User manual and installation guide

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About the manual

The manual describes the features of your PEC and how to use them; it does not describe ventilation strategies.

- All buttons and menu commands are **bolded**.
  For example, "Press **Program** until the LED for Alarm is lit."

- All LED display examples are in an LED font.
  For example, "Press **Up** or **Down** until A 20 displays and then press **Select**."

This is a hint or tip. It contains helpful information that might make it easier for you to set up or use your PEC.

This is a note. It contains information that may help you better understand your PEC.

This is a **caution**. It contains important information that you must follow when installing or servicing your PEC. Failure to follow this information can lead to damaged controls or equipment.

This is a **warning**. It contains important safety information that you must follow when installing or servicing your PEC. Failure to follow this information can lead to damaged controls or equipment, electrical shocks, or severe injury.

Table of contents

Chapter 1: Introducing the PEC

Chapter 1 introduces you to the Proportional Environment Control (PEC). Read chapter 1 before reading the rest of the manual. Topics in chapter 1 include:

Introducing the PEC

The PEC automatically controls the temperature in a room by operating two variable speed fans, an inlet actuator, and up to three single-speed fans or heaters.

Easy to use and program

The PEC comes with four factory-configured operating programs you can easily reconfigure for your ideal situation. The easy-to-use keypad and menu system make the PEC one of the easiest controls to program. The PEC's advanced and powerful features are never more than a few keystrokes away.

Versatility and peace of mind

The PEC has a 30-foot temperature probe that monitors temperatures and a single zone. For more versatility, you can connect four temperature probes together and use four-zone averaging. Temperature probes are available in 1, 6, 30, 75, or 150-foot lengths; you can extend them up to 500 feet using extension cable.

You can connect the PEC to an alarm siren or other external alarm system. Customizable alarm settings allow you to choose which alarm conditions you want to be notified about.

Common applications

Livestock applications

Livestock applications include buildings housing calves, rabbits, goats, hogs, poultry, and turkey. In these applications, the PEC often controls ventilation in a single 20 x 40-foot or smaller room. However, the PEC is not restricted to small rooms; some customers use it to control ventilation in sow breeding rooms that are 200 feet long.

Greenhouse applications

Greenhouse applications include controlling ceiling louvers, variable and single-speed fans, and heaters. Some operations use the proportional feature for misting or ground heat (water pipes).

Business and light-industrial applications

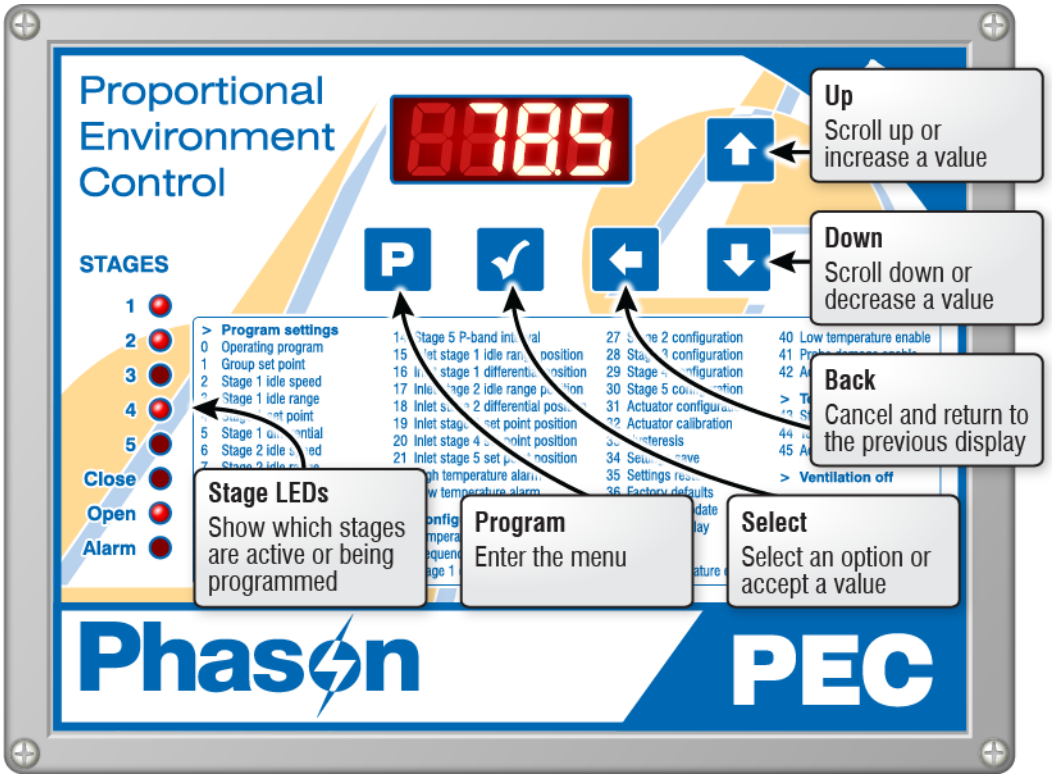
Business and light-industrial applications include machine shops, garages, and utility sheds where customers use the PEC to control fans and inlets. The PEC exhausts heat from the room made by equipment and/or regulates the temperature as service bays open and close.

Features

- Automatic temperature-based control, range: -13 to 125°F (-25 to 51.7°C)
- Seven configurable operating programs
- Two variable cooling stages for controlling fans
- Three general-purpose relays (heat or cool)
- Two inlet control relays
- One alarm relay (for external alarm system or siren)
- Four-character LED display and individual stage LEDs
- Minimum and maximum temperature logging
- Error code display
- Manual override/test mode
- Selectable motor curves
- Ventilation disable option
- Three-second full-power-turn-on for minimizing fan ice-up
- Actuator deicing
- Power-failure settings protection
- One temperature probe input
- Thirty-foot temperature probe, extendable to 500 feet
- *Easy System* compatible—edit and store configuration and settings on a computer. For more information, visit **www.phason.ca**.
- Rugged enclosure (corrosion resistant, water resistant, and fire retardant)
- CSA approval
- Limited warranty (two years)

Becoming familiar with the PEC

The four-character LED display shows temperatures, alarm messages, and programming information. If there is a dot in the top left corner of the display, you are in an editable menu.



NOTE

If you leave the PEC in a menu or display other than the main display, the control returns to the main display after five minutes without any key presses. The only exceptions are stage override mode and temperature override mode; the control remains in these modes until you manually exit them.

Menu layout

Press **Program** to cycle through the menus.

Press **Up** or **Down** to cycle through the menu items.

Main menu

A Pr	Program A
b Pr	Program B
C Pr	Program C
d Pr	Program D
E Pr	Program E
F Pr	Program F
G Pr	Program G
CONF	Configuration
ALEn	Alarm enable
tESt	Test
UENt	Ventilation ON/OFF
di CE	Actuator deicing

Program menu*

A 0	Operating program
A 1	Group set point
A 2	Stage 1 idle speed
A 3	Stage 1 idle range
A 4	Stage 1 set point
A 5	Stage 1 differential
A 6	Stage 2 idle speed
A 7	Stage 2 idle range
A 8	Stage 2 set point
A 9	Stage 2 differential
A 10	Stage 3 set point
A 11	Stage 4 set point
A 12	Stage 5 set point
A 13	Stage 5 P-band temperature
A 14	Stage 5 P-band interval
A 15	Inlet stage 1 idle range pos.
A 16	Inlet stage 1 differential pos.
A 17	Inlet stage 2 idle range pos.
A 18	Inlet stage 2 differential pos.
A 19	Inlet stage 3 set point pos.
A 20	Inlet stage 4 set point pos.
A 21	Inlet stage 5 set point pos.
A 22	High temperature alarm
A 23	Low temperature alarm

Configuration menu

24	Temperature unit
25	Frequency
26	Stage1 configuration
27	Stage 2 configuration
28	Stage 3 configuration
29	Stage 4 configuration
30	Stage 5 configuration
31	Actuator configuration
32	Actuator calibration
33	Hysteresis
34	Settings save
35	Settings restore
36	Factory defaults
37	Firmware update
38	Version display

Alarm menu

39	High alarm enable
40	Low alarm enable
41	Probe damage enable
42	Actuator jam enable

Test menu

43	Stage override menu
44	Temperature override
45	Actuator position display

* This is the display for program A. The display for programs B to G shows the appropriate letter first.

Chapter 2: Installing your PEC

Chapter 2 explains how to mount, install, and connect equipment to your PEC. Topics in chapter 2 include:

What you need to know before installing your PEC

Before installing your PEC, you need to do some initial preparation:

1. Read **Understanding power surges and surge suppression** below.

- ◇ If you do not install external surge suppression devices, you risk damage to the electronics inside your PEC, which may cause your PEC to fail.
- ◇ Because it is not possible to *completely* protect this product internally from the effects of power surges and other transients, we *highly recommend* that you install external surge suppression devices. For specific recommendations, see your electrical contractor.
- ◇ If you do not take these precautions, you acknowledge your willingness to accept the risk of loss or injury.

2. Using **Appendix D: Installation worksheet** on page 65, list all the equipment you want to control using this PEC. Install the equipment and make your electrical connections according to the sheet.

3. Using **Appendix E: Configuration worksheets** on page 66, decide which relays and variable stages you want to use for each piece of equipment, and how you want the equipment configured. You can connect more than one piece of equipment to a single relay or stage **as long as the total current draw does not exceed** the relay or stage's limit. For more information, read **Electrical ratings** on page 11.

Understanding power surges and surge suppression

Power surges can be caused by external influences (for example, lightning or utility distribution problems) or they can be caused internally (for example, starting and stopping inductive loads such as motors).

One of the most common causes of power surges is lightning. When lightning strikes the ground, it produces an enormously powerful electromagnetic field. This field affects nearby power lines, which transmit a surge to any device connected to it, such as lights, computers, or environmental controls like your PEC. Lightning does not have to strike a power line to transmit a surge.

Surge suppression devices offer some protection from power surges. Because it is not possible to internally protect this product completely from the effects of power surges and other transients, Phason *highly recommend* that you install external surge suppression devices. For specific recommendations, see your electrical contractor. If you do not take these precautions, you acknowledge your willingness to accept the risk of loss or injury.

Reducing electrical noise using filters

Electrical noise is caused by high voltage transients created when inductive loads, such as power contactors, are switched on or off. The strength of the transients can be over 1000 volts and can vary with the type of equipment and wiring, as well as several other factors.

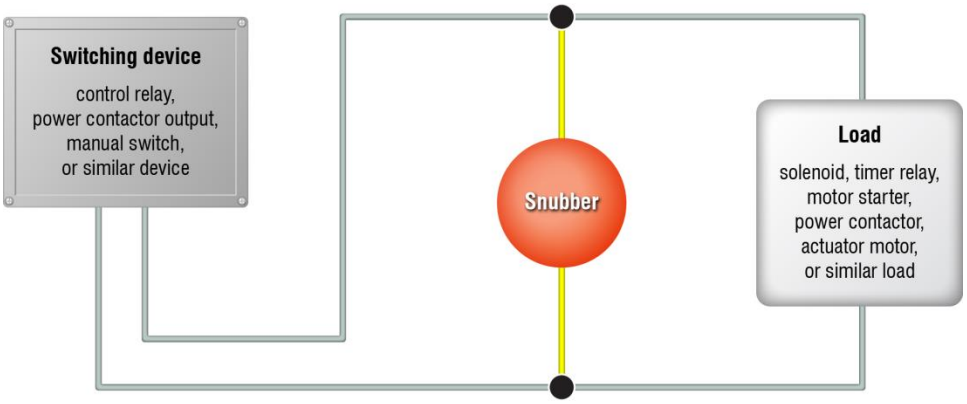
Visible symptoms of electrical noise include erratic control operation, cycling inlets, communication problems, and more. However, the effects of electrical noise are *not always visible*. Over time, electrical noise can cause electronic circuits, relay contacts, and power contactors to deteriorate.

Installing filters helps extend the life of equipment

Filters help prevent electrical noise problems by absorbing the transient energy. Even if you do not have *visible* symptoms of electrical noise, filters help keep controls operating reliably and can extend the life of the controls and equipment connected to them.

Phason's snubber filters (part number 127-0) are for use with solenoids, timer relays, DC motors, furnaces, and other equipment connected to the control's relays. You can also use the filters with loads connected to power contactors (part number 129-0).

Install a filter in parallel with the load, as shown in the following example.



- ◇ Do not use Snubber filters with variable stages.
- ◇ Some power contactors include snubber filters. For more information, read **Using power contactors to increase the capacity of relays** below.
- ◇ For more information about snubber filters or other Phason accessories, see your dealer or visit **www.phason.ca**.

Electrical ratings

Input power	120/230 VAC, 50/60 Hz
Variable stages ① (VAR 1, VAR 2)	5 FLA at 120/230 VAC, PSC motor 1/3 HP at 120 VAC, 1/2 HP at 230 VAC, PSC motor 7.5 A at 120/230 VAC, general-purpose (resistive)
Fuses (F2 and F3)	12 A, 250 VAC ABC-type ceramic
Relay stages ① (STAGE 3, STAGE 4, STAGE 5)	4.4 A at 120 VAC, 2.2 A at 230 VAC, general-purpose (resistive) 1/6 HP at 230 VAC 360 W tungsten at 120 VAC
Inlet relays	4.4 A at 120 VAC, 2.2 A at 230 VAC, 5 A at 30 VDC
Alarm relay	0.4 A at 125 VAC; 2 A at 30 VDC, resistive load 0.2 A at 125 VAC; 1 A at 30 VDC, inductive load
① You can connect more than one piece of equipment to a variable stage or relay as long as they are the same type (for example, two fans) and the total current draw does not exceed the stage's limit.	

The FLA (full load ampere) rating accounts for the increase in motor current draw when the motor operates at less than full speed. Make sure the motor/equipment connected to the variable stage does not draw more than 5 FLA.

Using power contactors to increase the capacity of relays

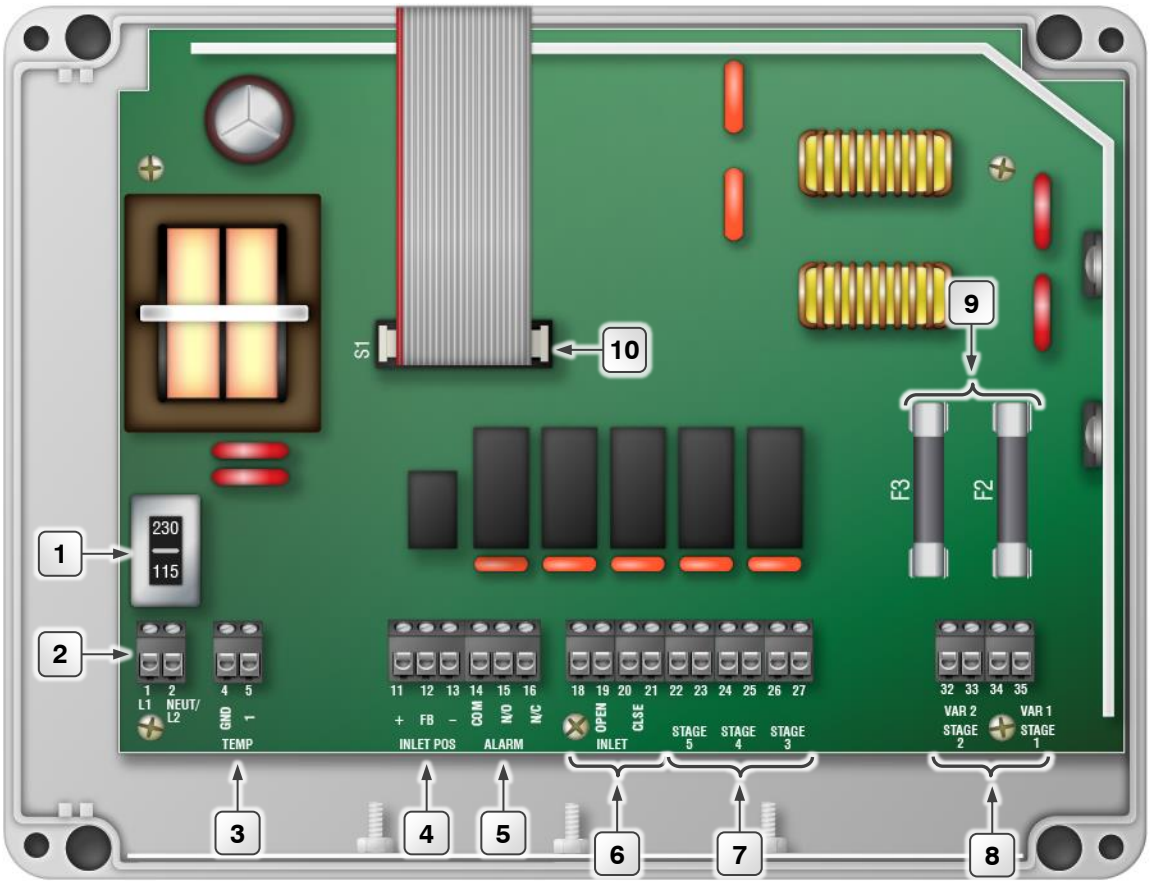
Phason's 240-volt power contactors are heavy-duty relays that allow you to increase the load handling capability of control relays. Power contactors are ideal for secondary ventilation fans and electric heaters.

