Single Circuit Micro-Processor-Based Heat Trace Controller

TT-GFT-1

Installation and Operation Manual

THERMATRACE

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Pilot Duty

The TT-GFT-1 Heat Trace Controller with Integral GFEP cannot be used for Pilot Duty applications.

Resistive Load Usage Only

This product is not for use with Inductive loads. Inductive loads may create nuisance tripping of the Ground–Fault

Equipment Protection Circuit

Abnormal Odor or Smoke

In the event of smoke or a burning or abnormal odor, immediately interrupt power to the unit by turning off the circuit breaker protecting the unit.

Electrical Shock / Fire Hazard

Any installation involving electric heater wiring must be grounded to earth to protect against shock and fire hazard. Suitable ground fault detection and interrupting systems must always be in use to reduce shock and fire hazard and to protect equipment.

Electric wiring to heating elements must be installed in accordance with National Electrical Code (NEC)/ Canadian Electrical Code requirements, as well as all other local and applicable electrical codes and any third-party standards. This product is intended for commercial and industrial applications. Follow the installation instructions contained in this manual and those provided by the heater manufacturer.

Size the circuit breaker appropriately for the expected load and inrush current. The maximum rated current for the TT-GFT-1 is 30 amps with resistive load.

Heater loads and their controls should not share a circuit branch with other types of equipment. A shared circuit may result in electromagnetic interference that can affect system operation.

Make certain that the heater shield is properly grounded. Failure to do so may result in damage to the equipment or fire.

Following installation and prior to beginning system operation, refer to and perform the Post-Installation Test described in this manual.

TT-GFT-1

The TT-GFT-1 Heat Trace Controller is a single circuit microprocessor–based heat–trace controller with integral Ground–Fault Equipment Protection (GFEP). The TT-GFT-1 heavy duty relay output (rated to switch up to 30 A resistive) can be applied to a broad spectrum of Freeze Protection applications The TT-GFT-1 and its heater load can operate with an available line voltage source of 110 – 277 V ac. The controller and heater load share the same supply connection. It can monitor both a primary control sensor and an optional secondary sensor that can be used to enable the system to run. The unit also contains a 3 amp dry contact alarm relay that can be used to annunciate an audible/visual alarm or provide a contact closure to a Building Management System. Additionally, the TT-GFT-1 comes standard with Bluetooth capability for ease of programming and monitoring.

The TT-GFT-1 is set in Fahrenheit, and the temperature Resolution for either setting is 1°. This allows the unit to provide control stability up to ± 1°. The Integral GFEP provides safety in compliance with national and local electrical codes. The unit's housing is a NEMA 4X IP66 weather–resistant enclosure for enhanced durability.

