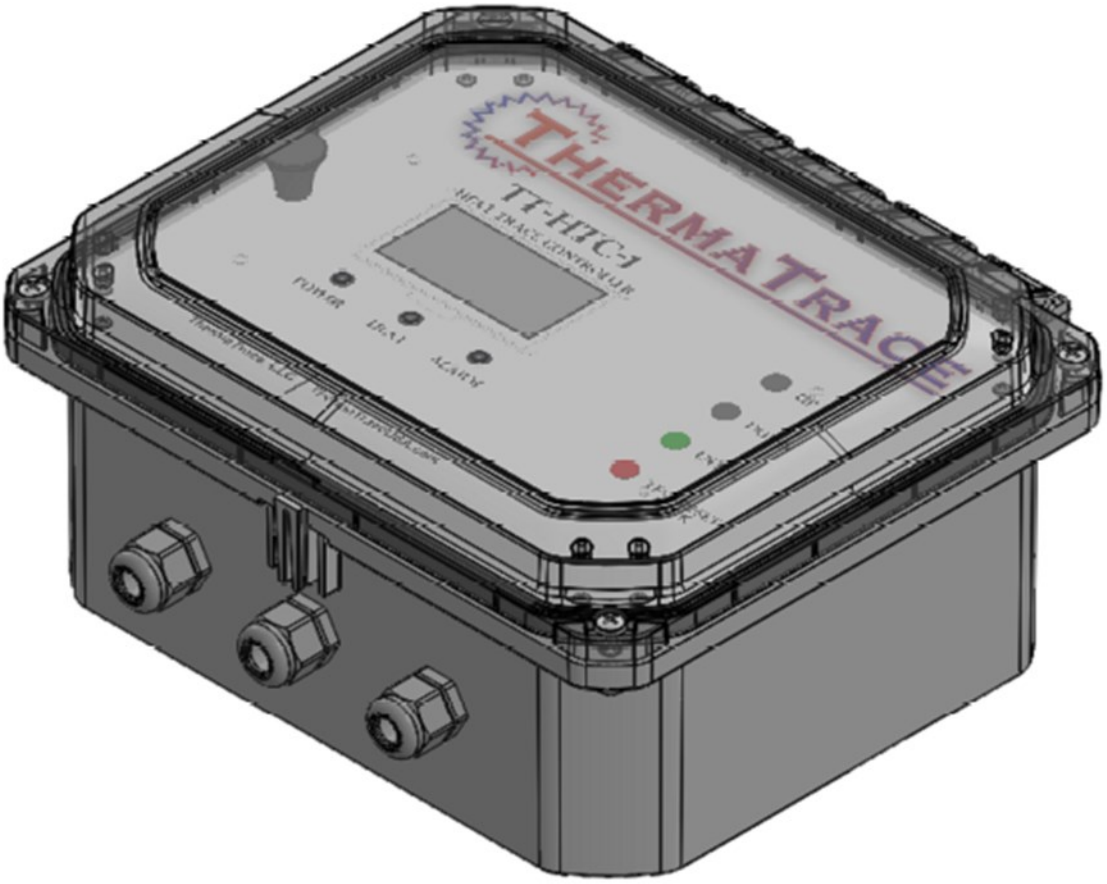
Single Circuit Micro-Processor-Based Heat Trace Controller

TT-HTC-1

Installation and Operation Manual



860-740-4880

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Specifications

Pilot Duty

The TT-HTC-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-HTC-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-HTC-1

The TT-HTC-1 Heat Trace Controller is a single circuit microprocessor–based heat–trace controller with integral Ground–Fault Equipment Protection (GFEP). The TT-HTC-1 heavy duty relay output (rated to switch up to 30 A resistive) can be applied to a broad spectrum of applications that require precision temperature control such as freeze protection, hot water temperature maintenance, grease waste, tank heating, and other process temperature control applications. The TT-HTC-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 TT-HTC-1 wall mount unit also includes an isolated RS485 communications port and is fully programmable via PC. 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-HTC-1 comes standard with Bluetooth capability for ease of programming and monitoring.

The TT-HTC-1 can be set in either Celsius or Fahrenheit, and the temperature resolution for either setting is 1°C. This allows the unit to provide control stability up to ±1°C. 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