Phason's power contactor relays have the following electrical ratings.

- Coil: 10.2 mA at 240 VAC
- Contact: 25 A at 240 VAC; resistive
  2 HP at 240 VAC, 1 HP at 120 VAC; motor, power factor 0.4
  1300 W at 120 VAC; tungsten

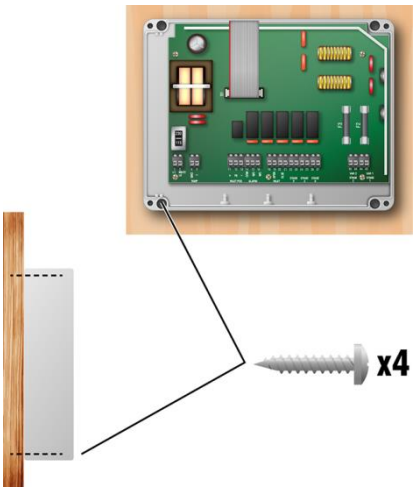
Phason offers three power contactor options. For more information, read **Replacement kits and optional accessories** on page 54.

Proportional Environment Control layout



1	**Voltage selection switch**: set this switch to the correct voltage before installing your PEC.
2	**Incoming power terminal**: connect the incoming power (120/230 VAC, 50/60 Hz) to this terminal.
3	**Temperature probe terminal**: connect the temperature probe to this terminal.
4	**Actuator feedback terminal**: connect the feedback from the actuators to these terminals.
5	**Alarm relay terminal**: connect an external alarm system or alarm siren to this terminal.
6	**Inlet actuator terminals** (OPEN and CLSE): connect an inlet actuator to these terminals.
7	**General-purpose relay terminals** (STAGE 3 to STAGE 5): connect single stage (on/off) equipment to these terminals. You can configure these relays as heat or cool.
8	**Variable stage terminals** (VAR 1, VAR 2): connect variable speed fans to these terminals.
9	**Variable stage fuses** (F3 for VAR 2, F2 for VAR 1): 12 A, 250 VAC ABC-type ceramic.
10	**Display cable**: make sure the ribbon cable from the display is properly connected to the socket.

Mounting your PEC



1. Select a location for your PEC. Make sure you have enough cable and wire to reach all the equipment (fans, heaters, actuators, and so on) that you want to control.
2. Remove the screws from the front cover and then gently lift it off.
3. Mount the enclosure to a wall using the four screws provided with the control. Insert the screws into the large holes in each corner of the box and tighten.

Connecting equipment to your PEC

Follow all instructions when installing your PEC and connecting equipment to it.

Use the electrical knockouts for bringing wires or cables into or out of your PEC enclosure. Do not make additional holes in the enclosure; this can damage the watertight seal or control components and void the warranty.

- Your PEC's test modes are useful for testing your equipment after installing and configuring it. For more information, read **Testing settings and equipment** on page 46.
- Refer to **Appendix D: Installation worksheet** on page 65 and **Appendix E: Configuration worksheets** on page 66 when installing equipment.

Connecting an actuator

Actuators are control elements that are not OFF or ON. Instead, they vary by a percentage. For example, inlets can be open various distances from 0 percent to 100 percent.

Typically, linear actuators are connected directly to inlets, or connected by cables and pulleys. Inlets are generally located in the ceiling or walls. Inlet systems are usually spring loaded to aid in closing the inlet, or counter weighted to aid in opening the inlets.

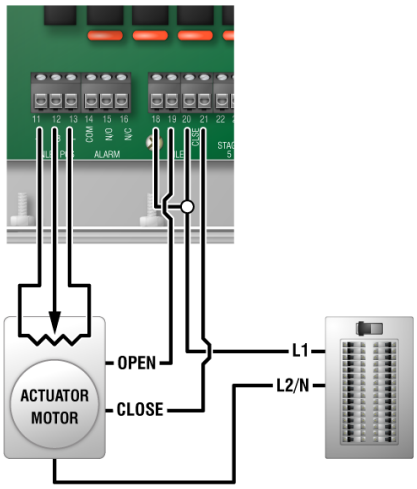
Feedback potentiometers

Each actuator you connect must have a feedback potentiometer. The feedback potentiometer, which you connect to the PEC's feedback terminal, lets the control know how far the actuator's arm is extended.

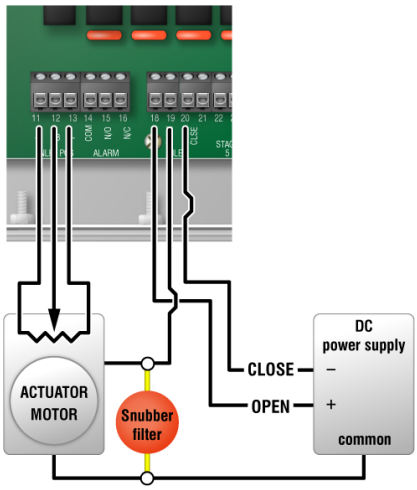
Most linear actuators are available with potentiometer feedback and internal adjustable limit switches. A 10,000 ohm, 10-turn feedback potentiometer is preferred, but the internal feedback potentiometer can range between 1000 and 20,000 ohms. Potentiometers outside of this range will affect the precision to which your PEC can control the actuator.

To connect actuators

AC-powered actuators



DC-powered actuators



The ratings of the actuator must not exceed the ratings of the PEC.

PEC inlet relay ratings: 4.4 A at 120 VAC, 2.2 A at 230 VAC, 5 A at 30 VDC

- ◇ A system operates more precisely when using the largest amount of stroke that is feasible with the actuator. The stroke is the distance the actuator arm extends or retracts.
- ◇ If you are unsure of the potentiometer wiring for your actuator, read **Determining correct actuator feedback wiring** on page 62.
- ◇ When routing the actuator feedback wires, do not run them in or along the same conduit as AC-power lines.
- ◇ When using a multimeter to measure AC voltage across the actuator motor, if a limit switch is open and both control relays are open, you might still read line voltage because of the control's filter circuit.

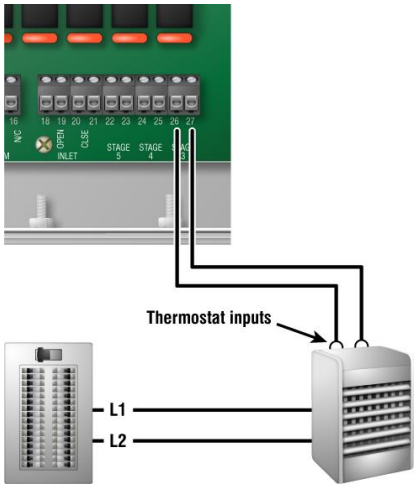
Connecting single-stage heating or cooling elements

Heating or cooling elements include equipment such as electric heaters, furnaces, and single-speed fans.

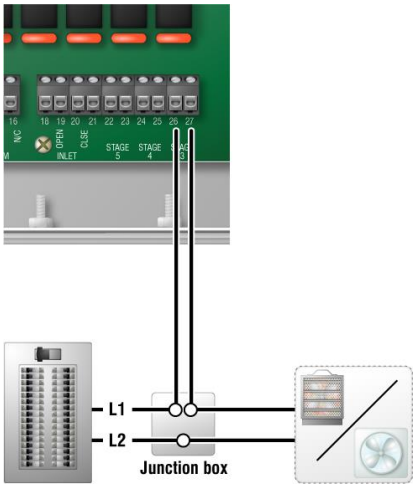
To connect single-stage heating or cooling elements

Connect single-speed heating or cooling elements to your PEC as shown in the following diagrams.

Gas-fired furnace or brooder



All other single-speed elements



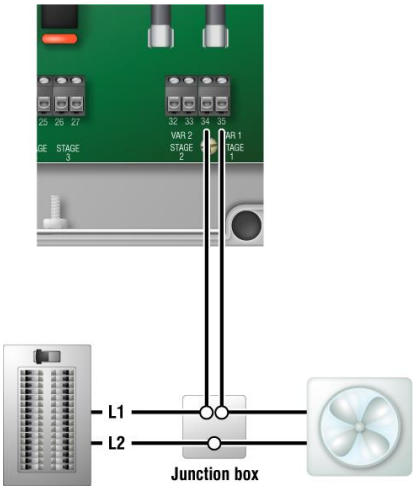
The ratings of the equipment must not exceed the ratings of your PEC's relays.

Relay ratings: 4.4 A at 120 VAC, 2.2 A at 230 VAC, general-purpose (resistive)
1/6 HP at 230 VAC
360 W tungsten at 120 VAC

Gas furnaces using hot-surface ignition or glow plug can draw more current than indicated on their nameplate and require power contactors. For more information, read your furnace dealer.

Connecting variable-stage cooling elements

The PEC has two variable-stage cooling terminals for connecting equipment such as variable-speed fans.



To connect variable-stage cooling elements

Connect variable cooling elements to your PEC as shown in the diagram.

Only permanent split capacitor motors appropriate for variable speed control, or shaded pole motors, can be used on the variable stages.

- ◇ If you are using three-phase power, connect the PEC and the variable cooling equipment to the same phase. For more information, read **Using three-phase power** below.
- ◇ The ratings of the equipment must not exceed the ratings of your PEC's variable stages.

Variable stage ratings: 5 FLA at 120/230 VAC, PSC motor
1/3 HP at 120 VAC, 1/2 HP at 230 VAC, PSC motor
7.5 A at 120/230 VAC, general-purpose (resistive)

Variable stage fuses: 12 A, 250 VAC ABC-type ceramic

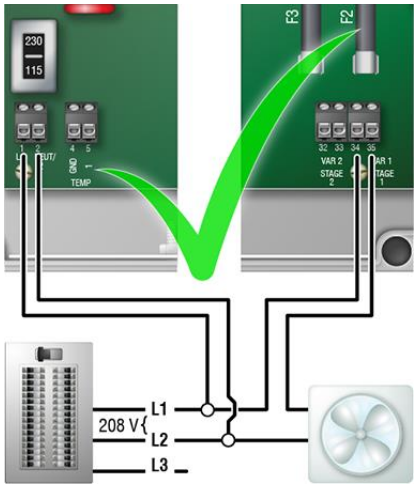
Using three-phase power

If you are connecting your PEC to a three-phase system, connect the control power and the variable cooling equipment to the same phase.

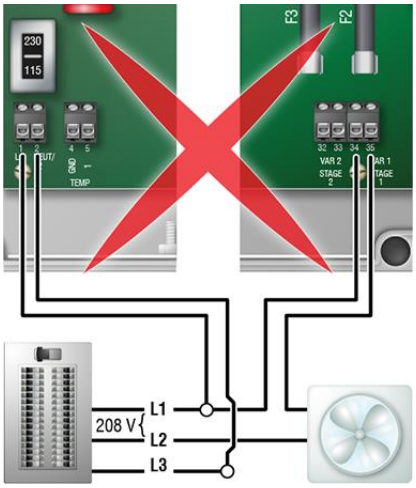
Your PEC must be powered from the same phases that supply the equipment. If your PEC power and the variable stages are wired to different phases, the equipment will operate erratically.

Connect the control power and variable cooling equipment as shown in the following example.

Correct three-phase wiring



Incorrect three-phase wiring



Connecting an alarm system

You can connect an alarm system to your PEC's alarm terminal. An alarm system can be a siren, alarm panel, or auto-dialer. Read your system's installation guide for installation instructions and information about the type of system: *normally open* or *normally closed*. Below are the descriptions for the alarm terminal.

- **COM**: common connection
- **N/O**: normally open; closes during alarm conditions
- **N/C**: normally closed; opens during alarm conditions

For the alarm system to sound (or dial out) during an alarm condition, you must enable the alarms. For more information, read **Programming alarm settings** on page 40.

The ratings of the alarm system must not exceed the ratings of the relay.

Alarm relay ratings: 0.4 A at 125 VAC; 2 A at 30 VDC, resistive load
0.2 A at 125 VAC; 1 A at 30 VDC, inductive load

To connect an alarm system

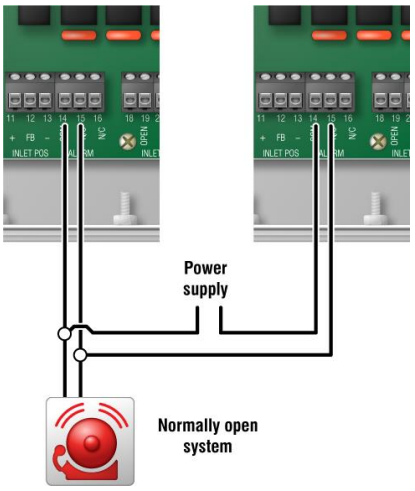
- If you are connecting the alarm system to a network of controls and your system uses a *normally open* connection (closes on alarm), connect the system as shown in the normally open diagram.

  Join all the COM connections together and all the N/O connections together. Your PEC alarm relays must be in parallel with each other so any PEC can trigger the alarm system when an alarm condition occurs.

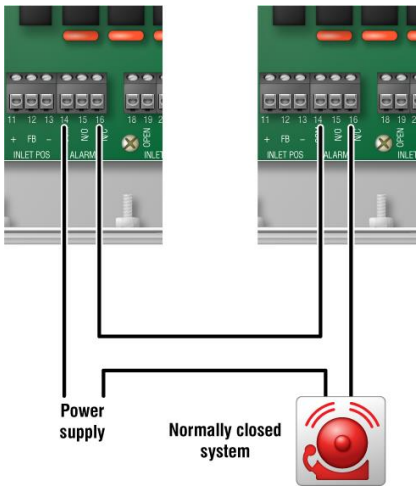
- If you are connecting the alarm system to a network of controls and your system uses a *normally closed* connection (opens on alarm), connect the system as shown in the normally closed diagram.

  Join the alarm relays in a continuous loop. Your PEC alarm relays must be in series with each other so any PEC can trigger the alarm system when an alarm condition occurs.

Normally open system (closed on alarm)



Normally closed system (open on alarm)



Connecting temperature probes

NOTE

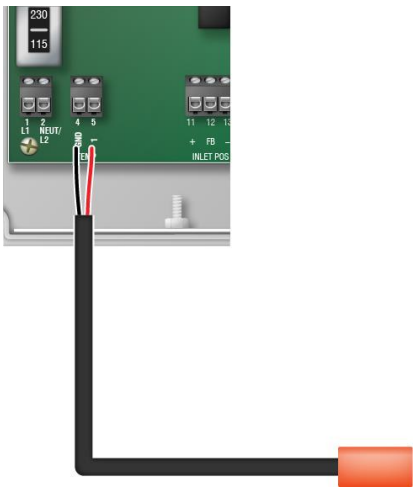
- ◇ Replace damaged probes as soon as possible. If there is no probe present or working properly, the PEC shuts off stages 3, 4, and 5, operates variable stages this 1 and 2 at idle speed, and positions the inlet for minimum ventilation.
- ◇ When routing the temperature probe cables, do not run them in or along the same conduit as AC-power lines.

TIP

- ◇ You can extend probe cables up to 500 feet. For more information, read the **Control Fundamentals** guide that came with your control.

To connect a single temperature probe

- Do not run the probe cable in the same conduit as AC power cables
- Do not run the sensor cable beside AC power cables or near electrical equipment.
- When crossing other cables or power lines, cross them at a 90-degree angle.

