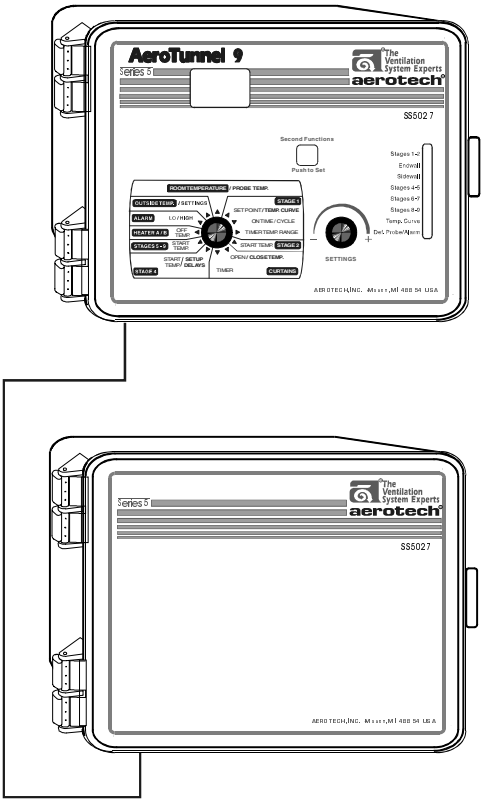
Tunnel Ventilation Controller

SS 5027

USER'S MANUAL



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FORM: QM 1324
March 2003

TABLE OF CONTENTS

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: SS 5027
Serial number: _____
Date installed: _____

FEATURES

The SS 5027 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 constant-speed cooling fans, as well as curtains, foggers, heaters and up to 6 tunnel stages can be connected to the controller.

The main features of the SS 5027 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.

RAMPING OPTION
The ramping option periodically calculates an optimal timer cycle to smooth the transition between minimum ventilation and full operation of stage 1 fans.

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

ZONED OR STAGED HEATERS

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.

OUTSIDE TEMPERATURE PROBE
Used to prevent curtains opening when the outside temperature is too low or activate tunnel mode when outside temperature is too high.

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 USING THE SB 2000
If the SS 5027 is used in combination with a SB 2000 controller, the movement of the air inlets can be coordinated with the operation of the stage 1 and 2 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.
NOTE: After programming the reference points for stage 2, press and hold the push-button for two seconds to end the programming sequence.

HIGH/LOW TEMPERATURE ALARM OUTPUT

AeroTunnel 9

Series 5

DIGITAL DISPLAY SCREEN

The Ventilation System Experts
aerotech®

SS5027

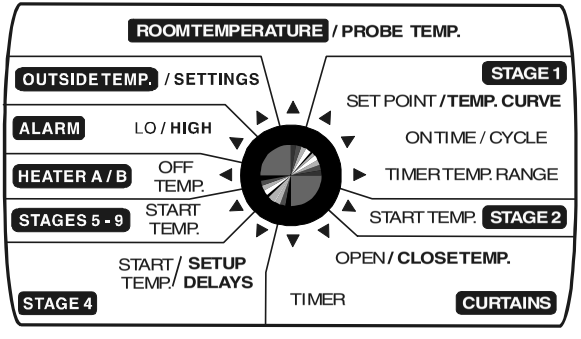
CONTROLLER STATUS LEDS

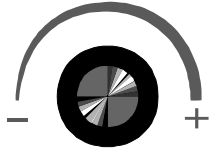
Stages 1-2
Endwall
Sidewall
Stages 4-5
Stages 6-7
Stages 8-9
Temp. Curve
Def. Probe/Alarm

Second Functions

Push to Set

FUNCTION SELECTION PUSH-BUTTON





SETTINGS
PARAMETER SELECTION KNOB

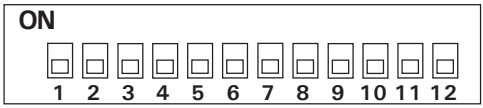
AEROTECH, INC. Mason, MI 48854 USA

CONTROLLER STATUS LEDS

LED	MEANING
STAGES 1-2	FLASHES WHEN STAGE 1 FANS ARE ON. TURNS ON WHEN STAGE 2 FANS ARE ON.
ENDWALL	FLASHES WHEN ENDWALL CURTAINS ARE CLOSING. TURNS ON WHEN ENDWALL CURTAINS ARE OPENING.
SIDEWALL	FLASHES WHEN SIDEWALL CURTAINS ARE CLOSING. TURNS ON WHEN SIDEWALL CURTAINS ARE OPENING.
STAGES 4-5	FLASHES WHEN STAGE 4 FANS ARE ON. TURNS ON WHEN STAGE 5 FANS ARE ON.
STAGES 6-7	FLASHES WHEN STAGE 6 FANS ARE ON. TURNS ON WHEN STAGE 7 FANS ARE ON.
STAGES 8-9	FLASHES WHEN ONE STAGE IS ON. TURNS ON WHEN TWO STAGES ARE ON.
T° CURVE	TURNS ON WHEN THE TEMPERATURE CURVE IS ACTIVATED. FLASHES WHEN THE MINIMUM VENTILATION SPEED CURVE IS ALSO ON.
DEF. PROBE/ ALARM	FLASHES WHEN A DEFECTIVE PROBE IS DETECTED. 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	STAGE 8 AND 9 COOLING	HEATER STAGES USED
4	STAGE 9 HEATING ONLY	STAGE 8 AND 9 HEATING
5	ZONED HEATING	STAGE HEATING
6	STAGE 3 ABSENT/ STAGE 7 PRESENT	STAGE 3 PRESENT/ STAGE 7 ABSENT
7	STAGED MIST STAGE	FLOATING MIST STAGE
8	STAGE 1 WITHOUT RAMPING	STAGE 1 WITH RAMPING
9	MIN. VENTILATION COMPENSATION DEACTIVATED	MIN. VENTILATION COMPENSATION ACTIVATED
10	RESERVED	
11	RESERVED	
12	RESERVED	

INSTALLATION

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.

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.

TEMPERATURE PROBES

1 Connecting the Probes

The controller is supplied with one room probe connected to input # 1 and one outside probe connected to input # 5. Three additional probes can be connected to inputs # 2, # 3 and # 4. If zoned heating is used, Heater A uses probe 1 and Heater B uses probe 2. If cascading heating is used, the average temperature from selected probes # 1, 2, 3 and 4 is used.

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.

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 Installing the Outside Probe

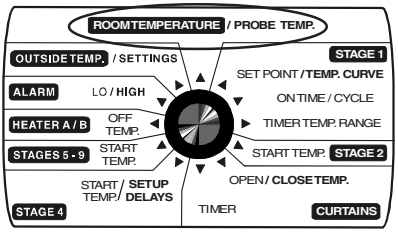
- Run the outside probe cable on the north side of the building, 6 ft (2 m) below the eave, inside a pale colored conduit.
- Be sure the probe cable is isolated from sheet metal or any other conductive material.
- Be sure no cable joint is exposed to air or water.

4 Defective Probes

Room 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:

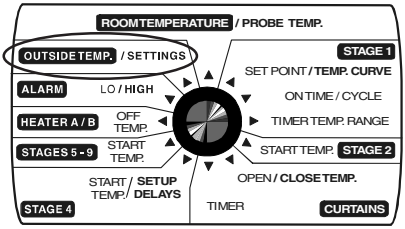
- Set the selection knob to **ROOM TEMPERATURE**. The room temperature is displayed.
- Press the push-button. If the probe connected to input # 1 and supplied with the controller is not defective, the letters"**PR1**" are displayed, alternating with the temperature measured by the probe. If the probe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



For each additional probe connected to the controller:

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

Outside Probe: If the outside probe is defective, the display shows the letter "**P**" when the parameter selection knob is set to **OUTSIDE TEMP.**



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:

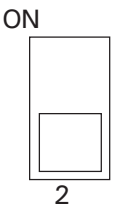
- Set internal switch # 1 to **OFF**. The Locked Parameter Pilot Light turns off.

TEMPERATURE SETTINGS

TEMPERATURE UNITS

Temperatures can be displayed in either Celsius or Fahrenheit units

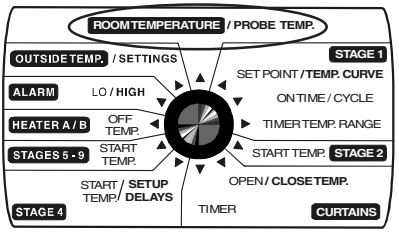
■ Set internal switch # 2 to the desired position:



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

VIEWING TEMPERATURES

The readout can display values from -40.0ºF to 120ºF (-40.0ºC to 48.9ºC). 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 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.