Features and Benefits

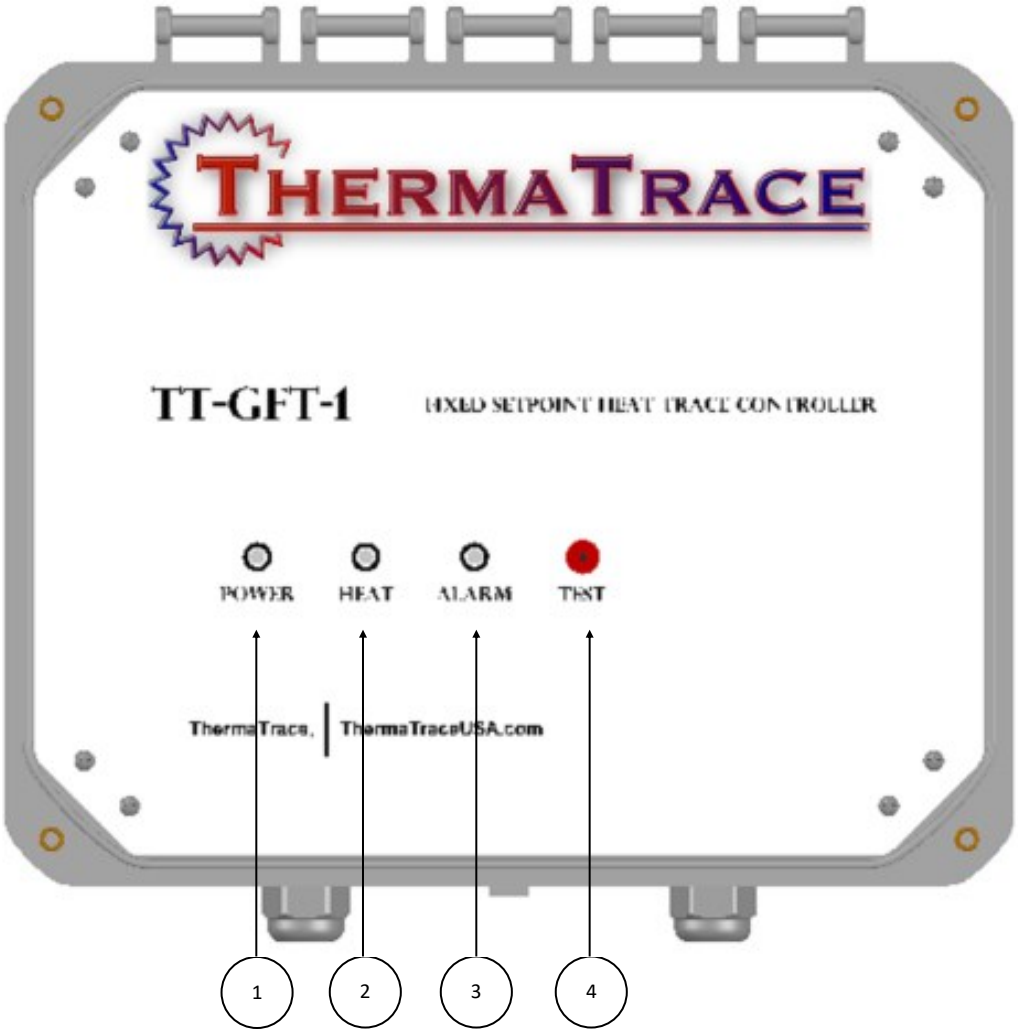
· RoHS Compliant	· AC Input: 110 to 277 VAC; Fused at 30A
· Compact size	· Temperature resolution: 1°F
· Thermistor and RTD sensor input	· Set point resolution: 1°F
· 30 AMP load current capable	· Ground Fault Alarm and Trip
· Heat operating mode	· High and Low Current Alarm
· Front Panel Mounted LED's and Test/Reset Button	· Ambient Temperature range: −40 °C to 50 °C
· Auto output shutdown if sensor is open or shorted	· AC/DC Power isolation: 1500VAC
· Optional High and Low Temperature Alarm settings	· LED indicators
· Bluetooth Ready	· Auxiliary Relay Output

The TT-GFT1 is permanently connected equipment and does not have an internal disconnect device. The installer must provide an accessible disconnect device, with short circuit and overcurrent protection (these are not supplied by ThermaTrace, LLC). When power is applied, the system will start.

UNIT INTERFACE

FRONT OF THE UNIT

The front of the unit consists of four LED's that allows the user to view the status of the system.



Key:

1. LED Power indicator, system is powered
2. LED Heat indicator, system is applying energy to the output load.
3. LED Alarm indicator, system has triggered an alarm condition
    A. Ground Fault Alarm
    B. Minimum Heater Current Alarm
    C. Sensor Failure
4. Test Button: This button will allow the user to activate test mode.

