

## Features

- Non-corrosive, fire retardant, moisture resistant enclosure
- Transient protected to ensure reliability
- Microprocessor-based
- Digital display of temperature, alerts and settings
- Variable speed with adjustable differential
- Idle Set mode with adjustable idle speed
- Automatic shut-off mode (Off Set-Back) with adjustable shut-off temperature
- Three second full power turn on to minimize fan motor ice-up
- Switch selectable for 115V AC or 230V AC operation
- 115/230V AC @ 10 Full Load Amps output for variable speed fans (with RFI noise suppressor)
- Compact design: 20cm (7.75in) height x 12cm (4.75in) width x 9.5cm (3.75in) depth
- Extendable temperature sensor
- Heater interlock to signal gas-fired furnace, or power contactors for electric heat
- Two year limited warranty



## Electrical Ratings

OPERATING VOLTAGE: 115V/230V AC, 60Hz

VARIABLE SPEED OUTPUT: 10 Full Load Amps @ 115/230V AC

**Warning:** Variable speed fan motors draw more current at reduced speeds than maximum speed. Fan motor specifications show current draw at maximum speed. Current over 10 Amps will cause overheating and eventual failure of the FHC-1D control. Please check current requirements for the fan motor by either measuring current draw at all speeds or consulting the dealer for information on that fan.

**CAUTION:** For controlling shaded pole, permanent split capacitor, or universal motors only.

The heater interlock output is a normally open relay contact. Use power contactors (not supplied) for electric heat or heat lamps. Connect directly for most gas furnaces.

HEATER INTERLOCK OUTPUT: 10 Full Load Amps @ 115/230V AC

**Warning:** When connecting to electric heaters or brooder lamps and a furnace, operation voltages may be different. This may damage the equipment.

## Introduction

Congratulations on the purchase of your new FHC-1D environment control! The FHC-1D is a microprocessor-based control that connects to a variable speed fan and a heater to efficiently control temperature. This manual will help you get the most from your FHC-1D. Take a few minutes to read this manual and become familiar with the proper safety and operating procedures. Follow the **Getting Started** section for step by step instructions on installing your FHC-1D.

## Getting Started

Fill out the information below to help configure your control and verify that you do not exceed the current ratings listed in the **Electrical Ratings** section.

Fans	A Maximum Current Draw Per Fan	B Number of Fans	A × B Total Current Draw
Make:			
Model:			
Voltage Rating:			
Power Factor:			
<b>Heater or Furnace</b>	Maximum Current Draw	Voltage Rating	
Make:			
Model:			

## Installation

**Warning:** The FHC-1D should be installed by a qualified electrician.

**CAUTION:** Turn off the power before installing or servicing the control.

### Mounting the Control

- Mount the control with the knockouts at the bottom of the enclosure. Failure to do this will void warranty.
- Use the knockouts at the bottom of the enclosure for mounting cable connectors.
- DO NOT make additional holes in the enclosure; this will void the warranty.
- Run all wires into the enclosure through the knockouts and connect all ground wires to the ground plate.

### Wiring the Control

- Turn off the power before doing any wiring.
- Set the voltage switch to the correct position for the line voltage used (115 or 230V AC).
- Take off the cover when removing electrical knockouts to prevent damaging the control.
- Read the **Electrical Ratings** section before installing the FHC-1D control.
- Connect the wires as shown **Figure 1**.

