



## TC4000

# Digital High Capacity Outdoor Temperature Controller

## Instruction Manual

	<p>You must read and understand this manual before installing, operating, or servicing this product. Failure to understand these instructions could result in an accident causing serious injury or death.</p> <p>Keep these instructions for future reference.</p>
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### INTRODUCTION

BriskHeat<sup>®</sup> TC4000 digital temperature controllers are designed for general purpose use in outdoor or indoor environments to control temperatures on applications requiring automatic control.

For additional information concerning this, or other BriskHeat<sup>®</sup> products, please contact your local BriskHeat<sup>®</sup> distributor or contact us toll free (U.S. / Canada only) at 1-800-848-7673 or 614-294-3376.

Save these instructions for future use.



### SAFETY ALERT SYMBOL

The symbol above is used to call your attention to instructions concerning your personal safety. It points out important safety precautions. It means “**ATTENTION! Become Alert! Your Personal Safety is involved!**” Read the message that follows and be alert to the possibility of personal injury or death.



Immediate hazards which **WILL** result in severe personal injury or death.



Hazards or unsafe practices that **COULD** result in severe personal injury or death.



Hazards or unsafe practices that **COULD** result in minor personal injury or property damage.

**IMPORTANT SAFETY INSTRUCTIONS**

**⚠ DANGER**

A person who has not read and understood all operating Instructions is not qualified to operate this product.

**⚠ DANGER**

- Do not immerse or spray any component of the control system with liquid.
- Keep volatile or combustible material away from controller when in use.
- Use controller only in approved locations.
- Keep sharp metal objects away from controller.
- Do not rely on the controller as a disconnect – only handle the output wires if you know the power is totally disconnected.

Failure to observe these warnings may result in electric shock, risk of fire, and personal injury.

**⚠ CAUTION**

- Inspect all components before use.
- Do not use control and heater if any component is damaged.
- Do not repair damaged or faulty controller or heaters.
- Do not crush or apply severe physical stress on any component of controller, including cord assembly.

Failure to observe these warnings may result in personal injury or damage to the product and/or property.

**⚠ WARNING**

**End User Must Comply With the Following:**

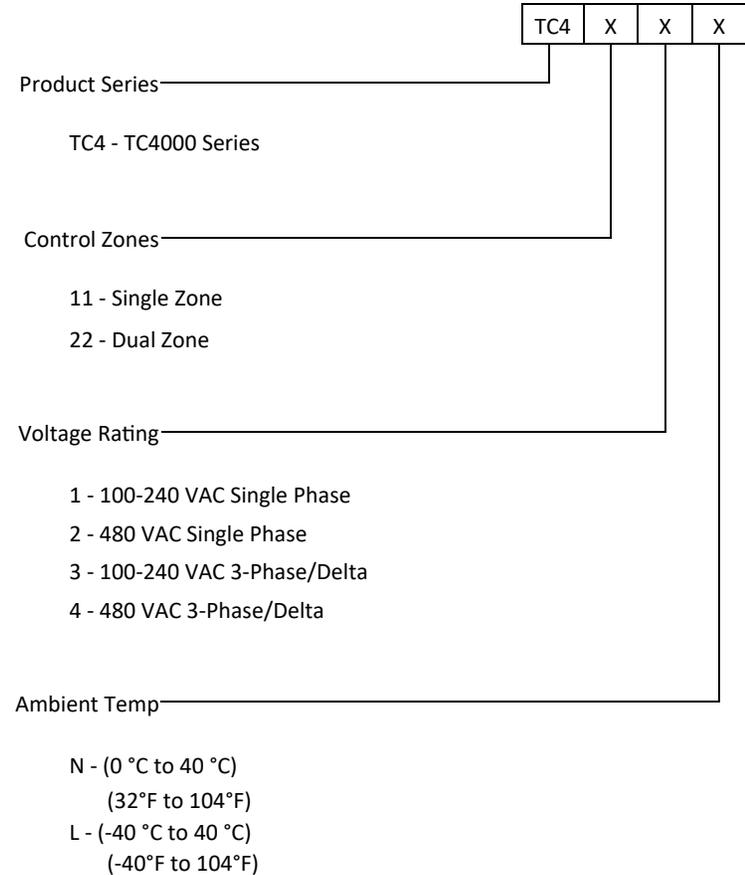
- Disconnect all supply power at the source before making any power connections.
- Only qualified personnel are allowed to connect electrical wiring.
- All electrical wiring must follow local electrical codes. BriskHeat<sup>®</sup> highly recommends following NEC Article 427.
- The person who performs the final installation / wiring must be qualified for this work.
- The end-user is responsible for providing a suitable disconnecting device.
- The end-user is responsible for providing suitable electrical protection device. It is highly recommended that a ground fault circuit breaker is used.