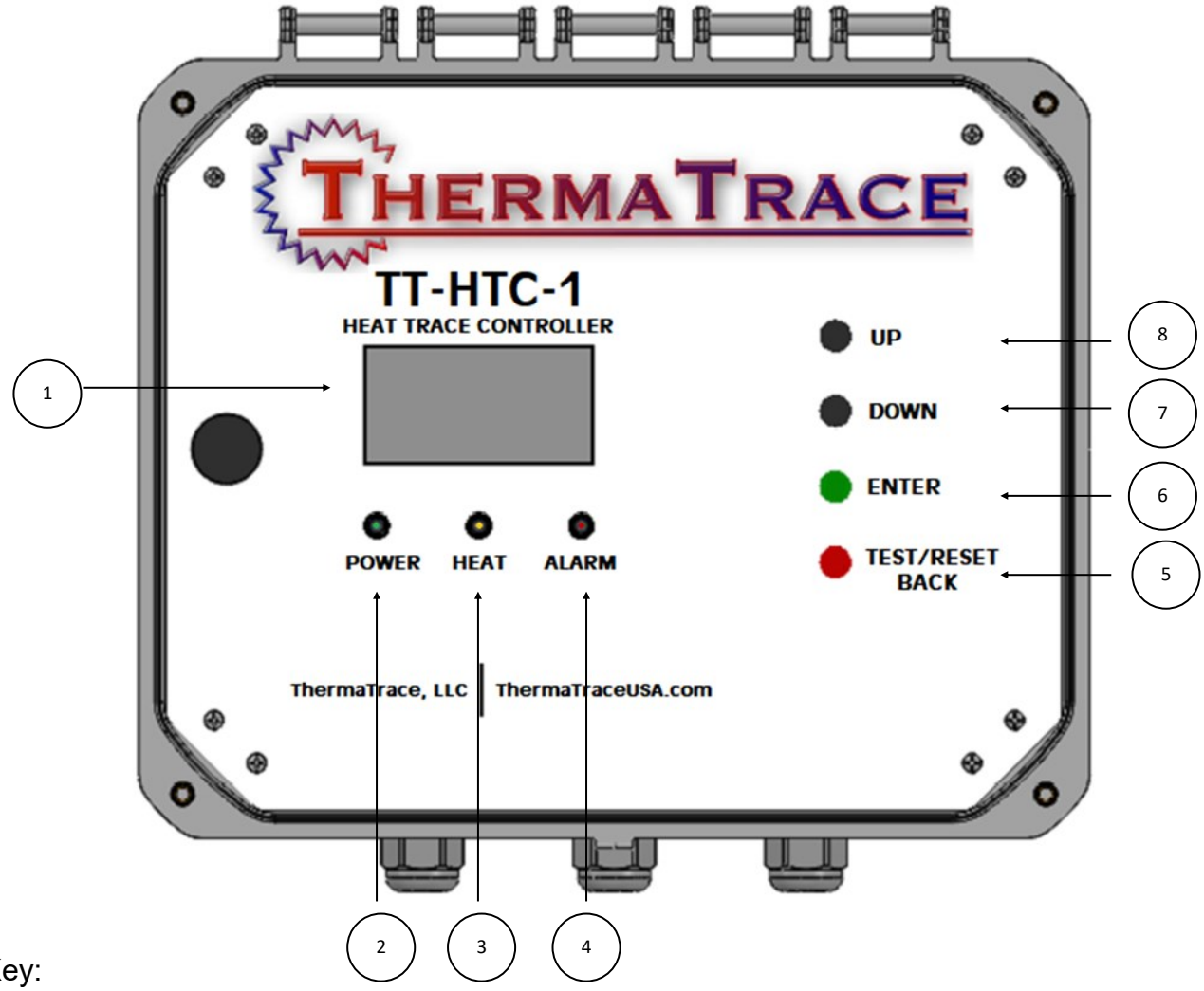
• RoHS Compliant	• AC Input: 110 to 277 VAC; Fused at 30A
• Compact size	• Temperature resolution: 1°C
• Thermistor and RTD sensor input	• Set point resolution: 1°C
• 30 AMP load current capable	• Ground Fault Alarm and Trip
• Heat operating mode	• High and Low Current Alarm
• Front Panel Mounted Display	• Ambient Temperature range: -20 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
• Isolated RS485 communication port	• Auxiliary Relay Output
• Bluetooth Ready	

The TT-HTC-1 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 an easy to use menu display that allows the user to change the basic functions of the thermal system with just a few button presses.



