TRACENET™ GENESIS

CONTROL AND MONITORING SYSTEM

Installation, Operation & Maintenance Guide

THERMON

TraceNet Genesis Installation, Operation & Maintenance Guide

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TraceNet Genesis Installation, Operation & Maintenance Guide

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NOTE: The TraceNet Command Communications Operating Instructions are addressed in a separate document covering TraceNet Genesis, as well as TN, TCM18, TC1818, TCM2, TC202, TC201, TC101, and ECM. TraceNet Genesis requires TraceNet Command Version 2.3.0+ for operation.

Section 1: Genesis Introduction And Overview

The following serves as a general guide and overview on the installation, startup, operation, and maintenance of a TraceNet Genesis heat tracing control panel. This guide is to be sent in conjunction with the project specific panel drawings and any other installation instructions/ guides and standards provided. In the unlikely event that a conflict or uncertainty arises, contact the Thermon engineering support personnel assigned to this project to clarify.

NOTE: All personnel should be properly trained and qualified to safely install, service, operate, and program this TraceNet heat tracing control panel as well as to install, operate, and maintain all associated heat tracing.

Section 2: Panel Inspection, Field Connections And Internal Wiring

A typical Genesis Panel may include electrical distribution (optional main breaker with branch breakers for each electrical heating circuit, either within the Genesis panel or in an adjacent electrical distribution enclosure. (Refer to the project specific drawings for each panel.)

Wide varieties of TraceNet Genesis panel configurations are possible and can be located in site locations having electrically classified areas and/or ordinary locations. The actual panel markings provided with the panel will detail the approvals for the specific location of the panel.

Recommended Visual Inspection Procedures:

- Inspect door and/or solid state heat sink gaskets for water intrusion as indicated by mineral deposits and rust. Where feasible replace any gaskets which appear to be faulty.
- Survey panel exterior and interior for dust, lint, moisture, or foreign residue. Remove any such residue with a lint free cloth material. Heavy residues may be addressed with wood scrapers and a cleaning agent. Do not soak parts with cleaning agent but only use dampened cloths in removing heavy residues. Excessive application of cleaning agents can damage components.
- Check for panel corrosion and scratches. Remove corrosion and prepare any damaged areas with sandpaper. Repaint with the approved primer and touch up paint.
- Check door hinges, latches, and other moving parts for proper operation. Use machine oil to lubricate the moving parts and restore proper operation where necessary.
- Check for mechanical damage to any windows as well as check the window seals. Repair or replace damaged materials. In all cases where equipment damage is observed, a root cause analysis should be initiated to determine any future corrective action needed to prevent a recurrence.

Wiring and Connections Survey

- The wiring and connections survey recommended is as follows:
- If the servicing of removable electrical connectors is to be conducted, then make certain the area is free of explosive atmospheres.
- If equipment is available, an infrared scan of the interior of the panel cabinet and associated wiring (during operation) is recommended.
- Any unusually high temperatures at connections are usually evidence of poor connections. Tighten connections, repair with new terminations, and/or replace any components which have been exposed to long term overheating. All terminal block connections should be tightened using a torque indicating screw driver to the levels indicated in Table 1 and project installation drawings.
- Check for corrosion at electrical connections and terminations. Where corrosion of electrical terminals is observed, this may be additional evidence of loose connections and excessive heat. A part replacement may be necessary.
- Inspect wiring for abrasion wear, mechanical damage, and thermal overexposure. Repair or replace any damaged or defective wiring. In all cases where equipment damage is observed, a root cause analysis should be initiated to determine any future corrective action needed to prevent a recurrence.

Control System Operation Check

The Genesis controller screen is an ideal resource in facilitating operation checks of the control system. To begin this program, energize the panel and the appropriate heat trace circuits for a minimum of 24 hours or until all circuits are cycling within their appropriate control band. A typical list of operational maintenance checks are available for a successful installation of a TraceNet Genesis heat tracing control and monitoring panel, a number of equally critical parts of the system must be installed properly. Areas requiring close attention are:

- The heat trace and insulation
- The RTD temperature sensor installation
- The distribution of the field RTD and power wiring
- The installation and routing of wiring inside the TraceNet panel.

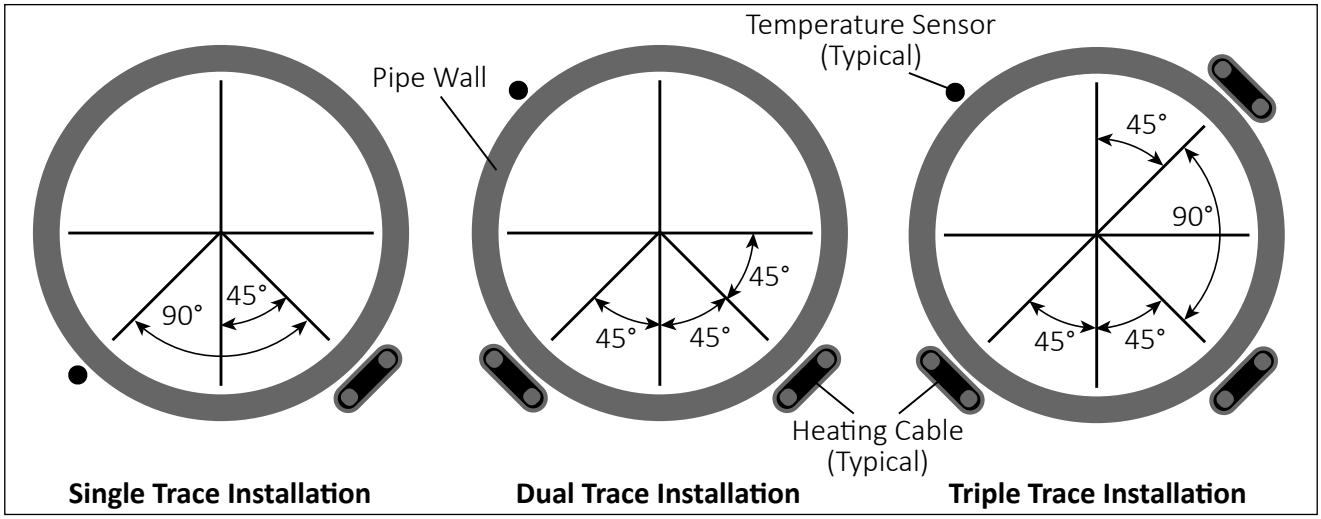
Note: The heat tracing system installation shall be in accordance with the electrical area classification requirements as well as shall conform to the latest requirements as detailed in applicable heat tracing standards, the local Electrical Code and plant standard practices. Where conflicts arise, contact the project engineer for resolution.

Heat Trace and Insulation Installation

All heat trace circuits and insulation shall be installed in accordance with project installation details provided. In addition, refer to the *Electric Heat Tracing Maintenance and Troubleshooting Guide* (Thermon Form No. 20745)

for general procedures and installation tips. RTD Installation and Wiring RTD control sensors should generally be installed on the process lines (see figure below) or in ambient (where ambient sensing is applied) in a location that is most representative of the entire heat trace circuit. In general, it is recommended that the sensors not be located at heat sinks such as pipe supports, pumps, and valves as the control system response needs to be based on the majority of the process line.

RTD Sensor Location On Piping



Power Distribution Wiring and Breakers

All field power wiring materials used shall be suitable for the intended service and shall be rated for insulation service temperatures up to and not exceeding 221°F (105°C) unless otherwise higher values are noted in project specifications. Circuit breakers (if not already supplied in the TraceNet panel) should be selected based on the heat trace type being used, the service voltage, and the circuit current draw characteristics. It is especially important when using self-regulating heat trace to make sure that the circuit breaker response curve type is coordinated with the startup characteristic of the heat trace cable in a cold start condition. All distribution wiring connections should be tightened using a torque indicating screw driver to the levels indicated below.

Recommended Torque Values (Typical)*

RTB6: 5.3–7 in. lbs. (0.6–0.79 Nm)

DCM w/Solid State Relays on Heat Sink: 12.5–13.5 in. lbs. (1.41–1.53 Nm)

Distribution Equipment: 13.2–15.9 in. lbs. (1.49–1.8 Nm)

* Required torque values may vary depending on individual panel designs and size of terminals. Refer to project documentation for additional information.

TraceNet Panel Wiring

TraceNet Genesis panels are configured and pre-wired into an integrated heat trace control and monitoring system. Clean terminal strips are provided to facilitate the field wiring into the panels. Refer to the project specific panel drawings when installing the field wiring within the panel. All terminal block connections should be tightened using a torque indicating screw driver to the levels indicated, including terminal block connections to/on TraceNet Genesis modules. All heat trace circuits should be properly terminated and meggered prior to energizing the heat trace power distribution and control panels. In addition, all pipes should be insulated and weather sealed to achieve the expected heat-up and temperature maintenance performance of the system.

Section 3: DCM, DTM & IOM Modules, Their Interconnectivity, And Setting Addresses

The TraceNet Genesis specific components include:

HMI (Human Machine Interface) serves as the central monitoring and interrogation point for a TraceNet Genesis control & monitoring system. It allows the operator to access operating control parameters and operating conditions throughout the heat tracing system network. The **HMI** communicates directly with other Genesis modules through CAN bus and with a DCS or host PC for TraceNet Command through Ethernet.

HMI

DCM

DCM With Solid State Relays Mounted On Heat Sink

DCM (Distributed Control Module) provides control output to solid state and/or mechanical relays as well as heater current and ground fault/earth leakage current measurement for up to six (6) EHT heaters/circuits. LEDs indicate output status for each circuit.

DTM

DTM (Distributed Temperature Module) is a DIN rail mountable six RTD sensor input module and provides input for up to six RTD sensors. Any RTD sensor may be mapped to any heater circuit on the CAN Bus network. As a single RTD sensor can provide temperature information for an entire Genesis panel (i.e. ambient sensing), the minimum number of DTM cards can be one (1). However, because individual EHT circuits can have multiple sensors (up to twenty (20) RTD sensors), the total number of DTM cards per panel can vary by system. Refer to the project specific drawings for each panel.

IOM

IOM (Input-Output Module) is a DIN rail mountable input/output module with one (1) dedicated system fault alarm output. (Outputs to signal a variety of conditions such as trips, low temperature alarms, ground/earth leakage alarms, etc. are planned in the future.)

See Section 5 for additional details about configuring the **DCM**, **DTM**, and **IOM** modules.

Section 4: Configuring the Genesis System And Programming The HMI Module

Circuit Overview

Provides a quick status of all circuits at a glance while highlighting one circuit a time with more detail. Each dot around the perimeter of the selector dial represents one circuit. Circuit 1 is at the top of the dial and circuit numbers ascend clock-wise around the dial.

- Red dots represent circuits in active alarm.
- Yellow dots represent circuits with acknowledged alarm.
- Green dots represent enabled circuits with no alarms present.
- Grey dots represent disabled circuits.

Note: *Temperature shown for line sensing control method.*

Note: *Operating current shown for ambient sensing control method.*

To move between circuits, touch the circuit dot, drag the black selector around the dial or use the arrows on either side of the circuit number. The center of the dial displays the highlighted circuit's live temperature, maintain temperature, circuit name, and on-off duty cycle. Touch anywhere inside the dial to enter that circuit's dashboard.

