FC-1T-1VAC-1F user manual

The FC-1T-1VAC-1F automatically controls the temperature in a room by adjusting the speed of variable speed fans and controlling a heater interlock.

When the temperature is at the set point, the FC-1T-1VAC-1F operates the fans at the idle speed setting and the heater is off. When the temperature exceeds the set point, the control increases the speed of the fans. When the temperature drops below the set point, the control shuts off the fans (in shut-off mode) or operates the fans at idle speed (idle mode) and switches on the heater. See the examples starting on page 3.

Features

- One variable speed output
- One heater interlock output
- Automatic shut-off and idle modes
- Adjustable off setback for shut-off mode
- Adjustable idle speed for idle mode
- Adjustable temperature set point
- Adjustable temperature differential
- Three-second full-power-turn-on to minimize fan ice-up
- Two-digit LED display
- Fahrenheit and Celsius display
- Error code display for troubleshooting
- Overload protection fuse
- Six-foot temperature probe (extendable)
- Rugged, NEMA 4X enclosure (corrosion resistant, water resistant, and fire retardant)
- CSA approval
- Two-year limited warranty

Installation

- ◇ Switch OFF the power at the source before connecting the incoming power wires.
- ◇ DO NOT switch on the power until you have finished all wiring and verified all equipment is properly connected and free of obstructions.

Electrical ratings

Input	◇ 120/230 VAC, 50/60 Hz
Variable stage	◇ 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
Variable stage fuse	◇ 15 A, 250 VAC ABC-type ceramic
Heater relay	◇ 10 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

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.

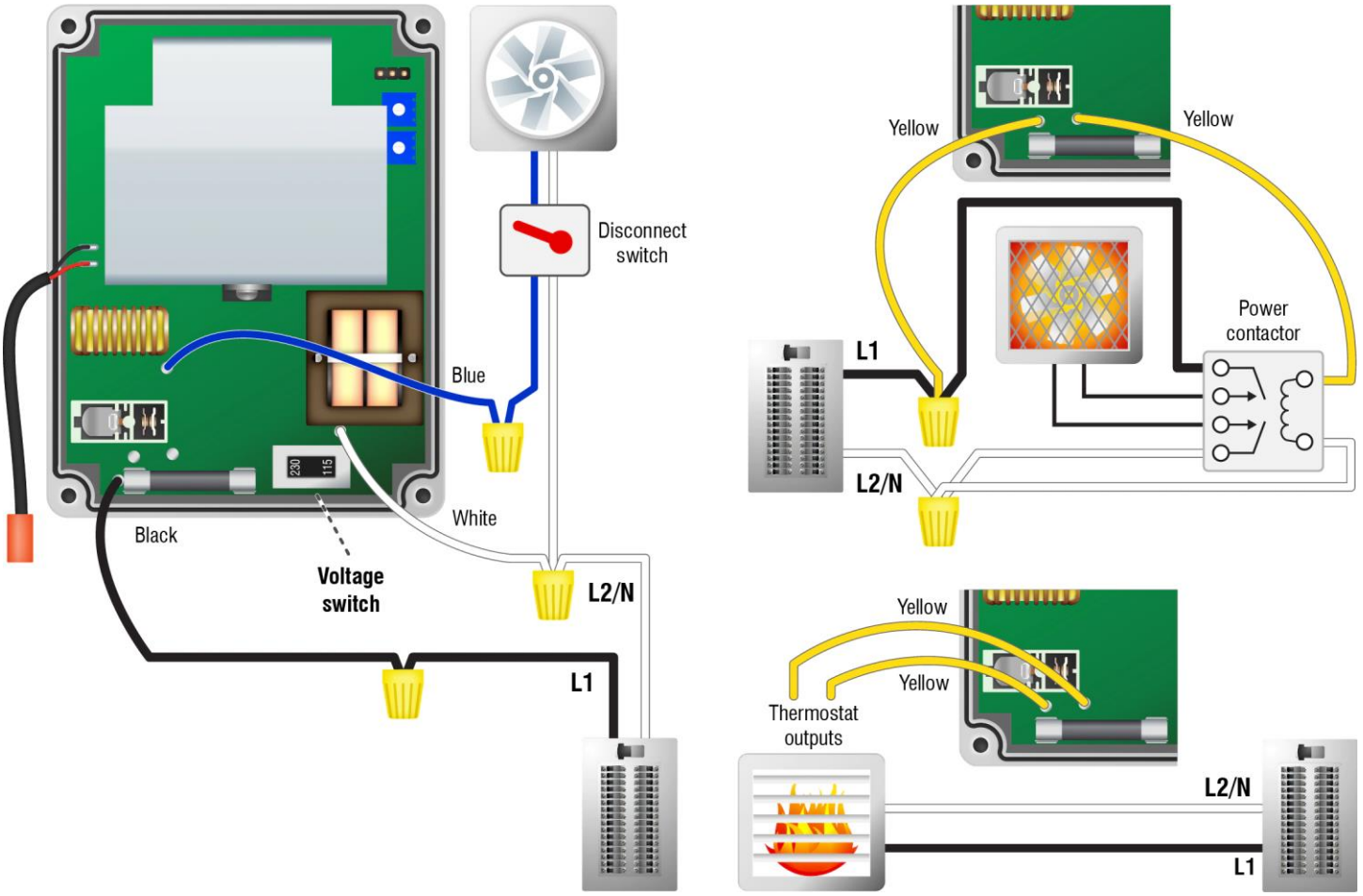
Fill in the table below to help configure your control and verify that you do not exceed the electrical ratings.