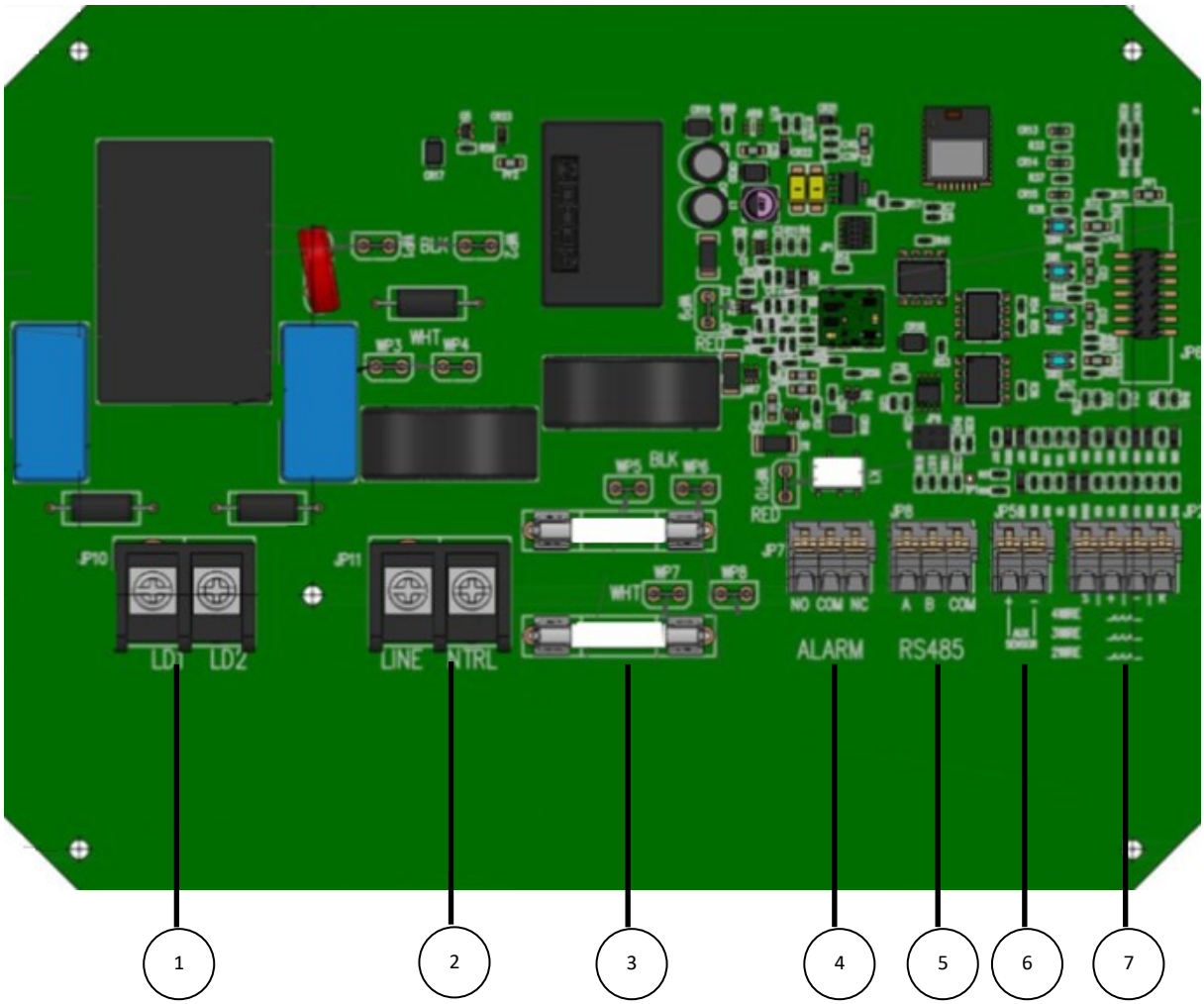
Key:

1. Display: This is a 128 x 64 Dot Matrix LCD display used to give users important information about the unit.
2. LED Power indicator, system is powered
3. LED Heat indicator, system is applying energy to the output load.
4. LED Alarm indicator, system has triggered an alarm condition
    A. Ground Fault Alarm
    B. Maximum Heater Current Alarm
    C. Minimum Heater Current Alarm
    D. High Temp Alarm
    E. Low Temp Alarm

5. Test Button: This button will allow the user to activate test mode and return to previous menu screens.
    A. Home Screen: activates ground fault test protocol.
    B. Menu Screen: Returns user to Home Screen
    C. System Setup: Returns user to Menu Screen
    D. Heater Setup: Returns user to Menu Screen
    E. Temperature Setup: Returns user to Menu Screen
    F. Diagnostics: Returns user to Menu Screen
    G. While changing parameters, activating this button will return you to the pervious screen and save changes.
6. Enter Button: This button allows the user to navigate screens and select/modify parameters.
7. Navigation Down Button: This button allows the user to scroll through options on the selected menu.
8. Navigation Up Button: This button allows the user to scroll through options on the selected

Figure 1.

The TT-HTC-1 wiring layout



Key:

1. Load Terminals: This is the output for the primary load the TT-HTC-1 will be controlling.
2. AC Power: This is the unit's connection to a 120 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: connection for connecting a PC to the controller for setup.
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° 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-HTC-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-HTC-1 controller has an ambient operating temperature range of −40 °F to 122 °F (−40 °C to 50°C).

