TC 202a

Control Module

Operating Guide

SWM-004.7

TC 202a

Control Module

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TC 202a Control Module

THE TC 202a MODULE . . .

The TC 202a is a microprocessor-based temperature control and monitoring module developed specifically for heat tracing. The dual circuit module provides heat tracing control, digital information display and alarms for high temperature, low temperature, high current, low current, high ground leakage current and damaged temperature sensor. Minimum and maximum temperatures monitored during a given period are retained for display on demand, independent of temperature alarm setpoints. The TC 202a module is suitable for either ambient or process sensing control.

The TC 202a module operates independently and can be connected to a data highway for remote systems communications functions through a personal computer or a distributed control system (DCS).

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DATA DISPLAY

The TC 202a module utilizes a backlit LCD display for reporting temperatures and operating parameters. Separate LED's indicate status of power to the TC 202a, power to the heat tracing circuits and any alarms affecting the system.

ALARM RELAY

The TC 202a is provided with a normally open, held closed on alarm, solid state alarm relay contact, rated 1A at 120/240 Vac. Inverse operation is programmable.

CONTROL RELAY

When heaters are to be switched with a solid state power relays, the TC 202a is configured with two DC logic outputs having a sink current capability of 15 mA. Alternately, when heaters are to be switched with a mechanical or sealed switch type relay, the TC 202a is configured with two normally open solid state control relay contacts rated 1A at 120/240 Vac.

CURRENT TRANSFORMERS

Each TC 202a is provided with two current transformers for each heater circuit. One current transformer continuously monitors the heater current. The other monitors the ground leakage current present in the heater and associated wiring.

COMMUNICATIONS

Each TC 202a module is provided with an RS-485 communications port for connection through a two wire twisted shielded pair network into a PC. Alternately, the Modbus ASCII protocol communications stream may be interfaced into the facility distributed control system (DCS).

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The TC 202a is designed to be an integral part of a **HeatChek™ control and monitoring unit**. Each unit typically includes one or more TC 202a modules, four or more current transformers, relays, and terminal blocks for field wiring; all prewired in an electrical enclosure suitable for the environment.

SOLID STATE RELAYS

The TC 202a module may be configured with solid state power relays. The single switch SSR30 relays are zero crossing solid state with a single cycle surge capacity of 600A and a one second overcurrent capacity of 80A. The dual switch SSR15 relay is a zero crossing solid state with a single cycle surge capacity of 500A and a one second overcurrent capacity of 80A. These relays are required when enabling the Power Clamp, Soft Start, and Proportional control features available in the TC 202a. Design current rating limits for these relays are determined by the enclosure size, ambient conditions and heat sink style. See Table 1 below for details.

Table 1: Current Rating

Maximum Heater Current Through Each Solid State Relay Switch									
Enclosure Option	Enclosure Size	Heat Sink, Style A SSR30A [2]		Heat Sink, Style A SSR15A [3,4]		Heat Sink, Style B SSR30B [2]		Heat Sink, Style B SSR15B [3,4]	
		40°F (4°C)	104°F (40°C)	40°F (4°C)	104°F (40°C)	40°F (4°C)	104°F (40°C)	40°F (4°C)	104°F (40°C)
PS2,SS2	14x12x6 in (355x305x-105 mm)	---	---	---	---	30	27	24	13.75
PS3,SS3	14x16x6 in (355x406x-152 mm)	30	12	19	6	30	30	24	14.75
P3	14x16x6 in (355x406x-152 mm)	30	12	19	6	---	---	---	---

[1] The current ratings are based on 40°F (4°C) or 104°F (40°C) outdoor ambients with solar loading. For ratings at different ambient conditions or for ratings in larger enclosure sizes, contact the factory.

[2] The SSR30 is a single switch solid state relay.

[3] The SSR15 is a dual switch solid state relay.

[4] The values given allow for the doubling of the heat generation which occurs in a dual switch type solid state relay.

A HeatChek control and monitoring unit utilizing the TC 202a module, solid state power relay and a NEMA 4 or 4X enclosure is approved for use in Class I, Division 2 Hazardous (Classified) Locations as well as Ordinary (Non-classified) Locations.

The TC 202a may also be configured for use with conventional mechanical relays or contactors. A HeatChek control and monitoring unit utilizing the TC 202a, conventional mechanical relay and NEMA 4 or 4X enclosure is approved for use in Ordinary (Non-classified) Locations.

TC 202a MODULE SPECIFICATIONS . . .

The TC 202a module has the general specifications as detailed below:

Control and Monitoring Capacity:	One resistive heat tracing circuit up to 30A[1] per circuit (depending on switch type)
Module Supply Voltage:	110-120 Vac or 208-240 Vac
Module Power Consumption:	6 watts per TC 101a module
Module Operating Ambient:	-40°F to +140°F (-40°C to +60°C)[2]
Maximum Storage Ambient:	158°F (70°C)
Data Retention:	Non volatile EEPROM
Power Clamp Function (Solid State Relay Only):	Programmable for power levels from 20% to 100% max.
Input:	Two 3 wire 100 ohms at 32°F (0°C) platinum RTD's
Temperature Range (control):	-40°F to 932°F or -40°C to 500°C with programmable control band in increments of one degree
Control:	On/Off, On/Off with Softstart, Proportional, and Proportional Self-Adjust
Module Dimensions:	8-3/4" x 5-1/8" x 2-5/8" (222 mm x 130 mm x 67 mm)
Ground Leakage Alarm/Trip:	30 to 150 mA in 1 mA increments
Self-Test Frequency:	Programmable from 2 to 99 hours
Communication:	Modbus ASCII via RS485 port

[1] Higher amperage indication/control capability is available on a special order basis.
[2] LCD display heater is recommended for ambients below -4°F (-20°C).

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TYPICAL HEATCHEK CONTROL AND MONITORING UNITS . . .

The TC 202a is modular in construction and can be configured in a variety of HeatChek control and monitoring units.

ORDINARY (NON-CLASSIFIED) LOCATIONS

Custom HeatChek control and monitoring units including multiple TC 202a's, mechanical relays, power distribution and NEMA 4 or 12 enclosures are suitable for use in Ordinary (non-classified) Locations.

HAZARDOUS (CLASSIFIED) LOCATIONS

Custom HeatChek control and monitoring units including multiple TC 202a's, mechanical relays, power distribution and NEMA 4 or 4X enclosures with an air or gas purge system are suitable for use in Class I, Division 2 Hazardous (classified) Locations.

INFORMATION

A typical unit is illustrated in Thermon Form No. TEP0025.

Specific wiring and equipment arrangement details are usually provided in drawings included within the HeatChek control and monitoring unit at time of shipment.

PROGRAMMING THE TC 202a MODULE . . .

ACCESSING THE PROGRAM MODE

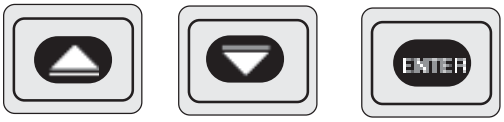
Press the PROG key to enter the programming mode.

