

Three Ventilation Stage Control

STAGES

1

2

3

Alarm

Easy

<p>> Program settings</p> <ul style="list-style-type: none"> 0 Operating program 1 Group set point 2 Stage 1 idle speed 3 Stage 1 idle range 4 Stage 1 set point 5 Stage 1 differential 6 Stage 2 idle speed 7 Stage 2 idle range 	<ul style="list-style-type: none"> 8 Stage 2 set point 9 Stage 2 differential 10 Stage 3 set point 11 High temperature alarm 12 Low temperature alarm <p>> Configuration</p> <ul style="list-style-type: none"> 13 Temperature unit 14 Frequency 	<ul style="list-style-type: none"> 15 Stage 1 configuration 16 Stage 2 configuration 17 Stage 3 configuration 18 Hysteresis 19 Settings save 20 Settings restore 21 Factory defaults 22 Firmware update 23 Version display 	<p>> Alarm</p> <ul style="list-style-type: none"> 24 High temperature enable 25 Low temperature enable 26 Probe damage enable 27 Power fail enable <p>> Test</p> <ul style="list-style-type: none"> 28 Stage override 29 Temperature override
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User manual and installation guide

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About the manual

The manual describes the features of your TVS and how to use them; it does not describe ventilation strategies or equipment you can connect to the control.

The following styles are in the manual.

- ◆ All buttons and menu commands are **bolded**.
For example, "Press **Program** until the LED for Alarm is lit."
- ◆ All LED display examples are in a seven-segment font.
For example, "Press **Up** or **Down** until **R 20** displays and then press **Select**."

Hint/tip



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

Note



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

Caution



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

Warning



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

How to use the manual

If you are not sure where to find something specific, look in the **Table of contents** at the front of the manual or the **Index** on page 61.

Below are some helpful suggestions.

- ◆ If you have not installed and configured your TVS, read **Chapter 2: Installing your TVS** on page 8 and **Chapter 3: Configuring your TVS** on page 23.
- ◆ If you are ready to install, configure, or program your TVS, use the worksheets starting in **Appendix D** on page 56.
- ◆ If you are not sure how to use the keypad or how to read the display and menus, read **Becoming familiar with the TVS** on page 5.
- ◆ If you need to program your TVS or adjust settings (set points, growth curves, fan speeds, etc.), read **Chapter 4: Programming the TVS** on page 29.
- ◆ If you have an alarm condition or warning displayed and are not sure what it means, look at **Appendix B: Troubleshooting** on page 51.
- ◆ If you are not sure of the meaning of a term, look it up in the **Glossary** on page 49.

Limited warranty

This warranty applies only to the Phason Three Ventilation Stage Control (TVS). If you need warranty service, return the product and original proof of purchase to your dealer.

Phason Inc. (Phason) warrants the TVS 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 TVS 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 TVS. Any implied warranties are excluded.

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

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 TVS without notice.

Service and technical support

Phason will be happy to answer all technical questions that will help you use your TVS. 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 51 and then follow the instructions for resolving the alarm condition.
- ◆ If you are having a problem using your TVS, look in the **Troubleshooting** table on page 53 and then follow the directions for correcting the problem.
- ◆ If you still have a problem with your TVS, collect the following information:
 - ◆ The serial number
 - ◆ Any messages displayed by your TVS
 - ◆ A description of the problem
 - ◆ A description of what you were doing before the problem occurred

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	Winnipeg, Manitoba	Fax	204-233-3252
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	R2J 4G7	Web site	www.phason.ca

<ul style="list-style-type: none">◇ 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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Chapter 1: Introducing the TVS

Chapter 1 introduces you to the Three Ventilation Stage Control (TVS). Read chapter 1 before reading the rest of the manual. Topics in chapter 1 include:

- ◆ **Introducing the TVS** below
- ◆ **Becoming familiar with the TVS** on page 5

Introducing the TVS

The TVS automatically controls the temperature in a room by operating two variable speed fans and a single-speed fan or heater. To control the temperature, the TVS operates the connected ventilation and/or heating equipment according to programmed settings.

Easy to use and program

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

Versatility and peace of mind

The TVS 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.

The TVS displays alert conditions such as high and low temperatures, power failure, and low line voltage, and can also connect to an alarm siren, alarm panel, or auto-dialer. 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 TVS often controls ventilation in a single 20 x 40-foot or smaller room.

Greenhouse applications

Greenhouse applications include controlling ceiling louvers, variable and single-speed fans, and heaters.

Business and light-industrial applications

Business and light-industrial applications include machine shops, garages, and utility sheds where customers use the TVS to control fans and heaters. The TVS 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: -13.0 to 125 °F (-25 to 51.7°C)
- ◆ Seven configurable operating programs
- ◆ Two variable cooling stages for controlling fans
- ◆ One general-purpose relay (heat or cool)
- ◆ 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
- ◆ 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
- ◆ Two-year limited warranty

Optional accessories

Several optional, convenient accessories are available to enhance and extend your TVS.

TVS Saver

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

Features

- ◆ Quick and easy to use
- ◆ Portable, reliable, and safe storage of configuration and settings
- ◆ Transferable to any TVS that has the same firmware version
- ◆ Compact design—fits in a pocket
- ◆ 90-day limited warranty

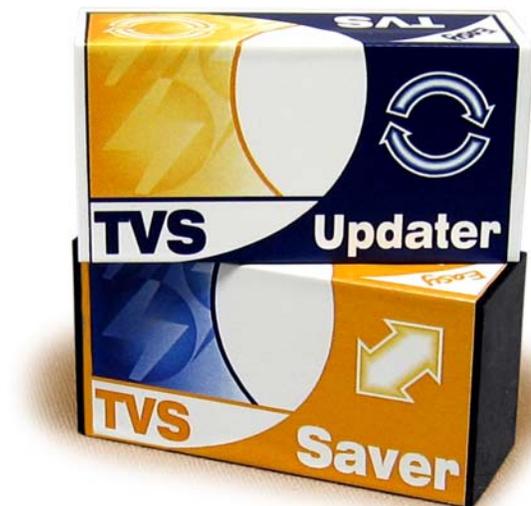
TVS Updater

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

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

Features

- ◆ Quick and easy to use
- ◆ Compact design—fits in a pocket
- ◆ 90-day limited warranty



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 be 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
- ◆ 90-day limited warranty



Parts and kits

Display kit

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

The display kit is model **K310056**.

Control kits

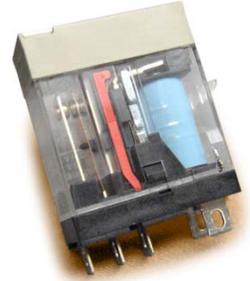
Should the bottom circuit board of your TVS control fail, there are two models of control kits available.

- ◆ **KTVS-B** has standard, soldered relays. This control board comes with the TVS standard version.
- ◆ **K102208-RS** has socketed, pluggable relays. This control board comes with the TVS RS version.

Either circuit board works with any PEC Plus control. The advantage of the RS version is that you can replace individual relays instead of the whole circuit board.

Replacement relays

If you have the TVS RS version, the relays in the bottom circuit board are replaceable. Phason sells packages of five relays. The relay package is model number **PKG-R52**.



Becoming familiar with the TVS

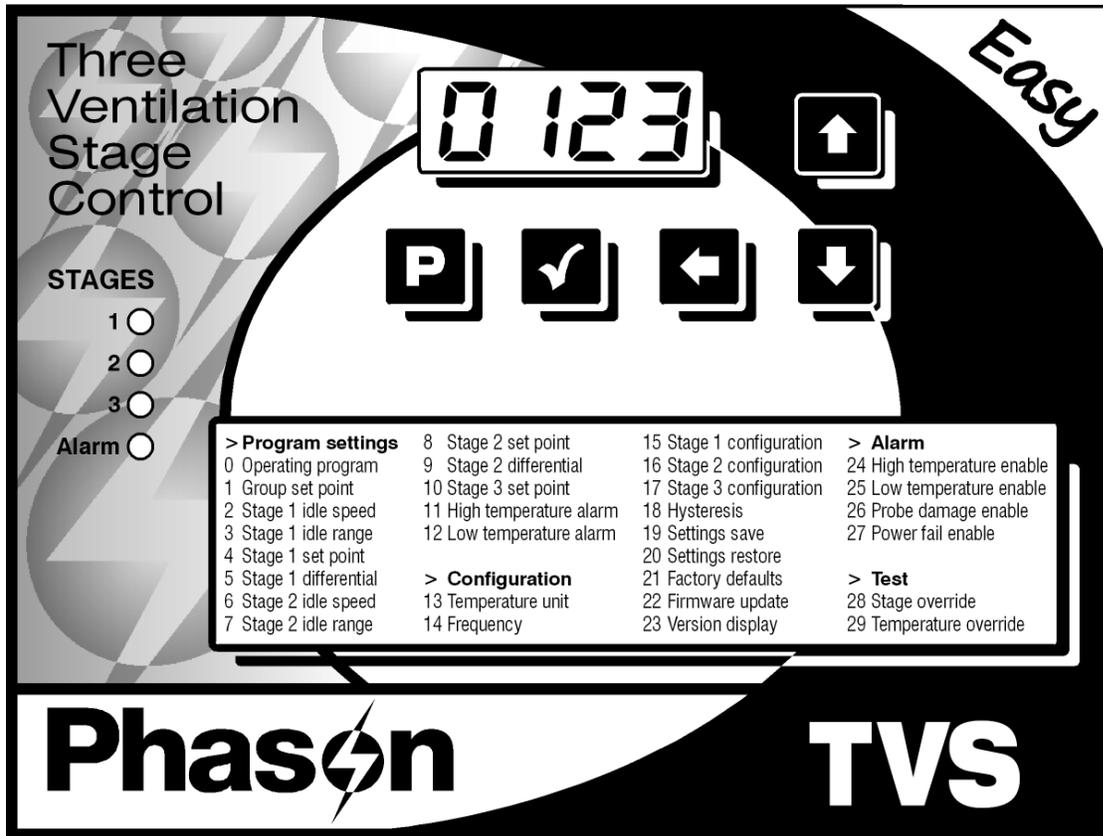
The TVS has a four-character LED display, status LEDs for each variable stage and relay, and five buttons for programming and interacting with the control.