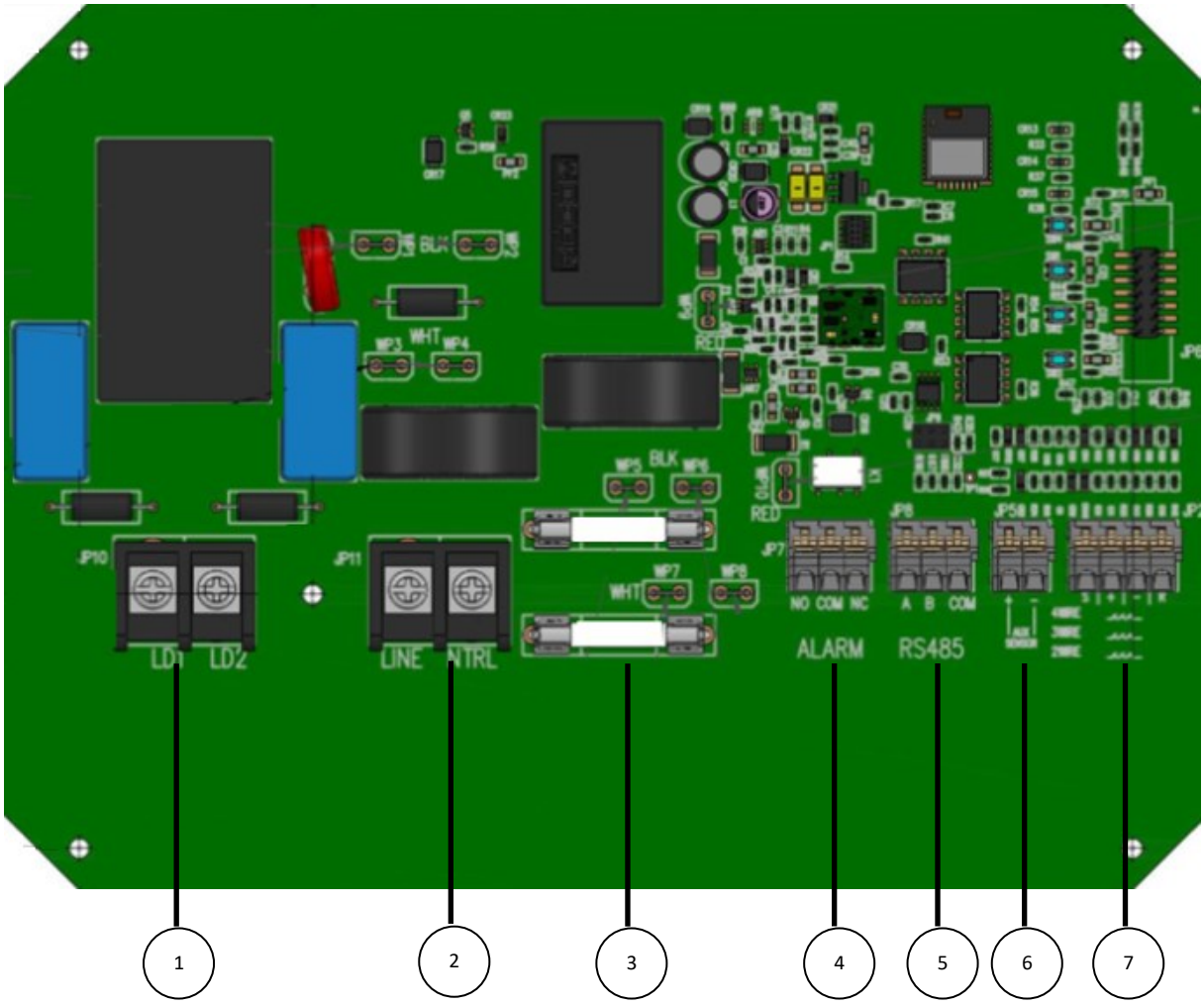
In the event of an alarm condition, the unit will provide LED Alarm Flash Codes. Below is a description of the Alarms indicated by the Flash Codes:

4 Short Pulse ,1 Long Pulse ======= Sensor Error Alarm
3 Short Pulse ,1 Long Pulse ======= High Temp Alarm
2 Short Pulse ,1 Long Pulse ======= Ground Fault Alarm
1 Short Pulse ,1 Long Pulse ======= Heater Load High Current Alarm

4 Short Pulse ======= Low Temp Warning
3 Short Pulse ======= Heater Load Under Current Warning
2 Short Pulse ======= Ground Fault Warning
1 Short Pulse ======= Ground Test Failed

Figure 1.

The TT-HTC-1 wiring layout



Key:

1. Load Terminals: This is the output for the primary load the TT-GFT-1 will be controlling.
2. AC Power: This is the unit's connection to a 110 or 208/277 volt line power.
3. Fuses: 30 Amps AC
4. Alarm Relay Output: This is the output for the alarm output device.
5. RS485 Communication Port: Disabled.
6. Auxiliary Temperature Sensor: This is for the connection to the unit's auxiliary sensor.
7. Temperature Sensor Control: This is for the connection to the unit's primary sensor.

A. SENSOR TYPES AND RECOMMENDED TEMPERATURE RANGES

This sensor chart will help guide you to selecting a sensor that best fits your application.

ThermaTrace, LLC Sensors:

Sensor Family	Tolerance	Temperature Range	Base Resistance (@25° C)
NTC10K	±1.0°C (0°C to 100°C)	**- 50 C to + 105 C**	10KΩ
NTC100K	±1.0°C (0°C to 100°C)	-40° to 150°C	100KΩ

Other General Sensors:

Sensor Family	Temperature Range	Base Resistance (@0°C)
PT100	-200° to 850°C	100Ω

Installation

The TT-GFT-1 Automatic Heat–Trace Control should be installed by a qualified, licensed electrician. Installation must conform to all applicable local and national electrical codes and laws. The unit's NEMA 4X IP66 enclosure allows for indoor or outdoor applications.