Fans	A) Maximum current draw per fan	B) Number of fans	Total current draw = A × B
Make			
Model			
Voltage rating			
Power factor			
Heater or furnace	**Maximum current draw**	**Voltage rating**	
Make			
Model			

NOTE

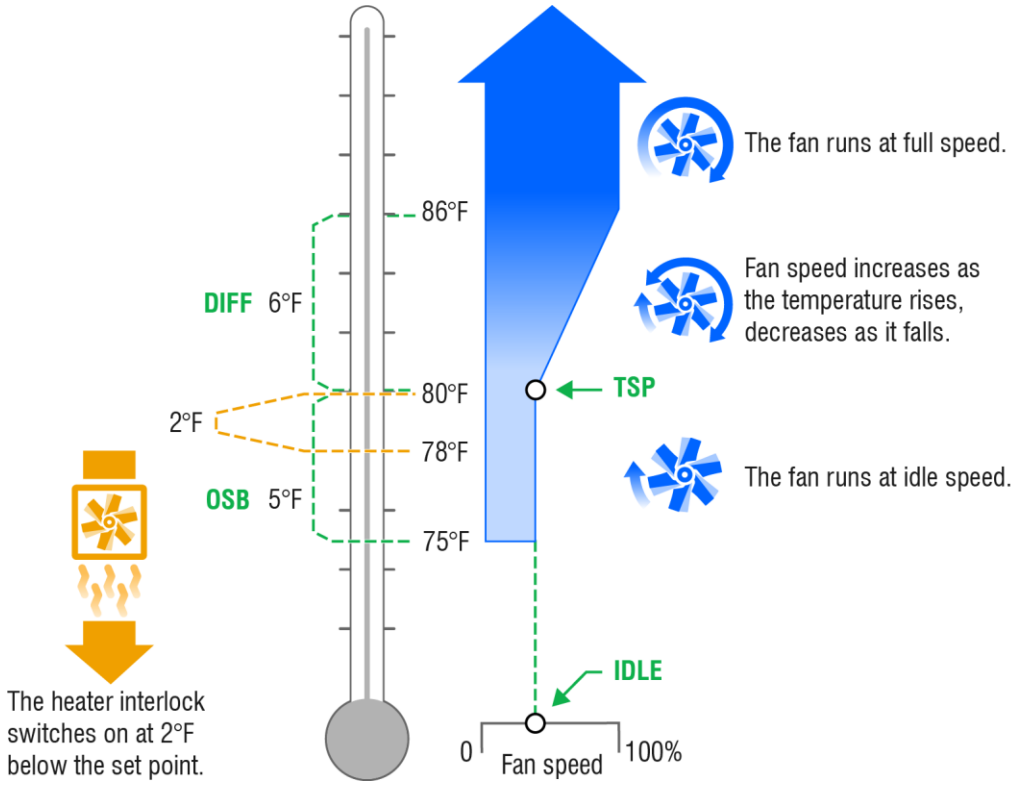
- ◇ The heater interlock output is a normally-open relay contact that switches a heater or furnace on on and off. The relay contacts close when the temperature is 2°F below the set point.
- ◇ Use power contactors for electric heat or heat lamps. Connect directly for most gas furnaces.

