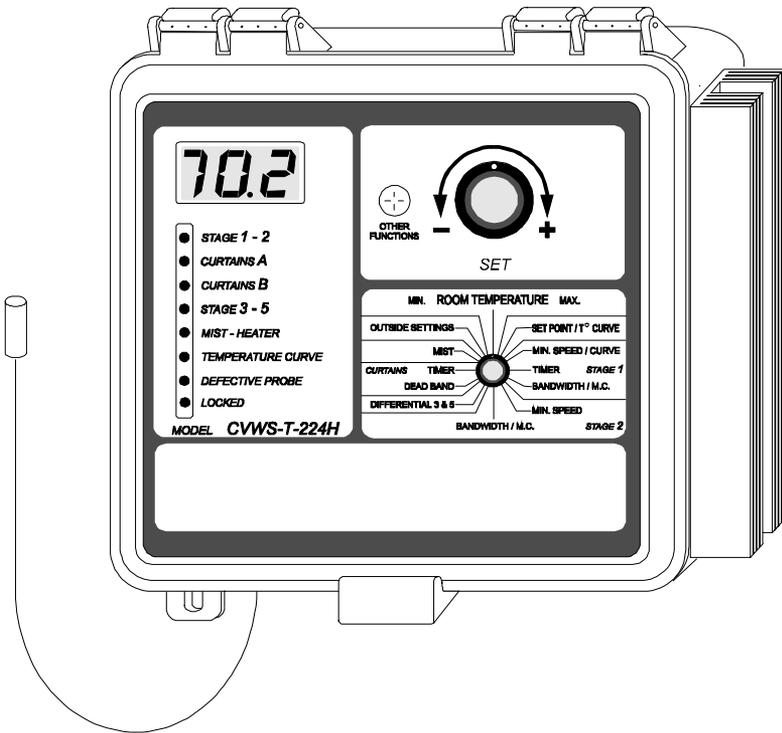

Temperature Controller

CVWS-T-224H

User's Guide



Read this guide carefully before using the controller.

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FOR CUSTOMER USE

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

Model number CVWS-T-224H
Serial number _____

FEATURES

The CVWS-T-224H 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. Two stages of variable speed fans, two stages of constant speed fans, as well as curtains, foggers and heaters can be connected to the controller.

The main features of the controller are as follows:

▶ **DIGITAL 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**

Pilot lights indicating the status of outputs allow you 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.

▶ **TWO INDEPENDENT ZONED NATURAL VENTILATION OUTPUTS**

Two independent natural ventilation outputs allow the controller to adjust the curtain opening according to the temperature of each zone.

▶ **OUTSIDE TEMPERATURE COMPENSATION ON NATURAL VENTILATION OUTPUTS**

The curtain timer settings are compensated proportionally to the outside temperature. The lower the outside temperature, the faster the curtains close. The higher the outside temperature, the faster the curtains open.

▶ **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 2 seconds at each start-up.

▶ **OVERLOAD AND OVERVOLTAGE PROTECTION**

Fuses located at the input and outputs of the controller protect its circuitry in the case of an overload or overvoltage.

▶ **COMPUTER CONTROL**

When used with a communication module, the controller communicates with a computer. This makes possible the centralization of information management and a more diversified control strategy.

PRECAUTIONS

We strongly recommend installing supplementary natural ventilation, a failure alarm system as well as a back-up thermostat on at least one cooling stage (refer to the wiring diagram enclosed with this user's manual to connect the thermostat).

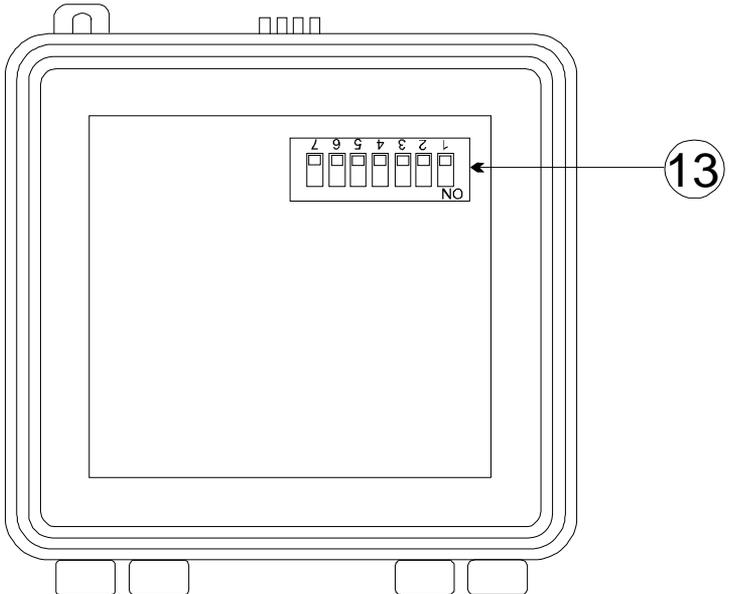
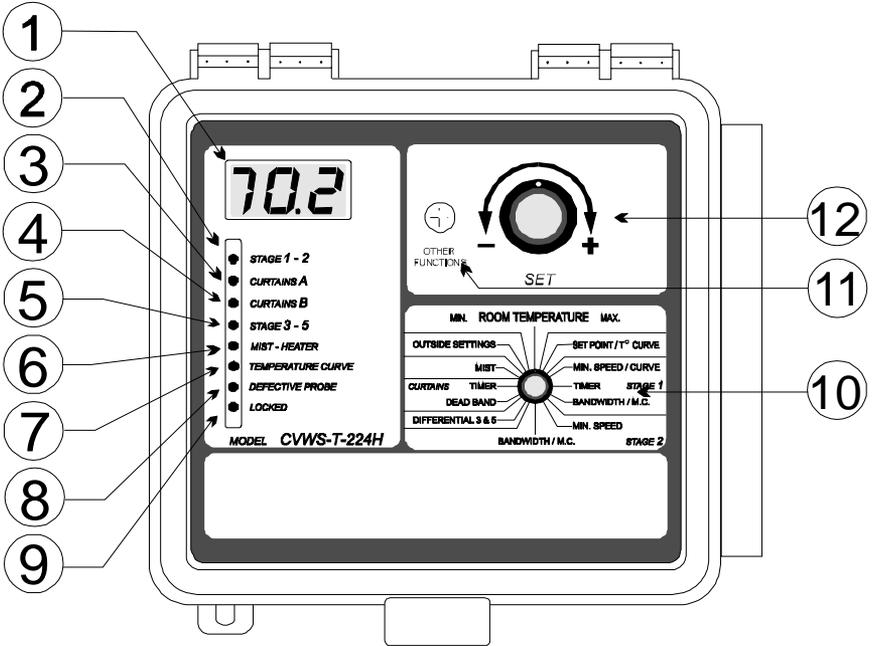
Fuses at the input and outputs of the controller adequately protect its circuitry in the case of an overload or overvoltage. However, we recommend installing an additional protection device on the supply circuit as well as an external relay on all ON-OFF stages to prolong the life of the controller.