A slightly different view for circuits set for ambient control emphasizes electrical current (amps) measurement versus present temperature.

Main Menu

To access the Main Menu, touch the 'hamburger' icon in the upper left corner of any screen. Use the Menu to navigate between Overview, Circuit List, Global Settings and the System screen as well as to switch between night and day color profiles and to Import and Export configurations, isometrics, etc.

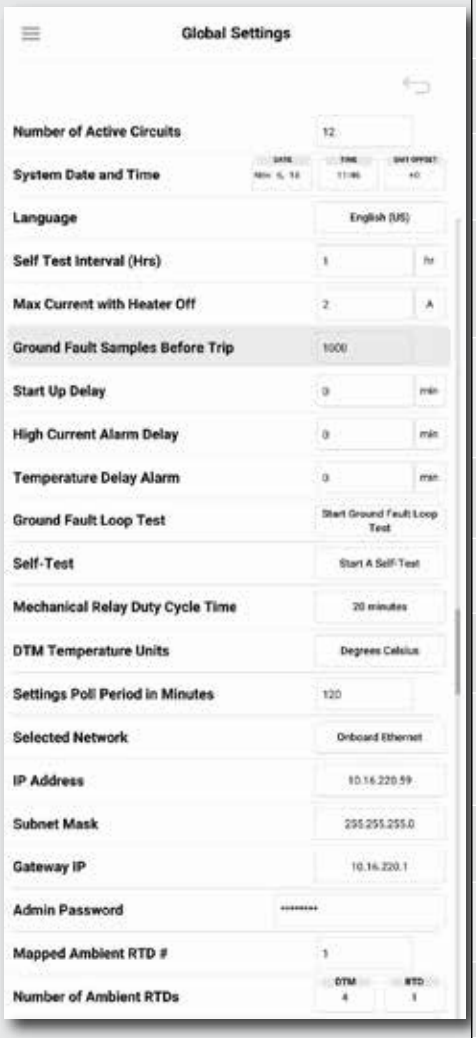
Admin Login

The user will be prompted to log in as an administrator when attempting to change any setting or set-point or Admin Login may be selected from the Menu. Admin mode is indicated by the red tint and red boarder on and around all screens. The system will remain in Admin Mode for 5 minutes after a valid password entry, even if actively programming circuits.

Note: The default login value is "abc123". It is not case-sensitive.

Global Settings

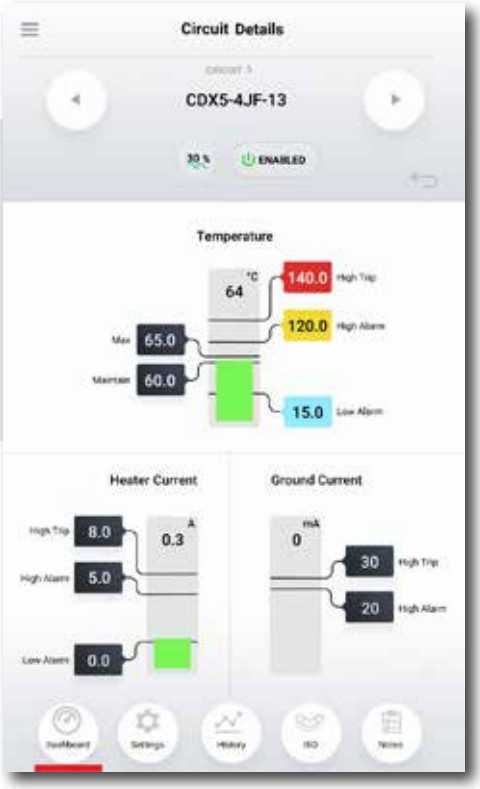
Global Settings can be reached from the Menu. These settings such as Temperature Units and Start-up Delay apply to the system as a whole.



Setting	Description	Acceptable	Lower Limit	Upper Limit	Units
Number of Active Circuits	Total number of circuits to display in Overview	Number	1	72	None
System Date and Time	Current Time and Date	Gregorian Calendar; 24 hr time; time zone offset from GMT			
Language	Displayed system language	English (US), English (UK), Arabic, Chinese, Spanish, French, Japanese, Korean, Russian			
Self Test Interval (Hrs)	Time in hours between automatically run self tests	Number	0	168	Hours
Max Current with Heater Off	Maximum current reading allowed when a heater is off before a circuit fault alarm is triggered	Number	0.5	5	A
Ground Fault Samples Before Trip	Number of ground current samples read above trip set point before trip is triggered. (does not affect time to trip because the samples are microseconds apart) This is to improve noise immunity.	Number	0	6	
Start Up Delay	Time in minutes before heaters turn on for the first time after system power up. This allows users to stagger start up across many panels to reduce load step on plant power.	Number	0	30	Minutes
High Current Alarm Delay	Time in minutes to delay current alarms after high readings. This is to prevent nuisance alarms on startup current.	Number	0	7	Minutes
Temperature Delay Alarm	Time in minutes to delay temperature alarms. This is useful for avoiding nuisance alarms due to steam-out.	Number	0	30	Minutes
Ground Fault Loop Test	Runs self contained test to confirm integrity of the ground current measurement system.	Touch to Start			
Self-Test	Runs self contained test including the ground fault loop test and additionally turns measures heater current with heater on and off to verify relay operation and current measurements.	Touch to Start			
Mechanical Relay Duty Cycle Time	Adjusts the duty cycle period for mechanical relays in proportional control mode.	Select from 20, 25 or 33			Minutes
DTM Temperature Units	Switch temperature units between Fahrenheit and Celcius	Fahrenheit, Celcius			
Settings Poll Period in Minutes	Time in minutes between requests from **HMI** to modules for all system information	Number	5	20	Minutes
Selected Network	Switch between Onboard Ethernet (default) or USB (for use with USB-Ethernet adapter- diagnostics)	Onboard/USB			
IP Address	Internet Protocol Address (see network administrator for IP Address assignments)	IPv4 Address	0.0.0.0	255.255.255.255	
Subnet Mask	Binary mask which defines the subnetwork to which a device belongs (see network administrator for Subnet Mask assignments)		0.0.0.0	255.255.255.255	
Gateway IP	First networking device connected to on the network (see network administrator for Gateway IP assignments)	IPv4 Address	0.0.0.0	255.255.255.255	
Admin Password	Password used to protect the system from unintended or unauthorized changes	Alpha-numeric 50 character limit			
Number of Ambient RTDs	Sets the number of ambient RTD sensors used by the system	Number	0	6	
Mapped Ambient RTD#	Address and Subaddress of the assigned RTD; the number of "Mapped Ambient RTD#" fields corresponds to the "Number of Ambient RTDs" value, i.e. if "Number of Ambient RTDs" is set to 3, there will be 3 "Mapped Ambient RTD#" fields to provide an address for each RTD	**DTM**: number 1-99; RTD: Number 1-6			

Dashboard/Circuit Details

The dashboard provides a comprehensive single circuit view. It includes the circuit number, tag, pipeline number, or other status as well as real-time temperature, heater current, ground leakage current and related alarm set points. This screen can be reached by tapping a circuit in the Overview or the Circuit List. The limits below define the lowest and highest possible values. (The bounds define the constraints for valid values, e.g. maintain temperature should not be set below the low temperature alarm.)

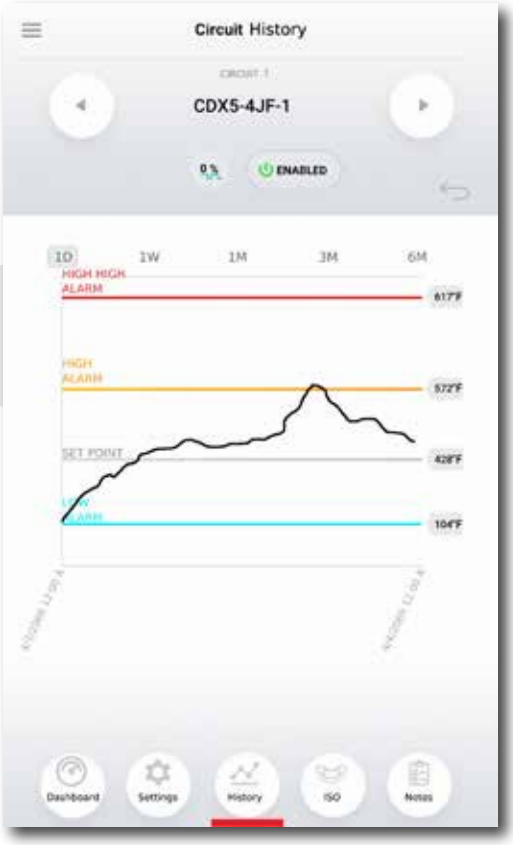


Set-point	Description	Available Options	Lower Limit	Lower Bound	Upper Bound	Upper Limit	Units
Circuit Information							
Circuit Number	Number of the circuit within the panel	Read-Only	1			72	None
Circuit Tag	Alpha-numeric Identifier	Dot, Read-only in Dashboard, User-defined in Settings				50	Characters
Circuit Status	Percent On (Duty-Cycle); Enable Button	Disabled, Enabled, Enabled Forced-On, Enabled Forced-Off				100	%
Temperature							
High High Alarm/ High Trip	High High Alarm: If Temperature Trip is disabled. High Trip: If Temperature Trip is enabled	User-Defined	-200 (-328)	High Temperature Alarm Set Point	Upper Limit	650 (1200)	°C (°F)
High Alarm	High Temperature Alarm activates at and above this set point	User-Defined	-200 (-328)	Max + 1	High High Alarm/ High Trip Set point	650 (1200)	°C (°F)
Max	Above Max heater duty cycle is 0%, i.e. Heater is off	User-Defined	1	1	High Alarm set point- Maintain set point- 1	650 (1200)	°C (°F)
Temperature	Real-time Temperature measurement	Read-only Measurement	-200 (-328)			650 (1200)	°C (°F)
Maintain	Set point at and below which heater duty cycle is 100%	User-Defined	-200 (-328)	Low Alarm set point + 1	Max- 1	650 (1200)	°C (°F)
Low Alarm	Low Temperature Alarm activates at and below this set point	User-Defined	-200 (-328)	Lower Limit	Maintain Temperature- 1	650 (1200)	°C (°F)
Heater Current							
High High Alarm/ High Trip	High High Alarm: If Current Trip is disabled. High Trip: If Current Trip is enabled	User-Defined	0	High Alarm	Upper Limit	100	A
High Alarm	High Current Alarm activates at and above this set point	User-Defined	0	Low Alarm + 1	High High Alarm/ High Trip	100	A
Low Alarm	Low Current Alarm activates at and below this set point	User-Defined	0		High Alarm set point- 1	100	A
Ground Current							
High High Alarm/ High Trip	High High Alarm: If Ground Trip is disabled. High Trip: If Ground Trip is enabled	User-Defined	20	High Alarm	Upper Limit	255	mA
High Alarm	High Ground Fault Current Alarm activates at and above this set point	User-Defined	20	Lower Limit	High High Alarm/ High Trip	255	mA

Circuit Settings

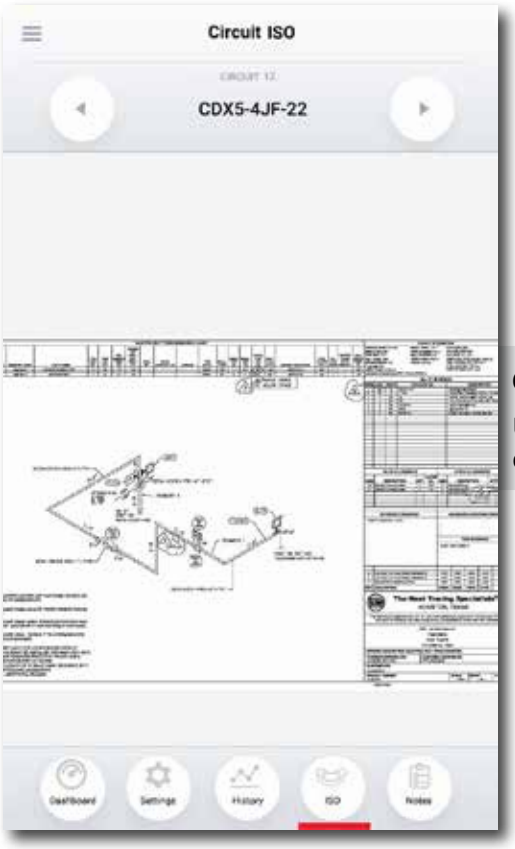
Settings **on a per circuit basis** (distinct from set points) can be found here. This includes things like trip enabling assignments with number and address of RTDs.