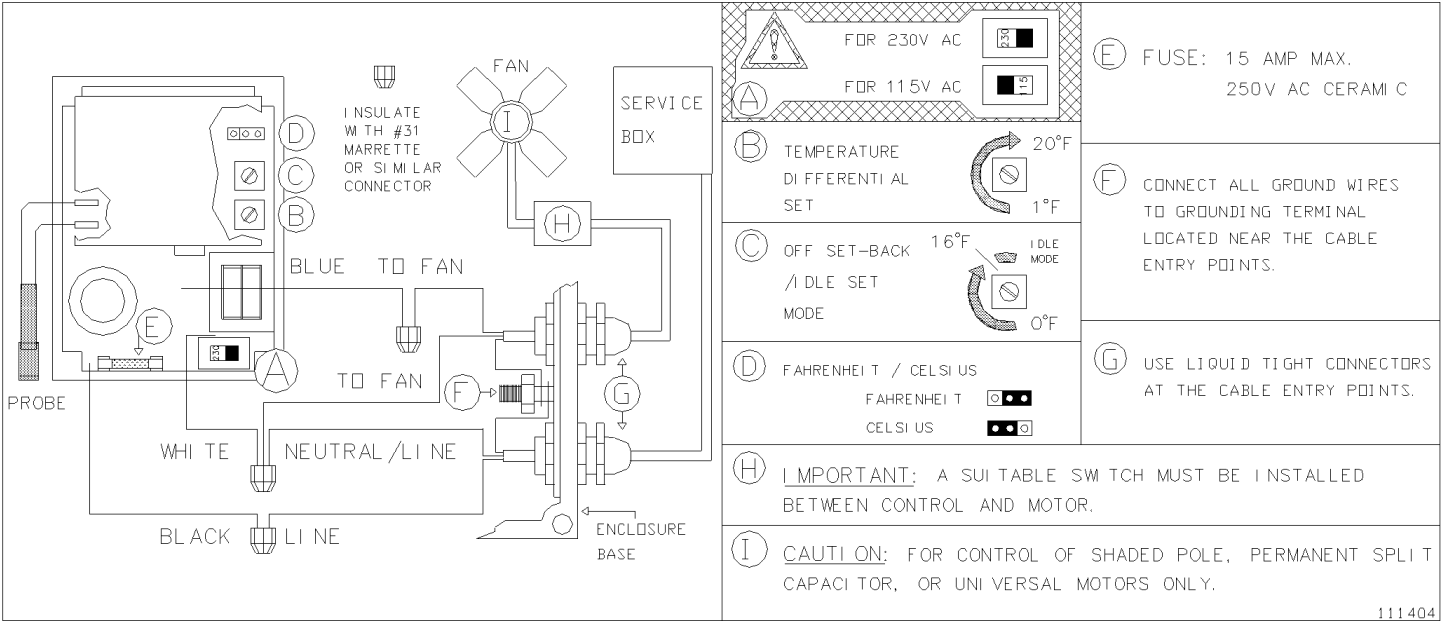


Figure 1: Wiring Diagram

Heater Interlock

The heater interlock turns a heater or furnace on or off. The relay contacts close when the temperature is 2°F below the TEMP SET.