Main display

The four-character, seven-segment LED display shows ambient 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.

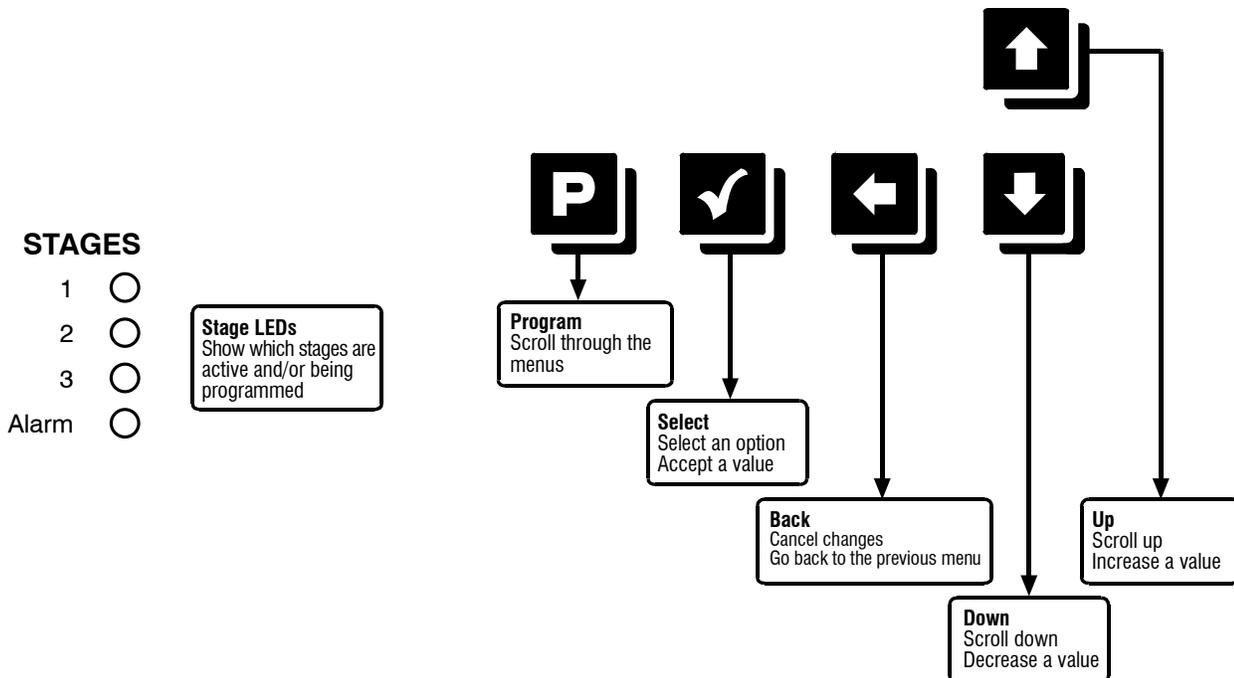


If you leave the TVS in a menu or display other than the main display, the control returns to the main display after five minutes without any key presses. The only exceptions are stage override mode and temperature override mode; the control remains in these modes until you manually exit them.



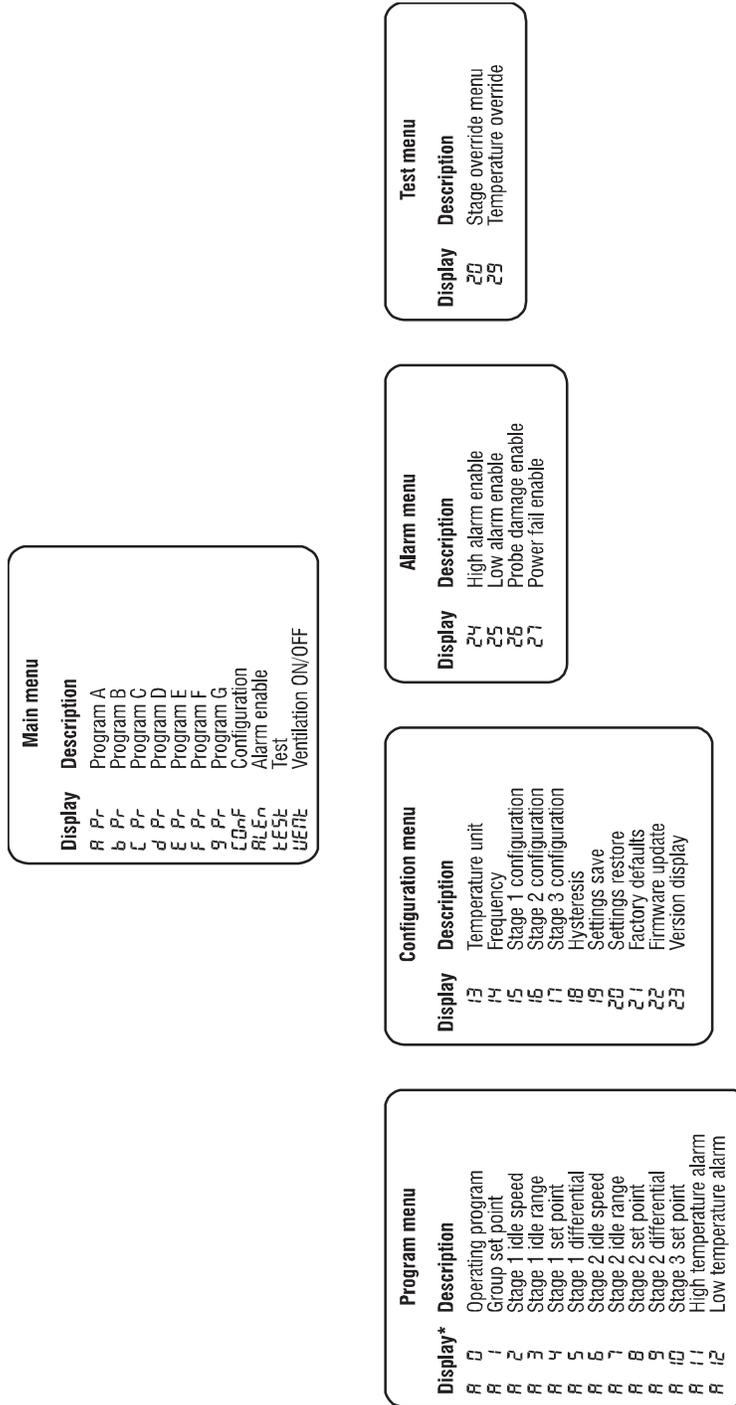
Buttons and status LEDs

The five control buttons (**Program, Select, Back, Down, and Up**) allow you to scroll through the program menus and enter programming information.



Menu layout

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



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

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

Chapter 2: Installing your TVS

Chapter 2 explains how to mount, install, and connect equipment to your TVS.

Topics in chapter 2 include:

- ◆ **What you need to know before installing your TVS** below
- ◆ **Connecting equipment to your TVS** on page 14
- ◆ **Finishing the installation** on page 22

What you need to know before installing your TVS

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

1. Read **Understanding power surges and surge suppression** on page 9.



- ◇ If you do not install external surge suppression devices, you risk damage to the electronics inside your TVS, which may cause your TVS 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 56, list all the equipment you want to control using this TVS. Install the equipment and make your electrical connections according to the sheet.
3. Using **Appendix E: Configuration worksheets** on page 57, 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 and horsepower draw does not exceed* the relay or stage's limit. For more information, read **Electrical ratings** on page 10.

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 TVS. 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.

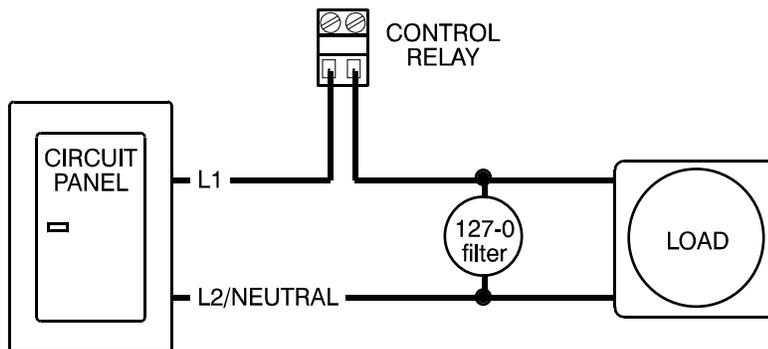
“Visible” symptoms of electrical noise include erratic control operation, cycling inlets, communication problems, and more. However, the affects of electrical noise are not always visible. Over time, electrical noise can cause electronic circuits, relay contacts, and power contactors to deteriorate.

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.

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** on page 11.
- ◇ 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 (STAGE 1, STAGE 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 stage ① (STAGE 3)	6 A at 120/230 VAC general-purpose (resistive) 1/3 HP at 120 VAC, 1/2 HP at 230 VAC 360 W tungsten at 120 VAC
Fuse (F1)	12 A, 250 VAC ABC-type ceramic
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 and horsepower 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.