Failure to observe these warnings may result in personal injury or damage to the product and/or property.

**SPECIFICATIONS**

- Maximum Controller Temperature Setting: 999 °F or 999 °C
- Input Voltage: 100-240, 480 VAC; may be operated as single, or three-phase.
- Accuracy: ±0.2% with sampling time of 60 ms
- Sensor input options: Type J, K, thermocouples.
- Product dimensions: 16.75 x 15.5 x 8.5 inches (H x W x D)
- Maximum weight of 18lbs (8kg)

**Part Number Matrix for TC4000 Series**



**INSTALLATION INSTRUCTIONS**

**WARNING**

Fire and shock hazard. This product is an electrical device that must be installed correctly to ensure proper operation and to prevent shock or fire. Read these important warnings and carefully follow all the installation instructions. Keep these instructions for future reference.

**The customer is responsible for providing suitable branch circuit protection for each zone, as well as providing a suitable disconnect for each zone.**

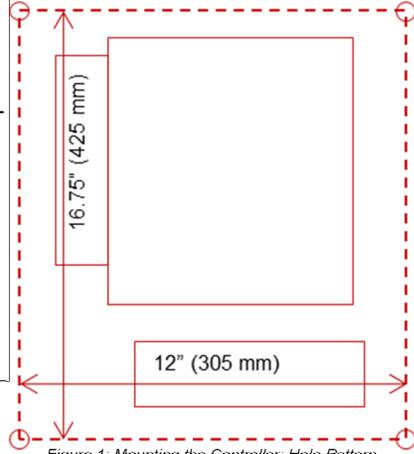


Figure 1: Mounting the Controller: Hole Pattern

**MOUNTING THE CONTROLLER:**

The following procedure should be used when installing the TC4000 temperature controller.

1. Choose an appropriate location considering the following:
  - a. Mounting location must provide strong, stable support.
  - b. Proximity to a suitable power supply.
  - c. Proximity to a means of disconnecting or switching equipment.
  - d. Proximity to heater load, in terms of sensors and monitoring. Thermocouples longer than 30m are not recommended.
  - e. The mounted location must provide easy access for the operator.
  - f. Appropriate clearances
 

*Example: clearance to open enclosure door at least 90°, clearance to allow easy connection of power cords and sensors*
  - g. Ambient operating temperature does not go beyond the range of:
 

N version: 32 °F to 104 °F (0 °C to 40 °C)

L version: -40 °F to 104 °F (-40 °C to 40 °C)
  - h. Humidity conditions within 20 - 85%, non-condensing temperatures
2. Mount the controller securely in the chosen location. All four mounting points must be used.
  - a. To mount from front (with the attached mounting brackets), simply hold the controller up to the mounting area, orient the mounting brackets as desired, and mark the new hole locations. Additional mounting hardware, suitable for the weight of the controller, may be required and is not included.
3. Supply power (inlet voltage) to be hardwired into controller.
4. As supplied, TC4000 controllers are NEMA 4X. To maintain this, all external connections must be installed with appropriate IP rated, liquid-tight fittings.
5. Ensure any heating elements connected to the controller are rated for the same voltage supplied to controller.
6. For protective grounding, connect suitably sized ground conductor at location marked in panel.

**Enclosure Openings**

For maximum flexibility, TC4000 controllers are sold with no openings already made in the enclosure. Holes for conduit and fittings may be made using a standard hole saw. Take care to avoid damaging components when making holes. Be sure to clear debris completely.