Setting	Description	Available Options	Lower Limit	Upper Limit	Units
Circuit Name	User defined Alpha-numeric Identifier unique to circuit	Alpha-numeric, Upper/Lower Case, hyphen, dot	1	50	Characters
Process Tag	User defined alpha-numeric				
Identifier For Grouping Circuits Together By Associated Process	Alpha-numeric, Upper/Lower Case, hyphen, dot	1		Characters	
Active Alarm	Hexadecimal code for active alarms and a button to display and acknowledge active alarms	Acknowledge individual alarms or acknowledge all alarms	0x0000	0xFFFF	
Alarm Acknowledge	Hexadecimal code for active alarms and a button to display and acknowledge active alarms	Acknowledge individual alarms or acknowledge all alarms	0x0000	0xFFFF	
High Trip Settings	Enable or disable buttons for Temperature, Current and Ground Current trips	Enable/Disable			
Control Type	Chose control method for circuit	On/Off, On/Off with Soft-Start, Proportional, Ambient Proportional Mechanical			
RTD Fault	Chose the forced duty cycle in the event of an RTD Fault	Number	0	100	%
Power Clamp	Maximum duty cycle allowed on circuit	Number	0	100	%
Times The Heater Has Cycled	Cycle count for mechanical relay controlled by circuit	Number; read-only	0	2,147,483,648	Since Commissioning
Heater Relay Type	Chose between mechanical or solid-state relays	Mechanical/SSR			
Heater Voltage	Voltage provided to trace heater	Number	0	600	Volts
Heater Amps Per Hour Accumulation	Running total of Amps accumulated since last reset of value	Number	0	2,147,483,648	
Heater Watts Per Hour Accumulation	Running total of Watts accumulated since last reset of value	Number	0	2,147,483,648	Watts
Time Heater Will Come Back On	Applies to APCM; time left until the heater switches on again	Number	0	32	Minutes
Ground Current Reading At Trip	Ground fault current reading that caused most recent trip	Number	20	255	mA
Heater Current Reading At High Current Trip	Heater current reading that caused most recent trip	Number	1	100	A
DCM Address	Address (displayed on each board) unique to each board that allows communication between modules	Number	1	99	



Circuit History

Plots up to six months of temperature and current data with accompanying set point changes.

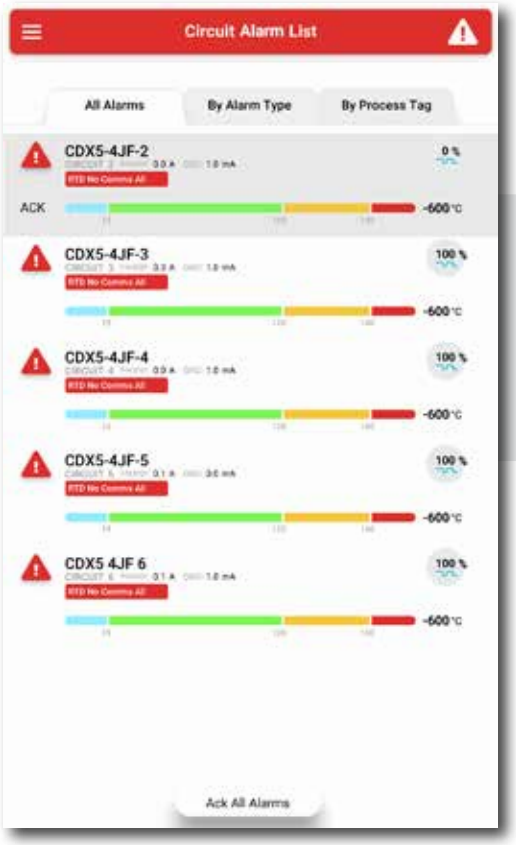


Circuit ISO

Use multi-touch pinch and zoom gestures to view the Isometric drawing for the circuit.

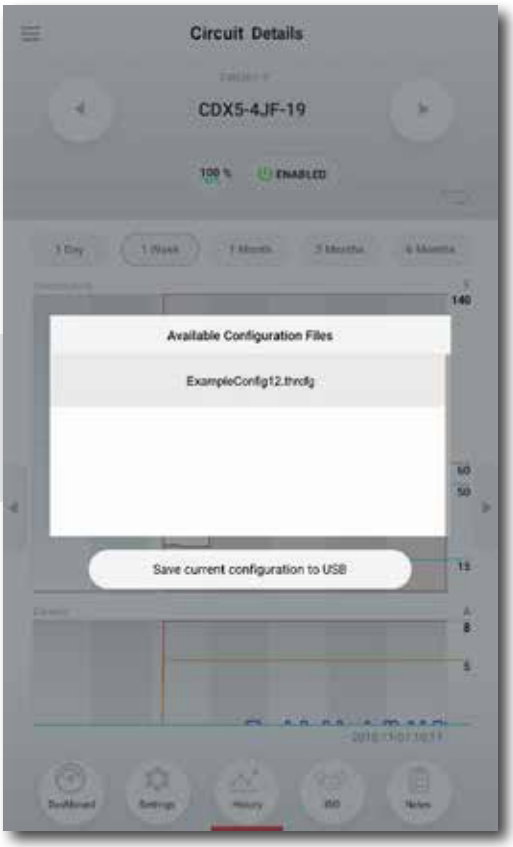
Circuit Notes

Useful notes can be stored here for any purpose such as for operators across shifts or for maintenance.



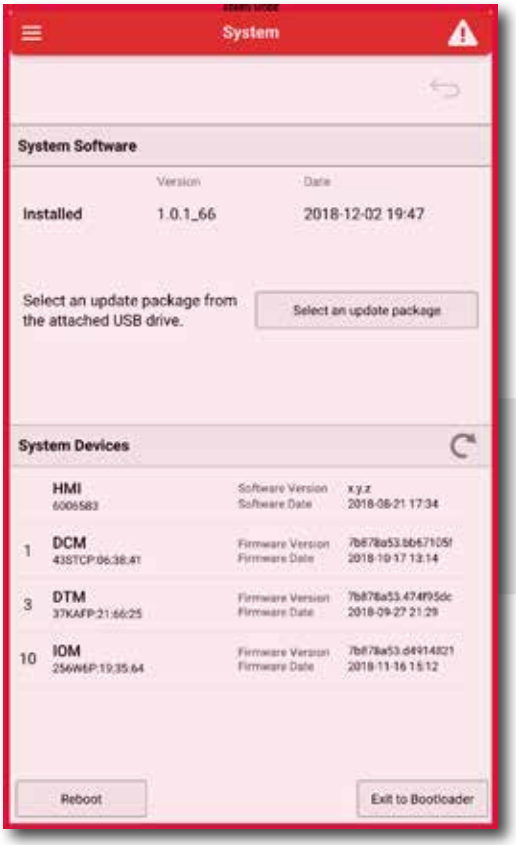
Circuit Alarm List

The Circuit Alarm List can be reached from the Menu. Here, live panes for each circuit in alarm, appear in a list organized with tabs for all alarms, by alarm type or by process. To acknowledge an alarm, tap Ack on the left of the circuit pane. A box will appear displaying each alarm for that circuit. Any individual alarm or all alarms for that circuit can be acknowledged.



Import/Export

The Import/Export feature is used to load isometrics and to import and export system configuration files to easily and quickly set up an entire panel. (Import/Export is via USB port on the back of the HMI.)