Notes:
(i) The display returns to the average room temperature after one minute.
(ii) At least one probe must be activated at all times. If only one probe remains active, the controller will lock the on/off switch for that probe.
(iii) Initially, only probe one is activated.

3 Viewing the Outside Temperature

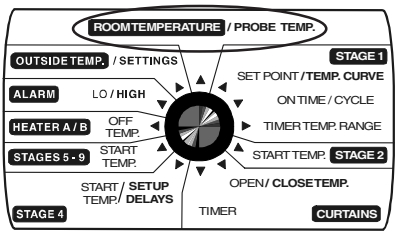
- Set selection knob to **OUTSIDE TEMP. / SETTINGS.** The outside temperature is displayed.

4 Viewing Minimum / Maximum Temperatures

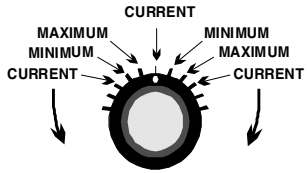
The minimum and maximum temperatures are the lowest and highest temperature values recorded since the last reset. Maximum and minimum temperatures values are recorded for the average room temperature as well as for individual probe temperatures.

- 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 flashes on



the display, alternating with the letters «**Lo**».

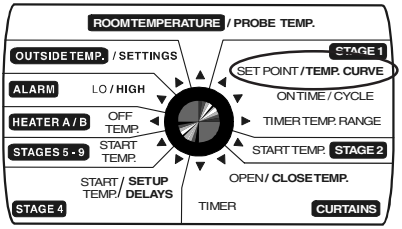


- Turn the adjustment knob clockwise one notch further. The maximum temperature flashes on the display, alternating with the letters «**Hi**».
- Turn the adjustment knob clockwise a third notch. The room temperature is displayed again.
- For each individual probe, press the push-button. The temperature 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 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 probe temperature is displayed again.
- Press the push-button to access the other probes, 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°F and 99.9°F (-40.0°C and 37.7°C).



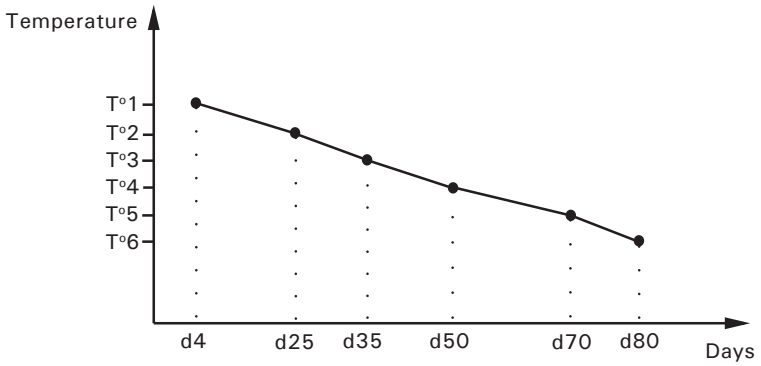
Adjusting the Temperature Set Point

- 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.

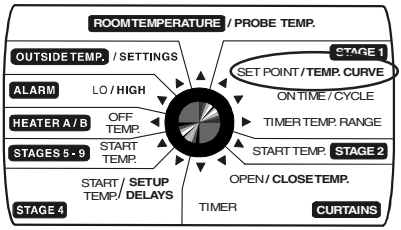
NOTES :

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°F (1.6°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 letter "**d**" followed by a day number flashes on the display.

- Using the adjustment knob, set the day number to the desired value.

- Press the push-button once again. The current temperature set point flashes on the display.

- 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

<u>If you have just finished specifying the points on the curve:</u>

- Press the push-button once again. The word **OFF** flashes on the display.

- Turn the adjustment knob clockwise one notch and leave in this position for at least 10 seconds. The word **ON** flashes on the display and after 10 seconds, the Temperature Curve Pilot Light turns on 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 and leave in this position for at least 10 seconds. The word **ON** flashes on the display and after 10 seconds, the Temperature Curve Pilot Light turns on 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 flashes 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.

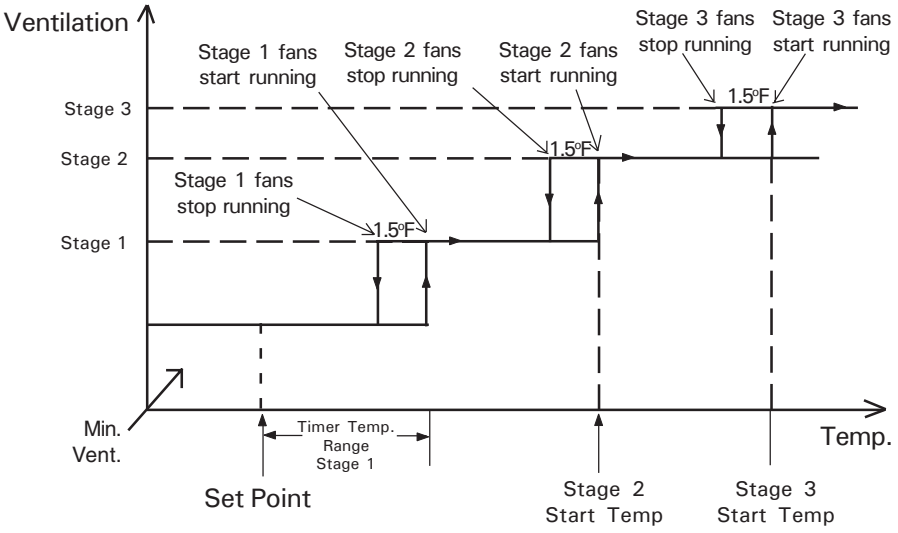
4 Deactivating the Temperature Curve

- Set the selection knob to **SET POINT / TEMP. CURVE**. The current temperature set point flashes on the display.
- 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 and leave in this position for at least 10 seconds. The word **OFF** flashes on the display and after 10 seconds, the Temperature Curve Pilot Light turns off indicating that the temperature curve is now deactivated.
- Set the selection knob to **ROOM TEMPERATURE**.

VENTILATION SETTINGS

COOLING OPERATION

The SS 5027 controls two stages of constant-speed fans (Stages 1-2) when tunnel ventilation is not in effect. An additional constant-speed stage can be added (Stage 3) by setting internal switch #6 to ON (when this is done, Stage 7 is no longer available for tunnel ventilation). The diagram below uses sample values to illustrate the operation of the cooling fans.



If the room temperature increases:

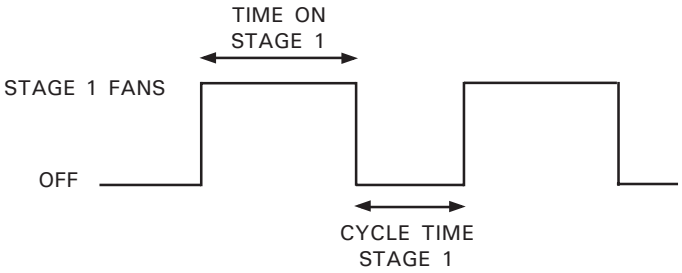
- When **room temperature < Set Point + Timer Temp. Range**, stage 1 fans run according to the minimum ventilation cycle.
- **At Set Point + Timer Temp. Range**: stage 1 fans run continuously.
- **At Stage 2 Starting Temp**: stage 2 fans start running.
- **At Stage 3 Starting Temp**: stage 3 fans start running.

If the room temperature decreases:

- **At Stage 3 Starting Temp - 1.5°F**: stage 3 fans return to a stop.
- **At Stage 2 Starting Temp - 1.5°F**: stage 2 fans return to a stop.
- **At Set Point + Timer Temp. Range - 1.5°F:** Stage 1 fans start to run according to the minimum ventilation cycle.

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.



Stage 1 fans run during time on. The Stage 1 Pilot Light turns on. During time off, the Stage 1 fans do not run. The Stage 1 Pilot Light turns off.

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.