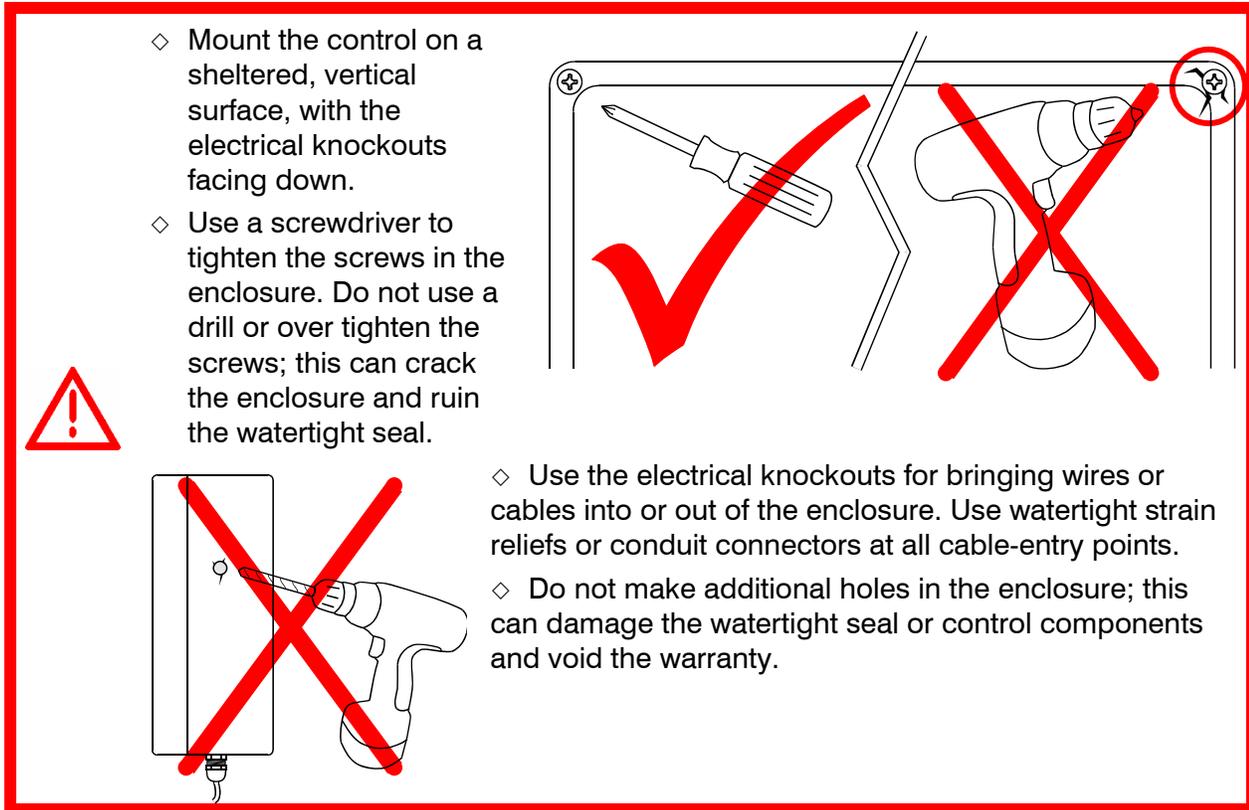
- ◆ **Power contactor relay** (PC-240) includes power contactor relay and mounting hardware for easy mounting in an enclosure.
- ◆ **Power contactor kit** (122-1) includes power contactor relay, on-off-auto switch and label, snubber filter (reduces electrical noise), and mounting hardware for easy mounting 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.

Precautions, guidelines, and warnings

Read **Servicing and maintaining your TVS** on page 42.



- ◇ The TVS must be installed by a qualified electrician.
- ◇ Before installing or servicing the TVS, switch OFF the power at the source.
- ◇ Install the TVS and all equipment connected to it according to local electrical codes.



Routing data wires

Routing data wires in the same conduit as, or beside AC power cables, can cause electrical interference, erratic readings, and/or improper control. Data wires include **all** of the following:

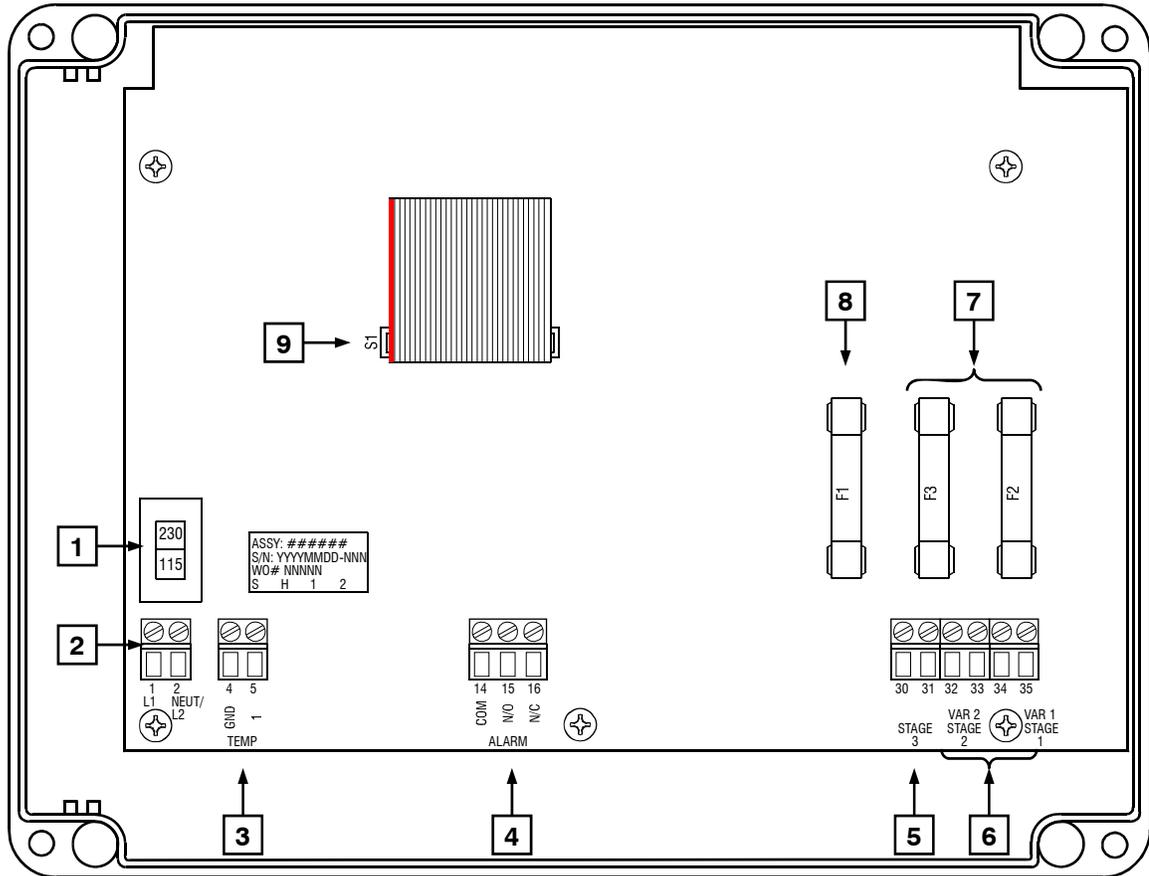
- ◆ Temperature probe and humidity sensor cables
- ◆ Actuator feedback (potentiometer) wires
- ◆ Data communication wires, including RS-232/RS-485
- ◆ Any cable or wire that does not provide AC power

Guidelines for routing data wires

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

If in doubt, **do not run any wire or cable that is not an AC-power wire** inside the same conduit or beside other AC-power wires.

TVS layout



- 1** **Voltage selection switch:** set this switch to the correct voltage before installing your TVS.
- 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** **Alarm relay terminal:** connect an external alarm system or alarm siren to this terminal.
- 5** **General-purpose relay terminal (STAGE 3):** connect single stage (on/off) equipment to this terminal. You can configure this relay as heat or cool.
- 6** **Variable stage terminals (VAR 1, VAR 2):** connect variable speed fans to these terminals.
- 7** **Variable stage fuses (F3 for VAR 2, F2 for VAR 1):** 12 A, 250 VAC ABC-type ceramic.
- 8** **Relay fuse (F1):** 12 A, 250 VAC ABC-type ceramic.
- 9** **Display cable:** make sure the ribbon cable from the display is properly connected to the socket.

Mounting your TVS

1. Select a location for your TVS. Make sure you have enough cable and wire to reach all the equipment (fans, heaters, 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 TVS

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



Your TVS's test modes are useful for testing your equipment after installing and configuring it. For more information, read **Testing settings and equipment** on page 40.



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

Connecting single-stage heating or cooling elements

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



Refer to **Appendix D: Installation worksheet** on page 56 and **Appendix E: Configuration worksheets** on page 57 when installing single-stage heating or cooling elements.



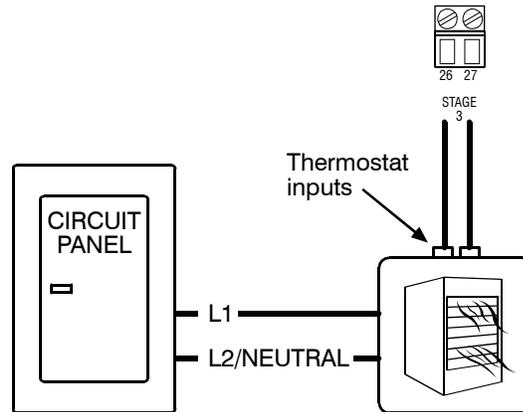
The ratings of the equipment must not exceed the ratings of your TVS's relays.

