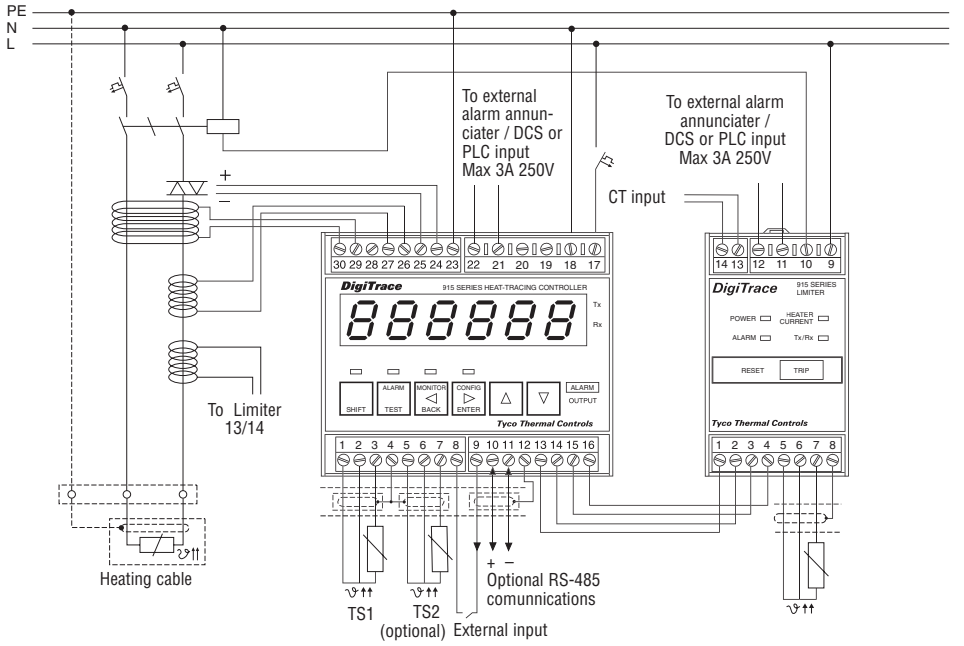
DigiTrace

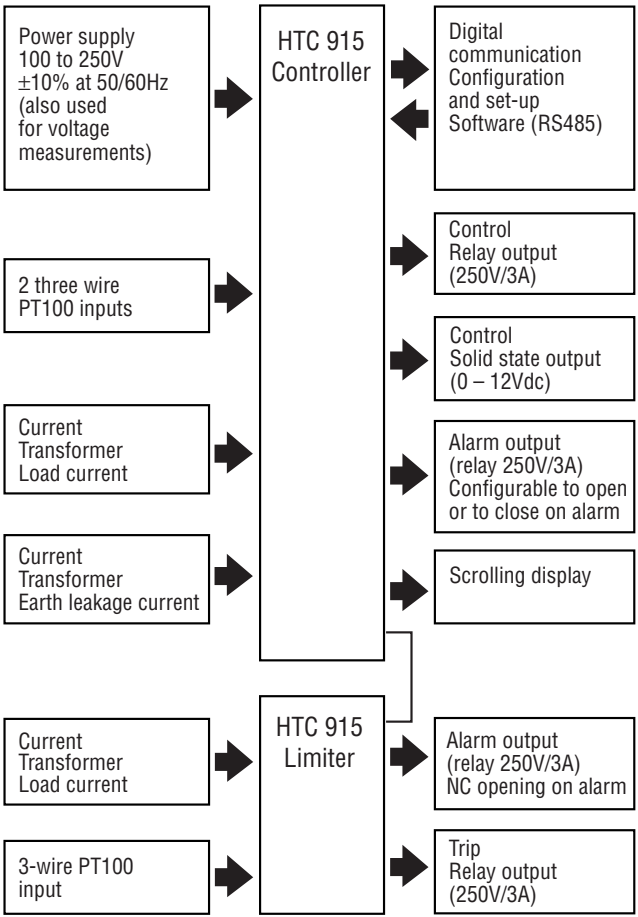
HTC-915

Installation & operating manual


PE
N
L
To external alarm annun-ciater / DCS or PLC input Max 3A 250V
To external alarm annunciater / DCS or PLC input Max 3A 250V
CT input
30 29 28 27 26 25 24 23
22 21 20 19 18 17
14 13
12 11 10 9
DigiTrace
915 SERIES HEAT-TRACING CONTROLLER
Tx
Rx
SHIFT
ALARM TEST
MONITOR BACK
CONFIG ENTER
ALARM OUTPUT
Tyco Thermal Controls
DigiTrace
915 SERIES LIMITER
POWER
HEATER CURRENT
ALARM
Tx/Rx
RESET
TRIP
Tyco Thermal Controls
1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16
1 2 3 4 5 6 7 8
To Limiter 13/14
Heating cable
TS1
TS2 (optional)
External input
Optional RS-485 comunnications

Index.

