with the temperature measured by the probe. If the probe is defective, the letters "**PR#**" are displayed, alternating with the letter "**P**".

# Motor Curves

The relationship between the voltage supplied to a motor and its operating speed is described by a motor curve. This curve varies with the make and capacity of the motor. The various motors available in the industry have been divided into ten categories and the controller has been programmed with a different motor curve for each of these categories. Select the appropriate curve to ensure that the controller supplies the correct voltage to the variable speed fan motors.

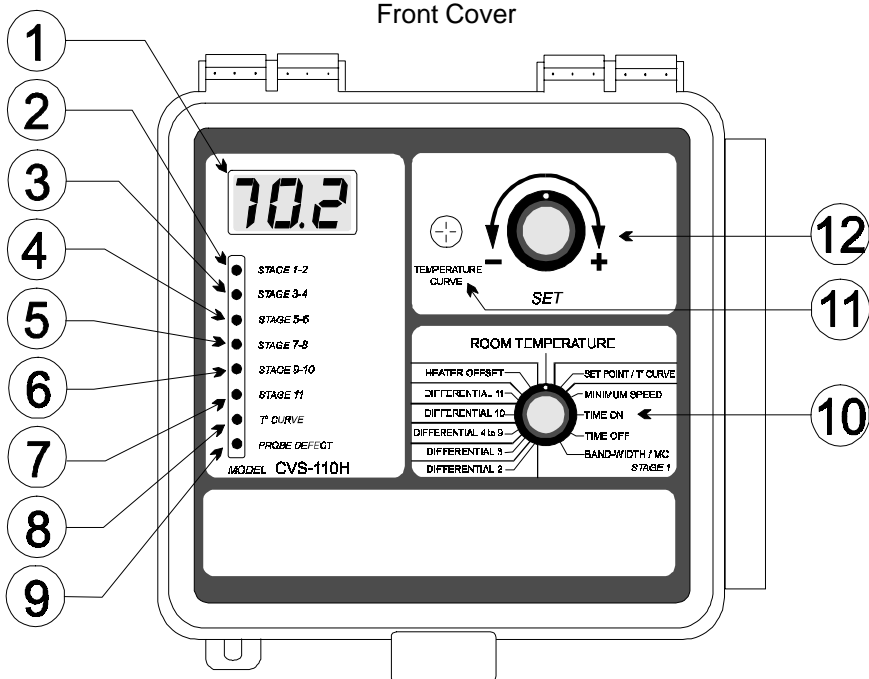
## To Select a Motor Curve

- In the list of motors enclosed with this user's manual, locate the make and capacity of your variable speed motors and note the corresponding curve number (1 to 10).
- Set the parameter selection knob to BAND-WIDTH/M.C. - STAGE 1. The differential appears flashing on the display.
- Press the push-button. The currently selected curve number appears flashing on the display.
- Using the adjustment knob, adjust the curve number to the desired value.
- Return to the differential display either by pressing the push-button once again or by waiting 10 seconds without changing the position of the adjustment knob.

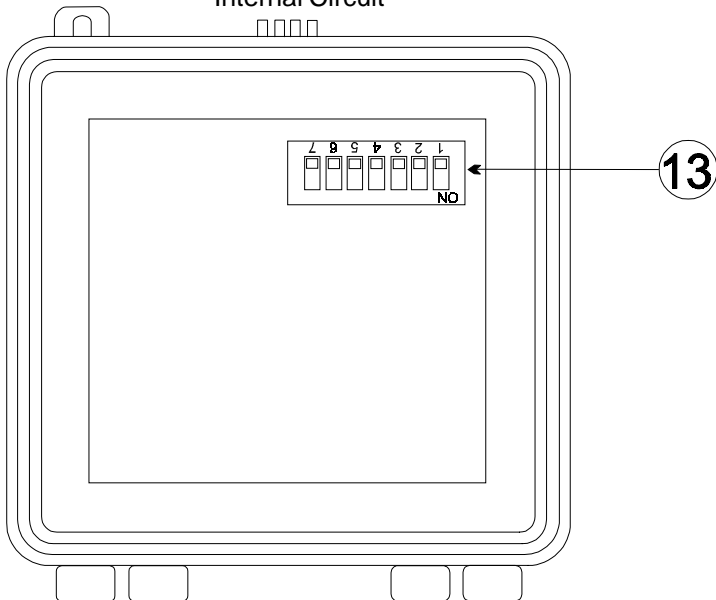
**FACTORY SETTING:** When the controller is shipped from the factory, curve number 4 has been selected.

# LOCATION OF THE CONTROLS

Front Cover



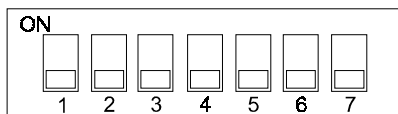
Internal Circuit



- 1 Three-Digit Display**  
Displays temperatures and other parameters shown on the Adjustment Knob.
- 2 Stage 1 and 2 Pilot Light**  
Flashes when Stage 1 fans are on and stays on when Stage 2 fans are on.
- 3 Stage 3 and 4 Pilot Light**  
Flashes when Stage 3 fans are on and stays on when Stage 4 fans are on.
- 4 Stage 5 and 6 Pilot Light**  
Flashes when Stage 5 fans are on and stays on when Stage 6 fans are on.
- 5 Stage 7 and 8 Pilot Light**  
Flashes when Stage 7 fans are on and stays on when Stage 8 fans are on.
- 6 Stage 9 and 10 Pilot Light**  
Flashes when Stage 9 fans are on and stays on when Stage 10 fans or heating units are on.
- 7 Stage 11 Pilot Light**  
Turns on when Stage 11 fans or heating units are on.
- 8 Temperature and Minimum Ventilation Curve Pilot Light**  
Turns on when the temperature curve is activated and blinks when both curves are activated.
- 9 Defective Probe Pilot Light**  
Turns on when a defective probe is detected.
- 10 Parameter Selection Knob**  
Used to select a parameter.
- 11 Push-Button for Other Functions**  
Used to access other functions such as specifying the points of a temperature curve.
- 12 Adjustment Knob**  
Used to adjust the value of a selected parameter.