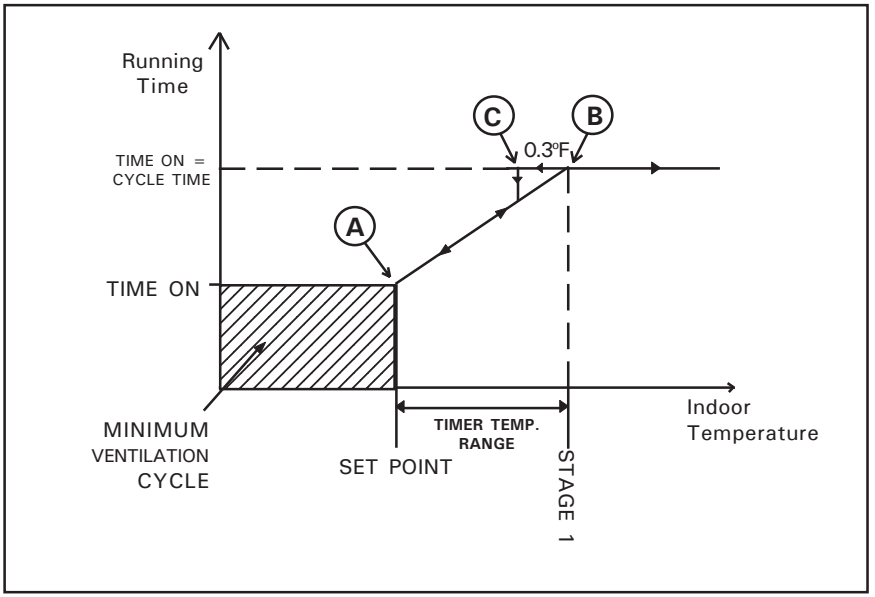
2. To stop the fans, set time on to zero and time off to any value.

3. To run the fans intermittently, set time on to the desired running time and time off to the desired off time.

RAMPING OPTION

The ramping option allows the user to smooth the transition between minimum cycle and full operation of stage 1 fans, i.e. in the temperature interval between the set point and the set point + timer temp. range.

Option 1: With Ramping

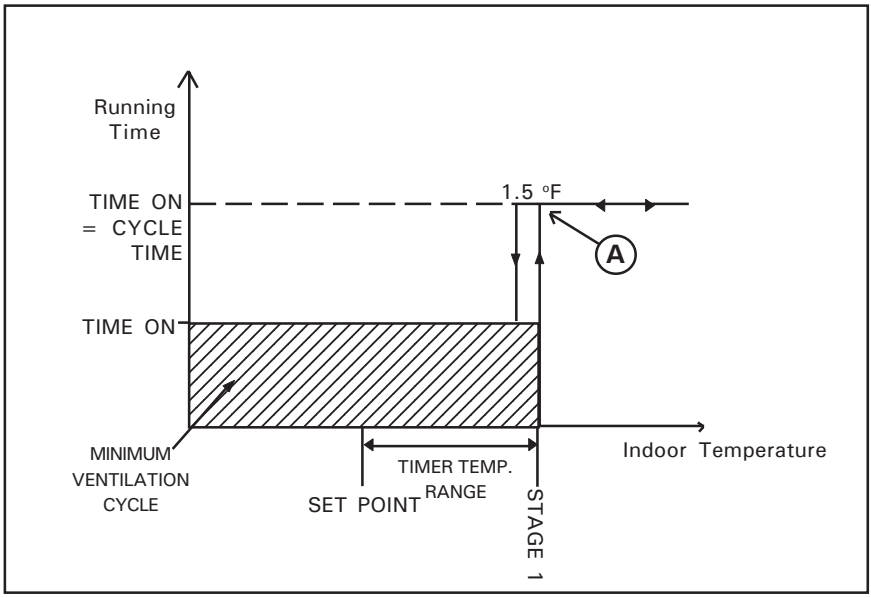


This option is activated by setting internal switch # 8 to ON. At room temperatures at or below the set point, the controller operates the Stage 1 fans according to the minimum ventilation cycle.

If the room temperature rises above the set point, a new TIME ON is calculated periodically as the temperature increases to allow a smooth progression (from point A to point B) up to full operation of the fans when the timer temp. range is reached.

If the room temperature decreases 0.3°F below the set point + timer temp. range, the TIME ON value of the minimum ventilation cycle decreases gradually from a value equal to the total cycle time (point C) to the value defined by the parameter settings (TIMER STAGE 1 - TIME ON).

Option 2: Without Ramping



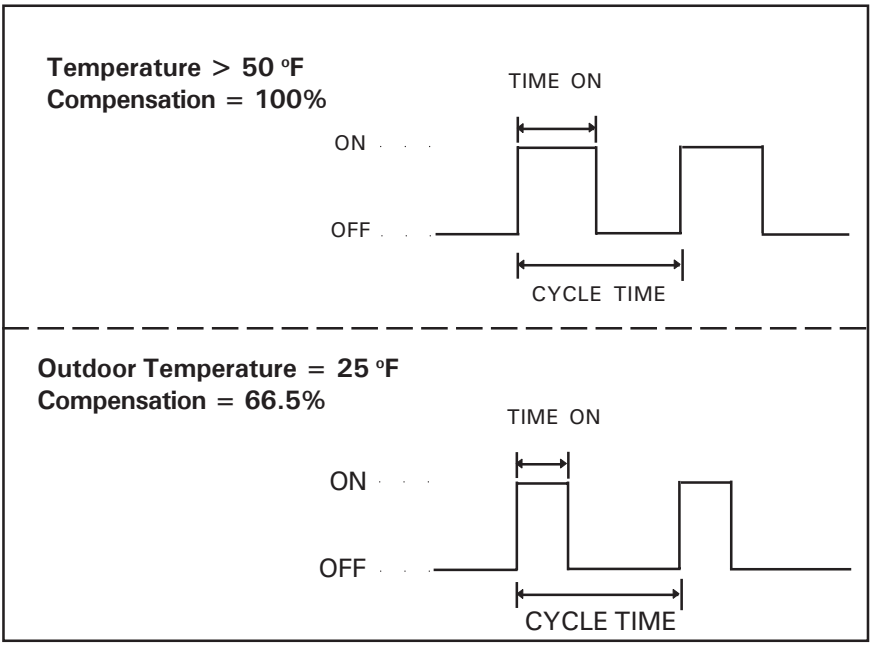
This option is activated by setting internal switch # 8 to OFF. When the temperature is less than the set point + timer temp. range, Stage 1 fans run according to the minimum cycle (see above). When the room temperature reaches point A, stage 1 fans run continuously with no transition.

When the temperature decreases 1.5°F below point A, Stage 1 fans start operating according to the minimum ventilation cycle.

MINIMUM VENTILATION COMPENSATION

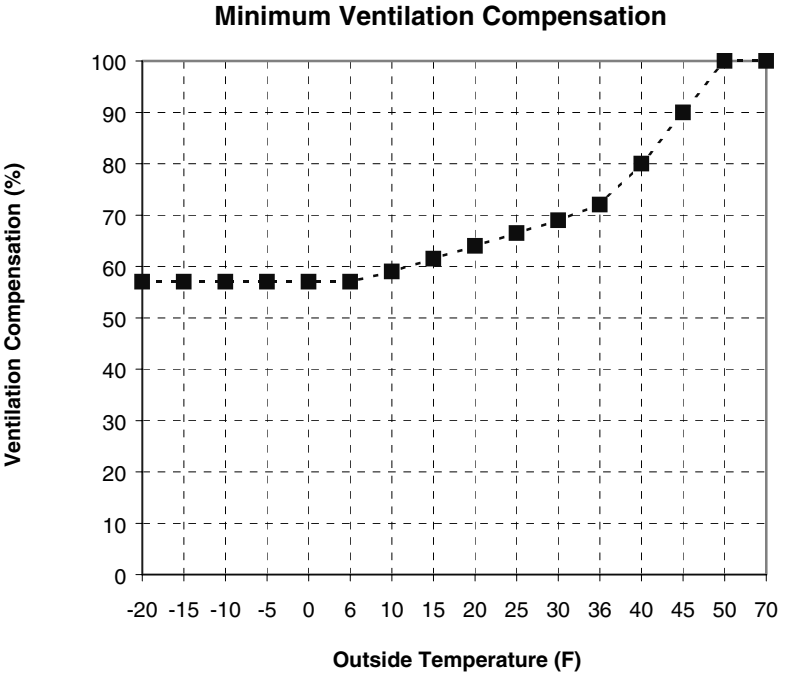
The SS 5027 has the capability of automatically adjusting the running time of the minimum ventilation fans as a function of outside temperature. As the weather gets colder, the on time is decreased gradually to compensate for the change. This can help reduce costs by reducing the ventilation when it is not required. A curve is used to calculate the required compensation as a percentage of current on time (see following page). Only the running time is adjusted; the total cycle time remains unchanged. Note that internal switch # 9 must be set to ON for this feature to work.