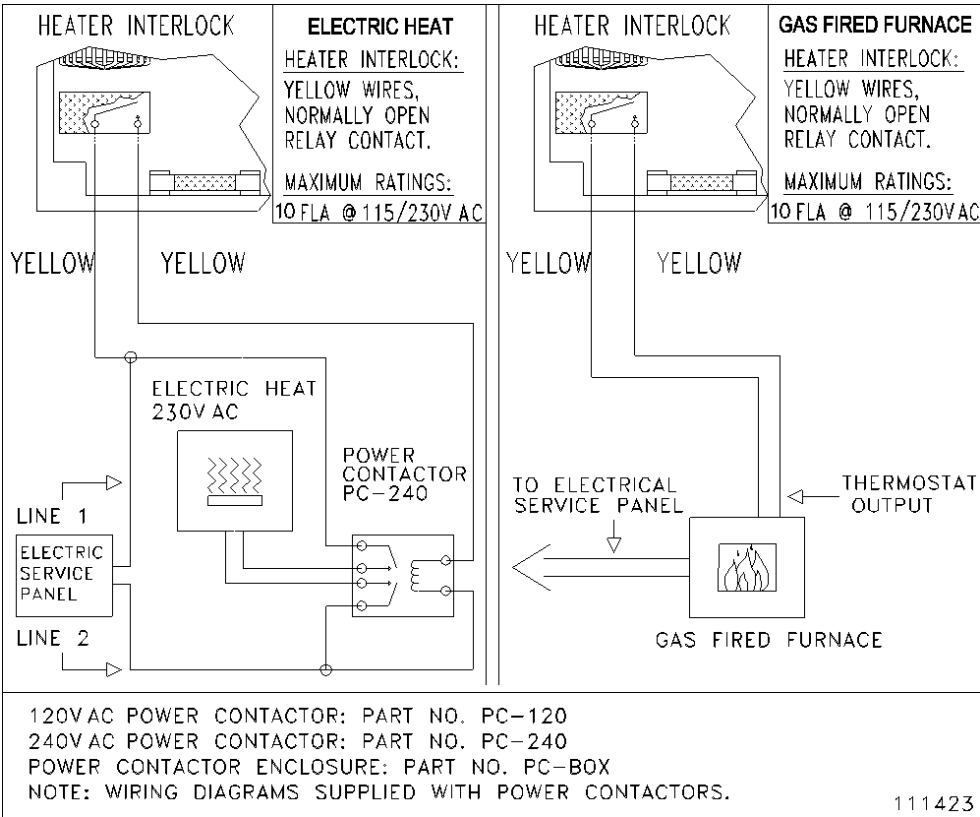


Figure 2: Heater Interlock Wiring Diagram

## Temperature Probe

- Connect the probe to the fast-on tabs.
- Gently pull on the probe to extend it out of the enclosure.
- Tighten the compression nut on the strain relief.

## Extending the Sensor

- You can extend the temperature sensor to suit your particular application. The maximum length of sensor depends on the level of electrical noise. With proper installation, sensor lengths of up to 500 feet are possible.
- To extend the sensor, use two wire, 18 AWG jacketed cable for a proper seal at the cable entry hole. We recommend Belden # 9408, Alpha # 5052, or an equivalent.
- Do not run the sensor cable next to other power cables or inside conduit.
- When crossing other cables, cross at 90°.
- For best results, solder all connections and apply heat shrink to insulate the wires.

Follow these steps to extend the sensor:

- Turn the power off to the control.
- Remove the four screws from the cover and lift the cover off.
- Disconnect the sensor connectors from the fast-on tabs.
- Cut the sensor cable approximately six inches from the connectors and pull the probe end of the sensor cable out of the box.
- Insert the extension wire into the box.
- Join the connector end of the sensor cable to one end of the extension wire and re-connect the cable to the fast-on tabs. Apply heat shrink or electrical tape to insulate the wires.
- Run the extended sensor cable to the desired location.
- Join the other end of the extension wire to the end of the sensor cable containing the probe. Apply heat shrink or electrical tape to insulate the wires.

NOTE: If the unit operates erratically with the extended temperature sensor, try running the sensor on a different path or shortening it. Ensure the sensor cable is not run beside other electrical wires or near electrical equipment.

## Four Zone Averaging

The FHC-1D can monitor the temperature in four different zones. The control takes an average of the four temperatures and operates according to the average temperature. To take advantage of this option, you must connect four temperature sensors to the unit. See **Figure 3** for wiring information.

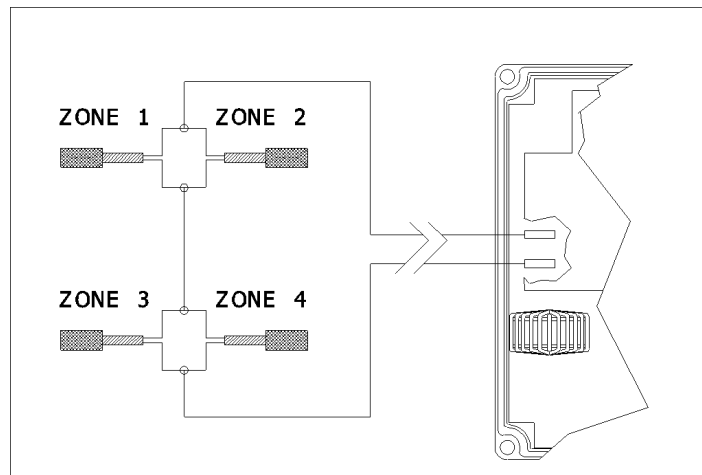


Figure 3: Four Zone Averaging

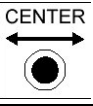

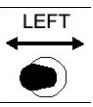
## Start-up

When power is applied to the FHC-1D the following will be displayed:

- 88** will be displayed for approximately 0.25 seconds (start-up).
- 00** will be displayed for approximately one second (self-test).
- 60** will be displayed for approximately one second. **60** indicates that the power system is 60Hz.
- The display will alternately flash between the temperature and **PF**. **PF** indicates a power interruption or start-up has occurred. Click the front cover switch to the right to clear the **PF**.
- The control is now in normal mode.