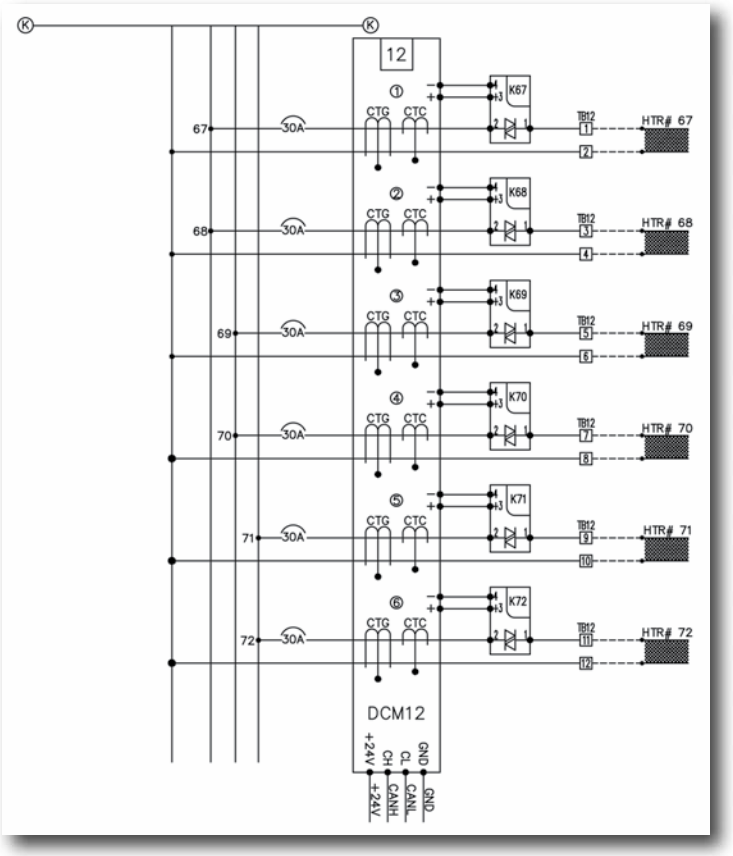


System

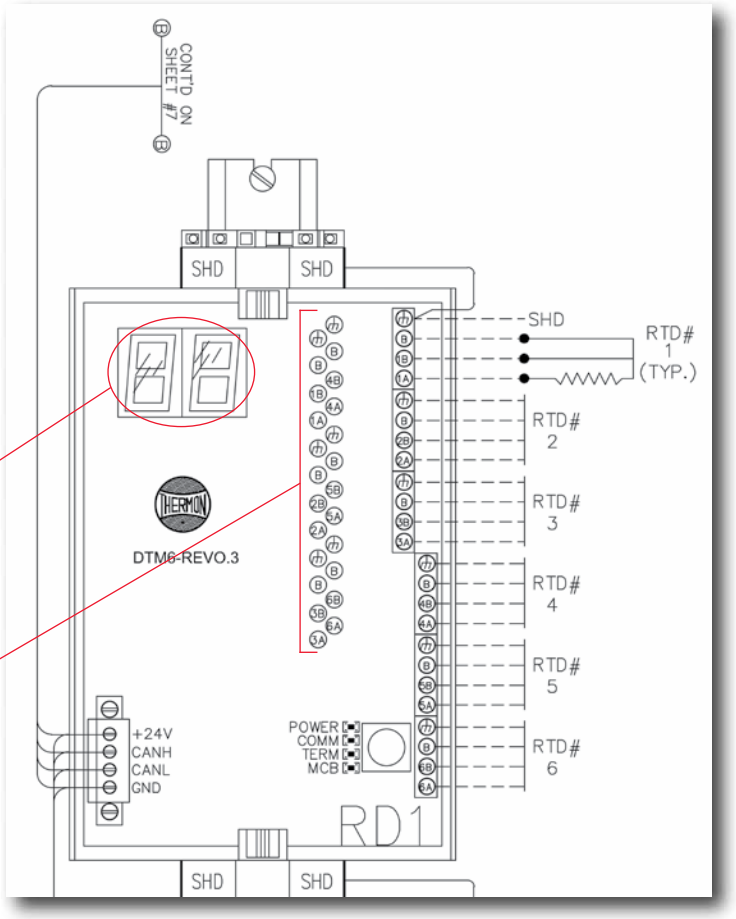
Provides a means of updating system software and firmware. Shows the current installed version. Use the *Mount USB Drive* button to show a list of all system devices, including address and firmware versions. Requires Admin Login for access.

Section 5: Configuring The Genesis DCM, DTM, And IOM Modules

DCM Module Wiring With Solid State Relays



DTM Module and RTD Wiring/Connections



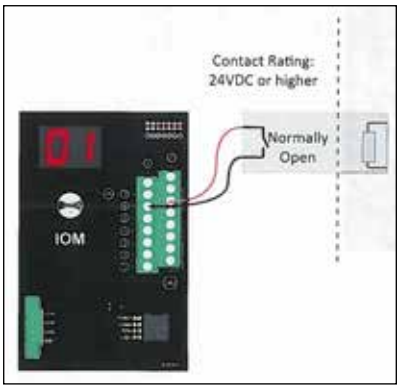
Two-digit code for DTM module

Sub-address of specific sensor for "RTD mapping"

Using IOM Inputs

The inputs on the IOM are labeled 1-6, plus 7 for system/common alarm.

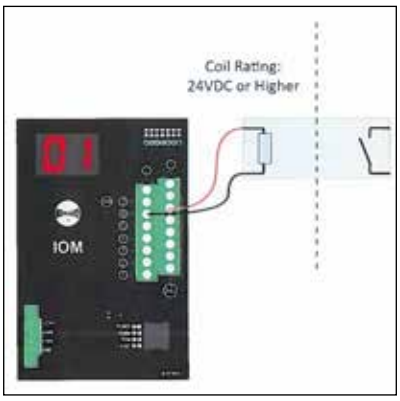
They are not intended to be directly driven by an output. They are designed to sense 24 VDC supplied by the IOM through an open or closed relay contact. This allows input from various types of signals from low voltage DC to high voltage AC. As long as the coil side of the relay used is appropriate for the signal and the contact side of the relay has a 24 VDC rating or better, any relay could be used. Thermon uses Phoenix Contact relays, such as PLC-RSC-24DC/2 l/EX-2909524, for many reasons including their broad approvals coverage, convenient size and DIN rail mounting. To use an IOM input, wire the appropriate relay as pictured in the diagram.



Using IOM Outputs

The outputs on the IOM are labeled 1-7. Output 7, also labeled SYS, is a non-configurable output for system fault alarm.

Each output is designed to drive Phoenix Contact relays PLC-RSC-24DC/2 l/EX-2909524 for remote or local signalling. For voltage specific current ratings refer to relay data sheet, PLC-RSC-24DC/2 l/EX. To use an IOM output, wire the appropriate relay as pictured in the diagram.

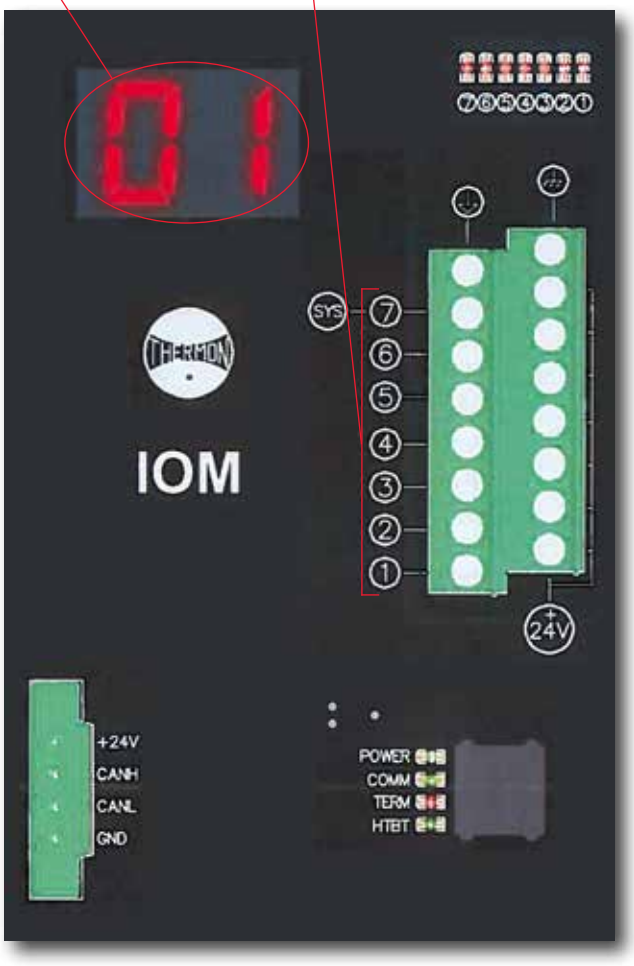


Default I/O Configuration

	I/O	Default LED State	Alarm LED State	Function
1	Output	ON	OFF	Standard Alarm
2	Output	ON	OFF	Trip
3	Output	ON	OFF	HIgh Temperature Alarm
4	Output	ON	OFF	Low Temperature Alarm/RTD Fault
5	Input	--	--	Load Shed
6	Input	--	--	Force On
7	Output	ON	Off	System Fault Alarm

Two-digit code for IOM module

Sub-address of specific sensor for "RTD mapping"



Interface

- Two 7-segment LED displays
- Driven by 2 latched shift registers
- Reverse surface mounted through board cutout
- Push-button to change address and terminate CAN

System Fault Alarm

- Normally ON, OFF on fault
- 8-bit counter clocked by free running ‘555 timer
- Processor must toggle input to clear counter before carry bit sets SYS Alarm

Section 6: Genesis Control Options and Examples

The TraceNet system allows a variety of control options for heat trace operation.

- Line sensing (RTD Sensor on pipe-wall)
- APC (Ambient Proportional Control)
- Ambient Sensing (On-Off Control)

The most energy efficient control mode is to use one (or more) line sensing RTD's for each heat trace circuit. When using this control mode, the TraceNet Genesis panel will have the RTD(s) connected to the DTM module in the panel.

Example 1: Line Sensing Control

When the RTD is directly sensing pipe-wall surface for control, the key parameters are "Maintain Temperature" at which the heat trace is energized or turned on. The "Max" temp setting is where the heat trace will be de-energized, or turned off. The difference between these control settings defines the "dead band" (aka "control differential")

From the line sensing RTD(s) the temperature of the process line is read by the Genesis and is/are also able to alarm for the user's low and high temperature alarm settings. (A "high-high" temperature setting with circuit "trip" option is also determined from the RTD(s) placed directly on the process line.)

Line sensing is the most energy efficient method of control as the heat trace is only energized when the temperature of the line is at the "Maintain" setting (or lower) and the heat trace is de-energized when the it reaches the "Max" setting, (aka "Maintain" plus "Dead Band".)

Ambient Sensing Options

Any ambient sensing control mode is less energy efficient than line-sensing control, but generally allows fewer heating circuits of longer lengths. This is because there is no concern about process flow paths for heating circuit layout, which will influence RTD placement, the number of sensors, and the number of heating circuits required.

There are two options for Ambient Sensing with the TraceNet Genesis System:

- **APC (Ambient Proportional Control)**

  With APC the heat trace will be set to operate at 100% power (continuously on) at the minimum ambient temperature, and reduce power as the ambient temperature rises to the maintain temperature. When the ambient temperature reaches the maintain temperature, the heat trace produces no heat for that circuit. This "Proportional Control" is achieved by cycling the power to the heat trace "on" and "off" so the time "on" is proportional to the difference between the "Maintain" and ambient temperatures. (**Note:** The minimum power level is 8%, so that the electrical current and earth leakage current levels can be accurately measured.)

- **Ambient "On-Off" Control**

  In this case the heat trace is fully "on" when the ambient temperature falls below the "Maintain" temperature and is fully "off" when the ambient temperature rises above the "Maintain" plus the minimum control dead band of +3° (°F or °C)

Example 2: APC (Ambient Proportional Control)

Maintain +40°F (+5°C) (i.e. to keep water from freezing) in a minimum ambient condition of -40°F (-40°C) with APC control method, follow this procedure:

The "Maintain" Temperature is set at +40°F (+5°C), at which the heat trace would be de-energized, or "Off".

The "Minimum Ambient" temperature (at or below which power is on 100%) would be programmed to be a value of -40°F (-40°C).

(Note that the difference between the Maintain and the Minimum Ambient temperature defines the "Dead Band", across which the time "on" and "off" is established do deliver the heat proportionally. The reduced power delivery results in overall energy consumption when compared to Ambient "On-Off" Control.)

APC control method can be successfully used for maintaining elevated temperatures as well. This can reduce the number of heating circuits by allowing longer heating circuits, but is not as energy efficient as line sensing RTD temperature control.

The APC control method has traditionally been used only with Solid State control relays because of rapid cycling of the control relays during operation. Now, by expanding the cycle time between "on" and "off", mechanical relays can be used.

Example 3: Ambient "On-Off" Control

As a third control mode option, the TraceNet Genesis panel may be configured for Ambient "On-Off" Control. In this case, one or two RTD's may be used to sense ambient temperature, typically in a shaded area subject to wind and rain in an area convenient to the panel location.

In this case, the heat trace operates at 100% power whenever the ambient temperature drops below the "Maintain" temperature. To winterize water lines this is typically +40 to 50°F (+5 to 10°C). If the ambient rises above this value, plus the minimum control dead band of +3° (°F or °C)) the heat trace will turn off.

This is a less energy efficient approach to heat trace control, but is consistent with what is routinely provided with ambient sensing mechanical thermostats controlling a contactor between a distribution panel's main circuit breaker and the branch breaker panel board.

