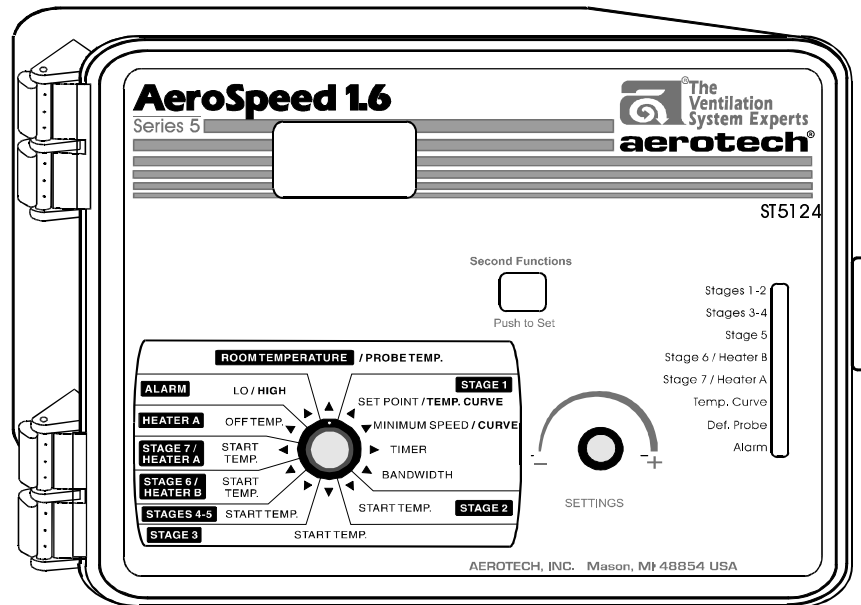


# Temperature Controller

# ST 5124

## USER'S MANUAL



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## 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).

Although fuses at the input and outputs of the controller protect its circuits in case of an overload or overvoltage, 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.

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

### FOR CUSTOMER USE

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

Model number: ST 5124

Serial number: \_\_\_\_\_

Date installed: \_\_\_\_\_

The ST 5124 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 four stages of constant-speed fans and two stages of either constant-speed fans or heating units. In addition, the second stage can also operate in a timer mode and the last cooling stage can be configured as a mist cooling stage.

The main features of the ST 5124 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 (in Fahrenheit or Celsius units).

## **PILOT LIGHTS**

Pilot lights indicating the state of outputs allow the user to monitor the operation of the system without having to enter the building.

## **MINIMUM VENTILATION CYCLE**

When ventilation is not required for cooling, the first stage 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 speed curve with up to six different points each.

## **CHOICE OF FIVE 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 five different motor curves, thus ensuring that the correct voltage is 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 for 2 seconds immediately following each start-up.

## **FOUR INDEPENDENT TEMPERATURE PROBE INPUTS**

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

## **OVERLOAD AND OVERVOLTAGE PROTECTION**

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

## **COMPUTER CONTROL**

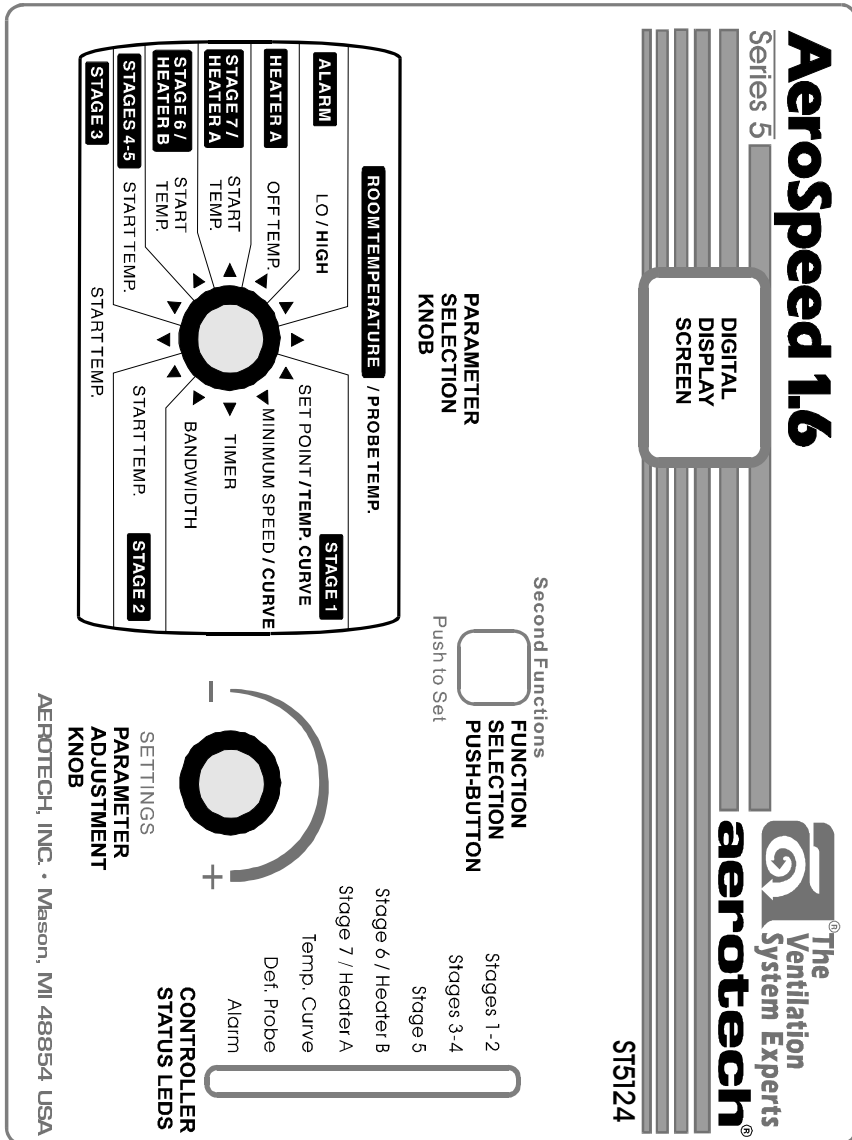
The controller can be connected to a computer, thus making it possible to centralize the management of information and diversify control strategies.

## **CONTROL OF AIR INLET MOVEMENT**

If the ST 5124 is used in combination with a SB 2000 controller, the movement of the air inlets can be coordinated with the operation of the fans using a potentiometer located on the curtain machine or baffle actuator. This allows the air inlets to be adjusted correctly, without the influence of uncontrollable factors such as wind or air from adjoining rooms. When tunnel ventilation is being used, the SB 2000 closes the air inlets.

## **HIGH/LOW TEMPERATURE ALARM OUTPUT**

# LOCATION OF THE CONTROLS

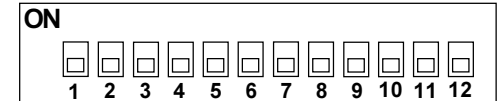


# ST 5124

## CONTROLLER STATUS LEDS

LED	MEANING
STAGES 1-2	FLASHES WHEN STAGE 1 FANS ARE ON. TURNS ON WHEN STAGE 2 FANS ARE ON.
STAGES 3-4	FLASHES WHEN STAGE 3 FANS ARE ON. TURNS ON WHEN STAGE 4 FANS ARE ON.
STAGE 5	TURNS ON WHEN STAGE 5 FANS ARE ON.
STAGE 6 / HEATER B	TURNS ON WHEN STAGE 6 FANS OR HEATING UNITS ARE ON.
STAGE 7 / HEATER A	TURNS ON WHEN STAGE 6 FANS OR HEATING UNITS ARE ON.
TEMP. CURVE	FLASHES WHEN THE TEMPERATURE CURVE IS ACTIVATED. TURNS ON WHEN THE MINIMUM VENTILATION SPEED CURVE IS ALSO ON.
DEF. PROBE	TURNS ON WHEN A DEFECTIVE PROBE IS DETECTED.
ALARM	TURNS ON WHEN AN ALARM IS DETECTED.

