User manual and installation guide

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Chapter 1: Introducing the FC-1T-2VAC-3F

Introducing the FC-1T-2VAC-3F

The FC-1T-2VAC-3F automatically controls the temperature in a room by operating two variable speed fans and up to three single-speed fans or heaters. To control the temperature, the FC-1T-2VAC-3F operates the connected ventilation and/or heating equipment according to program settings.

Easy to use and program

The FC-1T-2VAC-3F comes with seven factory-configured operating programs you can easily reconfigure for your ideal situation. The easy-to-use keypad and menu system make the FC-1T-2VAC-3F one of the easiest controls to program. The FC-1T-2VAC-3F's advanced and powerful features are never more than a few keystrokes away.

Versatility and peace of mind

The FC-1T-2VAC-3F has a 30-foot temperature sensor that monitors temperatures and a single zone. For more versatility, you can connect four temperature sensors together and use four-zone averaging. Temperature sensors are available in 1, 6, 30, 75, or 150-foot lengths; you can extend them up to 500 feet using extension cable.

The FC-1T-2VAC-3F 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.

Features

- Automatic temperature-based control with -13 to 125°F (-25 to 51.7°C) range
- Two variable cooling stages for controlling fans
- Three general-purpose relays (heat or cool)
- Alarm relay (for external alarm system or siren)
- Minimum and maximum temperature logging
- Ventilation disable option
- Manual override/test mode
- Selectable motor curves
- 3-second full-power-turn-on for minimizing fan ice-up
- Seven configurable operating programs
- One temperature input
- 30-foot temperature sensor, extendable to 500 feet
- Power-failure settings protection
- Error code display
- Four-character LED display and individual stage LEDs
- Rugged enclosure (corrosion resistant, water resistant, and fire retardant)
- CSA approval
- Limited warranty (two years)

Common applications

Livestock applications

Livestock applications include buildings housing calves, rabbits, goats, hogs, poultry, and turkey. In these applications, the FC-1T-2VAC-3F often controls ventilation in a single 20 x 40-foot or smaller room. However, the FC-1T-2VAC-3F is not restricted to small rooms; some customers use it to control ventilation in sow breeding rooms that are 200 feet long.

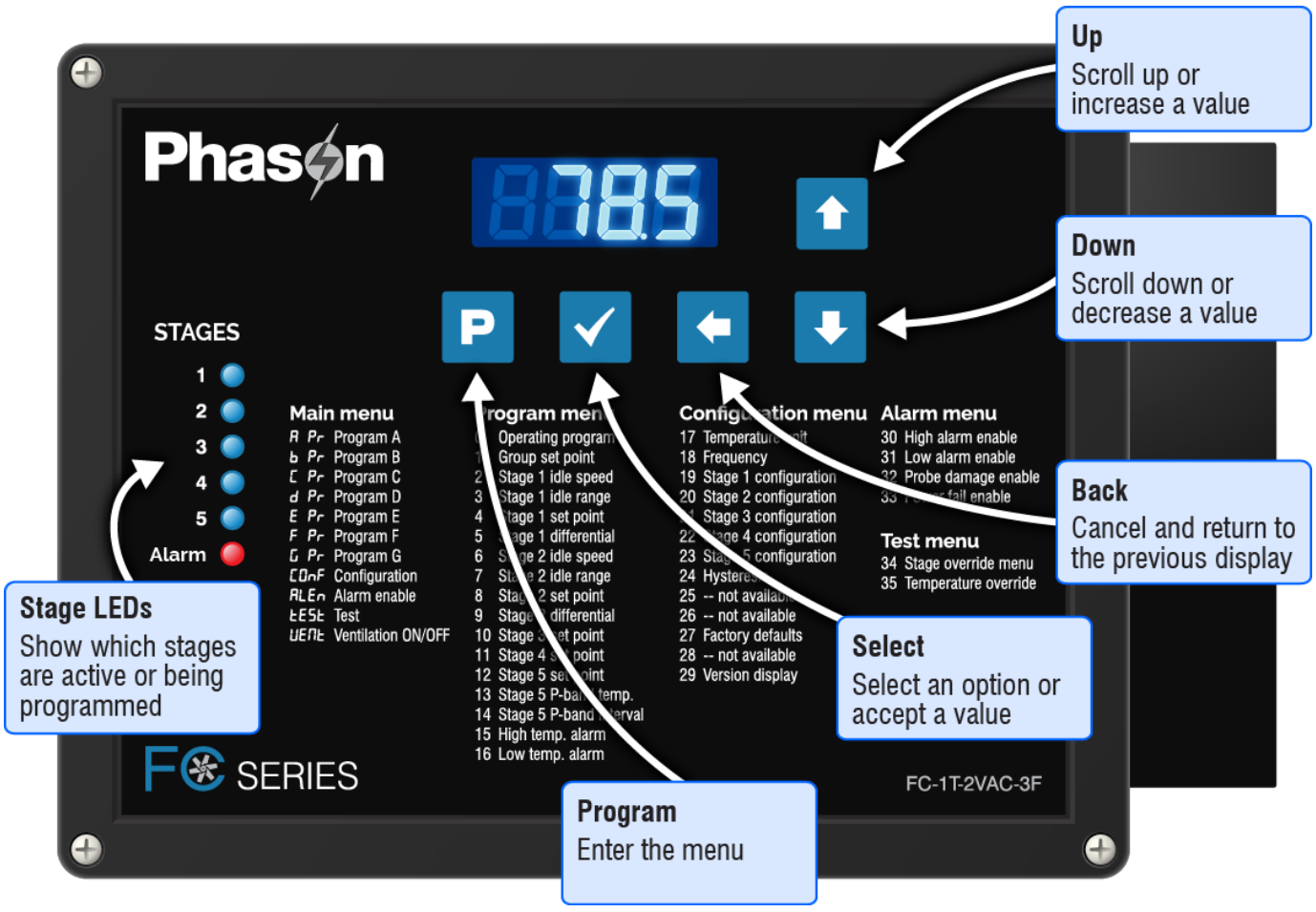
Greenhouse applications

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

Business and light-industrial applications

Business and light-industrial applications include machine shops, garages, and utility sheds where customers use the FC-1T-2VAC-3F to control fans and heaters. The FC-1T-2VAC-3F exhausts heat from the room made by equipment and/or regulates the temperature as service bays open and close.

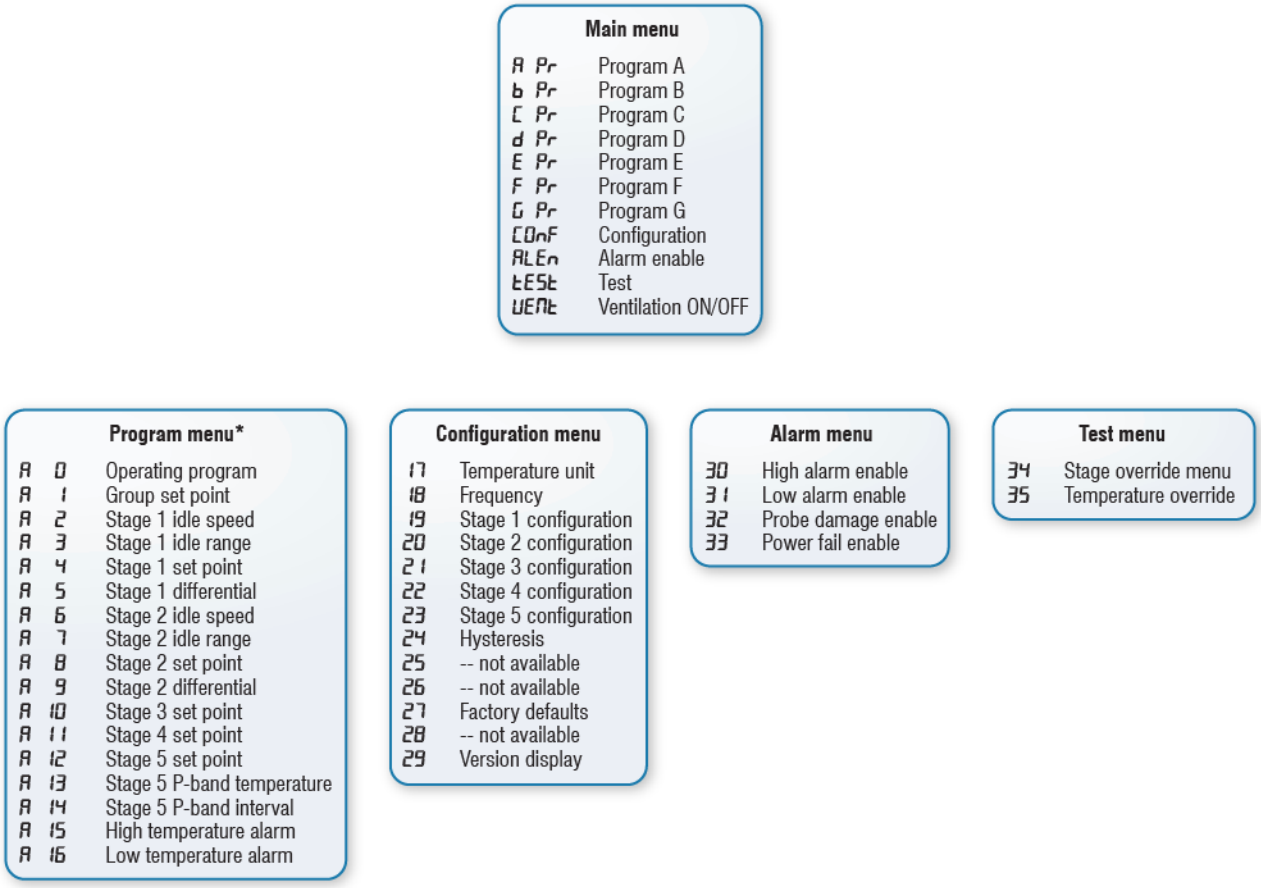
Becoming familiar with the FC-1T-2VAC-3F



Menu layout

If there is a dot in the top left corner of the display, you are in an editable menu. This means you can adjust the parameter.

Press P to cycle through the menus. Press ↑ or ↓ 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.

NOTE If you leave the FC-1T-2VAC-3F 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.

Chapter 2: Installing your FC-1T-2VAC-3F

- **What you need to know before installing your FC-1T-2VAC-3F** below
- **Connecting equipment to your FC-1T-2VAC-3F** on page 11
- **Finishing the installation** on page 16

What you need to know before installing your FC-1T-2VAC-3F

Before installing your FC-1T-2VAC-3F, you need to do some initial preparation:

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

- ◇ If you do not install external surge suppression devices, you risk damage to the electronics inside your FC-1T-2VAC-3F, which may cause your FC-1T-2VAC-3F 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 C: Installation worksheet** on page 46, list all the equipment you want to control using this FC-1T-2VAC-3F. Install the equipment and make your electrical connections according to the sheet.

3. Using **Appendix D: Configuration worksheets** on page 47, decide which relays and variable stages you want to use for each piece of equipment, and how you want the equipment configured. You can connect more than one piece of equipment to a single relay or stage as long as the total current draw does not exceed the relay or stage's limit. For more information, read **Electrical ratings** on page 9.