The TC 202a will then display the following message:

Then select the desired function key e.g. MAINTAIN TEMP (note that pressing any green key causes the controller to exit the programming mode).

If the function key is not a global function (e.g. CONFIG, DATA HWY), then the following message appears.

Select the desired circuit by pressing the UP or DOWN arrow keys and then pressing the ENTER key.



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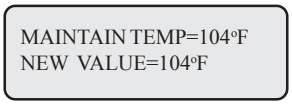
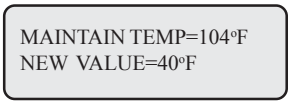
MAINTAIN TEMPERATURE (PROGRAM MODE)

Pressing the MAINTAIN TEMP function key allows the maintain temperature and RTD trip mode to be set.

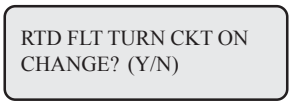
The following is a typical message which might appear:



Momentarily pressing the UP or DOWN arrow keys will cause the NEW VALUE to change by 1 degree increments. Holding the key down results in a 10 degree incremental change. If an upper or lower limit is reached, a MAX or MIN message will appear on the second line. This indicates that either the absolute maximum or minimum value has been reached or that the value has reached another alarm value.



Once the desired temperature value is set, press the ENTER key to save the value or PROG key to retain the old value. The following message will appear:



A "Yes" entry will result in an "Open" relay condition in the event of a RTD sensor failure. Press the UP arrow key for "Yes" or DOWN arrow key for "No". Then press the ENTER key to save. A "NO" entry will result in a closed relay condition in the event of a RTD sensor failure. The controller will then exit the programming mode and return to the Scan Mode.

HIGH TEMPERATURE ALARM (PROGRAM MODE)

Pressing the HIGH TEMP ALARM function key results in a display message such as the following:

HI TEMP ALARM=160°F
NEW VALUE=160°F

The TC 202a is set to alarm at 160°F on the current circuit. Should the control temperature reach 160°F, the red alarm LED on the TC 202a will begin to flash. In addition, the alarm relay contact will close (depending on configuration, inverse action may occur).

To change the current value, press the UP or DOWN arrow keys to increase or decrease the current HIGH TEMP ALARM setpoint.

HI TEMP ALARM=160°F
NEW VALUE=120°F

Once the desired temperature value is set, press the ENTER key to save the value.

Next, the following typical message will appear:

HI TEMP SEEN=200°F
RESET? (Y/N)

At some point since this controller was last reset, the temperature has attained 200°F. Press the UP arrow key and ENTER to clear this value and begin anew at the current value. Pressing ENTER or PROG key results in the current value of 200°F being retained.

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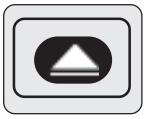
Subsequently, another message appears as typically shown below:

HIGH TEMP TRIP OFF
CHANGE? (Y/N)

The TC 202a is currently set to NOT trip the heater circuit if a high temperature alarm condition is reached, but rather to only "flash" the red alarm LED and close the common alarm relay contact (open if configured for inverse operation).

To retain the present mode of HIGH TEMP ALARM operation, press the ENTER or PROG key. Pressing the UP arrow key and ENTER will result in the TC 202a setting being changed to HIGH TEMP TRIP ON.



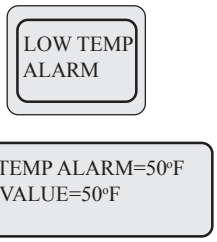
Once set in this manner, the heater circuit will trip (open heater relay contacts) should a high temperature alarm condition occur. The TC 202a will now require that 1) the operator press the ACKNOWLEDGE key, 2) and the high temperature alarm condition be cleared prior to automatic control being restored.

Subsequently, the TC 202a returns to the Scan Mode.

RETURN TO SCAN MODE

LOW TEMPERATURE ALARM (PROGRAM MODE)

Pressing the LOW TEMP ALARM function key results in a display message such as the following:



The TC 202a is set to alarm at 50°F on the current circuit number. Should the control temperature drop to 50°F, the red alarm LED on the TC 202a will begin to flash. In addition, the alarm relay contact will close (depending on configuration, inverse action may occur).

To change the present value, press the UP or DOWN arrow keys to increase or decrease the present LOW TEMP ALARM setpoint.

Once the desired temperature value is set, press the ENTER key to save the value.

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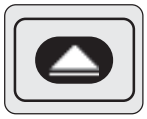
Next, the following typical message will appear:

LOW TEMP SEEN=35°F
RESET? (Y/N)

At some point since this controller was last reset, the control temperature has dropped to 35°F. Pressing the ENTER or PROG key results in the present value of 35°F being retained. Press the UP arrow key and ENTER to clear the stored value and begin anew at the current value.

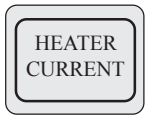


Subsequently, the TC 202a returns to the Scan Mode.

RETURN TO SCAN MODE

HEATER CURRENT (PROGRAM MODE)

Pressing the HEATER CURRENT key can yield a number of responses depending on the control method being used.



ON/OFF CONTROL

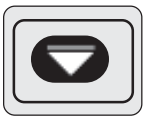
When the TC 202a is operating in the ON-OFF control mode, the TC 202a indicates no power clamping is available and the heater will operate at full power whenever it is energized.

SOFT-START CONTROL

When operated in the SOFT-START control mode, the TC 202a displays the following information.

In this case, the TC 202a is set to allow full power to the heater at the maintain temperature (after the 3.5 minute soft-start ramp up).

To change the setting, press the DOWN arrow key.



POWER AT M.TEMP=100%
NEW VALUE=70%

The TC 202a has now been adjusted to clamp the heater to a maximum power level of 70%.

Press the ENTER key to set the new value and return to Scan Mode.

RETURN TO SCAN MODE

PROPORTIONAL CONTROL MODE

When operated in the PROPORTIONAL control mode, the TC 202a displays the following information.

POWER AT M.TEMP=70%
NEW VALUE=70%

In this case, the TC 202a is set to allow only 70% of the full heater power at the maintain temperature. The power will linearly reduce (using cycle omission techniques) once the temperature climbs above the maintain temperature. This power reduction can reduce to as low as 20% at the maintain temperature setpoint plus control band. In most tracing operating conditions, the power turn down will be such that the controller attains an equilibrium controlled operation within the control band. If equilibrium is not reached, and the temperatures climb above the maintain temperature plus control band, the heater will turn off. Once temperatures drop below the maintain temperature setpoint plus control band, power will begin to ramp back up and will return to the power clamp percentage at the maintain temperature. Should the temperature fall below the maintain temperature and the power clamp percentage is less than 100%, power will continue to ramp up at the same linear rate until 100% power is attained.

Press the UP or DOWN arrow key to change the current value.

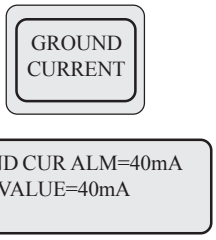
POWER AT M.TEMP=70%
NEW VALUE=90%

Press the ENTER key to set the new value and return to Scan Mode.