## INTERNAL SWITCHES



The internal switches are located on the inside of the front cover. When the controller is shipped from the factory, all the switches are set to OFF.

#	OFF	ON
1	UNLOCKED PARAMETERS	LOCKED PARAMETERS
2	FAHRENHEIT DEGREES	CELSIUS DEGREES
3	NO HEATING STAGES	HEATING STAGES
4	1 HEATER	2 HEATERS
5	STAGED MIST	FLOATING MIST
6	STAGE 2 WITHOUT TIMER	STAGE 2 WITH TIMER

## MOUNTING INSTRUCTIONS

Open the latch and lift the cover. Remove the black caps located on each of the four mounting holes. Mount the enclosure on the wall using four 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 in the mounting holes and tighten. Fasten the four black caps provided with the controller onto the four mounting holes. The enclosure must be mounted in a location that will allow the cover to be completely opened right up against the wall.

## CONNECTIONS

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

- Set the voltage switch to the appropriate voltage.
- Use the electrical knockouts provided at the bottom of the enclosure. Do not make additional holes in the enclosure, particularly on the top of the enclosure when using a SL 1400 communication board.
- For the heating stages, it may be necessary to install a transformer in order to supply the appropriate voltage to the heating unit.

**ALARM CONNECTION:** There are two types of alarms on the market. One type activates when current is cut off at its input, whereas the other activates when current is supplied at its input. For an alarm of the first type, use the NO terminal as shown on the wiring diagram. For an alarm of the second type, use the NC terminal.



**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 SHOCKS AND EQUIPMENT DAMAGE.**

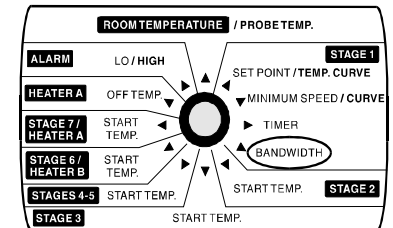
## MOTOR TYPES

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 five categories and the controller has been programmed with a different motor curve for each of these categories. To ensure that the controller supplies the correct voltages, an appropriate curve must be selected for Stage 1 according to the type of fan motors used (see table on following page).

### Selecting a Motor Type

Refer to the list of motors on the following page to determine which type number (1 to 5) is appropriate for the motors used.

- Set the selection knob to **STAGE 1 — BANDWIDTH**. The Stage 1 bandwidth flashes on the display.
- Press the push-button three times. The currently selected type is displayed, alternating with the letters "tYP".
- Use the adjustment knob to adjust the motor type to the desired value.
- Return to the Stage 1 bandwidth display by pressing the push-button.



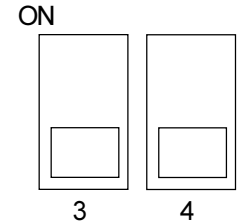
**HEATING / COOLING OPTION**

Stages 6 and 7 can operate as heating or cooling stages.

⇒ Set switches # 3 and # 4 to **OFF** to use both stages for cooling.

⇒ Set switch # 3 to **ON** and switch # 4 to **OFF** to use Stage 7 for heating and Stage 6 for cooling.

⇒ Set switches # 3 and # 4 to **ON** to use both stages for heating.



Note that if only one stage is used for heating, it must be Stage 7.

**TEMPERATURE PROBES**

**1 Connecting the Probes**

The controller is supplied with one room probe connected to input # 1. Three additional probes can be connected to inputs # 2, 3 and 4 in order to obtain a more accurate reading of the average room temperature and a faster reaction time (see wiring diagram enclosed).

**CAUTION:** Probes operate at low voltage and are isolated from the supply. Be sure that probe cables remain insulated from all high voltage sources. In particular, do not route the probe cables through the same electrical knockout as other cables. Do not connect the shield from the probe cable to an input or a ground.

**Minimum Speed Setting and Motor Curve Selection**

Fan Dia.	Model Numbers	Control Settings		Minimum Voltage Output	CFM at 0.05" S.P.
		Motor Curve	Minimum Speed		
9"	AT09Z1, AT10SP1, AT10AP1 (120 VAC)	1	45	81	50
	AT09Z2, AT10SP2, AT10AP2 (240 VAC)	1	45	42	50
14"	AT14Z, AT14F, AT14G	1	65	101	120
15"	AT15AP, AT15SP	1	65	101	110
16"	AT16Z, AT16F, AT16G	3	30	101	140
18"	AT18Z, AT18F, AT18G, GB18	3	40	107	600
24"	AT24Z, AT24F, AT24G, GB24	4	40	117	1250
36"	AT36Z, AT36ZB1, AT36G1, AT36GB1	5	30	130	1250

The above values assume the following conditions unless noted otherwise:

- 1) Input Voltage: 240 VAC
- 2) Static Pressure: 0.05" S.P.
- 3) Fan Accessories: Hood, Guard and Shutter if applicable.

For configurations or requirements other than above, refer to Form QM1065.

## 2 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) (the cable dimensions should not be under 18 AWG) to ensure the cable entry is liquid tight. Do not ground the shielding.
- It is preferable to solder the cable joint to ensure a proper contact between the two cables.

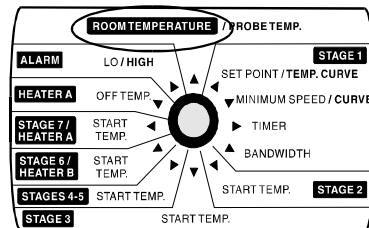
**CAUTION:** Do not run probe cables next to other power cables. When crossing over other cables, cross at 90°.

## 3 Defective Probes

If a defective probe is detected, the Defective Probe Pilot Light turns on. The room temperature shown on the display is then the average temperature measured by the probes in working condition. The controller will operate according to this temperature.

To identify the defective probe:

- Set the selection knob to **ROOM TEMPERATURE**. The room temperature is displayed.
- Press the push-button. If the probe connected to input # 1 and supplied with the controller is not defective, the letters "PR1" are displayed, alternating with the on/off state of the probe and the temperature measured by the probe.



If the probe is defective, the letters "PR1" are displayed, alternating with the state of the probe and 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 input to which the probe is connected) are displayed, alternating with the on/off state of the probe and the temperature measured by the probe. If the probe is defective, the letters "PR#" are displayed, alternating with the on/off state of the probe and the letter "P".

## CHANGING THE PARAMETER SETTINGS

### THE MEANING OF A FLASHING DISPLAY

The display will flash in certain cases and not in others. The flashing indicates that the value shown can be adjusted. A value that is not flashing cannot be adjusted.



### LOCKING THE PARAMETER SETTINGS

The parameter settings can be locked to prevent accidentally modifying them. When the settings are locked, only the temperature set point and the Stage 1 minimum ventilation speed can be modified (as long as the temperature curve and the minimum ventilation speed curve are deactivated respectively).

To lock the parameter settings:

- Set internal switch # 1 to **ON**. The Locked Parameter Pilot Light turns on.

To unlock the parameter settings:

- Set internal switch # 1 to **OFF**. The Locked Parameter Pilot Light turns off.

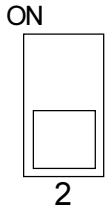
## TEMPERATURE SETTINGS

### TEMPERATURE UNITS

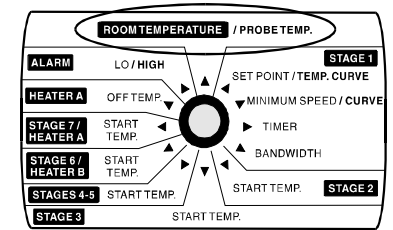
Temperatures can be displayed in either Celsius or Fahrenheit units

- Set internal switch # 2 to the desired position:

- **ON** to display temperatures in Celsius units.
- **OFF** to display temperatures in Fahrenheit units.