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 FC-1T-2VAC-3F. Lightning does not have to strike a power line to transmit a surge.

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

Reducing electrical noise using filters

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

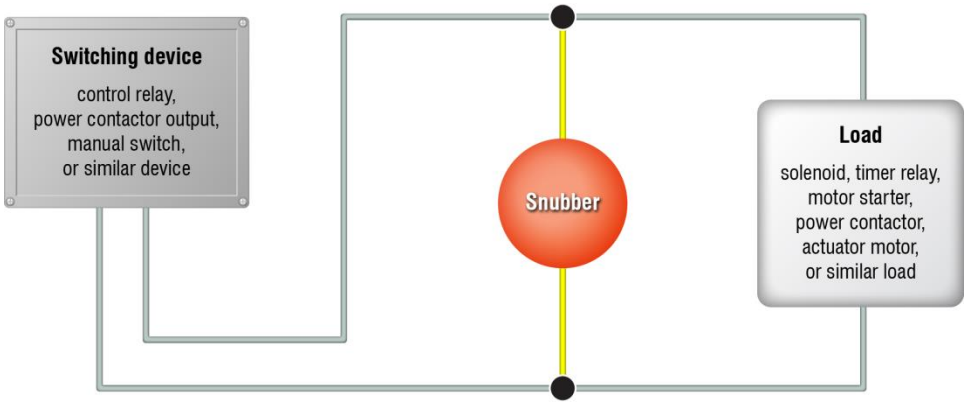
"Visible" symptoms of electrical noise include erratic control operation, cycling inlets, communication problems, and more. However, the effects of electrical noise are not always visible. Over time, electrical noise can cause electronic circuits, relay contacts, and power contactors to deteriorate.

Installing filters helps extend the life of equipment

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

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

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 9.
- ◇ 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	7 FLA at 120/230 VAC, PSC motor
(VAR 1, VAR 2)	1/2 HP at 120 VAC, 1 HP at 230 VAC, PSC motor
	10 A at 120/230 VAC, general-purpose (resistive)
Fuses (F2 and F3)	15 A, 250 VAC ABC-type ceramic
Relay stages ①	6 A at 120/230 VAC, general-purpose (resistive)
(STAGE 3, STAGE 4, STAGE 5)	1/3 HP at 120 VAC, 1/2 HP at 230 VAC
	360 W tungsten at 120 VAC
Fuses (F1, F4, and F5)	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 if they are the same type (for example, two fans) and the total current draw does not exceed the stage's limit.

NOTE 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 7 FLA.

Using power contactors to increase the capacity of relays

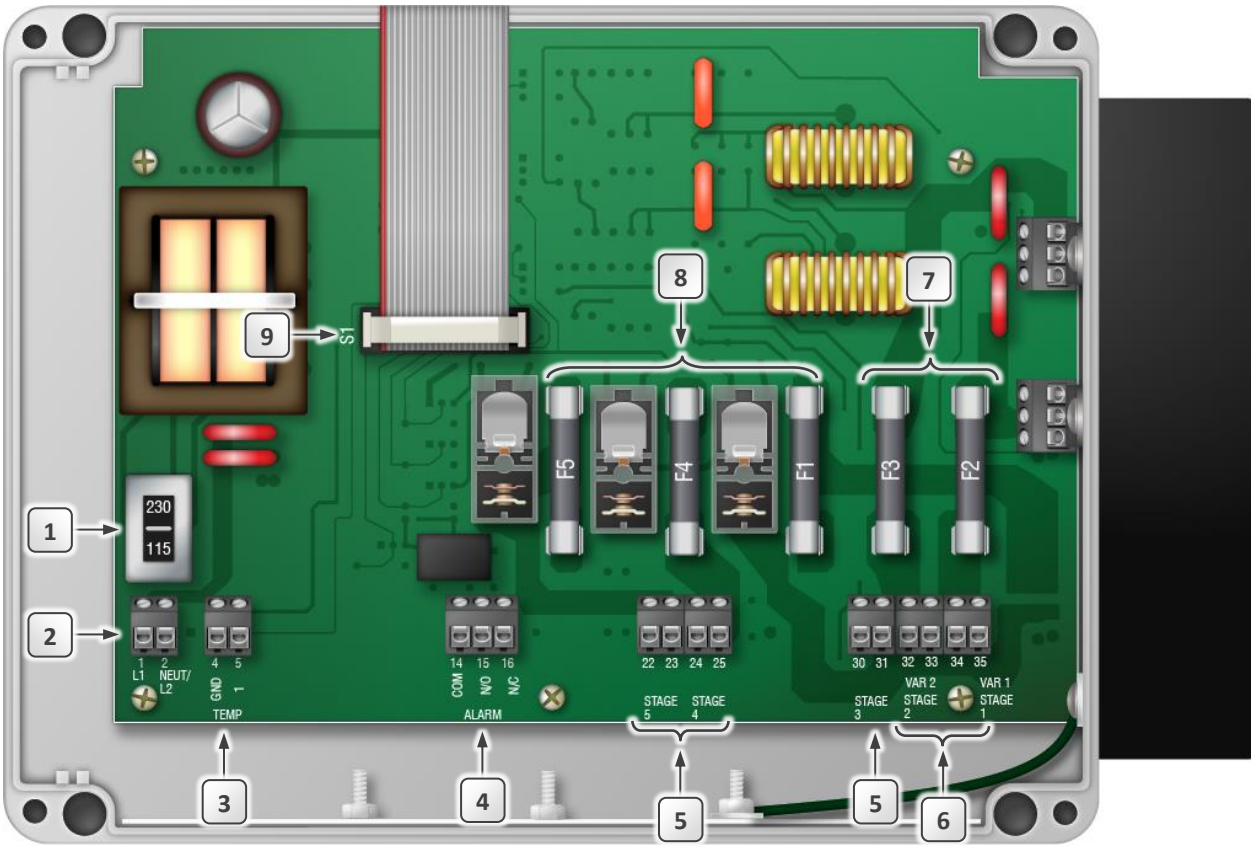
Phason's Manual Override Box (model MOB-4) has four 240-volt power contactors that allow you to increase the load handling capability of control relays. Manual Override Box is ideal for secondary ventilation fans and electric heaters.

MOB-4 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

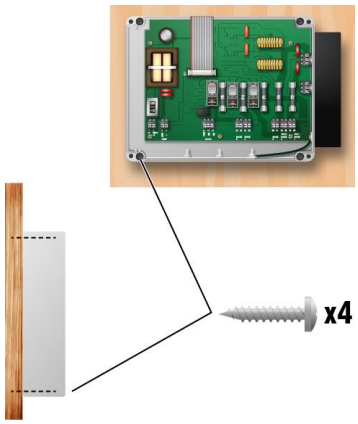
For more information, read **Replacement kits and optional accessories** on page 40

FC-1T-2VAC-3F layout



1	**Voltage selection switch**: set this switch to the correct voltage before installing your FC-1T-2VAC-3F.
2	**Incoming power terminal**: connect the incoming power (120/230 VAC, 50/60 Hz) to this terminal.
3	**Temperature sensor terminal**: connect the temperature sensor to this terminal.
4	**Alarm relay terminal**: connect an external alarm system or alarm siren to this terminal.
5	**General-purpose relay terminals** (STAGE 3 to STAGE 5): connect single stage (on/off) equipment to these terminals. You can configure these relays as heat or cool.
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): 15 A, 250 VAC ABC-type ceramic.
8	**Relay fuses** (F1 for STAGE 3, F4 for STAGE 4, and F5 for STAGE 5): 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 FC-1T-2VAC-3F



1. Select a location for your FC-1T-2VAC-3F. Make sure you have enough cable and wire to reach all the equipment 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 FC-1T-2VAC-3F

Follow all instructions when installing your FC-1T-2VAC-3F and connecting equipment to it.

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

- ◇ Your control's test modes are useful for testing your equipment after installing and configuring it. For more information, read **Testing settings and equipment** on page 36.
- ◇ Refer to **Appendix C: Installation worksheet** on page 46 and **Appendix D: Configuration worksheets** on page 47 when installing equipment.

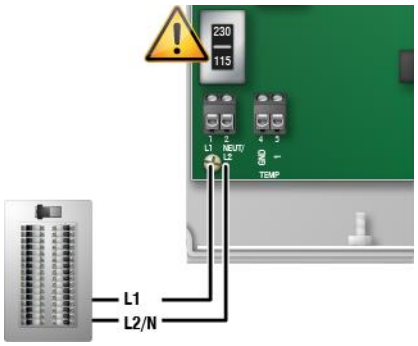
Connecting the power source

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

- ◇ Before connecting the power, set the voltage selection switch to the correct voltage.
- ◇ If you are using three-phase power, make sure the control power and the variable speed fans are connected to the same phase. For more information, read **Using three-phase power** on page 13.

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.



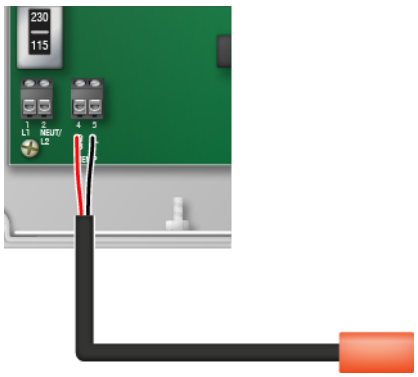
Connecting temperature sensors

NOTE

- ◇ Replace damaged sensors as soon as possible. If there is no sensor present or working properly, the FC-1T-2VAC-3F shuts off stages 3, 4, and 5 and operates variable stages 1 and 2 at idle speed.
- ◇ When routing the temperature sensor cables, do not run them in or along the same conduit as AC-power lines. For more information, read the **Control Fundamentals** guide that came with your control.
- ◇ You can extend sensor cables up to 500 feet. For more information, read the **Control Fundamentals** guide that came with your control.

To connect a single temperature sensor

- Do not run the sensor 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.



Connecting variable-stage cooling elements

The FC-1T-2VAC-3F has two variable-stage cooling terminals for connecting variable-speed fans.

To connect variable-stage cooling elements

Connect variable cooling elements to your FC-1T-2VAC-3F as shown in the diagram.

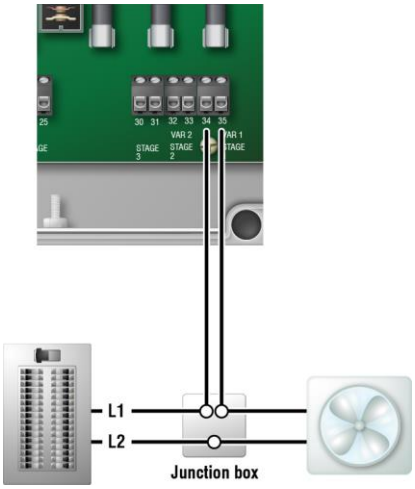
- **Only permanent split capacitor motors appropriate for variable speed control, or shaded pole motors, can be used on the variable stages.**
- If you are using three-phase power, connect the FC-1T-2VAC-3F and the equipment to the same phase. For more information, read Using three-phase power below.
- The ratings of the equipment must not exceed the ratings of the control's variable stages.