Programming the TC 202a when in Proportional with Self Adjust mode is done in an identical manner. However, in this mode the TC 202a will begin to automatically adjust the percentage power clamp value until the percentage power input at the maintain temperature closely approaches that of the actual heat loss and a close temperature approach occurs. Therefore the displayed power clamp value will change automatically during operation.

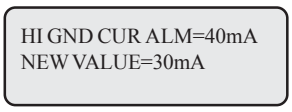
GROUND CURRENT (PROGRAM MODE)

Pressing the GROUND CURRENT function key results in a display message such as the following:



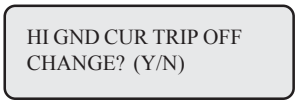
The TC 202a is set to alarm at a heater and associated wiring ground leakage current of 40mA. Should the ground leakage value reach 40mA, the red alarm LED on the TC 202a will begin to flash. In addition, the alarm relay contact will close (depending on configuration, inverse action may occur).

To change the value, press the UP or DOWN arrow keys to increase or decrease the HI GND CUR ALM setpoint.



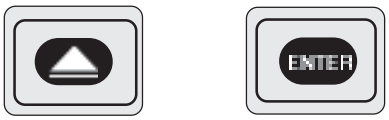
Once the desired new value is set, press the ENTER key to save the value.

Subsequently, another message appears as typically shown below:



The TC 202a is currently set to NOT trip the heater circuit if a high ground leakage condition occurs, but rather will only "flash" the red alarm LED and close the common alarm relay contact (open in inverse operation).

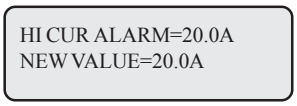
To retain the present mode of HI GND CUR TRIP operation, press the ENTER or PROG key. Pressing the UP arrow key and ENTER will result in the TC 202a setting being changed to HI GND CUR TRIP ON.



Subsequently, the TC 202a returns to the Scan Mode.

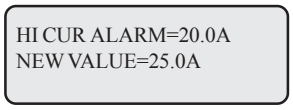
HIGH CURRENT ALARM (PROGRAM MODE)

Pressing the HIGH CURRENT ALARM function key results in a display message such as the following:



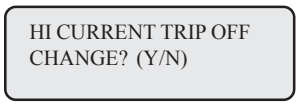
The TC 202a is set to alarm at heater current levels above 20 Amperes. Should the heater current reach 20A, the red alarm LED on the TC 202a will begin to flash. In addition, the alarm relay contact will close (depending on configuration, inverse action may occur).

To change the value, press the UP or DOWN arrow keys to increase or decrease the HIGH CURRENT ALARM setpoint.



Once the desired new value is set, press the ENTER key to save the value.

Subsequently, another message appears as typically shown below:



The TC 202a is currently set to NOT trip the heater circuit if a high heater current alarm condition occurs, but rather will only "flash" the red alarm LED and close the common alarm relay contact (open in inverse operation).

To retain the present mode of HIGH CURRENT ALARM operation, press the ENTER or PROG key. Pressing the UP arrow key and ENTER will result in the TC 202a setting being changed to HI CURRENT TRIP ON.

Once set in this manner, the heater circuit will trip (open heater relay contacts) should a high heater current alarm condition occur. The TC 202a will now require that the operator 1) press the ACKNOWLEDGE key, 2) and the high current alarm condition be cleared prior to automatic control being restored.

Subsequently, the TC 202a returns to the Scan Mode.

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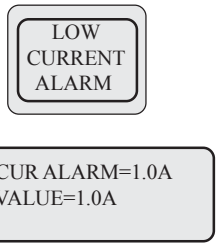
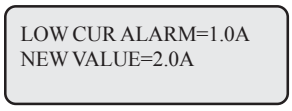
LOW CURRENT ALARM (PROGRAM MODE)

Pressing the LOW CURRENT ALARM function key results in a display message such as the following:



The TC 202a is set to alarm at heater current levels below 1 Ampere. Should the heater current drop to 1A, the red alarm LED on the TC 202a will begin to flash. In addition, the alarm relay contact will close (depending on configuration, inverse action may occur).

To change the value, press the UP or DOWN arrow keys to increase or decrease the LOW CURRENT ALARM setpoint.

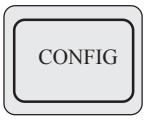


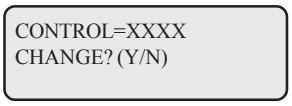
Once the desired new value is set, press the ENTER key to save the value.

Subsequently, the TC 202a returns to the Scan Mode.

CONFIG (PROGRAM MODE)

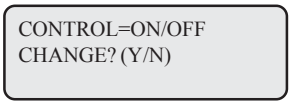
Pressing the CONFIG key results in the following display prompt:





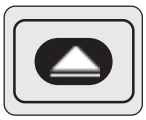
ON/OFF CONTROL MODE

If the controller is set for operation in the ON-OFF control mode, the following display will appear.



The TC 202a is currently programmed to turn on the heater at the maintain temperature setpoint. Upon reaching the maintain temperature setpoint plus control band, the heater circuit will then turn off.

To change from ON/OFF control to another control method, press the UP arrow key and press ENTER.



Otherwise, simply press the ENTER key to continue to the next programmable function.

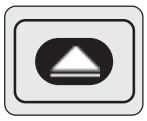
TC 202a Control Module

SOFT-START CONTROL MODE

CONTROL= SOFT START
CHANGE? (Y/N)

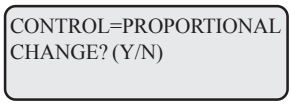
The TC 202a is currently programmed to turn on the heater at the maintain temperature setpoint. In this control mode the TC 202a on "turn on" will ramp up to the specified power clamp percentage at the maintain temperature (using cycle ommission techniques) over a span of 3.5 minutes. Upon reaching the maintain temperature setpoint plus control band, the heater circuit will then turn off. This ramp up feature is designed to specifically address a) cold start power surges associated with self-regulating and power limiting heaters, and b) reduce overshoot which may sometimes be present when utilizing high output heaters in low heat loss applications.

To change from SOFT-START control to another control method, press the UP arrow key and press ENTER.



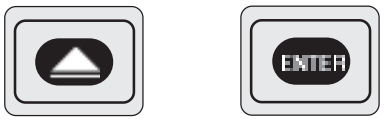
Otherwise, simply press the ENTER key to continue to the next programmable function.

PROPORTIONAL CONTROL MODE



The TC 202a is currently programmed to power the heater circuit to the power clamp percentage at the maintain temperature setpoint. The power will linearly reduce (using cycle ommission techniques) once the temperature climbs above the maintain temperature. This power reduction can reduce to as low as 20% at the maintain temperature setpoint plus control band. In most tracing operating conditions, the power turn down will be such that the controller attains an equilibrium controlled operation within the control band. If equilibrium is not reached, and the temperatures climb above the maintain temperature plus control band, the heater will turn off. Once temperatures drop below the maintain temperature setpoint plus control band, power will begin to ramp back up and will return to the power clamp percentage at the maintain temperature. Should the temperature fall below the maintain temperature and the power clamp percentage is set to a value less than 100%, power will continue to ramp up at the same linear rate until 100% power is attained.