### VIEWING TEMPERATURES



The readout can display values from  $-40.0^{\circ}\text{F}$  to  $120^{\circ}\text{F}$  ( $-40.0^{\circ}\text{C}$  to  $48.9^{\circ}\text{C}$ ). When the temperature drops below  $-9.9$  degrees, the negative sign is displayed separately, alternating with the numerical value.

#### **1** Viewing the Room Temperature

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

- Set the selection knob to **ROOM TEMPERATURE / PROBE TEMP.** The room temperature is displayed.

#### **2** Viewing the Probe Temperatures

The controller can display probe temperatures individually. Probes can also be turned on or off to control the temperature in different parts of the building.



- Set selection knob to **ROOM TEMPERATURE / PROBE TEMP**. The average room temperature is displayed.
- Press the push-button. The temperature reading from probe 1 is displayed, alternating with the letters "**Pr 1**" and the on/off state of probe 1.
- For each additional probe, press the push-button. The temperature reading from probe x is displayed, alternating with the letters "**Pr x**" and the on/off state of the probe, etc.
- Press the push-button once again to display the letters "**Pr 1**" alternating with the state of probe 1, i.e. ON / OFF (flashing). When a probe is activated, it is used in the calculation of the average room temperature.
- Use the adjustment knob to change the state of the probe.
- For each additional probe, press the push-button. The state of probe is displayed, alternating with the letters "**Pr x**", etc.

#### Notes:

- (i) The display returns to the average room temperature after one minute.
- (ii) Initially, only probe one is activated.
- (iii) At least one probe must be activated at all times.

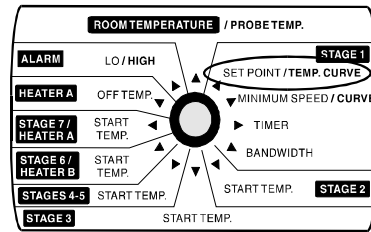
### 3 Viewing Minimum / Maximum Temperatures

The minimum and maximum temperatures are the lowest and highest temperature values recorded since the last reset. Maximum and minimum temperatures values are recorded for the average room temperature as well as for individual probe temperatures.

- Set the selection knob to **ROOM TEMPERATURE / PROBE TEMP**. The room temperature is displayed.
- Turn the adjustment knob clockwise by one notch. The minimum temperature is displayed, alternating with the letters "**Lo**".
- Turn the adjustment knob clockwise one notch further. The maximum temperature is displayed, alternating with the letters "**Hi**".
- Turn the adjustment knob clockwise a third notch. The room temperature is displayed again.
- For each individual probe, press the push-button. The temperature reading from probe x is displayed, alternating with the letters "**Pr x**" and the on/off state of the probe.
- Turn the adjustment knob clockwise by one notch. The minimum is displayed, alternating with the letters "**Lo**".
- Turn the adjustment knob clockwise one notch further. The maximum temperature is displayed, alternating with the letters "**Hi**".
- Turn the adjustment knob clockwise a third notch. The probe temperature is displayed again.
- For each additional probe, press the push-button. The temperature reading from probe x is displayed, alternating with the letters "**Pr x**" and the on/off state of the probe, etc.

**NOTE:** If you let the display flash for more than 10 seconds, the controller resets the minimum and maximum temperatures currently in memory (the display stops flashing to indicate that the reset has been done).

## TEMPERATURE SET POINT



The temperature set point is the target room temperature. It can be adjusted between  $-40.0^{\circ}\text{F}$  and  $99.9^{\circ}\text{F}$  ( $-40.0^{\circ}\text{C}$  and  $37.7^{\circ}\text{C}$ ).

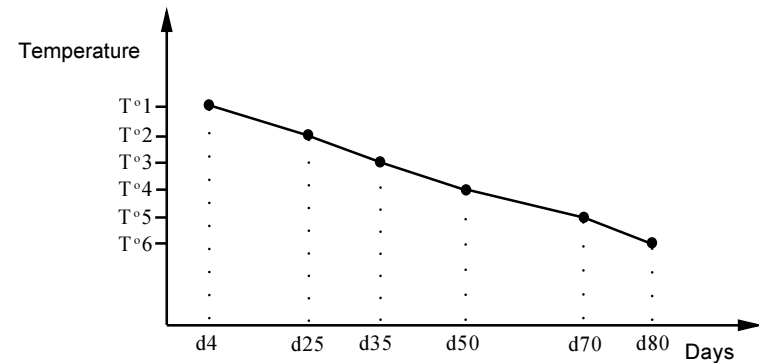
### Adjusting the Temperature Set Point

- Set the selection knob to **SET POINT / TEMP. CURVE**. The current set point flashes on the display.
- Use the adjustment knob to adjust the set point to the desired value.

**NOTE:** The temperature set point can be adjusted only if the temperature curve is deactivated (see following section).

## TEMPERATURE CURVE

The user can define a temperature curve to adjust the set point automatically over a given time period.



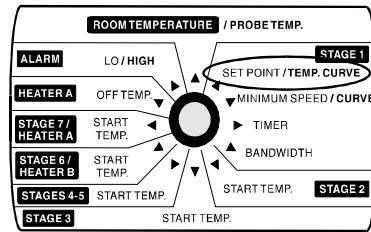
A curve is defined using six points. Each point specifies a day number and a set point for that day. Once the points of the curve are defined, the curve must be activated. The controller will change the temperature set point every hour in a linear fashion between consecutive points of the curve. When the last point of the curve is reached, the temperature set point for that day is maintained until the curve is reactivated.

### NOTES :

- i) All six points of the curve must be specified. If six points are not needed, repeat the last temperature value for each unnecessary point.
- ii) Certain restrictions apply to reduce the risk of errors:
  - The highest possible day number is 99.
  - Decreasing day numbers are not allowed.
  - Increasing temperatures are not allowed.
  - The temperature variation cannot exceed  $3^{\circ}\text{F}$  ( $1.6^{\circ}\text{C}$ ) per day.

## 1 Specifying the Curve

- Set the selection knob to **SET POINT / TEMP. CURVE**. The current temperature set point flashes on the display.



- Press the push-button. The word **OFF** is displayed indicating that the temperature curve is deactivated. If this is not the case, see below to deactivate the curve.

Repeat the following steps for each of the six points:

- Press the push-button once again. The word "**day**" is displayed, alternating with the day number.
- Using the adjustment knob, set the day number to the desired value.
- Press the push-button once again. The current temperature set point is displayed, alternating with the word "**set**".
- Using the adjustment knob, adjust the set point to the desired value.

Once the six points of the curve have been specified, activate the curve as explained below.

**NOTE:** Make sure the temperature curve is deactivated before specifying new points (see below).

## 2 Activating the Temperature Curve

If you have just finished specifying the points on the curve:

- Press the push-button once again. The word **OFF** flashes on the display.
- Turn the adjustment knob clockwise one notch. The word **ON** flashes on the display and the Temperature Curve Pilot Light flashes, indicating that the temperature curve is now activated.
- Set the selection knob to **ROOM TEMPERATURE**.

If you have previously defined the points on the curve:

- Set the selection knob to **SET POINT / TEMP. CURVE**. The current value of the temperature set point flashes on the display.
- Press the push-button. The word **OFF** flashes on the display.
- Press the push-button to display the points of the curve currently defined until the word **OFF** appears (thirteen clicks).
- Turn the adjustment knob clockwise one notch. The word **ON** flashes on the display and the Temperature Curve Pilot Light flashes, indicating that the temperature curve is now activated.
- Set the selection knob to **ROOM TEMPERATURE**.