Section 7: Genesis Testing and Start-Up

All heat trace circuits should be properly terminated and megger tested prior to energizing the TraceNet Genesis control panels. In addition, all pipes should be insulated with weather barrier to achieve the required temperatures to be maintained.

Troubleshooting Tips

When starting up a newly installed heat trace and control system, it is common to encounter numerous circuit alarms and possibly circuit "trip" events. Data entry errors, unanticipated temperature conditions and/or dead band settings that are too narrow, and other possible installation errors can be expected.

A table of Troubleshooting Tips is provided in Appendix C to assist during start-up.

Section 8: Operation and Maintenance of the Genesis Control and Monitoring System

Maintenance

Preventive maintenance consists of inspection, testing, checking connections, and general cleaning of equipment at scheduled intervals. The maintenance recommendations that follow are intended to support and in some cases "add to" those procedures detailed in the facility's Planned Maintenance System (PMS). In case of conflicts, contact the project engineer for resolution. When carrying out the scheduled maintenance program, the following safety precautions should be observed. Safety Precautions the heat tracing can be powered by the project specified nominal voltages ranging from 100 to 600 Vac. It is important that only authorized trained personnel conduct these maintenance and service activities. Before conducting any maintenance or service procedure, exercise required lockout and tag out procedures at the appropriate circuit breakers. Additionally, do additional testing within the control panel to ensure that the specific heat tracing and control circuit of interest is fully de-energized and the equipment is grounded. If it becomes necessary to service or test live equipment, the following instructions must be followed:

- Use one hand when servicing the equipment. Accidental death or severe injury may occur especially if a current path is created through the body from one hand to the other.
- First, de-energize the equipment. To de-energize any capacitors connected into the circuits, temporarily ground the terminals where work is to be done.
- Connect the multi-meter/instrument to the terminals of interest using a range higher than the expected. Make sure that you are not grounded whenever a need arises to adjust equipment or test circuit operation. Verify that all test equipment used is properly maintained and safe for the intended use.
- Without touching the multi-meter/instrument energize the equipment and read the values indicated on the multi-meter/instrument.
- Remove the test leads after de-energizing the circuit of interest.

Maintenance Schedule Recommendation

The service schedule is somewhat dependent on the "in service" hours. As a general rule, however, it is recommended that the heat tracing control and monitoring panel be serviced on a twelve month basis to start. The schedule may be adjusted depending on the operating history of the panel and as the historical maintenance records dictate.

TraceNet™ Genesis
Control & Monitoring Systems

QUICK START GUIDE

The TraceNet Genesis HMI serves as the central user interface.

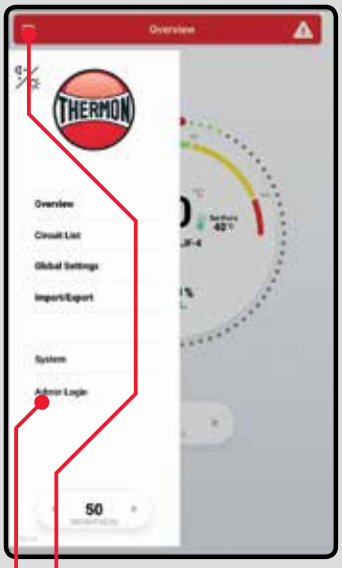
- View Status For 72 Circuits On Dashboard
- Allows Up To 20 RTD's Per Circuit
- Communications to Host Computer via Ethernet Communications
- Reduced Wiring And Connections
- Each RTD is Addressable
- Control Panel– IP66 IP Rating

The TraceNet Genesis has a simple "glove touch" interface that allows the operator to adjust and monitor heat tracing circuits. The following steps show navigation of the controller's basic functions.

OVERVIEW

The Overview screen displays information on any circuit.

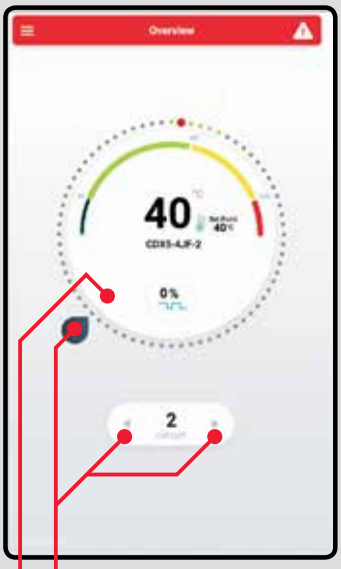
"HAMBURGER" MENU



To edit circuit values, log in by touching the "Hamburger" menu.

Select **Admin** to log in.

OVERVIEW



Rotate the teardrop cursor or use the arrows to select a circuit.

Touch inside the circuit dial to show the Circuit Dashboard.

CIRCUIT DASHBOARD

Touch any value on circuit details to edit a setpoint.

NUMBER PAD

Edit Maintain Temp, Alarms, and Control Band using the number pad.

Select check to accept new setpoint.

Select an icon at the bottom of any Circuit Screen::

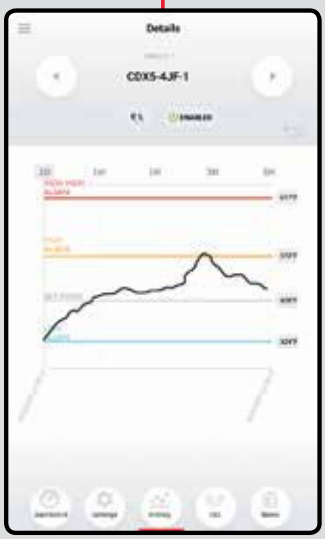
Select **Settings** to adjust variables specific to a circuit.

Select **History** to view up to 6 months of data for the circuit.

Select **ISO** to view the isometric drawing for the circuit.

Select **Notes** to add comments to a circuit.

SETTINGS



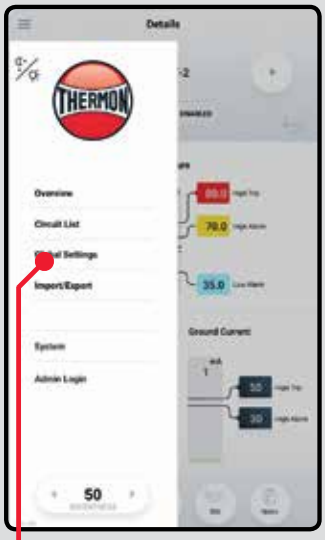
HISTORY

CIRCUIT ISO

NOTES

"HAMBURGER" MENU

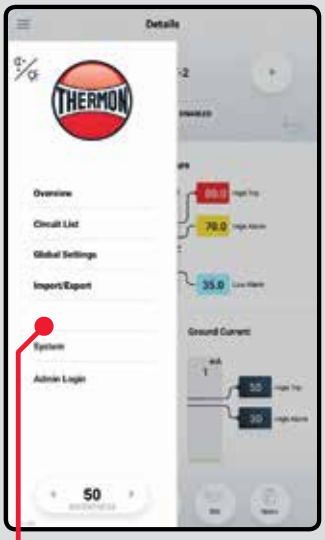
Select the "Hamburger" menu to make global adjustments.



Select **Global Settings** to adjust how the Genesis displays system-wide variables such as language, temperature, system time.

GLOBAL SETTINGS

Select any value on global settings to make adjustments to circuit level or updates to global settings.



Select **Import/Export** to import or export ISO drawings and circuit-level details.

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Form TEP217U-0219

TRACENET™ GENESIS

CONTROL AND MONITORING SYSTEM

SPECIFICATION GUIDE

APPLICATION OVERVIEW

Control and monitoring systems can play an essential role in heat tracing applications which range from freeze protecting water lines to maintaining elevated process temperatures. While mechanical thermostats have been used successfully for many heat tracing applications, a more complete control and monitoring solution can be necessary for critical heat tracing applications. Advancements in technology have made electronic control and monitoring units both cost effective and more reliable. These systems conserve energy, extend system life, and ensure accurate temperatures are maintained, for reduced operating cost and increased plant reliability.

TraceNet Genesis' key features include:

- Monitor electric heat trace circuit load currents
- Selectable control methods (On/Off, On/Off with Soft Start, Proportional, Ambient Proportional) for each individual circuit
- Programmable alarm set points, with time delay and remote alarm acknowledgment and reset capabilities
- Programmable "trip" set-points for each circuit
- Temperature sensor status indication
- Unique circuit identifier (48 characters maximum)
- Communication to host computer via Ethernet communications
- Adjustable ground/earth leakage "trip" and/or alarm capabilities
- Addressable RTD Temperature Sensors- up to 20per circuit
- Up to 6 months history to aid in troubleshooting
- ISO drawing in png format for viewing on Genesis HMI

GENESIS SYSTEM APPROVALS

Nonhazardous Locations
ETL Listed Conforms to: UL STD. 508A
Certified to: CSA STD. C22.2 NO. 14

Hazardous Locations (Purge)
ETL Listed Conforms to: UL STD. 508A. NFPA STD. 496
Certified to: CSA STD. C22.2 NO. 14

Hazardous Locations
ETL Listed Conforms to: UL STD. 508A. UL STD. 12.12.01
Certified to: CSA STD. C22.2 NO. 14. CSA STD. C22.2 NO. 213

1 Sysem approval requires panel to be fabricated at corporate headquarters.

GENESIS COMPONENT APPROVALS

TraceNet systems are certified for nonhazardous locations, hazardous locations, and Purge for hazardous locations

IEC/EN/UL/CSA 61010-1
Ex ec IIC T4 Gc; II 3 Ex ec IIC T4 Gc
Class I, Division 2, Groups ABCD T4; Class I, Zone 2 Group IIC T4

TRACENET GENESIS PANEL

SYSTEM SPECIFICATIONS (Based on lowest rating of all components)

Environmental:
Hazardous and Ordinary Locations
- Indoor and Outdoor-Solid State Relays

Ordinary Locations
- Indoor and Outdoor- Power Distribution and Mechanical Relays

Operating Ambient Range: -40°C to 60°C
Enclosures: Type 4X, IP 66 *
TraceNet Supply Voltage: 100-240 Vac, 50/60 Hz
Heat Tracing Voltages: 100-600 Vac
User Interface: 231 mm x 139 mm LVDS TFT LCD glove touch panel
Maximum Number of Circuits: Seventy-two (72)
Temperature Sensors per Circuit: Up to twenty (20) 100 Ω Platinum, 3 wire RTD's
Current Switching Device Options:
Solid State Relay **
1-pole
2-pole
Mechanical Relay:
Per design requirements
Control Methods:
Process Sensing:
On/Off, On/Off Soft Start, Proportional
Ambient Sensing:
Proportional, Ambient Proportional-Mechanical (APCM), APC
Control Temperature Range: -129°C to 600°C
Alarm Settings:
Low, High Temperature, and High Temperature Trip
Low, High Current, and High Current Trip
High Ground/Earth Leakage Current
RTD and Relay Faults
Loss of Communication
Programming Error
Trip Settings:
High Temperature, Heater Current, Ground or Earth Leakage Current
Networking Communications:
External: Ethernet
External Alarm Relays:
Up to seven mechanical, 6 A @ 250 Vac or Vdc

* Additional cabinet types are available. Contact Thermon for details.