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

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

DO NOT SPRAY WATER ON THE CONTROLLER

LOCATION OF CONTROLS



- 1 Digital display**
Displays the parameters shown around the parameter selection knob.
- 2 Stage 1 and 2 pilot light**
Flashes when the stage 1 fans are on. Turns on when the stage 2 fans are on.
- 3 Curtains A pilot light**
Flashes when the zone A curtains are closing. Turns on when the zone A curtains are opening.
- 4 Curtains B pilot light**
Flashes when the zone B curtains are closing. Turns on when the zone B curtains are opening.
- 5 Stage 3 - 5 pilot light**
Flashes when the stage 3 fans are on. Turns on when the stage 5 fans are on.
- 6 Heater-mist pilot light**
Flashes when the mist units are on. Turns on when the heater is on.
- 7 Temperature curve pilot light**
Turns on when the temperature curve is activated and flashes when both the temperature and minimum speed curves are activated.
- 8 Defective probe pilot light**
Turns on when a probe is defective.
- 9 Locked parameter pilot light**
Turns on when the parameters are locked.
- 10 Parameter selection knob**
Used to select a parameter.
- 11 Push-button**
Used to access the various adjustments.
- 12 Adjustment knob**
Used to adjust the value of a selected parameter.

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Internal switches

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

DESCRIPTION	SWITCH		OPERATING MODE
	#	POSITION	
Parameters	1	ON OFF	Locked parameters Unlocked parameters
Temperature units	2	ON OFF	° Celsius ° Fahrenheit
———	3	———	———
———	4	———	———
Heater differential	5	ON OFF	1°F (0.6°C) 2 °F (1.1°C)
Heater offset	6	ON OFF	1°F (0.6°C) 2 °F (1.1°C)
———	7	———	———

Mounting Instructions

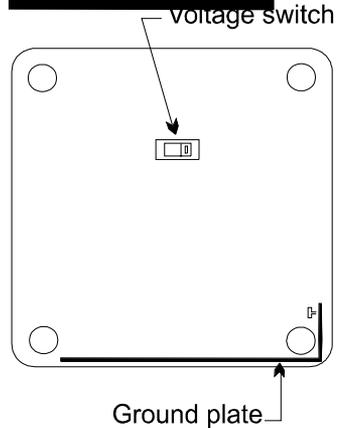
Remove the four screws in the front cover and lift the cover. Remove the black caps located on the three mounting holes. Mount the enclosure to the wall using three screws. Be sure the electrical knockouts are at the bottom of the enclosure in order to prevent water from entering the controller. Insert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

INSTALLATION

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



- It may be recommended to install a latch switch on the zone A or zone B curtain power unit to stop the stage 1, 2 and 3 cooling fans as the curtains open for natural ventilation (refer to the USING THE CONTROLLER section).



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.

Temperature Probes

The controller is supplied with one room probe for zone A connected to terminal # 1, one room probe for zone B connected to terminal # 2 and one outside probe connected to terminal # 4.

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.**

Installing the Room Probes

- Locate the room probe connected to terminal # 1 in the center of zone A and the room probe connected to terminal # 2 in the center of zone B.

Installing the Outside Probe

- Run the outside probe cable on the north side of the building, 2 m (6 ft) below the cornice, inside a pale coloured conduit.
- Be sure the probe cable is isolated from sheet metal or any other conductive material and no cable joint is exposed to air or water.

Defective Probes

1 Room Probes

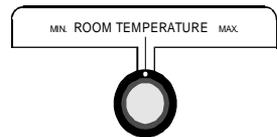
If one or both room probes are defective, the defective probe pilot light turns on. If both room probes are defective, the display shows the letter "P" when the parameter selection knob is set to ROOM and the controller operates according to the minimum ventilation cycle (refer to "Minimum ventilation cycle", page 24). Otherwise, the display shows the value of the temperature measured by the remaining room probe 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 is not defective, the letter "A" is displayed, alternating with the temperature measured by probe A. Otherwise, the letter "A" is displayed, alternating with the letter "P".



Press the push-button. If the probe connected to terminal # 2 is not defective, the letter "b" is displayed, alternating with the temperature measured by probe B. Otherwise, the letter "b" is displayed, alternating with the letter "P".

2 Outside probe

If the outside probe is defective, the display shows the letter "P" when the parameter selection knob is set to OUTSIDE SETTINGS and the outside set point temporarily becomes deactivated (refer to "Outside Set Point", page 23). The Defective Probe Pilot Light does not turn on when this happens.

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. When the controller is shipped from the factory, curve number 4 has been selected.

