TraceNet™ TC
Series Control System

TCM18 Panel Installation, Start-Up, and Maintenance Guide

Thermon Manufacturing Company

PN 50312

TCM18 Panel Installation and Start-Up Guide

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This guide is written and designed at Thermon Manufacturing Company, 100 Thermon Drive, San Marcos, TX 78667-0609, USA.

PRODUCT WARRANTY INFORMATION

The seller warrants all equipment manufactured by it to be free from defects in workmanship or material under normal use and service. If any part of the equipment proves to be defective in workmanship or material and if such part is, within 12 months of the date of shipment from sellers factory, and if the same is found by the seller to be defective in workmanship or material, it will be replaced or repaired, free of charge, F.O.B. the seller's factory. The seller assumes no liability for the use or misuse by the buyer, his employees, or others. A defect within the meaning of this warranty in any part of any piece of equipment shall not, when such part is capable of being renewed, repaired, or replaced, operate to condemn such piece of equipment. This warranty is in lieu of all other warranties (including without limiting the generality of the foregoing warranties of merchantability and fitness for a particular purpose), guarantees, obligations, or liabilities expressed or implied by the seller or its representatives and by statue or rule of the law.

PN 50312_0414

Contents

1 Introduction

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

All installation personnel should be properly trained and qualified to safely install, service, and program this TraceNet heat tracing control panel as well as to operate the associated heat tracing system.

THE PANEL LOCATION

A wide variety of TraceNet TC Series panel configurations are possible. The TraceNet modules are designed to operate in ambients ranging from -40°F (-40°C) to 140°F (60°C) and higher. The TraceNet panels can be located in site locations having electrical classifications ranging from ordinary to hazardous. The actual panel markings provided with the panel will detail the design intended specific location requirements.

INITIAL INSPECTION AND HANDLING

Upon receiving the TraceNet TC Series panel, it is important to confirm that the contents of the shipping containers agree with the shipping documents and with the purchase order. Also, it is important to check the shipped container exterior and packing materials for any possible freight damage. Where damage is observed, take photos and notify the carrier as well as your nearest Thermon engineering support center before proceeding further.

After carefully removing the panel from its shipping container, move the panel to its selected location utilizing the pallet base and the securement strapping provided using a lift truck/fork lift. Where lifting eyes are provided on the panel, they should be used when handling.

Where the panel has external heat sinks to dissipate the heat generated by solid state relay switching, it is recommended that a minimum of 6” (150 mm) of space be allowed between sinks and walls or other panels to minimize heat buildup at the heat sinks. Where heat sinks are present on adjacent panels, allow 12” (300 mm) spacing between heat sinks for sufficient natural air movement.

Adequate door clearance for service work entry and conduit panel entries should be anticipated when establishing the exact panel location. When the panel is located outdoors, a concrete base pad of sufficient height to avoid potential standing water should be constructed.

Once the panel has been properly located, refer to the project specific installation details for the recommended floor mounting as well as wall mounting details.

Once bolted in place, the panel is ready for final configuration, wiring, and site required assembly. Note that the TCM18 control and monitoring module is normally shipped in a separate container to minimize any undue impact stress during shipment. It should be removed from its shipping container again being attentive to any shipping damage that may have occurred during its transit. The TCM18 mounting details are likewise provided in the project specific drawing details.

Note: For installation requirements specific to purged panels, please see Appendix B.

2 Specifications

The general TraceNet TC Series panel specifications are as given below.

Interior panel operating ambient range	-40°F to 140°F (-40°C to 60°C)
Exterior panel operating ambient range	-40°F to 131°F (-40°C to 55°C)
Ambient storage range	-40°F to 158°F (-40°C to 70°C)
Relative humidity range	0 to 90% Non Condensing
Nominal instrument control voltage	100 to 240 Vac, 50/60 Hz
Temperature sensor types	100 Ohm 3 Wire Platinum RTD
Control temperature range	-200°F to 1112°F (-129°C to 600°C)
Maximum power consumption of TCM18 module	70 Watts

Current ratings in hazardous (classified) locations based on TraceNet TC Series panels for up to 72 circuits are as follows[1]:

Maximum Panel Exterior Ambient (°C)	For: 1 - 36 Circuits	For: 37 - 72 Circuits
	Maximum Allowable Average Amps per Relay (Calculated for each side of enclosure)[2]	
40	22.2	18.0
45	21.0	16.8
50	19.7	15.6
55	18.3	14.3

Current ratings in nonhazardous (ordinary) location based on TraceNet TC Series panels for up to 72 circuits are as follows[1]:

Maximum Panel Exterior Ambient (°C)	For: 1 - 36 Circuits	For: 37 - 72 Circuits
	Maximum Allowable Average Amps per Relay (Calculated for each side of enclosure)[2]	
20	27.0	22.7
25	25.8	21.6
30	24.7	20.4
35	23.5	19.2
40	22.2	18.0
45	21.0	16.8
50	19.7	15.6
55	18.3	14.3

Note 1: Contact the manufacturer for the maximum allowable amps per relay for custom enclosure sizes.