To change from PROPORTIONAL control to another control method, press the UP arrow key and press ENTER.



Otherwise, simply press the ENTER key to continue to the next programmable function.

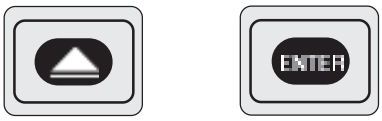
TC 202a Control Module

PROPORTIONAL WITH SELF-ADJUST CONTROL MODE

CONTROL= SELF ADJUST
CHANGE? (Y/N)

The TC 202a is currently programmed to turn on power at the maintain temperature setpoint. In this control mode the TC 202a will linearly begin reducing its power (using cycle omission techniques) as the temperature climbs above the maintain temperature. This power reduction can reduce to as low as 20% at the maintain temperature setpoint plus control band. In most tracing operating conditions, the power turn down will be such that the controller attains an equilibrium controlled operation within the control band. Once an equilibrium point is attained, the TC 202a will begin readjusting the slope of the ramp in order that the controlled temperature will begin to self adjust back toward the maintain temperature. If equilibrium is not reached and the temperatures climb above the maintain temperature plus control band, the heater will turn off. Once temperatures drop below the maintain temperature setpoint plus control band, power will begin to ramp back up.

To change from PROPORTIONAL WITH SELF ADJUST control to another control method, press the UP arrow key and press ENTER.

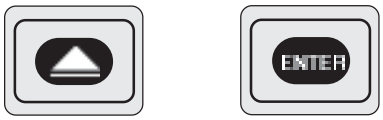


Otherwise, simply press the ENTER key to continue to the next programmable function.

Once having set the control mode of operation, the TC 202a prompts for a selection of the alarm relay action most appropriate.

ALARM SSR NORM OPEN
CHANGE? (Y/N)

The alarm relay is currently set to close on an alarm condition. Press the UP arrow key and then the ENTER key to change the present setting to the alternative option of the relay opening on an alarm condition.



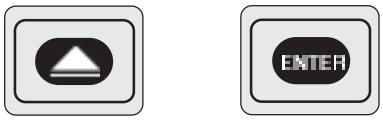
ALARM SSR NORM CLOSED
CHANGE? (Y/N)

If no change is desired, simply press the ENTER key to proceed to the next programmable function.

The TC 202a next prompts for the type of RTD sensing desired.

PIPE SENSE
CHANGE? (Y/N)

The TC 202a is currently programmed to use two RTD's (one for controlling each heater circuit). Press the UP arrow to change this setting to ambient sensing with one RTD.

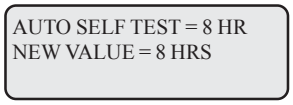


PIPE SENSE
CHANGE? (Y/N) Y

The TC 202a will now use the single RTD input to control "both" heater circuits.

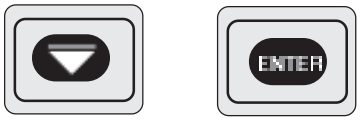
TC 202a Control Module

The TC 202a next prompts for the selection of the self-test time interval.



The TC 202a is currently programmed to do a self test every 8 hours. During this self test, the TC 202a will perform a power/continuity check by turning the heater circuits on and off and will alarm if a current of less than 300 mA difference is detected during the on-off cycle. In addition, the TC 202a will alarm should high ground leakage and low heater current conditions occur during the ON period.

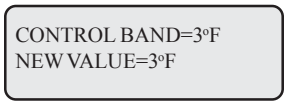
To deactivate the SELF TEST option, press the DOWN arrow key until the word "OFF" appears and then press the ENTER key.



To retain the present setting, simply press the ENTER key and the TC 202a will exit the programming mode.

CONTROL BAND (PROGRAM MODE)

Pressing the CONTROL BAND key results in the following display prompt:



ON/OFF OR SOFT-START CONTROL MODE

The TC 202a is currently programmed to turn on the heater at the maintain temperature setpoint and will turn off when sensing a temperature 3°F above this value.

PROPORTIONAL OR PROPORTIONAL SELF-ADJUST

The TC 202a is currently programmed to operate the heater at the programmed power clamp percentage at the maintain temperature. The power is currently set to reduce from the power clamp percentage at the maintain temperature to 20% at 3°F above and then to turn off. As an example, if the power at the maintenance temperature is set at 100% and that heater delivers 10 watt/ft, the ramp down of power will be:

Ramp Down = (10-0) watt/ft/3°F
= 3.33 watt/ft-°F

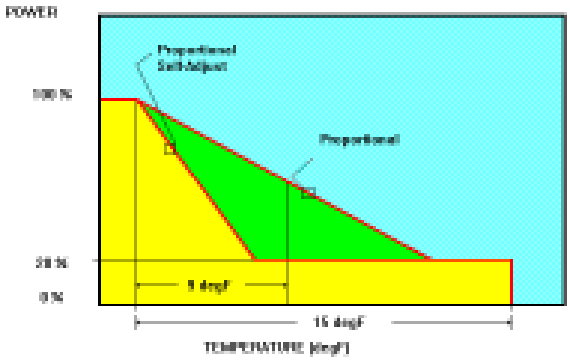
The ramp down will cease once power drops to 20% and the power level will hold at this level. Once the temperature climbs 3°F above the maintain temperature, the heater will turn off.

In the event that temperatures drop below the maintain temperature, the power will ramp up to 100% power at the same ramp rate.

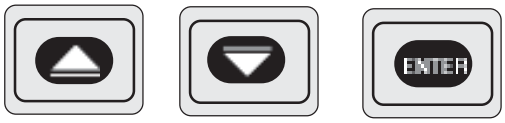
TC 202a Control Module

When operating in Proportional Self-Adjust mode, the TC 202a should be set at a control band of 9°F. Once the TC 202a controller has self-adjusted the control band can be reset at a tighter tolerance if so desired.

In the event that the control band is set at a level higher than 9°F (for example 15°F), the Proportional Self -Adjust control mode will limit the ramp down to 20% to occur over a span of 9°F and will hold the 20% level until the temperature climbs to 15°F above the maintain temperature, at which point the heater turns off. On the other hand, the Proportional control mode will continue to reduce the power ramp down rate as the control band increases above 9°F.



To retain the present control band setting, press the ENTER or PROG key. Press the UP or DOWN arrow key to increase or decrease the control band and press ENTER to save the new value.

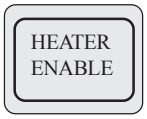


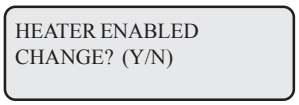
Subsequently, the TC 202a returns to the Scan Mode.

RETURN TO SCAN MODE

HEATER ENABLE (PROGRAM MODE)

Pressing the HEATER ENABLE key results in the following display prompt:





This heater circuit is currently enabled and the TC 202a will both monitor and control the heater output.

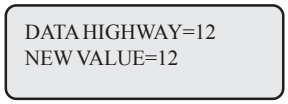
To retain the present heater status, press the ENTER or PROG key. Press the UP arrow key to disable the heater circuit and press ENTER to confirm the change. The heater is now disabled and will not turn on. Any alarms will be cleared. The controller is now in a monitor only mode of operation and will not alarm.