To Select a Motor Curve for Stage 1

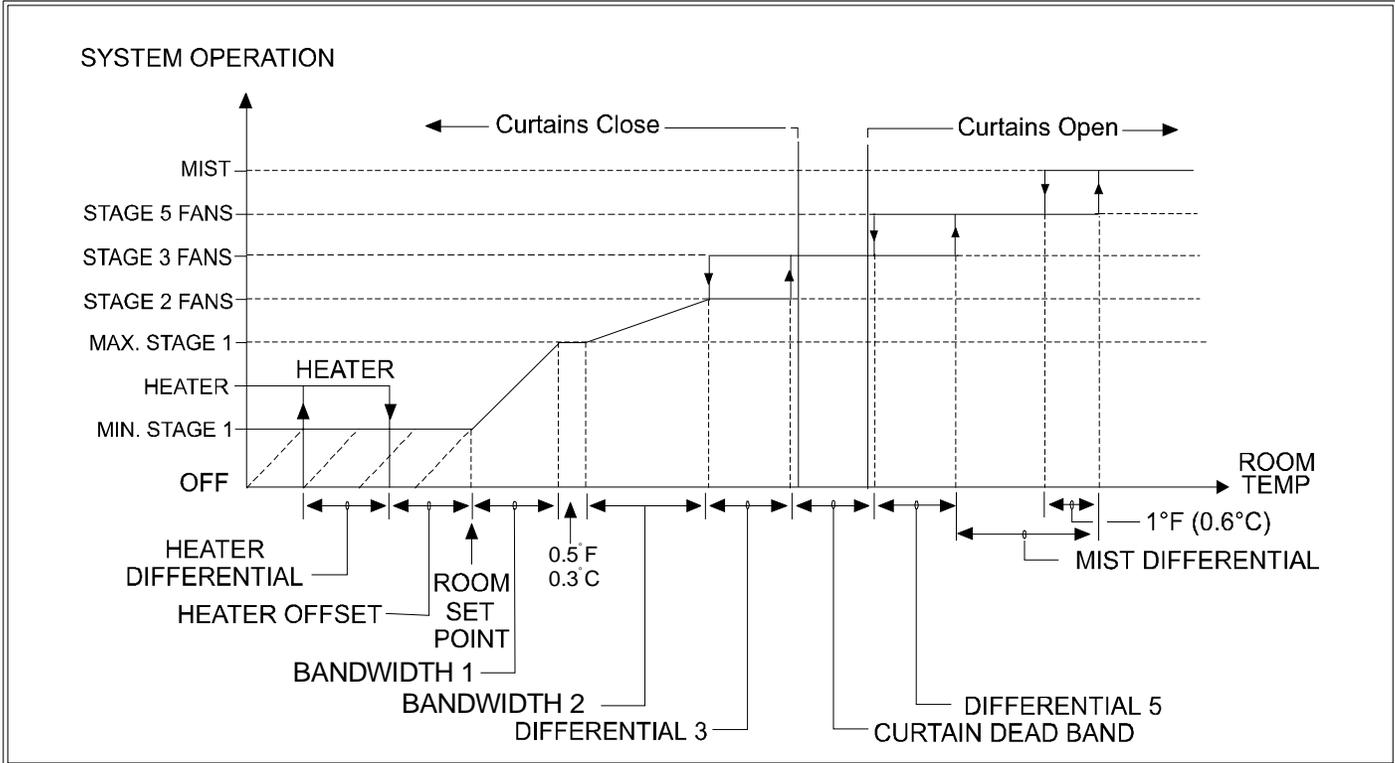
- In the list of motors enclosed with this user's manual, locate the make and capacity of your stage 1 variable speed motors and note the corresponding curve number (1 to 10).
- Set the parameter selection knob to BANDWIDTH / M.C. - STAGE 1. The stage 1 bandwidth appears flashing on the display.
- Press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

To Select a Motor Curve for Stage 2

- Repeat the steps described above, this time setting the parameter selection knob to BANDWIDTH / M.C. - STAGE 2.

OPERATION DIAGRAM

The diagram below provides an overview of how the controller operates. It shows the operation sequence of the system components and room temperatures at which on/off and open/close signals are given. For further information regarding each system component, refer to the USING THE CONTROLLER section.



USING THE CONTROLLER

Parameter Ranges

PARAMETER		ADJUSTMENT RANGE
TEMPERATURE SET POINT	Room set point	-40.0° to 99.9°F (-40° to 37.7°C)
	Outside set point	-40.0° to 99.9°F (-40° to 37.7°C)
STAGE 1 FANS	Minimum speed	10 to 100% of the full speed of the fans
	Time on	0 to 900 seconds, by increments of 15 seconds
	Time off	0 to 900 seconds, by increments of 15 seconds
	Bandwidth	0.5° to 20.0°F (0.3° to 11.1°C)
STAGE 2 FANS	Minimum speed	10 to 100% of the full speed of the fans
	Bandwidth	0.5° to 20.0°F (0.3° to 11.1°C)
CURTAINS	Time on	1 to 900 seconds, by increments of 1 second
	Time off	1 to 900 seconds, by increments of 1 second
	Dead band	0.5° to 20.0°F (0.3° to 11.1°C)
STAGE 3 & 5 FANS	Differential 3 and 5	0.5° to 20.0°F (0.3° to 11.1°C)
MIST	Time on	1 to 60 minutes, by increments of 1 minute
	Time off	0 to 60 minutes, by increments of 1 minute
	Differential	0.5° to 20.0°F (0.3° to 11.1°C)
HEATERS	Differential	1.0° or 2.0°F (0.6° or 1.1°C)
	Offset	1.0° or 2.0°F (0.6° or 1.1°C)

Factory Settings

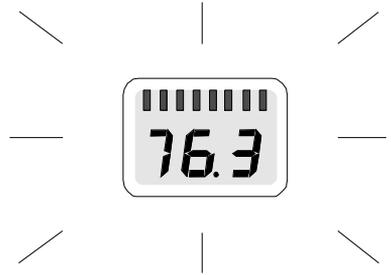
The controller is programmed at the factory with the settings shown below. Keep the settings that are convenient for you and make changes where necessary.