1. Set the **voltage switch** to the correct position for the line voltage used, 120 or 230 VAC.
2. Connect the wires as shown in the diagram.



Off setback mode example

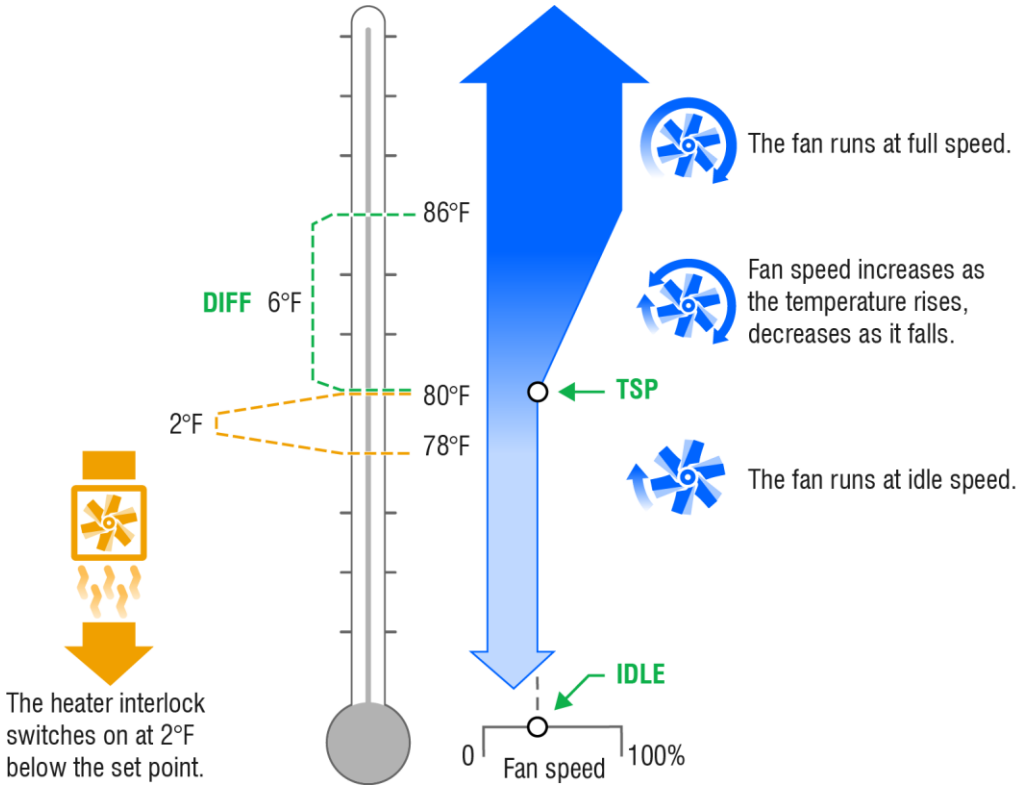
TSP: 80°F **DIFF:** 6°F **OSB:** 5°F **IDLE:** 20%



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

Idle mode example

TSP: 80°F **DIFF:** 6°F **OSB:** off **IDLE:** 20%



1. Below 78°F the heater interlock will be on.
2. The fan operates at idle speed (20% of maximum ventilation) when the temperature is below 80°F.
3. Between 80°F and 86°F (DIFF) the fan speed changes proportionally with the temperature. If the temperature increases, fan speed increases. If the temperature decreases, fan speed decreases.
4. The fan operates at maximum speed when the temperature is at or above 86°F (maximum ventilation).