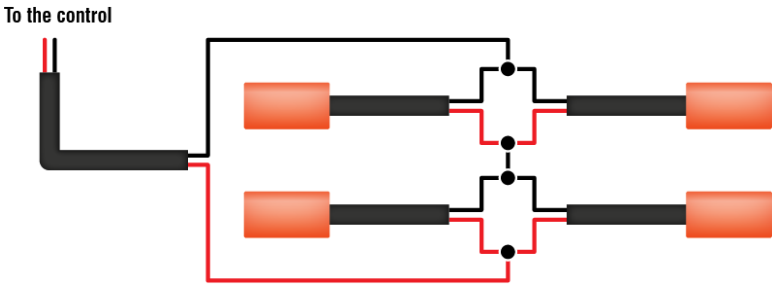


To use four-zone averaging

The PEC can monitor the temperature in four different zones using four-zone averaging. The control takes an average of the temperatures measured by the four probes and then operates according to the average temperature.

NOTE

You must use **four** probes for averaging. Using two, three, or more than four probes measures the temperature incorrectly.



Connecting the power source

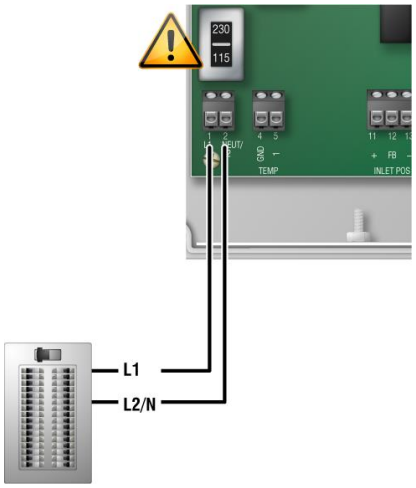
- ◇ Before connecting the incoming power, switch OFF the power at the source.
- ◇ Do not switch ON the power until you have finished all wiring and verified all equipment is properly connected and free of obstructions.

- ◇ Before connecting the power, set the voltage selection switch to the correct voltage.
- ◇ If you are using three-phase power, make sure the control power and the variable speed fans are connected to the same phase. For more information, read **Using three-phase power** on page 16.

You can connect your PEC to 120 or 230 VAC, 50 or 60 Hz power.

To connect the incoming power source

1. Set the voltage select switch to the correct voltage setting.
2. Connect the incoming power source as shown in the following diagram.



Finishing the installation

After installing and connecting equipment to your PEC, you are ready to finish the installation. Before you start configuring your PEC, you need to verify the connections and close the PEC.

Make sure the configuration worksheets in **Appendix E** correspond to how the equipment is connected to your PEC. It is very important that the connections and the worksheets are the same, because the next step after closing the cover is to tell your PEC which equipment is connected to each terminal.

1. Make sure all wires are properly connected to the correct terminals.
2. Make sure the voltage selection switch is in the correct setting, 115 or 230 VAC.
3. Make sure the display cable is properly connected. For more information, read **Proportional Environment Control layout** on page 12.
4. Place the cover on the control.

5. Switch on the power to your PEC.
   When you switch on the power to your PEC, the display should show - - - -, followed by the temperature.

   If the PEC display does not come on, go back to step 1.

   If the display shows an alarm message and/or the LED for Alarm is lit, read **Programming alarm settings, parameters 22 and 23** on page 40.
6. Insert the four screws into the cover and then tighten them.

Do not over tighten the screws. Avoid using power screwdrivers or drills.

Chapter 3: Configuring your PEC

Chapter 3 explains how to configure your PEC. Configuring your PEC includes telling it which equipment is connected to each terminal. Topics in chapter 3 include:

What you need to know before configuring your PEC

Configuring your PEC means telling it what equipment it will be controlling and how it will be controlling that equipment. For example, your PEC has three relay stages. You need to tell the stages if they will be controlling heating or cooling elements.

Before you begin configuring your PEC, make sure:

- It has power
- All equipment has been properly connected to the correct terminals.
- You know which equipment is connected to which relays and variable stages

This chapter does not explain set points, idle speeds, or other settings. For information about those settings, read **Chapter 4: Programming the PEC** on page 29.

- ◇ We recommend configuring *all* your control elements before programming the settings (temperature set points, idle speeds, and so on). Use the **Appendix E: Configuration worksheets** on page 66 to help you keep track of which equipment is connected to which relays and variable stages.
- ◇ If you receive an error message during configuration, look it up in **Appendix B: Troubleshooting** on page 58 and then follow the instructions for correcting the problem.
- ◇ Your PEC's built-in diagnostic tests are useful for testing your equipment after installing and configuring it. For more information, read **Testing settings and equipment** on page 46.

Configuring the main control functions

Before configuring the variable and relay stages, configure the main control functions. Main control functions include:

- Temperature units
- Frequency
- Hysteresis

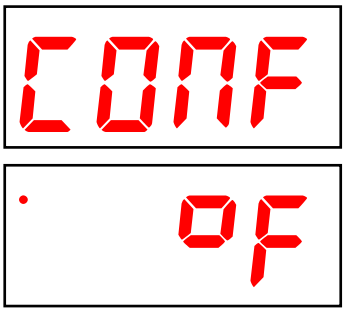
Selecting the temperature units, parameter 24

Your PEC can display temperatures in either degrees Fahrenheit (°F) or degrees Celsius (°C), but not both at the same time.

Default: Fahrenheit

To select the temperature unit

1. Press **Program** until CONF displays and then press **Select**.
   The display shows 24, the first item in the Configuration menu.
2. Press **Select**.
   The display shows the current temperature unit.
3. Press **Up** or **Down** to toggle between °F and °C and then press **Select**.
   The control returns to the Configuration menu.
4. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.



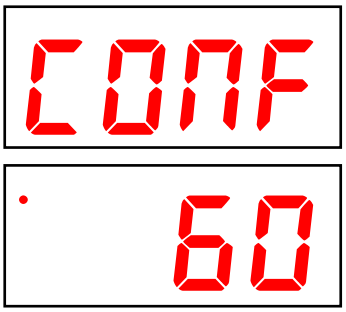
Selecting the operating frequency, parameter 25

In North America, utility companies supply power at 60 Hz. In some areas of the world, such as Europe, power is supplied 50 Hz.

Default: 60 Hz

To select the operating frequency

1. Press **Program** until CONF displays and then press **Select**.
   The display shows 24, the first item in the Configuration menu.
2. Press **Up** until 25 displays and then press **Select**.
   The display shows the current frequency.
3. Press **Up** or **Down** to toggle between 50 and 60 and then press **Select**.
   The control returns to the Configuration menu.
4. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.



Configuring hysteresis, parameter 33

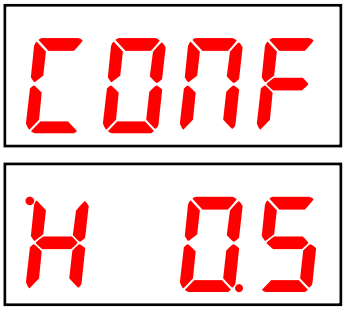
Hysteresis helps prevent damage to the relays, variable stages, and the equipment connected to them by preventing the stages from switching on and off rapidly when the temperature is hovering close to the set point.

Hysteresis is the number of degrees above the set point that a heating stage or relay switches off, and the number of degrees below the set point that a cooling stage or relay switches off. For example, a household thermostat might switch on a furnace at 68 °F when the house is cooling down, but switch it off at 70 °F when the house is warming up. The difference between these two values is the hysteresis.

Default: 0.5°F (0.3°C) *Range: 0.3 to 5.0°F (0.2 to 2.8°C)*

To configure the hysteresis

1. Press **Program** until CONF displays and then press **Select**.
   The display shows 24, the first item in the Configuration menu.
2. Press **Up** or **Down** until 33 displays and then press **Select**.
   The display shows the current configuration.
3. Press **Up** or **Down** to adjust the value and then press **Select**.
   The control returns to the Configuration menu.
4. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.



Configuring the stages

Your PEC has three types of stages: two variable stages, three relay (ON/OFF) stages, and one inlet actuator (OPEN and CLOSE) stage.

Configuring variable stages, parameters 26 and 27

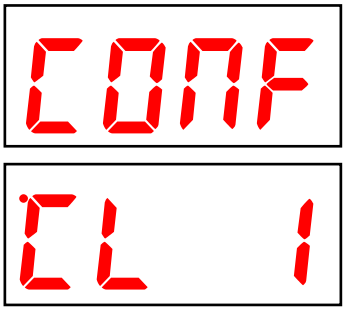
Variable stages 1 and 2 control elements that operate with gradually changing voltage, such as variable speed fans. There are three configuration options.

- **Off** (OFF) – the variable stage is always off.
- **Cooling 1** (CL 1) – the stage controls a variable speed fan using motor curve 1. Use motor curve 1 for most fans.
- **Cooling 2** to **Cooling 4** (CL 2, and so on) – the stage controls a variable speed fan using selected motor curve. Use one of motor curves 2 to 4 *only if* one of the following problems occur when using manual override to test.
  - The fan changes speed *only within* a small portion of the 0 to 100% range
  - The fan runs at full speed regardless of the 0 to 100% range

Default: stage 1 and 2 cool

- ◇ For more information about motor curves, including a table cross-referencing fan motors with recommended curves, read **Appendix G: Motor curves** on page 69.
- ◇ Use the **Variable stage configuration worksheet** on page 66 when configuring variable stages.
- ◇ For more information about how variable stages work, read **Programming variable stages** on page 33.

To configure variable stages



1. Press **Program** until CONF displays and then press **Select**.
   The display shows 24, the first item in the Configuration menu.
2. Press **Up** until 26 displays for variable 1 (or 27 for variable 2) and then press **Select**.
   The display shows the current configuration.
3. Press **Up** or **Down** to toggle between OFF and Cool and then press **Select**.
   The control returns to the Configuration menu.
4. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.

Configuring relay stages, parameters 28 to 30

The PEC has three relay stages you can configure as one of the following options.

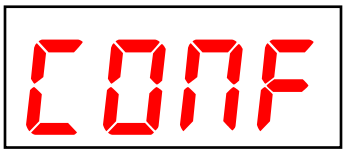
- **Off**: the relay is always open (OFF).
- **On**: the relay is always closed (ON). You can use this configuration as an override.
- **Cool**: the relay controls a cooling element and is on when the temperature is above the set point.
- **Heat**: the relay controls a heating element and is on when the temperature is below the set point.
- **Proportional cool** (stage 5 only): the relay controls a water pump or sprinkler solenoid and operates as a proportional cycle timer. The relay switches on for a portion of the cycle/interval and off for the remainder. The duration the relay is on depends on the temperature. Proportional control provides better control of temperature and more efficient operation.

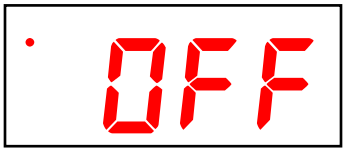
  Typical use for proportional cooling is soaking or direct evaporative cooling, which is often used in hog and dairy operations.
- **Proportional heat** (stage 5 only): the relay controls a pump or valve and operates as a proportional cycle timer. Typical use for proportional heating is in-floor heating using water pipes, which is often in livestock buildings.

Defaults: stage 3 and 4 COOL, stage 5 HEAT

- ◇ If you need to connect more cooling elements than you have relays available, and you are not using both variable stages, you can use an available variable stage as an ON/OFF stage (for 120/230 VAC-powered equipment only). For more information, read **Programming variable stages, parameters 2 to 9** on page 33.
- ◇ Use the **Relay stages worksheet** on page 68 when configuring relays.

To configure relay stages





1. Press **Program** until CONF displays and then press **Select**.
   The display shows 24, the first item in the Configuration menu.
2. Press **Up** until 28 displays for stage 3 (29 for stage 4, or 30 for stage 5) and then press **Select**.
   The display shows the current configuration.
3. Press **Up** or **Down** until you reach the option you want and then press **Select**.
   The control returns to the Configuration menu.
4. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.

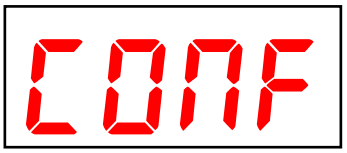
Configuring the inlet actuator, parameter 31

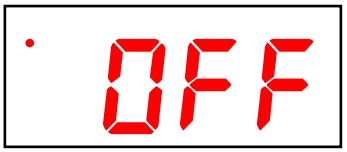
The PEC has one inlet stage for controlling inlets connected to an actuator.

Default: on/enabled

Use the **Relay stages worksheet** on page 68 when configuring relays.

To configure the actuator





1. Press **Program** until `CONF` displays and then press **Select**.
   The display shows `24`, the first item in the Configuration menu.
2. Press **Up** or **Down** until `31` displays and then press **Select**.
   The display shows the current configuration.
3. Press **Up** or **Down** to toggle between `OFF` and `ON` and then press **Select**.
   The control returns to the Configuration menu.
4. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.

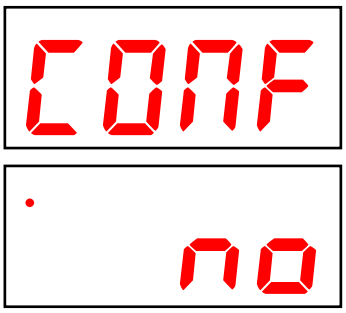
Calibrating an actuator, parameter 32

Before the PEC operates your equipment, you need to calibrate the actuator. Calibrating the actuator lets the PEC know the position of the actuator when it is fully extended and fully retracted. The PEC uses the limits to define the range of motion it uses when positioning the inlets. The limits tell the control how much to adjust when you want the actuators, for example, only 20% extended.

- ◇ Before calibrating the actuator, make sure the limit switches are set and the cable and counter weights can move freely.
- ◇ If the calibration procedure stops after closing the first time, or fails to position properly, the feedback signal is not connected properly. Verify that the potentiometer wiring is correct. For more information, read **Determining correct actuator feedback wiring** on page 62.

Phason recommends resetting the limit switches and calibrating the actuator at least once each year. This is because cables can stretch and equipment can come out of alignment (similar to tires on your car),

To calibrate actuators



1. Press **Program** until CONF displays and then press **Select**. The display shows 24, the first item in the Configuration menu.
2. Press **Up** or **Down** until 32 displays and then press **Select**. The display shows the current configuration.
3. Press **Up** or **Down** to change the no to YES and then press **Select**. The display shows UCAL and starts the calibration process. When the process is complete, the display shows donE.

   During the calibration process, the PEC attempts to open and then close the actuator all the way to limit switches.

   If the calibration procedure fails to complete the cycle, the feedback signal might not be connected properly. For more information, read **Determining correct actuator feedback wiring** on page 62.
4. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.

Testing the configuration

After configuring all the control elements (variable stages, relays, and so on), test your PEC to make sure the configuration is correct. In other words, make sure what you think is connected to a particular relay or stage *is* actually connected to that relay or stage.

You can test the configuration using the PEC's stage override mode. Stage override mode allows you to operate the equipment, regardless of temperature or time. As you operate each piece of equipment, visually check to see if that equipment is doing what you tell it.

For example, when you switch on stage 3 at the PEC, does the equipment you think is connected to that relay switch on?

For more information about stage override mode, read **Testing settings and equipment** on page 46.

Chapter 4: Programming the PEC

What you need to know before programming your PEC

Programming the PEC basically means telling the control what you want it to do with the equipment and when you want it done. For example, for a single-speed fan set for cooling, you might say "Switch on when the temperature reaches 80°F."

Before you begin programming your PEC, make sure:

- The control has power
- You know which equipment is connected to which stages
- You have *properly connected* all equipment to the *correct terminals*.
- You have properly configured and tested all equipment connected to the variable and relay stages. For more information, read **Chapter 3: Configuring your PEC** on page 22.

Use **Appendix F: Settings worksheets** on page 67 when programming your PEC.

Understanding how the PEC operates

Understanding how the PEC operates can help you configure and program your control more efficiently, and control your environment more effectively.

The configuration and settings for the following example are the factory defaults for program A.

1. **Group set point** is the target temperature for the room.

2. **Stage 1 idle speed** is the speed, in percentage of full power, at which the stage 1 fan operates for minimum ventilation.

3. **Stage 1 idle range** is the temperature below which the stage 1 fan is off and the inlet is closed. When the temperature is between the **Stage 1 idle range** and **Stage 1 set point**, the fan operates at **Stage 1 idle speed** and the inlet is open to the positions setting of parameter 15.

4. **Stage 1 set point** is the temperature above which the stage 1 fan speed increases toward its maximum and the inlet opens proportionally.