The TT-GFT-1 controller has an ambient operating temperature range of −40 °F to 122 °F (−40 °C to 50 °C).

Install the TT-GFT-1 on a fixed, flat, vertical surface using the unit's mounting flanges. The mounting flanges accommodate 1/4" or 6.3 mm fasteners.

The TT-GFT-1 nonmetallic enclosure has one 1.046" hole for conduit entry; this can hold both power and load wiring.

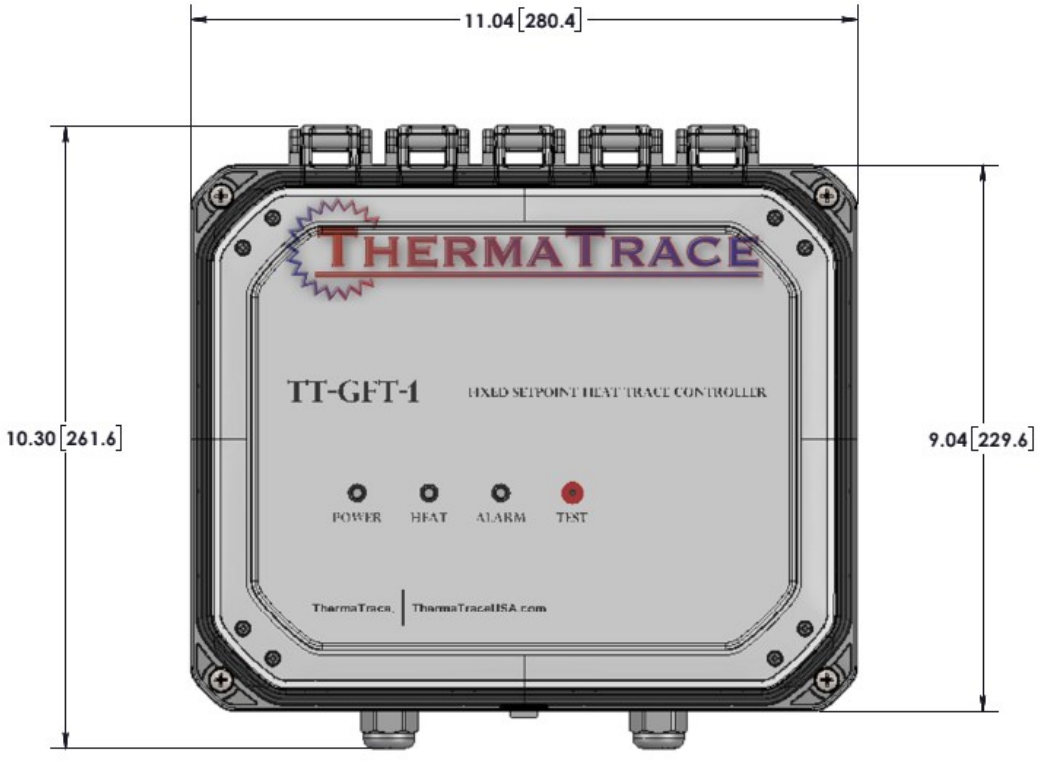
Use only Listed Type 4X IP66 liquid–tight conduit hubs or cable glands. Connect the hub to the conduit system before connecting the hub to the enclosure.

The unit comes with two installed liquid–tight cable glands. One of these fittings is for the temperature sensor cable, and the other is for the alarm relay cable.

The cable glands can accommodate cable diameters 0.08” to 0.24” (2 mm to 6 mm). The temperature sensor may be located up to 2,000' (610m) from the TT-GFT-1.

All leads should be terminated; no unsecured leads should be left inside the wiring compartment.

Figure 2.
Mounting dimensions



Power Source and Contactor Connections

Supply Voltage

The TT-GFT-1 operates from 110 – 277 V ac at 50/60 Hz. This control and its heater load should not share a circuit branch and circuit breaker with other types of equipment. A shared circuit may result in electromagnetic interference that can affect system operation. For line supply and load connections, use 10 AWG wires rated for at least 194 °F (90 °C). The connections are shown in Figure 3 and Figure 4.