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

  7 FLA at 120/230 VAC, PSC motor

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

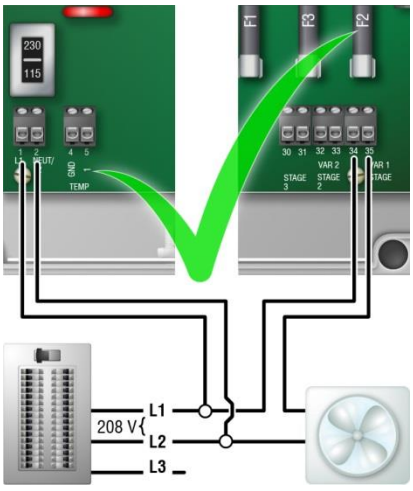
  Fuses: 15 A, 250 VAC ABC-type ceramic



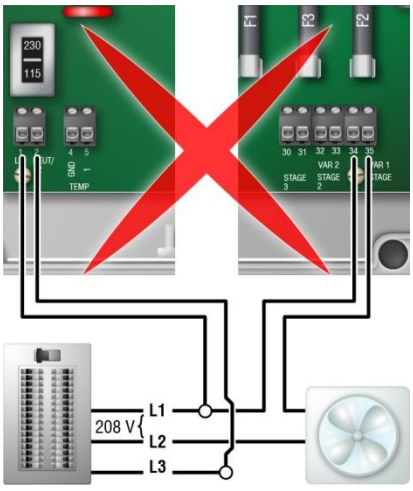
Using three-phase power

If you are connecting your FC-1T-2VAC-3F to a three-phase system, connect the control power and the variable cooling equipment to the same phase. The FC-1T-2VAC-3F must be powered from the same phases that supply the equipment. If the control's power and the variable stages are wired to different phases, the equipment will operate erratically.

Correct three-phase wiring



Incorrect three-phase wiring



Connecting fixed-stage heating or cooling equipment

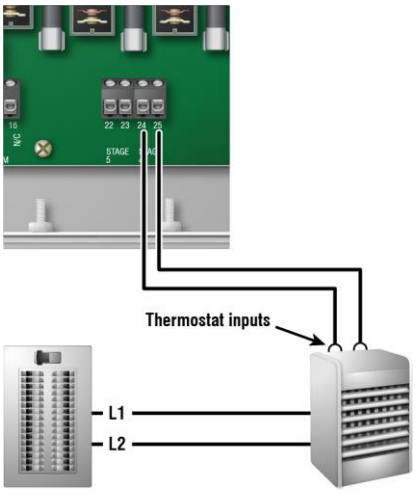
Heating or cooling equipment includes electric heaters, furnaces, and single-speed fans.

- ◇ The ratings of the equipment must not exceed the ratings of your FC-1T-2VAC-3F's relays.
  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
  Fuses:12 A, 250 VAC ABC-type ceramic
- ◇ Gas furnaces using hot-surface ignition or glow plugs can draw more current than indicated on their nameplate and require power contactors. For more information, read your furnace dealer.

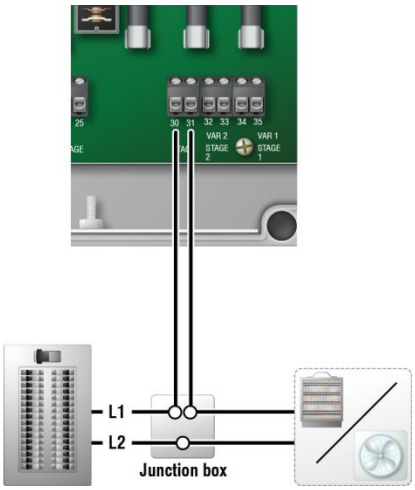
To connect fixed-stage heating or cooling equipment

Connect fixed-stage heating or cooling elements to your FC-1T-2VAC-3F as shown in the following diagrams.

Gas-fired furnace or brooder



All other single-speed elements



Connecting an alarm system

You can connect an alarm system to your FC-1T-2VAC-3F's alarm terminal. An alarm system can be a siren, alarm panel, or auto-dialer. Read your system's installation guide for installation instructions and information about the type of system: normally open or normally closed. Below are the descriptions for the alarm terminal.

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

For the alarm system to sound (or dial out) during an alarm condition, you must enable the alarms. For more information, read **Programming alarm settings** on page 32.

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

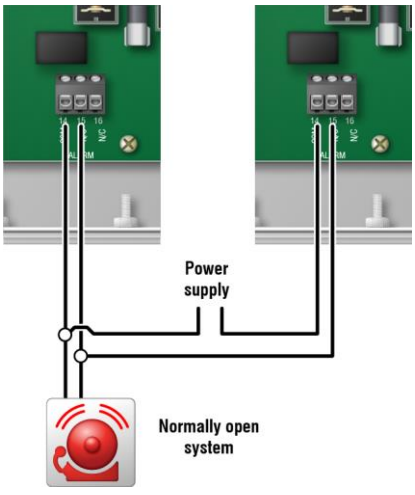
To connect an alarm system

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

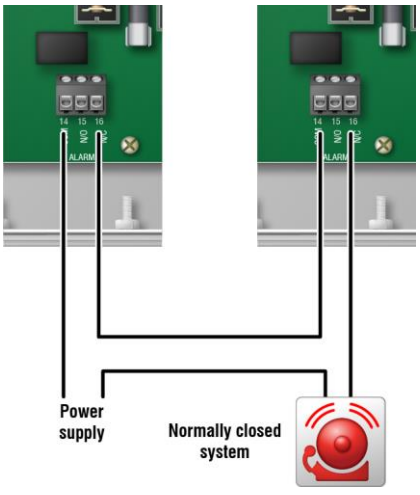
  Join all the COM connections together and all N/O connections together. The alarm relays must be in parallel with each other so any of the controls can trigger the alarm system when an alarm condition occurs.
- If you are connecting the alarm system to a network of controls and your system uses a normally closed connection (opens on alarm), connect the system as shown in the normally closed diagram.

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

Normally open system (closed on alarm)



Normally closed system (open on alarm)



Finishing the installation

After installing and connecting equipment to the FC-1T-2VAC-3F, you are ready to finish the installation.

If you used the configuration worksheets in **Appendix E**, make sure they match to how the equipment is connected to your control. It is very important that the connected to the terminals you think it is the same because the next step is to tell the control which equipment is connected to each terminal. You need to be sure you are controlling the equipment you think you are controlling.

Checklist

1. Make sure the voltage selection switch is in the correct setting.
2. Make sure all the wires are properly connected to the correct terminals.
3. Make sure the display cable is properly connected. For more information, read **FC-1T-2VAC-3F layout** on page 10.
4. Place the cover on the control.
5. Switch on the power to the control.
   When you switch on the power, the display should show ----, followed by the temperature. It may show the message PF.
   - If the FC-1T-2VAC-3F display does not come on, go back to step 1.
   - If the display shows an alarm message and/or the LED for Alarm is lit, read **Programming alarm settings, parameters 15 and** on page 32.
6. Tighten the four screws in the cover.

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

Chapter 3: Configuring the FC-1T-2VAC-3F

- **What you need to know before configuring the FC-1T-2VAC-3F** below
- **Configuring the main control functions** on page 18
- **Configuring the stages** on page 20
- **Testing the configuration** on page 22

What you need to know before configuring the FC-1T-2VAC-3F

Configuring the FC-1T-2VAC-3F means "telling" it what equipment it will be controlling and how it will be controlling that equipment. For example, the FC-1T-2VAC-3F has three relay stages. You need to "tell" the stages if they will be controlling cooling or heating equipment. Before you configure the control, 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 your FC-1T-2VAC-3F** on page 23.

◇ We recommend configuring all your equipment before programming the settings (temperature set points, idle speeds, and so on). Use the **Appendix D: Configuration worksheets** on page 47 to help you keep track of which equipment is connected to which variable stages and relays.

◇ If you receive an error message during configuration, look it up in **Appendix A: Troubleshooting** on page 41 and then follow the instructions for correcting the problem.

◇ Your FC-1T-2VAC-3F'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 36.

Configuring the main control functions

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

- Temperature units
- Frequency
- Hysteresis

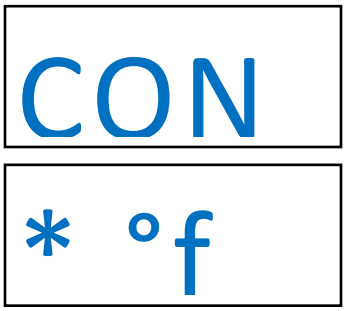
Selecting the temperature units, parameter 17

The FC-1T-2VAC-3F can display temperatures in either Fahrenheit (°F) or Celsius (°C).

Default: Fahrenheit

To select the temperature unit

1. Press **Program** until `(ONf` displays and then press **Select**.
   The display shows `17`, 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.



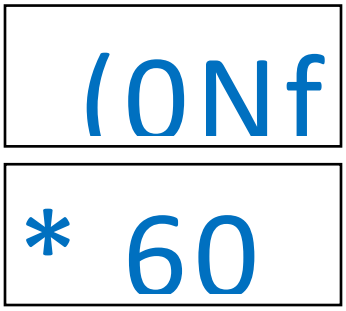
Selecting the operating frequency, parameter 18

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

Default: 60 Hz

To select the operating frequency

1. Press **Program** until (ONf displays and then press **Select**.
   The display shows 17, the first item in the Configuration menu.
2. Press **Up** until 18 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 24

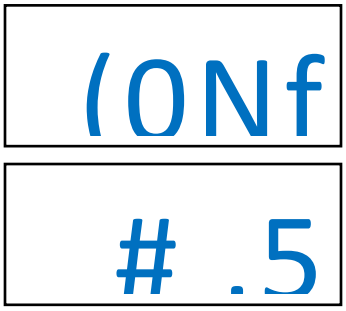
Hysteresis helps prevent damage to relays, variable stages, and the equipment connected to them by preventing the stages from switching on and off rapidly when the temperature is hovering close to the set point.

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 (ONf displays and then press **Select**.
   The display shows 17, the first item in the Configuration menu.
2. Press **Up** or **Down** until 24 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

Configuring variable stages, parameters 19 and 20

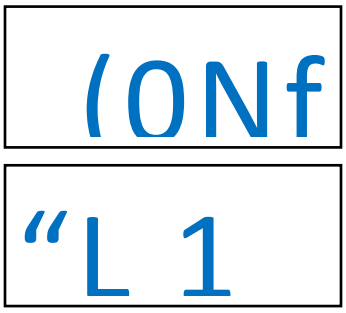
Variable stages 1 and 2 control elements that operate with gradually changing voltage, such as variable speed fans. There are three configuration options.

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

Default: stage 1 and 2 cool

- For more information about motor curves, including a table cross-referencing fan motors with recommended curves, read **Appendix F: Motor curves** on page 50.
- Use the **Variable stage configuration worksheet** on page 47 when configuring variable stages.
- For more information about how variable stages work, read **Programming variable stages** on page 26.