- NOTES:** (1) The controller only memorizes the last parameter settings. Each new setting replaces the preceding one.
- (2) If the power supply is cut off, the last parameter setting will be kept in memory until the power is restored.

PARAMETER		FACTORY SETTING
TEMPERATURE SET POINT	Room set point	75.0°F (23.9°C)
	Outside set point	60.0°F (15.6°C)
STAGE 1 FANS	Minimum speed	40 %
	Time on	15 seconds
	Time off	0 seconds
	Bandwidth	2.0°F (1.1°C)
STAGE 2 FANS	Minimum speed	40 %
	Bandwidth	2.0°F (1.1°C)
CURTAINS	Time on	30 seconds
	Time off	90 seconds
	Dead band	2.0°F (1.1°C)
STAGE 3&5 FANS	Differential 3 and 5	2.0°F (1.1°C)
MIST	Time on	1 minute
	Time off	15 minutes
	Differential	10°F (5.6°C)
HEATERS	Differential	2.0°F (1.1°C)
	Offset	2.0°F (1.1°C)

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.



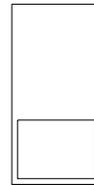
Temperature units

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.

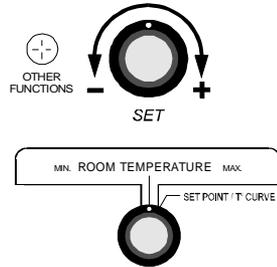
ON



2

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

Room Temperature



Room Temperature Display

The room temperature is the average value of the temperatures measured by the two room probes. The zone A temperature is the temperature measured by the room probe connected to terminal # 1. The zone B temperature is the temperature measured by the room probe connected to terminal # 2.

TO DISPLAY THE ROOM AND ZONE TEMPERATURES

- Set the parameter selection knob to ROOM. The room temperature appears on the display.
- Press the push-button. The letter "A" and the zone A temperature alternately appear on the display.
- Press the push-button once again. The letter "B" and the zone B temperature appear on the display.
- Press the push-button once again. The room temperature again appears on the display.

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 THE MINIMUM AND MAXIMUM TEMPERATURES

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

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.

TO RESET THE MINIMUM AND MAXIMUM TEMPERATURES (CONTINUED)

- 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 above).
- 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 20).
- 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.

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.

TO PROGRAM THE TEMPERATURE CURVE (CONT'D)

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.

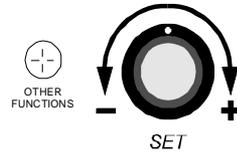
NOTE: When the temperature curve is activated, the current target room temperature can be viewed at any time by setting the parameter

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.

Outside Temperature



Outside Temperature Display

The outside temperature is the temperature measured by the outside probe.

TO DISPLAY THE OUTSIDE TEMPERATURE

- Set the parameter selection knob to OUTSIDE SETTINGS. The outside temperature appears on the display.

Outside Set Point

If the outside set point is activated, the controller compensates the curtain timer settings proportionally to the outside temperature. If the outside set point is deactivated, the curtains operate according to the curtain timer settings with no outside temperature compensation.

(Refer to "Curtains", page 36)

TO ADJUST THE OUTSIDE SET POINT

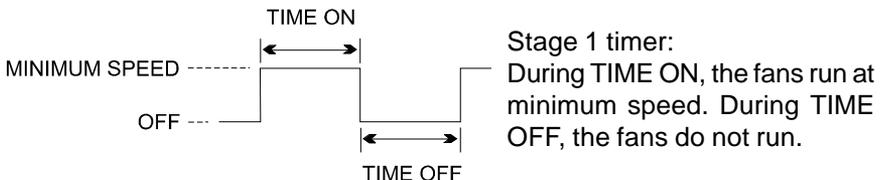
- Set the parameter selection knob to OUTSIDE SETTINGS. The outside temperature appears on the display.
- Press the push-button. The outside set point appears flashing on the display.
- Using the adjustment knob, adjust the outside set point to the desired value.
- Press the push-button once again. If the outside set point is presently activated, the word ON appears flashing on the display. If the outside set point is presently deactivated, the word OFF appears flashing on the display.
- Turn the adjustment knob clockwise to activate the outside set point (the word ON then appears flashing on the display) or counterclockwise to inactivate the outside set point (the word OFF then appears flashing on the display).

Stage 1 Fans

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 stage 1 fans run according to the stage 1 timer settings.

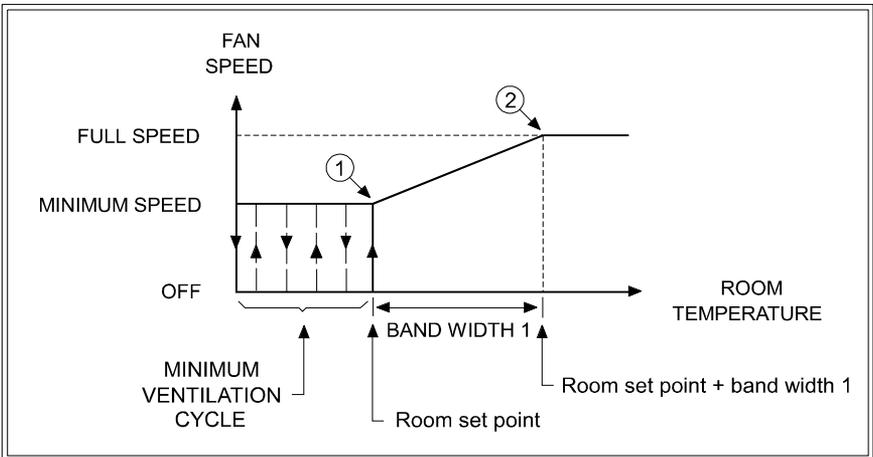


The fans can be set to operate in three different ways:

- 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.