Subsequently the TC 202a returns to the Scan Mode.

TC 202a Control Module

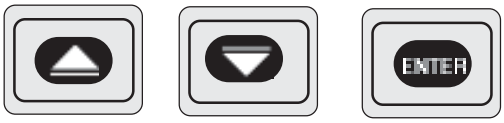
DATA HIGHWAY (PROGRAM MODE)

Pressing the DATA HIGHWAY key results in the following display prompt:

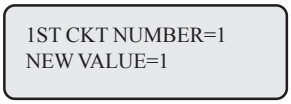


The TC 202a is currently identified as address number 12. This unique address allows the data highway communications software to identify the information being sent with a controller location and heater circuit number.

To retain the present address value, press the ENTER or PROG key. Press the UP or DOWN arrow key to increase or decrease the address value and press ENTER to confirm the new address.



After pressing the ENTER key the following message is displayed.

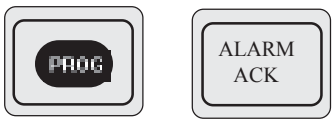


This is the assigned circuit number. Press the UP arrow key to change the circuit number designation and press ENTER to confirm the change. Changing this value has no affect on the Data Highway address value.

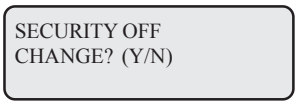
Subsequently the TC 202a returns to the Scan Mode.

SECURITY (PROGRAM MODE)

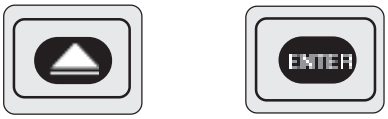
Once the TC 202a is fully programmed, it is possible to restrict access to further programming of the unit by disabling the program mode. In order to secure the programmed settings from further change, press the PROG key and then the ALARM ACK key.



The following display message will appear.



In order to restrict programming access, press the UP arrow key and ENTER key.



Subsequently the TC 202a returns to the Scan Mode.

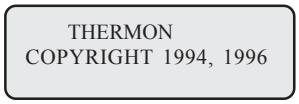
Pressing the PROG key now yields the following display:

Press the ALARM ACK, UP arrow, and ENTER keys sequentially to revert back to unrestricted programming access or simply press ENTER to leave the "SECURITY ON" and return to Scan Mode.

THE TC 202a IN OPERATION . . .

POWER UP (SCAN MODE)

On power up, the TC 202a will display the following two start-up screen messages.



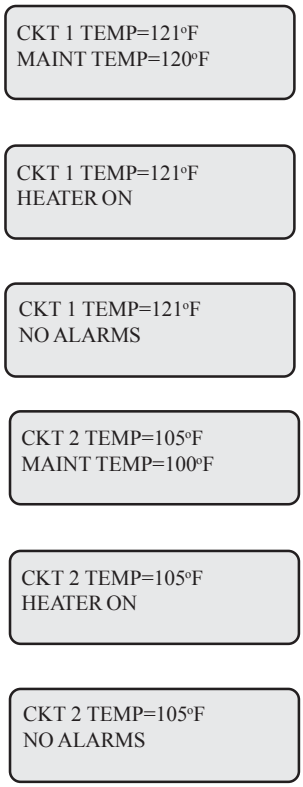
Then the TC 202a will go into Scan Mode.

Subsequently, a message indicating that a power loss occurred is given as typically shown.

This message will automatically clear after 30 minutes or can be manually cleared by pressing the ALARM ACK key.

TC 202a Control Module

After the power loss message has been cleared, the TC 202a will sequentially display the temperature reading along with the maintain temperature, heater status, and alarm status.

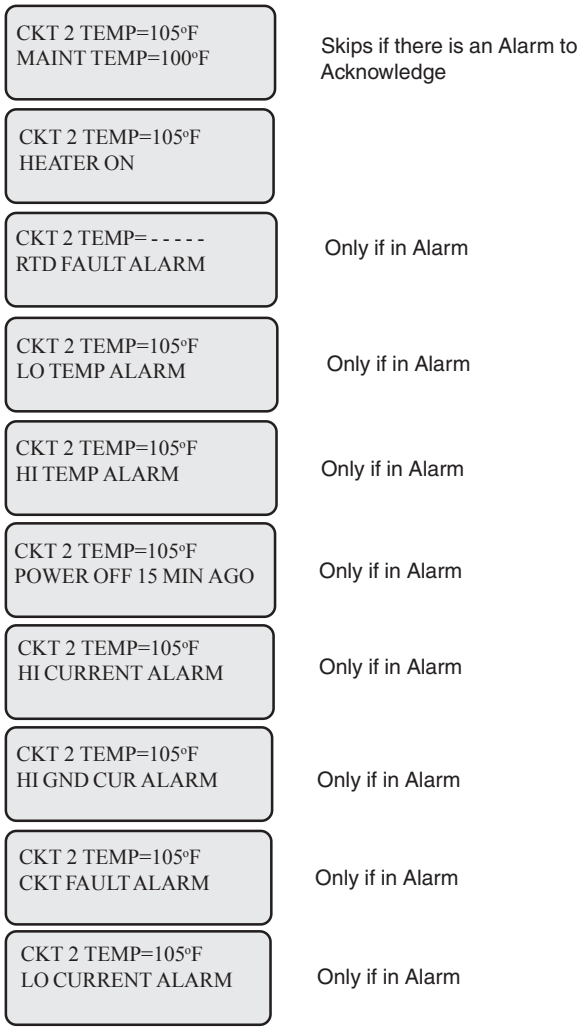


If alarms occur, the order in which they are displayed in the scan mode is as follows:

CKT 1 TEMP=121°F MAINT TEMP=120°F	Skips if there is an Alarm to Acknowledge
CKT 1 TEMP=121°F HEATER ON	
CKT 1 TEMP=----- RTD FAULT ALARM	Only if in Alarm
CKT 1 TEMP=121°F LO TEMP ALARM	Only if in Alarm
CKT 1 TEMP=121°F HI TEMP ALARM	Only if in Alarm
CKT 1 TEMP=121°F POWER OFF 15 MIN AGO	Only if in Alarm
CKT 1 TEMP=121°F HI CURRENT ALARM	Only if in Alarm
CKT 1 TEMP=121°F HI GND CUR ALARM	Only if in Alarm
CKT 1 TEMP=121°F CKT FAULT ALARM	Only if in Alarm
CKT 1 TEMP=121°F LO CURRENT ALARM	Only if in Alarm

TC 202a Control Module

(Continuing ...)



WHEN IN ALARM (SCAN MODE)

Un-Acknowledged Alarms

When an alarm condition occurs, the ALARM ON indicator will begin to flash, the alarm relay will close (open in inverse operation), and the module display will indicate the alarm condition.

Acknowledged Alarms

To acknowledge an alarm condition, press the ALARM ACK key when the alarm message is displayed (if the alarm message is not currently on the display, pressing the ALARM ACK key will activate the first alarm message). Acknowledged alarms are indicated by the suffix "ACK" appearing when the alarm condition is displayed. Acknowledged alarms will continue to be displayed alternating with the other Main Operation displays until the alarm condition clears. When all alarms have been acknowledged then the alarm light on the controller will cease flashing but will stay ON until all alarm conditions have cleared.