Examples of Ventilation Compensations



In the first example given on the following page, compensation is not needed when the outside temperature is greater than 50 °F. The fans operate according to the full running time defined by the parameter settings. In the second example, the running time is decreased to 66.5% of full running time to compensate for the colder outdoor temperature. Cycle time remains unchanged.

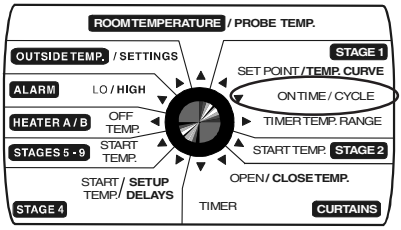
COMPENSATION CURVE



1 Adjusting Stage 1 ON Time and Cycle Time

The ON and CYCLE times can be adjusted between 0 and 900 seconds, in increments of 15 seconds.

- Set the selection knob to **STAGE 1 — ON TIME/CYCLE**. The current On time for Stage 1 flashes on the display.



- Use the adjustment knob to adjust time on to the desired value.

- Press the push-button. The current CYCLE time for Stage 1 flashes on the display, alternating with the letters "**CyC**".

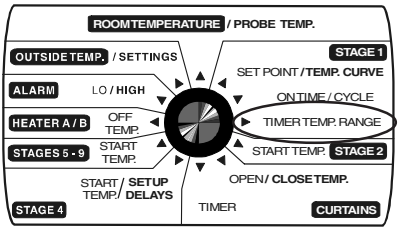
- Use the adjustment knob to adjust it to the desired value.

VENTILATION SETTINGS

1 Adjusting Stage 1 Timer Temperature Range

The stage 1 timer temperature range is the temperature difference between the set point and the temperature at which stage 1 fans run continuously. When this value is adjusted, all the starting values for consecutive stages are adjusted by the same amount. The timer temperature range can go from 0.5°F to 20.0°F (0.3°C and 11.1°C).

- Set the selection knob to **STAGE 1 — TIMER TEMP. RANGE**. The current timer temperature range flashes on the display.
- Use the adjustment knob to adjust the range to the desired value.



2 Adjusting the Stage 2 Starting Temperature and Natural Ventilation Mode Operation

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 set point + bandwidth (stage 1) can go from 0.5°F to 20.0°F (0.3°C to 11.1°C). In natural ventilation mode, stage 2 fans can be toggled on or off from the front panel (see the chapter on natural ventilation).

- 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.

- Press the push-button to change stage 2 operation in natural ventilation mode. The current setting (on/off) flashes on the display.

- Use the adjustment knob to change the setting.

3 Adjusting the Stage 3 Starting Temperature

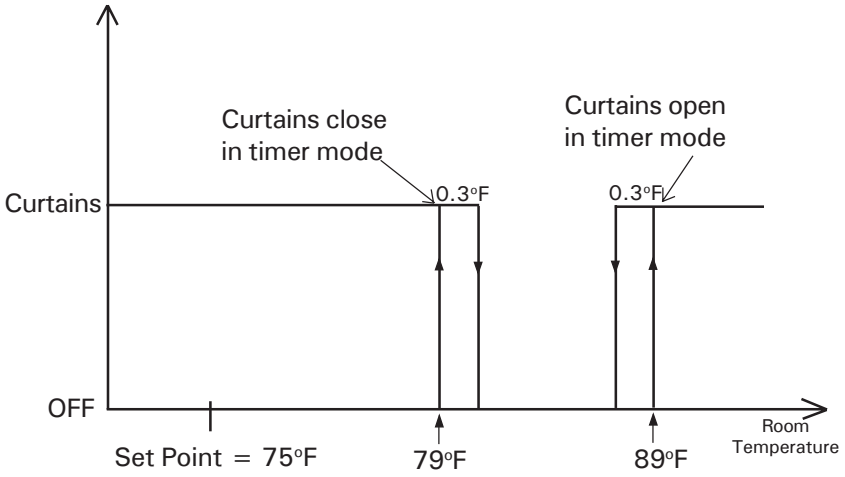
To use a third cooling stage when tunnel ventilation is not in effect, set internal switch 6 to ON (Stage 7 is no longer available for tunnel ventilation when this is done). The Stage 3 starting temperature is the temperature at which the Stage 3 fans start running (see the diagram above). The hysteresis is fixed at 1.5ºF 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). In natural ventilation mode, if internal switch #6 is ON, the stage 3 fans can be toggled on or off from the front panel (see the chapter on natural ventilation).

- Set the selection knob to **STAGE 2 — START TEMP.** The current stage 2 starting temperature is displayed, alternating with the letters " **St.2** ".

- Press the push-button twice. The current stage 3 starting temperature is displayed, alternating with the letters " **St.3** ". Use the adjustment knob to set the starting temperature to the desired value.

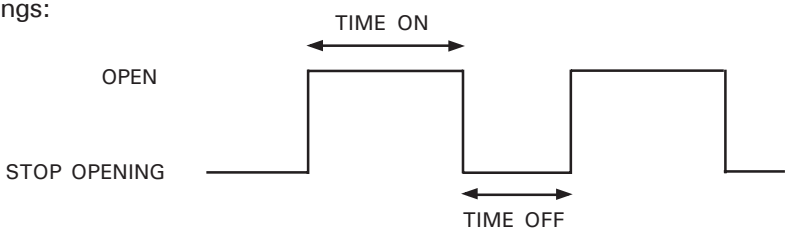
NATURAL VENTILATION

PRINCIPLE OF OPERATION



In the example above, when the temperature rises to 89°F, the sidewall and endwall curtains begin to open and continue to do so until fully open if the temperature remains above this point. If the temperature falls to 88.7°F, the curtains stop opening.

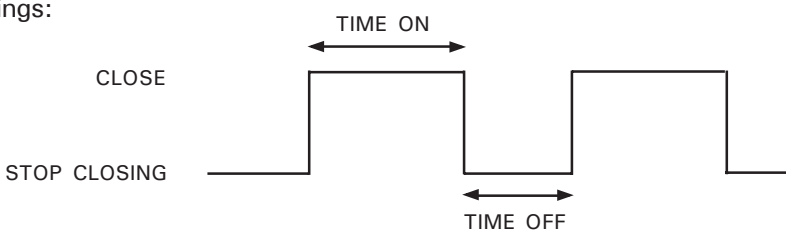
The curtains open intermittently according to the time on and time off settings:



The curtain opening cycle uses two time on values that are adjustable by the user. The initial time on value is used when the curtains open for the first time after having been at rest. Once the first time on/ time off cycle has elapsed, a separate time on value is used for all successive cycles as long as the temperature remains above the curtain opening temperature.

When the temperature falls to 79°F, the sidewall and endwall curtains begin to close and continue to do so until fully closed if the temperature remains below this point. If the temperature rises to 79.3°F, the curtains stop closing.

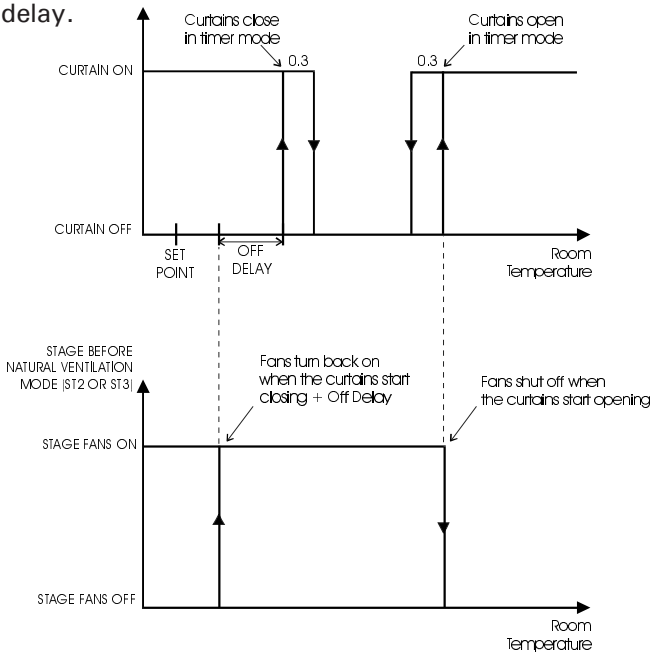
The curtains close intermittently according to the time on and time off settings:



NOTE: The curtains do not open if the current outside temperature is below the Low Outside Temperature Limit or above the High Outside Temperature Limit as defined in the Outside Settings (see below).