To configure variable stages



1. Press **Program** until `(ONf` displays and then press **Select**.
   The display shows `17`, the first item in the Configuration menu.
2. Press **Up** until `19` displays for variable 1 (or `20` for variable 2) and then press **Select**.
   The display shows the current configuration.
3. Press **Up** or **Down** until the configuration you want is displayed and then press **Select**.
   The control returns to the Configuration menu.
4. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.

Configuring relay stages, parameters 21 to 23

The FC-1T-2VAC-3F has three relay stages you can configure as one of the following options.

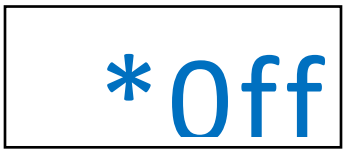
- **Off**: the relay is always open (OFF).
- **On**: the relay is always closed (ON). You can use this configuration as an override.
- **Cool**: the relay controls a cooling element and is on when the temperature is above the set point.
- **Heat**: the relay controls a heating element and is on when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

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

Defaults: stage 3 and 4 COOL, stage 5 HEAT

- If you need to connect more cooling elements than you have relays available, and you are not using both variable stages, you can use an available variable stage as an ON/OFF stage (for 120/230 VAC-powered equipment only). For more information, read **Programming variable stages, parameters 2 to 9** on page 26.
- Use the **Relay stages worksheet** on page 49 when configuring relays.

To configure relay stages



1. Press **Program** until (ONf displays and then press **Select**.
   The display shows 17, the first item in the Configuration menu.
2. Press **Up** until 21 displays for stage 3 (22 for stage 4, or 23 for stage 5) and then press **Select**.
   The display shows the current configuration.
3. Press **Up** or **Down** until you reach the option you want and then press **Select**.
   The control returns to the Configuration menu.
4. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice.

Testing the configuration

After configuring the control functions, variable stages, and relays, test the FC-1T-2VAC-3F to make sure the configuration is correct. In other words, make sure what you think is connected to a particular relay or stage *IS* connected to that relay or stage.

You can test the configuration using the control'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 control, 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 36.

Chapter 4: Programming your FC-1T-2VAC-3F

What you need to know before programming

Programming the FC-1T-2VAC-3F basically means "telling" the control what you want it to do with the equipment and when you want it done. For example, for a fixed-speed fan set for cooling you might say "Switch on when the temperature reaches 80°F." Before you begin programming the FC-1T-2VAC-3F:

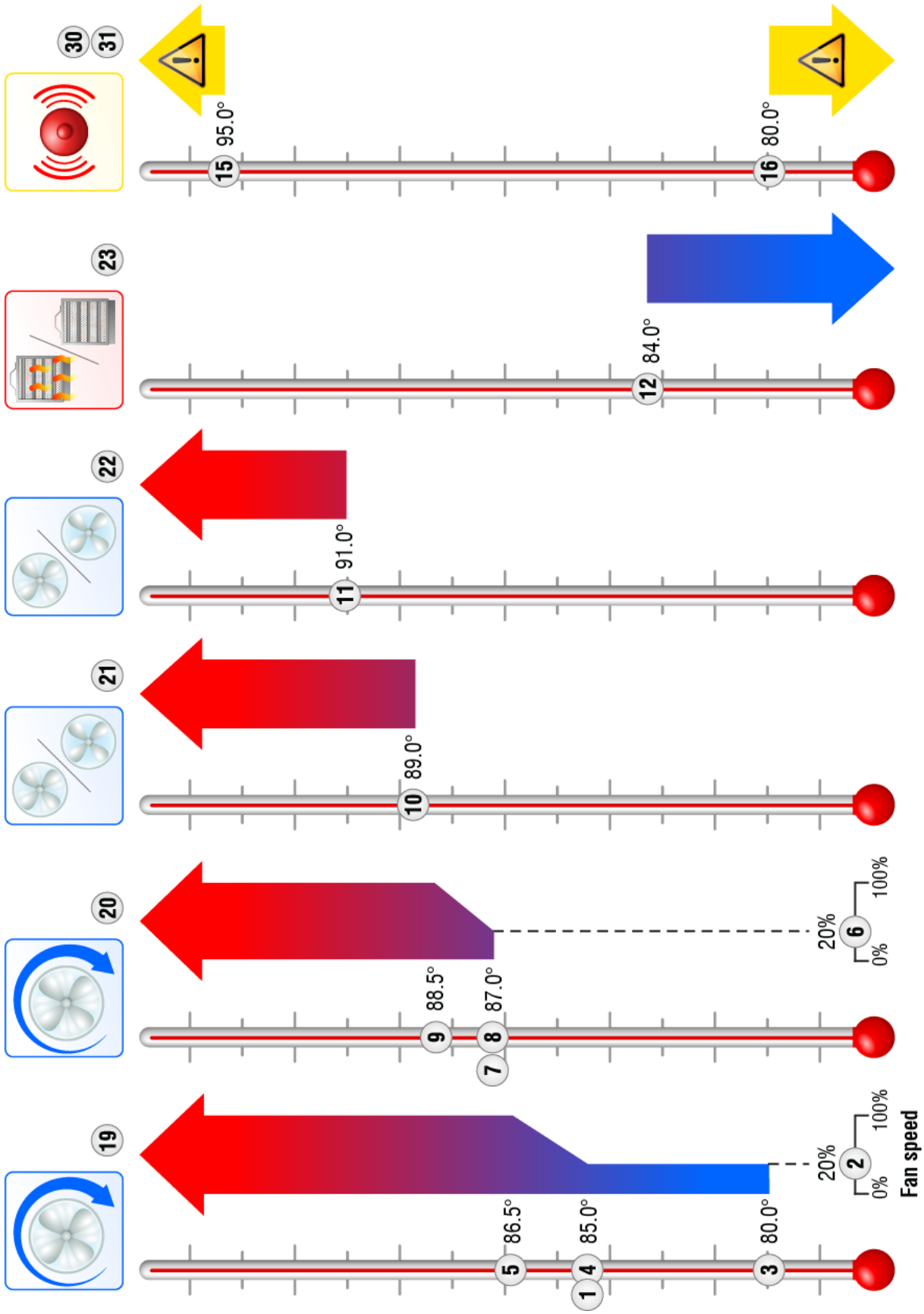
- The control has power
- You know which equipment is connected to which stages
- You have properly connected all equipment to the correct terminals.
- You have properly configured and tested all equipment connected to the variable and relay stages. For more information, read **Chapter 3: Configuring the FC-1T-2VAC-3F** on page 17.

Use **Appendix E: Settings worksheets** on page 48 when programming the FC-1T-2VAC-3F.

Understanding how the FC-1T-2VAC-3F operates

Understanding how the FC-1T-2VAC-3F operates can help you configure and program your control more efficiently and control your equipment 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 **Stage 1 idle range** and **Stage 1 set point**, the fan operates at **Stage 1 idle speed**.
4	**Stage 1 set point** is the temperature above which the stage 1 fan speed increases toward its maximum. You should set the **Stage 1 set point** to the same temperature as the **Group set point**.
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** (parameter 7).


30
31
95.0°
15
80.0°
16
23
84.0°
12
22
91.0°
11
21
89.0°
10
20
88.5°
9
87.0°
8
7
20%
6
100%
0%
19
86.5°
5
85.0°
1
4
80.0°
3
20%
2
100%
0%
Fan speed

7	**Stage 2 idle range** is the temperature above which the stage 2 fan operates at **Stage 2 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	**Stage 4 set point** is the temperature above which the stage 4 fan is on.
12	**Stage 5 set point** is the temperature below which the stage 5 heater is on.
15	**High temperature alarm** is the temperature equal to or above which the control signals a high temperature alarm.
16	**Low temperature alarm** is the temperature equal to or below which the control signals a low temperature alarm.
19	**Stage 1 configuration** in the example and factory defaults, stage 1 is configured as CL 1.
20	**Stage 2 configuration** in the example and factory defaults, stage 2 is configured as CL 1.
21	**Stage 3 configuration** in the example and factory defaults, stage 3 is configured as COOL.
22	**Stage 4 configuration** in the example and factory defaults, stage 4 is configured as COOL.
23	**Stage 5 configuration** in the example and factory defaults, stage 5 is configured as HEAT.
30	**High temperature enable** in the example and factory defaults, the high temperature alarm is enabled.
31	**Low temperature enable** in the example and factory defaults, the low temperature alarm is enabled.

Parameter		Program A setting
1	Group set point (°F)	85.0
2	Stage 1 idle speed (%)	20
3	Stage 1 idle range (°F)	80.0
4	Stage 1 set point (°F)	85.0
5	Stage 1 differential (°F)	86.5
6	Stage 2 idle speed (%)	20
7	Stage 2 idle range (°F)	87.0
8	Stage 2 set point (°F)	87.0
9	Stage 2 differential (°F)	88.5
10	Stage 3 set point (°F)	89.0
11	Stage 4 set point (°F)	91.0
12	Stage 5 set point (°F)	84.0
	13 and 14 are not used in the example.	

Parameter		Program A setting
15	High temperature alarm (°F)	95.0
16	Low temperature alarm (°F)	80.0
	17 and 18 are not relevant in the example.	
19	Variable 1 configuration	CL 1
20	Variable 2 configuration	CL 1
21	Stage 3 configuration	COOL
22	Stage 4 configuration	COOL
23	Stage 5 configuration	HEAT
	24 to 29 are not relevant in the example.	
30	High temperature enable	YES
31	Low temperature enable	YES

Programming the parameters

Programming the parameters explains parameters 1 to 23 and how to program them. For information about parameter 0, read **Selecting the operating program** on page 34.

Programming the group set point, parameter 1

The group set point is the target or desired temperature for the 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 equipment set points.

For a more-detailed description of how all settings work together, read **Understanding how the FC-1T-2VAC-3F operates** on page 23.

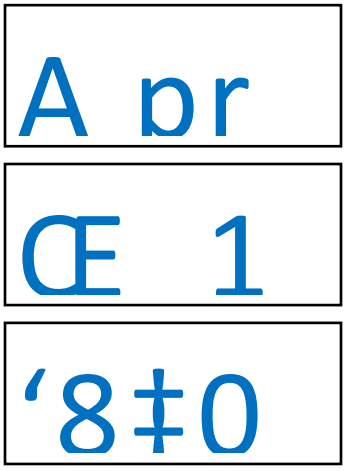
Use temperature override to test your high and low temperature alarms instead of adjusting the group set point. In temperature override mode, the alarm relay and status LEDs both operate as if they were in a real alarm situation. For more information, read **Using temperature override mode** on page 37.

NOTE

The examples in the procedure below use program A, which displays as a pr. Program B displays as b pr, C displays as C pr, and so on.