## 3 Viewing Current Set Point and Day Number

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

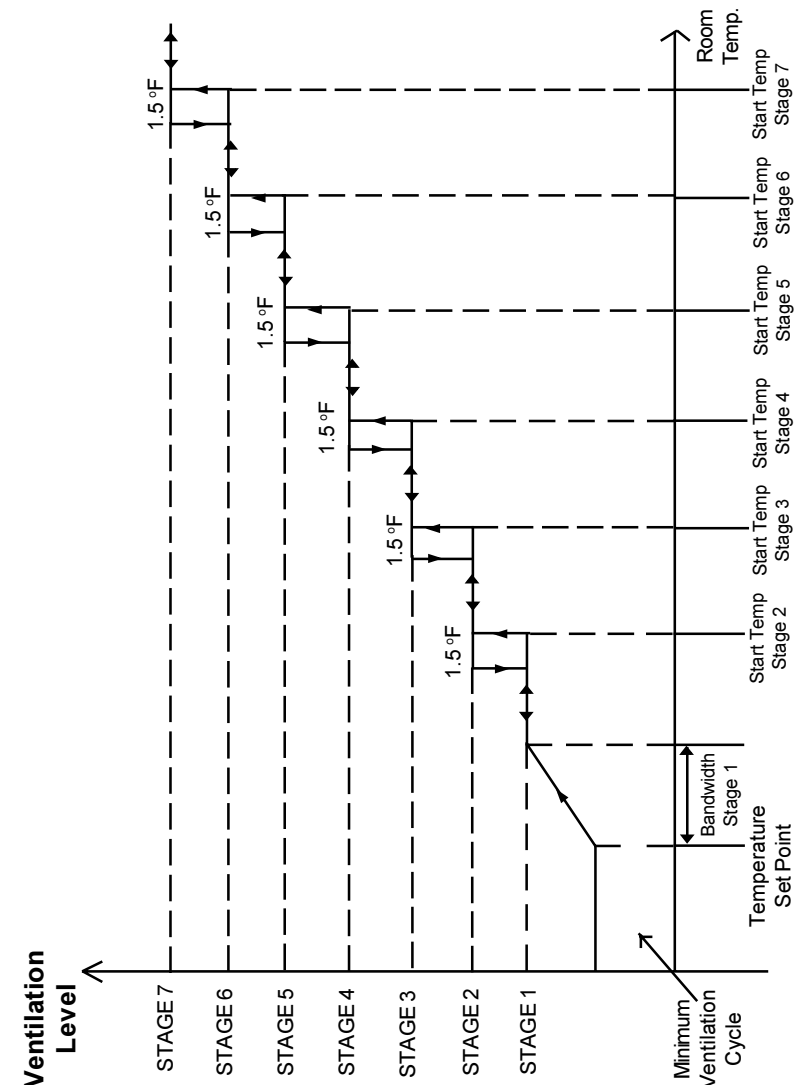
- Set the selection knob to **SET POINT / TEMP. CURVE**. The current temperature set point is displayed.
- Press the push-button. The current day number is displayed, alternating with the letters "**cur. day**".
- Use the adjustment knob to set the day number to the desired value.

## 4 Deactivating the Temperature Curve

- Set the selection knob to **SET POINT / TEMP. CURVE**. The current temperature set point is displayed.
- Press the push-button to display the points of the curve actually defined until the word **ON** appears (fourteen clicks).
- Turn the adjustment knob counterclockwise one notch. The word **OFF** flashes on the display and the Temperature Curve Pilot Light turns off, indicating that the temperature curve is now deactivated.
- Set the selection knob to **ROOM TEMPERATURE**.

## COOLING OPERATION

The ST 5124 controls one stage of variable-speed fans (Stage 1), four stages of constant-speed fans (Stages 2 - 5) and two optional stages of constant-speed fans (Stages 6 & 7).



### If room temperature rises:

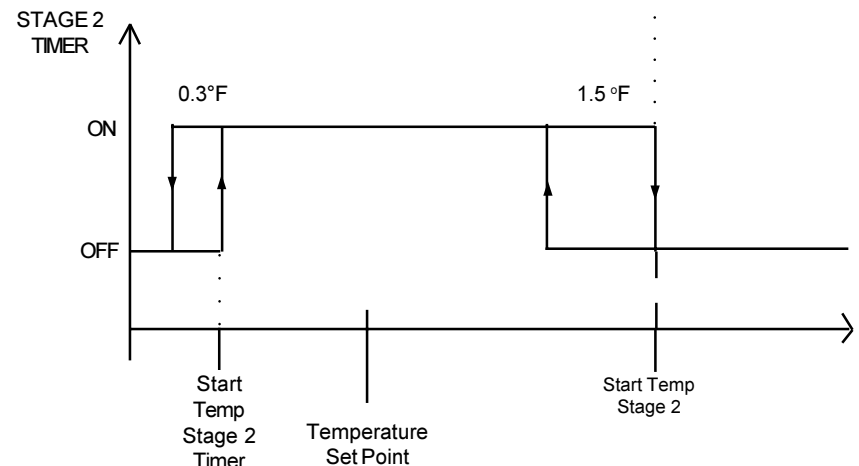
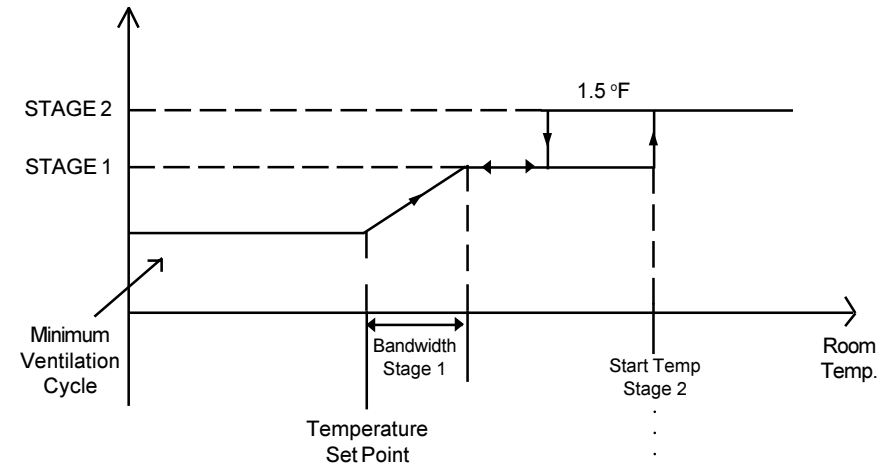
- When **room temperature < Set Point**, the stage 1 fans run at minimum speed according to the minimum ventilation cycle.
- **At Set Point**: the stage 1 fans stop operating according to the minimum ventilation cycle and increase in speed as the room temperature rises.
- **At Set Point + Bandwidth 1**: the stage 1 fans reach full speed.
- **At Stage 2 Starting Temp**: the stage 2 fans start running.
- **At Stage 3 Starting Temp**: the stage 3 fans start running.
- **At Stage 4 Starting Temp**: the stage 4 fans start running.
- **At Stage 5 Starting Temp**: the stage 5 fans start running.
- **At Stage 6 Starting Temp**: the stage 6 fans start running.
- **At Stage 7 Starting Temp**: the stage 7 fans start running.

### If the room temperature falls:

- **At Stage 7 Starting Temp - 1.5°F**: the stage 7 fans return to a stop.
- **At Stage 6 Starting Temp - 1.5°F**: the stage 6 fans return to a stop.
- **At Stage 5 Starting Temp - 1.5°F**: the stage 5 fans return to a stop.
- **At Stage 4 Starting Temp - 1.5°F**: the stage 4 fans return to a stop.
- **At Stage 3 Starting Temp - 1.5°F**: the stage 3 fans return to a stop.
- **At Stage 2 Starting Temp - 1.5°F**: the stage 2 fans return to a stop.
- **At Set Point + Bandwidth 1**: Stage 1 fans start decreasing in speed as the temperature decreases.
- **At Set Point**: the Stage 1 fans reach minimum speed.
- **Below the Set Point**: the stage 1 fans stop operating continuously and operate according to the minimum ventilation cycle at minimum speed.