5. **Stage 1 differential** is the temperature at which the stage 1 fan reaches full speed and the inlet reaches its next position setting (parameter 16).

(6) **Stage 2 idle speed** is the speed at which the stage 2 fan operates when the temperature is at the **Stage 2 idle range** (parameter 7).

(7) **Stage 2 idle range** is the temperature above which the stage 2 fan operates at **Stage 2 idle speed** and the inlet opens to its next position setting (parameter 17).

(8) **Stage 2 set point** is the temperature above which the stage 2 fan speed increases toward its maximum and the inlet opens proportionally.

(9) **Stage 2 differential** is the temperature at which the stage 2 fan reaches full speed and the inlet reaches its next position setting (parameter 18).

(10) **Stage 3 set point** is the temperature above which the stage 3 fan is on and the inlet opens to its next position setting (parameter 19).

(11) **Stage 4 set point** is the temperature above which the stage 4 fan is on and the inlet opens to its next position setting (parameter 20).

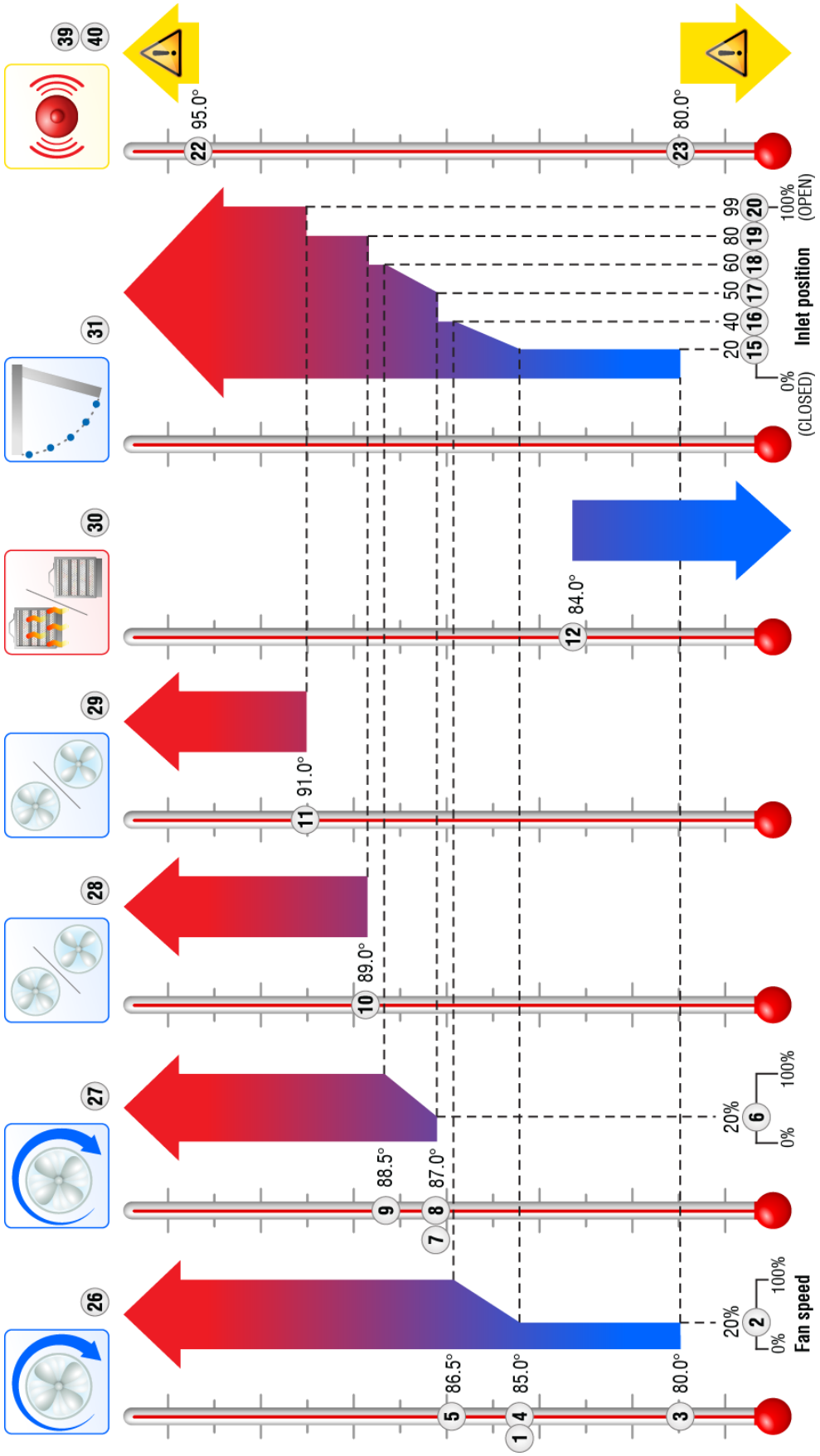
(12) **Stage 5 set point** is the temperature below which the stage 5 heater is on.

(15) **Inlet stage 1 idle range position** is the position the inlet is at when the temperature is between **Stage 1 idle range** and the **Stage 1 set point**.

(16) **Inlet stage 1 differential position** is the position the inlet is at when the temperature reaches the **Stage 1 differential**.

(17) **Inlet stage 2 idle range position** is the position the inlet is at when the temperature is between the **Stage 2 idle range** and the **Stage 2 set point**.

Parameter		Program A setting
1	Group set point (°F)	85.0
2	Stage 1 idle speed (%)	20
3	Stage 1 idle range (°F)	80.0
4	Stage 1 set point (°F)	85.0
5	Stage 1 differential (°F)	86.5
6	Stage 2 idle speed (%)	20
7	Stage 2 idle range (°F)	87.0
8	Stage 2 set point (°F)	87.0
9	Stage 2 differential (°F)	88.5
10	Stage 3 set point (°F)	89.0
11	Stage 4 set point (°F)	91.0
12	Stage 5 set point (°F)	84.0
13 and 14 are not used in the example.		
15	Inlet stage 1 idle range position (%)	20
16	Inlet stage 1 differential position (%)	40
17	Inlet stage 2 idle range position (%)	50
18	Inlet stage 2 differential position (%)	60
19	Inlet stage 3 set point position (%)	80
20	Inlet stage 4 set point position (%)	99
21 is not used in the example.		
22	High temperature alarm (°F)	95.0
23	Low temperature alarm (°F)	80.0
24 and 25 are not relevant in the example.		
26	Stage 1 configuration	CL 1
27	Stage 2 configuration	CL 1
28	Stage 3 configuration	COOL
29	Stage 4 configuration	COOL
30	Stage 5 configuration	HEAT
31	Actuator configuration	ON
32 to 38 are not relevant in the example.		
39	High temperature enable	YES
40	Low temperature enable	YES


39
40
95.0°
22
80.0°
23
99
80
60
50
40
20
20
19
18
17
16
15
100%
(OPEN)
Inlet position
0%
(CLOSED)
31
30
84.0°
12
29
91.0°
11
28
89.0°
10
27
88.5°
9
87.0°
8
7
20%
6
100%
0%
26
86.5°
5
85.0°
4
1
80.0°
3
20%
2
100%
0%
Fan speed

(18) **Inlet stage 2 differential position** is the position the inlet is at when the temperature reaches the Stage 2 differential.

(19) **Inlet stage 3 set point position** is the position the inlet is at when the temperature reaches the Stage 3 set point.

If a stage is configured as *heat*, the PEC does not use the inlet position setting for that stage.

(20) **Inlet stage 4 set point position** is the position the inlet is at when the temperature reaches the Stage 4 set point.

(22) **High temperature alarm** is the temperature equal to or above which the PEC signals a high temperature alarm.

(23) **Low temperature alarm** is the temperature equal to or below which the PEC signals a low temperature alarm.

(26) **Stage 1 configuration** in the example and factory defaults, stage 1 is configured as *CL 1*.

(27) **Stage 2 configuration** in the example and factory defaults, stage 2 is configured as *CL 1*.

(28) **Stage 3 configuration** in the example and factory defaults, stage 3 is configured as *COOL*.

(29) **Stage 4 configuration** in the example and factory defaults, stage 4 is configured as *COOL*.

(30) **Stage 5 configuration** in the example and factory defaults, stage 5 is configured as *HEAT*.

(31) **Actuator configuration** in the example and factory defaults, the actuator is configured as *ON*.

(39) **High temperature enable** in the example and factory defaults, the high temperature alarm is enabled.

(40) **Low temperature enable** in the example and factory defaults, the low temperature alarm is enabled.

Programming the parameters

Programming the parameters explains parameters 1 to 23 and how to program them. For information about parameter 0, read **Selecting the operating program** on page 44.

Programming the group set point, parameter 1

The group set point is the target or desired temperature for the room or zone. It is also the temperature tracked by the individual stages. The individual set points for each variable and relay stage will be adjusted relative to the group set point for that zone. For example, if you lower the group set point by 5 degrees, the set points for the variable and relay stages will also be lowered by 5 degrees.

Make sure you set the group set point before setting the individual set points.

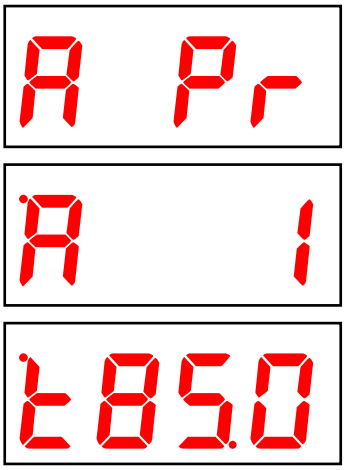
For a more-detailed description of how all settings work together, read **Understanding how the PEC operates** on page 29.

Use temperature override to test your high and low temperature alarms instead of adjusting the group set point. In temperature override mode, the alarm relay and status LEDs both operate as if they were in a real alarm situation. For more information, read **Using temperature override mode** on page 47.

The examples in the procedure below use program A, which displays as A Pr. For reference, program B displays as b Pr, program C displays as C Pr, and so on.

To program the group set point

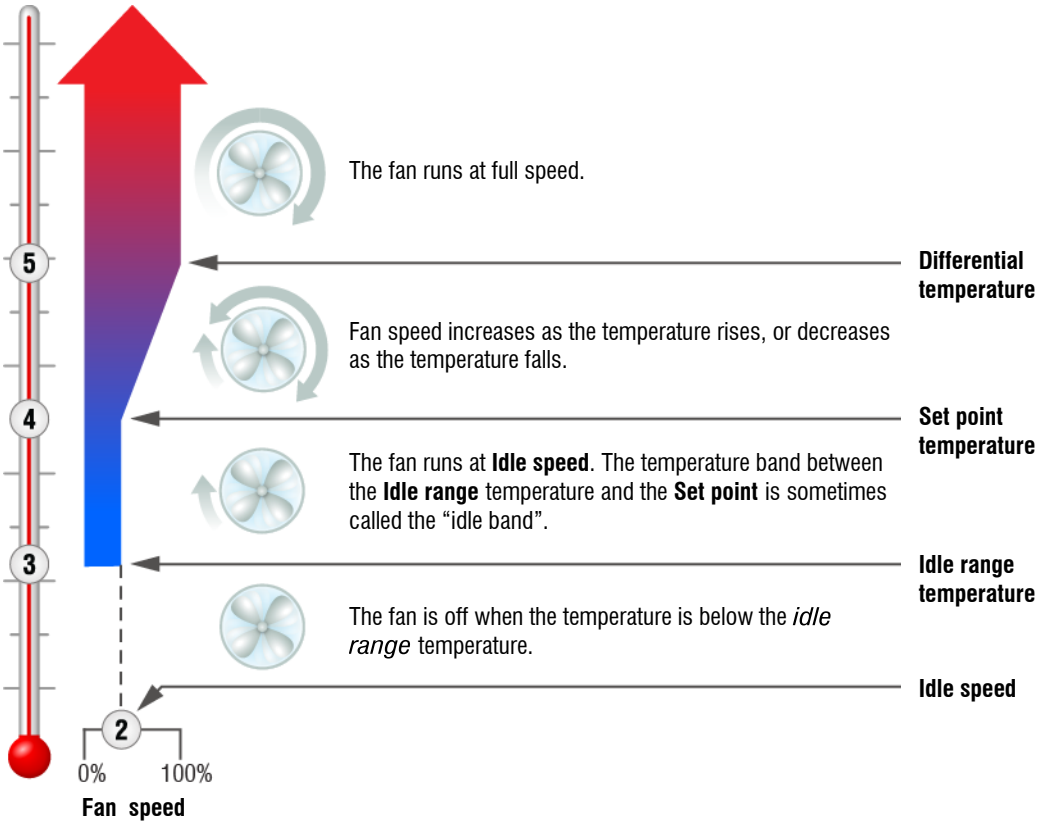
1. Press **Program** until the program you want to adjust displays, for example A Pr for program A.
2. Press **Select**.
   The display shows A 0, the first item in the Program settings menu.
3. Press **Up** until A 1 displays and then press **Select**.
   The display shows the current setting.
4. Press **Up** or **Down** to adjust the setting and then press **Select**.
   The control returns to the Program settings menu.
5. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.



Programming variable stages, parameters 2 to 9

There are four settings to program for each variable stage. The following diagram explains how the settings work together. For a more-detailed description of how all settings work together, read **Understanding how the PEC operates** on page 29.

- When the temperature is below the **Idle range**, the fan is off.
- When the temperature reaches the **Idle range**, the fan runs at the **Idle speed**. The fan continues to run at the **Idle speed** until the temperature rises to the **Set point**.
- When the temperature is between the **Set point** and **Differential**, fan speed increases or decreases proportionally with the temperature.
- When the temperature is at or above the **Differential**, the fan runs at full speed.



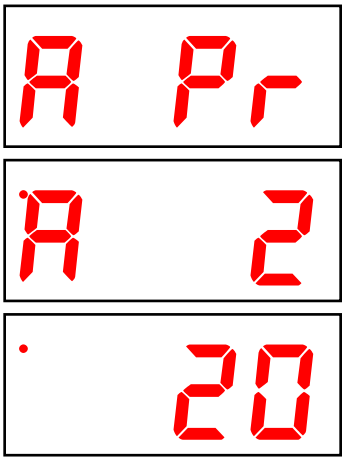
Use the **Variable stage settings worksheet** on page 67 when programming variable stages.

To program variable stage settings

The examples in the following procedure use program A and variable stage 1.

- ◇ Program A displays as A Pr, program B displays as b Pr, program C displays as C Pr, and so on.
- ◇ Variable stage 1 uses Program settings menu items 2, 3, 4, and 5. For variable stage 2, use menu items 6, 7, 8, and 9.

1. Press **Program** until the program you want to adjust displays, for example A Pr for program A.
2. Press **Select**.
   The display shows A 0, the first item in the Program settings menu.
3. Press **Up** until the setting you want to adjust displays, for example A 2 for **Stage 1 idle speed** and then press **Select**.
   The display shows the current setting.
4. Press **Up** or **Down** to adjust the setting and then press **Select**.
   The control returns to the Program settings menu.
5. Repeat steps 3 to 4 for each setting you want to adjust.
6. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.



Programming relay stages, parameters 10 to 14

There are two types of heating and cooling stage setups: *normal* and *proportional*. Normal is available for stages 3 to 5. Proportional is available only for stage 5.

For a detailed description of how normal settings work together with all others, read **Understanding how the PEC operates** on page 29.