Note 2: Based on factory panel wiring rated for 105°C.

TCM18 LCD heated display	1-3/4” (44 mm) x 4.875” (124 mm)
TCM18 touchpad	tactile feel, stainless steel dome keys
TCM18 communication	2 RS485 ports
TCM18 operating temperature range	-40°F (-40°C) to 140°F (60°C)
TCM18 alarm relay outputs -U Option	Three, sealed dry contacts rated @ 0.4 Amp, 24 Vdc
-A Option	Three, sealed dry contacts rated 100-240 Vac @ 0.5A

Entries into panels must meet IP54 and/or NEMA-4 ingress protection levels to maintain the environmental rating of the panel.

3 Module Connections

Due to its flexible architecture, a variety of TraceNet TC Series panel configurations are available. The specific project drawings should be followed when installing the power supply and field distribution wiring into the TraceNet panel as well as when installing the data highway interface wiring. As an overview and to provide a more general understanding of the inner workings of this panel, the following general connection diagrams are provided.

The TCM18 Connections

The TCM18 is the TraceNet interface to the outside world. It monitors the condition of the heat tracing circuits as well as the heat traced piping temperatures and allows interrogation of heat trace status, alerts the operator to alarm and trip events, and allows the changing of the operating parameters and system configuration.

The connections for the TCM18 are described in Figure 1 which follows.

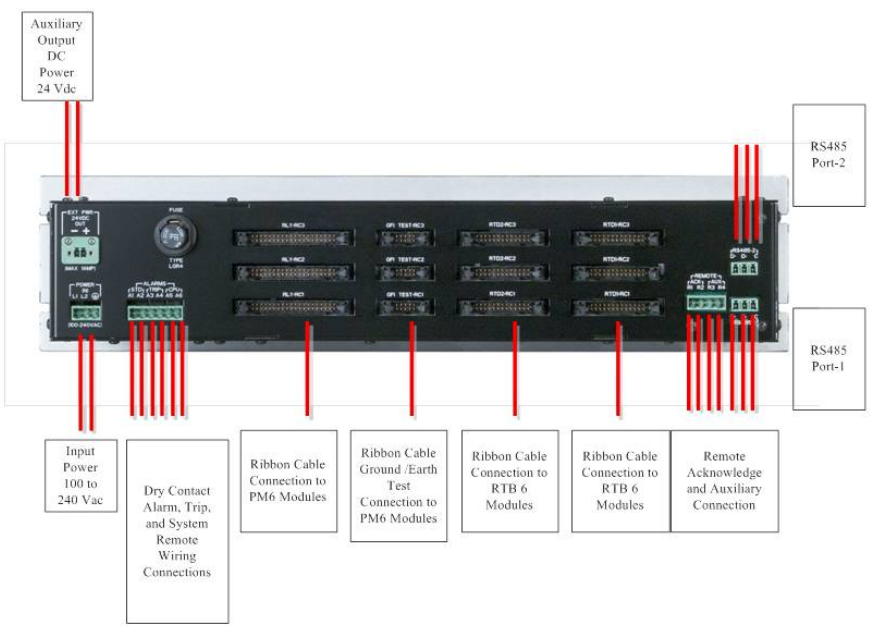

Figure 1: Wiring and Connection Details on the TCM18

The RTB6 Module Connections

The RTB6 module allows the connection of six 3-wire 100 Ohm platinum RTD inputs to the TraceNet control system. The RTB6 circuit board is a passive device which communicates the discrete temperature inputs into a 26 pin bundled ribbon cable which then interconnects to a TCM18 module.

The connections within a TraceNet panel for the RTB6 are shown in the illustration which follows.