Manual Reset

If a TRIP option has been set on a circuit, then all alarms for that circuit must be acknowledged before they will clear. When TRIP has been triggered, the alarm for that trip must be acknowledged and the alarm condition must clear before automatic control is restored.

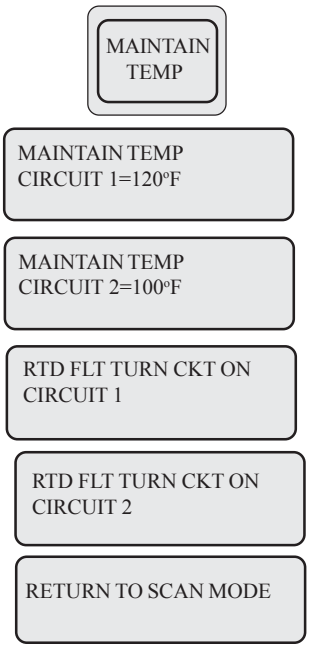
Automatic Reset

When no TRIP options have been set, the alarms will automatically clear when the alarm condition has cleared.

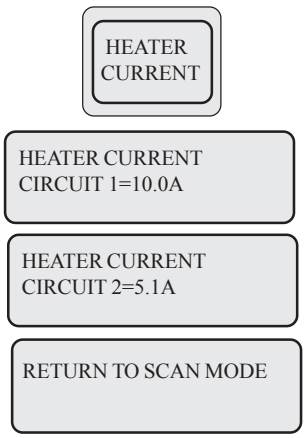
TC 202a Control Module

ACCESSING DATA (DISPLAY MODE)

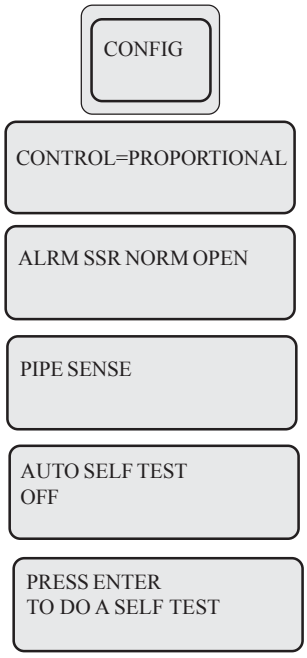
Press the MAINTAIN TEMP key to display the Maintain Temperature and the programmed mode of heater operation in the event of an RTD fault.



Press the HEATER CURRENT key to display the heater amperage as typically shown.



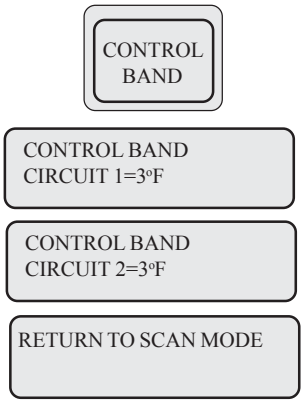
Press the CONFIG key to display the control method, alarm relay action, and the self test settings of all enabled circuits. A typical display sequence is shown.



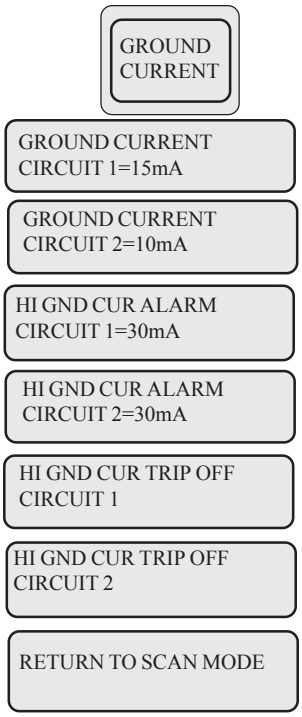
Pressing the ENTER key at this point will result in a SELF TEST being performed. Otherwise the TC 202a will automatically return to Scan Mode.

TC 202a Control Module

Press the CONTROL BAND key to display the control band settings as typically shown.

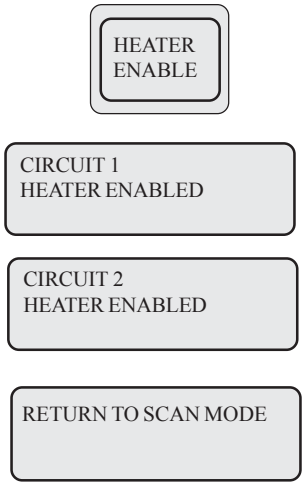


Press the GROUND CURRENT key to display ground leakage current from heater and associated wiring as well as the ground leakage alarm setting and the alarm trip setting as typically shown.

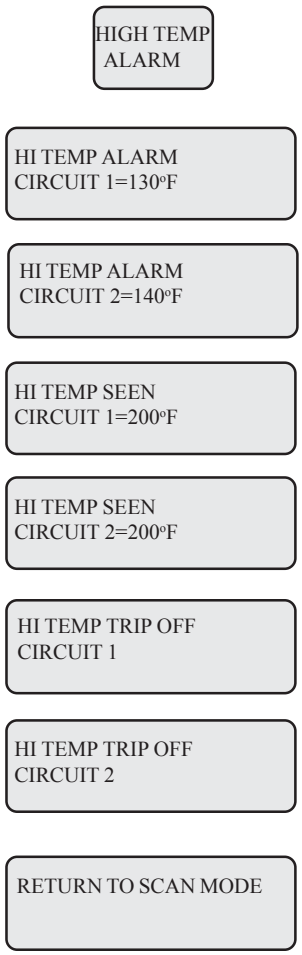


TC 202a Control Module

Press the HEATER ENABLE key to display the heater operating status. The heater status can be enabled, disabled, or tripped.

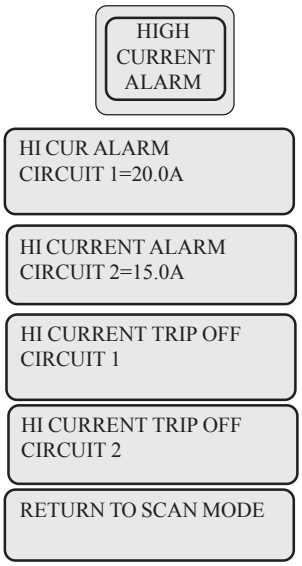


Press the HIGH TEMP ALARM key to display the high temperature alarm setpoint, the highest temperature seen, and the high temperature alarm trip setting as typically shown.

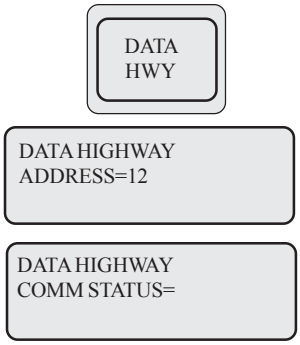


TC 202a Control Module

Press the HIGH CURRENT ALARM key to display the high heater current alarm setpoint and the high current alarm trip setting as typically shown.