Relay ratings: 6 A at 120/230 VAC general-purpose (resistive)
 1/3 HP at 120 VAC, 1/2 HP at 230 VAC
 360 W tungsten at 120 VAC

To connect single-stage heating or cooling elements

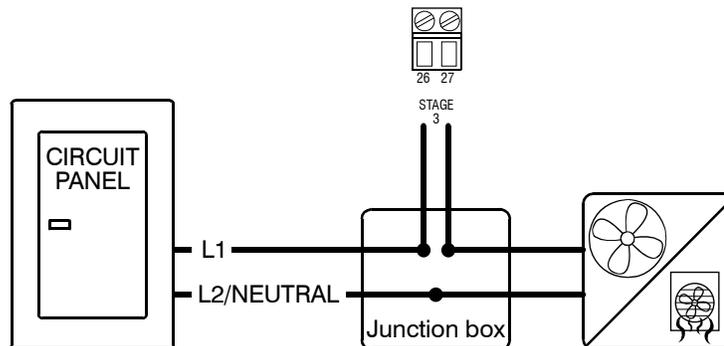
Connect single-speed heating or cooling elements to your TVS as shown in the following diagrams.

Gas-fired furnace or brooder



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.

All other single-speed heating or cooling elements



Connecting variable-stage cooling elements

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



Refer to **Appendix D: Installation worksheet** on page 56 and **Appendix E: Configuration worksheets** on page 57 when installing variable-stage elements.



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 TVS and the variable cooling equipment to the same phase. For more information, read **Using three-phase power** on page 17.
- ◇ The ratings of the equipment must not exceed the ratings of your TVS's variable stages.

Variable stage ratings: 5 FLA at 120/230 VAC, PSC motor

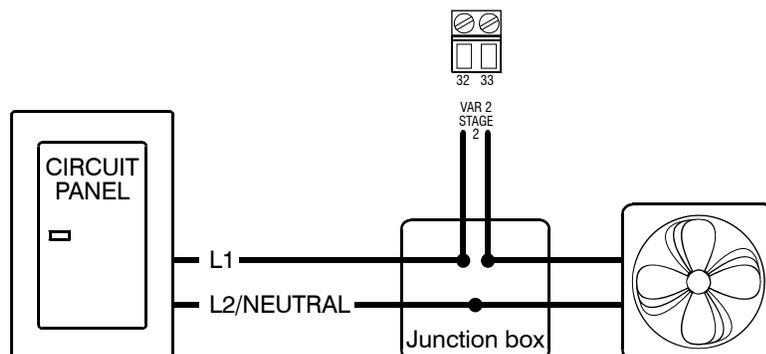
1/3 HP at 120 VAC, 1/2 HP at 230 VAC, PSC motor

7.5 A at 120/230 VAC, general-purpose (resistive)

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

To connect variable-stage cooling elements

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

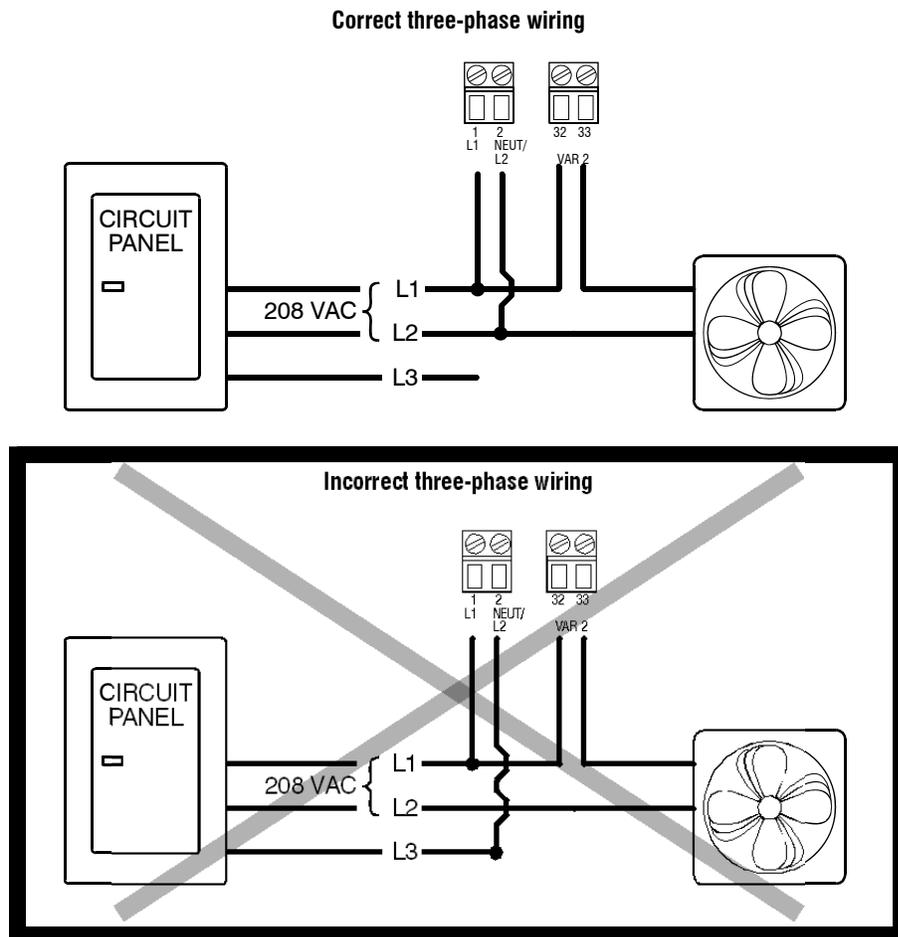


Using three-phase power

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

Your TVS must be powered from the same phases that supply the equipment. If your TVS 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.



Connecting temperature probes



When routing the temperature probe cables, do not run them in or along the same conduit as AC-power lines. Follow the guidelines on page 12.



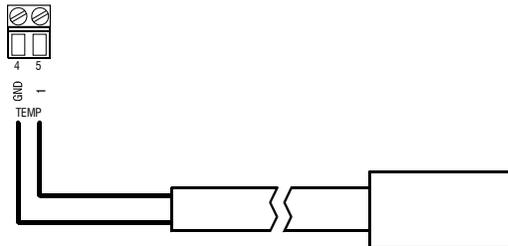
- ◇ You can extend probe cables up to 500 feet. For more information, read **To extend probe cable** below.
- ◇ You can monitor and average the temperatures in four zones. For more information, read **To use four-zone averaging** on page 20.



Replace damaged probes as soon as possible. If there is no probe present or working properly, the TVS shuts off stage 3 and operates variable stages 1 and 2 at idle speed.

To connect a single temperature probe

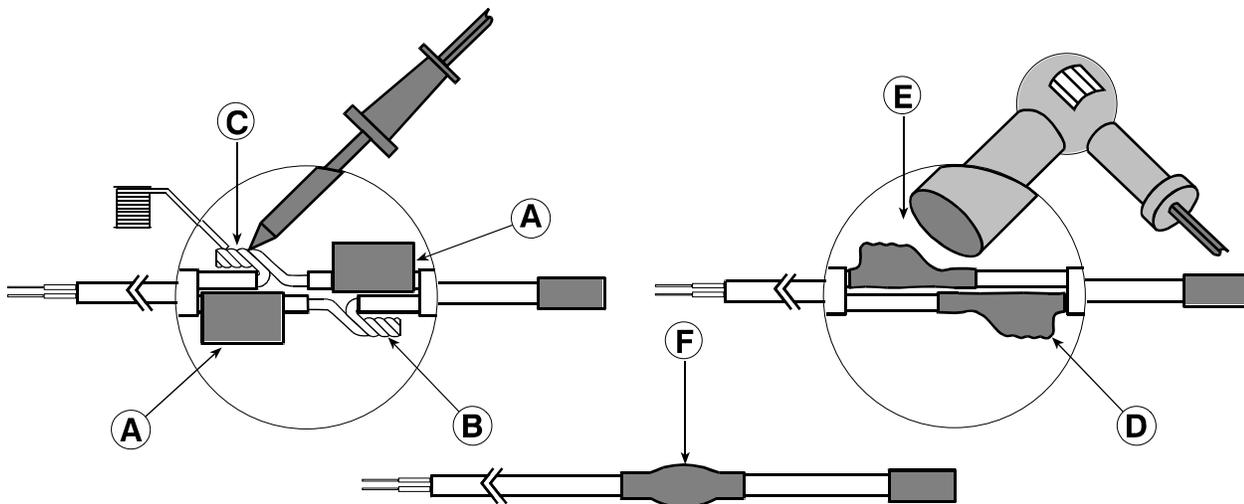
- ◆ Do not run the probe cable in the same conduit as AC power cables
- ◆ Do not run the sensor cable beside AC power cables or near electrical equipment.
- ◆ When crossing other cables or power lines, cross them at a 90-degree angle.



To extend probe cable

You can extend temperature probe cables to lengths of up to 500 feet. Follow the guidelines below and on page 12 when extending cables.

- ◆ Use 2-wire 18 AWG jacketed cable. Phason recommends Belden #9408, Alpha #5052, or an equivalent. Extension cable is also available from Phason. For more information, contact your dealer or Phason.
- ◆ Join the extension cable to the temperature probe cable as shown in the following diagram.
- ◆ If the unit operates erratically with the extended probe, run the cable along a different path or shorten it.