**Power Input/Output Connection**

The TC4000 is compatible with single- or 3-phase connections, and there are 2 voltage ranges offered: 100-240 VAC and 480 VAC, clearly labeled on the controller. Do not exceed the voltages listed on the controller!

Mains power must supply a Safety Ground connection to the controller.

Connect Mains power to the screw type terminal block.

Single-phase power is supported by supplying mains power to **N/L2 (DB1-1)** and **L1 (DB1-2)**.

3-phase Y or Delta is supported by supplying power to **L1 (DB1-1)**, **L2 (DB1-2)**, **L3 (DB1-3)** and **N (DB1-4)**. **This controller does not convert a Y feed into a Delta, or vice-versa.**

**WARNING**

Each electrical supply conductor must be connected directly to its intended Input (for example, Zone 1 Input). Also, because controller power is provided through the input power connection for Zone 1, Zone 1 must be connected to an electrical feed. If Zone 1 loses power, all control functionality will stop.

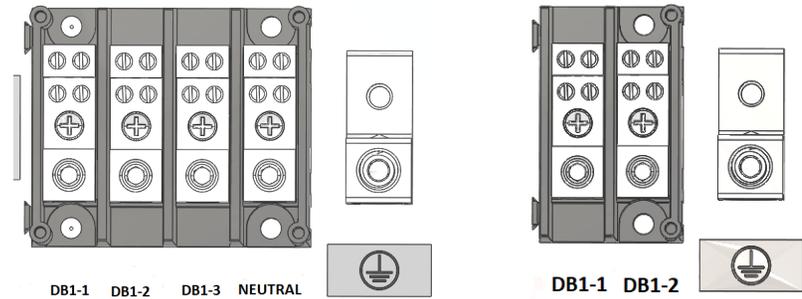
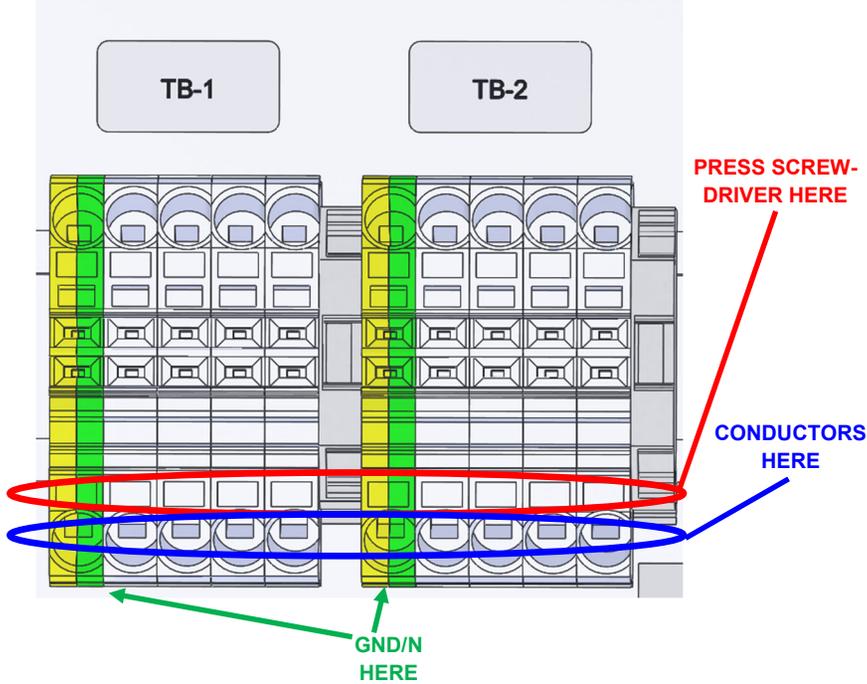


Figure 2: LEFT: 3-Phase or Delta Input Power

RIGHT: Single Phase Input Power

Input Power is supplied through the modular terminal blocks. These are clearly labeled **DB1-1**, **DB1-2**, **DB1-3**, **DB1-4** inside the controller, and the blocks are individually marked **L1**, **L2**, **L3**, **N**, **Gnd** as well. An allen wrench is required to insert connectors into the distribution block, and to disconnect. See Figure 2, above.