Contactor Ratings

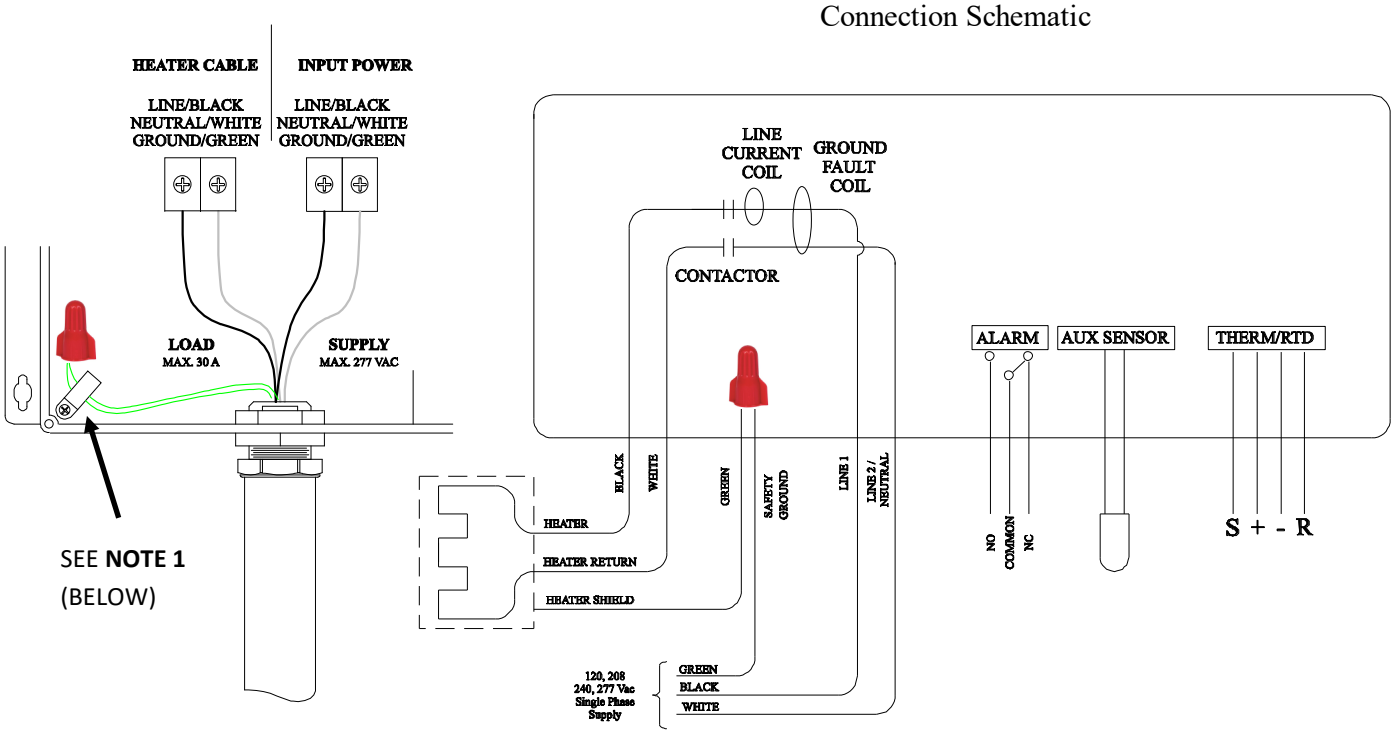
The heater contactor provides two (2) Form A (DPST) contacts rated for heater loads up to 30 A ac and 277 V ac. These two contacts are used to control both legs of the input power (Line and Neutral).

Manual Load Test

To manually energize the load press the Test/Reset pushbutton for three seconds. The output will switch on and stay on for five minutes or until Test/Reset key is pressed again. A manual load test is recommended upon installation to verify heater function and load current.

Line/Load Connections

Connection Schematic



NOTE 1:

Pull Ground Wires (Line and Load) through Panduit CCH50-S10-MO P-Type Clamp and affix together with 3M Wire Nut

Temperature Sensor

The TT-GFT-1 can use either a thermistor NTC10K or NTC100K , or a 2–,3–, or 4–wire RTD sensor.

Thermistor (NTC10K)

The NTC10K thermistor temperature sensor is supplied with an 16 ft. jacketed cable that has an operating range of −58 °F to 221 °F (- 50 C to + 105 C). See Figure 5 for proper wiring when using a thermistor sensor.