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

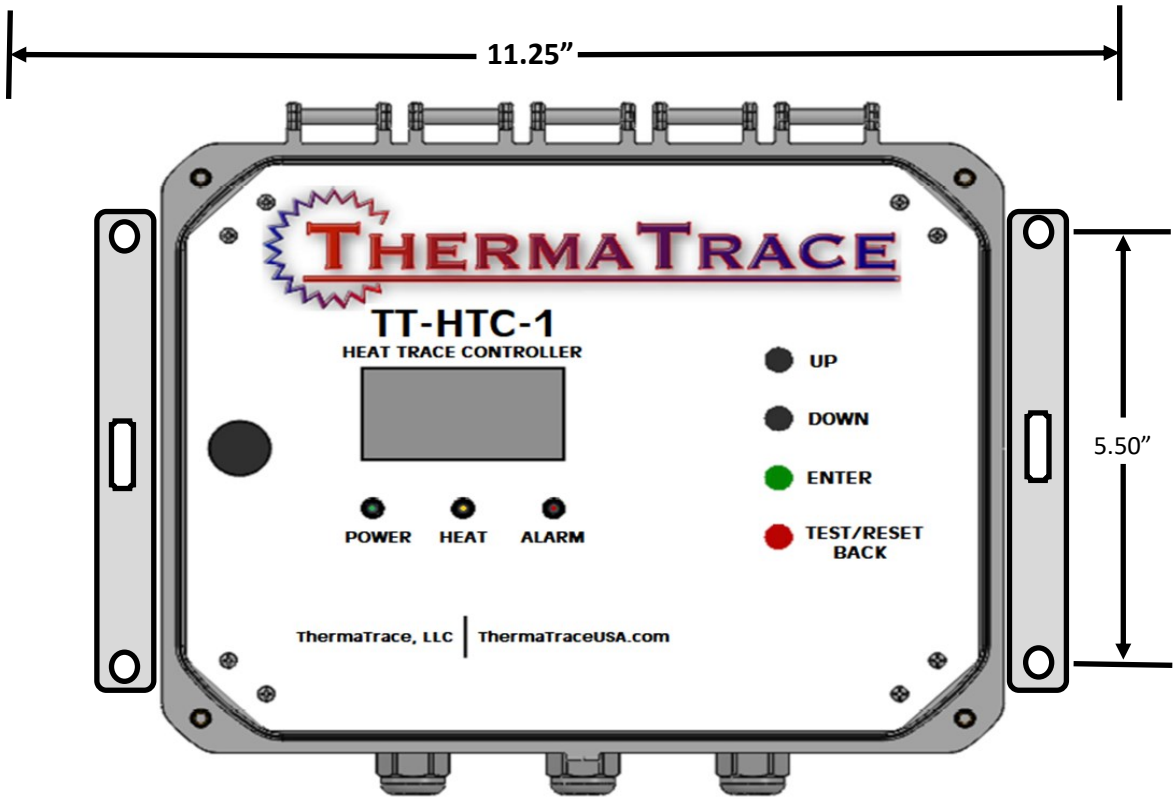
The TT-HTC-1 nonmetallic enclosure has one 1.046" hole for rigid conduit entry; this can hold both power and load wiring.

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-HTC-1.

Figure 2.
Mounting dimensions



Power Source and Contactor Connections

Supply Voltage

The TT-HTC-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.

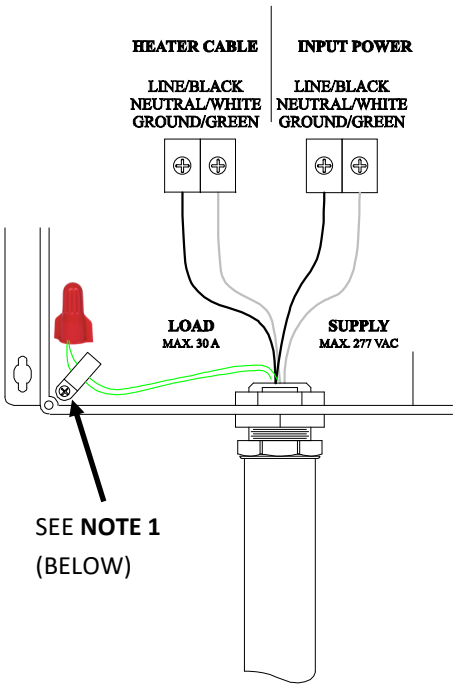
Contactor Ratings

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).