To program the group set point

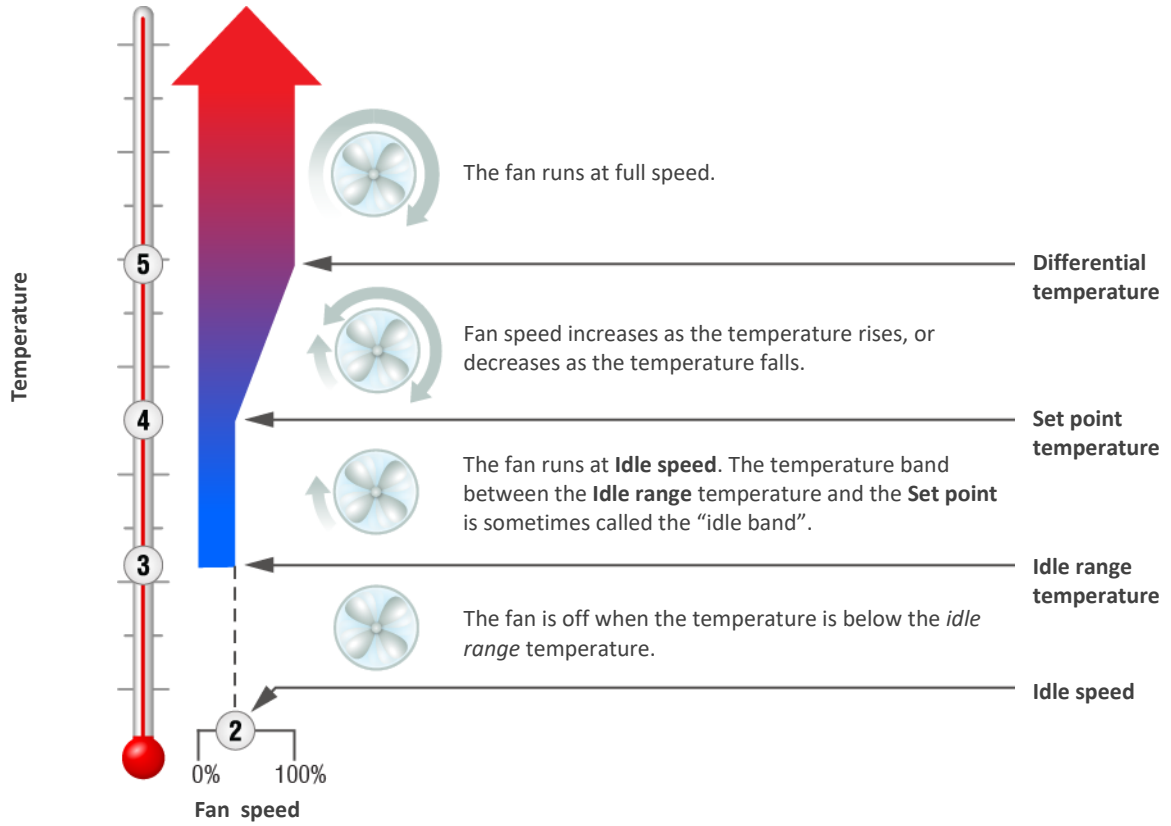
1. Press **Program** until the program you want to adjust displays, for example A pr for program A.
2. Press **Select**.
   The display shows Œ 0, the first item in the Program menu.
3. Press **Up** until Œ 1 displays and then press **Select**.
   The display shows the current setting.
4. Press **Up**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



Programming variable stages, parameters 2 to 9

There are four settings to program for each variable stage. The following diagram explains how the settings work together. For a more-detailed description of how all settings work together, read **Understanding how the FC-1T-2VAC-3F operates** on page 23.

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



Use the **Variable stage settings worksheet** on page 48 when programming variable stages.

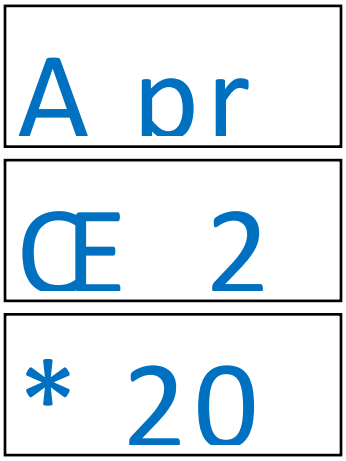
- ◇ If you need to connect more cooling elements than you have relays available, and you are not using both variable stages, you can use an available variable stage as an ON/OFF stage (for 120/230 VAC-powered equipment only).
- ◇ Set the Idle speed to 100% and Idle range to the temperature at which you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

To program variable stage settings

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

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

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



Programming relay stages, parameters 10 to 14

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

For a detailed description of how normal settings work together with all others, read **Understanding how the FC-1T-2VAC-3F operates** on page 23.

How proportional control works (stage 5 only)

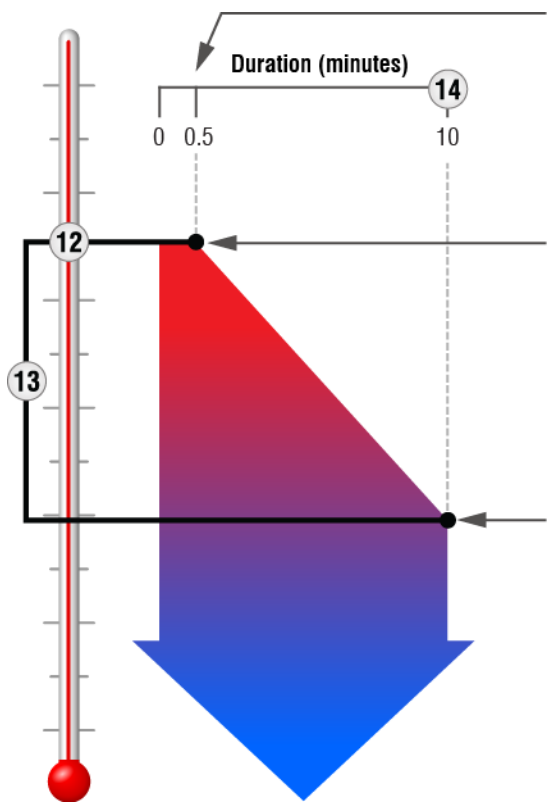
Proportional heating

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

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

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

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



The minimum relay ON duration is 0.5 minutes.

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

84.0°F

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

82.0°F

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

Proportional cooling

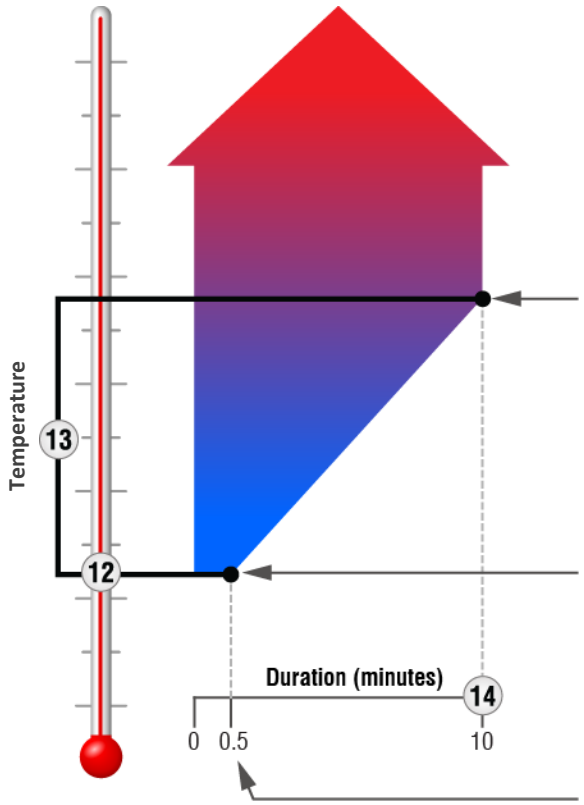
When configured for proportional cooling, the relay controls a water pump or sprinkler solenoid and operates as a proportional cycle timer. The relay switches on for a portion of the cycle/interval and off for the remainder. The duration the relay is on depends on the temperature.

Proportional cooling allows you to control temperatures more effectively and efficiently. Typical use for proportional cooling is soaking or direct evaporative cooling, which is often used in hog and dairy operations. The following example uses the default settings for Program A.

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

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

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



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

86.0°F

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

84.0°F

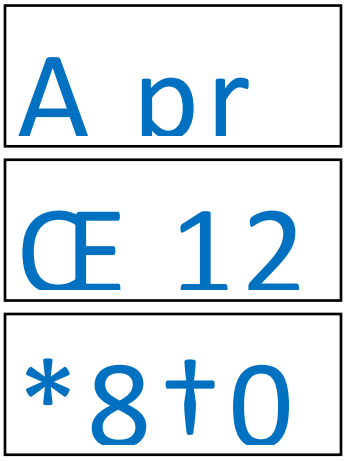
When the temperature is below the set point (12) the water pump is

The minimum relay ON duration is 0.5 minutes.

To program proportional band settings

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

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

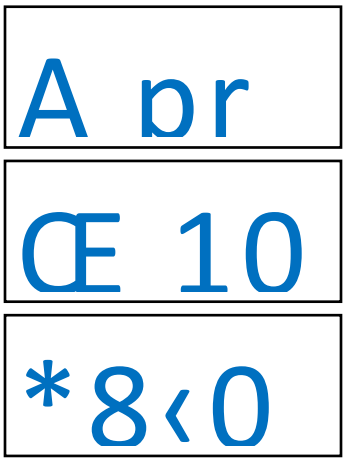


To program stage settings (no proportional band)

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

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

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



Programming alarm settings, parameters 15 and 16

There are four alarms. For a more-detailed description of how all settings work together, read **Understanding how the FC-1T-2VAC-3F operates** on page 23.

- High temperature
- Low temperature
- Sensor damage
- Power fail

The alarm settings for your FC-1T-2VAC-3F determine which alarm conditions are enabled, which are disabled, and their settings. All these work together to determine how and when the alarm relay activates (in other words, signals an alarm condition).

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

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

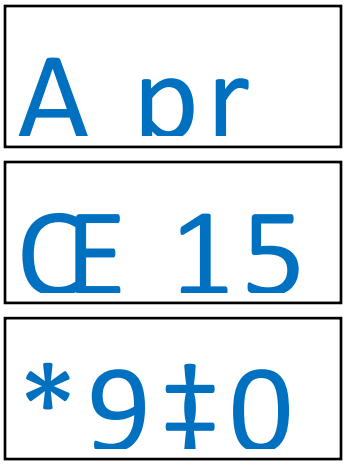
The exception to the one-minute minimum is the power fail alarm. The power fail alarm automatically triggers the relay on a loss of power.

- ◇ 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 35.
- ◇ 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 37.
- ◇ Use the **Alarm settings worksheet** on page 49 when programming alarms.

To program high and low temperature alarm settings

- ◇ The examples in the following procedure use program A. Program A displays as `a pr`, program B displays as `b pr`, program C displays as `C pr`, and program D displays as `d pr`.
- ◇ When you enable or disable an alarm, you do it for all programs and stages.