How proportional control works (stage 5 only)

Proportional heating

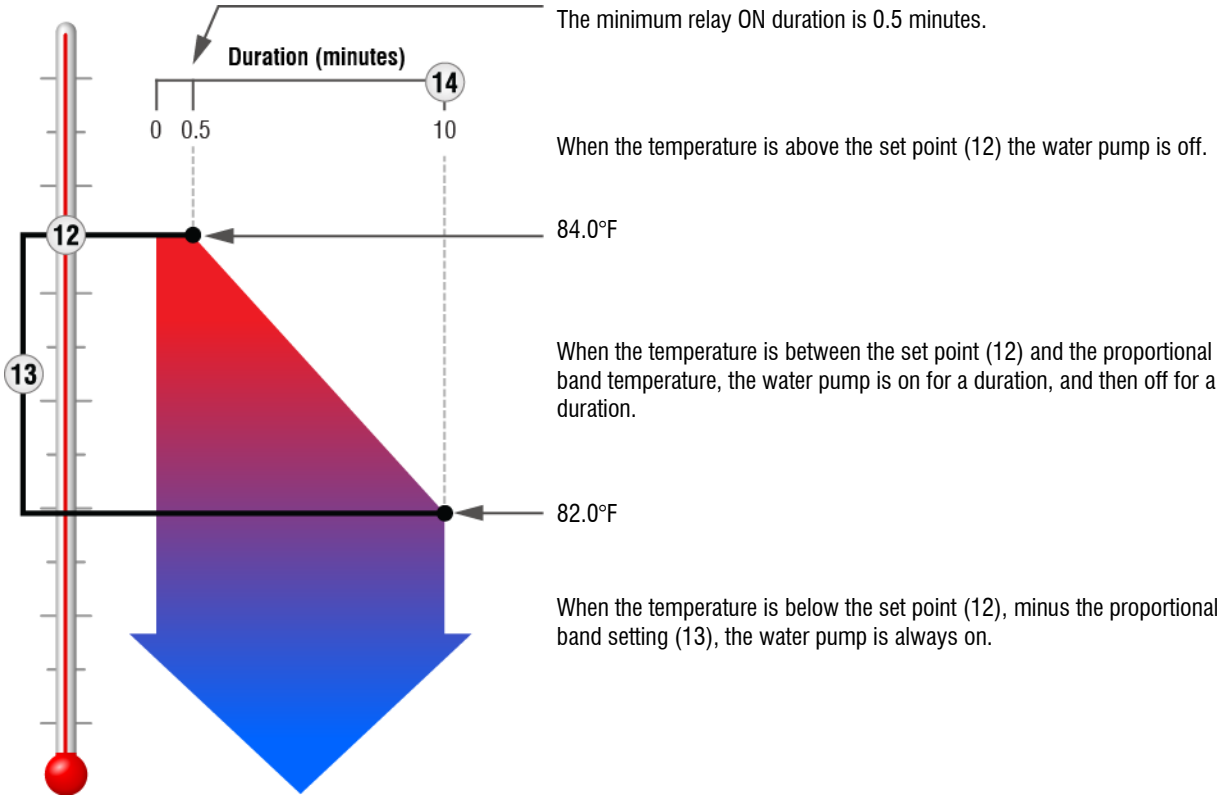
When configured for proportional heating, the relay controls a pump or valve and operates as a proportional cycle timer. Typical use for proportional heating is in-floor heating using water pipes, which is often in livestock buildings.

The following example uses the default settings for **Program A**.

- Parameter 12, **Stage 5 set point** = 84.0°F
- Parameter 13, **Stage 5 P-band temperature** = 2.0°F
- Parameter 14, **Stage 5 P-band interval** = 10 minutes

10 minutes ÷ 2.0 = 5 minutes change per degree, therefore:

- At 84.0: 0.5 min on (this is the minimum time regardless of interval parameter), 9.5 min off
- At 83.5: 2.5 min on, 7.5 min off
- At 83.0: 5 min on, 5 min off
- At 82.5: 7.5 min on, 2.5 min off
- At 82.0: 10 min on, 0 min off (always on)



Proportional cooling

When configured for proportional cooling, the relay controls a water pump or sprinkler solenoid and operates as a proportional cycle timer. The relay switches on for a portion of the cycle/interval and off for the remainder. The duration the relay is on depends on the temperature. Proportional cooling allows you to control temperatures more effectively and efficiently.

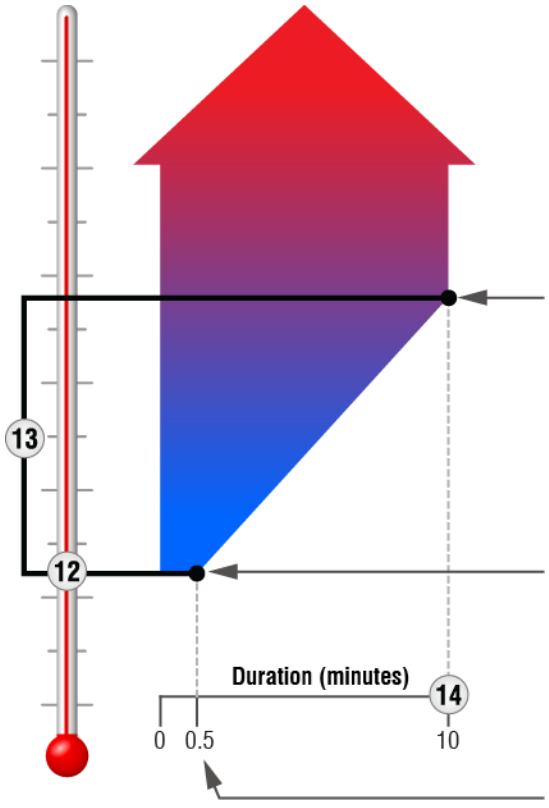
Typical use for proportional cooling is soaking or direct evaporative cooling, which is often used in hog and dairy operations.

The following example uses the default settings for **Program A**.

- Parameter 12, **Stage 5 set point** = 84.0°F
- Parameter 13, **Stage 5 P-band temperature** = 2.0°F
- Parameter 14, **Stage 5 P-band interval** = 10 minutes

10 minutes ÷ 2.0 = 5 minutes change per degree, therefore:

- At 84.0: 0.5 min on (this is the minimum time regardless of interval parameter), 9.5 min off
- At 84.5: 2.5 min on, 7.5 min off
- At 85.0: 5 min on, 5 min off
- At 85.5: 7.5 min on, 2.5 min off
- At 86.0: 10 min on, 0 min off (always on)



When the temperature is above the set point (12), plus the proportional band setting (13), the water pump is always on.

86.0°F

When the temperature is between the set point (12) and the proportional band temperature, the water pump is on for a duration, and then off for a duration.

84.0°F

When the temperature is below the set point (12) the water pump is off.

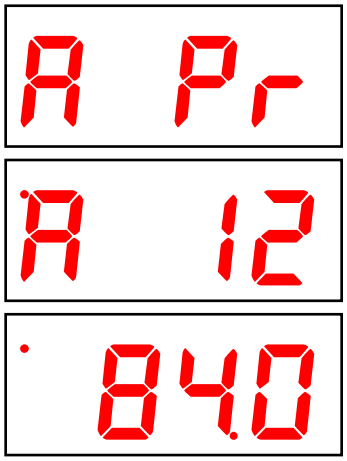
The minimum relay ON duration is 0.5 minutes.

To program proportional band settings

NOTE

The examples in the following procedure use program A. Program A displays as A Pr, program B displays as b Pr, program C displays as C Pr, and so on.

1. Press **Program** until the program you want to adjust displays, for example A Pr for program A.
2. Press **Select**.
   The display shows A 0, the first item in the Program settings menu.
3. Press **Up** or **Down** until the setting you want to adjust displays, for example A 12 for **Stage 5 set point** and then press **Select**.
   The display shows the current setting.
4. Press **Up** or **Down** to adjust the setting and then press **Select**.
   The control returns to the Program settings menu.
5. Repeat steps 3 to 4 for each setting you want to adjust.
6. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.

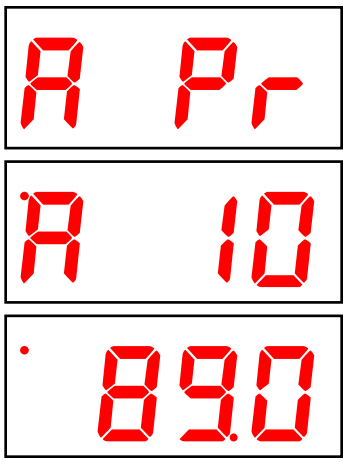


To program stage settings (no proportional band)

The examples in the following procedure use program A and stage 3.

- ◇ Program A displays as A Pr, program B displays as b Pr, program C displays as C Pr, and so on.
- ◇ Stage 3 uses Program settings menu item 10. For stage 4, use menu item 11. For stage 5, use menu item 12.

1. Press **Program** until the program you want to adjust displays, for example A Pr for program A.
2. Press **Select**.
   The display shows A 0, the first item in the Program settings menu.
3. Press **Up** or **Down** until the setting you want to adjust displays, for example A 10 for **Stage 3 set point** and then press **Select**.
   The display shows the current setting.
4. Press **Up** or **Down** to adjust the setting and then press **Select**.
   The control returns to the Program settings menu.
5. Repeat steps 3 to 4 for each setting you want to adjust.
6. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.



Programming inlet actuator, parameters 15 to 21

Before programming the inlet actuator, make sure you have calibrated it. For more information, read **Calibrating** on page 27.

(15) **Inlet stage 1 idle range position** is the position the inlet is at when the temperature is between **Stage 1 idle range** (parameter 3) and the **Stage 1 set point**, parameter 4.

(16) **Inlet stage 1 differential position** is the position the inlet is at when the temperature reaches the **Stage 1 differential** (parameter 5).

(17) **Inlet stage 2 idle range position** is the position the inlet is at when the temperature is between the **Stage 2 idle range** (parameter 7) and the **Stage 2 set point**, parameter 8.

(18) **Inlet stage 2 differential position** is the position the inlet is at when the temperature reaches the **Stage 2 differential** (parameter 9).

(19) **Inlet stage 3 set point position** is the position the inlet is at when the temperature reaches the **Stage 3 set point**, (parameter 10).

(20) **Inlet stage 4 set point position** is the position the inlet is at when the temperature reaches the **Stage 4 set point**, (parameter 11).

(21) **Inlet stage 5 set point position** is the position the inlet is at when the temperature reaches the **Stage 5 set point**, (parameter 12).

- ◇ The PEC does not use the inlet position setting for HEAT or PROPORTIONAL stages.
- ◇ For a more-detailed description of how all settings work together, read **Understanding how the PEC operates** on page 29.

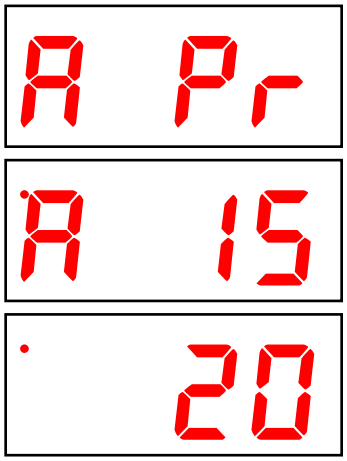
- ◇ Use the **Actuator settings worksheet** on page 68 when setting up actuators.
- ◇ For winter months when the actuator should remain in a specific position, go to **Actuator configuration** (parameter 31) and switch off the actuator. Then, go to **Stage override** (parameter 43) so you can manually control the actuator. If you do not switch off the actuator before going into stage override, the actuator will reposition when you leave the stage override display.

To program actuator settings

The examples in the following procedure use program A.

- ◇ Program A displays as A Pr, program B displays as b Pr, program C displays as C Pr, and so on.

1. Press **Program** until the program you want to adjust displays, for example A Pr for program A.
2. Press **Select**.
   The display shows A 0, the first item in the Program settings menu.
3. Press **Down** until the setting you want to adjust displays, for example A 15 for **Inlet stage 1 idle range position** and then press **Select**.
   The display shows the current setting.
4. Press **Up** or **Down** to adjust the setting and then press **Select**.
   The control returns to the Program settings menu.
5. Repeat steps 3 to 4 for each setting you want to adjust.
6. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.



Programming alarm settings, parameters 22 and 23

In addition to a power-failure alarm, there are four other alarms. For a more-detailed description of how all settings work together, read **Understanding how the PEC operates** on page 29.

- High temperature
- Low temperature
- Probe damage
- Actuator jam

The alarm settings for your PEC determine which alarm conditions are enabled, which are disabled, and their settings. All these work together to determine how and when the alarm relay activates (in other words, signals an alarm condition).

The alarm relay activates if an enabled alarm condition is present for longer than the minimum duration of one minute. The one-minute minimum duration prevents alarms from occurring when the temperature rises or drops for just a few seconds.

For example, the high temperature alarm setting is 85.0°F. If the temperature rises to 86 degrees, but drops below 85 degrees 30 seconds later, the alarm relay does not activate. If the temperature rises to 86 degrees and stays there for more than 1 minute, the alarm relay activates. The alarm relay remains activated until the temperature drops below the alarm setting.

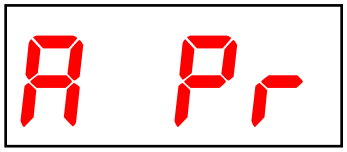
The exceptions to the one-minute minimum are the **actuator jam** and **power fail** alarms. The actuator jam alarm activates 20 seconds after the PEC detects it and the power fail alarm automatically triggers the relay on a loss of power.

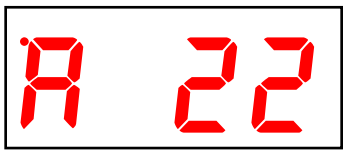
- ◇ Phason does not recommend disabling the actuator jam alarm. With the actuator jam alarm enabled, if the potentiometer feedback wires are damaged, the PEC stops the positioning process if feedback is not detected within 20 seconds.
- ◇ With the actuator jam alarm *not enabled*, if the potentiometer feedback wires are damaged, the PEC cannot read the feedback and tries to position the actuator completely open or completely closed.

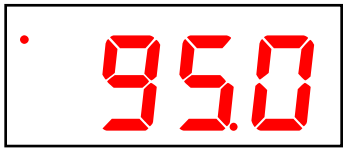
- ◇ When an alarm occurs, the **Alarm** LED switches on and the alarm message displays. For more information about acknowledging and responding to alarms, read **Acknowledging alarms** on page 44.
- ◇ Use temperature override to test your high and low temperature alarms instead of adjusting the group set point. In temperature override mode, the alarm relay and status LEDs both operate as if they were in a real alarm situation. For more information, read **Using temperature override mode** on page 47.
- ◇ Use the **Alarm settings worksheet** on page 69 when programming alarms.

To program high and low temperature alarm settings

The examples in the following procedure use program A. Program A displays as A Pr, program B displays as b Pr, program C displays as C Pr, and so on.







1. Press **Program** until the program you want to adjust displays, for example A Pr for program A.
2. Press **Select**.
   The display shows A 0, the first item in the Program settings menu.
3. Press **Down** until the setting you want to adjust displays, for example A 22 for **High temperature alarm** and then press **Select**.
   The display shows the current setting.
4. Press **Up** or **Down** to adjust the setting and then press **Select**.
   The control returns to the Program settings menu.
5. Repeat steps 3 to 4 for each setting you want to adjust.
6. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.

To enable or disable alarms

- ◇ When you enable or disable an alarm, you do it for all programs and stages.
- ◇ Phason does not recommend disabling the actuator jam alarm. With the actuator jam alarm enabled, if the potentiometer feedback wires are damaged, the PEC stops the positioning process if feedback is not detected within 20 seconds.
- ◇ With the actuator jam alarm *not enabled*, if the potentiometer feedback wires are damaged, the PEC cannot read the feedback and tries to position the actuator completely open or completely closed.

1. Press **Program** until ALEn displays and then press **Select**.
   The display shows 39, the first item in the Alarm enable menu.
2. To enable or disable the **High temperature alarm**, press **Select**.
   The display shows the current configuration.

   Press **Up** or **Down** to toggle between no (not enabled) and YES (enabled), and then press **Select**.
   The control returns to the Alarm enable menu.
3. To enable or disable the **Low temperature alarm**, press **Up** or **Down** until 40 displays and then press **Select**.
   The display shows the current configuration.

   Press **Up** or **Down** to toggle between no and YES and then press **Select**.
   The control returns to the Alarm enable menu.
4. To enable or disable the **Probe damage alarm**, press **Up** or **Down** until 41 displays and then press **Select**.
   The display shows the current configuration.

   Press **Up** or **Down** to toggle between no and YES, and then press **Select**.
   The control returns to the Alarm enable menu.
5. To enable or disable the **Actuator jam alarm**, press **Up** or **Down** until 42 displays and then press **Select**.
   The display shows the current configuration.

   Press **Up** or **Down** to toggle between no and YES, and then press **Select**.
   The control returns to the Alarm enable menu.
6. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.

Chapter 5: Monitoring and maintaining your PEC

Chapter 5 explains how to monitor the PEC after you have installed, configured, and programmed it. Topics in chapter 5 include:

Monitoring your PEC

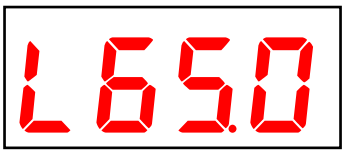
Your PEC displays temperature, alarm, and status information. Monitoring the control regularly gives you a better idea of what is going on in your facility. When in normal operation, the display shows the ambient temperature.