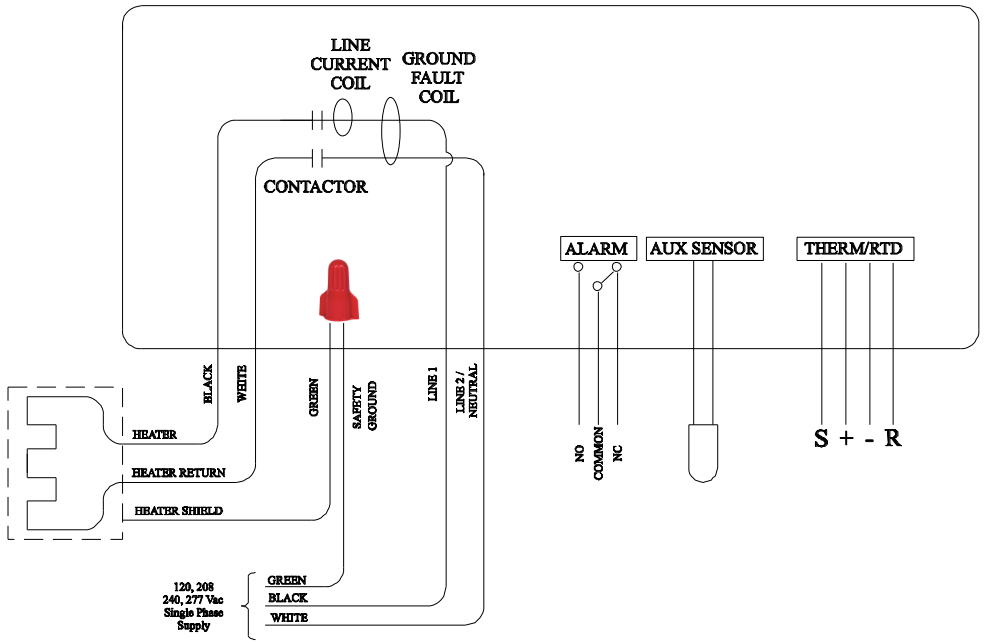
Manual Load Test

To manually energize the load, select the Settings screen and then hold Test/Reset pushbutton for five 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

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-HTC-1 can use either a thermistor NTC10K or NTC100K (NTC100K, or a 2–,3–, or 4–wire RTD sensor.

Thermistor (NTC100K)

The NTC100K thermistor temperature sensor is supplied with a 20 ft. jacketed cable that has an operating range of −40 °F to 302 °F (−40 °C to 150 °C). See Figure 5 for proper wiring when using a thermistor sensor.

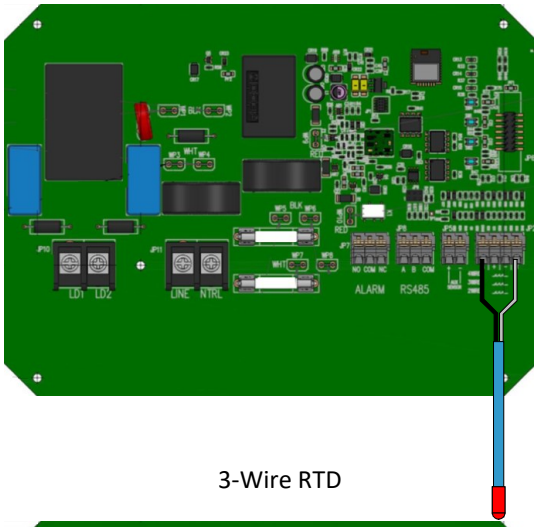
RTD

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

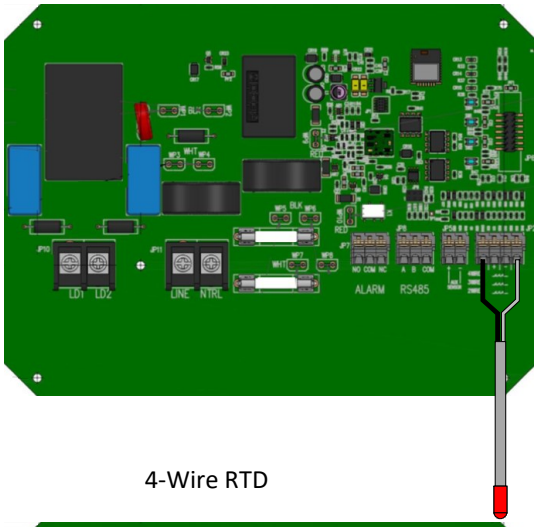
Note: The sensor must be selected in the Sensor Type parameter setting screen also.

Figure 5.