** Rating based on extended heat sinks. Multiple single pole relays may be used for two and three phase circuits. Higher voltage rated relays are also available as an option.

HMI (HUMAN MACHINE INTERFACE)

The HMI serves as the central monitoring and interrogation point for a TraceNet™ Genesis system, including its heat tracing control modules. Through its touch screen monitor, the HMI allows the operator to access operating control parameters and operating conditions throughout the heat tracing system network.

The HMI communicates directly with TraceNet Command and DCS systems through its Ethernet port.

Circuit History For Trending

Circuit Dashboard

Circuit Isometric Drawing

"Glove Touch" User Interface

HMI SPECIFICATIONS

Operating supply voltage	24 Vdc
Max Power consumption	30 Watts
Clock speed	1.5 GHZ
Processor	32 Bit Arm Cortex A15
IP Rating	Type 4X, IP66
Brightness	1000 cd/m^2
Input/Output ports	Ethernet/USB
Maximum storage temperature	85°C
Minimum storage temperature	-40°C
Operating ambient temperature range	-40°C to 70°C

HMI DIMENSIONAL DATA

HMI PRODUCT FEATURES

- TraceNet Genesis HMI Is IP66
- Module operates in a wide range of ambient conditions
- Multi-language capability
- Color display utilizes LED backlighting to maximize service life and is additionally programmable for “sleep mode” operation
- Utilizes projected capacitive touch screen for user input functions
- Intuitive user friendly graphical interface
- Type 4X, IP66 panel mount enclosure which may be installed on panel with access door or inside on panel swingout
- Optically bonded display for bright sunlight visibility

DCM (DISTRIBUTED CONTROL MODULE)

The DCM serves as the power switching module, using solid state relays for a TraceNet™ network of heat tracing control modules.

DCM FEATURES

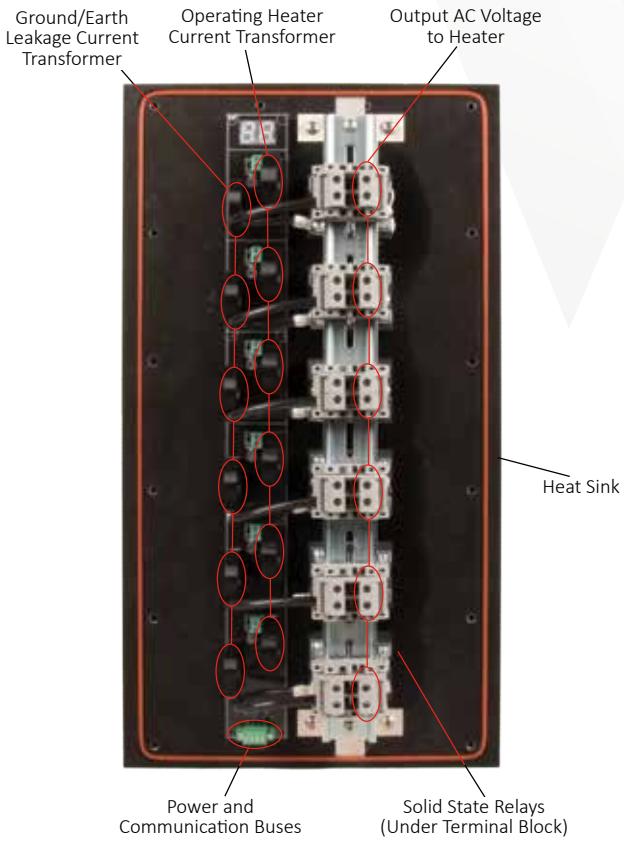
- Operates in a wide range of ambient conditions
- Single or dual pole solid state switching
- Nickel plated terminal construction
- Black anodized aluminum heat sink capable of dissipating the heat generated for up to a total of 180 Amps continuous
- Includes a ground/earth leakage circuit test loop which allows the operator to conduct a functionality test on each circuit
- The DCM module has the following control modes:
  1. On-Off
  2. On-Off with Soft-Start (solid state relays only)
  3. Proportional (solid state relays only)
  4. Ambient Proportional (solid state relays only)
  5. Ambient Proportional- Mechanical
- Activates test functions including:
  1. Ground/Earth Leakage Fault Circuit Test
  2. Loss of Heater Current Test
- Activates programmed control function based on the temperature values provided by up to 20 RTD's per circuit
- Monitors ground/earth leakage and heater operating current in heat tracing circuits

DCM COMPONENT SPECIFICATIONS

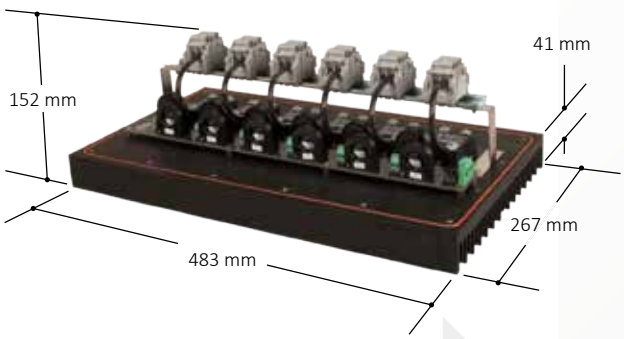
Circuit control capacity ..... up to six heat trace circuits
Storage ambient temp. range..... -40°C to 105°C
Operating ambient temp. range..... -40°C to 100°C
Power terminal connections[1]
0.5 to 10 mm², 630 Vac
Printed circuit board ..... conformal coated
Heat sink ..... Type 4X, IP66

1. DIN-rail mounted terminal blocks for line voltage to be off PC board.

DCM CONNECTION DIAGRAM



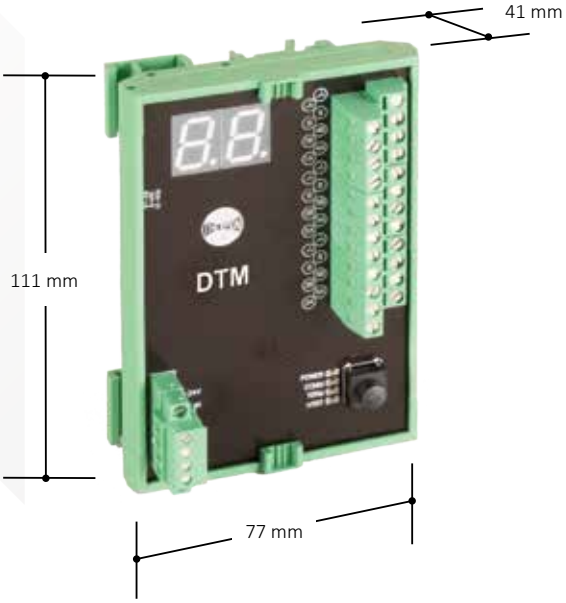
DCM DIMENSIONAL DATA



DTM (DISTRIBUTED TEMPERATURE MODULE)

The DTM is a DIN rail mountable six RTD sensor input module which links the field RTD wiring to the DCM module via CANBus. Any RTD sensor may be mapped to any heater circuit on the CANBus network.

DTM DIMENSIONAL DATA



DTM PRODUCT FEATURES

- Up to six RTD sensors that can be independently addressed to one or more heat trace circuits
- DIN rail mountable
- Conformal coated printed circuit board for use in panels located in indoor and outdoor environments

DTM COMPONENT SPECIFICATIONS

Storage ambient temp. range..... -40°C to 105°C
Operating ambient temp. range.....-40°C to 100°C[1]
Terminal connections.....up to 2.5 mm²
Maximum RTD capacity 6

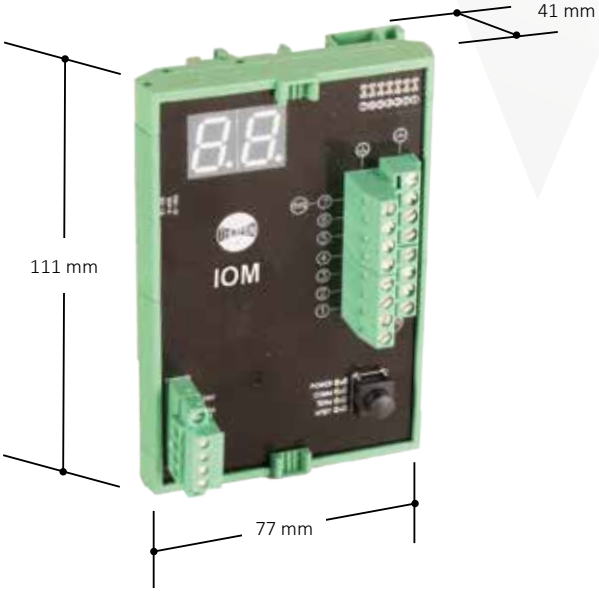
1. For designs that allow operation in ambient conditions below-40°C contact Thermon..

DTM CONNECTION DIAGRAM

IOM (INPUT OUTPUT MODULE)

The IOM is a DIN rail mountable input/output module with 6 individually configurable input/output channels and one dedicated system fault alarm output. Outputs may be configured to signal a variety of conditions such as trips, low temperature alarms, ground/earth leakage alarms, etc. Inputs may be used to trigger a variety of events such as load shed or forcing on circuits.

IOM DIMENSIONAL DATA



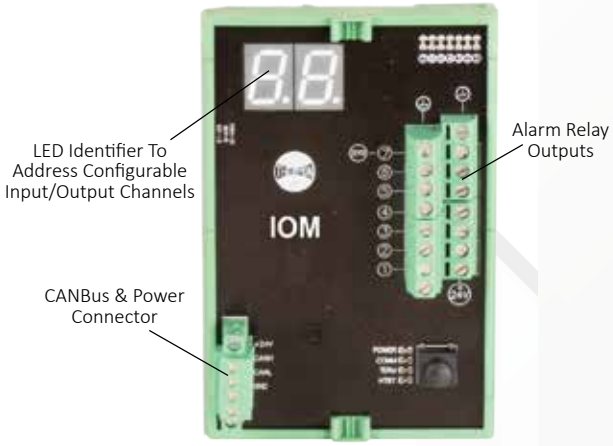
IOM PRODUCT FEATURES

- Operates in a wide range of ambient conditions
- DIN rail mountable
- Conformal coated printed circuit board for use in panels located in indoor and outdoor environments

IOM COMPONENT SPECIFICATIONS

Storage ambient temp. range..... -40°C to 105°C
Operating ambient temp. range.....--40°C to 100°C
Terminal connections.....up to 2.5 mm²

IOM CONNECTION DIAGRAM



TRACENET COMMAND

Genesis Systems communicate via Ethernet to the Thermon TraceNet Command electric tracing circuit monitoring software. TraceNet Command provides centralized electric tracing information for all panels in a facility, such as:

- Heat tracing circuit status
- Temperatures, heater operating and earth/ground current alarm/trip events
- Event history
- Data trending
- Maintenance and troubleshooting guidance