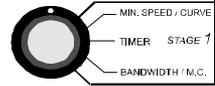
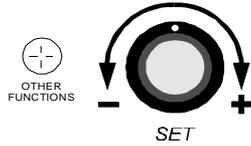
Figure 1 : Stage 1 fans - operation diagram



2 Variable speed ventilation

When the room temperature rises to the room set point (point 1), the stage 1 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 1" (point 2), the stage 1 fans reach full speed. Above this temperature, the controller continues to supply full speed voltage. However, a latch switch should cut off power to the stage 1 fans as the zone A or zone B curtains open for natural ventilation.

Adjusting the Stage 1 Parameters



TO ADJUST THE STAGE 1 TIMER

- Set the parameter selection knob to STAGE 1 - TIMER. The word ON and the current time on alternately appear flashing on the display.
- Using the adjustment knob, adjust the time on to the desired value.
- Press the push-button. The word OFF and the current time off alternately appear flashing on the display.
- Using the adjustment knob, adjust the time off to the desired value.

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 "Set Point - 5.0°F (2.8°C) - Heating Offset - Heater Differential", 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.

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.

Minimum Speed Curve (cont'd)

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.
- 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).

Minimum Speed Curve (cont'd)

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 STAGE 1 BANDWIDTH

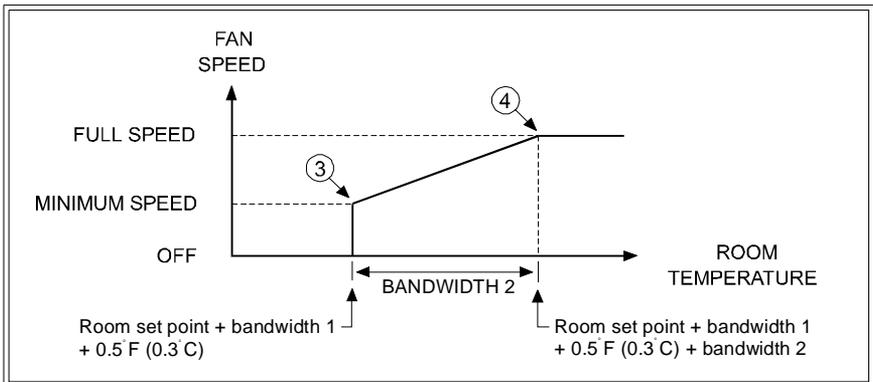
- Set the parameter selection knob to STAGE 1 - BANDWIDTH. The current bandwidth appears flashing on the display.
- Using the adjustment knob, adjust the bandwidth to the desired value.

Stage 2 Fans

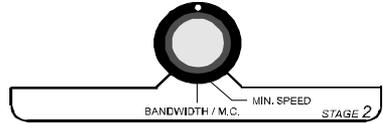
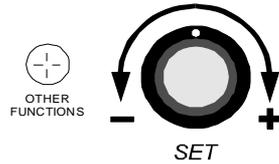
Description of operation Refer to figure 2 on next page)

When the room temperature rises to "room set point + bandwidth 1 + 0.5°F (0.3°C)" (point 3), the stage 2 fans start to run at minimum speed and increase in speed proportionally to the room temperature. When the room temperature rises to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2" (point 4), the stage 2 fans reach full speed. Above this temperature, the controller continues to supply full speed voltage. However, a latch switch should cut off power to the stage 2 fans as the zone A or zone B curtains open for natural ventilation.

Figure 2 : Stage 2 fans - operation diagram



Adjusting the Stage 2 Parameters



TO ADJUST THE STAGE 2 MINIMUM SPEED

- Set the parameter selection knob to STAGE 2 - MIN.SPEED. The current minimum speed appears flashing on the display.
- Using the adjustment knob, adjust the minimum speed to the desired value.

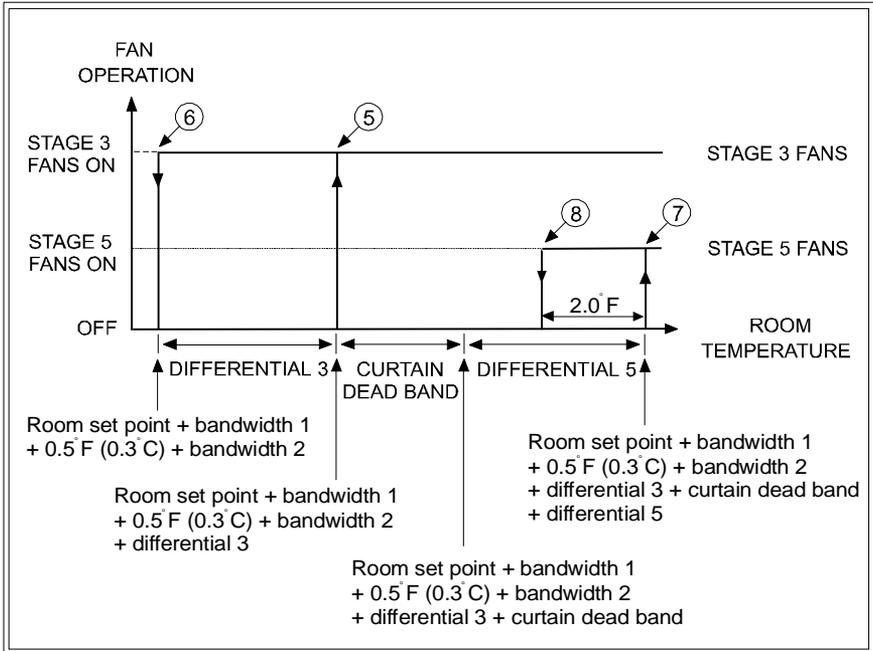
TO ADJUST THE STAGE 2 BANDWIDTH

- Set the parameter selection knob to STAGE 2 - BANDWIDTH. The current bandwidth appears flashing on the display.
- Using the adjustment knob, adjust the bandwidth to the desired value.