Stage 2 or 3 Operation in Natural Ventilation Mode

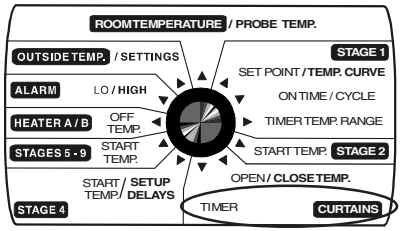
When the curtains open, the controller goes into natural ventilation mode. In this mode, the user has the capability of toggling the stage before the natural ventilation mode (stage 2 or 3) on or off from the front panel (the push-button is used to access this feature). The fans of the stage before natural ventilation mode (stage 2 or 3) start operating when the temperature drops below the temperature at which the curtains start closing + the OFF delay.



SETTINGS

1 Adjusting the Opening and Closing Temperatures

The opening and closing temperatures are the temperature values at which the curtains open or close. The hysteresis is fixed at 0.3°F and determines when the curtains stop operating. When these values are adjusted, all the starting values for consecutive stages are adjusted by the same amount. The closing temperature is bounded below by the temperature at which Stage 2 fans turn off. The difference between the opening and closing temperatures can go from 0.5°F to 20.0°F (0.3°C to 11.1°C).



- Set the selection knob to **CURTAINS - OPEN/CLOSE TEMP**. The current curtain opening temperature flashes on the display, alternating with the letters **OPE**.
- Use the adjustment knob to set the opening temperature to the desired value.
- Press the push-button. The current curtain closing temperature flashes on the display, alternating with the letters **CLO**.
- Use the adjustment knob to set the closing temperature to the desired value.

2 Adjusting the Initial Curtain Time On Value

The curtain opening cycle uses two time on values that are adjustable by the user. The initial time on value is used when the curtains open for the first time after having been at rest. Once the first time on/ time off cycle has elapsed, a separate time on value is used for all successive cycles as long as the temperature remains above the curtain opening temperature.

- Set the selection knob to **CURTAINS - TIMER**. The current initial curtain opening time on value flashes on the display, alternating with " **ini** " and " **On** ".

- Use the adjustment knob to set the initial opening time on value to the desired value.

3 Adjusting the Curtain Timer

- Set the selection knob to **CURTAINS - TIMER**. The current initial curtain opening time on value flashes on the display, alternating with " **ini** " and " **On** ".
- Press the push-button. The current curtain opening time on value flashes on the display alternating with the word " **OPE** " and " **On** ".
- Use the adjustment knob to set the opening time on value to the desired value.
- Press the push-button. The current opening time off value flashes, alternating with the word " **OPE** " and " **Off** ".
- Use the adjustment knob to set the opening time off value to the desired value.
- Press the push-button. The current curtain closing time on value flashes on the display, alternating with " **CLO** " and " **On** ".
- Use the adjustment knob to set the closing time on value to the desired value.
- Press the push-button. The current closing time off value flashes, alternating with the word " **CLO** " and " **Off** ".
- Use the adjustment knob to set the closing time off value to the desired value.

The time on and time off parameters can take values from 0 to 900 seconds.

4 Adjusting the Outside Temperature Limit

This value is used to ensure that the natural ventilation mode does not start (i.e. the curtains are not opened) when the outside temperature is too low. If the outside temperature is below the low temperature limit, the curtains do not open. Limit values range from -40°F to 99.9 °F (-40°C to 37.7°C) and are bounded by the high temperature limit (used in tunnel ventilation).

- Set the selection knob to **OUTSIDE TEMP.** / **SETTINGS**. The current outside temperature is displayed.
- Press the push-button. The current lower limit is displayed, alternating with the letters **LO**.
- Use the adjustment knob to set the lower limit to the desired value.

5 Adjusting the OFF Delay

The Off delay is used to determine at which temperature below the curtain start closing temperature the stage 2 or 3 fans start operating. The Off delay ranges from 0 to 2°F (0 to 1.1°C) below the curtains start closing temperature.

- Set the selection knob to **STAGE 2 — START TEMP.** The current starting temperature flashes on the display.
- If stage 3 is used (internal switch #6 ON), press the push-button four times to select the Off delay menu. If the stage 3 is not used (internal switch #6 OFF), press the push-button twice in order to select the Off delay menu. The Off delay menu flashes alternating with the word **"OFF"** and **"DEL"**
- Use the adjustment knob to change the setting.

TUNNEL VENTILATION

CURTAIN SETUP

To position the curtains for tunnel ventilation, the controller fully closes the sidewall curtains and fully opens the endwall curtains. This is referred to as doing the curtain setup. Either one of the curtains may already be in the required position, depending on when the setup is done.

The curtain setup is done when the following conditions are met:

EITHER Room Temperature > = Stage 6 Starting Temperature

OR

Room Temperature > = Stage 4 Starting Temperature

AND

Outside Temperature > = High Outside Temperature Limit

When these conditions are met, the controller waits a user-specified delay called the **In Tunnel Delay** before going into the tunnel ventilation mode. During this delay, the curtains are set up. All other stages are inactive except Stages 1 and 2.

After the delay has elapsed, the cooling stages operate according to the room temperature as shown in the following diagram except for Stage 4 which is always in operation. (The diagram assumes that stages 8 and 9 are used for cooling). Note that internal switch #6 must be set to OFF to use Stage 7 for tunnel ventilation (Stage 3 is no longer available for normal cooling purposes when this is done).

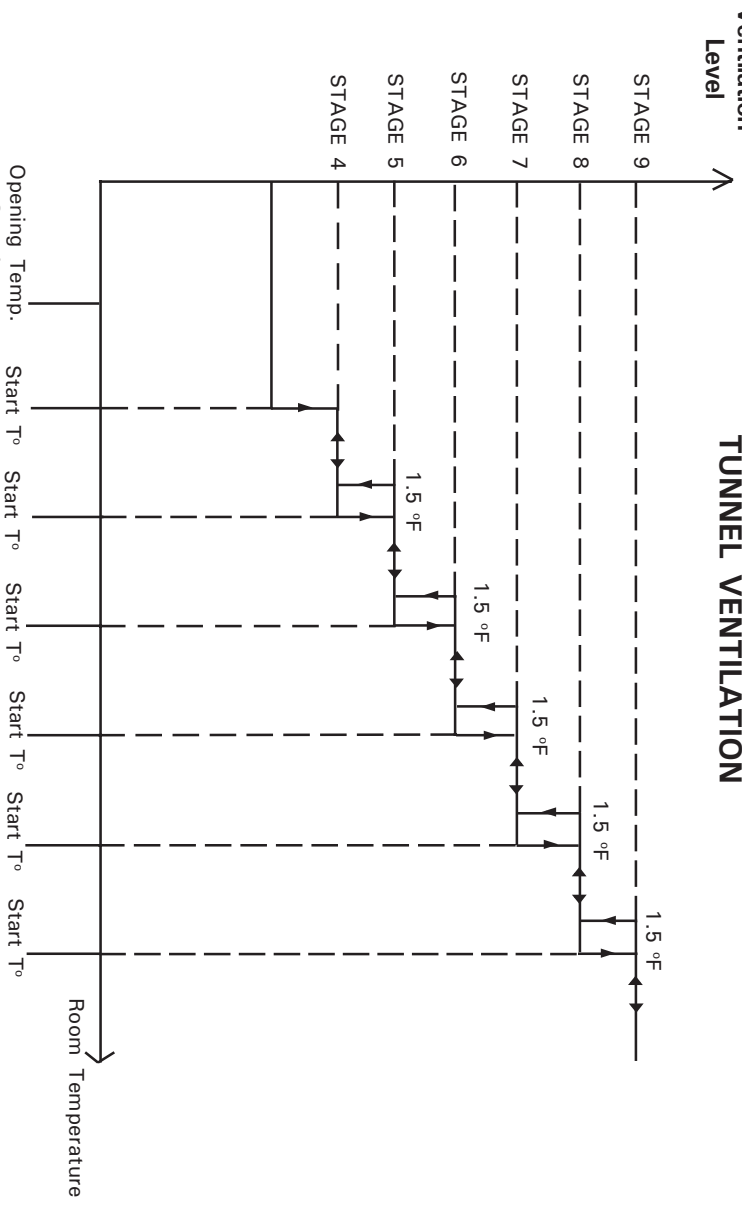
The curtain setup is undone when the following conditions are met:

Room Temperature < = Stage 6 Stop Temperature

AND

Outside Temperature < = High Outside Temperature Limit - 3ºF

When these conditions are met, the controller undoes the curtain setup in two phases lasting 240 seconds in all. In the first phase, the controller fully opens the sidewall and endwall curtains. All stages are inactive except Stage 4. The duration of this phase is determined by a


TUNNEL VENTILATION
Ventilation Level
STAGE 9
STAGE 8
STAGE 7
STAGE 6
STAGE 5
STAGE 4
1.5 °F
1.5 °F
1.5 °F
1.5 °F
1.5 °F
Opening Temp. Curtains
Start T° Stage 4
Start T° Stage 5
Start T° Stage 6
Start T° Stage 7
Start T° Stage 8
Start T° Stage 9
Room Temperature

user-specified delay called the **Out Tunnel Delay**. In the second phase, Stage 1 fans operate at full-speed and Stage 2 fans operate normally. If the curtains are not yet fully open, they continue opening. All other stages are inactive. The duration of this phase is the time remaining after the out tunnel delay has been subtracted from the total duration of 240 seconds.

After the delay has elapsed, the cooling stages operate according to the room temperature as shown in the preceding diagram. The table below summarizes stage operations going into and coming out of tunnel ventilation mode.

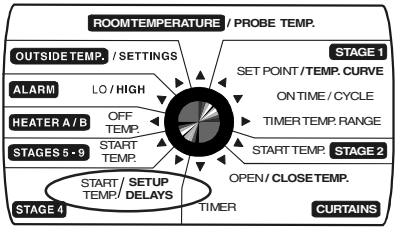
	NORMAL MODE	NATURAL VENTILATION MODE	TUNNEL VENTILATION MODE			
			CURTAIN SETUP		CURTAIN SETUP UNDONE	
	OPERATION	OPERATION	IN TUNNEL DELAY	OPERATION	PHASE I (OUT TUNNEL DELAY)	PHASE II
STAGE 1 FANS	ON/OFF AS NEEDED	ON	ON	ON	ON	ON
STAGE 2 FANS	ON/OFF AS NEEDED	ON/OFF USER SETTING	ON	ON	ON	ON
SIDEWALL CURTAINS	OPEN/CLOSE WITH TIMER	OPEN WITH TIMER	FULL CLOSE	FULL CLOSE	FULL OPEN	FULL OPEN
ENDWALL CURTAINS	OPEN/CLOSE WITH TIMER	OPEN WITH TIMER	FULL OPEN	FULL OPEN	FULL OPEN	FULL OPEN
STAGE 4 FANS	OFF	OFF	OFF	ON NONSTOP	ON	OFF
STAGE 5 FANS	OFF	OFF	OFF	ON/OFF AS NEEDED	OFF	OFF
STAGE 6 FANS	OFF	OFF	OFF	ON/OFF AS NEEDED	OFF	OFF
STAGE 7 FANS	OFF	OFF	OFF	ON/OFF AS NEEDED	OFF	OFF
STAGE 8 FANS	OFF	OFF	OFF	ON/OFF AS NEEDED	OFF	OFF
STAGE 9 FANS	OFF	OFF	OFF	ON/OFF AS NEEDED	OFF	OFF

SETTINGS

1 Adjusting the In and Out Tunnel Delays

The In Tunnel Delay is the delay for doing the curtain setup when going from normal mode to tunnel ventilation mode (see above). It can be adjusted from 0 to 240 seconds. When undoing the curtain setup, the duration of the first phase is determined by the Out Tunnel Delay. This value can be adjusted from 0 to 240 seconds. Note that the total delay for undoing the curtain setup (Phase I and Phase II) is 240 seconds.

- Set the selection knob to **START TEMP / SETUP DELAYS — STAGE 4**. The current starting temperature flashes on the display.



- Press the push-button. The current In Tunnel Delay is displayed, alternating with the word "**in**".

- Use the adjustment knob to adjust the In Tunnel Delay to the desired value.

- Press the push-button. The current Out Tunnel Delay is displayed, alternating with the word "**out**".

- Use the adjustment knob to adjust the Out Tunnel Delay to the desired value.

2 Adjusting the Stage 4 Tunnel Starting Temperature

Each tunnel ventilation stage is activated by specifying a starting temperature. When adjusting these temperatures, remember that changes made to one of the stages will adjust the starting temperatures of all the consecutive stages. The starting temperature is bounded below by the opening temperature of the curtains + 0.5°F and above by the curtain opening temperature + 20°F.

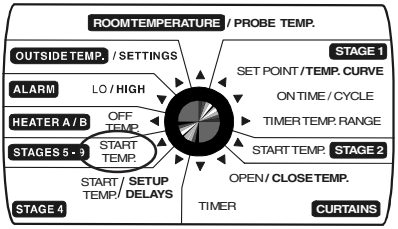
- Set the parameter selection knob to **START TEMP / SETUP DELAYS — STAGE 4**. The current starting temperature for Stage 4 flashes on the display.

- Turn the adjustment knob to adjust the starting temperature to the desired value.

3 Adjusting the Stage 5 to 9 Tunnel Start Temperatures

Each tunnel ventilation stage is activated by specifying a starting temperature. When adjusting these temperatures, remember that changes made to one of the stages will adjust the starting temperatures of all the consecutive stages. Starting temperatures are bounded below by the starting temperature for the preceding stage + 0.5°F and above by the starting temperature for the preceding stage + 20°F. Note that the last cooling stage is a mist stage (see below).

- Set the parameter selection knob to **START TEMP. — STAGES 5 - 9**. The current starting temperature for Stage 5 is displayed, alternating with the letters "**st.5**".



- Turn the adjustment knob to adjust the starting temperature to the desired value.

- Press the push-button as required to select one of the other stages up to stage 9. For each stage, the starting temperature is displayed, alternating with the letters "st.x" where x is the number of the stage. Note that stage 7 is not available when internal switch #6 is set to ON.

- Turn the adjustment knob to adjust the starting temperature to the desired value.

4 Adjusting the High Outside Temperature Limit

This value is used to determine when the curtain setup is done or undone (see Curtain Setup). The upper limit can range from -40°F to 99.9 °F (-40°C to 37.7°C) and is bounded below by the lower limit (used for natural ventilation).

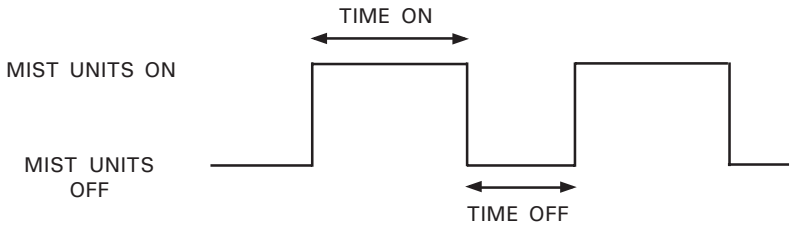
- Set the selection knob to **OUTSIDE TEMP.** / **SETTINGS**. The current outside temperature is displayed.
- Press the push-button twice. The current upper limit is displayed, alternating with the letters **HI**.
- Use the adjustment knob to set the upper limit to the desired value.

MIST COOLING

The last tunnel cooling stage operates according to a separate timer and can be configured as a mist cooling stage. The number of heating stages being used determines which stage this is.