Startup

When the control powers up:

1. 88 will display for 0.25 seconds (start-up).
2. 00 will display for 1 second (self-test).
3. 60 will display for 1 second. The 60 means that the frequency is 60 Hz.
4. The display will flash between the temperature and PF (power failure). Click the switch to the right to clear the message.

Display alerts

PS	The temperature sensor cable has short circuited.
PO	The temperature sensor is damaged or the connecting wire is broken.
tS	The Temperature knob has been turned. The display will alternately flash tS and the ambient temperature. The control will not accept the new setting until the switch is clicked to the set position. *OR* The voltage switch is set to 230 but the incoming power is 120 volts. Make sure the voltage switch is in the correct position.
PF	There has been a power failure. The display will flash between the temperature and PF. Click the switch to the right to clear the message.

Programming

Abbreviations

TSP - temperature set point **DIFF** - differential **OSB** - off setback **IDLE** - idle speed

Defaults and ranges

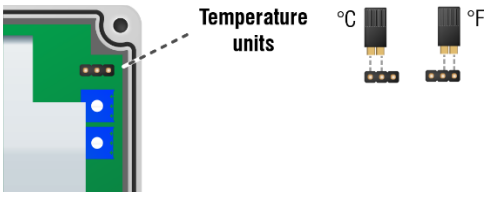
Parameter	Code	Range		Factory setting	Location
°F or °C (ambient temperature)		–22 to 99°F	(–30 to 38°C)	°F	Internal jumper
TSP		32 to 99°F	(0 to 38°C)	N/A	External knob
DIFF	d1	1 to 20°F	(0.6 to 12°C)	6°F	Internal trimmer
OSB	oS	0 to 16°F	(0 to 9°C)	5°F	Internal trimmer
IDLE	id	0 - 99%		N/A	External knob

Switch functions

Switch position	Function
CENTER	Displays the ambient temperature
RIGHT	Allows you to view and adjust the temperature set point Clears alarms
LEFT	Allows you to view and adjust the differential, off setback, and idle speed. Each time the switch is clicked and held in this position, the next parameter is displayed. The display flashes between the parameter code (two letters) and it's setting (two digits). You can adjust the parameter at this point. The cycle starts over after the last parameter. To restart at the beginning of the cycle, click the switch to the right.

Changing the temperature display units

The °F/°C jumper lets you select whether the control displays temperatures in degrees Fahrenheit or Celsius. To change the setting, position the jumper as shown.



Hysteresis

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

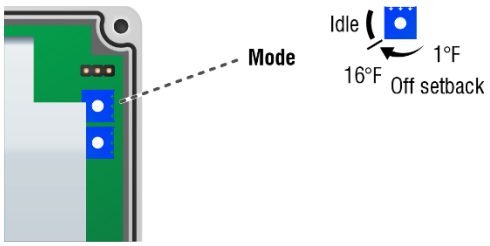
The FC-1T-1VAC-1F has a 1°F (0.5°C) hysteresis. This means the fan will turn off at 1°F below the point it turned on at. For example, if the temperature set point is 75°F, the fan will turn on at 75°F, off at 74°F.

Off setback (OSB)

OSB is the number of degrees below the temperature set point (TSP) that the fan will switch between off and idle. Idle mode provides minimum ventilation at temperatures below the TSP. See the example on page 3.

To adjust OSB

1. Click the switch to the right to start at the beginning of the parameter list.
2. Click the switch to the left two times and then hold. The display flashes between oS and the setting. If id displays, the control is in idle mode.
3. Use a small flat screwdriver to adjust the internal trimmer to the desired OSB or turn the trimmer fully clockwise to put the control into idle mode.