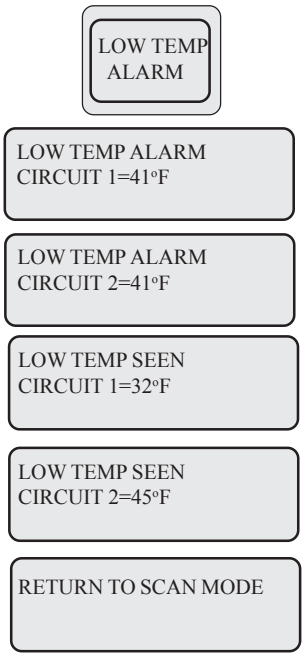


Press the DATA HWY key to display the Data Highway address setting and the present communication status for the module as typically shown.

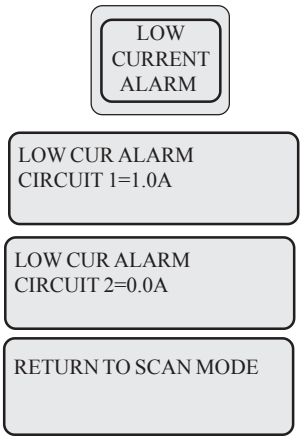


In the event of no RS 485 communications (denoted by empty field to the right of the "equals"), press the ENTER key to continue.

Press the LOW TEMP ALARM key to display the low temperature alarm setpoint and lowest temperature seen as typically shown.



Press the LOW CURRENT ALARM key to display the low heater current alarm setpoint as typically shown.



TC 202a Control Module

UNDERSTANDING ALARM CONDITIONS

When temperature related alarm conditions do occur, the below information may be useful in establishing the cause and appropriate action.

HIGH TEMPERATURE (HI TEMP)

Low Limit:	Maintain temperature plus controlband value
High Limit:	932°F or 500°C
Range:	-40°F to 932°F or -40°C to 500°C
Cause:	Sensed temperature exceeds programmed high temperature alarm setpoint
Controller Action Taken:	Alarm Only or Alarm and Trip Heater (if trip is set)

LOW TEMPERATURE (LOW TEMP)

Low Limit:	-40°F or -40°C
High Limit:	Maintain temperature value
Range:	-40°F to 932°F or -40°C to 500°C
Cause:	Sensed temperature is below programmed low temperature alarm setpoint
Controller Action Taken:	Alarm Only

RTD FAULT

Cause:	RTD resistance not in the 86.27 to 280.75 ohms range
Controller Action Taken:	Alarm and Heater is Energized or Alarm and Heater is Tripped (if trip is set)

When heater related alarms occur, the below information may be useful in establishing a cause and an appropriate action.

HIGH CURRENT (HI CUR)

Low Limit:	Low current alarm value
High Limit:	30.0A
Range:	30A plus
Cause:	Heater current is more than high current alarm value
Controller Action Taken:	Alarm Only or Alarm and Trip Heater (if trip is set)

LOW CURRENT (LOW CUR)

Low Limit:	0.0A
High Limit:	High current alarm value
Range:	30A plus
Cause:	Heater current is less than low current alarm value
Controller Action Taken:	Alarm Only

HIGH GROUND CURRENT (HI GND CUR)

Low Limit:	20mA
High Limit:	150mA
Range:	20 to 150mA
Cause:	An excessive heater/wiring leakage current is present
Controller Action Taken:	Alarm Only or Alarm and Trip Heater (if trip is set)

CIRCUIT FAULT (CKT FAULT)

Checks For:	Damaged relay
Cause:	Relay locked open or closed
Controller Action Taken:	Alarm Only

POWER OFF

Cause:	Loss of voltage to unit
Controller Action Taken:	None
Reset Procedure:	Power off message will clear itself after 30 minutes or can be manually cleared with the ALARM ACK key

TC 202a Control Module

TYPICAL CONTROL APPLICATIONS . . .

AMBIENT SENSING FREEZE PROTECTION -
PROPORTIONAL CONTROL WITH SOLID STATE RELAY OUTPUT

When configured with solid state relays, the TC 202a has been designed to allow wide band proportional control. This method of control is ideal in tracing designs where simple ambient sensing freeze protection is required. In this mode of control, the TC 202a will (by cycle omission techniques) proportionally increase the power to the heat tracing as the ambient temperature drops. A typical application for this type of control might be the freeze protection of water lines in a water treatment facility. Assume the following heat tracing operating design –

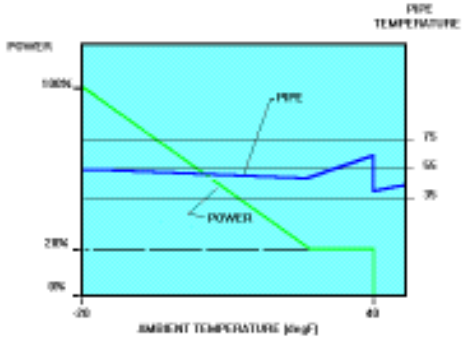
Heat Tracing Type:	Self-Regulating Parallel Heater Cable
Selected Design Safety Factor:	30%
Minimum Ambient:	-20°F
Minimum Water Maintain Temp:	40°F

A typical list of the key TC 202a settings is as given below:

Control Parameter	**Setting**
Control Method	Proportional
Maintain Temperature*	-20°F
Percent Power at Maintain Temp.	100%
Control Band	60°F
Sensing Type	Ambient Sense - 1 RTD

*Note that the maintain temperature is the temperature where 100% power is supplied to the heater.

Having set in these values along with appropriate alarm settings, the following control can typically be achieved.



FOUNDATION HEAVE PROTECTION - PROPORTIONAL WITH SELF-ADJUST CONTROL WITH SOLID STATE RELAY OUTPUT

Cryogenic vessels and refrigerated rooms often utilize heating systems beneath to prevent heaving due to the freezing of the soil/foundation base structure. A typical heat tracing application of this type might require an operating tracing design as follows:

Internal Room Temperature:	-27°F
Minimum Maintain Temperature of Soil:	40°F
Maximum Foundation Temperature:	80°F
Heater Cable Type:	Constant Wattage
Design Safety Margin:	42%

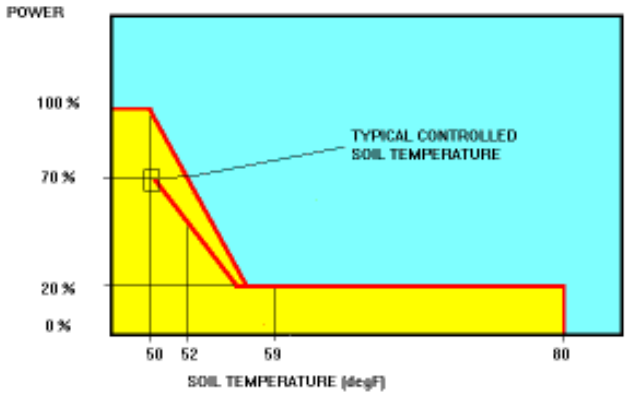
Each of the circuits on the TC 202a control module can be typically set at the control settings given below:

Control Parameter	**Setting**
Control Method	Proportional with Self-Adjust
Maintain Temperature	50°F
Control Band	30°F
High Alarm Temperature	90°F
High Temperature Trip	On
Low Alarm Temperature	38°F
Sensing Type	Pipe Sensing (2 RTD's each of which controls one circuit)

TC 202a Control Module

These settings assume the system was designed with a 42% safety margin. By clamping the power to the 70% value, the heater output should match the heat load. The heater should be continually operating using cycle omission techniques in a warming mode (and will thus minimize condensation within the heating system). After attaining 50°F, the TC 202a will linearly reduce power (the minimum level of power is 20% after 9°F rise) until an equilibrium value between 50°F and 80°F is obtained. In the unlikely event that the 80°F setting is exceeded, the control will de-energize the heater circuit. A high temperature alarm will activate should the RTD sensor detect a temperature above the 90°F value and the circuit will trip.