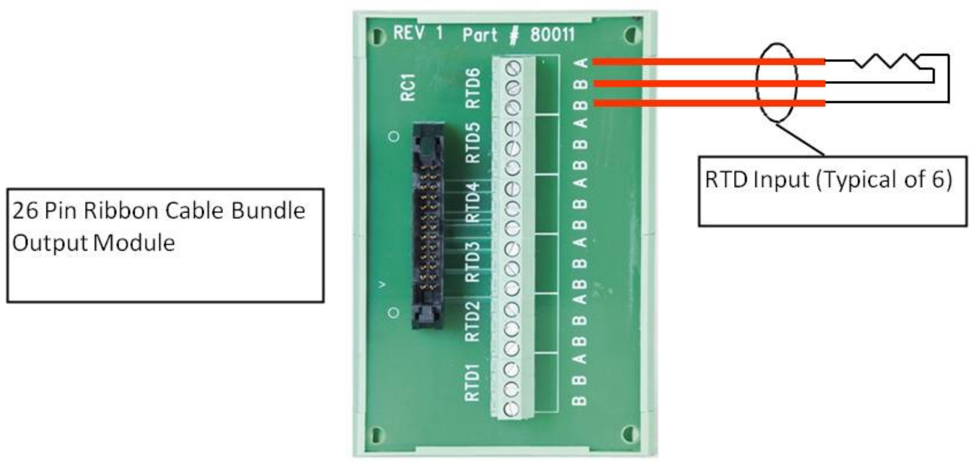

Figure 2: RTB6 Wiring and Connections

The PM6 Connections

The PM6 serves as the heat trace power solid state switching module for a TraceNet TCM18 controller. It includes the heater and ground current measurement transformers, solid state heat trace control relays, and the heat dissipating heat sink. This module includes a ground leakage functional test circuit. In addition, alarm and trip output capability to indicating lights on the panel front door are also provided.The module connections for the PM6 are as detailed in the following illustration.

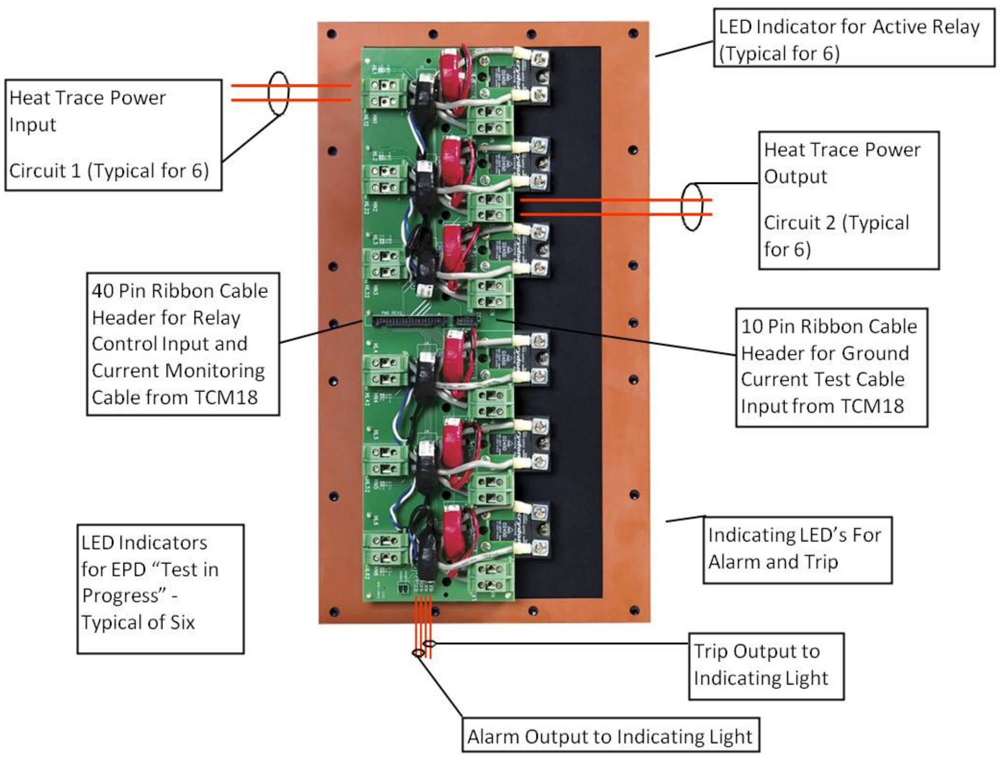

Figure 3: PM6 Wiring and Connections

The RM6 Connections

The RM6 is a DIN rail mounted six circuit relay interface module for linking to individual solid state or mechanical relays via ribbon cable from the TCM18 controller. The RM6 includes individual terminal strips which allow the interconnection of individually mounted heater and ground current sensing transformers. This module is primarily used where custom current transformers, solid state relays with integral heat sinks, or individual pilot and mechanical relays are to be used. The module connections for the RM6 are as detailed in the following illustration.