Heater output connections are spring-type connections. Zone 1 is marked TB-1 and Zone 2 (if applicable) is marked TB-2. All that is needed is a small screwdriver to push deeply into the terminal's adjacent slot, to temporarily loosen each terminal clamp.



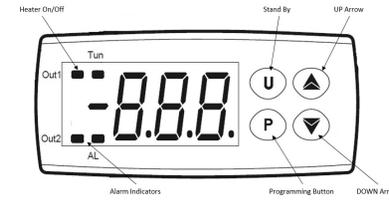
Each zone provides **L1-L3, Neutral**, and Ground (**Gnd**). The terminals are individually marked L1, L2, and L3 as well. Connect the output Gnd wire directly to the terminal block Gnd for that zone (Gnd terminal block is used as a pass-through). Customers using 3-Phase Y connections should connect the output N wire directly to the terminal block N for that zone (N terminal block is also used as a pass-through). The Neutral terminal block is not switched, floating, and is provided as a pass-through connection for a 3-Phase Y configuration.

### Temperature Sensor Connection:

The TC4000 controller can directly accept thermocouples with mini-connectors. Supported thermocouples are (J, K). The sensor type must be set in the controller. Be sure to observe correct polarity when wiring thermocouples.

### Sensor Placement:

Place the temperature sensor tip between the surfaces to be heated and the heater to be controlled. The tip must be placed in a location which best reflects the application. Depending on the object's size and shape, there may be spots that are warmer or colder due to different thermal transfer parameters. If all areas of the object must reach a minimum temperature, then place the sensor tip on the coldest spot. If the temperature of any area of the object cannot go above the controller's set point, then place the sensor tip on the hottest spot. If a temperature differential is allowable, then place the tip on an area where the temperature is between the hottest and coldest.



### BUTTON FUNCTIONS:

#### UP ARROW - SCROLL UP

Allows the operator to adjust temperature setting and parameter options (See PARAMETERS section for more information).

Down arrow - Scroll Down and Quick Temperature Set Point Access.

Allows quick access to modify controller set point value when pushed once. Allows the operator to adjust temperature setting and parameter options (See PARAMETERS section on Page 7 for more information).

U button - Standby Mode

Press to toggle the temperature controller in/out of standby mode. While in standby mode, the heater will de-energized and all heating and temperature monitoring operations cease until taken out of standby mode.

P button - Programming Mode

Grants access to program the temperature controllers parameters (See PARAMETERS section on Page 7 for more information).

### QUICK START OPERATION:

1. Default temperature set-point is 0, default unit is °C.
2. Press Down Arrow to access / change the temperature set-point parameter.
3. Press Up/Down arrows to adjust the temperature to desired set-point.
4. Press and Hold the P button exit the temperature set-point parameter.

### TO CHANGE TEMPERATURE UNITS (°C OR °F) OR ELEMENT TYPE:

1. Press and hold the P button for approximately 5 seconds.
2. Use (▲▼) buttons to select the "r.P." (Restricted Parameters) parameter keyword on the controller.
3. Press the P button to select. The controller will alternately flash the parameter's keyword (r.P.) and its current value.
4. Use (▲▼) to adjust the parameter value from 0 to 1.
5. Press the P button to save the desired value. The display will return to flashing only the selected parameter's keyword.
6. Use (▲▼) buttons to select the "SEn" (sensor) parameter keyword on the controller.
7. Press the (P) button to select. The controller will alternately flash the parameter's keyword (SEn) and its current value.
8. Use (▲▼) to adjust the parameter value. See PARAMETERS section on page 8 for more information.
9. Press the (P) button to save the desired value. The display will return to flashing only the selected parameter's keyword.
10. Exit the programming mode by pressing and holding (▲) for approximately five seconds or wait 30 seconds for the controller to automatically exit the programming mode. When the temperature displays, the controller is no longer in the programming mode.