- A** Slide three pieces of heat shrink tubing over the wires: one for the red wire, one for the black wire, and one for both.
- B** Strip the ends of the wires and then twist them together.
- C** Solder the wires together using rosin-core flux solder. **DO NOT** use acid core solder.
- D** Slide the heat shrink tubing over the solder joints.
- E** Shrink the tubing using a heat gun.
- F** Your connection should look like this.

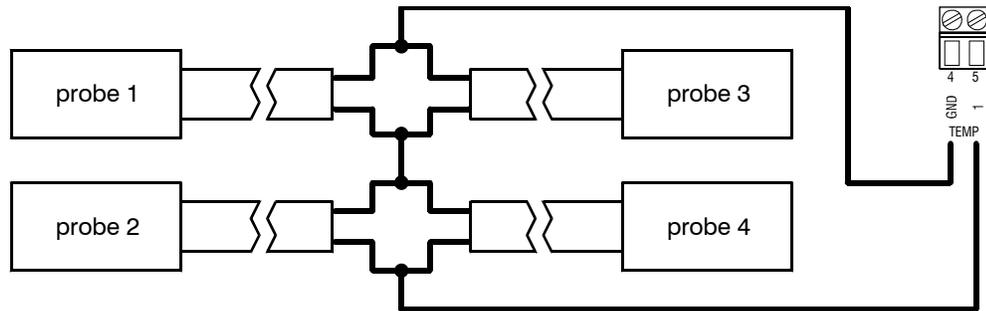
To use four-zone averaging

The TVS 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.

Connect four temperature probes as shown in the following diagram. Follow the guidelines in **To extend probe cable** on page 19.



Connecting the power source

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



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 17.

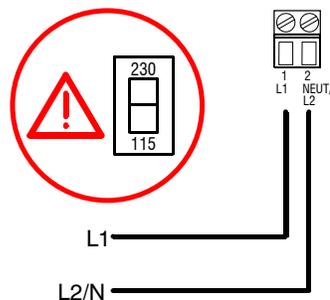


Before connecting the incoming power, switch OFF the power at the source.

Do not switch ON the power until you have finished all wiring and verified all equipment is properly connected and free of obstructions.

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 TVS, you are ready to finish the installation. Before you start configuring your TVS, you need to verify the connections and close the TVS.

Verifying your connections

Make sure the configuration worksheets in **Appendix E** correspond to how the equipment is connected to your TVS. 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 TVS which equipment is connected to each terminal.

Closing the cover

After you have finished connecting all equipment, wiring, and cables to your TVS, it is time to verify the wires are connected properly and then close the cover.

1. Make sure all the wires are properly connected to the correct terminals.
2. Make sure the voltage selection switch is in the correct setting.
3. Make sure the display cable is properly connected. For more information, read **TVS layout** on page 13.
4. Place the cover on the control.
5. Switch on the power to your TVS.
 - ◆ When you switch on the power, the display should show `----`, followed by the temperature.
 - ◆ If the TVS 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, press **Select** to clear the message. For information about the alarm messages, read **Alarm settings worksheet** on page 58.
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 TVS

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

- ◆ **What you need to know before configuring your TVS** below
- ◆ **Configuring the main control functions** on page 24
- ◆ **Configuring the stages** on page 26
- ◆ **Testing the configuration** on page 28

What you need to know before configuring your TVS

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

Before you begin configuring your TVS, 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 TVS** 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 57 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 51 and then follow the instructions for correcting the problem.
- ◇ Your TVS'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 40.

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

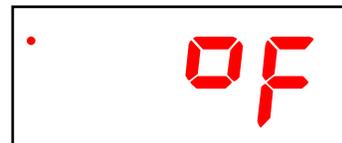
Selecting the temperature units, parameter 13

Your TVS 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 **13**, 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.



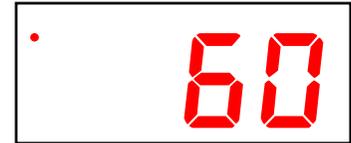
Selecting the operating frequency, parameter 14

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 **13**, the first item in the Configuration menu.
2. Press **Up** until **14** 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 18

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 **13**, the first item in the Configuration menu.
2. Press **Up** or **Down** until **18** 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

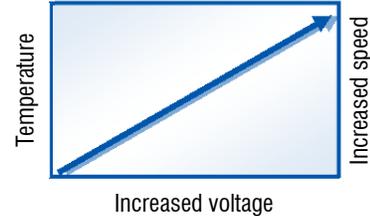
Your TVS has two types of stages: two variable stages and one (ON/OFF) stage.

Configuring variable stages, parameters 15 and 16

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



- 
 - ◇ For more information about motor curves, including a table cross-referencing fan motors with recommended curves, read **Appendix G: Motor curves** on page 59.
 - ◇ Use the **Variable and relay stages configuration worksheet** on page 57 when configuring variable stages.
 - ◇ For more information about how variable stages work, read **Programming variable stages** on page 33.

Default: cooling 1

To configure variable stages

1. Press **Program** until **CONF** displays and then press **Select**.
The display shows **13**, the first item in the Configuration menu.
2. Press **Up** until **15** displays for variable stage 1 (or **16** for variable stage 2) and then press **Select**.
The display shows the current configuration.

3. Press **Up** or **Down** to choose the configuration 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 relay stage, parameter 17

The TVS has one relay stage 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.



- ◇ 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 **Variable and relay stages configuration worksheet** on page 57 when configuring relays.

Default: COOL

To configure the relay stage

1. Press **Program** until **CONF** displays and then press **Select**.
The display shows **13**, the first item in the Configuration menu.
2. Press **Up** until **17** displays 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.

Testing the configuration

After configuring all the control elements (variable stages, relays, and so on), test your TVS 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 TVS'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 TVS, 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 40.

Chapter 4: Programming the TVS

Chapter 4 discusses how to program your TVS with the settings it uses to control your equipment.

What you need to know before programming your TVS

Programming the TVS 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 TVS, 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 TVS** on page 23.



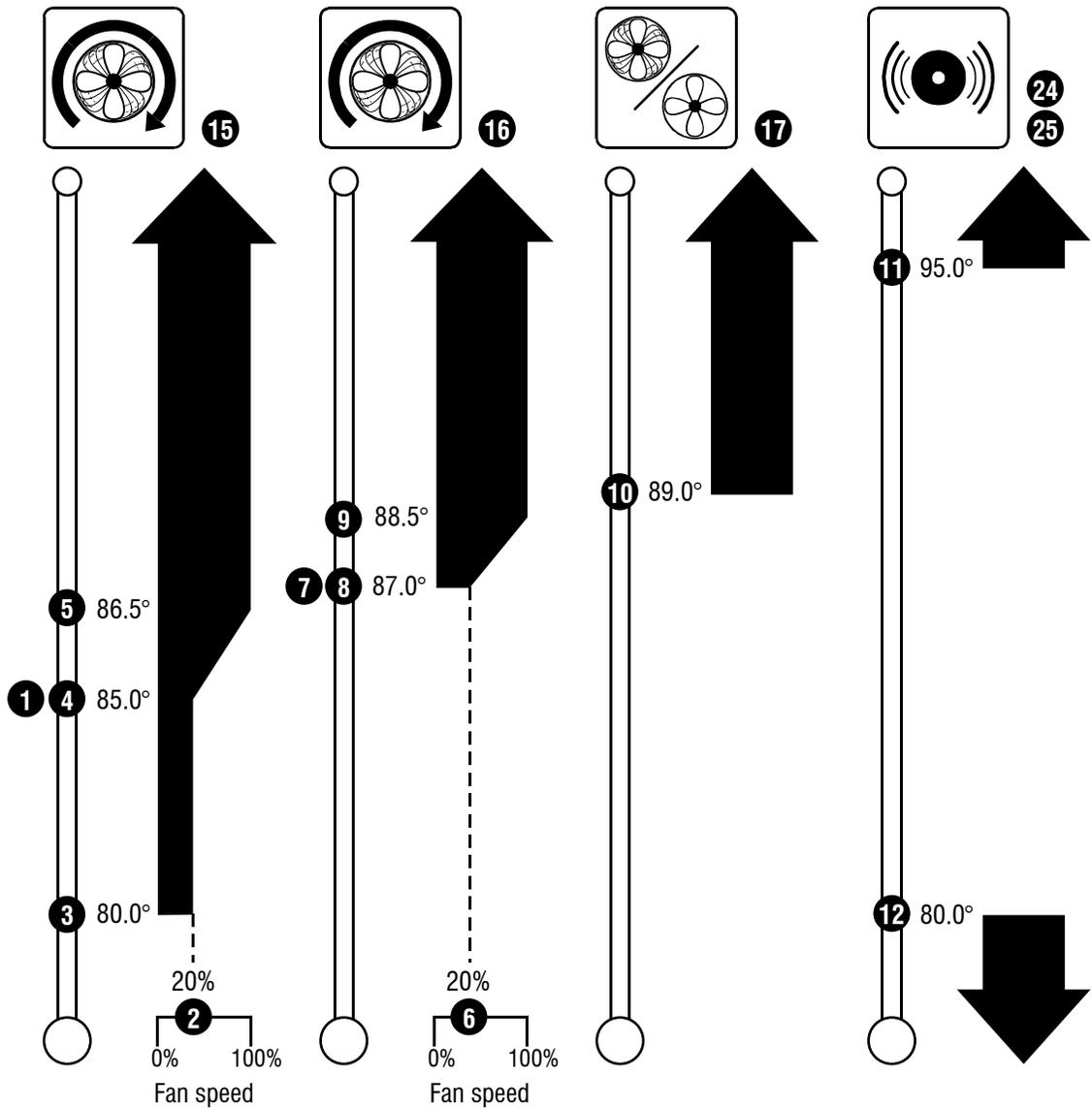
Use Appendix F: Settings worksheets on page 58 when programming your TVS.