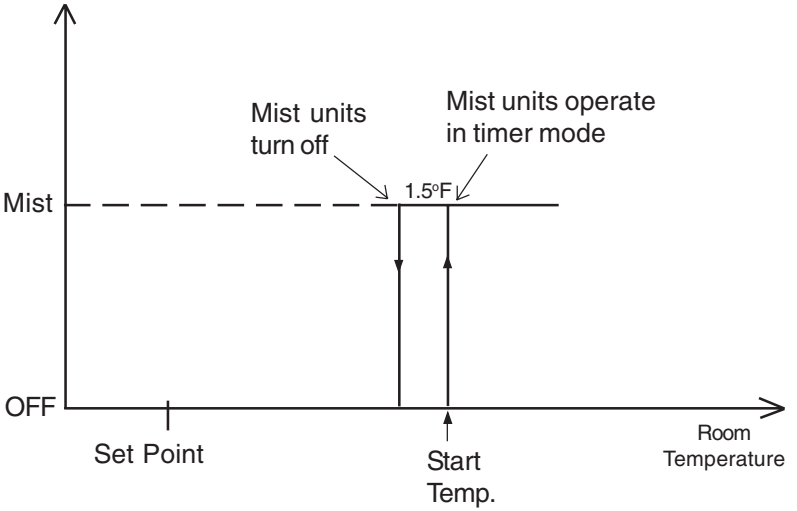
NUMBER OF HEATING STAGES	MIST STAGE
0	9
1	8
2	7*

The mist timer is defined below. If a mist stage is not needed, time off should be set to zero.



* Note that if stage 7 is not used for tunnel ventilation (internal switch #6 is ON), the mist stage is stage 6.

The mist stage can be operated either with respect to the other cooling stages (staged) or with respect to the set point (floating). To use the second method, set internal switch #7 to ON. The diagram below illustrates the operation of a mist stage.



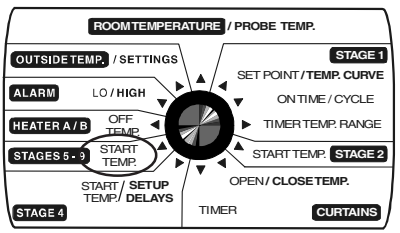
1 Adjusting the Mist Starting Temperature

The starting temperature can be adjusted in the same way as a fan stage (see above). Note that if a floating mist is used, the starting temperature ranges from 0.5ºF above the set point up to 40.0ºF above the set point.

2 Adjusting the Mist Timer

The time on and time off parameters can take values from 0 to 60 minutes.

- Set the selection knob to **START TEMP — STAGES 5 - 9**. The current starting temperature for Stage 5 flashes on the display, alternating with the letters **st.5**.

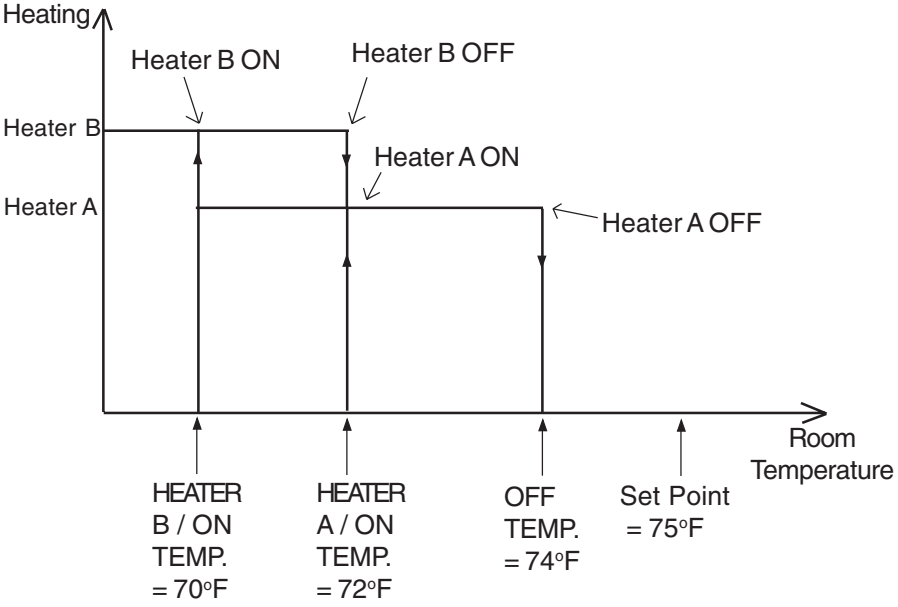


- Press the push-button as required to step to the mist stage. The starting temperature is displayed, alternating with the letters "st.x" where x is the number of the mist stage.
- Press the push-button once again. The current time on flashes, alternating with the word **On**.
- Use the adjustment knob to set the time on to the desired value.
- Press the push-button. The current time off flashes, alternating with the word **OFF**.
- Use the adjustment knob to set the time off to the desired value.

HEATER SETTINGS

Two modes of heating are available: staged and zoned heating. Use the dipswitch settings to select the desired mode. When staged heating is used, the temperature used is the average room temperature. When zoned heating is used, Heater A uses the temperature readings from probes 1 and 2 and Heater B uses the temperature readings from probes 3 and 4.

STAGED HEATERS



If the room temperature rises:

- at 72°F: Heater B turns off.

- at 74°F: Heater A turns off.

If the room temperature falls:

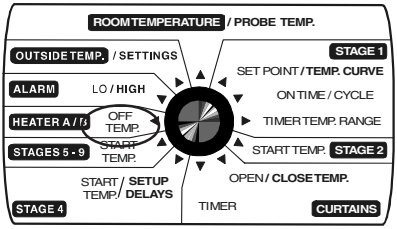
- at 72°F: Heater A turns on.

- at 70°F: Heater B turns on.

1 Adjusting Off Temperature for Staged Heaters

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

- Set selection knob to **HEATER A/ B — 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 Starting Temperatures for Staged Heaters

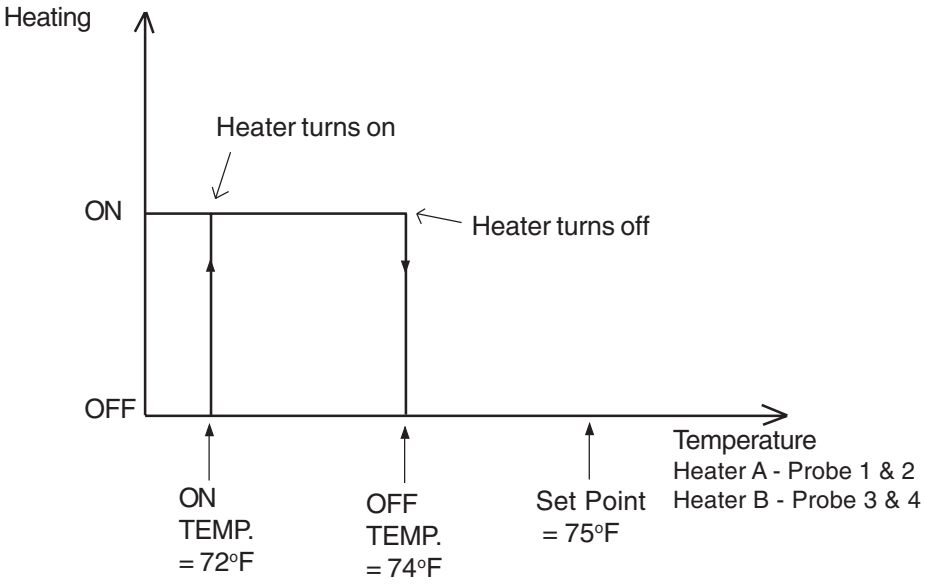
The starting temperature is the temperature at which the heater turns on. The Heater A starting temperature is bounded above by the off temperature — 0.5°F and below by the off temperature — 20°F. The Heater B starting temperature is bounded above by the Heater A starting temperature — 0.5°F and below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

- Set the selection knob to **START TEMP. — STAGE 5 - 9**. The current starting temperature for stage 5 is displayed, alternating with the letters "**st.5**".
- Press the push-button as required until the letters **HA** appear, alternating with the starting temperature for Heater A.
- Use the adjustment knob to adjust the starting temperature to the desired value.

- Press the push-button once. The letters **Hb** appear, alternating with the starting temperature for Heater B.

- Use the adjustment knob to adjust the starting temperature to the desired value.

ZONED HEATING



If the room temperature rises:

- at 74°F: Heater A (Probe 1 & 2) turns off.
  Heater B (Probe 3 & 4) turns off.

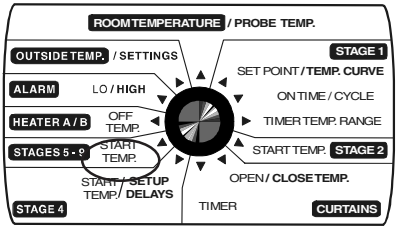
If the room temperature falls:

- at 72°F: Heater A (Probe 1 & 2) turns on.
  Heater B (Probe 3 & 4) turns on.