### 13 - Internal switches

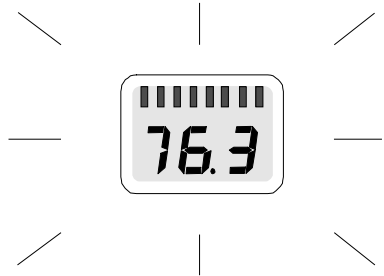
Used to set the operating modes as described in the table below.



DESCRIPTION	SWITCH		OPERATING MODE
	#	POSITION	
Locking of the parameters	1	ON OFF	Locked parameters Unlocked parameters
Temperature units	2	ON OFF	° Celsius ° Fahrenheit
Probe # 2	3	ON OFF	Probe # 2 activated Probe # 2 deactivated
Probe # 3	4	ON OFF	Probe # 3 activated Probe # 3 deactivated
Probe # 4	5	ON OFF	Probe # 4 activated Probe # 4 deactivated
COOLING OR HEATING	6 and 7	6: OFF ; 7: ON / OFF 6: ON ; 7: ON 6: ON ; 7: OFF	Stage 10 and 11: cooling Stage 10 and 11: heating Stage 10: cooling; Stage 11: heating

## The Meaning of a Flashing Display

The display flashes certain values and does not flash others. The flashing indicates that the displayed value can be adjusted. A value that is not flashing can not be adjusted.

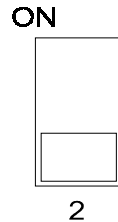


## Temperature Units

Temperatures can be displayed either in degrees Celsius or in degrees Fahrenheit.

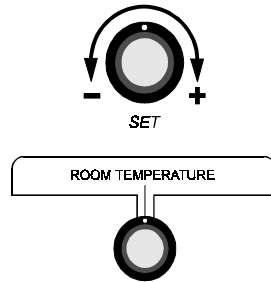
■ Set switch # 2 to the desired position:

- ON to display temperatures in degrees Celsius.
- OFF to display temperatures in degrees Fahrenheit.



**FACTORY SETTING:** When the controller is shipped from the factory, switch # 2 is set to OFF (temperatures are displayed in degrees Fahrenheit).

# Viewing Temperatures



## Room Temperature Display

The room temperature is the average value of all temperatures measured by room probes that are activated and in proper operating condition.

### TO DISPLAY THE ROOM TEMPERATURE

- Set the parameter selection knob to ROOM. The room temperature appears on the display.

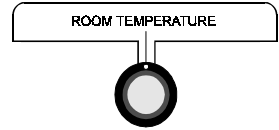
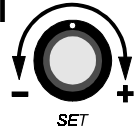
### TO DISPLAY PROBE TEMPERATURES

- Set the parameter selection knob to ROOM. The room temperature appears on the display.
- Press the push-button. The letters "PR1" are displayed, alternating with the temperature measured by the probe connected to terminal # 1 (supplied with the controller).

For each additional probe connected to the controller:

- Press the push-button. The letters "PR#" (where # is the number of the terminal to which the probe is connected) are displayed, alternating with the temperature measured by the probe.

# Minimum and Maximum Temperature Recall



The minimum and maximum temperatures are the lowest and highest values of all room temperatures measured since the last reset.

## TO RECALL MINIMUM AND MAXIMUM TEMPERATURES

- Set selection knob to ROOM. The room temperature appears on the display.
- Turn adjustment knob clockwise by one notch. The minimum temperature appears flashing on the display.
- Turn adjustment knob clockwise one notch further. The maximum temperature appears flashing on the display.
- Turn adjustment knob clockwise a third notch. The room temperature again appears on the display.
- If adjustment knob is turned counterclockwise rather than clockwise, the display sequence will be reversed (room-maximum-minimum-room).

The minimum and maximum temperatures are the lowest and highest values of all room temperatures measured since the last reset.



## Minimum and Maximum Temperature Reset

The reset erases the current minimum and maximum temperatures. From the moment the reset is completed, the controller begins to store in memory the new minimum and maximum temperatures measured by the probes.

### TO RESET THE MINIMUM AND MAXIMUM TEMPERATURES

- Set the parameter selection knob to ROOM. The room temperature appears on the display.
- Turn the adjustment knob clockwise (or counterclockwise) by one notch and leave it in this position. The minimum (or maximum) temperature first appears flashing on the display. After 10 seconds, the display stops flashing and the room temperature again appears on the display, indicating that the reset is completed.

**NOTE :** To avoid resetting the minimum et maximum temperatures while recalling them, be sure to return to the room temperature display within the 10 second delay.

## Room Set Point/Temperature Curve

There are two ways to specify the target room temperature:

- 1 Adjust the room set point to the desired value and do not activate the temperature curve. The controller will operate according to this target room temperature as long as the temperature curve remains deactivated.
- 2 Program a temperature curve comprised of six points and activate the temperature curve. For each of the six points, you must specify a day number and a room set point for this day number. The controller will automatically change the target room temperature every hour in a linear fashion between two consecutive points. When the last point is reached, the temperature curve becomes deactivated. The controller continues to operate according to the last room set point until you activate the temperature curve once again or specify a new room set point. You can also deactivate the temperature curve before the last point is reached.