NOTE: If **Pd** or **PS** is displayed, the probe is not connected properly. See the **Display Alerts** section.

## Displaying and Adjusting Parameters

Switch Position	Function
	Displays the temperature of the air surrounding the temperature probe
	Allows viewing and adjustment of the TEMP SET Clears alerts
	Allows viewing and adjustment of the Temperature Differential ( <b>d l</b> ), Off Set-Back ( <b>o5</b> ), and Idle Speed ( <b>ld</b> ). Each time the switch is clicked and held in this position, the next parameter is displayed. The display will alternately flash the parameter code (two letters) and it's setting (two digits). The parameter can be adjusted at this point. The cycle will start over after the last parameter. To restart at the beginning of the cycle, click the switch to the right

Parameter	Code	Range	Factory Setting	Location
Temperature Set Point	N/A	32 to 99 °F or 0 to 38 °C	N/A	External Knob
Idle Speed	<b>ld</b>	0 - 99%	N/A	External Knob
Temperature Differential	<b>d l</b>	1 to 20 °F or 0.6 to 12 °C	6 °F	Internal Trimmer
Off Set-Back	<b>o5</b>	0 to 16 °F or 0 to 9 °C	5 °F	Internal Trimmer
°F or °C	<b>°F / °C</b>	-22 to 99 °F or -30 to 38 °C	°F	Internal Jumper

## Temperature Display

When the switch on the control is in the center position, the control displays the ambient temperature. The temperature range is -22 to 99 °F or -30 to 38 °C. The control can maintain the temperature to between 32 to 99 °F or 0 to 38 °C

## Temperature Set Point (TEMP SET)

The TEMP SET is the desired temperature. It is also the reference for the Off Set-Back (OSB) and Temperature Differential (DIFF) settings.

To display and adjust the TEMP SET:

- Hold the switch in the set (right) position.
- Adjust the **Temperature** knob to the desired setting.

NOTE: You must hold the switch in the set position while turning the **Temperature** knob. If this is not done correctly, the display will flash between **LS** and temperature, indicating the **Temperature** knob has accidentally been turned. The control will not accept the new setting until the switch is clicked to the right.

## Temperature Differential (DIFF):

The DIFF is the number of degrees Celsius or Fahrenheit above the TEMP SET that the fan reaches maximum speed. For example, if the TEMP SET is 80 °F and the DIFF is 6 °F, the fan will increase from IDLE at 80 °F to maximum speed at 86 °F. See **Figures 4 and 5** for examples.

To display and adjust the DIFF:

- Click the switch to the right to start at the beginning of the parameter list.
- Click the switch to the left once and hold. The display will flash between **dl** and the setting.
- Use a small flat screwdriver to adjust the internal trimmer. See **Figure 1**, section B for trimmer location.

NOTE: The difference in motor power factors can cause the actual differential to be less than the displayed value. If the power factor of the motor is available, use the correction numbers and formula listed below to calculate the correct DIFF setting.

Power Factor	Correction (°F)
1.0	1.00
0.9	1.05
0.8	1.10
0.7	1.25
0.6	1.33
0.5	1.60

$$\text{Actual DIFF} = \text{Desired DIFF} \times \text{Correction}$$

**Example 1:** To have an actual differential of 6 °F with a motor that has a power factor of 0.7, set the DIFF to 7.5 °F.

$$6^{\circ}\text{F} \times 1.25 = 7.5^{\circ}\text{F}$$

**Example 2:** To have an actual differential of 5 °F with a motor that has a power factor of 0.5, set the DIFF to 8.0 °F.

$$5^{\circ}\text{F} \times 1.6 = 8.0^{\circ}\text{F}$$

If you do not know the power factor, measure the correction as follows:

- Ensure the IDLE is set properly (See IDLE section).
- Set the DIFF to 10° F with the internal trimmer.
- Observe the temperature (in the digital display).
- Hold the switch to the right and adjust the TEMP SET to equal the temperature. The fan will operate just above minimum Idle.
- Slowly decrease the TEMP SET and listen to the fan increase in speed.
- When the motor reaches full speed, record the TEMP SET (FULL SPEED TEMP SET).
- Calculate the correction using the formula below.

$$\text{Correction} = 10^{\circ}\text{F} \div (\text{FULL SPEED TEMP SET} - \text{TEMPERATURE})$$

**Example 3:** For a TEMPERATURE of 75° F and a FULL SPEED TEMP SET of 82° F

$$\text{The correction would be: } 10^{\circ}\text{F} \div (82^{\circ}\text{F} - 75^{\circ}\text{F}) = 1.43$$

If the desired differential is 5° F, the actual differential can be calculated as follows:

$$5^{\circ}\text{F} \times 1.43 = 7.15^{\circ}\text{F}.$$

Set the DIFF to 7° F for an actual differential of 5° F.

### Off Set-Back/IDLE SET Mode (OSB)

The OSB is the number of degrees Celsius or Fahrenheit below the TEMP SET that the fan will switch between OFF and IDLE. IDLE mode provides minimum ventilation at temperatures below the TEMP SET. See **Figure 4** for example of OSB.

To display and adjust the OSB:

- Click the switch to the right to start at the beginning of the parameter list.
- Click the switch to the left two times and hold. The display will flash between **OS** and the setting. If **ID** is displayed, the control is in IDLE SET mode.
- Use a small flat screwdriver to adjust the internal trimmer to the desired OSB or turn the trimmer fully clockwise to put the control into IDLE SET mode. See **Figure 1**, section C for trimmer location.

### Adjusting Minimum Ventilation in OSB Mode

NOTE: A temperature probe must be connected to the control to adjust the IDLE properly.

- Turn the **Idle Speed** knob fully counter-clockwise, then back ¼ turn clockwise.
- Click the front cover switch to the right and hold while turning the **Temperature** knob fully clockwise, then release the switch. The fan should not be running.
- Click the front cover switch to the right and hold while *slowly* turning the **Temperature** knob counter-clockwise. When the fan runs full speed, release the front cover switch and the **Temperature** knob. The fan will run at maximum speed for approximately three seconds, then at IDLE. The **Temperature** knob should be approximately 1° F higher than the temperature.
- Slowly adjust the **Idle Speed** knob until a satisfactory IDLE (minimum ventilation) is reached. A voltmeter is helpful for determining the voltage. If you are unsure, please consult your fan dealer for the minimum idle voltage for your fan motor.
- Click the front cover switch to the right and adjust the **Temperature** knob to the desired temperature.
- Release the switch to complete the procedure.

### Adjusting Minimum Ventilation in IDLE SET Mode

- Turn the **Idle Speed** knob fully counter-clockwise.
- Click the front cover switch to the right and hold while turning the **Temperature** knob fully clockwise, then release the switch. The fan should be running at IDLE.
- Slowly adjust the **Idle Speed** knob until a satisfactory IDLE (minimum ventilation) is reached. A voltmeter is helpful for determining the voltage. If you are unsure, please consult your fan dealer for the minimum idle voltage for your fan motor.
- Click the front cover switch to the right and adjust the **Temperature** knob to the desired temperature.
- Release the switch to complete the procedure.

### Temperature Display

The °F / °C jumper lets you select whether the control will display degrees Fahrenheit or Celsius.

To verify the °F / °C setting:

- Click the front cover switch to the right to start at the beginning of the parameter list.
- Click the switch to the left three times. °C or °F will be displayed.
- To change the setting, position the jumper as shown in **Figure 1**, section D.

### Idle Speed (IDLE)

The IDLE is the speed of the fan in IDLE SET mode. IDLE is displayed as a percentage of maximum speed. See **Figures 4 and 5** for examples.