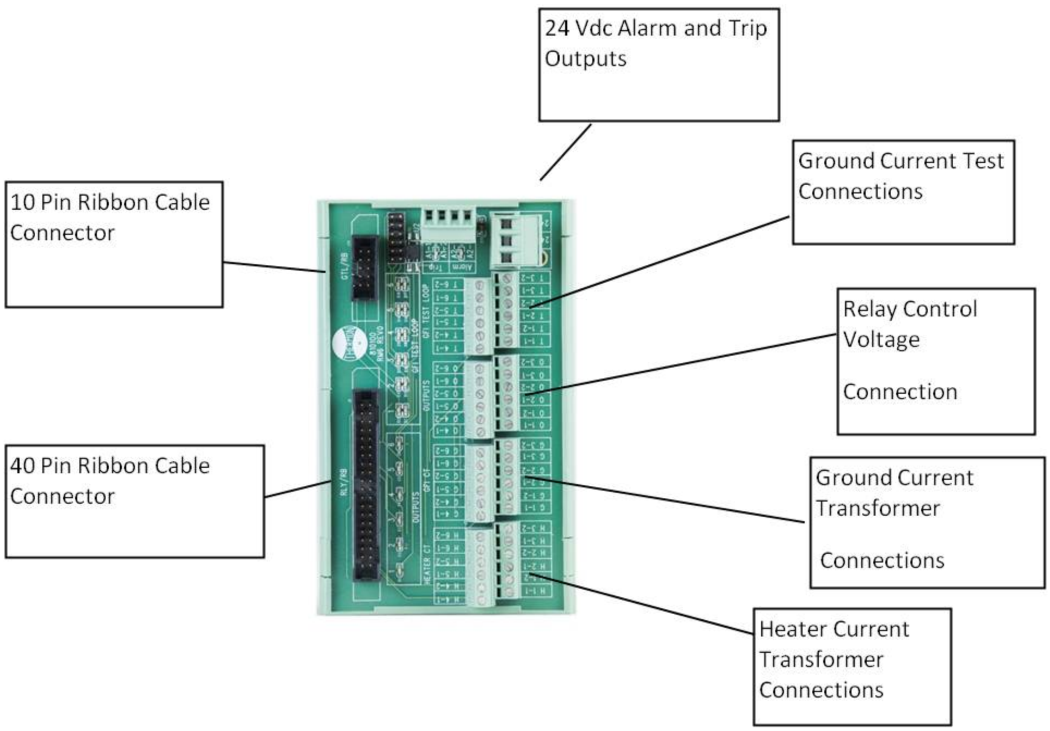

Figure 4: RM6 Wiring and Connections

When receiving a new TraceNet TC Series control panel shipment, it is recommended that all module connections within the panel be re-torqued to the recommended tightness levels as provided in the project panel drawing and in Table 1 Chapter 4. Occasionally, it is possible that handling and shipment can loosen some wiring terminations or components cables.

Servicing allowed for removable electrical connectors only when the area is known to be free of explosive atmospheres.

4 Field and Panel Wiring

For a successful installation of a TraceNet TC Series 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, and the installation and routing of wiring inside the TraceNet panel.

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 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. The RTD control sensor location on the process piping should follow the guidelines detailed below.

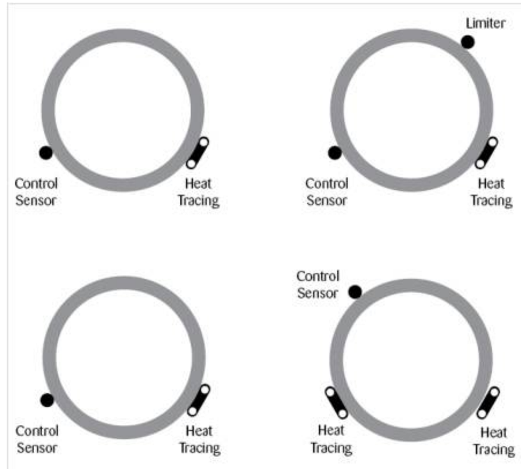

Figure 5: RTD Sensor Location

Where limiter RTD sensors are installed on the process piping it should follow the guidelines above. In cases where the limiter is to be installed on the heater itself, it is important to recognize that an offset should be anticipated in the limiter trip value to allow for sensor reading error and overshoot.