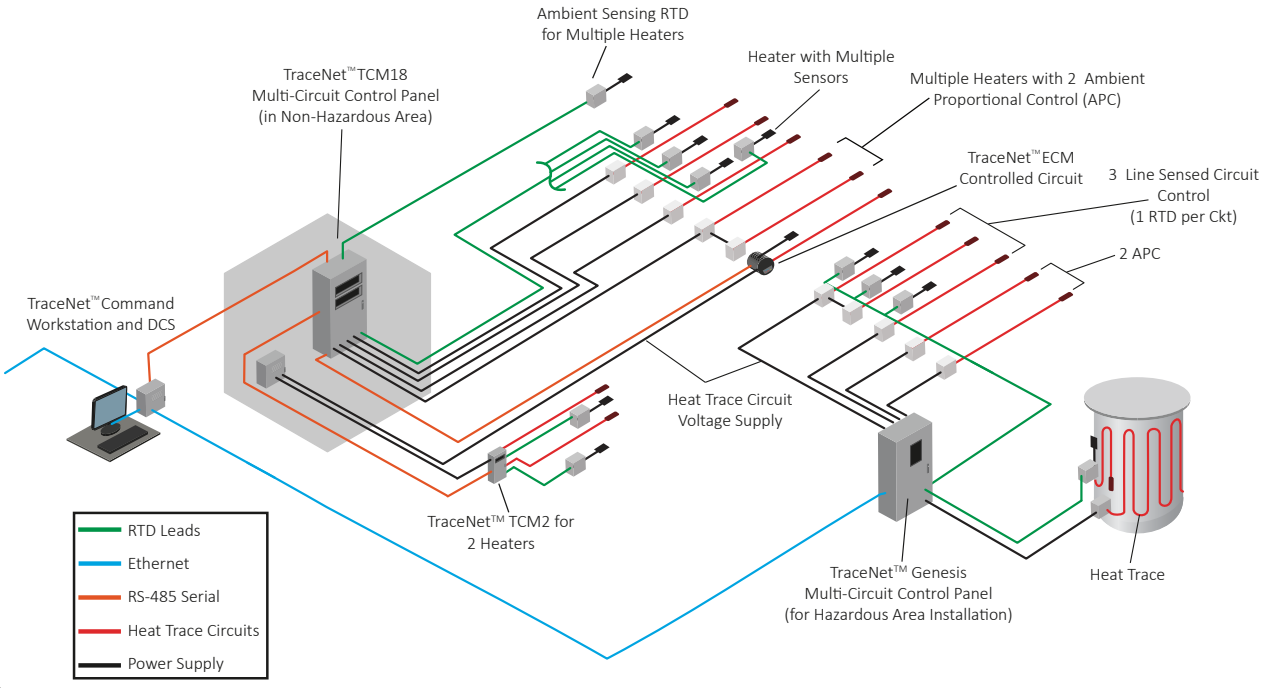
TraceNet Command also gives the operator the ability on all panels from a single location to:

- Change set points as well as alarm and trip values
- Reconfigure system control parameters
- Provide heat tracing management reports
- Load shed circuits on a priority level basis

DCS (DISTRIBUTED CONTROL SYSTEMS) COMMUNICATIONS

Genesis Systems communicate via Ethernet to the plant DCS. The same operating data and control capabilities that are available through TraceNet Command are also accessible in the plant control room at the DCS.

Centralized/Distributed Control Systems Communications via Thermon's TraceNet™ Command



PRODUCT REFERENCE LEGEND

TNG - 1836 - SSD - 120S130 - H1 - ND - P/N

TraceNet Genesis Series [1]

Heat Trace Control Relays

18
36
54
72

RTD Inputs

18
36
54
72
108
144

Enclosure Type

SS = Stainless Steel Type 4X/IP66
PS = Painted Steel Type 4/IP66
SSP = Stainless Steel Type 4X/IP66 (with purge)
PSP = Painted Steel Type 4/IP66 (with purge)
X = Custom [2]

Trace Heater Operating Voltage(s)

100 Vac
120 Vac
200 Vac
208 Vac
220 Vac
230 Vac
240 Vac
277 Vac
480 Vac
600 Vac

Enclosure Size
H x W x D mm

A = 914 x 762 x 406 mm
B = 1219 x 914 x 406 mm
C = 1524 x 914 x 406 mm
D = 1524 x 914 x 610 mm
E = 1524 x 1219 x 610 mm
F = 1829 x 914 x 406 mm
G = 1829 x 914 x 610 mm
J = 1829 x 1219 x 610 mm
H = 1829 x 1524 x 610 mm
I = 1829 x 1829 x 610 mm
X = Custom [2]

Heat Trace Control Relays

S1 = Solid State Single Pole
S2 = Solid State Two Pole
M1 = Mechanical Single Pole
M2 = Mechanical Double Pole

Amperage Rating for Control Relays

Location

O = Ordinary Locations
H1 = Class/Division Hazardous Locations (NoAm Norms)
H2 = Ex Explosive Atmospheres (ATEX or IECEx)

Distribution

ND = No Distribution
MBx/BF y/z= Main Breaker/Breaker Frame Capacity/Number of Breakers

Thermon Part Number

Notes:

1. Other options for the TraceNet, such as installations in conditions below-40°C.
2. Contact Thermon for additional information.

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Appendix C: Troubleshooting Tips For Reliable Electrical Heat Trace Performance

Troubleshooting Tips

Troubleshooting tips are provided here as a beginning point in correcting start-up issues and clearing out alarm and trip events.

High Temperature Reading/Alarm

The following summarizes some of the possible causes and solutions for heat tracing high temperature alarms.

Possible Cause	Recommended Solutions
Temperature of product in process line is above alarm set point or the expected reading due to events other than heat tracing—high processing temperatures, steam-outs, etc.	Let process return to normal condition or adjust alarm set point (if approved by project engineer) to allow for this processing condition.
High alarm setting programmed or expected reading did not consider natural temperature overshoot associated with the control scheme.	Move control set point down to allow for overshoot or raise the high temperature alarm set point (if approved by project engineer). It may also be possible to decrease the control band on the control circuit or adjust the type of control from on-off to proportional.
Improperly located RTD sensor.	Is the RTD sensor installed next to a heated tank or a steam jacketed pump that might cause a higher than expected reading? Is the RTD sensor on the heater itself? Move the RTD sensor to location more representative of the majority of the piping. Is the sensor location representative for properly controlling under all flow scenarios? Review location of the RTD(s) with respect to the known process flow patterns which occur and change as appropriate.
Wrong insulation size, type, or thickness on all of the line being traced.	Measure circumference of insulation, divide by π, and compare to insulation diameter charts for proper over sizing. Check insulation type and thickness against design specification. Replace insulation or review system design for alternate operating possibilities.
Wrong insulation size, type, or thickness on part of the line being traced.	The insulation system should be as specified in the design for the entire circuit being traced. Having a lower heat loss on one part of the circuit and higher heat loss insulation on the other part of the circuit (perhaps where the RTD sensor is) will result in the better insulated line being too hot. Redo the insulation to assure uniformity and consistency.
Damaged RTD temperature sensor.	Disconnect RTD sensor and measure resistance. Compare to resistance tables for corresponding value of temperature. Compare to pipe or equipment temperature known by another probe or sensor. If different, the RTD sensor may need replacement.
Heat tracing over designed in heat output and or/ due to cable availability or natural design selections available. This can result in higher than expected temperatures due to overshoot (especially when used with on-off control mode). This can also occur in an ambient sensing control modes.	Review design as well as installation instructions. Check heat tracing for presence of proper current. Since replacing the circuit may not be a desirable option here, the first approach should be to adjust the control method which the TraceNet control system has been configured in.
Heat tracing circuits are mis-wired such that the RTD for circuit 1 is controlling circuit 2, etc.	Trace and recheck field and panel wiring. Use circuit "turn-on " and "turn-off" technique or disconnect RTD's one at a time to see if the proper RTD failure alarm occurs on the right circuit. Let process return to normal condition or adjust alarm set point (if approved by project engineer) to allow for this processing condition.

Low Temperature Reading/Alarm

The following summarizes some of the possible causes and solutions for heat tracing low temperature readings/ alarms.

Possible Cause	Recommended Solutions
Temperature of product in process line is below the alarm set point or expected reading due to events other than heat tracing—low pumping temperatures, etc.	Let process operations return to normal conditions and then recheck for alarms. Alternately adjust alarm set point (with project engineers approval) to allow for this process condition.
Low temperature alarm programmed setting or expected reading did not consider natural temperature undershoot associated with control scheme.	Move control set point up to allow for natural undershoot or lower the low temperature alarm set point (when approved by project engineer).
Damaged, open, or wet thermal insulation does not allow the heat provided to hold the desired temperature.	Repair damage to insulation.
Wrong insulation size, type, or thickness on all of circuit being traced.	Measure circumference of insulation, divide by π, and compare to insulation diameter charts for proper over sizing. Check insulation type and thickness against design specification. Replace insulation or review system design for alternate operating possibilities which involve more heat output.
Wrong insulation size, type, or thickness on part of circuit being traced.	The insulation system should be as specified in the design for the entire circuit being traced. Having a high heat loss on one part of the circuit and a lower heat loss insulation on the other part of the circuit (perhaps where the sensor is) will result in the poorly insulated line being too cold. Redo the insulation to assure uniformity and consistency.
Improperly located RTD temperature sensor.	Is RTD sensor next to pipe support, equipment, or other heat sink? Move RTD sensor to location more representative of the majority of the piping.
Improperly installed RTD temperature sensor or RTD temperature probe.	Permanent RTD temperature sensors are most accurate when installed along the pipe or equipment with at least a foot of probe and sensor wire running along the pipe before exiting through the insulation. Permanent RTD sensors which enter the insulation at 90 degrees may be more sensitive to error associated with them, depending on insulation installation or how well the sensor is physically attached. Adjust control set point to compensate for any accuracy offset. When using a 90 degree RTD probe for diagnostics, verify this measurement technique on a known pipe in the same general temperature range and insulation configuration.
Damaged RTD sensor.	Disconnect RTD sensor and measure resistance. Compare to resistance tables for corresponding value of temperature. Compare to pipe or equipment temperature known by another probe or sensor. If different, the RTD sensor may need replacement.
Heat tracing undersized, improperly installed or damaged.	Review design/installation. Check heat tracing for presence of proper current and also meg for dielectric resistance. Repair or replace heat tracing.
Heat tracing circuits are wired such that the RTD for circuit A is controlling circuit B, etc.	Trace and recheck field and panel wiring. Use circuit “turn-on “ and “turn-off” technique or disconnect RTD’s one at a time to see if the proper RTD failure alarm occurs on the right circuit.
Heat tracing does not heat. Breaker has been switched off due to maintenance activities or has possibly malfunctioned.	As soon as maintenance activities cease and after conferring with operations manager, switch breaker back ON. Note that some period of time will elapse before the temperature alarm goes away (pipes and equipment take time to heat up).

RTD Sensor Alarm

The following summarizes some of the possible causes and solutions for a heat tracing RTD sensor reading alarm.

Possible Cause	Recommended Solutions
RTD connections are wired improperly or have become loose.	Confirm wiring and connections are correct.
RTD has failed open or has extremely high resistance or RTD has failed shorted or has very low resistance.	Perhaps lightning has damaged the sensor? Maybe the piping has had some welding going on nearby? Maybe the RTD has gotten wet? Replace RTD.

Communications Alarm

The following summarizes some of the possible causes and solutions for heat tracing communications alarms.