Displaying the minimum and maximum temperatures

The PEC logs the minimum and maximum temperatures. You can view and reset the temperatures.

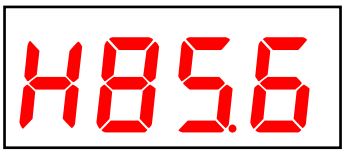
To view the minimum temperature

At the main display, press **Down**.
The display shows the lowest temperature since being reset.



To view the maximum temperature

At the main display, press **Up**.
The display shows the highest temperature since being reset.



To reset the minimum and maximum temperatures

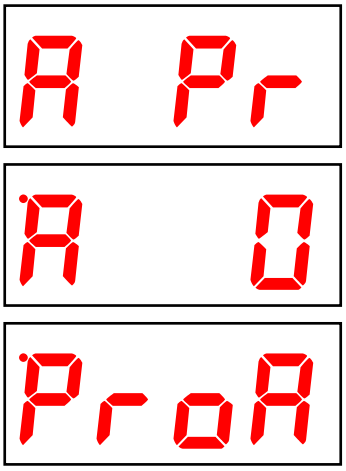
At the main display, press **Program** and **Down**.
The control resets the minimum and maximum temperatures.

Selecting the operating program

The PEC has seven configurable programs, *A*, *B*, *C*, D, E, F, and G. If you are running a livestock or poultry operation, you might use different programs for different stages of development. Another option is to use different programs for different seasons.

The default operating program is program A. Any of the programs can be the operating program. For a list of the factory defaults for the programs, see the table starting on page 63.

To select the operating program



1. Press **Program** until one of the four Program settings menus displays, for example A Pr for program A. *At this point, it does not matter which program menu you select.*
2. Press **Select**.
   The display shows A 0, the first item in the Program settings menu.
3. Press **Select**.
   The display shows the current operating program.
4. Press **Up** or **Down** to change the operating program and then press **Select**.
   The control returns to the Program settings menu.
5. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.

Acknowledging alarms

The alarm relay activates if an enabled alarm condition is present for longer than the minimum duration of one minute. The one-minute minimum duration prevents alarms from occurring when the temperature rises or drops for just a few seconds.

The exceptions to the 1-minute minimum are the actuator jam and power fail alarms. The actuator jam alarm activates 20 seconds after the PEC detects it. The power fail alarm automatically triggers the relay on a loss of power.

When an alarm occurs, the alarm relay activates, the LED for **ALARM** switches on, and the alarm message displays. If there is more than one message, after acknowledging the first alarm, the next one displays.

For example, if you have a high temperature and an actuator jam alarm, the display shows H-AL. After acknowledging the high temperature alarm, the display shows Act J. When all alarms have been acknowledged, the display shows the temperature.

Actuator jam alarm

When an act jam alarm occurs, go to **Actuator position display** (parameter 45). The PEC will try to reposition the actuator. If the number on the display does not change but the actuator moves, there is a problem with the feedback potentiometer or its wires.

To prevent further alarms, go to **Actuator configuration** (parameter 31) and switch off the actuator. If the actuator is not jammed, go to **Stage override** (parameter 43) to control the actuator manually.

- ◇ Phason does not recommend disabling the actuator jam alarm. With the actuator jam alarm enabled, if the potentiometer feedback wires are damaged, the PEC stops the positioning process if feedback is not detected within 20 seconds.
- ◇ With the actuator jam alarm *not enabled*, if the potentiometer feedback wires are damaged, the PEC cannot read the feedback and tries to position the actuator completely open or completely closed.

To acknowledge alarms

Press **Select**.
If there was only one alarm message, the PEC clears the message and returns to the main display. If there are additional alarm messages, the PEC displays the next message.

- ◇ Acknowledging alarms clears the alarm message; it does not deactivate the alarm relay or LED. To deactivate the alarm relay, resolve the problem causing the alarm condition.
- ◇ If you acknowledge the alarm, but do not resolve the problem causing the alarm condition, the alarm message displays again after five minutes without any key presses.
- ◇ If the condition causing the alarm returns to normal (for example, the temperature drops below the high alarm setting), the alarm relay and LED deactivate, but the alarm message remains.

For a list of alarm messages, their descriptions, and possible resolutions, read **Alarm and error messages** on page 59.

Testing settings and equipment

The PEC has three test utilities.

- Stage override mode
- Temperature override mode
- Actuator position display

Using stage override mode

Stage override mode is for individually testing the installation and equipment connected to the PEC. When you enter stage override mode, all stages switch off. You can then change the output of the stages: 0 to 100% for variable stages, OFF or ON for relay stages and the alarm relay.

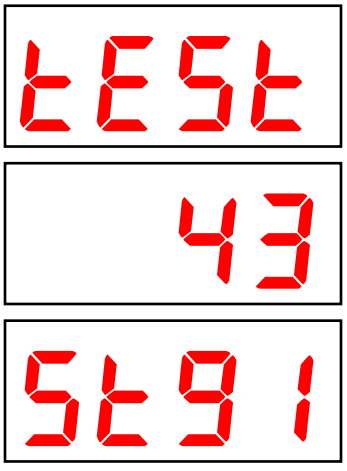
For the inlet, there are two options: *open* and *close*. When you select open, the PEC displays the position and then opens the inlet until you press **Select**. When you select close, the PEC displays the position and then closes the inlet until you press **Select**.

All equipment remains at the state you set it until you leave stage override mode, then it returns to normal, programmed operation. For example, if stage 3 is a cooling stage and you switch it ON, it remains on until you leave stage override mode.

NOTE

- ◇ When the PEC is in stage override mode, it does not operate the equipment according to the measured temperature.
- ◇ The PEC does not exit test mode on its own. When you are finished testing, press **Back** until the control exits test mode.

To use stage override mode



1. Press **Program** until tESt displays and then press **Select**. The display shows 43, the first item in the Test menu.
2. Press **Select**. The display shows St9 1, the first item in the Stage override submenu.
3. Press **Up** or **Down** until the stage you want to test displays, for example ALA for the alarm relay and then press **Select**. The display shows the current setting.
4. Press **Up** or **Down** to adjust the setting and then press **Select**. The control returns to the Stage override menu.

For the inlet, you do not need to press **Up** or **Down**. When you select oPEn, the PEC displays the position and then opens the inlet until you press **Select**. When you select cLoS, the PEC displays the position and then closes the inlet until you press **Select**.

5. Repeat steps 3 to 4 for each stage you want to test.
6. To return to the Main menu, press **Back** twice. To return to the Main display, press **Back** three times.

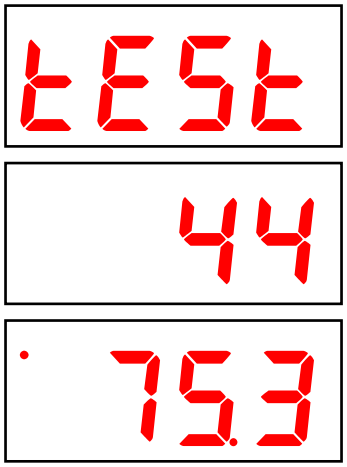
Using temperature override mode

Temperature override mode is for testing the PEC configuration and settings. It allows you to test the settings by simulating the temperature. Instead of adjusting the output of a variable stage or state of a relay, you adjust the "test temperature".

As you increase or decrease the test temperature, all stages and relays operate according to their programmed settings and the test temperature, giving you an idea of how your system performs over a full range of temperatures.

- ◇ When the PEC is in temperature override mode, it operates according to the test temperature, not according to the temperature measured by the probe.
- ◇ The PEC does not exit test mode automatically. When you are finished testing, press **Back** until the control exits test mode.

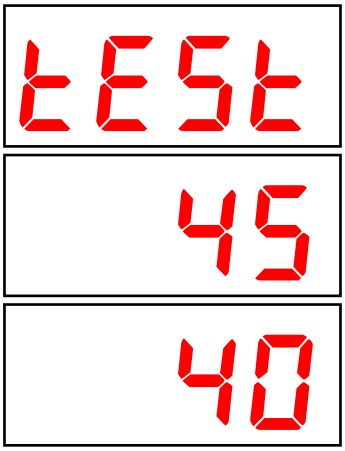
To use temperature override mode



1. Press **Program** until tESt displays and then press **Select**. The display shows 43, the first item in the Test menu.
2. Press **Up** or **Down** until 44 displays and then press **Select**. The display shows the current temperature, which is now the test temperature.
3. Press **Up** or **Down** to adjust the test temperature The control responds to the changes in the test temperature.
4. To return to the Main menu, press **Back** twice. To return to the Main display, press **Back** three times.

Using the actuator position display

The actuator position display shows the position of the actuator according to the feedback received from the potentiometer. If the actuator has not been calibrated, the display shows UCAL.



To display the actuator position

1. Press **Program** until tESt displays and then press **Select**. The display shows 43, the first item in the Test menu.
2. Press **Up** or **Down** until 45 displays and then press **Select**. The display shows the current actuator position.
3. To return to the Main menu, press **Back** twice. To return to the Main display, press **Back** three times.

Servicing and maintaining your PEC

Topics in this section include:

Enabling and disabling ventilation

Normally, ventilation is *enabled* and the variable and relay stages function according to the program settings. This is the default setting and we refer to it as *normal operation*.

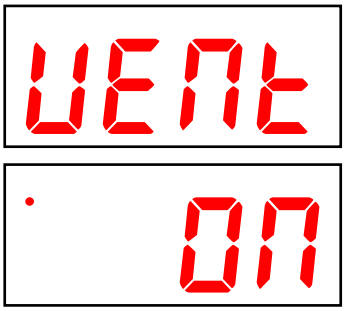
Occasionally, you might want to disable the ventilation. For example, if a room is vacant, you might want to disable ventilation to conserve energy.

When ventilation is **disabled**:

- Variable stages are off
- Cooling stages (relay) are off
- Actuators close
- Heating stages function normally
- The display alternates between the current temperature and UoFF
- Alarms do not display

DO NOT use the disable ventilation function to shut down fans while working on wiring. When working on any wiring, switch OFF the power at the source.

To enable or disable ventilation

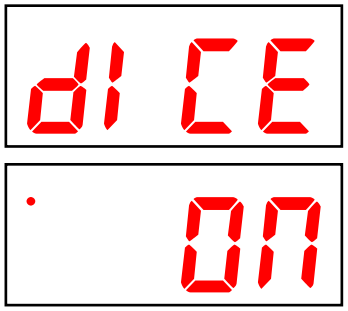


1. Press **Program** until UENt displays and then press **Select**.
   The display shows the current setting.
2. Press **Up** or **Down** to toggle between OFF and On and then press **Select**.
   The control returns to the Main menu.
3. To return to the Main display, press **Back**.

Enabling and disabling actuator deicing

Actuator deicing opens the actuator by 5% when the actuator has not moved for two hours. After the actuator moves the 5%, it moves back to its proper position. The default for actuator deicing is *disabled*.

To enable or disable actuator deicing



1. Press **Program** until dI CE displays and then press **Select**.
   The display shows the current setting.
2. Press **Up** or **Down** to toggle between OFF and On and then press **Select**.
   The control returns to the Main menu.
3. To return to the Main display, press **Back**.

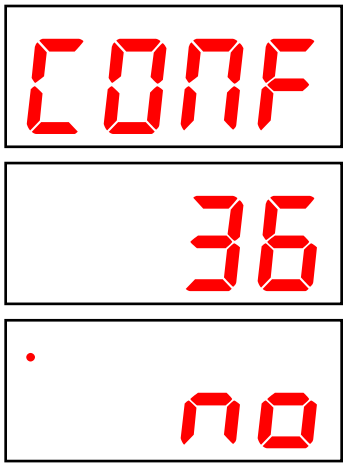
Restoring the factory defaults

When your PEC leaves the factory, it comes with default settings and configuration. When you program your PEC, you change its configuration and settings. Resetting your PEC erases all the configuration and settings you programmed and restores them to what they were when the control left the factory.

For a list of the factory defaults, read **Appendix C: Factory defaults** on page 63.

> **Restore the factory defaults only as a last resort. It erases ALL your configuration and settings and you will have to reconfigure the control.**
>
> If you restore your PEC to its factory defaults, disconnect the power to all loads and then reconfigure the control before restoring power to the loads.

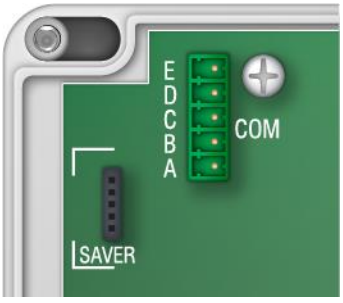
To restore the factory defaults



1. Press **Program** until CONF displays and then press **Select**. The display shows 24, the first item in the Configuration menu.
2. Press **Down** until 36 displays and then press **Select**.
3. Press **Up** or **Down** to change the no to YES and then press **Select**. The control restores the factory defaults. When complete, the display shows donE.
4. To return to the Configuration menu, press **Back** once. To return to the Main menu, press **Back** twice. To return to the Main display, press **Back** three times.

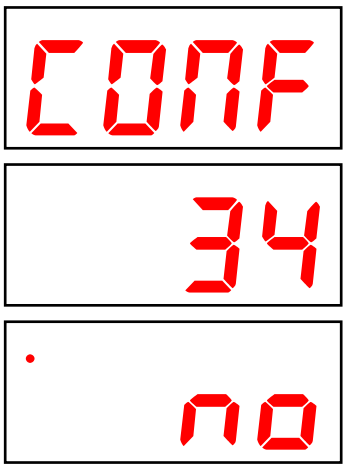
Saving and restoring settings

The PEC Saver is an innovative and easy-to-use product that allows you to store your PEC configuration and settings.



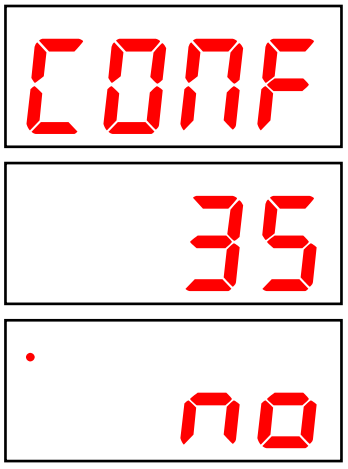
The PEC Saver stores a complete copy of all a PEC's configuration and settings. You can restore the configuration and settings any time, or even use them to set up new PECs in seconds!

To save your settings



1. Loosen the four screws in the PEC enclosure and then gently remove the cover. Make sure not to disconnect the ribbon cable.
2. Insert the PEC Saver into the connector marked SAVER on the inside top-left of the cover.
3. Press **Program** until CONF displays and then press **Select**. The display shows 24, the first item in the Configuration menu.
4. Press **Down** until 34 displays and then press **Select**.
5. Press **Up** or **Down** to change the no to YES and then press **Select**. The control saves the information to the PEC Saver. When complete, the display shows donE.
6. To return to the Configuration menu, press **Back** once. To return to the Main menu, press **Back** twice. To return to the Main display, press **Back** three times.
7. Remove the PEC Saver.
8. Replace the cover and then tighten the four screws.

To restore your settings



1. Loosen the four screws in the PEC enclosure and then gently remove the cover. Make sure not to disconnect the ribbon cable.
2. Insert the PEC Saver into the connector marked SAVER on the inside top-left of the cover.
3. Press **Program** until CONF displays and then press **Select**. The display shows 24, the first item in the Configuration menu.
4. Press **Down** until 35 displays and then press **Select**.
5. Press **Up** or **Down** to change the no to YES and then press **Select**. The control reads the information from the PEC Saver. When complete, the display shows donE.
6. To return to the Configuration menu, press **Back** once. To return to the Main menu, press **Back** twice. To return to the Main display, press **Back** three times.
7. Remove the PEC Saver.
8. Replace the cover and then tighten the four screws.

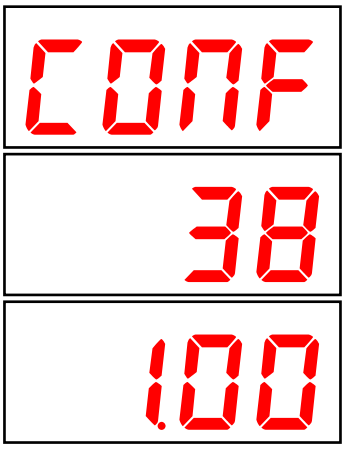
Displaying the firmware version

Firmware is similar to operating system software for a computer. Firmware contains instructions that tell the PEC how it operates. Just like computer operating systems (such as Windows™ XP) have version numbers, the firmware has a version number.