Having set in these values as well as the appropriate other limit/control values, the following typical control can be achieved.



PROCESS TEMPERATURE MAINTENANCE - PROPORTIONAL CONTROL WITH SOLID STATE RELAY OUTPUT

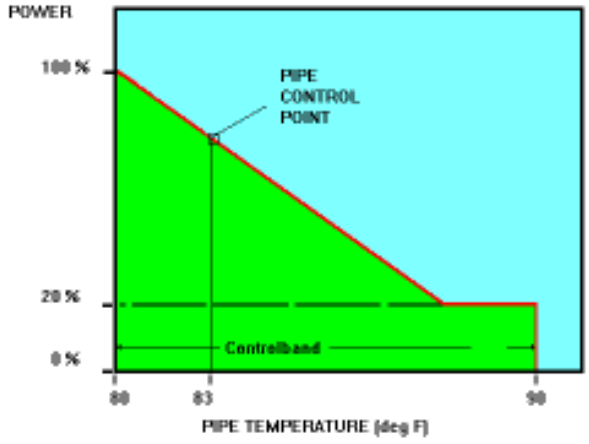
The TC 202a features the option of proportional control for those applications where close temperature control on process piping which may have varying process temperature conditions. A typical heat traced piping application might be a corn syrup viscosity control application. Due to the sensitivity of the syrup to color degradation the syrup must be maintained below 90°F. Typical heat tracing design requirements are listed as follows:

Syrup Maintain Temperature:	80°F
Heater Cable Type:	Constant Wattage
Maximum Syrup Temperature:	90°F

Each of the circuits on the TC 202a control module could be typically set as shown below:

Control Parameter	**Setting**
Control Method	Proportional
Maintain Temperature	80°F
Control Band	10°F
High Alarm Temperature	90°F
High Temperature Trip	On
Low Alarm Temperature	75°F
Power at Maintain Temperature	100%
Sensing Type	Pipe Sensing (2 RTD's each of which controls one circuit)

Having set in these values as well as the appropriate other limit/control values, the following typical control can be achieved.



TC 202a Control Module

PROCESS TEMPERATURE CONTROL - MECHANICAL RELAYS

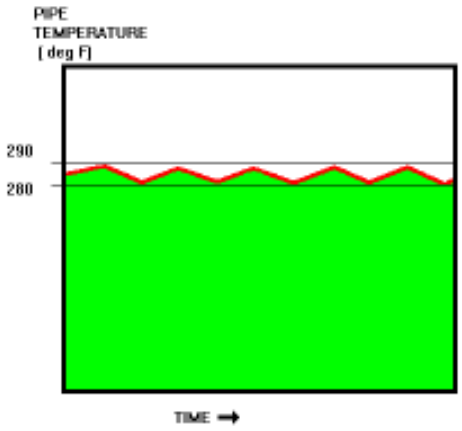
Extremely versatile, the TC 202a can be configured with a mechanical relay output option. This option is often selected in high heat output tracing applications where either high current or high voltage switching is required. One such tracing application might be the temperature maintenance of a long sulfur transfer line. Typical tracing design requirements are listed as follows:

Heater Cable Type:	Skin Effect Heat Tube
Voltage Switched:	900 Vac
Current Switched:	120A
Sulfur Maintenance Temperature:	282°F
Sulfur Freeze Point:	260°F
Sulfur Congeal Point:	320°F

The TC 202a control controller setup could be typically as shown below:

Control Parameter	**Setting**
Control Method	On/Off
Maintain Temperature	282°F
Control Band	5°F
High Alarm Temperature	300°F
Low Alarm Temperature	260°F
Sensing Type	Pipe Sensing (2 RTD's each of which controls one circuit)

Having set in these values as well as the appropriate other limit/control values, the following typical control can be achieved.



COMMUNICATIONS . . .

The TC 202a is standardly provided with a RS485 communications port. This port allows for communication through a Modbus ASCII protocol to a PC workstation or the facility distributed control system (DCS). Through this communications link, most of the operating parameters which are programmable at the module are accessible at the central PC workstation or DCS system console.

For communications linking between the TC 202a and a PC workstation, refer to the TraceView™ Explorer User Guide.

For communications linking information between the TC 202a and the facility DCS system, refer to the DCS Operations Guide, SWM-008.X.

TC 202a Control Module

OPTIONS AND ACCESSORIES . . .

Thermon can provide a variety of options and accessories to complete the installation. Some typical accessories are listed below.

SW-TVE

TraceView™ Explorer is a PC-based communications software package developed specifically for centralized control and monitoring of the various field mounted HeatChek™ units. TraceView Explorer, operating within the Windows environment, allows the changing of control and alarm setpoints, adjustment of controller operating parameters, and acknowledgement of all alarms from the control room or motor control center. TraceView Explorer permits the viewing of heat tracing isometrics on demand and allows online access to heat tracing and controller diagnostic information. Continuous data logging and reporting of heat tracing operations/alarm status as well as historical trend data storage (for later retrieval to spreadsheet or database software) is also provided.

TraceView Explorer can be configured for up to two data highways (with each data highway including up to 247 HeatChek control and monitoring units[1]). Communications can be achieved at distances up to 4000 ft. (1220 m) on the RS485 two wire twisted shielded communication link.

[1] A minimum of one repeater module is recommended for every thirty-one modules configured into a single data highway.

RTD-100

This three wire resistance temperature detector (RTD) is rated to 500°F (260°C). Provided with a standard aluminum termination head, the RTD sensor is insulated with fiberglass and shielded with Type 316 stainless steel housing.

LCDHx

This heater and power supply kit can be added for situations where the LCD display must be read in ambients below -4°F (-20°C).

DCALxx

Interposing DC alarm relays can be added for use in ordinary and hazardous locations to interface to plant DCS systems.

IM-1

Interface module for linking RS485 two-wire twisted shielded pair into RS232 port of PC.

HELP . . .

This HeatChek control and monitoring unit is intended to be used with only the support of this instruction booklet. If special support needs do arise, Thermon provides local support through its area representatives and affiliate companies as well as through a toll free user support line.

For toll free support dial 1-800-820-HEAT(4328). Information may also be obtained by accessing the Thermon website at www.Thermon.com.

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