Stage 3 and 5 Fans

Description of Operation Refer to figure 3 below)

Figure 3: Stage 3 and 5 Fans - Operation Diagram

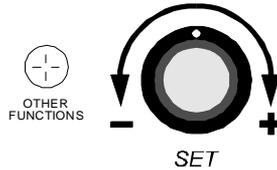


When the room temperature rises to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2 + differential 3" (point 5), the stage 3 fans start to run. The controller continues to supply voltage as long as the room temperature remains above "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2" (point 6). However, a latch switch should cut off power to the stage 3 fans as the zone A or zone B curtains open for natural ventilation. When the room temperature falls to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2" (point 6), the stage 3 fans return to a stop.

When the room temperature rises to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2 + differential 3 + curtain dead band + differential 5" (point 7), the stage 5 fans start to run. When the room temperature falls

to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2 + differential 3 + curtain dead band + differential 5 - 2.0°F" (point 8), the stage 5 fans return to a stop.

Adjusting the Stage 3 and 5 Parameters



TO ADJUST THE STAGE 3 AND 5 DIFFERENTIAL

- Set the parameter selection knob to **DIFFERENTIAL 3 and 5**. The current differential for stage 3 alternates with the letters "d - 3" on the display.
- Using the adjustment knob, adjust the differential to the desired value.
- Press the push-button. The current differential for stage 5 alternates with the letters "d-5" on the display.
- Using the adjustment knob, adjust the differential to the desired value.

Note that Stage 5 has a fixed hysteresis of 2.0°F.

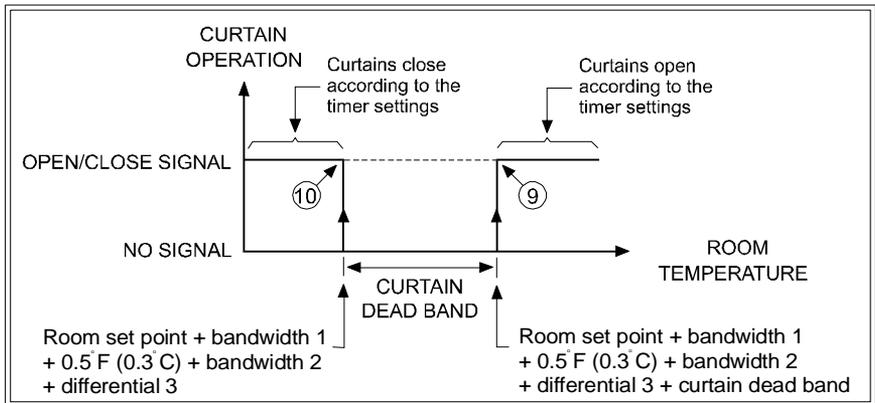
Curtains

Description of Operation Refer to figure 4 below)

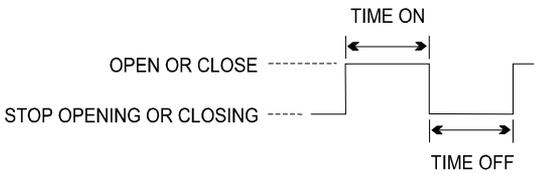
When the zone A temperature rises to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2 + differential 3 + curtain dead band" (point 9), the zone A curtains begin to open according to the curtain timer settings and continue to do so until fully open if the zone A temperature remains above this point. When the zone A temperature falls to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2 + differential 3" (point 10), the zone A curtains begin to close according to the curtain timer settings and continue to do so until fully closed if the zone A temperature remains below this point.

When the zone B temperature rises to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2 + differential 3 + curtain dead band" (point 9), the zone B curtains begin to open according to the curtain timer settings and continue to do so until fully open if the zone B temperature remains above this point. When the zone B temperature falls to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2 + differential 3" (point 10), the zone B curtains begin to close according to the curtain timer settings and continue to do so until fully closed if the zone B temperature remains below this point.

Figure 4 : Curtains - operation diagram



Outside Temperature Compensation



Curtain timer:

During TIME ON, the curtains open or close. During TIME OFF, the curtains stop opening or closing.

1 If the outside set point is inactivated:

The curtains operate according to the curtain timer settings. There is no outside temperature compensation.

2 If the outside set point is activated:

The controller compensates the curtain timer settings proportionally to the outside temperature, as described hereafter.

- If the outside temperature is above the outside set point:

When the curtains open, the controller increases TIME ON by 5% for every degree that the outside temperature exceeds the outside set point and decreases TIME OFF by the same amount.



The higher the outside temperature, the faster the curtains open.

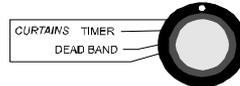
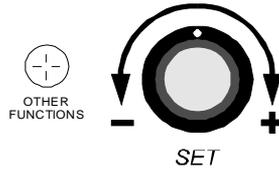
- If the outside temperature is below the outside set point:

When the curtains close, the controller increases TIME ON by 5% for every degree that the outside set point exceeds the outside temperature and decreases TIME OFF by the same amount.



The lower the outside temperature, the faster the curtains close.

Adjusting the Curtain Parameters



TO ADJUST THE CURTAIN DEAD BAND

- Set the parameter selection knob to CURTAINS - DEAD BAND. The current curtain dead band appears flashing on the display.
- Using the adjustment knob, adjust the curtain dead band to the desired value.

TO ADJUST THE CURTAIN TIMER

- Set the parameter selection knob to CURTAINS - TIMER. The word ON and the current time on alternately appear flashing on the display.
- Using the adjustment knob, adjust the time on to the desired value.
- Press the push-button. The word OFF and the current time off alternately appear flashing on the display.
- Using the adjustment knob, adjust the time off to the desired value.

Mist

Description of Operation Refer to figure 5 below)

When the room temperature rises to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2 + differential 3 + curtain dead band + differential 5 + mist differential" (point 11), the mist begins to operate according to the mist timer settings. When the room temperature falls to "room set point + bandwidth 1 + 0.5°F (0.3°C) + bandwidth 2 + differential 3 + curtain dead band + differential 5 + mist differential - 1°F (0.6°C)" (point 12), the mist stops operating.