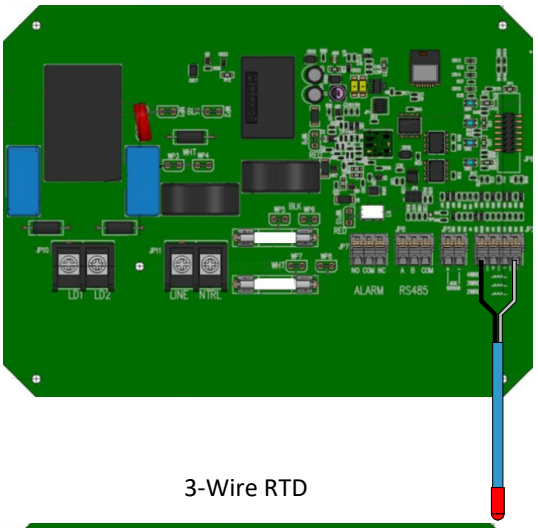
RTD

The unit can use an RTD sensor for applications requiring a wider temperature range. The TT-GFT-1 can operate with 2–, 3–, or 4–wire RTD sensors. See Figure 5 for proper wiring.

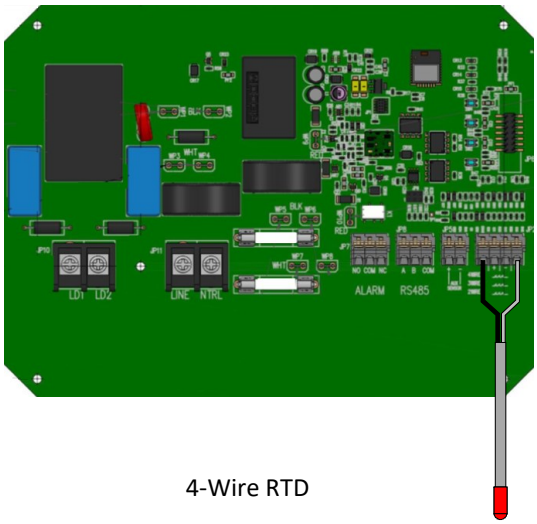
Note: The sensor must be selected and factory programmed.

Figure 5.

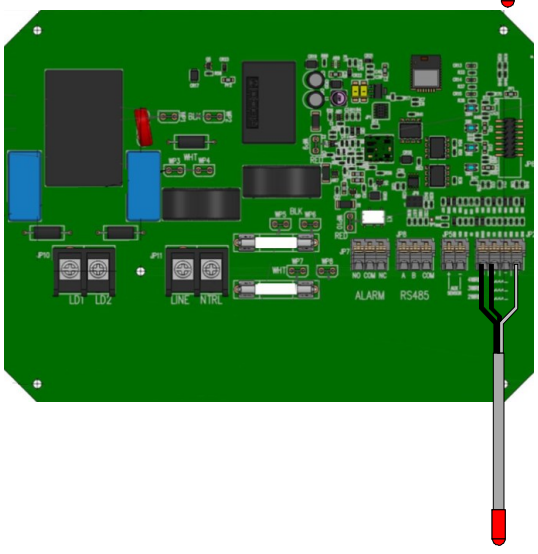
Thermistor



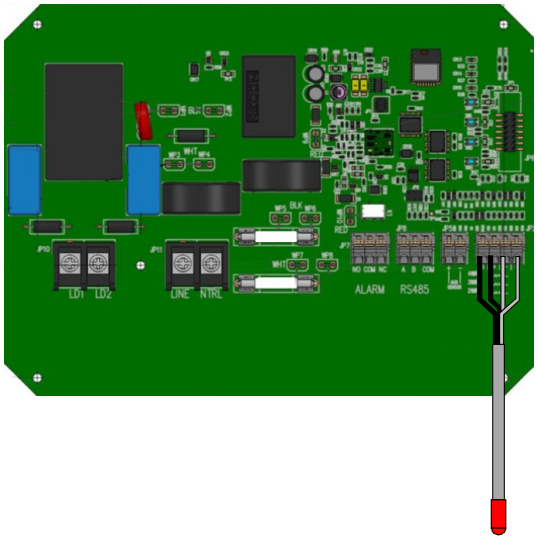
2-Wire RTD



3-Wire RTD



4-Wire RTD



External Alarm

Alarm Connections

An alarm or power–off condition can be communicated by either opening or closing a relay contact. It is important to make the proper alarm relay connections to achieve the desired result. The middle terminal labeled COM (Common) is used in both wiring configurations. Connect one alarm relay lead to the COM terminal.