If you need to contact Phason Customer Support about your PEC, you might need to provide them with the firmware version of your control. For more information about technical support, read the back cover of the manual. The PEC displays the firmware version as a number in the format #.##.

To display the firmware version

1. Press **Program** until CONF displays and then press **Select**. The display shows 24, the first item in the Configuration menu.
2. Press **Down** until 38 displays and then press **Select**. The display shows the firmware version.
3. To return to the Configuration menu, press **Back** once. To return to the Main menu, press **Back** twice. To return to the Main display, press **Back** three times.



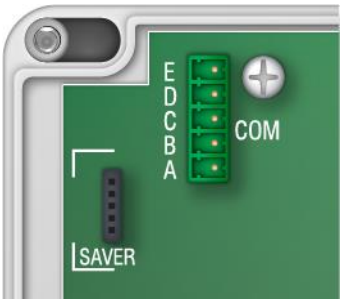
Updating the firmware

The optional PEC Updater is an innovative and easy-to-use product that allows you to upgrade your control's firmware. Phason constantly improves and adds new features to their products. With the PEC Updater, you can upgrade the firmware in your PEC as these features become available. The PEC Updater takes only seconds to use and can upgrade all the PEC controls at your site.

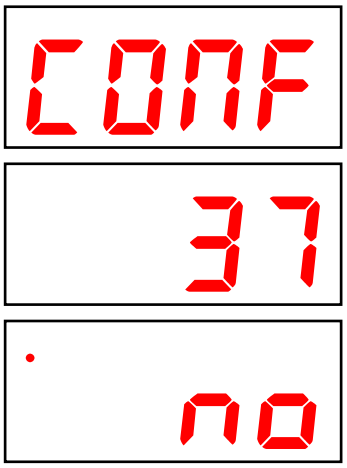
There are two methods for updating the PEC firmware: *power on* and *power off*.

- **Power on**: the power on method allows you to update the PEC firmware using the menu system, without having to switch the incoming power off and then on. If the power on method fails, use the power off method.
- **Power off**: the power off method allows you to update the PEC firmware by switching the incoming power off and then on. Use the power off method if the power on method fails.

The inside of the PEC cover is where you connect the PEC Updater. The cover label must face the right when you plug the updater into the socket.



To update the firmware using the "power on" method



1. Loosen the four screws in the PEC enclosure and then gently remove the cover. Make sure not to disconnect the ribbon cable.
2. Insert the PEC Updater into the connector marked **SAVER** on the inside top-left of the cover.
3. Press **Program** until CONF displays and then press **Select**.
   The display shows 24, the first item in the Configuration menu.
4. Press **Down** until 37 displays and then press **Select**.
5. Press **Up** or **Down** to change the no to YES and then press **Select**.
   The PEC updates its firmware. During the update, the display is blank and the control beeps.

   When the update is complete, the display shows - - - - for a couple seconds and then shows the ambient temperature.
6. Remove the PEC Updater.
7. Verify that the control functions properly.
8. Replace the cover and then tighten the four screws.

To update the firmware using the "power off" method

1. Loosen the four screws in the PEC enclosure and then gently remove the cover. Make sure not to disconnect the ribbon cable.
2. Insert the PEC Updater into the connector marked **SAVER** on the inside top-left of the cover.
3. Switch off the power to the PEC for at least five seconds.
4. Switch on the power to the PEC.
   The PEC updates its firmware. During the update, the display is blank and the control beeps.

   When the update is complete, the display shows - - - - for a couple seconds and then shows the ambient temperature.
5. Remove the PEC Updater.
6. Verify that the control functions properly.
7. Replace the cover and then tighten the four screws.

Replacement kits and optional accessories

Replacement kits and several optional, convenient accessories are available to enhance and extend your PEC.

Parts and kits

Display kit, model K310063

Should the display of your PEC control fail, you can replace it with a kit. After replacing the display, you will need to reconfigure and program control.

Control kits, model KPEC-B

Should the bottom circuit board of your PEC control fail, you can replace it with a kit.

PEC Saver

The PEC Saver is an innovative and easy-to-use product that stores a complete copy of a PEC's configuration and settings. You can restore the configuration and settings any time, or even use them to set up new PECs in seconds!

Features

- Quick and easy to use
- Portable, reliable, and safe storage of configuration and settings
- Transferable to any PEC that has the same firmware version
- Compact design that fits in a pocket
- Limited warranty (90 days)

PEC Updater

The optional PEC Updater is an innovative and easy-to-use product that updates a PEC's firmware.

Phason constantly improves and adds new features to their products. With the PEC Updater, you can update the firmware in your PEC as these features become available. The PEC Updater takes only seconds to use and can upgrade all the PEC controls at your site.

Features

- Quick and easy to use
- Compact design that fits in a pocket
- Limited warranty (90 days)

Power contactors

Phason's 240-volt power contactors are heavy-duty relays that increase the load handling capability of control relays. Power contactors are ideal for secondary ventilation fans and electric heaters.

- **Power contactor relay** (PC-240): includes power contactor relay and mounting hardware for easy mounting in an enclosure.
- **Power contactor kit** (122-1): includes power contactor relay, on-off-auto switch and label, snubber filter (reduces electrical noise), and mounting hardware for easy mounting in an enclosure.
- **Power contactor unit** (129-0): includes two power contactor relays, two on-off-auto switches, and two snubber filters, mounted in a large enclosure. The enclosure has room for two additional contactor relays or kits.

Temperature probes and extension cable

Temperature probes monitor temperatures ranging from –49 to 122°F (-45 to 50°C). The probes are available in 1, 6, 30, 75, or 150-foot cable lengths and can extended up to 500 feet using extension cable. Extension cable is available in 500-foot lengths.

Features

- Easy installation
- Rugged and durable design
- Weather and UV-resistant cable
- Limited warranty (90 days)

Appendixes

This section contains reference information that is useful when installing, configuring, setting up, or troubleshooting your PEC.

Appendix A: Glossary

actuator deicing	Actuator deicing opens the actuator by 5% when the actuator has not moved for two hours. After the actuator moves the 5%, it moves back to its proper position.
control elements	Devices connected to your PEC, such as fans, heaters, actuators, and so on.
differential	The temperature setting above which a variable stage's fan runs at full speed. For more information, read **Programming variable stages, parameters 2 to 9** on page 33.
firmware	The internal program instructions of your PEC. You can update the firmware version of your PEC to the latest version using a PEC Updater. For more information, read **Updating the firmware** on page 52.
group set point	The desired temperature for the room. For more information, read **Programming the group set point, parameter 1** on page 33.

hysteresis

The number of degrees above the set point that a heating stage or relay switches off, and the number of degrees below the set point that a cooling stage or relay switches off.

For example, a household thermostat might switch on a furnace at 68 °F when the house is cooling down, but switch it off at 72 °F when the house is warming up. The difference between these two values is the hysteresis.

For more information, read **Configuring hysteresis, parameter 33** on page 24.

idle range

The temperature setting below which a variable stage's fan is off and the inlet is closed. When the temperature is between the idle range and set point, the fan operates at idle speed and the inlet is open the corresponding amount.

For more information, read **Programming variable stages, parameters 2 to 9** on page 33.

idle speed

The percentage of full power at which a variable speed fan operates for minimum ventilation.

For more information, read **Programming variable stages, parameters 2 to 9** on page 33.

Inlet stage 1 idle range position

The position the inlet is at when the temperature is between stage 1 idle range and the stage 1 set point. Also the position for minimum ventilation.

For more information, read **Programming inlet actuator, parameters 15 to 21** on page 39.

Inlet stage 1/2 differential position

The position the inlet is at when the temperature reaches the stage 1 or 2 differential.

For more information, read **Programming inlet actuator, parameters 15 to 21** on page 39.

Inlet stage 2 idle range position

The position the inlet is at when the temperature is between the *stage 2 idle range* and the *stage 2 set point*.

For more information, read **Programming inlet actuator, parameters 15 to 21** on page 39.

Inlet stage 3/4/5 set point position

The position the inlet is at when the temperature reaches the stage 3/4/5 set point.

For more information, read **Programming inlet actuator, parameters 15 to 21** on page 39.

minimum duration

The minimum amount of time an alarm condition must be present before the PEC signals an alarm. The minimum duration (one minute) prevents alarms from activating when the temperature rises or drops for just a few seconds.

For more information, read **Programming alarm settings, parameters 22 and 23** on page 40.

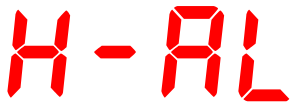
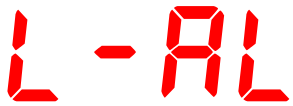
minimum idle	See *idle speed*.
minimum position	See *Inlet stage 1 idle range position*.
set point	For variable stages, the temperature above which fan speed increases toward its maximum and the inlet opens proportionally. For more information, read **Programming variable stages, parameters 2 to 9** on page 33. For relay stages, the temperature at which the stage switches between the OFF and ON state. For more information, read **Programming relay stages, parameters 10 to 14** on page 26.
spikes	Short-term deviations or changes from a desired voltage level or signal. These deviations can cause damage to electronic devices, or cause them to malfunction. Spikes are often caused by sudden excess power, also known as 'power surges', or by drops in power, knows as 'brown outs'. For more information, read **Understanding power surges and surge suppression** on page 9.
terminal block	The part of your PEC where you connect the wires for incoming power, control elements, and so on. For more information, read **Proportional** Environment Control layout on page 12.

Appendix B: Troubleshooting

- If you see an alarm message and are not sure what it means, look it up in the **Alarm and error messages** table on page 59 and then follow the instructions for resolving the alarm condition.
- If you are having a problem using your PEC, see if the problem is described in the **Troubleshooting** table on page 60 and then follow the directions for correcting the problem.

Alarm and error messages

The following table lists the alarm and error messages, the possible causes, and their possible solutions. If you see a message and are not sure what it means, look it up in the table and then follow the instructions for resolving the condition.

Alarm message	Possible cause	Possible solution
 High temperature alarm	The temperature has gone above the high temperature alarm point.	◇ Try to lower the temperature by turning heaters down or off, or by increasing or turning on cooling elements (such as fans or misters), or by a combination of both. ◇ Check the temperature probes. ◇ Check to see if a fan has failed. ◇ Check the alarm settings. For more information, read **Programming alarm settings** on page 40.
 Low temperature alarm	The temperature has gone below the low temperature alarm point.	◇ Try to raise the temperature by turning heaters up or on, or by decreasing or turning off cooling elements (such as fans or misters), or by a combination of both. ◇ Check the temperature probes. ◇ Check to see if a heater has failed. ◇ Check the alarm settings. For more information, read **Programming alarm settings** on page 40.
 Probe damage alarm	A temperature probe is damaged or disconnected.	◇ Check the wire between the control and the probe. Any wire damage can cause the alarm. ◇ Replace or reconnect the temperature probe. The control should recover automatically.
 Actuator jam alarm	The control is attempting to open or close an inlet or other element operated by an actuator, and has not received the correct response from the positioning motor.	◇ After acknowledging the alarm, go to parameter 45, which resets the alarm and tries to reposition the actuator. ◇ If the position number does not change but the actuator moves, there is a problem with the potentiometer wires. Turn off the actuator (parameter 31) and then follow the instructions in **Determining correct actuator feedback wiring** on page 62. ◇ If the actuator does not move, make sure an external manual override switch is not activated. If there is no external switch, or the switch is not the problem, the problem is with the actuator motor or its wiring. Turn off the actuator (parameter 31) and troubleshoot the actuator using parameter 43. ◇ Recalibrate the actuator. For more information, read **Calibrating an actuator, parameter 32** on page 27.
 Error 1 - SAVER error	The PEC Saver is not in place when trying to save or restore settings	◇ Make sure the PEC Saver is inserted correctly and then try again.

Troubleshooting

The following table lists some problems, possible causes, and possible solutions. If you are having a problem using your PEC, see if the problem is described in the Troubleshooting table and then follow the directions for correcting the problem.

Problem	Possible cause	Possible solution
Power supply components blown out Burn marks on boards and components Motors and fans slow down or stop	Power surge, brownout, or power outage	◇ Avoid the problem in future by providing proper voltage and protection for the control.
No power and/or display	A circuit breaker at service panel is off or tripped.	◇ Reset the circuit breaker.
	Incorrect incoming power wiring	◇ Correct the wiring.
	The display board connect cable is not plugged into the control board properly.	◇ Plug in the display board cable. For more information, read **Proportional** Environment Control layout on page 12.
	The 115/230 VAC switch is in the wrong position	◇ Switch off the power, set the switch to the correct setting, and then switch on the power. For more information, read **Proportional** Environment Control layout on page 12.
Temperature does not change	The control is in temperature override mode.	◇ Exit test mode. For more information, see **Using temperature override mode** on page 47.
Display showing unusually high or low temperature	The probe is not a Phason probe.	◇ Remove the probe and then install a Phason probe.
	The extension cable connected to the temperature probe is providing a poor connection	◇ Check the extension cable connection and re-solder it if necessary.
	Damaged probe	◇ Replace the temperature probe.
Variable fan runs at maximum	Incorrect wiring	◇ Correct the wiring. For more information, read **Connecting variable-stage cooling elements** on page 16.
	The *idle speed* is too high.	◇ Decrease the *idle speed* setting. For more information, read **Programming variable stages** on page 33.
	The *differential* setting is the same as the *set point*.	◇ Adjust the *set point* to the desired temperature. For more information, read **Programming variable stages** on page 33.
	Incorrect motor curve	◇ Configure the stage to use the other motor curve. For more information, read **Configuring the stages** on page 24.

Problem	Possible cause	Possible solution
Variable fan not running	Incorrect wiring	◇ Correct the wiring. For more information, read **Connecting variable-stage cooling elements** on page 16.
	The fuse is open or blown.	◇ Check why the fuse was blown and repair any problems. Replace the fuse.
	The variable stage is configured as OFF	◇ Configure the variable stage for cooling. For more information, read **Configuring the stages** on page 24.
	The *idle speed* setting is too low.	◇ Increase the *idle speed* setting. For more information, read **Programming variable stages** on page 33.
	The *idle range* temperature setting is too high.	◇ Decrease the *idle range* temperature setting. For more information, read **Programming variable stages** on page 33.
	The temperature *set point* is above room temperature.	◇ Adjust the *set point* to the desired temperature. For more information, read **Programming variable stages** on page 33.
	There is no power to the fan.	◇ Switch on the power.
	Faulty fan/heater	◇ Replace the equipment.
	Circuit breaker open	◇ Reset the breaker.
Variable speed fan comes on, runs at full speed, and then turns off, keeps cycling.	The hysteresis is not high enough. The outside temperature is rising and falling quickly. This happens most often in the spring and fall.	◇ Adjust the hysteresis setting.
Variable speed fan responds to only a small portion of the 0 to 100% range	Incorrect motor curve	◇ Configure the stage to use the other motor curve. For more information, read **Configuring the stages** on page 24.
Relay does not switch ON the load	Incorrect wiring	◇ Correct the wiring. For more information, read the appropriate installation section.
	The stage is configured as OFF, as cool for a heater, or as heat for a fan.	◇ Configure the relay properly. For more information, read ◇ **Configuring relay stages, parameters 28 to** 30 on page 26.
	The set point is incorrect	◇ Adjust the setting. For more information, read the appropriate programming section.
	No power to the load	◇ Switch on the power.
	Faulty equipment	◇ Replace the equipment.
	Circuit breaker open	◇ Reset the breaker.
	Blown relay	◇ Solve the problem that caused the relay to blow and then replace the circuit board or use a different relay.
Relay does not switch OFF the load	The stage is configured as ON.	◇ Configure the relay properly. For more information, read ◇ **Configuring relay stages, parameters 28 to** 30 on page 26.