To display and adjust the IDLE:

- Click the switch once to the right to start at the beginning of the parameter list.
- Click the switch to the left four times and hold. The display will alternately flash **Id** and the setting.
- Adjust the **Idle Speed** knob on the front cover to the desired fan speed (minimum ventilation).

### Hysteresis

The FHC-1D has a 1°F (0.5°C) hysteresis. This means the fan will turn off 1°F below the point it turned on. For example, if TEMP SET is 75°F, the fan will turn on at 75°F, off at 74°F. This prevents the fan from flickering on and off at the TEMP SET.

## Display Alerts

The FHC-1D has several visible display alerts:

Display	Cause
<b>PS</b>	The temperature probe or sensor cable has short circuited.
<b>Pd</b>	The temperature probe is damaged or the connecting wire is broken.
<b>tS</b>	The <b>Temperature</b> knob has accidentally been turned. The display will alternately flash <b>tS</b> and the temperature. The control will not accept the new setting until the switch is clicked to the set position. See the <b>Temperature Display</b> section on page 5 for more details.
<b>PF</b>	The power has been interrupted. The display will flash between <b>PF</b> and the temperature. To clear the alarm, click the switch to the right. The control will function normally.



## Operation

### Example 1, Operation in Off Set-Back (OSB) Mode

Parameter	Settings
TEMP SET	80 ° F
DIFF	6 ° F
OSB	5 ° F
IDLE	20% of maximum ventilation

#### Description of Operation

- 1) The fan will be off and the heater interlock will be on when the temperature is below 75 ° F.
- 2) When the temperature increases to 75 ° F (OSB) the fan operates at full speed for three seconds, then IDLE (minimum ventilation of 20%). The fan will continue to IDLE between 75 ° F and 80 ° F.
- 3) At 78 ° F the heater interlock shuts off.
- 4) Between 80 ° F and 86 ° F (DIFF) the fan speed will change proportionally with the temperature. If the temperature increases, fan speed increases. If the temperature decreases, fan speed decreases.
- 5) The fan will run at maximum speed when the temperature is at or above 86 ° F (maximum ventilation).
- 6) When the temperature drops, the reverse will happen.