## OPERATION OVERVIEW

### NOTE: READ ALL INSTRUCTIONS PRIOR TO APPLYING POWER TO THE CONTROLLER

- All TC4000 Controllers require temperature sensors, which may be Type-J, Type-K. Verify correct polarity of the sensor connection prior to use.
- Verify proper placement of the temperature sensor.
- Properly connect power leads of each heater into the appropriate contactor(s).
- Plug the selected thermocouple into the TC4000's jack corresponding to the heating zone being controlled.
- When all is ready, turn on the power feeding this system.
- Press the **P** key and use the **▼** and **▲** arrow keys for each zone controller to adjust the setpoint.

### Parameter protection through a password:

The instrument has a function that protects the parameters through a password, programmable through parameter *PP*. If you wish to have this protection, you must set the *PP* parameter to the number you would like to be your password and then exit from parameters programming.

When the protection is active, to be able to have access to the parameters, press the **P** key and keep it pressed for about 5 s. Afterwards, the display shows *r.P*, press **P** again, the instrument shows 0.

Now, through the **▲** and **▼** keys, set the number of your password and press **P** again.

If the password is correct the display shows the code that identifies the first parameter and it will be possible to program it with the same procedure as described on the previous paragraph. The password protection is disabled when *PP* = 0.

**▲** If the password is forgotten, use password -18. This allows to access the protected parameters and verify/ modify the *PP* parameter.

### Factory Reset (load default parameters)

It is possible to restore the instruments factory configuration. To load the factory default parameter settings, proceed as follows:

- Enter in configuration mode (see 5.4 paragraph).
- If no password is programmed, set *PP* different from 0.
- Exit from configuration mode.
- Press the **P** button for more than 7 seconds. The display shows *rP*.
- Release the **P** button and push it again. The display shows 0.
- Using the **▲** and **▼** buttons set the value -48.

Once the password has been confirmed by pressing the **P** key, the display shows for approximately 2 s "----", the instruments then runs through the start up procedure resetting all the parameters to the factory defaults.

## PARAMETERS

No	Par.	Description	Range	Default	Prot .
1	SPL	Minimum Set Point Value	-99.9 ÷ SPH E.U.	-99	Yes
2	SPH	Minimum Set Point Value	SPL ÷ 999 E.U	999	Yes
3	SP1	Set point	SPL ÷ SPH E.U.	0	No
4	SP2	Second Set Point	SPL ÷ SPH E.U.	0	Yes
5	AL	Alarm threshold	-99.9 ÷ 999 E.U.	0	Yes
6	tun	Autotuning	ALL Performed at every start up onE Performed at the first start up ub Performed when <b>U</b> key is pressed	onE	Yes
7	Pb	Proportional Band	1 ÷ 999 E.U.	50	Yes
8	ti	Integral time	0 (OFF)/1 ÷ 500 seconds	100	Yes
9	td	Derivative time	0 (OFF)/1 ÷ 200 seconds	25	Yes
10	SEn	Input type F type	JC TC J (°C) CA.C TC K (°C) JF TC J (°F) CA.F TC K (°F)	J.C	Yes
		A type	Pt.C PT 100 (°C) Pt.F PT 100 (°F)	Pt.C	Yes
		T type	nC.C NTC (°C) PC.C PTC (°C) nC.F NTC (°F) PC.F PTC (°F) P1C PT 1000 (°C) P1F PT 1000 (°F)	nC.C	Yes
11	DP	Decimal point	YES Autoranging visualization no Visualization with no decimal point	no	Yes
12	CA	Offset on the displayed value	-300 ÷ 300 E.U	0	Yes
13	Ft	Filter on the displayed value	0 (OFF)/1 ÷ 20 s	0	Yes
14	01F	Out1 function	<b>H.rE</b> PID control with heating action <b>C.rE</b> PID control with cooling action <b>on.H</b> ON/OFF control with heating action <b>on.C</b> ON/OFF control with cooling action	HrE	Yes