As a general rule, field RTD wiring and power wiring should not be routed in the same conduit or proximity in a tray as the temperature signals can become distorted and result in improper readings.

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 exceeding 221°F (105°C) unless otherwise higher values are noted in project specifications. Power supply wiring from the power transformers to the power distribution panel and distribution wiring to the heat trace circuits shall be rated for the heat trace use voltage or higher and sized sufficiently large in wire size to minimize voltage drop. Circuit breakers if not already supplied in the TraceNet panel should be selected based on the heat trace cable type being used, the service voltage, and the circuit current draw characteristics. It is especially important when using self regulating cable 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 in Table 1.

Location of Terminals	Torque Values (Typical)*
RTB6	5.3 to 7.0 in. lbs. (0.60 to 0.79 N-m)
PM6	12.5 to 13.5 in. lbs. (1.41 to 1.53 N-m)
Distribution Equipment	13.2 to 15.9 in. lbs. (1.49 to 1.80 N-m)

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

Table 1: Recommended Torque Values

TraceNet Panel Wiring

TraceNet TC Series panels are configured and prewired 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. Field wiring is conventionally shown by dashed lines. All field power wiring materials used shall be suitable for the intended service and shall be rated for insulation service temperatures up to and exceeding 221°F (105°C) unless otherwise higher values are noted in project specifications. All TraceNet components terminal block connections should be tightened using a torque indicating screw driver to the levels indicated in Table 1.

Serial Communication Wiring

TraceNet TC Series panels may be linked together for communications with a RS485 communication cable at distances up to 4000 feet (300 m.) or more. In addition, a termination module should be used at each end of the RS485 network. The recommended communication cables for use in the RS485 network are as given in Table 2 which follows.

Cables for RS485 Communication

CableType	Recommended
120 Ohm, -20 to +60 C 22AWG FHDPE insulation PVC outer jacket	Belden 3107A or equal
120 Ohm, -30 to +80 C 24AWG PE insulation PVC outer jacket	Belden 9842 or equal
120 Ohm, -70 to +200 C 24AWG Teflon FFEP insulation Teflon FEP outer jacket	Belden 89842 or equal

Note all these products are designated as 120 ohm impedance for balanced line communication uses.

Table 2: Recommended RS485 Cable Type

5 The User Interface

The TCM18 functions as the user interface for a TraceNet TC Series control panel network of heat tracing control modules. The TCM18 allows the operator to access operating control parameters and operating conditions throughout the heat tracing system network.

There are four display message lines on the TCM18 display. All interfacing to the TCM18 and the heat tracing circuit information is via the dedicated tactile feel membrane touchpad and the companion four line LCD display as shown in Figure 6

Figure 6: TCM18 Control and Monitoring Module Front Panel

On power up, the TCM18 will display the following start-up screen message:

Figure 7: TCM18 Start-Up Screen

After this start-up message, the TCM18 will immediately proceed to operation in its SCAN

MODE.

The TCM18 will operate in a heat tracing circuit SCAN MODE during normal operation. That is, the LCD display will automatically scroll through each enabled heat tracing circuit number, indicating the actual measured temperature and the control set point for maintain temperature on the first two display screen lines. The third display screen line will indicate the heater status (ON % or OFF) and the heat tracing circuit heater current value. The fourth display screen line will indicate any alarm(s) present on the circuit displayed. Where multiple alarm events occur on a circuit, the TCM18 will display only one alarm message at a time until all have been cleared. A typical SCAN MODE screen when the heat tracing circuit is operating normally is as shown below in Figure 8:

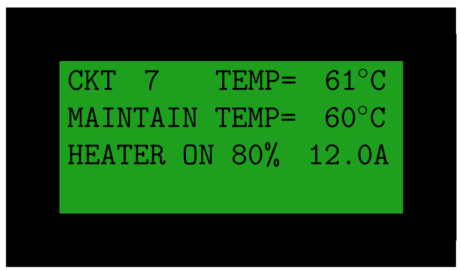

Figure 8: Typical TCM18 information when in SCAN MODE

Note that the fourth message line on the display screen will be empty as long as there are no alarm or trip conditions present on a given circuit. During SCAN MODE, the TCM18 will sequence through all enabled heat tracing circuits beginning with the first circuit and then loop back to the first circuit after displaying the last circuit and repeat the scanning process.