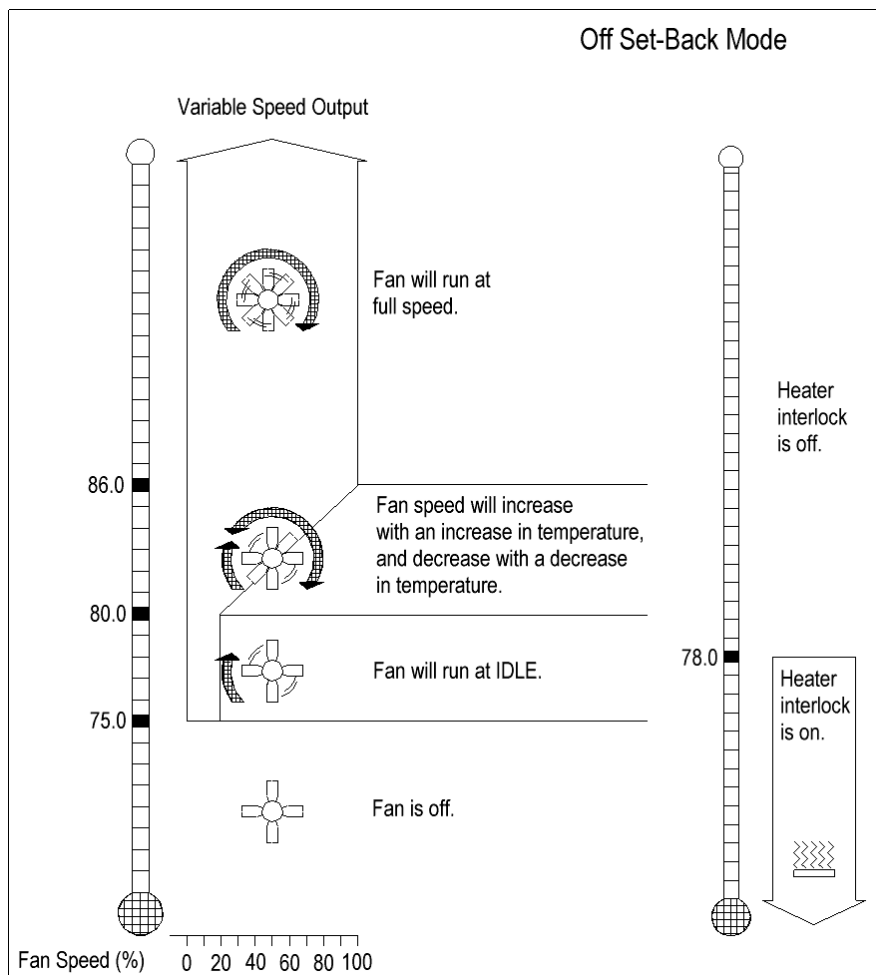


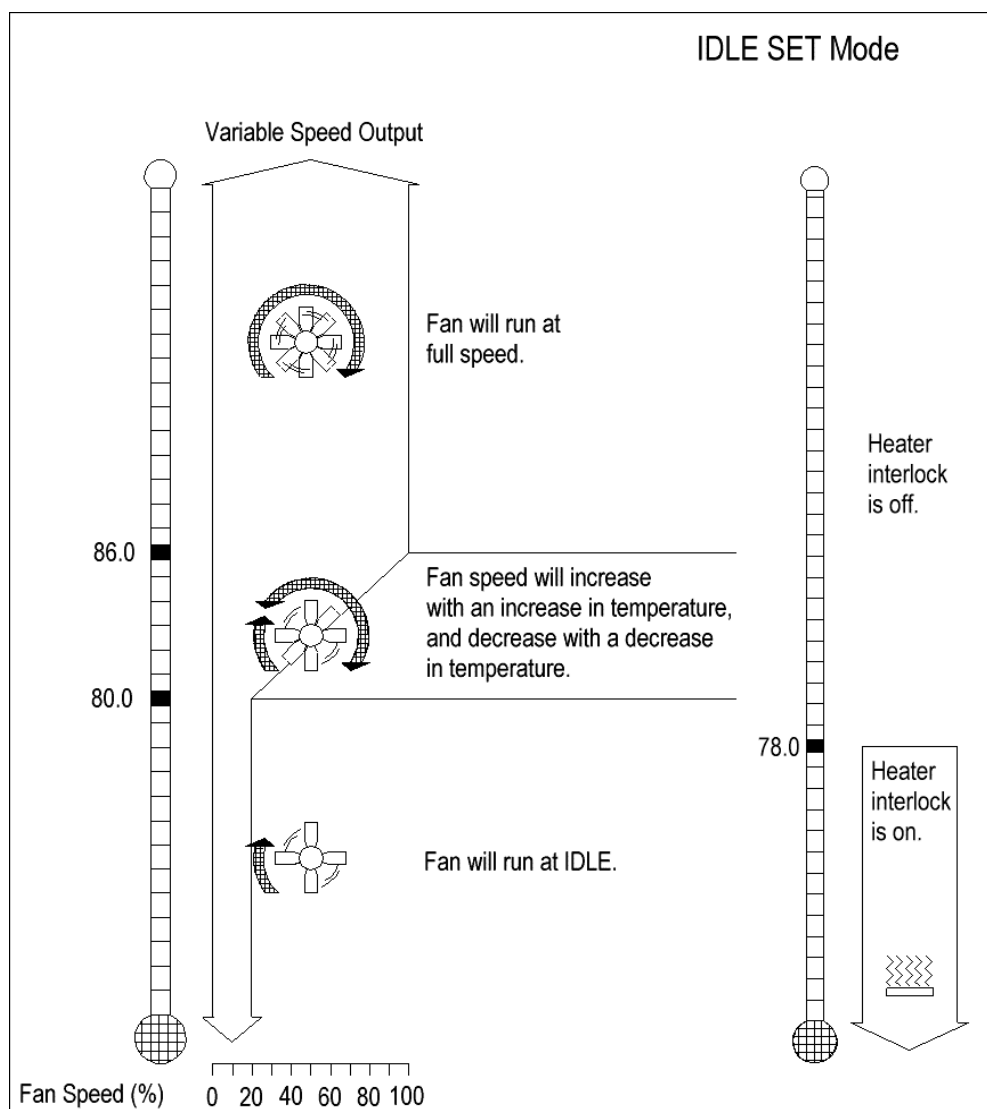
Figure 4: Off Set-Back Mode

**Example 2, Control Operation in IDLE SET Mode**

Parameter	Settings
TEMP SET	80 °F
DIFF	6 °F
OSB	OFF
IDLE	20% of maximum ventilation