Minimum ventilation in OSB mode

1. There must be a temperature probe connected before you can adjust the minimum ventilation.
2. Turn the IDLE SPEED knob fully **counter-clockwise** and then back 1/4-turn **clockwise**.
3. Click the front cover switch to the right and hold while turning the TEMPERATURE knob fully clockwise and then release the switch. The fan should not be running
4. Click the front cover switch to the right and hold while slowly turning the TEMPERATURE knob counter-clockwise. When the fan runs full speed, release the front cover switch and the TEMPERATURE knob.
5. The fan runs at maximum speed for approximately three seconds, then changes to idle speed. The TEMPERATURE knob should be approximately 1°F higher than the temperature.
6. Slowly adjust the IDLE SPEED knob until a satisfactory speed has been reached. A voltmeter is helpful for determining the voltage. If you are unsure, see your fan dealer for the minimum idle voltage for your fan motor.
7. Click the front cover switch to the right and adjust the TEMPERATURE knob to the desired temperature.
8. Release the switch.

Minimum ventilation in IDLE mode

1. Turn the IDLE SPEED knob fully **counter-clockwise**.
2. Click the front cover switch to the right and hold while turning the TEMPERATURE knob fully **clockwise** and then release the switch. The fan should be running at idle speed.
3. Slowly adjust the IDLE SPEED knob until a satisfactory idle speed has been reached.
   A voltmeter is helpful for determining the voltage. If you are unsure, see your fan dealer for the minimum idle voltage for your fan motor.
4. Hold the front cover switch to the right and then adjust the TEMPERATURE knob to the desired temperature.
5. Release the switch.

Idle speed (IDLE)

Idle speed is a percentage of maximum speed and is also known as minimum ventilation. See the example on page 4.

To adjust idle speed

1. Click the switch to the right to start at the beginning of the parameter list.
2. Click the switch to the left four times and then hold.
   The display alternately flashes between id and the setting.
3. Adjust the IDLE SPEED knob on the front cover to the desired fan speed.
4. Release the switch

Temperature set point (TSP)

TSP is the desired temperature. It is also the reference for the off setback (OSB) and temperature differential (DIFF) settings.

To adjust TSP

1. Click the switch to the right and hold.
2. Adjust the TEMPERATURE knob to the desired setting.

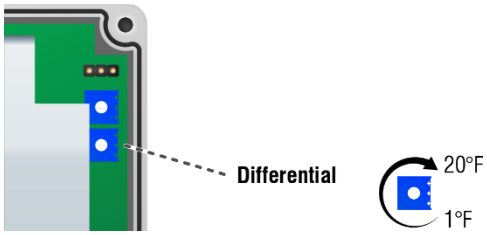
You must hold the switch in the set position while turning the TEMPERATURE knob. If this is not done correctly, the display will flash between tS and the temperature display, indicating the knob has accidentally been turned. The control will not accept the new setting until the switch is clicked to the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

Temperature differential (DIFF)

DIFF is the number of degrees above the TSP that the fan reaches maximum speed. For example, if the TSP 80°F and the DIFF is 6°F, the fan will increase from idle at 80°F to maximum speed at 86°F.

To display and adjust DIFF

1. Click the switch to the right to start at the beginning of the parameter list.
2. Click the switch to the left once and then hold.
   The display flashes between **d1** and the setting.
3. Use a small flat screwdriver to adjust the internal trimmer.



Power factor

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

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

ACTUAL DIFFERENTIAL = DESIRED DIFFERENTIAL × CORRECTION

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

6°F × 1.25 = 7.5°F

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

5°F × 1.6 = 8.0°F

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

1. Set the idle speed. See **Minimum ventilation in IDLE mode** on page 7 for the proper procedure.
2. Set the differential to 10°F with the internal trimmer. Note the temperature (**T1**) in the digital display.
3. Press and hold the switch to the right and adjust the TSP to equal the temperature from step 2.
   The fan operates just above the idle speed.
4. Slowly decrease the TSP and listen to the increase in fan speed. When the motor reaches full speed, note the temperature set point (**T2**).
5. Calculate the correction using the formula: CORRECTION = 10°F ÷ (T2 – T1)

Example 3
For a T1 temperature of 75°F and a T2 temperature of 82°F, calculate the correction as follows:
10°F ÷ (82°F-75°F) = 1.43

If the desired differential is 5°F, calculate the actual differential as follows:
5°F × 1.43 = 7.15°F.

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