To access information on a specific heat tracing circuit, press the appropriate yellow or red key. Pressing these keys will directly access the information and functions associated with that key. As a typical example, press the MAINTAIN TEMP key as shown in Figure 9.

Figure 9: TCM18 Touch Pad

This will result in the display screen response as illustrated below in Figure 10.

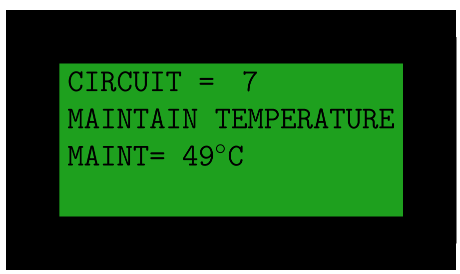

Figure 10: TCM18 LCD Response

The TCM18 has an electronic password security provision. To access the programming mode, enter the 4 digit numerical security code. If no code has been entered, press the PROG key followed by the ALARM ACK key and subsequently followed by the PROG key. Next, successively select a numerical code using the UP and DOWN arrow keys along with the ENTER key. An entry of 0000 will deactivate the security code feature. Note that once a security code has been entered, the user has unlimited access as long as activity is present. A period of inactivity of 30 minutes or more will result in programming access being denied. At this point, re-entry of the security code will be required. If the security code is forgotten at some future date, enter a value of 1954 (during the first 5 minutes after power is applied to the TCM18) as the security code, then a new code may be entered by pressing the ALARM ACK key and subsequently followed by the PROG key.

To program circuit control settings or control parameters, multiple keys in sequence will need to be pressed. For example, to change the settings associated with the MAINTAIN TEMP key, first press the green PROG key.

Figure 11: TCM18 PROG Key

The Display now reads as shown below:

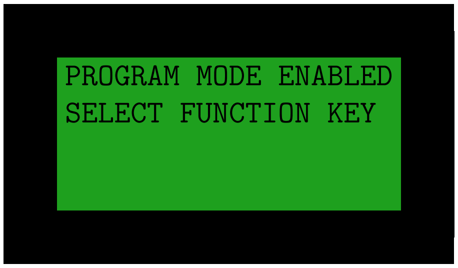

Figure 12: Program Mode Enabled

Press the MAINTAIN TEMP key.

Figure 13: MAINTAIN TEMP Key

The Display now reads as shown below with the flashing cursor ▮ representing the active data entry field:

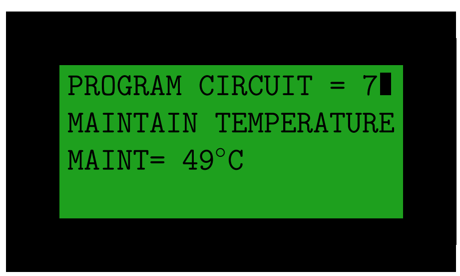

Figure 14: Programming Maintain Temperature

Pressing the green UP or DOWN Arrow programming keys followed by the green ENTER key allows the selection of the heat tracing circuit to program.

Figure 15: Programming Keys

The display screen will now shift the cursor to the next value to program as shown in the following display.

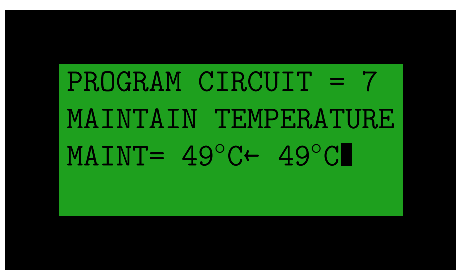

Figure 16: Changing Maintain Temperature

A single press of the green UP or DOWN arrow programming key will increase or lower the Maintain Temperature set point by a single degree. Holding these keys down will increase the indexing speed for cases where a significantly large increase or decrease in set point is required. Once the new set point is reached, press the green ENTER key to save the new set point.

Figure 17: The ENTER Key

The DISPLAY screen now appears as shown in Figure 18.

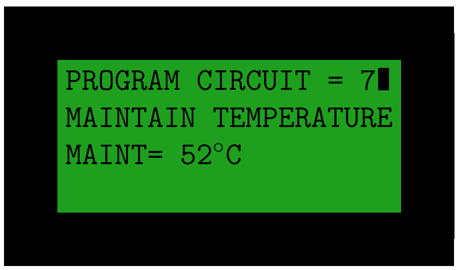

Figure 18: Selecting a New Circuit Number

At this point, pressing the green UP or DOWN arrow key will select the next heat tracing circuit to program. Alternatively, press the green PROG key to exit and return to SCAN MODE. However, if for some reason this is not done, the screen will automatically return to SCAN mode operation.