**The room set point and the points of the temperature curve can be adjusted only if the temperature curve is deactivated:**

- If the temperature curve pilot light is off, the temperature curve is presently deactivated and you can proceed with the adjustment.
- If the temperature curve pilot light is on, the temperature curve is presently activated. Before proceeding with the adjustment, deactivate the curve as follows.

### **To deactivate the temperature curve**

- Set the parameter selection knob to SET POINT/ T°CURVE. The current room set point appears flashing on the display.
- Press the push-button repeatedly until the word ON appears flashing on the display.
- Turn the adjustment knob counterclockwise one notch and leave it in this position for at least 10 seconds. The word OFF appears flashing on the display and after 10 seconds, the temperature curve pilot light turns off, indicating that the temperature curve is now deactivated. Set the parameter selection knob to ROOM.

## TO ADJUST THE ROOM TEMPERATURE SET POINT

- Be sure the temperature curve is deactivated (read the instructions on page 18).
- Set the parameter selection knob to SET POINT/T°CURVE. The current room set point appears flashing on the display.
- Using the adjustment knob, adjust the set point to the desired value.

## TO PROGRAM THE TEMPERATURE CURVE

**NOTES:** • All six points of the curve must be specified. If you do not need six different points, repeat your last room set point for each unnecessary point of the curve.

- To reduce the risk of errors:

- The highest possible day number is 99.
- You can not specify decreasing day numbers.
- You can not specify an increasing temperature curve.
- The temperature variation can not exceed 3°F (1.6°C) per day.

### **To specify the six points of the temperature curve:**

- Be sure the temperature curve is deactivated (read the instructions on page 18).
- Set the parameter selection knob to SET POINT/T°CURVE. The current room set point appears flashing on the display.
- Press the push-button. The word OFF appears on the display, indicating that the temperature curve is deactivated.

## TO PROGRAM THE TEMPERATURE CURVE (CONT'D)

Repeat the following steps for each of the six points:

- Press the push-button once again. A day number, preceded by the letter "d", appears flashing on the display.
- Using the adjustment knob, adjust the day number to the desired value.
- Press the push-button once again. The current room set point for this day number appears flashing on the display.
- Using the adjustment knob, adjust the room set point to the desired value.

When the six points of the temperature curve have been specified, activate the curve as follows.

### **To activate the temperature curve**

- Press the push-button once again. The word OFF appears flashing on the display.
- Turn the adjustment knob clockwise one notch and leave it in this position for at least 10 seconds. The word ON appears flashing on the display and after 10 seconds, the temperature curve pilot light turns on, indicating that the temperature curve is now activated.
- Set the parameter selection knob to ROOM.

**NOTE:** When the temperature curve is activated, the current target room temperature can be viewed at any time by setting the parameter selection knob to SET POINT / T°CURVE. The current day number can then be viewed by pressing the push-button.

## **TO DISPLAY CURRENT SET POINT TO DISPLAY / MODIFY CURRENT DAY NUMBER**

When the temperature curve is activated, the current temperature set point and day number can be displayed at any time. The current day number can also be adjusted in order to move forward or backward on the temperature curve.

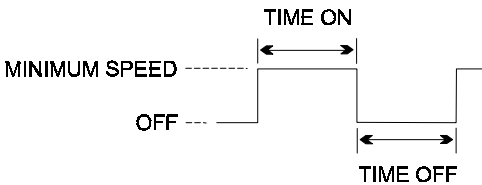
- Set the parameter selection knob to SET POINT / T° CURVE. The current temperature set point appears on the display.
- Press the push-button. The current day number is displayed.
- Use the adjustment knob to set the day number to the desired value.

# Stage 1 Parameters

**Description of Operation** (👉 Refer to figure 1 on next page)

## 1 Minimum Ventilation Cycle

When the room temperature is below the room set point, the cooling fans run according to the timer settings.



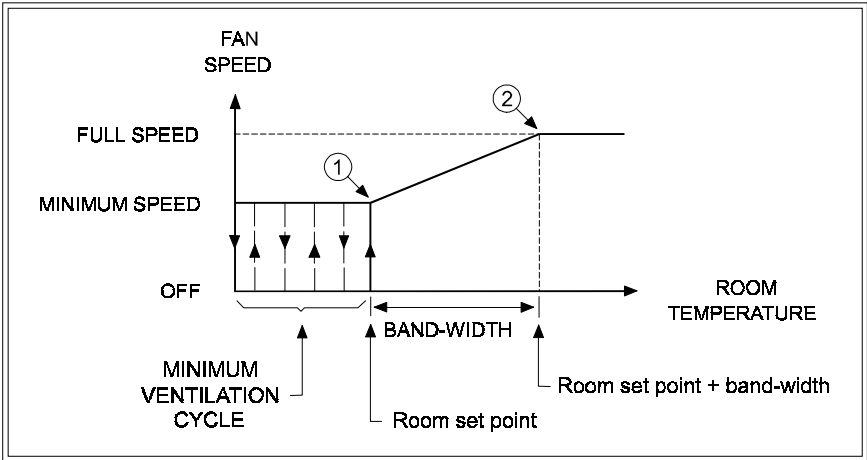
**Cooling Timer:**  
During TIME ON, the fans run at minimum speed. During TIME OFF, the fans do not run.

The fans can be set to operate in three different ways:

- 1 - To run the fans continuously, set time off to zero and time on to any value other than zero.
- 2 - To stop the fans, set time on to zero and time off to any value equal to or other than zero.
- 3 - To run the fans intermittently, set time on to the desired running time and time off to the desired off time.