**Description of Operation**

- 1) Below 78 °F the heater interlock will be on.
- 2) The fan will operate at IDLE (20% of maximum ventilation) when the temperature is below 80 °F.
- 3) Between 80 °F and 86 °F (DIFF) the fan speed will change proportionally with the temperature. If the temperature increases, fan speed increases. If the temperature decreases, fan speed decreases.
- 4) The fan will run at maximum speed when the temperature is at or above 86 °F (maximum ventilation).
- 5) When the temperature drops, the reverse happens.

**Figure 4: IDLE SET Mode**

## Care and Maintenance

Moisture will not cause a problem with the control if proper care is taken during installation. The control's enclosure is made of fire retardant plastic and sealed with a rubber gasket. The sensor entry is sealed with a liquid tight cable connector.

Use caution when washing the room with a high-pressure washer. DO NOT direct a high-pressure washer at the control. To clean the surface of the control, wipe it with a damp cloth.

### Maintenance

- After the first two weeks of operation, remove the cover from the unit and check inside for moisture. Be sure to turn off the power to the control before removing the cover.
- If moisture is present, wipe the control out with a dry cloth. Check the cable entry points and rubber gasket for proper sealing.
- If the cable connectors are not sealing, apply RTV or Silicon II sealant around the cable.

NOTE: Some silicone sealants release acetic acid while curing. Let the sealant cure completely (one to three days) before closing the control. Failure to do this may damage the control and void the warranty.

- Check the control again after two weeks to verify that it is sealing properly.
- Inspect the control once a year for moisture. Proper care and maintenance will extend the life of the control.

**Warning:** This control is designed and manufactured to provide reliable performance but is not guaranteed to be 100% free of defects. Even reliable products may experience occasional failures and this possibility should be recognized by the user. If this product is used in a life support ventilation system where failure could result in loss or injury, the user should provide adequate back-up ventilation, supplementary natural ventilation or an independent failure alarm system. The user's lack of such precautions acknowledges their willingness to accept the risk of such loss or injury.

## LIMITED WARRANTY

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PHASON warrants this unit, the FHC-1D, subject to the following terms and conditions. This warranty is valid only to the original purchaser for a period of two years from the date of manufacturing. The manufacturing date is stated in the first eight digits of the serial number in the form year-month-day. PHASON hereby warrants that should this product prove defective by reason of improper workmanship, PHASON will repair the unit, effecting all necessary parts replacements without charge for either parts or labour.

### CONDITIONS

1. Installation must be made in accordance with our enclosed installation instructions.
2. The unit must not have been previously altered, modified or repaired by anyone other than PHASON.
3. The unit must not have been subject to accident, misuse, abuse or operated or installed contrary to the instructions contained in the accompanying manual. The opinion of PHASON with respect to these matters shall be final.
4. The person requesting the services provided hereunder must be the original purchaser of the unit and furnish proof of purchase upon request.
5. This warranty is applicable only to the PHASON FHC-1D Temperature Control.
6. All transportation charges on units submitted for warranty repair must be borne by the purchaser.
7. For warranty services, return unit together with original proof of purchase to your dealer.

EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, NO OTHER WARRANTIES, WHETHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL APPLY TO THIS UNIT. ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. PHASON SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES SUSTAINED IN CONNECTION WITH THE SAID UNIT. PHASON NEITHER ASSUMES NOR AUTHORIZES ANY REPRESENTATIVES OR OTHER PERSONS TO ASSUME FOR IT ANY OBLIGATION OR LIABILITY OTHER THAN SUCH AS IS EXPRESSLY SET FORTH HEREIN.

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PHASON reserves the right to improve or alter the FHC-1D without notice.

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