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



To enable or disable alarms

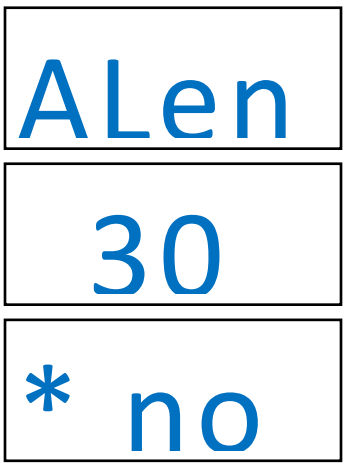
1. Press **Program** until ALen displays and then press **Select**.
   The display shows 30, the first item in the Alarm enable menu.
2. To enable or disable the High temperature alarm, press **Select**.
   The display shows the current configuration.

   Press **Up** or **Down** to toggle between no (not enabled) and yes (enabled), and then press **Select**.
   The control returns to the Alarm enable menu.
3. To enable or disable the Low temperature alarm, press **Up** or **Down** until 31 displays and then press **Select**.
   The display shows the current configuration.

   Press **Up** or **Down** to toggle between no and yes, and then press **Select**.
   The control returns to the Alarm enable menu.
4. To enable or disable the Sensor damage alarm, press **Up** or **Down** until 32 displays and then press **Select**.
   The display shows the current configuration.

   Press **Up** or **Down** to toggle between no and yes, and then press **Select**.
   The control returns to the Alarm enable menu.
5. To enable or disable the Power fail alarm, press **Up** or **Down** until 33 displays and then press **Select**.
   The display shows the current configuration.

   Press **Up** or **Down** to toggle between no and yes, and then press **Select**.
   The control returns to the Alarm enable menu.
6. To return to the Main menu, press **Back** once. To return to the Main display, press **Back** twice. Chapter 5: Monitoring and maintaining your FC-1T-2VAC-3F



Chapter 5: Monitoring the FC-1T-2VAC-3F

- **Monitoring the FC-1T-2VAC-3F** below
- **Testing settings and equipment** on page 36
- **Servicing and maintaining your** on page 37

Monitoring the FC-1T-2VAC-3F

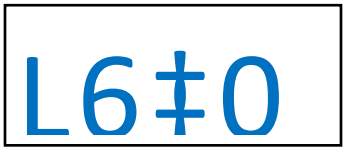
Your FC-1T-2VAC-3F displays temperature, alarm, and status information. Monitoring the control regularly gives you a better idea of what is going on in your facility. When in normal operation, the display shows the ambient temperature.

Displaying the minimum and maximum temperatures

The FC-1T-2VAC-3F logs minimum and maximum temperatures. You can view and reset the temperatures.

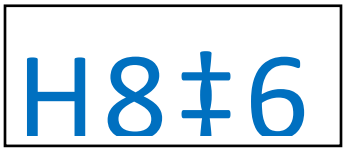
To view the minimum temperature

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



To view the maximum temperature

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



To reset the minimum and maximum temperatures

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

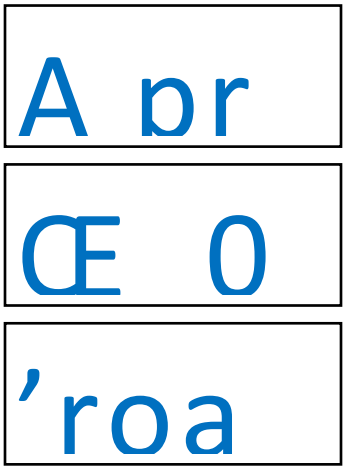
Selecting the operating program

The FC-1T-2VAC-3F 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 44.

To select the operating program

1. Press **Program** until one of the seven 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 `Œ 0`, the first item in the Program 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 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 sensor damage alarm, the display shows `X-AL`. 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 was only one alarm message, the FC-1T-2VAC-3F clears the message and returns to the main display. If there are additional alarm messages, the FC-1T-2VAC-3F displays the next message.

- ◇ Acknowledging alarms clears the alarm message; it does not deactivate the alarm relay or LED. To deactivate the alarm relay, resolve the problem causing the alarm condition.
- ◇ If you acknowledge the alarm, but do not resolve the problem causing the alarm condition, the alarm message displays again after five minutes without any key presses.
- ◇ If the condition causing the alarm returns to normal (for example, the temperature drops below the high alarm setting), the alarm relay and LED deactivate, but the alarm message remains.
- ◇ For a list of alarm messages, their descriptions, and possible resolutions, read **Alarm and error messages** on page 41.

Testing settings and equipment

The FC-1T-2VAC-3F has two test utilities: Stage override mode and Temperature override mode.

Using stage override mode

Stage override mode is for individually testing the installation and equipment connected to the FC-1T-2VAC-3F. When you enter stage override mode, all stages switch off. You can then change the output of the stages: 0 to 100% for variable stages, OFF or ON for relay stages and the alarm relay.

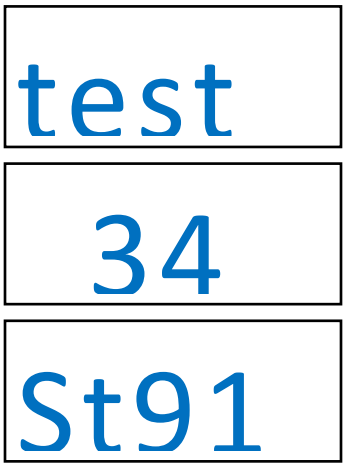
All equipment remains at the state you set it until you leave stage override mode, then it returns to normal, programmed operation. For example, if stage 3 is a cooling stage and you switch it ON, it remains on until you leave stage override mode.

NOTE

- ◇ When the FC-1T-2VAC-3F is in stage override mode, it does not operate the equipment according to the measured temperature.
- ◇ The FC-1T-2VAC-3F 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 `34`, the first item in the Test menu.
2. Press **Select**.
   The display shows `st91`, the first item in the Stage override submenu.
3. Press **Up** or **Down** until the stage you want to test displays, for example `ALA` for the alarm relay and then press **Select**.
   The display shows the current setting.
4. Press **Up** or **Down** to adjust the setting and then press **Select**.
   The control returns to the Stage override menu.
5. Repeat steps 3 to 4 for each stage you want to test.
6. To return to the Main menu, press **Back** twice. To return to the Main display, press **Back** three times.



Using temperature override mode

Temperature override mode is for testing the FC-1T-2VAC-3F 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".

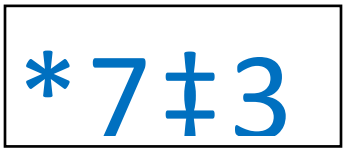
As you increase or decrease the test temperature, all stages and relays operate according to their programmed settings and the test temperature, giving you an idea of how your system performs over a full range of temperatures.

NOTE

- ◇ When the FC-1T-2VAC-3F is in temperature override mode, it operates according to the test temperature, not according to the temperature measured by the sensor.
- ◇ The FC-1T-2VAC-3F 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 `34`, the first item in the Test menu.
2. Press **Up** or **Down** until `35` 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.



Servicing and maintaining your control

- **Enabling and disabling ventilation** (on page 38)
- **Restoring the factory defaults, parameter 27** (on page 38)
- Displaying the firmware version, parameter 29 (on page 39)
- **Replacement kits and optional accessories** (on page 40)

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

Restoring the factory defaults, parameter 27

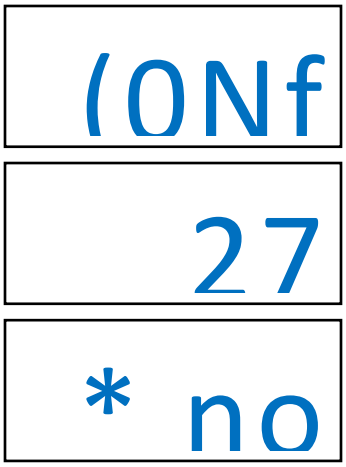
When the FC-1T-2VAC-3F leaves the factory, it comes with default settings and configuration. When you program your control, you change its configuration and settings. Resetting your control erases all the configuration and settings you programmed and restores them to what they were when the control left the factory.

For a list of the factory defaults, read **Appendix B: Factory defaults** on page 44.

- ◇ **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 FC-1T-2VAC-3F 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 (ONf displays and then press **Select**.
   The display shows 17, the first item in the Configuration menu.
2. Press **Down** until 27 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.



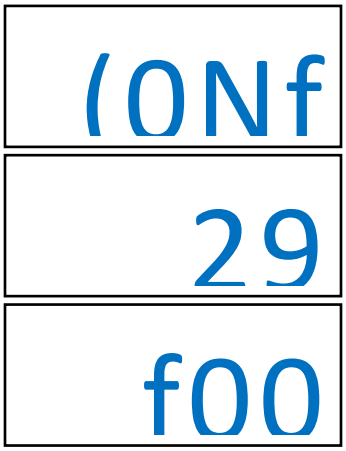
Displaying the firmware version, parameter 29

Firmware is like operating system software for a computer. Firmware contains instructions that tell the FC-1T-2VAC-3F how it operates. Just like computer operating systems, such as Windows™, have version numbers, the firmware has a version number. The FC-1T-2VAC-3F displays the firmware version as a number in the format #.##.

If you need to contact your dealer about your FC-1T-2VAC-3F, you might need to provide them with the firmware version of your control.

To display the firmware version

1. Press **Program** until (ONf displays and then press **Select**.
   The display shows 24, the first item in the Configuration menu.
2. Press **Down** until 29 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.



Replacement kits and optional accessories

For information about any parts and accessories, contact your dealer or visit **www.phason.ca.**

Parts and kits

Display kit

If the FC-1T-2VAC-3F display fails, you can replace it with a kit. The display kit is model **KDSP-1T-2VAC-3F**. After replacing the display, you will need to configure and program control.

Control kit

If the bottom circuit board of the FC-1T-2VAC-3F control fails, you can replace it with a kit. The control kit is model **KCON-1T-2VAC-3F**.

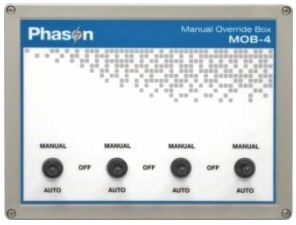
Replacement relays

You can buy packages of replacement relays. Each relay package has five relays.
The package is model number **PKG-R52**.

Phason 3K Series temperature sensors and extension cable

Phason 3K Series temperature sensors monitor temperatures ranging from –49 to 122°F (-45 to 50°C). The sensors are available in 1, 6, 30, 75, or 150-foot cable lengths and can extended up to 500. Extension cable is available in 500-foot lengths.

Power contactors



The Manual Override Box (model MOB-4) increases the load handling capability of relays and provides an external disconnect. The MOB-4 includes four 240 V power contactor relays with AUTO-OFF-MANUAL switches and snubber filters. If you need to override an actuator or curtain machine, an actuator override kit is available.