Running the fans continuously or intermittently even though ventilation is not required for a cooling purpose is useful to reduce the level of humidity and supply oxygen to the room. It also prevents the fans from freezing in the winter.

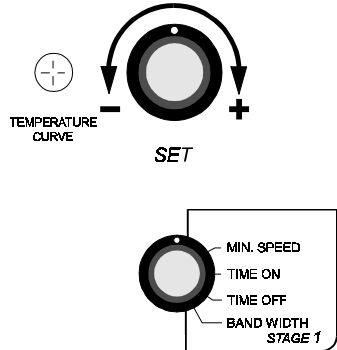
Figure 1 : Cooling Fans - Operation Diagram



## 2 Variable Speed Ventilation

When the room temperature rises to the room set point (point 1), the cooling fans stop running according to the minimum ventilation cycle. They begin to run continuously and increase in speed proportionally to the room temperature. When the room temperature rises to "room set point + band-width" (point 2), the cooling fans reach full speed. Above this temperature, the controller continues to supply full speed voltage.

# Adjusting the Stage 1 Parameters



## TO ADJUST TIME ON

- Set selection knob to TIME ON. The current time on appears flashing on the display.
- Using adjustment knob, adjust the time on to the desired value.

Time on can be adjusted between 0 and 900 seconds, by increments of 15 seconds.

## TO ADJUST TIME OFF

- Set selection knob to TIME OFF. The current time off appears flashing on the display.
- Using adjustment knob, adjust the time off to the desired value.

Time off can be adjusted between 0 and 900 seconds, by increments of 15 seconds.



The minimum speed can be specified in two ways: either with a single minimum speed or with a minimum speed curve, as described hereafter.

### 1 - With a single minimum speed

When a single minimum speed is specified and the minimum speed curve is deactivated (or the minimum speed curve is activated but not effectively operating), the fans run at this speed.

## **Single Minimum Speed**

The single minimum speed can be adjusted only if the minimum speed curve is deactivated or if the minimum speed curve is activated but not effectively operating. If it is effectively operating, deactivate the curve as follows.

### **To Deactivate the Minimum Speed Curve**

- Set selection knob to MIN. SPEED. The current stage 1 single minimum speed appears flashing on the display.
- Press push-button repeatedly until the word ON appears flashing on the display.
- Turn adjustment knob counterclockwise one notch. The word OFF appears flashing on the display, indicating that the minimum speed curve is now deactivated.

### **To Adjust the Single Minimum Speed**

- Set selection knob to MIN.SPEED. The current stage 1 single minimum speed appears flashing on the display.
- Turn adjustment knob to adjust the minimum speed to the desired value.

The minimum speed can be adjusted between 10 and 100% of the full speed of the fans.

## 2 - With a minimum speed curve

When a minimum speed curve is specified and activated, the controller automatically adjusts the minimum speed over a given period of time. The minimum speed curve is comprised of six points. A day number as well as a minimum speed for this day number must be specified for each of the six points. When the minimum speed curve is activated, the controller adjusts the minimum speed every hour in a linear fashion between two consecutive points.

However, if the room temperature falls below the value given in Table 1 below, the fans will begin to run at the minimum speed specified for the first point of the curve and will continue to do so as long as the room temperature remains below the set point. When the room temperature rises above the set point, the fans will return to the current minimum speed.

When the last point of the curve is reached, the curve becomes deactivated. The controller maintains the minimum speed specified for this point until the curve is reactivated or until a new single minimum speed is specified.

**Table 1.**

<b>STAGE 11 OPERATION</b>	<b>THRESHOLD VALUE</b>
<b>Cooling</b>	"Set Point - 5.0°F (2.8°C)"
<b>Heating</b>	"Set Point - 5.0°F (2.8°C) - Heating Offset - Stage 11 Differential" <b>OR</b> "Set Point", if the parameter settings are such that the preceding value is greater than the set point.

The minimum speed curve and the temperature curve are related in the following ways:

- The minimum speed curve can be activated only if the temperature curve is already activated.

- All points of the minimum speed curve, other than the first one, are automatically given day numbers identical to those specified for the temperature curve. Only the first point of the minimum speed curve has an adjustable day number. This day number must be higher or equal to the day number specified for the first point of the temperature curve and lower than the day number specified for the second point of the temperature curve.

For example:

	TEMPERATURE CURVE	MINIMUM SPEED CURVE
POINT 1	d5	d5 to d9 (adjustable)
POINT 2	d10	d10 (not adjustable)

- When the minimum speed curve is activated, it will effectively be operating (i.e. the controller will begin to adjust the minimum speed according to the specified points of the curve) only when the current day number of the temperature curve reaches the first day number of the minimum speed curve.

For example:

	TEMPERATURE CURVE		MINIMUM SPEED CURVE	
	Day number	Temperature	Day number	Speed
POINT 1	d5	90.0 °F	d7	10 %
POINT 2	d10	85.0 °F	d10	20 %

☞ If you activated the temperature curve yesterday, the current day number of the temperature curve is d6. Therefore, if you activate the minimum speed curve today, it will effectively be in operation only tomorrow, when the current day number of the temperature curve reaches d7. In the meantime, the fans will run at the specified single minimum speed.

☞ If you activated the temperature curve three days ago, the current day number of the temperature curve is d8. Therefore, if you activate the minimum speed curve today, it will effectively be in operation the moment you activate it. In this case, the current minimum speed will be a value between 10% and 20%.