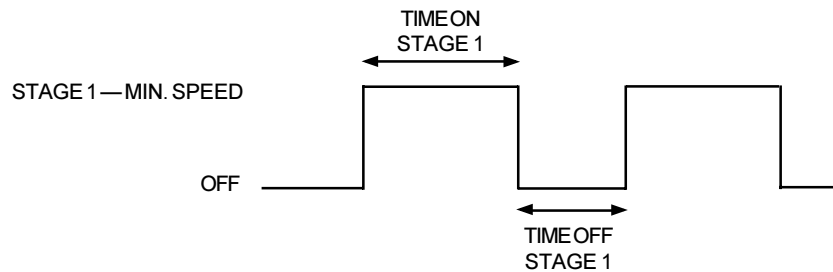
### STAGE 2 - TIMER MODE

In addition, the stage 2 can also operate according to a timer cycle (internal switch #6 ON). The user defines a start temperature for the stage 2 timer. The timer then stops at the beginning of stage 2 normal operation.



## MINIMUM VENTILATION CYCLE

When the room temperature is below the set point, the Stage 1 fans operate according to the minimum ventilation cycle. Running the fans even though ventilation is not required for a cooling purpose is useful to reduce humidity levels and supply oxygen to the room. It also prevents the fans from freezing in winter.



During time on, the Stage 1 fans run at Stage 1 minimum speed. The Stage 1 Pilot Light turns on. During time off, the Stage 1 fans do not run. The Stage 1 Pilot Light turns off. The Stage 1 minimum speed can also be defined by a speed curve (see below).

**NOTE:** The controller supplies maximum voltage to the variable-speed fans for 2 seconds immediately following each start-up.

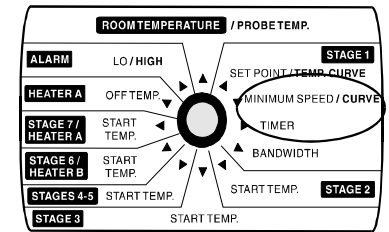
### Minimum Ventilation Cycle Settings

1. To run the fans continuously at minimum speed, 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.
3. To run the fans intermittently, set time on to the desired running time and time off to the desired off time.

## 1 Adjusting Minimum Speed

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

- Set the selection knob to **STAGE 1 — MINIMUM SPEED/CURVE**. The current minimum speed for Stage 1 flashes on the display.
- Use the adjustment knob to adjust the minimum speed to the desired value.



**NOTE:** The minimum speed can be adjusted only if the minimum speed curve is deactivated or if the minimum speed curve is activated but not currently operating (see below).

## 2 Adjusting Stage 1 Time On and Time Off

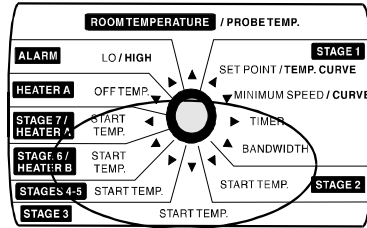
- Set the selection knob to **STAGE 1 — TIMER**. The current time on for Stage 1 flashes on the display, alternating with the letters "On".
- Use the adjustment knob to adjust time on to the desired value.
- Press the push-button. The current time off for Stage 1 flashes on the display, alternating with the letters "Off".
- Use the adjustment knob to adjust time off to the desired value.

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

## VENTILATION SETTINGS

### 1 Adjusting the Stage 1 Bandwidth

The Stage 1 bandwidth is the temperature interval within which the Stage 1 variable-speed fans increase or decrease in speed proportionally to the temperature (see the diagram above). The hysteresis is fixed at 0.3°F and determines when the fans start operating according to the minimum ventilation cycle. When this value is adjusted, all the starting values for consecutive stages are adjusted by the same amount. The bandwidth can be adjusted from 0.5°F to 20.0°F (0.3°C and 11.1°C).



- Set the selection knob to **STAGE 1 — BANDWIDTH**. The current bandwidth flashes on the display.
- Use the adjustment knob to adjust the bandwidth to the desired value.

### 2 Adjusting the Stage 2 Starting Temperature

The Stage 2 starting temperature is the temperature at which the Stage 2 fans start running (see the diagram above). The hysteresis is fixed at 1.5°F and determines when the fans return to a stop. When this value is adjusted, all the starting values for consecutive stages are adjusted by the same amount. The difference between the starting temperature and the bandwidth (stage 1) can go from 0.5°F to 20.0°F (0.3°C to 11.1°C). Note that if the stage 2 is also used in timer mode (internal switch #6 to ON), the stage 2 starting temperature is the temperature at which the timer returns to a stop.

- Set the selection knob to **STAGE 2 — START TEMP.** The current starting temperature flashes on the display.
- Use the adjustment knob to adjust the temperature to the desired value.

### 3 Adjusting the Stage 2 Timer Temperature

If the stage 2 uses the timer mode (internal switch #6 to ON), the stage 2 timer temperature is the temperature at which the timer starts running. The timer temperature for the stage 2 timer can be set from 0 to 20°F (0.0°C to 11.1°C) below the stage 2 starting temperature.

- Set the selection knob to **STAGE 2 — START TEMP.** The current starting temperature flashes on the display.
- Press the push-button once. The timer temperature flashes on the display alternating with the letters "Ti".
- Use the adjustment knob to adjust the temperature to the desired value.

### 4 Adjusting the Stage 2 Time On and Time Off

If the stage 2 uses the timer mode (internal switch #6 to ON), the time On and Time Off must be set by the user.

- Set the selection knob to **STAGE 2 — START TEMP.** The current starting temperature flashes on the display.
- Press the push-button twice. The Time On flashes on the display alternating with the letters "ON".
- Use the adjustment knob to adjust the Time On to the desired value.
- Press the push-button. The Time Off flashes on the display alternating with the letters "OFF".
- Use the adjustment knob to adjust the Time Off to the desired value.

## 5 Adjusting the Stage 3 Starting Temperature

The Stage 3 starting temperature is the temperature at which the Stage 3 fans start running (see the diagram above). The hysteresis is fixed at 1.5°F and determines when the fans return to a stop. When this value is adjusted, all the starting values for consecutive stages are adjusted by the same amount. The difference between the starting temperature and the Stage 2 starting temperature can go from 0.5°F to 20.0°F (0.3°C to 11.1°C).

- Set the selection knob to **STAGE 3 — START TEMP**. The current starting temperature flashes on the display.
- Use the adjustment knob to adjust the temperature to the desired value.

## 6 Adjusting the Stage 4 and 5 Starting Temperatures

The Stage 4 and 5 starting temperatures are the temperatures at which the Stage 4 and 5 fans respectively start running (see the diagram above). The hysteresis is fixed at 1.5°F and determines when the fans return to a stop. When one of these values is adjusted, all the starting values for consecutive stages are adjusted by the same amount. The difference between a starting temperature and the starting temperature of the preceding stage can go from 0.5°F to 20.0°F (0.3°C to 11.1°C).

- Set the selection knob to **STAGES 4-5 — START TEMP**. The current starting temperature for stage 4 is displayed, alternating with the letters "St 4".
- Use the adjustment knob to adjust the temperature to the desired value.
- Press the push-button. The current starting temperature for stage 5 is displayed, alternating with the letters "St 5".
- Use the adjustment knob to adjust the temperature to the desired value.