Appendixes

- **Appendix A: Troubleshooting** below
- **Appendix B: Factory defaults** on page 44
- **Appendix C: Installation worksheet** on page 46
- **Appendix D: Configuration worksheets** on page 47
- **Appendix E: Settings worksheets** on page 48
- **Appendix F: Motor curves** on page 50

Appendix A: 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 FC-1T-2VAC-3F, see if the problem is described in the **Troubleshooting** table on page 42 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
K-AL High temperature alarm	The temperature has gone above the high temperature alarm point.	◇ Try to lower the temperature by turning heaters down or off, or by increasing or turning on cooling elements (such as fans or misters), or by a combination of both. ◇ Check the temperature sensors. ◇ Check to see if a fan has failed. ◇ Check the alarm settings. For more information, read **Programming alarm settings** on page 32.
L-AL Low temperature alarm	The temperature has gone below the low temperature alarm point.	◇ Try to raise the temperature by turning heaters up or on, or by decreasing or turning off cooling elements (such as fans or misters), or by a combination of both. ◇ Check the temperature sensors. ◇ Check to see if a heater has failed. ◇ Check the alarm settings. For more information, read **Programming alarm settings** on page 32.

Alarm message	Possible cause	Possible solution
pbad Sensor damage alarm	A temperature sensor is damaged or disconnected.	◇ Check the wire between the control and the sensor. Any wire damage can cause the alarm. ◇ Replace or reconnect the temperature sensor. The control should recover automatically.
PF Power fail alarm	There has been a power failure.	◇ Check to see why the power failed and then fix the problem.

Troubleshooting

The following table lists some problems, possible causes, and possible solutions. If you are having a problem using your FC-1T-2VAC-3F, see if the problem is described in the Troubleshooting table and then follow the directions for correcting the problem.

Problem	Possible cause	Possible solution
◇ Power supply components blown out ◇ Burn marks on boards and components ◇ Motors and fans slow down or stop	Power surge, brownout, or power outage	◇ Avoid the problem in future by providing proper voltage and protection for the control.
No power and/or display	A circuit breaker at service panel is off or tripped.	◇ Reset the circuit breaker.
	Incorrect incoming power wiring	◇ Correct the wiring.
	The display board connect cable is not plugged into the control board properly.	◇ Plug in the display board cable. Read **FC-1T-2VAC-3F layout** on page 10.
	The 115/230 VAC switch is in the wrong position	◇ Switch off the power, set the switch to the correct setting, and then switch on the power. Read **FC-1T-2VAC-3F layout** on page 10.
Temperature does not change	The control is in temperature override mode.	◇ Exit test mode. For more information, see **Using temperature override mode** on page 37.
Display showing unusually high or low temperature	The sensor is not a Phason sensor.	◇ Remove the sensor and then install a Phason sensor.
	The extension cable connected to the temperature sensor is providing a poor connection	◇ Check the extension cable connection and re-solder it if necessary.
	Damaged sensor	◇ Replace the temperature sensor.
Variable fan runs at maximum	Incorrect wiring	◇ Correct the wiring. Read **Connecting variable-stage cooling elements** on page 13.

Problem	Possible cause	Possible solution
	The *idle speed* is too high.	◇ Decrease the *idle speed* setting. Read **Programming variable stages** on page 26.
	The *differential* setting is the same as the *set point*.	◇ Adjust the *set point* to the desired temperature. Read **Programming variable stages** on page 26.
	Incorrect motor curve	◇ Configure the stage to use the other motor curve. Read **Configuring the stages** on page 20.
Variable fan not running	Incorrect wiring	◇ Correct the wiring. Read **Connecting variable-stage cooling elements** on page 13.
	The fuse is open or blown.	◇ Check why the fuse was blown and repair any problems. Replace the fuse.
	The variable stage is configured as OFF	◇ Configure the variable stage for cooling. Read **Configuring the stages** on page 20.
	The *idle speed* setting is too low.	◇ Increase the *idle speed* setting. Read **Programming variable stages** on page 26.
	The *idle range* temperature setting is too high.	◇ Decrease the *idle range* temperature setting. Read **Programming variable stages** on page 26.
	The temperature *set point* is above room temperature.	◇ Adjust the *set point* to the desired temperature. Read **Programming variable stages** on page 26.
	There is no power to the fan.	◇ Switch on the power.
	Faulty fan/heater	◇ Replace the equipment.
	Circuit breaker open	◇ Reset the breaker.
Variable speed fan responds to only a small portion of the 0 to 100% range	Incorrect motor curve	◇ Configure the stage to use the other motor curve. Read **Configuring the stages** on page 20.
Variable speed fan comes on, runs at full speed, and then turns off, keeps cycling.	The hysteresis is not high enough. The outside temperature is rising and falling quickly. This happens most often in the spring and fall.	◇ Adjust the hysteresis setting.
Relay does not switch ON the load	Incorrect wiring	◇ Correct the wiring.
	The stage is configured as OFF, as cool for a heater, or as heat for a fan.	◇ Configure the relay properly. Read **Configuring relay stages, parameters 21 to 23** on page 21.
	The set point is incorrect	◇ Adjust the setting. Read the appropriate programming section.
	No power to the load	◇ Switch on the power.
	Faulty equipment	◇ Replace the equipment.
	Circuit breaker open	◇ Reset the breaker.
	Blown relay	◇ Solve the problem that caused the relay to blow, and then replace the relay or circuit board.

Problem	Possible cause	Possible solution
Relay does not switch OFF the load	The stage is configured as ON.	◇ Configure the relay properly. Read **Configuring relay stages, parameters** on page 21.
Alarm relay not operating alarm system	Incorrect wiring	◇ Correct the wiring. Read **Connecting an alarm system** on page 15.
Staged element cycles on and off	The set points are too close together with variable speed fans.	◇ Adjust the hysteresis setting. ◇ Move the sensor 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 B: Factory defaults

When the FC-1T-2VAC-3F leaves the factory, it comes with default settings and configuration. Configuring and programming it changes the values. Resetting the FC-1T-2VAC-3F erases all the configuration and settings you programmed and then restores the factory defaults. For more information, read **Restoring the factory defaults, parameter 27** on page 38.

Parameter		Program defaults					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	Stage 4 set point (°F/°C)	91.0	87.0	82.0	79.0	74.0	-13.0 to 125 °F (-25 to 51.7°C)
12	Stage 5 set point (°F/°C)	84.0	79.0	74.0	69.0	64.0	-13.0 to 125 °F (-25 to 51.7°C)
13	Stage 5 P-band temperature (°F/°C)	2.0	2.0	2.0	2.0	2	1 to 16.0°F (0.6 to 8.9°C)
14	Stage 5 P-band interval (minutes)	10	10	10	10	10	5 to 25 minutes
15	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)
16	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)
17	Temperature unit					°F	°F/°C
18	Frequency					60	50/60 Hz

Parameter		Program defaults	Range/options
19	Stage 1 configuration	CL 1	OFF/CL 1 to CL 4
20	Stage 2 configuration	CL 1	OFF/CL 1 to CL 4
21	Stage 3 configuration	COOL	OFF/ON/COOL/ HEAT
22	Stage 4 configuration	COOL	OFF/ON/COOL/ HEAT
23	Stage 5 configuration	HEAT	OFF/ON/COOL/HEAT/P-COOL/P-HEAT
24	Hysteresis (°F/°C)	0.5	0.3 to 5.0°F (0.2 to 2.8°C)
30	High temperature enable	YES	NO/YES
31	Low temperature enable	YES	NO/YES
32	Sensor damage enable	YES	NO/YES
33	Power fail enable	YES	NO/YES

Appendix C: Installation worksheet

List all the equipment that the FC-1T-2VAC-3F will control.

Use the **Installation worksheet** when you fill in the **Configuration worksheets** (starting on page 47).

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

Appendix D: Configuration worksheets

Use the **Installation Worksheet** on page 46 when completing the configuration worksheets.

Main control function worksheet

For each item, circle or write in the configuration.

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

Variable stage configuration worksheet

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

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

Relay configuration worksheet

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

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

Appendix E: Settings worksheets

Appendix F contains worksheets for you to use when programming your FC-1T-2VAC-3F. Each worksheet contains a brief explanation of the information required. For more information about programming, see **Chapter 4: Programming your FC-1T-2VAC-3F** on page 23.

Variable stage settings worksheet

Parameter	Stage 1	Stage 2	Range/options
Group set point①			-13.0 to 125 °F (-25 to 51.7°C)
Stage # idle speed			0 to 100 %
Stage # idle range			-13.0 to 125 °F (-25 to 51.7°C)
Stage # set point①			-13.0 to 125 °F (-25 to 51.7°C)
Stage # differential			-13.0 to 125 °F (-25 to 51.7°C)
① Recommend these be set to the same value.			

Relay stages worksheet

Parameter	Setting	Range/options
Stage 3 set point		-13.0 to 125 °F (-25 to 51.7°C)
Stage 4 set point		-13.0 to 125 °F (-25 to 51.7°C)
Stage 5 set point		-13.0 to 125 °F (-25 to 51.7°C)
Stage 5 P-band temperature①		1 to 16.0°F (0.6 to 8.9°C)
Stage 5 P-band interval①		5 to 25 minutes

① Required only if stage 5 is configured as proportional heat or proportional cool.

Alarm settings worksheet

The alarm settings for your FC-1T-2VAC-3F 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 (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 32.

Alarm	Configuration		Setting	Description
High temperature① K-AL	ON	OFF		The highest temperature to which you can safely allow your facility to rise Cannot be lower than low temperature alarm
Low temperature① L-AL	ON	OFF		The lowest temperature to which you can safely allow your facility to fall Cannot be higher than high temperature alarm
Sensor damage PbAd	ON	OFF		Damaged or disconnected temperature sensor
Power fail PF	ON	OFF		Incoming power interruption

① Temperature in °F/°C, *range: -13 to 125°F (-25 to 51.7°C)*

Appendix F: Motor curves

Motor curves provide a way to proportionally increase or decrease speed, regardless of motor manufacturer. For example, a Multifan motor might require 130 VAC to run at 50% RPM, while a Marathon motor might need 100 VAC to run at 50% RPM. Without a motor curve, the Multifan motor would run at a slower RPM than the Marathon motor at the same settings.

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

Use manual override or test mode to test and evaluate the operation and performance of your fan motors. For more information, read **Testing settings and equipment** on page 36.

- 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

Manufacturer	Diameter (inches)	Model	Specifications	Recommended curve
	20		0.53 HP, 1700 RPM	2
	24		0.63 HP, 1700 RPM	2
Franklin	10		1/6 HP, 3450 RPM	2
Leeson	14		1/4 HP, 1625 RPM	2
	18		1/3 HP, 1625 RPM	2
	24		1/3 HP, 1140 RPM	2
	24		1/2 HP, 1625 RPM	2
	36		3/4 HP, 1625 RPM	2
Magnetek	12		1/6 HP, 3300 RPM	2
	12		1/6 HP, 1725 RPM	2
	36		1/2 HP, 840 RPM	4
Marathon	12		1/4 HP, 1625 RPM	2
	24		1/2 HP, 1625 RPM	2
Multifan	18	4E45	1600 RPM	4
	20	4E50		4

Service and technical support

Your dealer will be happy to answer all technical questions that will help you use the FC-1T-2VAC-3F. Before contacting them, check the following:

- Read this manual for information about the feature with which you are having trouble.
- If you are having a problem using the FC-1T-2VAC-3F, look in **Appendix A: Troubleshooting**, starting on page 41 and follow the directions for correcting the problem.
- If you still have a problem with the FC-1T-2VAC-3F, collect the following information:
  - The serial number
  - Any messages displayed by the FC-1T-2VAC-3F
  - A description of the problem
  - A description of what you were doing before the problem occurred

- Phason controls are designed and manufactured to provide reliable performance, but they are not guaranteed to be 100 percent free of defects. Even reliable products can experience occasional failures and the user should recognize this possibility.
- If Phason products are used in a life-support ventilation system where failure could result in loss or injury, the user should provide adequate back up ventilation, supplementary natural ventilation, or an independent failure-alarm system. The user's lack of such precautions acknowledges their willingness to accept the risk of such loss or injury.