## Minimum Speed Curve

The points of the minimum speed curve can be adjusted only if the minimum speed curve is deactivated. If the minimum speed curve is activated, deactivate the curve as follows.

### To Deactivate the Minimum Speed Curve

- Set selection knob to MIN. SPEED. The current single minimum speed appears flashing on the display.
- Press push-button repeatedly until the word ON appears flashing on the display.
- Turn adjustment knob counterclockwise one notch. The word OFF appears flashing on the display, indicating that the minimum speed curve is now deactivated.

### To Specify the Points of the Minimum Speed Curve

- Set selection knob to MIN.SPEED. The current stage 1 single minimum speed appears flashing on the display.
- Press push-button. The word OFF appears on the display, indicating the minimum speed curve is deactivated.

Repeat the following steps for each of the six points:

- Press push-button once again. A day number, preceded by the letter "d", appears flashing on the display.

## Minimum Speed Curve (cont'd)

- For the first point of the curve, use adjustment knob to adjust the day number to the desired value. For all other points of the curve, the day number can not be adjusted.
- Press push-button once again. The current minimum speed for this day number appears flashing on the display.
- Turn adjustment knob to adjust the minimum speed to the desired value.

### NOTES:

(1) All six points of the curve must be specified. If you do not need six different points, repeat your last minimum speed for each unnecessary point of the curve.

(2) To reduce the risk of errors:

- it is not permitted to specify decreasing minimum speeds;
- the minimum speed variation can not exceed 10% per day.

When the six points of the minimum speed curve have been specified, activate the minimum speed curve as described below (the minimum speed curve can be activated only if the temperature curve is activated).

### To Activate the Minimum Speed Curve

- Press push-button once again. The word OFF appears flashing on the display.
- Turn adjustment knob clockwise by one notch. The word ON appears flashing on the display, indicating that the minimum speed curve is now activated.

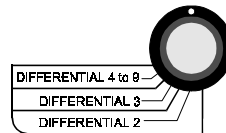
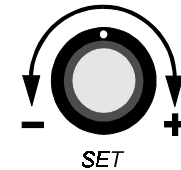
**NOTE:** When the minimum speed curve is operating, the current minimum speed can be viewed at any time by setting selection knob to MIN.SPEED. The current day number can then be viewed by pressing the push-button.

## TO ADJUST THE BAND-WIDTH

- Set the parameter selection knob to BAND-WIDTH. The current band-width appears flashing on the display.
- Using the adjustment knob, adjust the band-width to the desired value.

The band-width is the temperature difference between the moment the stage 1 fans start to run and the moment they return to a stop. It can be adjusted between 0.5° and 20.0°F (0.3° and 11.1°C).

## Stage 2-9 Parameters



## Stage 2 Differential

- Set selection knob to DIFFERENTIAL 2. The current differential for stage 2 appears flashing on the display.
- Using adjustment knob, adjust the differential to the desired value.

The stage 2 differential is the temperature difference between the moment the stage 2 constant speed fans start to run and the moment they return to a stop. The differential can be adjusted between 0.5° and 20.0°F (0.3° and 11.1°C).

## Stage 3 Differential

- Set selection knob to DIFFERENTIAL 3. The current differential for stage 3 appears flashing on the display.
- Using adjustment knob, adjust the differential to the desired value.

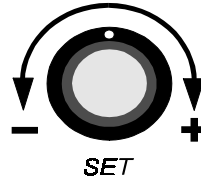
The stage 3 differential is the temperature difference between the moment the stage 3 constant speed fans start to run and the moment they return to a stop. The differential can be adjusted between 0.5° and 20.0°F (0.3° and 11.1°C).

## Stage 4-9 Differential

- Set selection knob to DIFFERENTIAL 4 to 9. The current differential for stages 4 to 9 appears flashing on the display.
- Using adjustment knob, adjust the differential to the desired value.

The differential is the temperature difference between the moment the stage's constant speed fans start to run and the moment they return to a stop. The differential can be adjusted between 0.5° and 20.0°F (0.3° and 11.1°C).

## Stage 10 Parameters



### 1 COOLING

#### Stage 10 Cooling Differential

- Set selection knob to DIFFERENTIAL 10. The current differential for stage 10 appears flashing on the display.
- Using adjustment knob, adjust the differential to the desired value.

The stage 10 cooling differential is the temperature difference between the moment the stage 10 constant speed fans start to run and the moment they return to a stop. The differential can be adjusted between 0.5° and 20.0°F (0.3° and 11.1°C).

### 2 HEATING

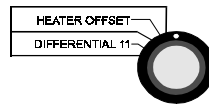
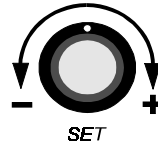


## Stage 10 Heating Differential

- Set selection knob to DIFFERENTIAL 10. The current differential for stage 10 appears flashing on the display.
- Using adjustment knob, adjust the differential to the desired value.

The stage 10 heating differential is the temperature difference between the moment the stage 10 heating units turn on and the moment they turn off. The differential can be adjusted between 0.5° and 20.0°F (0.3° and 11.1°C).

## Stage 11 Parameters



### 1 COOLING

## Stage 11 Cooling Differential

- Set selection knob to DIFFERENTIAL 11. The current differential for stage 11 appears flashing on the display.
- Using adjustment knob, adjust the differential to the desired value.

The stage 11 cooling differential is the temperature difference between the moment the stage 11 constant speed fans start to run and the moment they return to a stop. The differential can be adjusted between 0.5° and 20.0°F (0.3° and 11.1°C).

## 2 HEATING

### Stage 11 Heating Differential

- Set selection knob to DIFFERENTIAL 11. The current differential for stage 11 appears flashing on the display.
- Using adjustment knob, adjust the differential to the desired value.