## 7 Adjusting the Stage 6 Starting Temperature

The Stage 6 starting temperature is the temperature at which the Stage 6 fans start running (see the diagram above). The hysteresis is fixed at 1.5°F and determines when the fans return to a stop. When this value is adjusted, all the starting values for consecutive stages are adjusted by the same amount. The difference between the starting temperature and the Stage 5 starting temperature can go from 0.5°F to 20.0°F (0.3°C to 11.1°C).

- Set the selection knob to **STAGE 6 — START TEMP**. The current starting temperature flashes on the display.
- Use the adjustment knob to adjust the temperature to the desired value.

## 8 Adjusting the Stage 7 Starting Temperature

The Stage 7 starting temperature is the temperature at which the Stage 7 fans start running (see the diagram above). The hysteresis is fixed at 1.5°F and determines when the fans return to a stop. When this value is adjusted, all the starting values for consecutive stages are adjusted by the same amount. The difference between the starting temperature and the Stage 6 starting temperature can go from 0.5°F to 20.0°F (0.3°C to 11.1°C).

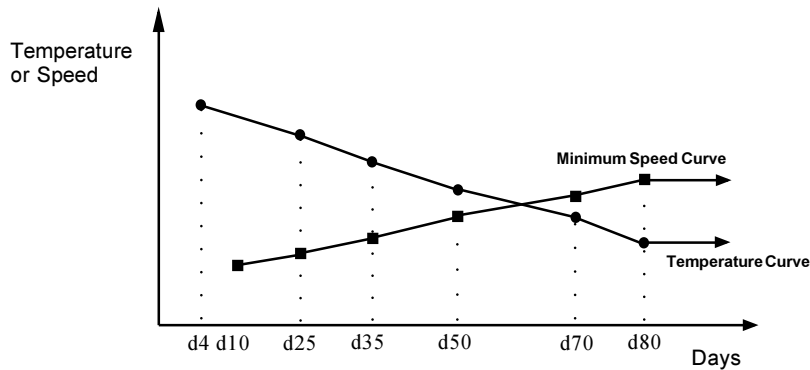
- Set the selection knob to **STAGE 7 — START TEMP**. The current starting temperature flashes on the display.
- Use the adjustment knob to adjust the temperature to the desired value.



**MINIMUM VENTILATION SPEED CURVE**

The user can define a minimum ventilation speed curve to adjust the Stage 1 minimum speed automatically over a given time period. Each curve is defined by six points. Each point specifies a day number and a fan speed for that day. Once the points are defined, the minimum speed curve must be activated. When the minimum speed curve is activated, the controller adjusts the Stage 1 minimum speed every hour in a linear fashion between two consecutive points.

When the last point of the curve is reached, the curve is 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 using the first method.



**NOTE:**

If the room temperature falls below the threshold value given in Table 1, 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, calculated according to the minimum speed curve.

Table 1.

STAGE 7 OPERATION	THRESHOLD VALUE
Cooling	"Set Point - 5.0°F (2.8°C)"
Heating	Heater A Starting Temperature - 5.0°F (2.8°C)

**Interaction Between the Temperature Curve and the Minimum Speed Curve**

- 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 greater or equal to the day number specified for the first point of the temperature curve and less than the day number specified for the second point of the temperature curve (see example 1).

**EXAMPLE 1**

	TEMPERATURE CURVE	MINIMUM SPEED CURVE
POINT 1	d5	d5 to d19 (adjustable)
POINT 2	d20	d20 (not adjustable)

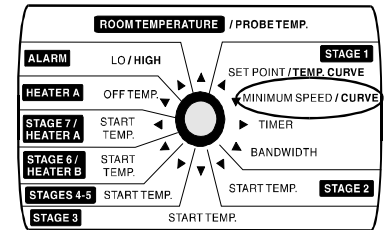
- When the minimum speed curve is activated, it will effectively be operating (i.e. the controller will begin to adjust the minimum speed according to the specified points of the curve) only when the current day number of the temperature curve reaches the first day number of the minimum speed curve.

## EXAMPLE 2

	TEMPERATURE CURVE		MINIMUM SPEED CURVE	
	Day	Temperature	Day	Speed
POINT 1	d5	90.0 °F	d10	10 %
POINT 2	d20	85.0 °F	d20	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 in 4 days, when the current day number of the temperature curve reaches d10. In the meantime, the fans will run at the specified single minimum speed (see example 2).
- If you activated the temperature curve six days ago, the current day number of the temperature curve is d11. 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%.

## 1 Specifying the Minimum Speed Curve



- Set the selection knob to **STAGE 1 — MINIMUM SPEED / CURVE**. The current minimum speed flashes on the display.
- Press the push-button. The word **OFF** is displayed, indicating that the minimum speed curve is deactivated. If this is not the case, deactivate the curve as described below.

Repeat the following steps for each of the six points:

- Press the push-button once again. The word "**day**" is displayed, alternating with the day number.
- For the first point of the curve, use the 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 the push-button once again. The minimum speed for that day is displayed, alternating with the letters "**SPd**".
- Use the adjustment knob to adjust the minimum speed to the desired value.

### NOTES:

- The minimum speed curve must be deactivated before specifying the points on the curve (see below).
- 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.

- iii) Certain restrictions apply to reduce the risk of errors:
- decreasing minimum speeds are not allowed.
  - the minimum speed variation cannot exceed 10% per day.

## 2 Activating the Minimum Speed Curve

If you have just finished specifying the points on the curve:

- Press the push-button once again. The word **OFF** is displayed.
- Turn the adjustment knob clockwise by one notch. The word **ON** flashes on the display and the Minimum Speed Curve Pilot Light turns on, indicating that the minimum speed curve is now activated.

If you have previously specified the points on the curve:

- Set the selection knob to **STAGE 1 — MINIMUM SPEED / CURVE**. The current minimum speed flashes on the display.
- Press the push-button to display the points of the curve currently defined until the word **OFF** appears (fourteen clicks).
- Turn the adjustment knob clockwise by one notch. The word **ON** flashes on the display and the Minimum Speed Curve Pilot Light turns on, indicating that the minimum speed curve is now activated.

## 3 Viewing Current Minimum Speed and Day

When the minimum speed curve is activated, the current minimum speed and day number can be viewed at any time. To modify the day number, refer to the section on temperature curves.

- Set the selection knob to **STAGE 1 — MINIMUM SPEED / CURVE**. The current minimum speed is displayed.
- Press the push-button. The current day is displayed, alternating with the letters "**cur. dAY**".

## 4 Deactivating the Minimum Speed Curve

- Set the selection knob to **STAGE 1 — MINIMUM SPEED / CURVE**. The current minimum speed is displayed.
- Press the push-button to display the points of the curve currently defined until the word **ON** appears (fourteen clicks).
- Turn the adjustment knob counterclockwise by one notch. The word **OFF** flashes on the display and the Minimum Speed Curve Pilot Light starts blinking, indicating that the minimum speed curve is now deactivated.