Problem	Possible cause	Possible solution
Actuator moves to an incorrect position or moves in the opposite direction. Actuator moves using manual override, but not during normal operation.	Actuator needs calibrating	◇ Calibrate the actuator. For more information, read **Calibrating an actuator, parameter 32** on page 27.
Alarm relay not operating alarm system	Incorrect wiring	◇ Correct the wiring. For more information, read **Connecting an alarm system** on page 17.
Actuator calibration cycle starts, but does not complete. Actuator continually moves back and forth in small movements.	Damaged or incorrect feedback wiring	◇ Follow the instructions in **Determining correct actuator feedback wiring** below and then recalibrate.
Actuator does not move during calibration, but moves using an external override.	Incorrect wiring between the control and external override	◇ Correct the wiring. For more information, read **Connecting an actuator** on page 13. ◇ If the wiring is correct, remove the wires from the relay terminals. Verify the relays are switching by measuring the resistance across the terminals while using manual override on the control.
Staged element cycles on and off	The set points are too close together with variable speed fans.	◇ Adjust the hysteresis setting. ◇ Move the temperature probe closer to the heater. ◇ Widen the set points.
	The heater is too large for the room.	◇ Replace the heater with a smaller output unit.
	The stage is set up as proportional control.	◇ Change the configuration from proportional control.

Determining correct actuator feedback wiring

After installing a new actuator or potentiometer, or due to age-related potentiometer wear, the actuator might not move correctly. Common symptoms include:

- The actuator oscillating back and forth
- The actuator not traveling the full stroke during calibration

The feedback potentiometer wiring must be properly connected to the control. Determining the correct wiring can be difficult on some actuators or potentiometers.

Potentiometers have three wires: positive (+), negative (–), and feedback (FB). If the feedback wire is not connected to the FB terminal on the control, the actuator will not function properly.

Because the wires are often different colors and are not always labeled the same as above, measuring the resistance between the wires is the best way to determine which wire is the feedback wire. Follow the steps below to measure the resistance and determine the correct wiring.

- ◇ Before checking the potentiometer wires, verify that the power wires are properly connected.
- ◇ Test the actuator using stage override mode.

1. Manually move the actuator away from the end of its stroke by at least a quarter of its total stroke.
2. Disconnect all three potentiometer wires from the control.
3. Number the wires 1, 2, and 3, in any order.
4. Set your ohmmeter to measure the potentiometer's maximum resistance, normally 20,000 Ω.
5. Measure and record the resistance between wires 1 and 2. _____ Ω
6. Measure and record the resistance between wires 1 and 3. _____ Ω
7. Measure and record the resistance between wires 2 and 3. _____ Ω
8. The pair of wires with the highest measured value are the positive and negative wires. Connect the wires to the positive and negative actuator terminals on the control. At this time, do not be concerned with which wire you connect to which terminal.
9. Connect the remaining wire to the feedback terminal.
10. Test the actuator using automatic mode to see if the control moves it properly. If the actuator moves in the opposite direction than it should, switch the positive and negative wires on the control.

Appendix C: Factory defaults

When your PEC leaves the factory, it comes with default settings and configuration. Configuring and programming your PEC changes the factory defaults.

Resetting your PEC erases all the configuration and settings you programmed and then restores the defaults. For more information, read **Restoring the factory defaults** on page 50.

The following table shows all the factory defaults and ranges.

Parameter		Default					Range/options
		A	B	C	D	E, F, G	
1	Group set point (°F/°C)	85.0	80.0	75.0	70.0	65.0	-13 to 125°F (-25 to 51.7°C)
2	Stage 1 idle speed (%)	20	20	30	30	20	0 to 100 %
3	Stage 1 idle range (°F/°C)	80.0	75.0	70.0	65.0	60.0	-13 to 125°F (-25 to 51.7°C)
4	Stage 1 set point (°F/°C)	85.0	80.0	75.0	70.0	65.0	-13 to 125°F (-25 to 51.7°C)
5	Stage 1 differential (°F/°C)	86.5	82.0	77.0	73.0	68.0	-13 to 125°F (-25 to 51.7°C)
6	Stage 2 idle speed (%)	20	20	30	30	20	0 to 100 %
7	Stage 2 idle range (°F/°C)	87.0	82.0	77.5	73.0	68.0	-13 to 125°F (-25 to 51.7°C)
8	Stage 2 set point (°F/°C)	87.0	82.0	77.5	73.0	68.0	-13 to 125°F (-25 to 51.7°C)
9	Stage 2 differential (°F/°C)	88.5	84.0	79.5	76.0	71.0	-13 to 125°F (-25 to 51.7°C)
10	Stage 3 set point (°F/°C)	89.0	85.0	80.0	77.0	72.0	-13 to 125°F (-25 to 51.7°C)
11	Stage 4 set point (°F/°C)	91.0	87.0	82.0	79.0	74.0	-13 to 125°F (-25 to 51.7°C)
12	Stage 5 set point (°F/°C)	84.0	79.0	74.0	69.0	64.0	-13 to 125°F (-25 to 51.7°C)
13	Stage 5 P-band temperature (°F/°C)	2.0	2.0	2.0	2.0	2	1 to 16.0°F (0.6 to 8.9°C)
14	Stage 5 P-band interval (minutes)	10	10	10	10	10	5 to 25 minutes
15	Inlet stage 1 idle range position (%)	20	20	30	30	20	0 to 100 %
16	Inlet stage 1 differential position (%)	40	40	40	40	40	Parameter 15 to 100 %
17	Inlet stage 2 idle range position (%)	50	50	50	50	50	Parameter 16 to 100 %
18	Inlet stage 2 differential position (%)	60	60	60	60	60	Parameter 17 to 100 %
19	Inlet stage 3 set point position (%)	80	80	80	80	80	Parameter 18 to 100 %
20	Inlet stage 4 set point position (%)	99	99	99	99	99	Parameter 19 to 100 %
21	Inlet stage 5 set point position (%)	99	99	99	99	99	Parameter 20 to 100 %
22	High temperature alarm (°F/°C)	95.0	90.0	90.0	85.0	85.0	-13 to 125°F (-25 to 51.7°C)
23	Low temperature alarm (°F/°C)	80.0	75.0	70.0	65.0	65.0	-13 to 125°F (-25 to 51.7°C)
24	Temperature unit			°F			°F/°C
25	Frequency			60			50/60 Hz
26	Stage 1 configuration			CL 1			OFF/ CL 1 to CL 4
27	Stage 2 configuration			CL 1			OFF/ CL 1 to CL 4
28	Stage 3 configuration			COOL			OFF/ON/COOL/ HEAT
29	Stage 4 configuration			COOL			OFF/ON/COOL/ HEAT
30	Stage 5 configuration			HEAT			OFF/ON/COOL/HEAT/ P-COOL/P-HEAT
31	Actuator configuration			ON			OFF/ON
32	Actuator calibration			NO			NO/YES
33	Hysteresis (°F/°C)			0.5			0.3 to 5.0°F (0.2 to 2.8°C)
39	High temperature enable			YES			NO/YES
40	Low temperature enable			YES			NO/YES
41	Probe damage enable			YES			NO/YES
42	Actuator jam enable			YES			NO/YES

Appendix D: Installation worksheet

Use the following worksheet to list all the equipment (fans, heaters, and so on that you want your PEC to control. We recommend you make a copy of the worksheet before filling it in incase you need more than one sheet or you make a mistake.

Use the **Installation worksheet** when you fill in the **Configuration worksheets** (starting on page 66).

Stage	Equipment to connect and notes
Example: *VAR 1*	*36-inch variable speed fan, 2.5 FLA, 3/4 HP*
VAR 1	
VAR 2	
STAGE 3	
STAGE 4	
STAGE 5	
INLET	
ALARM	

Appendix E: Configuration worksheets

Use the **Installation Worksheet** on page 65 when completing the configuration worksheets.

Main control function worksheet

For each item, circle or write in the configuration.

Item	Description	Configuration
Units	The unit of measure for temperature.	°C °F
Frequency	The line frequency of the incoming power.	50 Hz 60 Hz
Hysteresis	The number of degrees above the set point that a heating stage or relay switches off, and the number of degrees below the set point that a cooling stage or relay switches off.	_____ degrees *Range: 0.3 to 5.0°F (0.2 to 2.8°C)*

Variable stage configuration worksheet

For each variable stage, enter a description (for reference only) and put a check mark in the appropriate column. The first two lines are an example.

Stage	Description	Off	Cool 1	Cool 2
1	*Stage 1 fan*		✓	
2	*Unused*	✓		
1				
2				

Relay configuration worksheet

For each stage, enter a description (for reference only) and put a check mark in the appropriate column. The first table is an example.

Stage	Description	Off	On	Heat	Cool	Proportional heat	Proportional cool
3	*36-inch fan*				✓		
4	*24-inch fans*				✓		
5	*Gas furnace*			✓			
3							
4							
5							

Appendix F: Settings worksheets

Appendix F contains worksheets for you to use when programming your PEC settings. Each worksheet contains a brief explanation of the information required. For more information about programming your PEC, see **Chapter 4: Programming the PEC** on page 29.

Variable stage settings worksheet

Parameter	Stage 1	Stage 2	Range/options
Group set point①			-13 to 125°F (-25 to 51.7°C)
Stage # idle speed			0 to 100 %
Stage # idle range			-13 to 125°F (-25 to 51.7°C)
Stage # set point①			-13 to 125°F (-25 to 51.7°C)
Stage # differential			-13 to 125°F (-25 to 51.7°C)
① Recommend these be set to the same value.			

- ◇ If you need to connect more cooling elements than you have relays available, and you are not using both variable stages, you can use an available variable stage as an ON/OFF stage (for 120/230 VAC-powered equipment only).
- ◇ Set the *idle speed* to 100% and *idle range* to the temperature at which you want the stage to switch on/off. You no longer have “variable” speed or power; instead, you have either "full on" or "full off", the same as a regular cooling stage. The *set point* and *differential* settings have no effect when you use a variable stage this way.
- ◇ The *set point* and *differential* settings must be greater than the *idle range*.

Actuator settings worksheet

Parameter	Setting	Range/options
Inlet stage 1 idle range position		0 to 100 %
Inlet stage 1 differential position		Parameter 15 to 100 %
Inlet stage 2 idle range position		Parameter 16 to 100 %
Inlet stage 2 differential position		Parameter 17 to 100 %
Inlet stage 3 set point position		Parameter 18 to 100 %
Inlet stage 4 set point position		Parameter 19 to 100 %
Inlet stage 5 set point position		Parameter 20 to 100 %

Relay stages worksheet

Parameter	Setting	Range/options
Stage 3 set point		-13 to 125°F (-25 to 51.7°C)
Stage 4 set point		-13 to 125°F (-25 to 51.7°C)
Stage 5 set point		-13 to 125°F (-25 to 51.7°C)
Stage 5 P-band temperature ①		1 to 16.0°F (0.6 to 8.9°C)
Stage 5 P-band interval ①		5 to 25 minutes
① Required only if stage 5 is configured as proportional heat or proportional cool.		

Alarm settings worksheet

The alarm settings for your PEC determine which alarm conditions are enabled, which are disabled, and their settings. All these work together to determine how and when the alarm relay activates (in other words, signals an alarm condition).

The alarm relay activates if an enabled alarm condition is present for longer than the minimum duration of one minute. The minimum duration prevents alarms from occurring when the temperature rises or drops for just a few seconds.

The exceptions to the one-minute minimum are the actuator jam and power fail alarms. The actuator jam alarm activates five seconds after the PEC detects it and the power fail alarm automatically triggers the relay on a loss of power.

For more information, read **Programming alarm settings** on page 40.

Alarm	Configuration		Setting	Description
High temperature① H-AL	ON	OFF		The highest temperature to which you can safely allow your facility to rise; this cannot be lower than low temperature alarm.
Low temperature① L-AL	ON	OFF		The lowest temperature to which you can safely allow your facility to fall; this cannot be higher than high temperature alarm.
Probe damage PbAd	ON	OFF		Damaged or disconnected temperature probe
Actuator jam ActJ	ON	OFF		Actuator jammed
① Temperature in °F/°C, *range: -13 to 125°F (-25 to 51.7°C)*				

Appendix G: Motor curves

Motor curves provide a way to proportionally increase or decrease speed, regardless of motor manufacturer.

For example, a Multifan motor might require 130 VAC to run at 50% RPM, while a Marathon motor might need 100 VAC to run at 50% RPM. Without a motor curve, the Multifan motor would run at a slower RPM than the Marathon motor at the same settings.

Selecting the correct motor curve allows you to set, for example, 50 on the control, and get much closer to 50% RPM on the motor then you would otherwise.

Use manual override or test mode to test and evaluate the operation and performance of your fan motors. For more information, read **Testing settings and equipment** on page 46.

- If your fan motors are not running at approximately the correct RPM for the control settings, find your fan in the following table, and then select the motor curve for your fan manufacturer and model/specification.
- If your fan motor is not listed, use the default motor curve (curve 1). If the default motor curve does not operate your fan motor correctly, test the motor using manual override or test mode while selecting the different curves.

Manufacturer	Diameter (inches)	Model	Specifications	Recommended curve
Aerotech	09	AT09Z2	3350 RPM	2
	36	AT36Z1		4
Airstream	12	APP12F	1/4 HP, 1765 RPM	3
	36	APP36		4
Baldor	14		1/4 HP, 1700 RPM	4
	18		1/3 HP, 1700 RPM	4
	24		1/3 HP, 1140 RPM	4
Canarm	09	PLF9	1/5 HP	4
	12	PLF12		2
	14	PLF14		2
	16	PLF16	1/4 HP	2
	18			2
Choretime (GE)	12		1/3 HP, 1140 RPM	1
Emerson	12		1/6 HP, 3400 RPM	2
Exafan	10		1/4 HP, 1700 RPM	2
	14		1/4 HP, 1700 RPM	2
	16		1/3 HP, 1700 RPM	2
	18		1/3 HP, 1700 RPM	2
	20		0.53 HP, 1700 RPM	2
	24		0.63 HP, 1700 RPM	2
Franklin	10		1/6 HP, 3450 RPM	2
Leeson	14		1/4 HP, 1625 RPM	2
	18		1/3 HP, 1625 RPM	2
	24		1/3 HP, 1140 RPM	2
	24		1/2 HP, 1625 RPM	2
	36		3/4 HP, 1625 RPM	2
Magnetek	12		1/6 HP, 3300 RPM	2
	12		1/6 HP, 1725 RPM	2
	36		1/2 HP, 840 RPM	4
Marathon	12		1/4 HP, 1625 RPM	2
	24		1/2 HP, 1625 RPM	2
Multifan	18	4E45	1600 RPM	4
	20	4E50		4

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Limited warranty

This warranty applies only to the Phason Proportional Environment Control (PEC). If you need warranty service, return the product and original proof of purchase to your dealer.

Phason Inc. (Phason) warrants the PEC subject to the following terms and conditions.

This warranty is valid only to the original purchaser of the product, for two years from the manufacturing date. 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 the PEC fail because of improper workmanship, Phason will repair the unit, effecting all necessary parts replacements without charge for either parts or labor.

Conditions

- Installation must be done according to our enclosed installation instructions.
- The product must not have been previously altered, modified, or repaired by anyone other than Phason.
- The product must not have been involved in an accident, misused, abused, or operated or installed contrary to the instructions in our user and/or installation manuals. Phason's opinion about these items is final.
- The person requesting warranty service must be the original purchaser of the unit, and provide proof of purchase upon request.
- All transportation charges for products submitted for warranty must be paid by the purchaser.

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 the PEC. Any implied warranties are excluded.

Phason is not liable for consequential damages caused by the PEC.

Phason does not assume or authorize any representatives, or other people, to assume any obligations or liabilities, other than those specifically stated in this warranty.

Phason reserves the right to improve or alter the PEC without notice.

Service and technical support

Phason will be happy to answer all technical questions that will help you use your PEC. Before contacting Phason, check the following:

- Read this manual for information about the feature with which you are having trouble.
- If you see an alarm message and are not sure what it means, look it up in the **Alarm and error messages** table on page 59 and then follow the instructions for resolving the alarm condition.
- If you are having a problem using your PEC, look in the **Troubleshooting** table on page 60 and then follow the directions for correcting the problem.
- If you still have a problem with your PEC, collect the following information:
  - The serial number
  - Any messages displayed by your PEC
  - A description of the problem
  - A description of what you were doing before the problem occurred

- ◇ Phason controls are designed and manufactured to provide reliable performance, but they are not guaranteed to be 100 percent free of defects. Even reliable products can experience occasional failures and the user should recognize this possibility.
- ◇ If Phason products are 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.

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