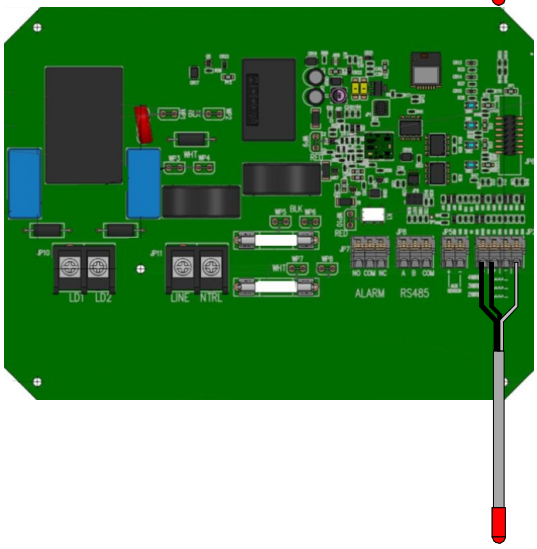
Thermistor



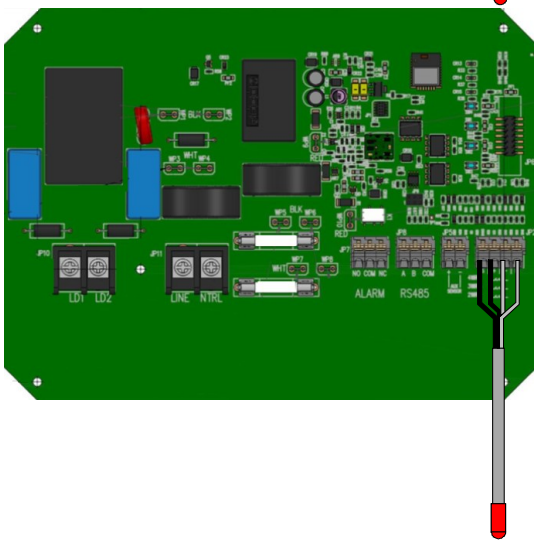
2-Wire RTD



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.**

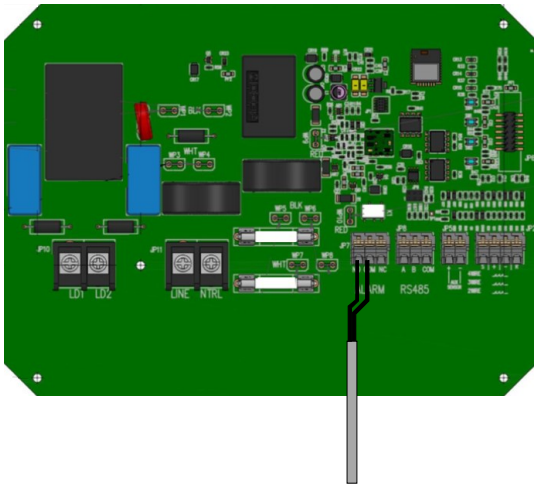
If the unit has power, and there are no alarm conditions then the NO and COM terminals will be connected. If the unit loses power or an alarm condition occurs then the NC and COM terminals will be connected.

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

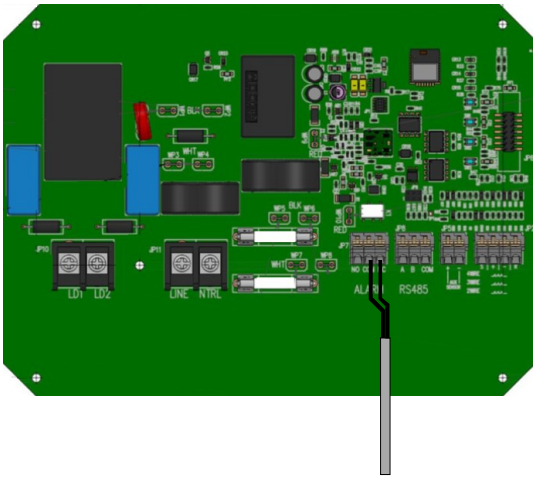
Figure 6.

External Alarm wiring.

Wiring to Normally Open Alarm Contact



Wiring to Normally Closed Alarm Contact



Operation

The TT-HTC-1 can maintain temperatures from a setpoint ranging from −1 °F to 999 °F . The usable temperature range is sensor dependent. The heater will energize when the temperature drops below the designated setpoint. The heater will de-energize when the temperature meets the designated High Temperature.

The TT-HTC-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 if the Low Current delay is set to five seconds or less. The Auto Self Test does not clear alarms, but otherwise functions the same as the Manual Self Test.