Understanding how the TVS operates

Understanding how the TVS 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. When the temperature is between the *idle range* and set point, the fan operates at *idle speed*.
- 4 **Stage 1 set point** is the temperature above which the stage 1 fan speed increases toward its maximum.
- 5 **Stage 1 differential** is the temperature at which the stage 1 fan reaches full speed.
- 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 (number 7).
- 7 **Stage 2 idle range** is the temperature above which the stage 2 fan operates at *idle speed*.
- 8 **Stage 2 set point** is the temperature above which the stage 2 fan speed increases toward its maximum.
- 9 **Stage 2 differential** is the temperature at which the stage 2 fan reaches full speed.
- 10 **Stage 3 set point** is the temperature above which the stage 3 fan is on.
- 11 **High temperature alarm** is the temperature equal to or above which the TVS signals a high temperature alarm.
- 12 **Low temperature alarm** is the temperature equal to or below which the TVS signals a low temperature alarm.
- 15 **Stage 1 configuration** in the example and factory defaults, variable 1 is configured as *cool*.
- 16 **Stage 2 configuration** in the example and factory defaults, variable 2 is configured as *cool*.
- 17 **Stage 3 configuration** in the example and factory defaults, stage 3 is configured as *cool*.
- 24 **High temperature enable** in the example and factory defaults, the high temperature alarm is enabled.
- 25 **Low temperature enable** in the example and factory defaults, the low temperature alarm is enabled.

Parameter	Program A	Parameter	Program A
1 Group set point (°F)	85.0	13 and 14 are not used in the example.	
2 Stage 1 idle speed (%)	20	15 Stage 1 configuration	COOL
3 Stage 1 idle range (°F)	80.0	16 Stage 2 configuration	COOL
4 Stage 1 set point (°F)	85.0	17 Stage 3 configuration	COOL
5 Stage 1 differential (°F)	86.5	18 to 23 are not relevant in the example.	
6 Stage 2 idle speed (%)	20	24 High temperature enable	YES
7 Stage 2 idle range (°F)	87.0	25 Low temperature enable	YES
8 Stage 2 set point (°F)	87.0		
9 Stage 2 differential (°F)	88.5		
10 Stage 3 set point (°F)	89.0		
11 High temperature alarm	95.0		
12 (°F)	80.0		
Low temperature alarm (°F)			



Programming the parameters

Programming the parameters explains parameters 1 to 12 and how to program them. For information about parameter 0, read **Selecting the operating program, parameter 0** on page 39.

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.

To learn how all settings work together, read **Understanding how the TVS operates** on page 30.



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 41.



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

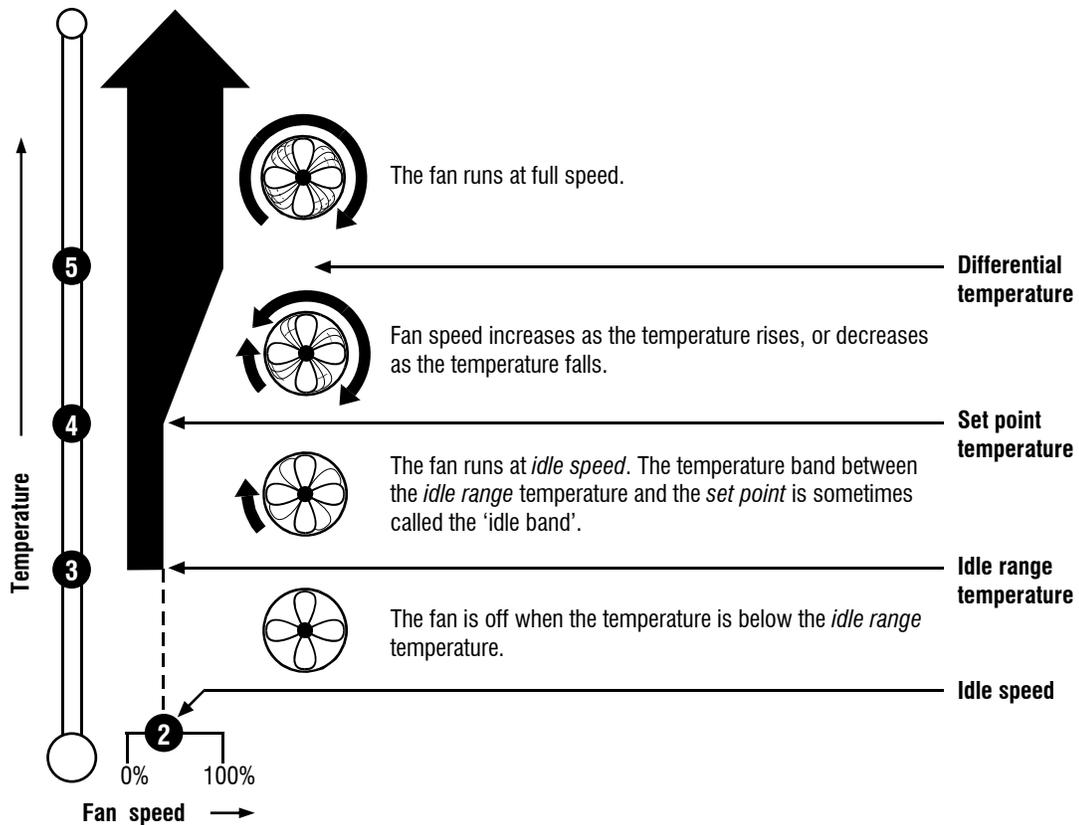
To program the group set point

1. Press **Program** until the program you want to adjust displays, for example $R Pr$ for program A.
2. Press **Select**.
The display shows $R 0$, the first item in the Program settings menu.
3. Press **Up** until $R 1$ 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

Stages 1 and 2 are variable stages. 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 TVS operates** on page 30.

- ◆ 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 and relay stages** settings worksheet on page 58 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 $R P_r$, program B displays as $b P_r$, program C displays as ζP_r , 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 $R P_r$ for program A.
2. Press **Select**.
The display shows $R \square$, the first item in the Program settings menu.
3. Press **Up** until the setting you want to adjust displays, for example $R \zeta$ 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 the relay stage, parameter 10

Stage 3 is a relay stage, meaning it is either ON or OFF. Parameter 10 is the stage 3 set point, the temperature at which the relay switches ON/OFF. For a description of how all settings work together, read **Understanding how the TVS operates** on page 30.

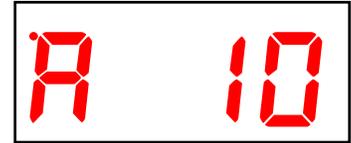
To program the relay stage



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

Program A displays as $R P_r$, program B displays as $b P_r$, program C displays as ζP_r , 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 **A 10** 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 alarm settings, parameters 11, 12, 24 to 27

The alarm settings for your TVS 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, let's say the high temperature alarm setting is 85.0 degrees Fahrenheit. 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 exception to the one-minute minimum is the *power fail* alarm. The power fail alarm automatically triggers the relay on a loss of power.



- ◇ 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 39.
- ◇ 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 41.
- ◇ Use the **Alarm settings worksheet** on page 58 when programming alarms.

To program high and low temperature alarm settings

NOTE

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

1. Press **Program** until the program you want to adjust displays, for example \overline{A} \overline{Pr} for program A.
2. Press **Select**.
The display shows \overline{A} $\overline{0}$, the first item in the Program settings menu.
3. Press **Down** until the setting you want to adjust displays, for example \overline{A} $\overline{11}$ for the *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 alarm 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

1. Press **Program** until \overline{ALEn} displays and then press **Select**.
The display shows $\overline{24}$, 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.
 - a) Press **Up** or **Down** to toggle between \overline{no} (not enabled) and \overline{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 $\overline{25}$ displays and then press **Select**.
The display shows the current configuration.
 - a) Press **Up** or **Down** to toggle between \overline{no} and \overline{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 $\overline{26}$ displays and then press **Select**.
The display shows the current configuration.
 - a) Press **Up** or **Down** to toggle between \overline{no} and \overline{YES} and then press **Select**.
The control returns to the Alarm enable menu.

5. To enable or disable the *power fail alarm*, press **Up** or **Down** until **27** displays and then press **Select**.
The display shows the current configuration.
 - a) 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 TVS

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

- ◆ **Monitoring your TVS** below
- ◆ **Testing settings and equipment** on page 40
- ◆ **Servicing and maintaining your TVS** on page 42

Monitoring your TVS

Your TVS 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 TVS 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.

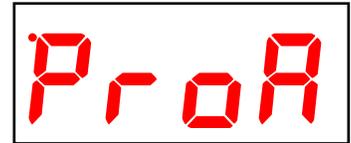
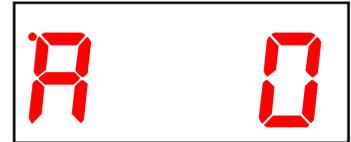
Selecting the operating program, parameter 0

The TVS 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 seven programs can be the operating program. For a list of the factory defaults for the programs, see the table starting on page 55.

To select the operating program

1. Press **Program** until one of the 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 exception to the one-minute minimum is the *power fail* alarm. 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 probe damage alarm, the display shows **H-RL**. After acknowledging the high temperature alarm, the display shows **PbAd**. When all alarms have been acknowledged, the display shows the temperature.