The stage 11 heating differential is the temperature difference between the moment the stage 11 heating units turn on and the moment they turn off. The differential can be adjusted between 0° and 20.0°F (0° and 11.1°C).

### Heating Offset

The heating offset is the number of degrees below the set point at which the heating units turn off. The heating offset can provide substantial energy savings if correctly adjusted according to the outside temperature.

When the heating offset is deactivated, it can be adjusted only to a positive value. When the heating offset is activated, it can be adjusted to a positive or negative value. Adjusting the heating offset to a negative value allows the heating units to operate when the room temperature is above the set point.

### To Activate / Deactivate the Heating Offset

- Set selection knob to HEATER OFFSET. The current heating offset appears flashing on the display.
- Press push-button. The word ON or OFF appears flashing on the display. Turn the adjustment knob clockwise one notch to activate the heating offset (the word ON appears flashing on the display) or counterclockwise to deactivate the heating offset (the word OFF appears flashing on the display).

## To Adjust the Heating Offset

- Set selection knob to HEATER OFFSET. The current heating offset appears flashing on the display.
- Turn adjustment knob to adjust the heating offset to the desired value.

The heating offset can be adjusted between 0° and 20.0°F (0° and 11.1°C) and between -9.9° and 20.0°F (-5.5 and 11.1°C) when the heating offset is activated.

## Locking the Parameters

The parameters can be locked to prevent their settings from being accidentally modified. When the parameters are locked, only the temperature set point (if the temperature curve is deactivated) and the minimum speed (as long as the minimum speed curve is deactivated) can be modified.

To lock the parameters:

- Set switch # 1 to ON.

To unlock the parameters:

- Set switch # 1 to OFF.

**FACTORY SETTING :** When the controller is shipped from the factory, switch # 1 is set to OFF (parameters are unlocked).

# HOW THE CONTROLLER OPERATES

## 1 IF STAGES 10 AND 11 ARE USED FOR COOLING

Refer to the diagram on the following page for the description that follows:

**If the room temperature rises:**

- **When room < set point + bandwidth 1**, the stage 1 fans run according to the minimum ventilation cycle.
- **At POINT 1:** the stage 1 fans stop operating according to the minimum ventilation cycle (point 1) and start to run continuously.
- **At POINT 3:** the stage 2 fans start to run.
- **At POINT 5:** the stage 3 fans start to run.

Etc...

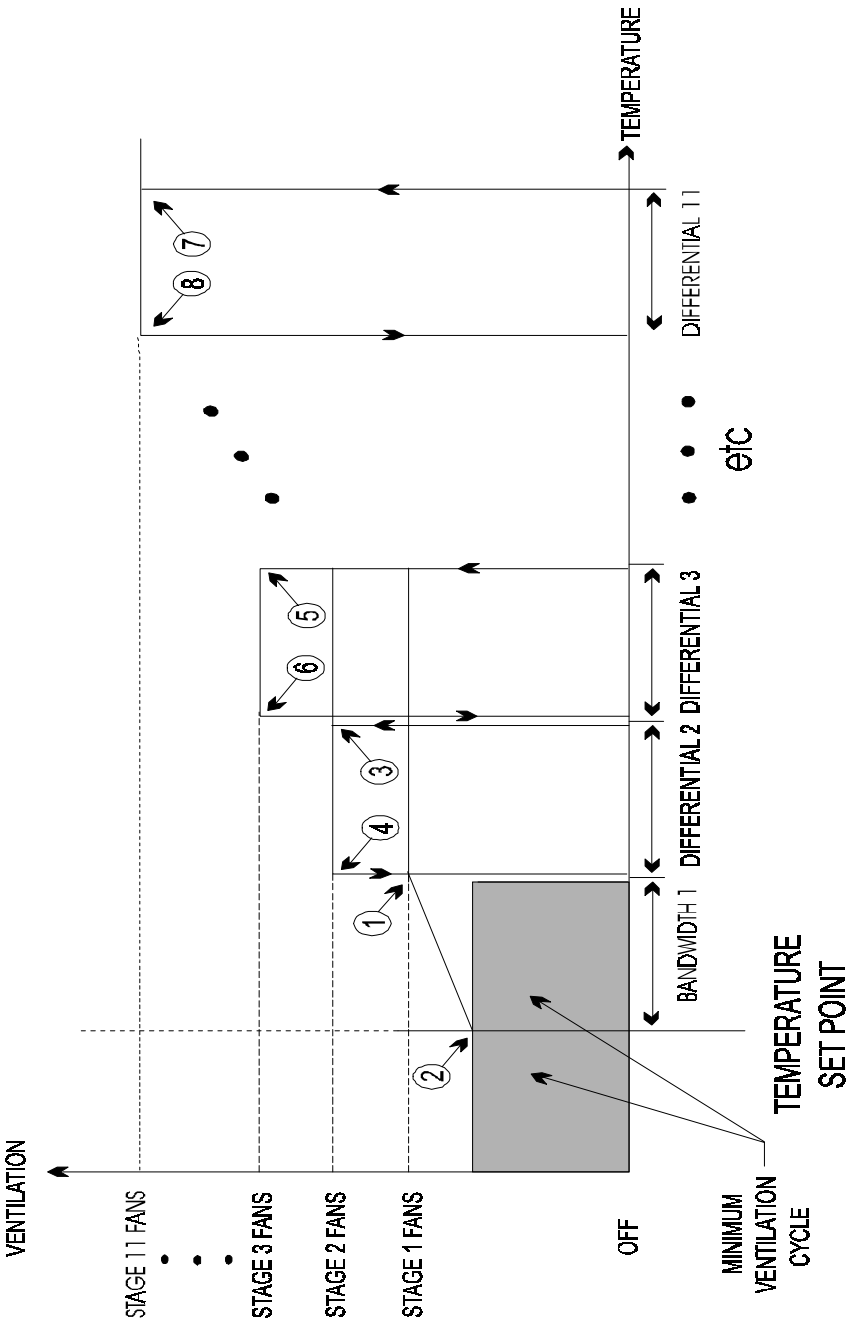
- **At POINT 7:** the stage 12 fans start to run.