**PARAMETERS**

No	Par.	Description	Range	Default	Prot.
15	tr1	Out1 cycle time	1 ÷ 250 seconds	30	Yes
16	o2F	Out2 Function			Yes
		When: o1F = H.rE or o1F = C.rE	no Not used HAL Absolute high alarm LAL Absolute low alarm b.AL Band alarm (simmetric to the set point) dHA Deviation high alarm dLA Deviation low alarm	No	Yes
		When: o1F = on.H or o1F = on.C	no Not used HAL Absolute high alarm LAL Absolute low alarm b.AL Band alarm (simmetric to the set point) dHA Deviation high alarm dLA Deviation low alarm SP.C SP2 ON/OFFcontrol with cooling action SP.H SP2 ON/OFF control with heating action nr ON/OFF neutral zone	No	Yes
17	d1	Out1 hysteresis or neutral zone	0.1 ÷ 999 E.U.	1	Yes
18	d2	Out2 hysteresis	0.1 ÷ 999 E.U.	1	Yes
19	ALF	Alarm function	AL Automatic reset Alarm AL.n Latched Alarm AL.A Ack Alarm	AL	Yes
20	ALt	Alarm inhibition time at start up or after a set point change	0 (OFF)/0.01 ÷ 9.59 hh.mm	0	Yes
21	Pct	Compressor protection time	0 (OFF)/0.01 ÷ 9.59 hh.mm	0	Yes
22	Sst	Soft start time	0 (OFF)/0.01 ÷ 9.59 hh.mm	0	Yes

**PARAMETERS**

No	Par.	Description	Range	Default	Prot.
23	SSP	Power during Soft Start	0 ÷ 100%	0	Yes
24	UbF	U key function	no No function Tun It activates the manual tun- ing Sb Stand-by mode Sb.o Stand-By mode with display off	tun	Yes
25	PP	Protection Password	1 ÷ 999	0	Yes
26	Lo	Key lock time out	0 (key lock disabled)/1 ÷ 30 min		Yes

**Configuration of Parameters:**

1. If the controller is in Stand-by mode, return the controller to normal operations.
2. Press and hold the P button for approximately 5 seconds. Use the UP and DOWN buttons to select the desired parameter to change.
3. Press the P button to select the desired parameter. The instrument will alternatively visualize the parameter's code and its current value.
4. To modify the value of the parameter, press the UP and DOWN buttons.
5. Press the P button to save the new value. The display will return to visualize only the code of the selected parameter.
6. Press the UP and DOWN buttons to select another parameter to modify using the steps above.
7. To exit the programming mode, press and hold the UP button for approximately five seconds or wait 30 seconds for the controller to automatically exit the programming mode. When the temperature displays, the controller is no longer in the programming mode.

**Stand - by:**

Press and hold the U (Stand-by) button to turn on stand-by mode. The heater will not heat while the controller is in this mode. To return the controller to normal operations, press and hold the U button until the temperate displays on the screen.

**ALARM SETTINGS**

The alarm displays when the sensing element temperature extends past the High Limit Alarm. This device's alarm is identified by the illumination of the AL and OUT2 red LEDs. The alarm settings are accessed under the Alarm Function (AL.F) parameter. The three available alarm settings are:

- AL - Automatic reset Alarm - When the temperature extends past the High Limit Alarm, the alarm automatically disengages.
- AL. n - Latched Alarm - When the temperature extends past the High Limit Alarm, the alarm display will remain engaged until it is manually reset. To manually reset the alarm, press and hold both the U and P buttons for 5 seconds.
- AL.A - Acknowledgeable alarm - While the temperature is extends past the High Limit Alarm, the alarm can be acknowledged and disengaged by pressing and holding both the U and P buttons for 5 seconds. The alarm will automatically reset when the temperature returns to within the High Limit Alarm if it is not acknowledged prior.