To acknowledge alarms

Press **Select**.

If there is only one alarm message, the TVS clears the message and returns to the main display. If there are additional alarm messages, the TVS displays the next message.



For a list of alarm messages, their descriptions, and possible resolutions, read **Alarm and error messages** on page 51.



- ◇ 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.

Testing settings and equipment

The TVS has two test utilities: *stage override mode* and *temperature override mode*.

Using stage override mode, parameter 28

Stage override mode is for individually testing the installation and equipment connected to the TVS. 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 the relay stage and the alarm relay.

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.



- ◇ When the TVS is in stage override mode, it does not operate the equipment according to the measured temperature.
- ◇ The TVS 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 **28**, the first item in the Test menu.
2. Press **Select**.
The display shows **5291**, the first item in the Stage override submenu.
3. Press **Up** or **Down** until the stage you want to test displays, for example **RLA** 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.
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, parameter 29

Temperature override mode is for testing the TVS 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 TVS is in temperature override mode, it operates according to the test temperature, not according to the temperature measured by the probe.
- ◇ The TVS 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 **28**, the first item in the Test menu.
2. Press **Up** or **Down** until **29** 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.

A red LED display showing the word "TEST" in a seven-segment font.A red LED display showing the number "29" in a seven-segment font.A red LED display showing the number "75.3" in a seven-segment font, with a small dot above the decimal point.

Servicing and maintaining your TVS

Topics in this section include:

- ◆ **Enabling and disabling ventilation** (below)
- ◆ **Restoring the factory defaults, parameter 21** (on page 43)
- ◆ **Saving and restoring settings, parameters 19 and 20** (on page 44)
- ◆ **Displaying the firmware version, parameter 23** (on page 45)
- ◆ **Updating the firmware, parameter 22** (on page 46)
- ◆ **Servicing the control** (on page 47)

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
- ◆ 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 **VENT** 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, parameter 21

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

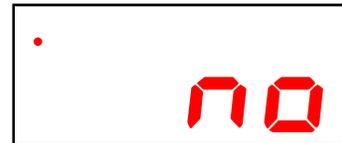
For a list of the factory defaults, read **Appendix C: Factory defaults** on page 55.



- ◇ **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 TVS 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

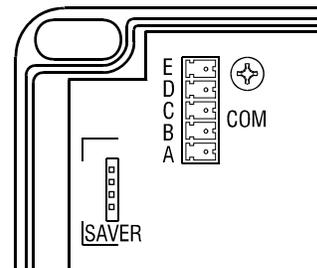
1. Press **Program** until **CONF** displays and then press **Select**.
The display shows **13**, the first item in the Configuration menu.
2. Press **Down** until **21** displays and then press **Select**.
3. Press **Up** or **Down** to change the **no** to **YES** and then press **Select**.
The control 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, parameters 19 and 20

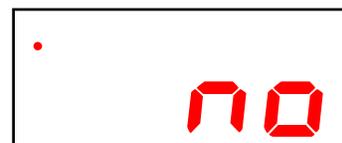
The TVS Saver is an innovative and easy-to-use product that allows you to store your TVS configuration and settings.

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



To save your settings

1. Loosen the four screws in the TVS enclosure and then gently remove the cover. Make sure not to disconnect the ribbon cable.
2. Insert the TVS 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 **13**, the first item in the Configuration menu.
4. Press **Down** until **19** 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 TVS 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.

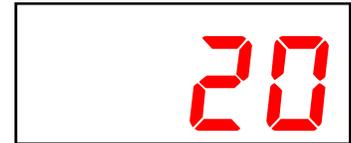


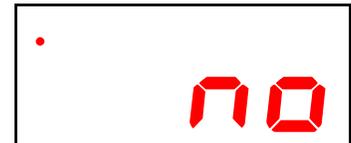
7. Remove the TVS Saver.
8. Replace the cover and then tighten the four screws.

To restore your settings

1. Loosen the four screws in the TVS enclosure and then gently remove the cover. Make sure not to disconnect the ribbon cable.
2. Insert the TVS 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 **13**, the first item in the Configuration menu.
4. Press **Down** until **20** 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 TVS 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 TVS Saver.
8. Replace the cover and then tighten the four screws.


 A red LED display showing the word "CONF" in a stylized, blocky font.


 A red LED display showing the number "20" in a stylized, blocky font.


 A red LED display showing a period "." followed by the word "no" in a stylized, blocky font.

Displaying the firmware version, parameter 23

Firmware is similar to operating system software for a computer. Firmware contains instructions that tell the TVS 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 TVS, you might need to provide them with the firmware version of your control. For more information about technical support, read **Service and technical support** at the front of the manual.

The TVS 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 **13**, the first item in the Configuration menu.
2. Press **Down** until **23** 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.

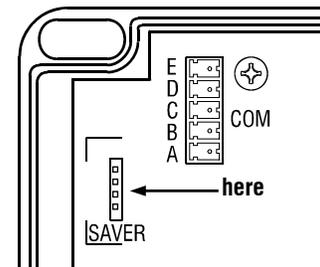
Updating the firmware, parameter 22

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

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

- ◆ **Power on:** the power on method allows you to update the TVS 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 TVS 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 TVS cover is where you connect the TVS 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 TVS enclosure and then gently remove the cover. Make sure not to disconnect the ribbon cable.
2. Insert the TVS 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 **13**, the first item in the Configuration menu.
4. Press **Down** until **22** displays and then press **Select**.

5. Press **Up** or **Down** to change the **no** to **YES** and then press **Select**.
The TVS 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 TVS 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 TVS enclosure and then gently remove the cover. Make sure not to disconnect the ribbon cable.
2. Insert the TVS Updater into the connector marked **SAVER** on the inside top-left of the cover.
3. Switch off the power to the TVS for at least five seconds.
4. Switch on the power to the TVS.
The TVS 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 TVS Updater.
6. Verify that the control functions properly.
7. Replace the cover and then tighten the four screws.

Servicing the control

Servicing and maintaining your TVS will extend the life of the control and your equipment.



Before installing or servicing your TVS, switch OFF the power at the source.

Cleaning

- ◆ Use caution when washing the room with a high-pressure washer.
- ◆ To clean the surface of the control, wipe it with a damp cloth.



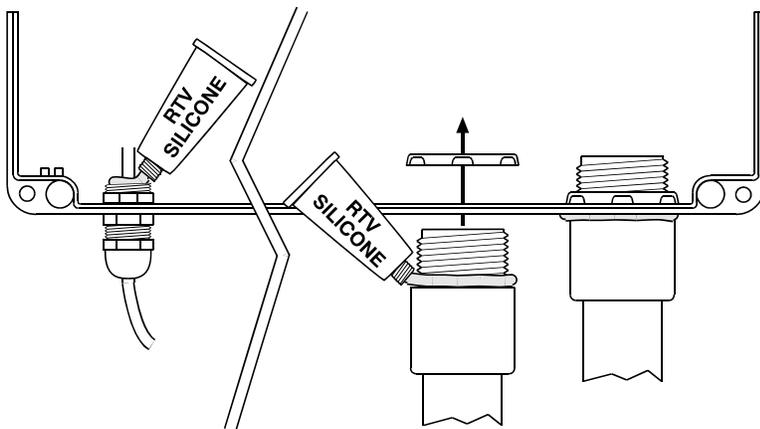
- ◇ DO NOT direct a high-pressure washer at the control.
- ◇ Do not use harsh or abrasive cleaners or rub the surface of the control with your bare hands.

Moisture

Moisture will not cause problems with the control if you take proper care during installation.

1. After the first two weeks of operation, remove the cover from the unit and check inside for moisture. Be sure to turn off the power to the control before opening the cover.
2. If there is moisture present, wipe it out with a dry cloth and check the cable entry points and rubber gasket for proper sealing.
3. If the cable connectors are not sealing, apply RTV or Silicon II (non acetic acid) sealant around the cable.

Some silicone sealants release acetic acid while curing. This can cause corrosion and damage the control. Let the silicone cure completely (one to three days) with the cover open and ensure no moisture enters the control. Failure to do this might damage the control and void the warranty.



4. Open and inspect the control after two weeks to verify it is sealing properly.



Open and inspect the control for moisture once a year. Proper care and maintenance will extend the life of the control.

Appendices

The appendices contain reference information that is useful when installing, configuring, setting up, or troubleshooting your TVS.

- ◆ **Appendix A: Glossary** below
- ◆ **Appendix B: Troubleshooting** on page 51
- ◆ **Appendix C: Factory defaults** on page 55
- ◆ **Appendix D: Installation worksheet** on page 56
- ◆ **Appendix E: Configuration worksheets** on page 57
- ◆ **Appendix F: Settings worksheets** on page 58
- ◆ **Appendix G: Motor curves** on page 59

Appendix A: Glossary

AC power	Utility companies supply electrical power as alternating current, which is referred to as AC power.
control elements	Devices connected to your TVS, such as fans and heaters.
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 TVS. You can update the firmware version of your TVS to the latest version using a TVS Updater. For more information, read Updating the firmware on page 46.
group set point	The desired temperature for the room. For more information, read Programming the group set point, parameter 1 on page 32.

hysteresis	<p>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.</p> <p>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.</p> <p>For more information, read Configuring hysteresis, parameter 18 on page 25.</p>
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idle range	<p>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.</p> <p>For more information, read Programming variable stages, parameters 2 to 9 on page 33.</p>
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idle speed	<p>The percentage of full power at which a variable speed fan operates for minimum ventilation.</p> <p>For more information, read Programming variable stages, parameters 2 to 9 on page 33.</p>
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minimum duration	<p>The minimum amount of time an alarm condition must be present before the TVS signals an alarm. The minimum duration (one minute) prevents alarms from activating when the temperature rises or drops for just a few seconds.</p> <p>For more information, read Programming alarm settings, parameters 11, on page 35.</p>
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minimum idle	See <i>idle speed</i> .
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relay	An electromagnetic switch that is either on (closed) or off (open).
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set point	<p>For variable stages, the temperature above which fan speed increases toward its maximum. For more information, read Programming variable stages, parameters 2 to 9 on page 33.</p> <p>For relay stages, the temperature at which the stage switches between the OFF and ON state. For more information, read Programming the relay stage, parameter 10 on page 27.</p>
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spikes	<p>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, known as 'brown outs'.</p> <p>For more information, read Understanding power surges and surge suppression on page 9.</p>
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terminal block The part of your TVS where you connect the wires for incoming power, control elements, and so on.