TIP: In many cases, the programmed value can be the same for a majority of heat tracing circuits. Note that when sequencing through the circuit numbers, there is an ALL option. This allows the programming of the same set point for all circuits on this particular TCM18 module and permits only entering the set point once. When selecting the ALL option, the values programmed into the first circuit will initially appear as a starting point for any value changes.

This TCM18 user interface should be found to be very intuitive and require minimal training to perform day to day operations. The TraceNet system is a fully featured heat trace control and monitoring system and thus has many advanced options in setup and configuration. *A companion document "TCM18 Operating Guide - PN 50308" included with the documentation package covers the full features of this interface in much more detail.*

6 Heat Trace Control

The TraceNet system allows a variety of control options for heat trace operation. The most energy efficient control mode is to use one or more process sensing RTD's for each heat trace circuit. When configured with two RTD sensors, TraceNet will control off of the lowest reading and alarm off of the highest reading encountered. In the case of process sensing control, however, one must be aware of the normal flow directions within the process piping and only group process piping having a common flow condition with the control sensors. A failure to do so can result in non flowing areas cooling and freezing where the flowing portions have appropriately turned the heat trace circuit off. Process sensing control is also a necessity where steam outs and high exposure temperature process conditions are expected and where the heat trace (due to its inherent characteristics) cannot be operated during such events. When using this control mode, the TraceNet TC Series panel will have RTD's hard wired directly back to the panel.

As an alternate control mode which is a bit less energy conservative, the TraceNet TC Series panel may be configured for Ambient Proportional Control (APC). In this case, one or two RTD's may be used to sense ambient temperatures in the process area. The heat trace will be set to operate at 100% power at the maintenance temperature (which is the minimum ambient condition) and then ramp down to a 20% power level at the maintenance temperature plus the control band. If the ambient rises above this value, the heat trace will then turn off. For example, to freeze protect a process unit in a minimum ambient of -40°F (-40°C), one would set the circuit to operate on APC. The Maintenance Temperature (at or below which power is on 100%) would be programmed to be a value of -40°F (-40°C). The Control Band would be set to 90°F (50°C) and thus the heat trace circuit would turn off above 50°F (= -40 + 90) or 10°C (= -40 + 50) ambient conditions. Obviously, this type of control mode will reduce RTD requirements but still achieve a good measure of temperature control. In addition, due to the amount of power cycling it is important to realize that this should only be utilized when using solid state relay switching of the heat tracing circuits. APC control should not be used where steam outs and high exposure temperature process conditions are expected and where the heat trace due to its inherent characteristics cannot be operated during such events.

As a third control mode option, which is a less energy conservative approach, the TraceNet TC Series panel may be configured for Ambient ON/OFF Control. In this case, one or two RTD's may be used to sense ambient temperatures in the process area. The heat trace will be set to operate at 100% power whenever the ambient temperature drops below the maintenance temperature which is typically set at 50°F (10°C). If the ambient rises above this value, the heat trace will turn off. Obviously, this type of control mode will also reduce RTD requirements. In this case, there will naturally be some temperature overshoot expected in the process as the ambient approaches the turn off point. In this case, mechanical relay switching of the heat tracing circuits may be used. Ambient Sensing ON/OFF control should not be used where steam outs and high exposure temperature process conditions are expected and where the heat trace due to its inherent characteristics cannot be operated during such events.

7 System Start-Up

For information on entering and/or changing individual control and monitoring parameters through the TCM18, refer to the System Start-Up Operating Guide PN 50308.

Starting Up the Heat Trace System

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.

Troubleshooting Tips

When starting up a newly installed heat trace and control system, it is not uncommon to encounter numerous alarm and trip events. Data entry errors, unanticipated temperature overshoots due to system inertia or too tight control band settings, and incomplete installation details are just a few of the many contributing factors to this result. A table of Troubleshooting Tips is provided in Appendix A to assist during start-up.