FC SERIES Quickstart guide

Display cable (A)
Disconnect the cable during installation. Reconnect it when done.

Voltage switch (B) ⚠
Set the switch to the correct line voltage.

Incoming power (C: 1, 2)
Connect the incoming power from the panel.

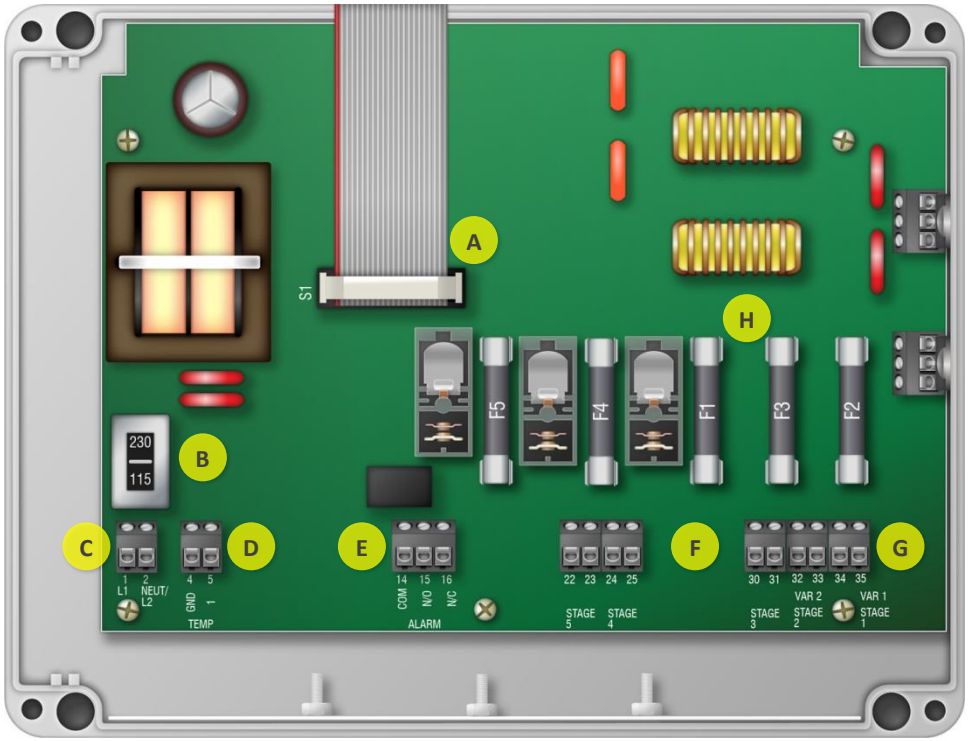
Temperature sensor (D: 4, 5)
Connect the temperature sensor.

Alarm relay (E: 14 - 16)
Connect an external alarm system or siren.

General-purpose relays (F: 22 - 25, 30 - 31)
Connect single-speed/stage heating/cooling equipment.

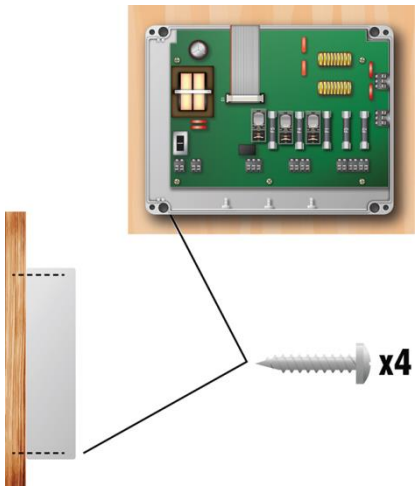
Variable stages (G: 32 - 35)
Connect variable speed fans.

Fuses (H)
Fuses F2 and F3 are for the variable stages. F1, F4, and F5 are for the relays.



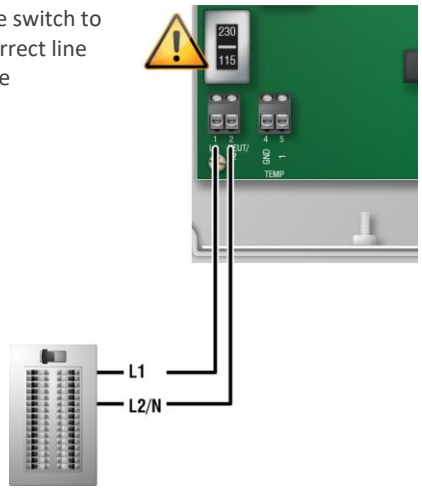
You can connect more than one piece of equipment to a variable stage or relay as long as it is the same type (for example, two fans) and the total current draw does not exceed the ratings.

Mounting holes and orientation

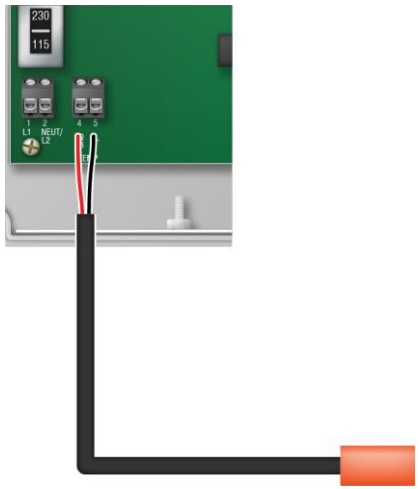


Incoming power

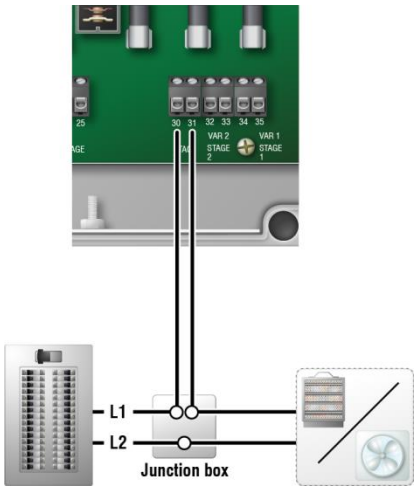
Set the switch to the correct line voltage



Temperature sensor



Single-speed fan or electric heater



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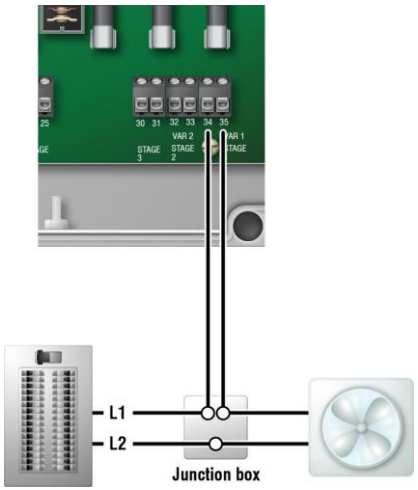
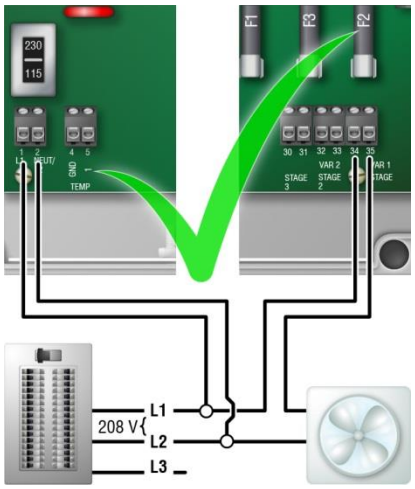
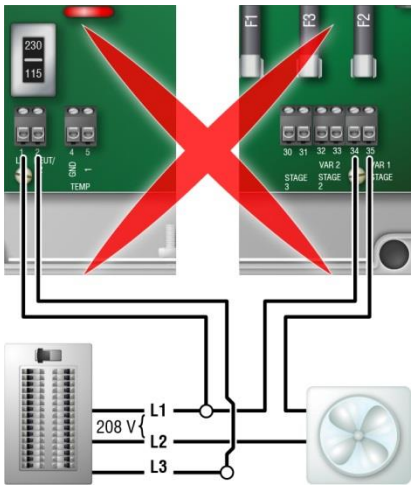
Variable speed fan



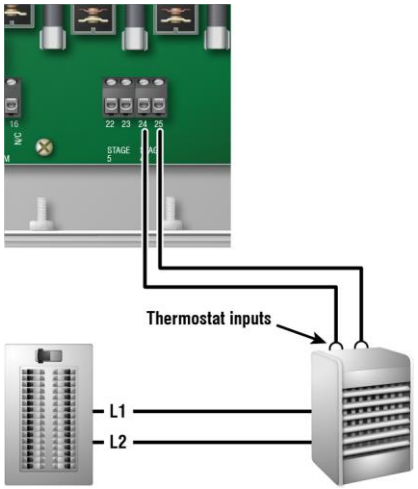
Correct three-phase wiring



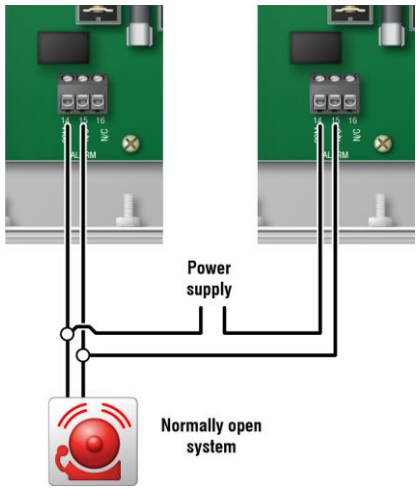
Incorrect three-phase wiring



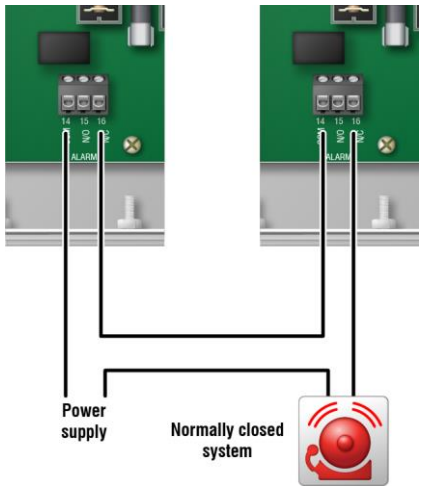
Gas-fired furnace



Normally open alarm system



Normally closed alarm system



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