**If the room temperature falls:**

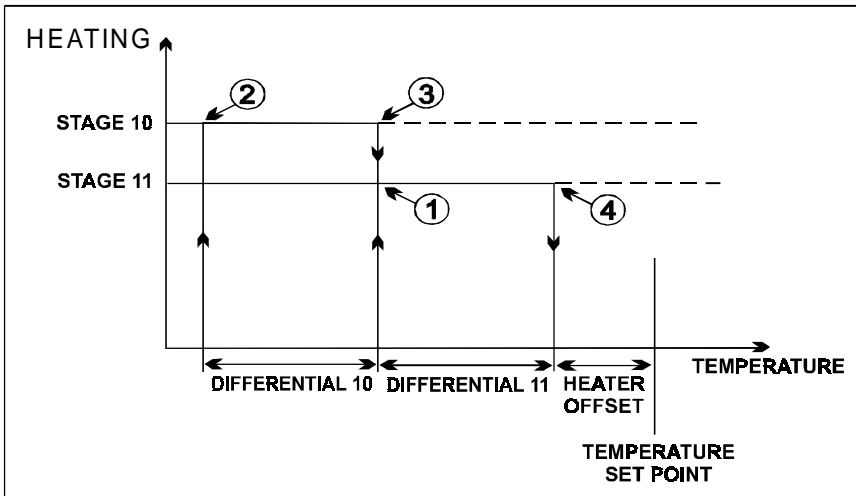
- **At POINT 8:** the stage 12 fans return to a stop.

Etc...

- **At POINT 6:** the stage 3 fans return to a stop.
- **At POINT 4:** the stage 2 fans return to a stop.
- **At POINT 2:** the stage 1 fans stop running continuously and operate according to the minimum ventilation cycle.



## 2 IF STAGES 10 AND 11 ARE USED FOR HEATING



When stages 10 and 11 are used for heating, stages 1 to 9 operate in the same manner as described for cooling; however stages 10 and 11 operate at room temperatures below the set point, as described hereafter.

NOTE: *Heat offset* can be adjusted to a positive or negative value. When positive, stages 10 and 11 operate at room temperatures below the set point as illustrated. When negative, stages 10 and 11 may operate at room temperatures above the set point.

### If the room temperature falls:

- **AT POINT 1:** the stage 11 heating units turn on.
- **AT POINT 2:** the stage 10 heating units turn on.

### If the room temperature rises:

- **AT POINT 3:** the stage 10 heating units turn off.
- **AT POINT 4:** the stage 11 heating units turn off.

## TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	SOLUTION
<p>There is no display.</p>	<p>The circuit breaker at the service panel is off or tripped.</p> <p>The wiring is incorrect.</p> <p>The F5 input fuse is open.</p> <p>The voltage selector switch is in the wrong position.</p> <p>The display board interconnect cable is unplugged from the power supply board.</p>	<p>Reset the circuit breaker.</p> <p>Correct the wiring.</p> <p>Replace the fuse.</p> <p>Set the switch to the correct position.</p> <p>Plug in the cable.</p>
<p>The display shows the letter "P".</p>	<p>Probe # 1 is connected improperly.</p>	<p>Correct the sensor's connection.</p>
<p>The Defective Probe pilot light is turned on.</p>	<p>One or more sensors are defective.</p>	<p>Follow the procedure described in DEFECTIVE SENSORS to identify which sensor(s) is (are) defective. Replace the defective sensor(s).</p>

PROBLEM	CAUSE	SOLUTION
<p>The display shows sudden variations in the room temperature.</p>	<p>A variation in resistance is induced on a sensor.</p> <p>There is electrical noise near the cable of an extended sensor.</p>	<p>Be sure the sensors are dry and move them away from drafts and from all sources of radiant heating.</p> <p>Do not run sensor cables next to other power cables. When crossing other power cables, cross at 90 °.</p>
<p>The Stage 1 fans are not running.</p>	<p>The wiring is incorrect.</p> <p>The stage's F2 fuse is open.</p> <p>The display board inter-connect cable is not plugged into the power supply board properly.</p> <p>The minimum speed is too low.</p> <p>The fan motor is defective.</p>	<p>Correct the wiring. In particular, be sure two different lines are connected to each motor: line L1 modulated by the controller should be combined with another line (N for 115V or L2 for 230V) to activate the motor. Also, be sure the stage's COMMON is supplied by line L1.</p> <p>Replace the fuse.</p> <p>Be sure the cable is firmly plugged in.</p> <p>Adjust the minimum speed to a higher value.</p> <p>Verify if the motor is defective by connecting it to an alternate power supply. If it still is not operating, replace the motor.</p>