1. FUNCTIONAL OVERVIEW



2. INSTALLATION AND WIRING

Caution: Ensure all personnel involved in installation, servicing, and programming are qualified and familiar with electrical equipment, their ratings and proper practices and codes. Multiple voltages and signal levels may be present during the installation, operation, and servicing of this product. Do not power the product until the safety provisions outlined in this section have been observed.

⚠ **Caution:** Note all warnings regarding connections to terminals which may be used with external circuits. These may be hazardous live signals.

2.1. Introduction

This section includes information regarding the initial inspection, preparation for use, and storage instructions for the 915 series heat trace control and optional limiter modules.

2.2. Initial Inspection

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been verified for completeness and the equipment has been checked mechanically and electrically. Procedures for configuring and operating the 915 control and limiter modules are given in sections 3 through 9. If the shipment is incomplete, there is mechanical damage, a defect, or the controller does not pass the electrical performance tests, notify the nearest Tyco Thermal Controls representative. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as your tyco thermal controls representative. Keep the shipping materials for the carrier's inspection.

2.3. Operator Safety Considerations

The 915 control and limiter modules are suitable for use in ordinary locations only.

Caution: some wiring configurations will use more than one power source and all must be de-energized prior to performing any maintenance on a controller circuit.

⚠ **Caution:** protection provided by this equipment may be impaired if the device is used outside of its ratings or for applications other than it is intended.

2.4. Operating Environment

The operating environment should be within the limitations outlined in the specifications section found in appendix A.

2.5. Installation Location

The wide ambient operating temperature range of the controller permits installation in most any convenient location. Considerations should include expected atmospheric conditions, accessibility for maintenance and testing, the location of existing conduits and hazardous area rating. Ambient temperature conditions may affect load current ratings.

Caution: Always be sure that the intended location is classified as an area for which the product is approved.

2.6. Mounting Procedures

The 915 control and optional limiter modules use a standard 35 mm x 7.5 mm (EN50022 compatible) rail for mounting purposes.

Caution: Always ensure that the power to the unit is turned off during installation or removal to avoid the risk of injury and damage to the controllers.

⚠ **Warning:** The 915 control module must be protected by external overcurrent and disconnect devices. This may be a circuit breaker or a combination of disconnect switch and fuses, etc.

The disconnect device must:

- Disconnect all ungrounded, current-carrying conductors
- Should be located in close proximity to the equipment
- Be within easy reach of the operator
- Be marked as the disconnecting device for the equipmentection x - maintenance

3. MAINTENANCE

3.1. Operator Maintenance

The 915 controller is designed to be a maintenance free product. Once installed properly the only maintenance required is re-tightening of the terminal connections approximately one week after installation and inspection periodically thereafter.

Terminal assignments for the controller

1. RTD 1 source
2. RTD 1 sense
3. RTD 1 common
4. Shield
5. RTD 2 source
6. RTD 2 sense
7. RTD 2 common
8. External Input + (Inhibit/override)
9. External Input – (Inhibit/override)
10. Communications (RS-485+)
11. Communications (RS-485 -)
12. Shield
13. Digital common (to Limiter 1)
14. +12Vdc out (to Limiter 2)
15. TX data (to Limiter 3)
16. RX data (from Limiter 4)

⚠
17. Mains Input (L1)
18. Mains Input (L2/neutral)
19. Control relay output
20. Control relay output
21. Alarm relay output
22. Alarm relay output

23. PE
24. SSR control output +
25. SSR control output –
26. Load Current CT input
27. Load Current CT input
28. Shield
29. GF CT input
30. GF CT input

Terminal assignments of the limiter

1. Digital common (from HTC 13)
2. +12Vdc in (from HTC 14)
3. RX data (from HTC 15)
4. TX data (to HTC 16)
5. RTD 1 source
6. RTD 1 sense
7. RTD 1 common
8. Shield
9. Control relay output
10. Control relay output
11. Alarm relay output
12. Alarm relay output
13. Load Current CT input
14. Load Current CT input

⚠ **Warning:** Terminals 17 to 22 are for use only with equipment which has no live parts which are accessible. Control relay contact terminals 19 and 20 are typically used to control an external contactor coil. Alarm relay contact terminals 21 and 22 are typically used to connect to external indicating or monitoring devices such as alarm lights, DCS, etc.