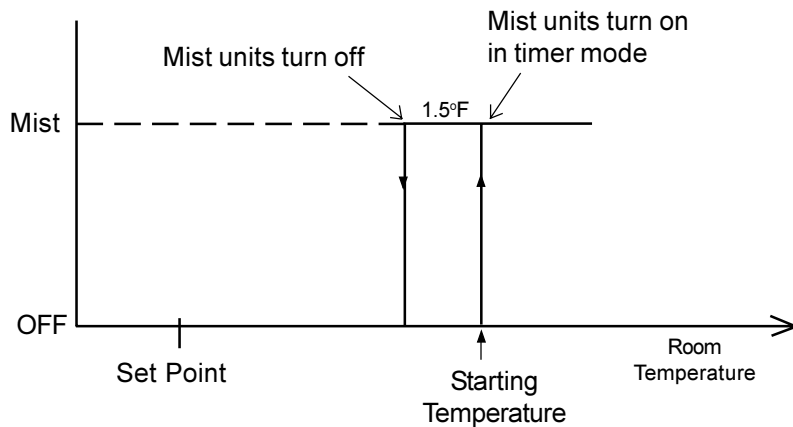
**MIST COOLING**

A mist cooling stage can be operated in one of two modes:

(i) **STAGED MIST** (internal switch #5 is OFF): the mist stage is the last stage to be turned on in the cooling sequence (it is preceded by all the fan stages);

(ii) **FLOATING MIST** (internal switch #5 is ON): the mist stage is independent of the staged fan sequence and can be turned on anywhere in the sequence. The diagram below illustrates this:

**Operation of a Floating Mist Stage**



The number of heating stages determines which stage is assigned as the mist stage:

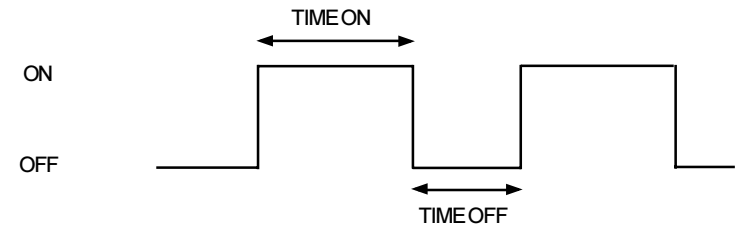
<u>NUMBER OF HEATING STAGES</u>	<u>MIST STAGE</u>
0	7
1	6
2	5

To access the parameters, position the selector switch at the starting temperature of the mist stage. The parameter settings are as follows:

Starting Temperature (°F or °C) - The mist starting temperature is the temperature at which the mist units turn on (see the diagram below). The starting temperature minus 1.5 °F is the temperature at which the mist units turn off.

Time on (minutes) - The mist units operate according to a timer cycle. The time on is the running time of the mist units.

Time off (minutes) - The time off is the off time of the mist units. Note that time off must be non-zero in order for the controller to recognize the stage as a mist stage.



**1 Adjusting the Mist Starting Temperature**

If the mist stage is staged (internal switch #5 is OFF), the difference between the starting temperature and the starting temperature of the preceding fan stage can go from 0.5°F to 20.0°F (0.3°C and 11.1°C). If the mist stage is floating (internal switch #5 is ON), the difference between the starting temperature and the set point can go from 0.5°F to 40.0°F (0.3°C and 22.2°C).

- Set the parameter selection knob to the starting temperature setting of the mist stage. The current starting temperature appears flashing on the display.
- Using the adjustment knob, set the starting temperature to the desired value.

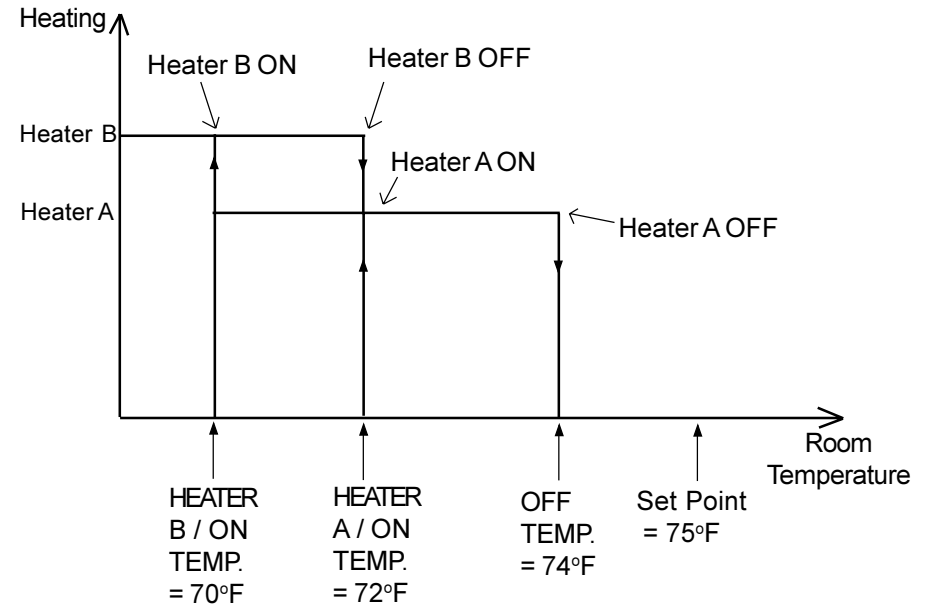
## 2 Adjusting the Mist Timer Settings

Time on and Time off can be adjusted between 0 and 60 minutes, in increments of 1 minute.

- Set the parameter selection knob to the starting temperature setting of the mist stage. The current starting temperature appears flashing on the display.
- Push the push-button. The word "On" flashes on the display, alternating with the current time on value.
- Turn the adjustment knob to adjust the time on to the desired value (in minutes).
- Press the push-button once again. The word "Off" flashes on the display, alternating with the current time off value.
- Turn the adjustment knob to adjust the time off to the desired value (in minutes). Note that time off must be non-zero in order for the controller to operate the stage as a mist stage.

## PRINCIPLE OF OPERATION

The graph below explains the operation of the heaters using sample values.



If the room temperature rises:

- at 72°F: Heater B turns off.
- at 74°F: Heater A turns off.

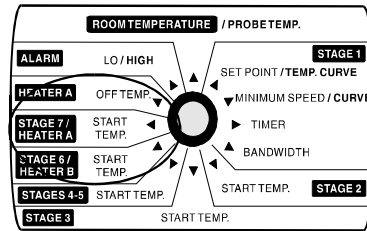
If the room temperature falls:

- at 72°F: Heater A turns on.
- at 70°F: Heater B turns on.

## 1 Adjusting the Heater Off Temperature

The heater off temperature can provide substantial energy savings if correctly adjusted according to the outside temperature. It is the temperature at which the heating units turn off (see diagram above). The off temperature is bounded above by the set point plus 9.9°F and below by the set point — 20°F.

- Set selection knob to **HEATER A — OFF TEMP.** The current off temperature flashes on the display.
- Use the adjustment knob to adjust the off temperature to the desired value.



## 2 Adjusting the Heater Starting Temperatures

The starting temperature is the temperature at which the heater turns on. The Heater A starting temperature is bounded above by the off temperature — 1.0°F and below by the off temperature — 20°F. The Heater B starting temperature is bounded above by the Heater A starting temperature — 0.5°F and below by the Heater A starting temperature — 20°F.

- Set the selection knob to **HEATER A — START TEMP. or HEATER B — START TEMP.** The current starting temperature for the heater selected flashes on the display.
- Use the adjustment knob to adjust the starting temperature to the desired value.

A test mode allows you to simulate temperature changes and verify controller performance. In test mode, the temperature probe inputs are turned off, allowing the user to change the temperature used by the controller to operate the stages. The controller operates as before using the new temperature settings.

### To enter test mode:

- Turn the selector knob to the **ROOM TEMPERATURE** position. The current room temperature is displayed.
- Press and hold the push-button for 5 seconds. The letters "TST" are displayed, alternating with the room temperature.
- Turn the adjustment knob to adjust the room temperature to the desired value. The controller operates the stages according to the new temperature setting.