Note that the heaters turn on only if the average room temperature is lower than the set point.

1 Adjusting Off Temperatures for Zoned Heaters

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



- Set selection knob to **HEATER A/B — OFF TEMP**. The current off temperature for Heater A is displayed, alternating with the letters "**HA**".
- Use the adjustment knob to adjust the off temperature to the desired value.
- Press the push-button. The current off temperature for Heater B is displayed, alternating with the letters "**Hb**".
- Use the adjustment knob to adjust the off temperature to the desired value.

2 Adjusting Starting Temperatures for Zoned Heaters

The starting temperature is the temperature at which the heater turns on. The starting temperature is bounded above by the off temperature — 0.5°F and below by the off temperature — 20°F. As the heaters operate on separate probes, starting temperatures can be identical for both heaters.

- Set the selection knob to **START TEMP. — STAGE 5 - 9**. The current starting temperature for stage 5 is displayed, alternating with the letters "**st.5**".
- Press the push-button as required until the letters **HA** appear, alternating with the starting temperature for Heater A.

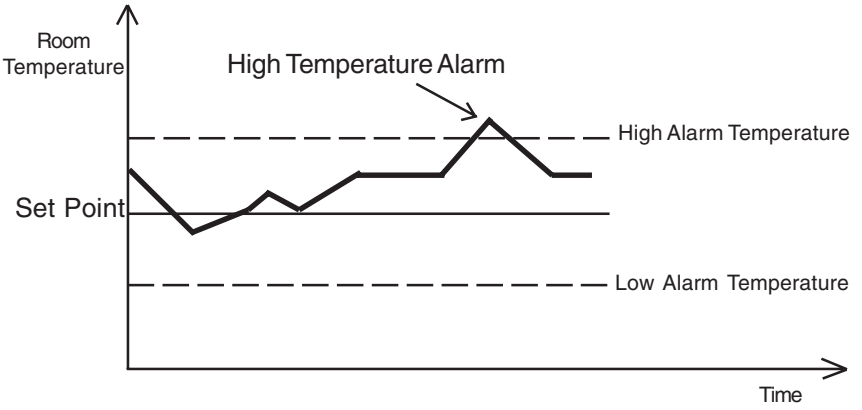
- Use the adjustment knob to adjust the starting temperature to the desired value.

- Press the push-button once. The letters **Hb** appear, alternating with the starting temperature for Heater B.

- Use the adjustment knob to adjust the starting temperature to the desired value.

ALARM SETTINGS

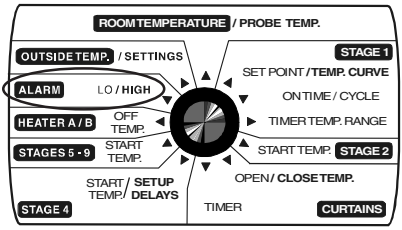
The controller sets off an alarm in the case of a power failure, a fault in the supply circuit or a high or low temperature. Temperature alarms are defined according to the set point as shown in the diagram below.



The situation changes for high temperature alarms, however, when the outside temperature is greater than the set point. In this case, the set point is replaced by the outside temperature as the reference point. This means an alarm is set off when the indoor temperature reaches Outside Temperature + High Alarm Offset. A third parameter, called the absolute high temperature, is defined to continue monitoring the indoor temperature for high temperatures. When the indoor temperature reaches the absolute high temperature, an alarm is set off.

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. The absolute high temperature ranges from –40°F to 120°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.

- Press the push-button. The current absolute high temperature is displayed, alternating with the letters «**AbS**».

- Use the adjustment knob to set the absolute high 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 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"

PROBLEM	CAUSE	SOLUTION
The defective probe pilot light is on.	A room or outside probe is defective.	Refer to "defective probes"
The display shows sudden variations in the room or outside temperature.	A variation in resistance is induced on a probe.	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"
	There is electrical noise near a probe cable.	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°.
Stage 1 fans do not stop running when the controller is operating in minimum ventilation cycle.	The cycle time is set at the same value as the On Time.	Set the cycle time to a higher value than the On Time.
	The wiring is incorrect.	Correct the wiring. In particular, make sure two different lines are connected to each motor: line L1 modulated by the controller should be combined with another line (N for 115V or L2 for 230V) to activate the motor. Also, be sure the stage 1 COMMON is supplied by line L1.

PROBLEM	CAUSE	SOLUTION
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 minutes. 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.	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.
	The stage's fuse is open.	Replace the fuse.
	The display board interconnect cable is not properly plugged into the power supply board.	Be sure the cable is firmly plugged in.
	The fan motor or heater is defective.	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.
	The controller is defective.	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.

PROBLEM	CAUSE	SOLUTION
The curtains do not work.	The fuse on the one of the curtain outputs is blown.	Replace the fuse.
The heaters, mist units and curtains do not work.	The slave box is not properly connected to the master.	Verify the connection.
	The fuse on the slave box is blown.	Replace the fuse.
	The voltage selector on the slave box is not properly set.	Set the voltage selector to the proper voltage.

TECHNICAL SPECIFICATIONS

MASTER BOX:

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 9 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 4: ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A FAN,10A RES, fuse F3-15A slow blow.

Stage 5: ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A FAN,10A RES, fuse F4-15A slow blow.

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

SLAVE BOX:

Supply: - 115/230 VAC (-18%, +8%), 60 Hz, L1 same phases as Stage 1, overload and overvoltage protection fuse F9-1A fast blow.

- 12 VDC for AC back-up supply; can activate stages 6 through 9 and curtains if supplied with DC back-up voltage.

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

Endwall Curtains: OPEN-CLOSE output, 115/230 VAC, 60 Hz, 30VDC, 5A winch output, fuse F3-5A fast blow.

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

Stage 7: ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A MOTOR OUTPUT,10A RES, fan / mist, fuse F6-10A slow blow.

Stage 8: ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A MOTOR OUTPUT,10A RES, fan / mist / heater B, fuse F7-10A slow blow.

Stage 9: ON-OFF output, 115/230 VAC, 60 Hz, 30VDC, 6A MOTOR OUTPUT,10A RES, fan / mist / heater A, fuse F8-10A 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)
Temperature Curve[a]		OFF	days < 100
Stage 1	Timer Temp. Range	3°F (1.7°C)	0.5 to 20 °F (0.3 to 11.1 °C)
	Time On	15 seconds	0 to 900 seconds by increments of 15 seconds
	Cycle Time	300 seconds	
Stage 2 - Starting Temp.		79°F(26.1°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Set Point
Stage 3 - Starting Temp.		81°F (27.2°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Set Point
Curtains	Opening Temperature	81°F(27.2°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Stage 2/3 Starting Temp.
	Closing Temperature	79.5°F(26.4°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Opening Temp.
	Opening Initial Time On	20 seconds	(0 to 900 sec.)
	Opening Time On	20 seconds	0 to 900 seconds by increments of 1 second
	Opening Time Off	60 seconds	
	Closing Time On	20 seconds	0 to 900 seconds by increments of 1 second
	Closing Time Off	60 seconds	
High Outside Temp. Limit		75°F(23.9°C)	-40 to 99.9 °F (-40 to 37.7 °C)
Low Outside Temp. Limit		50°F(10°C)	
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)	
	Absolute Temperature	95°F (35°C)	-40 to 120.0 °F (-40 to 48.9 °C)

(a) The range of values for curve temperatures is 35°F to 99.9°F (1.7°C to 37.7°C).

PARAMETER		FACTORY SETTING	RANGE OF VALUES
Stage 4 Starting Temp.		83°F(28.3°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Curtain Opening Temp.
In Tunnel Delay		45 seconds	0 to 240 seconds
Out Tunnel Delay		45 seconds	
Stage 5- Starting Temp.		85°F(29.4°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Stage 4 Starting Temp.
Stage 6- Starting Temp.		87°F(30.6°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Stage 5 Starting Temp.
Stage 7- Starting Temp.		89°F(31.7°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Stage 6 Starting Temp.
Stage 8- Starting Temp.		91°F(32.8°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Stage 7 Starting Temp.
Stage 9- Starting Temp.		93°F(33.9°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Stage 8 Starting Temp.
Mist	Time ON	1 Min.	0 to 60 Min.
	Time OFF	1 Min.	0 to 60 Min.
Heater Off Temp.		74°F(23.3°C)	0.5 to 20 °F (0.3 to 11.1 °C)from Set Point

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.