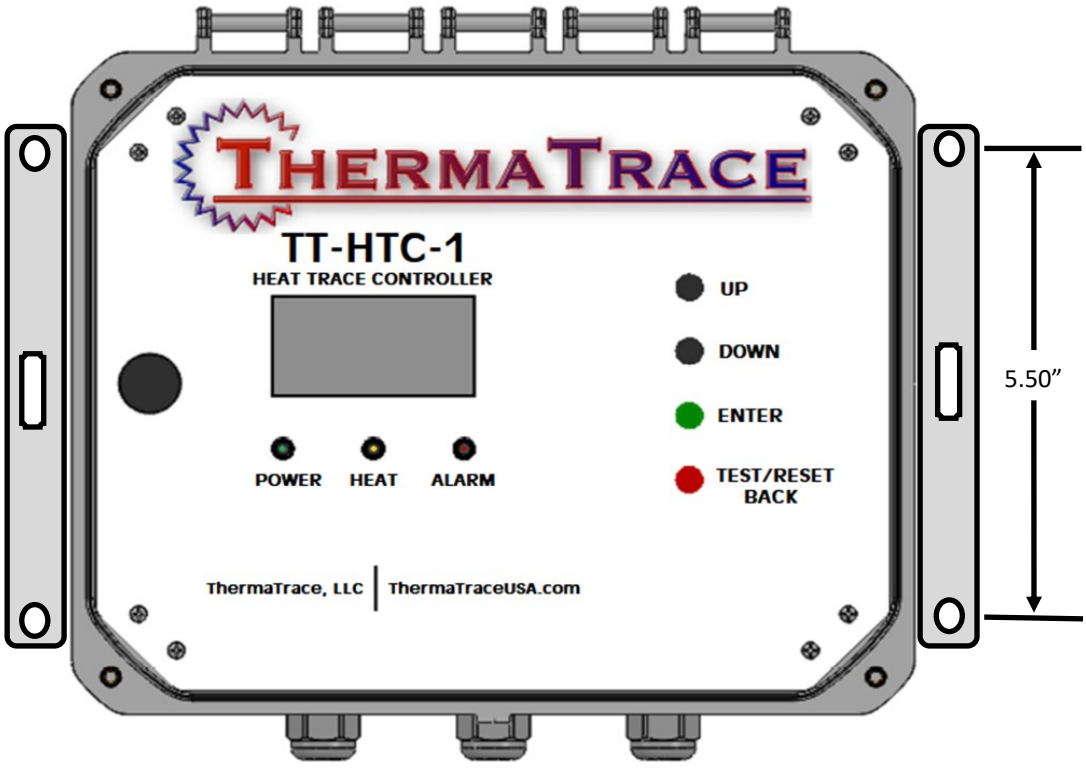


Figure 7.

Front Panel

TT-HTC-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

The Alarm Condition can be displayed by entering the Programming Menu:

- Press the "**ENTER"** button
- Press the "**DOWN**" button until the arrow is pointing to the "DIAGNOSTICS" Menu,
- Press "**ENTER**" and the display will indicate the Alarm Condition.

Also, the Red ALARM Indicator LED will blink in a specific pattern that corresponds to

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.

TT-HTC-1 Programming Guide

To enter the Programming Menu where you can view or edit system parameter settings, press the ENTER pushbutton .

Once in the PROGRAMMING Menu, to enter a MENU (System Setup, Heater Setup, Temperature Setup, Diagnostics, or Exit) press the UP or Down Button until the arrow is pointing at the Menu Item you wish to select. Once the arrow is pointing to that Menu item, press the ENTER Button. You can move throughout that Menu by pressing the UP or Down button. Once on a particular MENU Item that you want to edit the parameter, press the ENTER Button. You can change the parameter setting by pressing the Up or Down Button. Once the value for the setting is entered, press the ENTER Button to save your selection. Press the DOWN Button until the arrow points to EXIT, then press ENTER. This will bring you back to your previous MENU Screen where you can make additional changes to your settings.

Once all of your design parameters have been entered Press the TEST/RESET Back button to get back to the Display screen

The Programming Menu has five Options;

SYSTEM SETUP, HEATER SETUP, TEMPERATURE SETUP, DIAGNOSTICS, and EXIT

All settings are stored in the unit's non-volatile memory, this means that the TT-HTC-1 will retain the inputted settings even if the unit looses or is disconnected from the power source.

SYSTEM SETUP MENU

SYSTEM SETUP

DIAG INTERVAL 0-240

This function sets a frequency when the TT-HTC-1 will energize the Heat Trace . This will allow the controller to detect possible Alarm conditions in periods not calling for heat. The parameter can be set from 0-240 hours.

SYSTEM SETUP

MODBUS ADDRESS 111

This Display indicates the MODBUS Address

SYSTEM SETUP

SENSOR OFFSET 00.2

This function provides an offset value to the temperature sensor

SYSTEM SETUP

SENSOR TYPE T100

This function allows you to select the temperature sensor that you will use.

Options:

RTD 2, Two Wire RTD, 100 Ohm

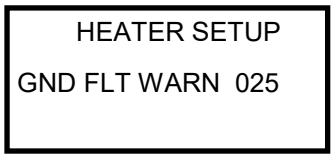
RTD 3, Three Wire RTD, 100 Ohm

RTD 4, Four Wire RTD, 100 Ohm

T10K, Thermistor, 10,000

T100K, Thermistor, 100,000

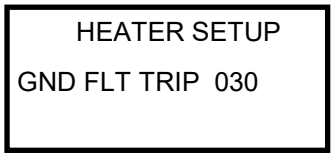
HEATER SETUP MENU



This function sets the Ground Fault Alarm Setpoint in milliamps.