If the system needs a contact to close to signal an alarm or power–off condition, connect the other alarm relay lead to the **NC (Normally Closed) terminal.** See Figure 6.

If the system needs a contact to open to signal an alarm or power–off condition, then connect the other alarm relay lead to the **NO (Normally Open) terminal.**

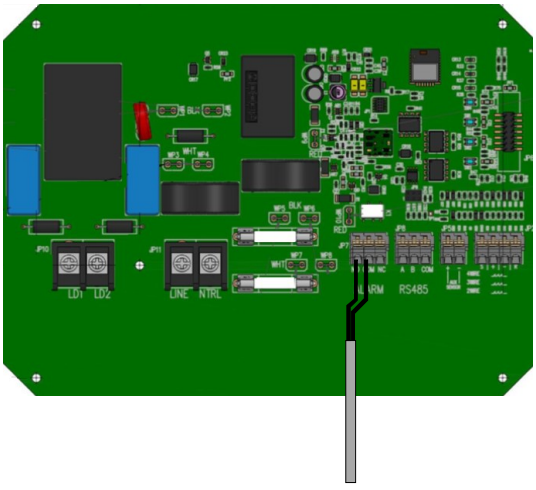
If the unit has power, and there are no alarm conditions then the NO and COM terminals will be connected. If the unit loses power or an alarm condition occurs then the NC and COM terminals will be connected.

Note: The "Normally" condition of the relay is the alarm condition for the unit.

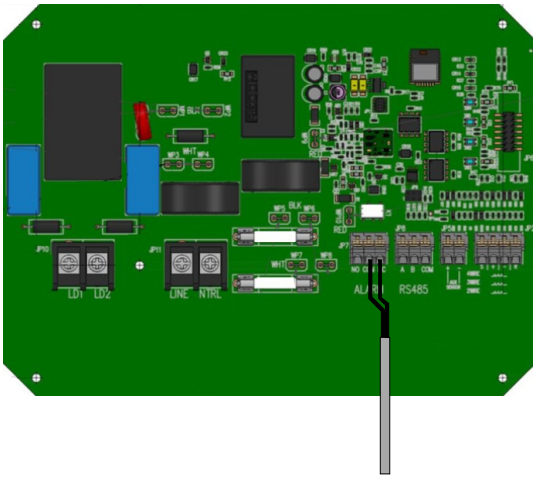
Figure 6.

External Alarm wiring.

Wiring to Normally Open Alarm Contact



Wiring to Normally Closed Alarm Contact



Operation

The TT-GFT-1 setpoint is factory programmed at 40 °F . The heater will energize when the temperature drops below the designated setpoint. The heater will de-energize when the temperature meets the designated Setpoint Temperature.

The TT-GFT-1 features self–testing GFEP, which switches the system off when it detects excessive ground current leakage. The GFEP eliminates the extra expenses associated with having to provide a GFEP Circuit Breaker or external GFEPD.

Alarms

Critical Alarms are Latching alarms and include Ground Fault, High Current, Stuck Relay, Internal Circuit, and Power Fail. Critical alarms always turn off the heat. To continue normal operation, any of these will require a manual reset. The manual reset (TEST/RESET BACK pushbutton) will start a self test, and if all Critical Alarms are cleared then normal operation will resume.

Non-critical Alarms are Non-Latching and include Low Current, Low Temperature, High Temperature, and Sensor Fault. A Sensor Fault will stop temperature regulation (with heat on or off depending on the Fail Mode setting), but as soon as the sensor is corrected, then operation will immediately resume. The other Non-critical Alarms do not inhibit operation.

Note: Latching alarms require manual clearing to resume operation.

The Manual Self Test clears all alarms, checks Ground Fault Current, and checks Low Current . The Auto Self Test (factory programmed interval of 24 hours) does not clear alarms, but otherwise functions the same as the Manual Self Test.

Figure 7.

Front Panel

TT-GFT-1 Front Panel

Refer to Figure 7.