8 Maintenance

Preventative 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. The recommended typical list of tools and test equipment follows:

Tools	Comment
Multimeter	Calibrated and in Safe Working Order
Flashlight	
Vacuum Cleaner	Nonmetallic Nozzle
Screw Drivers	Standard as Well as Torque Type
Wrenches	Standard as Well as Torque Type
Fuse Extractor	
Stiff Bristle Wire Brush	
Infrared Camera	Helpful in Checking Out Connections

The recommended spare parts inventory list for this panel follows:

Spare Parts Description	Quantity
TCM18 Control Module	
PM6	
D2450 SSR Relay	
D60125 SSR Relay	
D6090 SSR Relay	

The recommended typical list of cleaning materials follows:

Materials	Comment
Lockout and tag out safety tags	
Dry lint free cloths	
Cleaning agent	
Medium grit sandpaper	
Touch up paint	
Machine oil	
Grease	
Electrical tape	Refer to specific panel materials list for tapes being used. Use only Thermon approved or equivalent materials.
Damp cloth	To avoid electrostatic discharge, clean window with damp cloth only.

Recommended Visual Inspection Procedures

The interior and exterior of the control and monitoring panel should be inspected as follows:

- Inspect door and /or 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 the 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 (while in 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 TCM18 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 given in the following table.

Tests	Description
Perform Self Test	The Self Test function (under the CONFIG key) checks circuit breaker and output relay functionality. This function also checks for high ground/earth leakage alarms in the heat tracing circuits.
Perform SCAN Mode Review	Operator should do a visual check for out of range temperatures and low or high heater and ground/earth leakage current in the heat tracing circuit(s). No alarms shall be present on any circuits in the fourth line of the display screen.
Perform Simulated Ground / Earth Leakage Trip Exercise	The TCM18 can simulate a high ground/earth leakage (under the CONFIG key) and manually cause a trip to occur. This allows operator to verify that the ground/earth leakage function is operable.

9 Notes

10 More Information

More extensive information about TraceNet and Thermon heat trace products may be downloaded at www.Thermon.com. Contact your nearest engineering service center for more detailed information regarding this specific project panel. In addition, Thermon's product support group may be contacted for information of a more general nature.

Appendix A

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.

Cause	Possible 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 miswired 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.

Cause	Possible 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 not so well 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.

Cause	Possible 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.

Cause	Possible Solutions
Improperly set controller address, duplicate addresses, or improper configuration firmware/software.	Change controller address or re-configure 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.

Cause	Possible 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 250mA, 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.

Cause	Possible Solutions
Self regulating heater or power limiting heater current may exceed set value during normal operation or start-up operations.	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, re-do 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 the possible causes and solutions for heat tracing low current readings/alarms.

Cause	Possible Solutions
Self-regulating or power limiting heater may be operating at higher than design pipe temperatures due to processing conditions 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, re-do 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.

Cause	Possible 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 B

This Appendix applies to TraceNet TC Series panels without purge equipment. The TC Series panels have been certified to be in compliance with IEC 60079-0: 2011, IEC 60079-15: 2010, EN 60079-0: 2012, and EN 60079-15: 2010.

MARKINGS FOR TC SERIES PANELS

The panels shall be marked IECEx FMG 12.0018X Ex nA IIC T4 Gc, and/or CE Ex II 3 G Ex nA IIC T4 Gc FM13ATEX0073X, along with Ta = -40°C to +55°C and IP54.

Appendix C

This Appendix applies to TraceNet TC Series panels with purge equipment. The TC Series panels have been certified to be in compliance with IEC 60079-0: 2011 and IEC 60079-2: 2007.

MARKINGS FOR TC SERIES PANELS

The panels shall be marked IECEx FMG 11.0028X Ex pxb IIC T4 Ta = -20°C to +50°C, for Zone 1 applications.

The panel shall be marked IECEx FMG 11.0028X Ex pzc IIC T4 Ta = -20°C to +55°C, for Zone 2 applications.

SUPPLY LINES FOR PROTECTIVE GAS

a. The point at which the protective gas enters the supply lines(s) shall be situated in a non-hazardous location.

b. The intake line(s) to a compressor should not pass through a hazardous area. If the compressor intake line passes through a hazardous area, it should be constructed of noncombustible material and protected against mechanical damage and corrosion.

c. The purge duration shall be increased by the time necessary to purge the free volume of the associated lines (if applicable) which are not a part of the certified panel by at least five times their volume at the minimum flow rates (see panel markings) specified by the manufacturer.

POWER FOR PROTECTIVE GAS SUPPLY

The electrical power for the protective gas supply shall be taken from a power source separate from the power source of the panel.

ENCLOSURE MAXIMUM OVERPRESSURE

The purge equipment inlet pressure shall be limited to 120 PSI.

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