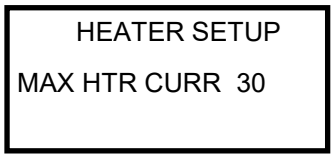
Setting from 000-999 mA.

*This must be below Ground Fault Trip Setpoint.



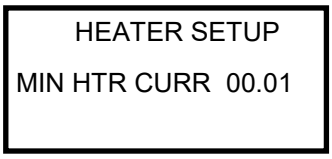
This function sets the Ground Fault Trip Setpoint in milliamps.

Setting from 001-999 mA.



This function sets the Maximum Heater Current Alarm Setpoint

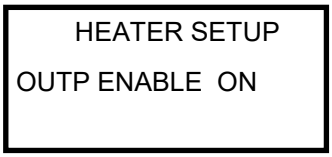
Setting from 00.01 - 30.00 AMPS.



This function sets the Minimum Heater Current Alarm Setpoint

Setting from 00.01 - 30.00 AMPS.

*This must be below Maximum Heater Current Setpoint.

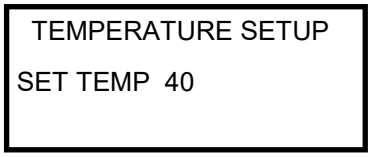


This function allows the user to Enable or Disable the power to the Heat Trace Circuit.

Setting: On or OFF

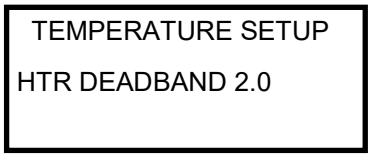
This function allows the user Exit the HEATER SETUP MENU and return to the PROGRAMMING MENU

TEMPERATURE SETUP MENU



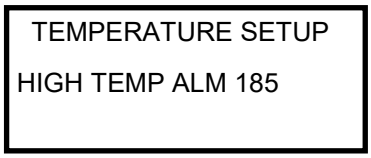
This function sets the Temperature Setpoint for the system.

Setting from –1 deg F to 999 deg F



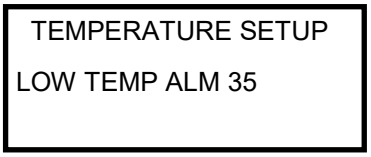
This function sets the Deadband for the Heater control.

Setting from o deg F to 100 deg F



This function sets the HIGH TEMPERATURE ALARM Setpoint,

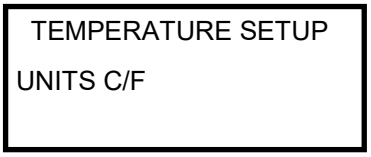
Setting from OFF to 999 deg F



This function sets the LOW TEMPERATURE ALARM Setpoint,

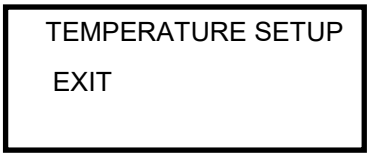
Setting from OFF to 999 deg F

*This LOW TEMPERATURE ALARM Setpoint must be below SETPOINT TEMPERTAURE.



This function sets the units of measure for temperature

Select C (Celsius) or F (Fahrenheit)



This function allows the user Exit the TEMPERATURE SETUP MENU and return to the PROGRAMMING MENU

DIAGNOSTICS MENU

This MENU will display any ALARM and its' current value.

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	Adjustable −1 °F to 999°F Default 40 °F
Low–temperature alarm	OFF to 999 °F Default 35 °F
High–temperature alarm	OFF to 999 °F Default 140 °F
Low–current alarm	0.01 A to 30.0 A
High–current alarm	0.01 A to 30.0 A Default 30.0 A
Ground fault Trip	0.01 mA to 999 mA Default 30 mA
Ground fault Alarm	0.00 mA to 999 mA Default 25 mA
Self–Test Interval	1 h to 240 h Default 24 h
Temperature Unit	°F or °C Default °F

User Interfaces

Pushbuttons	UP, DOWN, ENTER, TEST / RESET BACK

Remote Interface

Alarm relay	Isolated DPDT AMP Class 2 contact

Indicators

Status indicator	Power (Green) Heater (Yellow) Summary alarm (Red)
Display	2.7" OLED graphic 128x64
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: 100k ohms at 25 °C, Thermistor: 10k ohms at 25 °C, RTD Sensor: Platinum, Alpha = 0.00385, ITS–90, 100 ohms at 0 °C Input supports 2–wire, 3–wire, or 4–wire connection

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	Adjustable 001 mA to 999 mA Default 30 mA
Alarm Range	Adjustable 000 mA to 999 mA Default 25 mA
Automatic self–test	Verifies GFEP functionality every 24 hr. and whenever the load is energized

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 V ac resistive
System Rating Continuous	30 Amps
System Rating Inrush	30 Amps