**Glossary**

Alarm	Output that trips when a certain condition is reached, for example, a defined temperature. Note that the TC4000 only provides visual alarm capability, on the controller display.
Control output	Output that controls the process and is switched on and off as needed.
Hysteresis	In the context of ON/OFF control of a heating system, Process Value (PV) must exceed Setpoint Value (SV) by a certain quantity before the controller switches the heater off, and PV must fall below SV by a certain quantity before the heater is turned on. In each of these two cases, "certain quantity" could be equal or different, depending on how the controller is set.
ON/OFF	Control process based on full-power activation and deactivation of the output. Also called "Bang/Bang" or "Hysteresis" control. See "Hysteresis." - This type of control is not intelligent, and is not very accurate, but is simple, effective, and controls how often ON/OFF switchings of the output happen. Minimizing how often ON/OFF switchings happen minimizes component wear and tear.
Overshoot	Situation in which Process Value exceeds Setpoint Value because the control action stopped too late. The ON/OFF controls have an overshoot greater than the PID controls.
Process Value / PV	The value that the process variable (temperature, valve opening, etc.) has at that moment.
Sensor	Device that translates physical phenomena (such as change in resistance based on temperature) into electrical signals that can be measured and processed by the controller
Setpoint Value / SV	The value that the process variable (temperature, valve opening, etc.) has to reach and maintain.
Thermocouple	Sensor that transmits an electrical signal of a few millivolts. Cannot be tested for galvanic continuity. It needs specially designed extension cables.
Undershoot	Situation in which Process Value does not reach Setpoint Value because the control action stopped too soon.

**TROUBLESHOOTING GUIDE**

Please read this guide prior to contacting BriskHeat<sup>®</sup>. This guide is designed to answer the most commonly asked questions. If you are unable to identify the problem or need additional assistance, please contact your local distributor or BriskHeat at **1-800-848-7673 (U.S. & Canada), 1-614-294-3376 (worldwide), or bhtsales1@briskheat.com.**

PROBLEM	SOLUTION(S)
Controller does not turn on	Verify that the controller and heaters are connected to proper voltage, according to product identification labels.  Controllers' fuse blown – check with multimeter and replace.
Does not heat	Verify heater is connected to proper voltage. The identification label located on the power cord displays the heater's voltage requirement.  Using an ohm meter, check to see if there is a resistance reading (not an open circuit) in the heater.  Many special heater plugs require special crimping tools. Ensure good connection between the heater wiring, plug and input receptacle.  Use a Volt-Ohm meter to check the outlet receptacle.
Circuit breaker is tripping	Validate that the circuit breaker is capable of handling the Amp requirement of heater. The identification label located on the power cord displays the heater's amperage requirement.  Examine heater and cord for any damage.
Something has lightly spilled on exterior or interior of heater	Apply any general household cleaner, that does not contain any silicone rubber dissolving type ingredients, with a clean cloth fabric. Do not connect any heater to a TC4000 that is not clean and in good repair.
Controller is heating to an incorrect Setpoint Temperature	Controller will attempt to provide power to the heater whenever the PV is less than SV. If thermocouple is not exposed to heater, the controller will operate at 100% in an attempt to reach SV.
Controller Error Codes	<p>Over range      Under range</p> <p>      </p> <p>If these error messages occur, contact Briskheat<sup>®</sup> for service.</p> <p><b>EPr</b>—If the controller displays EPr, this error message will disappear automatically. If this error message occurs multiple times, please contact your Briskheat<sup>®</sup> representative for service.</p> <p>Sensor break</p> <p></p> <p>Replace sensor. If problem still exists contact Briskheat<sup>®</sup> for service.</p>

**MAINTENANCE AND CLEANING**

**UNPLUG DEVICE BEFORE CLEANING**

After device is unplugged, wipe down with a damp rag. Examine cords and heaters for wear or damage. If damaged, replace affected components immediately.

**WARRANTY INFORMATION**

BriskHeat warrants to the original purchaser of this product for the period of eighteen (18) months from date of shipment or twelve (12) months from date of installation, whichever comes first. BriskHeat's obligation and the exclusive remedy under this warranty shall be limited to the repair or replacement, at BriskHeat's option, of any parts of the product which may prove defective under prescribed use and service following BriskHeat's examination, is determined by BriskHeat to be defective. The complete details of the warranty can be found online at [www.BriskHeat.com](http://www.BriskHeat.com) or by contacting us at 1-800-848-7673 (toll free, U.S. / Canada) or 1-614-294-3376 (worldwide).



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