PROBLEM	CAUSE	SOLUTION
<p>The Stage 1 fans run continuously at full speed.</p>	<p>The wiring is incorrect.</p> <p>The room temperature is above the set point.</p>	<p>Correct the wiring.</p> <p>Adjust the set point to the desired value.</p>
<p>The Stage 1 fans run erratically.</p>	<p>The selected motor curve is inappropriate.</p> <p>The band-width is too small.</p> <p>The time on or time off is too short.</p>	<p>Select an appropriate motor curve.</p> <p>Adjust the band-width to a higher value.</p> <p>Adjust the time on or time off to a higher value.</p>
<p>The Stage 1 fans do not stop running when the controller is operating in minimum ventilation cycle.</p>	<p>Time on is set to a value other than zero.</p> <p>The wiring is incorrect.</p>	<p>Set time on to zero.</p> <p>Correct the wiring. In particular, be sure two different lines are connected to each motor: line L1 modulated by the controller should be combined with another line (N for 115V or L2 for 230V) to activate the motor. Also, be sure the stage's COMMON is supplied by line L1.</p>

PROBLEM	CAUSE	SOLUTION
<p>Stage 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 is not operating.</p>	<p>The stage's fuse is open.</p> <p>The display board inter-connect cable is not plugged into the power supply board properly.</p> <p>The wiring is incorrect.</p> <p>The fan motor or heating unit is defective.</p> <p>The controller is defective.</p>	<p>Replace the fuse.</p> <p>Be sure the cable is firmly plugged in.</p> <p>Correct the wiring. In particular, be sure two different lines are connected to each motor or heating unit: line L1 modulated by the controller should be combined with another line (N for 115V or L2 for 230V) to activate the motor or heating unit. Also, be sure the stage's COMMON is supplied by line L1.</p> <p>Verify if the motor or heating unit is defective by connecting it to an alternate power supply. If it still is not operating, replace it.</p> <p>Listen to see if there is a clicking sound when the stage's pilot light turns on. If there is no clicking sound, contact your distributor to repair the controller.</p>

# TECHNICAL SPECIFICATIONS

## MASTER BOX

**Supply:** - 115/230 VAC (-18%,+8%), 60 Hz, L1 same phases as stage 1, overload and overvoltage protection fuse F5-1A fast blow.

- 12 VDC for AC back-up supply; can activate stages 2 to 11 if supplied with DC back-up voltage.

## AUXILIARY BOX NO.1

**Supply:** - 115/230 VAC (-18%,+8%), 60 Hz, overload and overvoltage protection fuse F6-1A fast blow.

- 12 VDC for AC back-up supply, can activate stages 2 and 3 if supplied with DC back-up voltage.

**Stage 1:** Variable output, 60 Hz, 10A FAN (3/4HP/115VAC)/(1.5HP/230VAC), same phases as supply, fuse F2-15A slow blow.

**Stage 2:** ON-OFF output, 115/230 VAC, 60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F3-15A slow blow.

**Stage 3:** ON-OFF output, 115/230 VAC, 60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F4-15A slow blow.

## AUXILIARY BOX NO.2

**Supply:** - 115/230 VAC (-18%,+8%), 60 Hz, overload and overvoltage protection fuse F6-1A fast blow.

- 12 VDC for AC back-up supply, can activate stages 4 to 7 if supplied with DC back-up voltage.

**Stage 4:** ON-OFF output, 115/230 VAC, 60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F1-10A slow blow.

**Stage 5:** ON-OFF output, 115/230 VAC, 60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F2-10A slow blow.

**Stage 6:** ON-OFF output, 115/230 VAC, 60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F3-10A slow blow.

**Stage 7:** ON-OFF output, 115/230 VAC, 60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F4-10A slow blow.

### **AUXILIARY BOX NO. 3**

**Supply:** - 115/230 VAC (-18%,+8%), 60 Hz, overload and overvoltage protection fuse F6-1A fast blow.

- 12 VDC for AC back-up supply, can activate stages 8 to 11 if supplied with DC back-up voltage.

**Stage 8:** ON-OFF output, 115/230 VAC, 60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F5-10A slow blow.

**Stage 9:** ON-OFF output, 115/230 VAC, 60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F6-10A slow blow.

**Stage 10:** ON-OFF output, 115/230 VAC, 60 Hz, 30 VDC, 6A FAN, 10A RES, heating or ventilation, fuse F7-10A slow blow.

**Stage 11:** ON-OFF output, 115/230 VAC, 60 Hz, 30 VDC, 6A FAN, 10A RES, heating or ventilation, fuse F8-10A slow blow.

### **OTHER**

**Probes:** Low voltage (< 5V), isolated from the supply. Operating range: -40.0° to 120.0°F(-40.0° to 49°C). Accuracy: 1.8°F (1°C) between 41° and 95°F (5° and 35°C).

**Enclosure:** ABS, moisture and dust-tight.

**The temperature where the controller is installed MUST AT ALL TIMES REMAIN BETWEEN 32 AND 104 °F (0 and 40 °C).**

## FACTORY SETTINGS

The controller is programmed at the factory with the settings shown below. You may leave as such the settings that are convenient for you and change the others.

These initial parameter settings will not be retained in the controller's memory. Each new setting will replace the preceding one.

If the power supply is cut off, the last parameter setting will be retained in memory until the power is restored.

PARAMETER		INITIAL SETTING
TEMPERATURE SET POINT	Temperature set point	75°F (23.9°C)
	Temperature curve	OFF
STAGE 1	Minimum speed	40%
	Time on	15 seconds
	Time off	0 seconds
	Band-width	3°F (1.7°C)
STAGE 2	Differential	2°F (1.1°C)
STAGE 3	Differential	2°F (1.1°C)
STAGES 4-9	Differential	2°F (1.1°C)
STAGE 10	Differential	2°F (1.1°C)
STAGE 11	Heater offset	0.5°F (0.3°C)
	Differential	2°F (1.1°C)