INDICATOR LIGHTS

- **POWER Indicator Light-**This Green LED indicates that the TT-HTC-1 is receiving line power
- **Heat Indicator Light**-This Yellow LED indicates that the Heat Trace is Energized
- **Alarm Indicator Light**-This Red LED indicates that an Alarm condition exists; Ground Fault, High Temperature, Low Temperature, High Current, Low Current, Sensor Failure

  In the event of an alarm condition, the unit will provide LED Alarm Flash Codes. Below is a description of the Alarms indicated by the Flash Codes:

4 Short Pulse ,1 Long Pulse ======= Sensor Error Alarm
3 Short Pulse ,1 Long Pulse ======= High Temp Alarm
2 Short Pulse ,1 Long Pulse ======= Ground Fault Alarm
1 Short Pulse ,1 Long Pulse ======= Heater Load High Current Alarm

4 Short Pulse ======= Low Temp Warning
3 Short Pulse ======= Heater Load Under Current Warning
2 Short Pulse ======= Ground Fault Warning
1 Short Pulse ======= Ground Test Failed

Note: Because the unit has no ON/OFF power switch, power runs to the unit as soon as line power is connected to it. When the unit has power, the green POWER Indicator Light will be lit.

SPECIFICATIONS

General

Certifications	ETL Tested to UL 60730–1, UL 1053, Listed CSA E60730–1:13

Environmental

Area of use	Nonhazardous locations
Operating temperature range	−40 °F to 122 °F (−40 °C to 50 °C)

Enclosure

Dimensions	10.00" (W) x 8.40" (H) x 5.2" (D) 264 mm (W) x 213 mm (H) x 133 mm (D)
Ingress protection	NEMA 1,2,3,3R,3RX,3S,3SX,3X,4,4X, 5,12,13, IP65, IP66
Cover attachment	Polycarbonate cover, plastic screws
Cable entries	Two liquid–tight cable glands installed for sensor and alarm leads, cable diameter 0.08” to 0.24” (2 mm to 6 mm) One 1.046" hole to accommodate a $^{3}/_{4}$" conduit fitting for power wiring connection
Material	Polycarbonate
Weight	3.7 lb.
Mounting	Wall mount with flanges

Wiring Terminal Ratings

Power	Barrier Strip Terminals for Line, Neutral, and Ground; use 10 AWG wires rated for at least 194 °F (90 °C)
Sensors	Terminal Block, rising cage clamp, 12 AWG Aluminum or 14–18 AWG Copper
Alarm relay	Terminal Block, rising cage clamp, 12 AWG Aluminum or 14–18 AWG Copper

Parameter Settings

Temperature setpoint	Default 40 °F (Custom setting by Factory)
Low–temperature alarm	OFF (Custom setting by Factory)
High–temperature alarm	OFF (Custom setting by Factory)
Low–current alarm	0.01 A Default 0.1 A Enabled
High–current alarm	OFF (Custom setting by Factory)
Ground fault Trip	Default 30 mA
Ground fault Alarm	Default 25 mA
Self–Test Interval	Default 24 h
Temperature Unit	°F OFF (Custom setting by Factory)

System Rating 110-277 VAC

System Rating continuous 30 Amps Max

System Rating Inrush amperes 30 Amps

Ground Fault Current Sensing Trip-Energy Level at a 0.25 second rating

User Interfaces

Pushbuttons	TEST / RESET BACK

Remote Interface

Alarm relay	Isolated DPDT AMP Class 2 contact

Indicators

Status indicator	Power (Green) Heater (Yellow) Summary alarm (Red)
Summary alarm relay	Low temperature, High temperature, Low load current, High load current, High ground fault Current, Stuck relay, Sensor Fault, Internal fault

Control Ratings

Temperature accuracy	+/− 2 °F (1 °C)

Temperature Sensors

Temperature inputs	Thermistor: 10k ohms at 25 °C (Default) Thermistor: 100k ohms at 25 °C (Custom configured at factory) RTD Sensor: Platinum, (Custom configured at factory) Alpha = 0.00385, ITS–90, (Custom configured at factory) 100 ohms at 0 °C, (Custom configured at factory) Input supports 2–wire, 3–wire, or 4–wire connection, (Custom configured at factory)

GFEP (Ground–Fault Equipment Protection)

Operation	Continuously tests ground fault current whenever the load is on; also manually and periodically tests equipment ground fault current with each self–test.
Trip Range	Default 30 mA
Alarm Range	Default 25 mA
Automatic self–test	Verifies GFEP functionality every 24 hr.

Power

Supply voltage	110 – 277 V ac 50/60 Hz
Controller power consumption	5 W maximum, 2 W idle
Load rating	30 A, 100 – 277 Vac resistive
System Rating	110-277 VAC
System Rating continuous	30 Amps Max
System Rating Inrush amperes	30 Amps

Ground Fault Current Sensing Trip-Energy Level at a 0.25 second rating