For more information, read **TVS layout** on page 13.

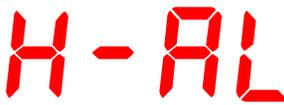
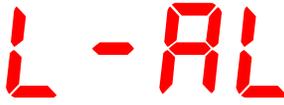
voltage Electromotive force or potential difference, usually expressed in volts (V).

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 below and then follow the instructions for resolving the alarm condition.
- ◆ If you are having a problem using your TVS, see if the problem is described in the **Troubleshooting** table on page 53 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.	<ul style="list-style-type: none"> ◇ 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 35.
 Low temperature alarm	The temperature has gone below the low temperature alarm point.	<ul style="list-style-type: none"> ◇ 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 35.

 <p>Probe damage alarm</p>	<p>A temperature probe is damaged or disconnected.</p>	<ul style="list-style-type: none"> ◇ 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.
 <p>Probe failure alarm</p>	<p>There has been a power failure.</p>	<ul style="list-style-type: none"> ◇ Check to see why the power failed and then fix the problem.
 <p>Error 1 - SAVER error</p>	<p>The TVS Saver is not in place when trying to save or restore settings</p>	<ul style="list-style-type: none"> ◇ Make sure the TVS 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 TVS, 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. Incorrect incoming power wiring The display board connect cable is not plugged into the control board properly. The 115/230 VAC switch is in the wrong position	◇ Reset the circuit breaker. ◇ Correct the wiring. ◇ Plug in the display board cable. For more information, read TVS layout on page 13. ◇ Switch off the power, set the switch to the correct setting, and then switch on the power. For more information, read TVS layout on page 13.
Temperature does not change	The control is in temperature override mode.	◇ Exit test mode. For more information, see Using temperature override mode on page 41.
Display showing unusually high or low temperature	The probe is not a Phason probe. The extension cable connected to the temperature probe is providing a poor connection Damaged probe	◇ Remove the probe and then install a Phason probe. ◇ Check the extension cable connection and re-solder it if necessary. ◇ Replace the temperature probe.
Variable fan runs at maximum	Incorrect wiring The <i>idle speed</i> is too high. The <i>differential</i> setting is the same as the <i>set point</i> . Incorrect motor curve	◇ Correct the wiring. For more information, read Connecting variable-stage cooling elements on page 16. ◇ Decrease the <i>idle speed</i> setting. For more information, read Programming variable stages on page 33. ◇ Adjust the <i>set point</i> to the desired temperature. For more information, read Programming variable stages on page 33. ◇ Configure the stage to use the other motor curve. For more information, read Configuring the stages on page 26.

<p>Variable fan not running</p>	<p>Incorrect wiring</p> <p>The fuse is open or blown.</p> <p>The variable stage is configured as OFF</p> <p>The <i>idle speed</i> setting is too low.</p> <p>The <i>idle range</i> temperature setting is too high.</p> <p>The temperature <i>set point</i> is above room temperature.</p> <p>There is no power to the fan. Faulty fan/heater Circuit breaker open</p>	<ul style="list-style-type: none"> ◇ Correct the wiring. For more information, read Connecting variable-stage cooling elements on page 16. ◇ Check why the fuse was blown and repair any problems. Replace the fuse. ◇ Configure the variable stage for cooling. For more information, read Configuring the stages on page 26. ◇ Increase the <i>idle speed</i> setting. For more information, read Programming variable stages on page 33. ◇ Decrease the <i>idle range</i> temperature setting. For more information, read Programming variable stages on page 33. ◇ Adjust the <i>set point</i> to the desired temperature. For more information, read Programming variable stages on page 33. ◇ Switch on the power. ◇ Replace the equipment. ◇ Reset the breaker.
<p>Variable speed fan responds to only a small portion of the 0 to 100% range</p>	<p>Incorrect motor curve</p>	<ul style="list-style-type: none"> ◇ Configure the stage to use the other motor curve. For more information, read Configuring the stages on page 26.
<p>Variable speed fan comes on, runs at full speed, and then turns off, keeps cycling.</p>	<p>The hysteresis is not high enough. The outside temperature is rising and falling quickly. This happens most often in the spring and fall.</p>	<ul style="list-style-type: none"> ◇ Adjust the hysteresis setting.
<p>Relay does not switch ON the load</p>	<p>Incorrect wiring</p> <p>The stage is configured as OFF, as cool for a heater, or as heat for a fan.</p> <p>The set point is incorrect</p> <p>No power to the load Faulty equipment Circuit breaker open Blown relay</p>	<ul style="list-style-type: none"> ◇ Correct the wiring. For more information, read the appropriate installation section. ◇ Configure the relay properly. For more information, read Configuring the relay stage, on page 27. ◇ Adjust the setting. For more information, read the appropriate programming section. ◇ Switch on the power. ◇ Replace the equipment. ◇ Reset the breaker. ◇ Solve the problem that caused the relay to blow and then replace the circuit board or use a different relay.
<p>Relay does not switch OFF the load</p>	<p>The stage is configured as ON.</p>	<ul style="list-style-type: none"> ◇ Configure the relay properly. For more information, read Configuring the relay stage, on page 27.
<p>Alarm relay not operating alarm system</p>	<p>Incorrect wiring</p>	<ul style="list-style-type: none"> ◇ Correct the wiring. For more information, read Connecting an alarm system on page 18.

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.

Appendix C: Factory defaults

When your TVS leaves the factory, it comes with default settings and configuration. Configuring and programming your TVS changes the factory defaults. Resetting your TVS erases *all* the configuration and settings you programmed and then restores the defaults. For more information, read **Restoring the factory defaults** on page 43.

The following table lists 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	-13.0 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	-13.0 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	-13.0 to 125 °F (-25 to 51.7°C)
5 Stage 1 differential (°F/°C)	86.5	82.0	77.0	73.0	68.0	-13.0 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	-13.0 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	-13.0 to 125 °F (-25 to 51.7°C)
9 Stage 2 differential (°F/°C)	88.5	84.0	79.5	76.0	71.0	-13.0 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	-13.0 to 125 °F (-25 to 51.7°C)
11 High temperature alarm (°F/°C)	95.0	90.0	90.0	85.0	85.0	-13.0 to 125 °F (-25 to 51.7°C)
12 Low temperature alarm (°F/°C)	80.0	75.0	70.0	65.0	65.0	-13.0 to 125 °F (-25 to 51.7°C)
13 Temperature unit	°F					°F/°C
14 Frequency	60					50/60 Hz
15 Stage 1 configuration	CL 1					OFF/CL 1 to CL 4
16 Stage 2 configuration	CL 1					OFF/CL 1 to CL 4
17 Stage 3 configuration	COOL					OFF/ON/COOL/ HEAT
18 Hysteresis (°F/°C)	0.5					0.3 to 5.0°F (0.2 to 2.8°C)
24 High temperature enable	YES					NO/YES
25 Low temperature enable	YES					NO/YES
26 Probe damage enable	YES					NO/YES
27 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 TVS to control. We recommend you make a copy of the worksheet before completing it 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 57).

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

Appendix E: Configuration worksheets



Use the **Installation Worksheet** on page 56 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 <i>Range: 0.3 to 5.0°F (0.2 to 2.8°C)</i>	

Variable and relay stages configuration worksheet

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

Stage	Description	Off	On	Heat	Cool
1	Stage 1 fan				✓
2	Unused	✓			
3	36-inch fan				✓
1					
2					
3					

Appendix F: Settings worksheets

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

Variable and relay stages settings worksheet

Parameter	Stage 1	Stage 2	Stage 3	Range/options
Group set point ^①				32.0 to 99.9°F (0 to 37.7°C)
Stage # idle speed				0 to 100 %
Stage # idle range				32.0 to 99.9°F (0 to 37.7°C)
Stage # set point	① _			32.0 to 99.9°F (0 to 37.7°C)
Stage # differential				32.0 to 99.9°F (0 to 37.7°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, but they must be greater than the *idle range*.

Alarm settings worksheet

The alarm settings for your TVS 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 exception to the one-minute minimum is the power fail alarm. The power fail alarm automatically triggers the relay on a loss of power.

For more information, read **Programming alarm settings** on page 35.

Alarm	Configuration	Setting	Description
High temperature ^① <i>H-RL</i>	ON OFF		The highest temperature to which you can safely allow your facility to rise; this cannot be lower than low temperature alarm.
Low temperature ^① <i>L-RL</i>	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 <i>PbRd</i>	ON OFF		Damaged or disconnected temperature probe
Power fail <i>PF</i>	ON OFF		Incoming power interruption
① Temperature in °F/°C, range: 32.0 to 99.9°F (0 to 37.7°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 than 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 40.

- ◆ 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
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
	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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