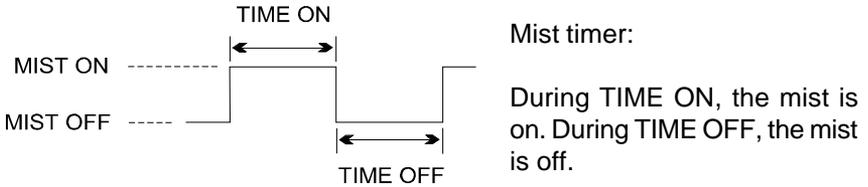
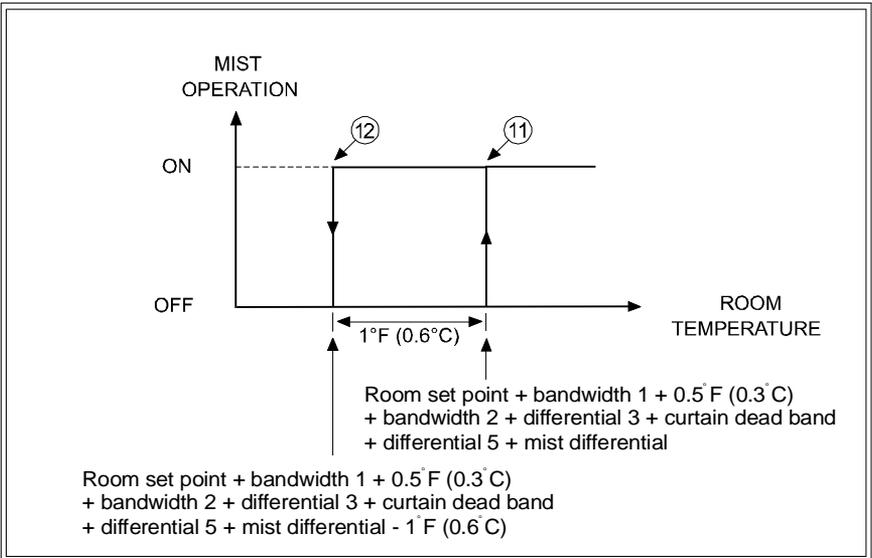
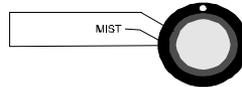
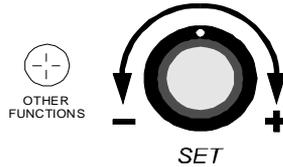


Figure 5 : Mist - operation diagram



Adjusting the Mist Parameters



TO ADJUST THE MIST DIFFERENTIAL

- Set the parameter selection knob to MIST. The current mist differential appears flashing on the display.
- Using the adjustment knob, adjust the differential to the desired value.

TO ADJUST THE MIST TIMER

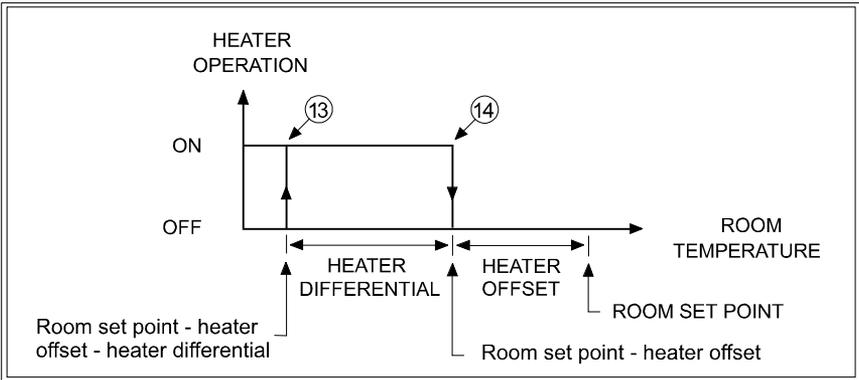
- Set the parameter selection knob to MIST. The current differential appears flashing on the display.
- Press the push-button. The word ON and the current time on alternately appear flashing on the display.
- Using the adjustment knob, adjust the time on to the desired value.
- Press the push-button. The word OFF and the current time off alternately appear flashing on the display.
- Using the adjustment knob, adjust the time off to the desired value.

Heaters

Description of Operation Refer to figure 6 below)

When the room temperature falls to "room set point - heater offset - heater differential" (point 13), the heaters turn on. When the room temperature rises to "room set point - heater offset" (point 14), the heaters turn off.

Figure 6 : Heaters - operation diagram

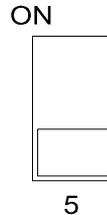


Adjusting the Heater Parameters

TO ADJUST THE HEATER DIFFERENTIAL

The heater differential can be adjusted to 1°F(0.6°C) or 2°F(1.1°C):

- Set switch # 5 to ON to adjust the heater differential to 1°F (0.6°C).
- Set switch # 5 to OFF to adjust the heater differential to 2°F (1.1°C).

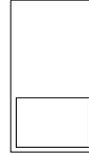


TO ADJUST THE HEATER OFFSET

The heater offset can be adjusted to 1°F(0.6°C) or 2°F(1.1°C):

- Set switch # 6 to ON to adjust the heater offset to 1°F (0.6°C).
- Set switch # 6 to OFF to adjust the heater offset to 2°F (1.1°C).

ON



6

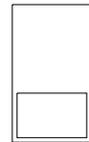
Locking the Parameters

Locking the parameters prevents accidental or unauthorized modification of the parameter settings. When the parameters are locked, only the room set point and the points of the temperature curve (if the temperature curve is deactivated), as well as the stage 1 minimum speed (as long as the minimum speed curve is deactivated) can be modified. All other settings can not be modified.

TO LOCK OR UNLOCK THE PARAMETERS

- Set switch # 1 to ON to lock the parameters.
- Set switch # 1 to OFF to unlock the parameters.