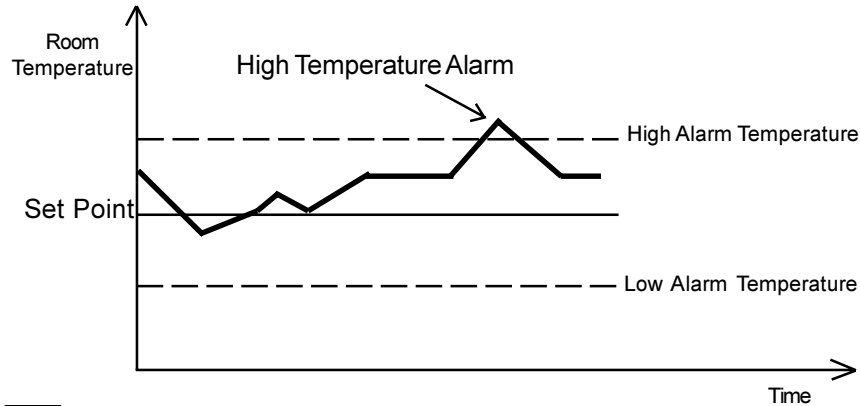
### To exit test mode:

- Turn the selector knob to the **ROOM TEMPERATURE** position. The current room temperature is displayed.
- Press and hold the push-button for 5 seconds.

**NOTE:** If no user activity is recorded after 5 minutes in test mode, the controller resumes normal operation.

## ALARM SETTINGS

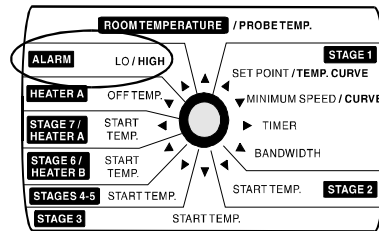
The controller sets off an alarm in the case of a power failure, a fault in the supply circuit or a high or low temperature. Temperature alarms are defined according to the set point as shown in the diagram below.



### 1 Adjusting the Alarm Settings

The high and low alarm settings are specified as a temperature value. The high alarm temperature ranges from set point + 0.5°F to set point + 40°F. The low alarm temperature ranges from set point - 40°F to set point - 0.5°F.

- Set the selection knob to **ALARM** — **LO / HIGH**. The current low alarm temperature flashes on the display, alternating with the word "**LO**".



- Use the adjustment knob to set the low alarm temperature to the desired value.
- Press the push-button. The current high alarm temperature flashes on the display, alternating with the word "**HI**".
- Use the adjustment knob to set the high alarm temperature to the desired value.

## TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	SOLUTION
There is no display.	The circuit breaker at the service panel is off or tripped.	Correct the problem and 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 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"

## ST 5124

PROBLEM	CAUSE	SOLUTION
The display shows sudden variations in the room or outside temperature.	<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>
The stage 1 variable speed cooling fans are not running.	<p>The wiring is incorrect.</p> <p>The stage 1 fuse is open.</p> <p>The display board interconnect cable is not properly plugged into the power supply board.</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 COMMON is supplied by line L1.</p> <p>Correct the problem and replace the fuse.</p> <p>Be sure the cable is firmly plugged in.</p>

## ST 5124

PROBLEM	CAUSE	SOLUTION
The stage 1 variable speed cooling fans are not running. (continued)	<p>The minimum speed is too low.</p> <p>The fan motor is defective.</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>
The stage 1 variable speed cooling fans run erratically.	<p>The selected motor curve is inappropriate.</p> <p>The stage 1 differential 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 stage 1 differential 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>



## ST 5124

PROBLEM	CAUSE	SOLUTION
The stage 1 variable speed cooling fans run continuously when the room temperature is below the room set point (minimum ventilation cycle).	The stage 1 time off is set to zero.  The wiring is incorrect.	Set the stage 1 time off to a value other than zero.  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 COMMON is supplied by line L1.
The mist is not operating as desired.	The mist time on and time off were incorrectly adjusted.	The mist time on and time off are in <u>minutes</u> . Adjust the mist time on and time off correctly.
The cooling fans are not running.  or  The heaters are not turning on.	The wiring is incorrect.          The stage's fuse is open.	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.  Replace the fuse.

## ST 5124

PROBLEM	CAUSE	SOLUTION
The cooling fans are not running.  or  The heaters are not turning on.  (continued)	The display board interconnect cable is not properly plugged into the power supply board.  The fan motor or heater is defective.       The controller is defective.	Be sure the cable is firmly plugged in.     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.    Listen to see if there is a clicking sound when the stage or heater pilot light turns on. If there is no clicking sound, contact your distributor to repair the controller.

## TECHNICAL SPECIFICATIONS

**Supply:** - 115/230 VAC (-18%, +8%), 60 Hz, L1 same phases as Stage 1, overload and overvoltage protection fuse F11-1A fast blow.

- 12 VDC for AC back-up supply; can activate stages 2 through 7 if supplied with DC back-up voltage.

**Stage 1:** Variable output, 60 Hz, 10A FAN (3/4 HP/115 VAC) / (1.5 HP/230VAC), fuse F1-15A slow blow.

**Stage 2:** ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A FAN, 10A RES, fuse F2-15A slow blow.

**Stage 3:** ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A FAN, 10A RES, fuse F3-15A slow blow.

**Stage 4:** ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A FAN, 10A RES, fuse F4-15A slow blow.

**Stage 5:** ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A FAN, 10A RES, fuse F5-15A slow blow.

**Stage 6:** ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A FAN, 10A RES, heating or cooling, fuse F6-15A slow blow.

**Stage 7:** ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A FAN, 10A RES, heating or cooling, fuse F7-15A slow blow.

**Alarm:** ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 3A, fuse F8-3A slow blow.

**Probes:** Low voltage (< 5V), isolated from the supply. Operating range: -40.0° to 120.0°F (-40.0° 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 located MUST ALWAYS REMAIN BETWEEN 32° AND 104°F (0° AND 40°C).**

## FACTORY SETTINGS

PARAMETER		FACTORY SETTING	RANGE OF VALUES
Temperature Set Point		75°F (23.9°C)	-40 to 99.9 °F (-40 to 37.7 °C)
Stage 1	Minimum Speed	40 %	10 % to 100 %
	Time On	15 seconds	0 to 900 seconds by increments of 15 seconds
	Time Off	0 seconds	
	Bandwidth	3.0°F (1.7°C)	0.5 to 20 °F (0.3 to 11.1 °C)
Stage 2 Starting Temp.		80°F (26.7°C)	0.5 to 20 °F (0.3 to 11.1 °C) from Bandwidth
Stage 3 Starting Temp.		82°F (27.8°C)	0.5 to 20 °F (0.3 to 11.1 °C) from Stage 2 Starting Temp.
Stage 4 Starting Temp.		84°F (28.9°C)	0.5 to 20 °F (0.3 to 11.1 °C) from Stage 3 Starting Temp.
Stage 5 Starting Temp.		86°F (30.0°C)	0.5 to 20 °F (0.3 to 11.1 °C) from Stage 4 Starting Temp.
Stage 6 Starting Temp.		89°F (31.7°C)	0.5 to 20 °F (0.3 to 11.1 °C) from Stage 5 Starting Temp.
Stage 7 Starting Temp.		90°F (32.2°C)	0.5 to 20 °F (0.3 to 11.1 °C) from Stage 6 Starting Temp.
Mist	Starting Temperature	90°F (32.2°C)	0.5 to 20 °F (0.3 to 11.1 °C) from previous stage's Starting Temp.
	Time On	1 minute	0 to 60 minutes by increments of 1 minute
	Time Off	0 minutes	
Heater A Starting Temp.		72.5°F (22.5°C)	1.0 to 20 °F (0.3 to 11.1 °C) from Off Temperature
Heater B Starting Temp.		70.5°F (21.4°C)	0.5 to 20 °F (0.3 to 11.1 °C) from Heater A Starting Temp.
Heater Off Temperature		74.5°F (23.6°C)	0.5 to 20 °F (0.3 to 11.1 °C) from Set Point
Alarm	Low Temperature	65°F (18.3°C)	0.5 to 40 °F (0.3 to 22.2°C) from Set Point
	High Temperature	87°F (30.6°C)	

## NOTES:

- i) These initial parameter settings will not be retained in the controller's memory. Each new setting will replace the preceding one.
- ii) If the power supply is cut off, the last parameter settings will be retained in memory until the power is restored.