Possible Cause	Recommended Solutions
Improperly set controller address, duplicate addresses, or improper configuration of firmware/software.	Change controller address or reconfigure firmware/software.
Loose or open connection in RS485 line.	Recheck for continuity in all communication lines.
Too many modules in network.	Check network limitations versus actual configuration.
Too long of an accumulated communication distance.	Consider the addition of a repeater.
Too many reflections of signal usually caused by improper terminations in network.	Add termination resistors as appropriate.

Circuit Fault Alarm

The following summarizes some of the possible causes and solutions for heat tracing circuit fault alarms.

Possible Cause	Recommended Solutions
Upon initial installation start-up, improper wiring of the relay or low current in heater.	Confirm correct wiring and presence of the heater. Where normal operating amperage is in range of 0 to 250 mA, disabling the Self-Test function or adding multiple loops through the current sensing toroid may be required.
During daily operations; possibly indicates relay contact failure.	If relay has failed, replace.
Breaker off.	Turn on breaker after conferring with operations manager.

High Current Readings/Alarms

The following summarizes some of the possible causes and solutions for heat tracing high current readings or alarms.

Possible Cause	Recommended Solutions
Self regulating heater or power limiting heater current may exceed set value during normal operation or start-up operation.	Increase high current alarm set point (if approved by project engineer). For startup operation current alarm nuisances, it may also be desirable to increase the delay time (before a current reading is done after turn on) set in the controller.
Self-regulating or power limiting heater may be operating at cooler than design pipe temperatures due to processing conditions and thus heaters may be drawing higher current values.	Increase high current alarm set point (if approved by project engineer).
Self-regulating or power limiting heater may be operating in its cold start regime.	When reading current on one of these type heaters, it is necessary to read the current at steady state. One may have to wait as long as 5 minutes for heater steady state values. After five minutes the current value will continue to drop as the pipe or equipment begins to warm.
Heater circuit may be longer than anticipated in the design stage.	Verify installed length (if possible) and if different review design. If length is different but performance-wise the “as built” design is acceptable, initiate “as built” drawing change and change controller high current setting.
Wrong heater wattage or heater resistance may be installed.	Check heater set tags or markings on heater cable against installation drawings. As an additional check, disconnect heater from power and measure DC resistance.
Heat tracing may be powered on wrong voltage.	Recheck heater supply voltage.
Current sensing circuitry may have encountered a problem.	Use a different current clamp type meter which is known to be accurate and do a comparative reading. Investigate current measurement circuitry further. Note that one should only read heater currents when the heater is 100% on.
Field heater wiring is improperly labeled and/or connected such that the heater and the circuit number are not matched.	Trace out the circuit wiring from the field back into the panel and subsequently to the controller. Wherever possible, turn the circuit “off” and “on” and watch for an appropriate response. If this is the problem, redo the wiring.
Short circuit in a series resistance circuit.	Disconnect heater from power, meg between each of the conductors and ground for proper dielectric rating. If okay, measure resistance of circuit for agreement with design values.

Low Current Readings/Alarms

The following summarizes some of the possible causes and solutions for heat tracing low current readings or alarms.

Possible Cause	Recommended Solutions
Self-regulating or power limiting heater may be operating at higher than design pipe temperatures due to processing con- ditions and thus heaters may be drawing lower current values.	Decrease low current alarm setpoint (if approved by project engineer).
Loss of a branch of the heat tracing circuit.	Measure total current and each branch current. Compare to design values. Check all connections.
Breaker off.	Turn breaker back on after conferring with operations manager.
Heat tracing cable may have been exposed to temperatures in excess of their maximum temperature ratings (excessive steam-out temperatures or upset process temperature events) and could have damaged the heater.	Replace heater.
Controller may be in error in reading current.	Use a different current clamp type meter which is known to be accurate and do a comparative reading. If the current measuring circuitry is in error, investigate controls further. Note that one should only read heater currents when the heater is 100% on.
Heater circuit may be shorter than anticipated in the design stage.	Verify installed length (if possible) and if different review design. If length is different but performance-wise the “as built” design is acceptable, initiate “as built” drawing change and change controller low current setting. Check heater set tags or markings on heater cable against installation drawings. As an additional check, disconnect heater from power and measure DC resistance.
Wrong heater wattage or heater resistance may be installed.	Measure pipe temperature and measure steady-state heater current, voltage, and length. Compare to manufacturer’s rated power curve. Replace heat tracing cable if necessary.
Heat tracing may be powered on wrong voltage.	Recheck heater supply voltage.
Current sensing circuitry may have encountered a problem.	Use a different current clamp type meter which is known to be accurate and do a comparative reading. Investigate current measurement circuitry further. Note that one should only read heater currents when the heater is 100% on.
Field heater wiring is improperly labeled and/or connected such that the heater and the circuit number are not matched.	Trace out the circuit wiring from the field back into the panel and subsequently to the controller. Wherever possible, turn the circuit “off” and “on” and watch for an appropriate response. If this is the problem, redo the wiring.
Open circuit in a series resistance circuit.	Disconnect heater from power, meg between each of the conductors and ground for proper dielectric rating. If okay, measure resistance of circuit for agreement with design values.

High Ground Current Alarm

The following summarizes some of the possible causes and solutions for heat tracing high ground current alarm.

Possible Cause	Recommended Solutions
Heat tracing is damaged.	Disconnect heat tracing circuit and determine if alarm clears. If so, repair heat tracing.
Wiring to heat tracing had high leakage current.	Disconnect heat tracing and sequentially disconnect power wiring until the alarm ceases. Check last section removed for damage.
Improper wiring of current sense wires through toroid.	The current sensing toroid must have the outgoing heater current lead and the return current heater lead run through the toroid for a proper ground leakage measurement. Redo wire routing if only one wire has been run through the current sensing toroid.
Heat tracing power wires in a multiple circuit system improperly paired.	If the return current wire in the toroid is from a different circuit the two heater currents will not cancel and leave only leakage to be measured. Correct wiring.
Heat tracing circuit has higher than expected leakage due to circuit length or higher voltage.	Replace the EPD breaker with a higher ground current trip device if available. Where a controller (with variable leakage trip functions) is doing the ground leakage detection function, increase ground leakage alarm set point (if approved by project engineer).

If issues remain after exercising all these possible causes and solutions for heat tracing alarms and trips, contact your nearest Thermon engineering center for assistance and/or for arranging for field service.

Appendix D: Genesis Modbus Memory Reference

Circuit Settings				
FUNCTION CODE	**Memory Location (CKT1)**		**Description**	**Allowed Values**
	DEC	**HEX**		
Add CKT# x 100 to Base Memory Location to get the MODBUS Data Address CKT 1's Maintain Temp = 101+ 1*100 = 101 (0x0064) CKT 72's Maintain Temp = 101 + 72*100 = 7201(0x1C21) (Values below represent ckt 1's location)				
03/06	100	0x0064	Alarm Acknowledge	Bit Value 0x8000(bit) High Current Trip 0x4000(bit) Programing error 0x2000(bit) Current over .5A when circuit off 0x1000(bit) High Ground Trip bit 0x0800(bit) RTD Fault No Communication for all assigned RTD's 0x0400(bit) High Temperature trip 0x0200(bit) RTD Fault (all assigned RTD's in fault) 0x0100(bit) Not Used 0x0080(bit) High Current 0x0040(bit) Low Current 0x0020(bit) Circuit Fault 0x0010(bit) High ground current 0x0008(bit) RTD Fault No Communication 0x0004(bit) High temperature Alarm 0x0002(bit) RTD Fault (one or more assigned RTD's in fault) 0x0001(bit) Low temperature Alarm
03/06	101	0x0065	Maintain temp	10x True Value
03/06	102	0x0066	Control Band	10x True Value
03/06	103	0x0067	High Temperature Trip Alarm	
03/06	104	0x0068	High Temp Alarm	
03/06	105	0x0069	Low Temp Alarm	10x True Value
03/06	106	0x006A	High Ground Fault Trip Alarm	Value in (ma)
03/06	107	0x006B	High Ground Fault Alarm	Value in (ma)
03/06	108	0x006C	High Current Alarm Trip	10x True Value (A)
03/06	109	0x006D	High Current Alarm	10x True Value (A)
03/06	110	0x006E	Low Current Alarm	10x True Value (A)
03/06	111	0x006F	Circuit Enable/ Status	Bit definitions 0x0008(bit) Heater Forced Off = 1 normal = 0 0x0004(bit) Heater Forced On = 1 normal = 0 0x0002(bit) Heater Tripped = 1 normal = 0 0x0001(bit) Heater Enabled = 1 , Disabled = 0
03/06	112	0x0070	Control Type	0 = On/Off 1 = On/Off with a Soft Start 2 = Proportional 3 = Ambient Proportional Mechanical 4 = PID
03/06	113	0x0071	Number of RTDs per Circuit	1 to 20
03/06	114	0x0072	RTD Fault power	Range = 0 to 100%
03/06	115	0x0073	Power Clamp	Range = 0 to 100%

Circuit Readings			
Function Code	**Base Memory Location (CKT1)**	**Description**	**Notes**

	Dec	Hex		
Add CKT# x 100 to Base Memory Location to get the MODBUS Data Address (Values offset from the CANBus memory map by -80 eg alarms in CANBus is memory location 185, in Modbus is 185)				
4	100	0x064	Control Temperature for the DCM RTD Reading for the DTM	Value x10 This location on the DCM is the temperature that it has decide to control off. This location on the DTM is an RTD reading.
4	101	0x065	Which DTM and RTD that the circuit is controlling from	low Byte = DTM address 1-199 High Byte = RTD from DTM 1-6
4	102	0x066	Heater Current	Value x 10 (A)
4	103	0x067	Ground Current	Value in (ma)
4	104	0x068	Heater Percent On	Range = 0-100%
4	105	0x069	Alarms	Bit definitions 0x8000(bit) High Current Trip 0x4000(bit) Programing error 0x2000(bit) Current over .5A when circuit off 0x1000(bit High Ground Trip bit 0x0800(bit) RTD Fault No Communication for all assigned RTD's 0x0400(bit) High Temperature trip 0x0200(bit) RTD Fault (all assigned RTD's in fault) 0x0100(bit) Not Used 0x0080(bit) High Current 0x0040(bit) Low Current 0x0020(bit) Circuit Fault 0x0010(bit) High ground current 0x0008(bit) RTD Fault No Communication 0x0004(bit) High temperature Alarm 0x0002(bit) RTD Fault (one or more assigned RTD's in fault) 0x0001(bit) Low temperature Alarm
4	109	0x06D	RTD 1 Temperature Reading	Value x10
4	113	0x071	RTD 2 Temperature Reading	Value x10
4	117	0x075	RTD 3 Temperature Reading	Value x10
	...			
4	185	0x0B9	RTD 20 Temperature Reading	Value x10

Appendix E: Recommended Wiring For RS 485 Communications

Cable Type	Recommended
120 ohm,-20°C to +60°C (-4°F to +140°F) 22AWG FHDPE insulation PVC outer jacket	Belden 3107A or equal
120 ohm,-30°C to +80°C (+22°F to +176°F) 24AWG PE insulation PVC outer jacket	Belden 9842 or equal
120 ohm, +70°C to +200°C (+94°F to +392°F) 24AWG Teflon FEP insulation, Teflon FEP outer jacket	Belden 89842 or equal

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