ON



1

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

TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	SOLUTION
There is no display.	The circuit breaker at the service panel is off or tripped.	Reset the circuit breaker.
	The wiring is incorrect.	Correct the wiring.
	The voltage selector switch is in the wrong position.	Set the switch to the correct position.
	The display board interconnect cable is not properly plugged into the power supply board.	Be sure the cable is firmly plugged in.
The display shows "P" when the parameter selection knob is set to OUTSIDE SETTINGS.	The outside probe is connected improperly.	Correct the outside probe connection.
	The outside probe is defective.	Refer to "Defective Probes"
The display shows "P" when the parameter selection knob is set to ROOM.	A room probe is connected improperly.	Correct the room probe connection.
	A room probe is defective.	Refer to "Defective Probes"
The defective probe pilot light is on.	A room probe is defective.	Refer to "defective probes"

PROBLEM	CAUSE	SOLUTION
<p>The display shows sudden variations in the room or outside temperature.</p>	<p>A variation in resistance is induced on a probe.</p> <p>There is electrical noise near a probe cable.</p>	<p>Be sure the probes are dry. Locate them away from drafts and sources of radiant heating. Be sure the outside probe is installed correctly. Refer to "Installing the Outside Probe"</p> <p>Isolate the probe cables from all high voltage sources. Do not route probe cables and other power cables through the same electrical knockout. Do not run probe cables next to other power cables. When crossing other power cables, cross at 90°.</p>
<p>The stage 1 or stage 2 variable speed fans are not running.</p>	<p>The wiring is incorrect.</p> <p>The stage 1 or stage 2 fuse is open.</p> <p>The display board interconnect cable is not properly plugged into the power supply board.</p> <p>The minimum speed is too low.</p> <p>The fan motor is defective.</p>	<p>Correct the wiring. Be sure two different lines are connected to each fan 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 1 and 2 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>Check 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 or stage 2 variable speed fans run erratically.</p>	<p>The selected motor curve is inappropriate.</p> <p>The band width is too small.</p> <p>The stage 1 time on or time off is too short.</p> <p>A variation in resistance induced on a room probe causes this probe to measure sudden variations in the room temperature.</p> <p>Electrical noise near a room probe cable causes this probe to measure sudden variations in the room temperature.</p>	<p>Select an appropriate motor curve. Refer to "Motor Curves"</p> <p>Adjust the band width to a higher value.</p> <p>Adjust the stage 1 time on or time off to a higher value.</p> <p>Be sure the room probes are dry. Locate them away from drafts and sources of radiant heating.</p> <p>Isolate the room probe cables from all high voltage sources. Do not route probe cables and other power cables through the same electrical knockout. Do not run probe cables next to other power cables. When crossing other power cables, cross at 90°.</p>
<p>The stage 1 variable speed fans run continuously when the room temperature is below the room set point.</p>	<p>The stage 1 time off is set to zero.</p> <p>The wiring is incorrect.</p>	<p>Set the stage 1 time off to a value other than zero.</p> <p>Correct the wiring. Be sure two different lines are connected to each fan 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 1 and 2 COMMON is supplied by line L1.</p>

PROBLEM	CAUSE	SOLUTION
<p>The stage 3 fans are not running.</p> <p>or...</p> <p>The stage 5 fans are not running.</p> <p>or...</p> <p>The heaters are not turning on.</p>	<p>The wiring is incorrect.</p> <p>The stage's fuse is open.</p> <p>The display board interconnect cable is not properly plugged into the power supply board.</p> <p>The fan motor or heater is defective.</p> <p>The controller is defective.</p>	<p>Correct the wiring. Be sure two different lines are connected to each fan motor or heater: the controller's output line L1 should be combined with another line (N for 115V or L2 for 230V) to activate the fan motor or heater. 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>Check if the motor or heater is defective by connecting it to an alternate power supply. If it still is not operating, replace the motor or heater.</p> <p>Listen to see if there is a clicking sound when the stage or heater-mist pilot light turns on. If there is no clicking sound, your controller needs repair.</p>
<p>The mist is not operating as desired.</p>	<p>The mist time on and time off were incorrectly adjusted.</p> <p>There is a 1°F(0.6°C) hysteresis on the mist. See "Mist".</p>	<p>The mist time on and time off are in <u>minutes</u>. Adjust the mist time on and time off correctly.</p> <p>Adjust the mist differential accordingly.</p>

TECHNICAL SPECIFICATIONS

MASTER BOX

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 Stage 3, Stage 5 as well as curtains, mist and heaters if supplied with DC back-up voltage.

Stage 1: Variable output, 60 Hz, 10A FAN (3/4HP/15VAC)/(1.5HP/230VAC), fuse F1-15A slow blow.

Stage 2: Variable output, 60 Hz, 10A FAN (3/4HP/15VAC)/(1.5HP/230VAC), fuse F2-15A slow blow.

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 stage 3 fans, stage 5 fans and Zone A curtains if supplied with DC back-up voltage.

Zone A curtains: OPEN-CLOSE output, 115/230 VAC, 60 Hz, 30VDC, 5A winch output, fuse F1-5A fast blow.

Stage 3: ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A FAN, 10A RES, fuse F3-10A slow blow.

Stage 5: ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A FAN, 10A RES, fuse F4-10A 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 curtains, mist and heaters if supplied with DC back-up voltage.

Zone B curtains: OPEN-CLOSE output, 115/230 VAC, 60 Hz, 30VDC, 5A winch output, fuse F1-5A fast blow.

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

Heaters: ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A motor output, 10A RES, fuse F4-10A slow blow.

OTHER

Probes: Low voltage (< 5V), isolated from the supply. Operating range: -40.0°F to 120.0°F (-40.0°C to 48.9°C). Accuracy: 1.8°F (1°C) between 41° and 95°F (5° and 35°C).

Enclosure: ABS, moisture and dust-tight.

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