Caution: Be certain power is off to the controller before attempting to test or service the heat tracing.

Do not rely on the controller as a disconnect device!

3.2. Replaceable Parts

There are no user-serviceable parts in the 915 series controller or accessories. The unit is designed to be easily changed out in the field in a matter of minutes. A 915 appearing inoperative should be returned to the nearest Tyco Thermal Controls service center for service.

Warning: Tampering with the 915 components without approval from Tyco Thermal Controls could result in the products' warranty being void.

The 915 Control Module incorporates an internal fuse of the following type(s):

- CE marked units (rated 250 Vac max.): Wickman #19372 250V, 4A fast acting type.
- CSA marked units (rated 277 Vac max.): Littelfuse #446004 350V, 4A fast acting type.

3.3 Cleaning

If the 915 components require cleaning, a damp cloth may be used to wipe the units. This should only be done while the units are disconnected from their power source. Do not use any harsh chemicals or solvents, as this may damage the housing or finish.

4. ELECTRICAL CONNECTIONS

Connections are made via screw connections suitable to accept cable diameters between 0.5 and 2.5 mm^2 (24 to 12 Awg).
Either solid or stranded wires may be used.

Installation notes.

- The choice of cables used to make the electrical connections must be conform to the appropriate local and national regulations.
- The installation and electrical connection must only be carried out by trained or specialist personnel.
- If contact with live parts is possible while working on the unit, it must be completely isolated from the mains supply. Be aware that the unit might have cables connected to it which are powered from different sources.

- Magnetic or electric fields, eg: from transformers, mobile phones or electrostatic discharge must be avoided in the vicinity of the instrument.
- Route input, output and supply lines separately.
- Arrange sensor cable extensions as twisted and screened cables. Do not run them close to power cables. The shield, if any, shall be earthed on the controller's side only.
- The instrument is not approved for installations in hazardous area.
- Fluctuations in the supply signals are only permissible within the specified tolerances.

5. CONNECTION DIAGRAM OF THE CONTROLLER

Connection details PT100 Temperature Input:

(TS1: Source/sense 1 / 2, common to terminal 3)

(TS2: Source/sense 5 / 6, common to terminal 7)

The shield of both sensors can be terminated at terminal nr 4.

In order to provide a temperature reading for the controller, either two- or three wire PT100 resistance elements can be used.

Note:

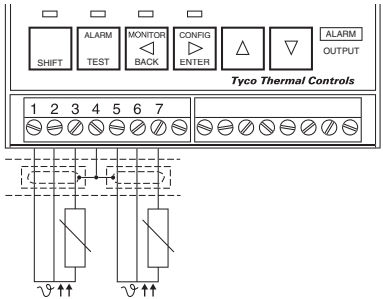
3 wire PT100 sensors typically have 2 wires in the same color (source / sense) The third wire colored differently is the common.

- For extension of the PT100 connection cables, only shielded cables having a suitable cross-section should be used.
- The maximum resistance added by the extension should be no more than 20 Ohm maximum.
- Use only wires having the same cross-section. (1 mm^2 min)
- In order to avoid ground loops the shield must be earthed on the controller side only.
- For 2-wire connections short the source and sense terminals together. Use wires of adequate section (1.5 mm^2 min) Note that for each multiple of 15 m extension cable with a cross-section of 1.5 mm^2 the error is about +1°K

Connect the PT100 element as described here below:

Temperature sensor

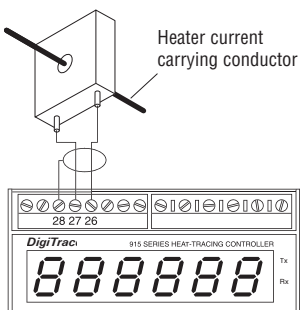
TS1	Source	(RED)	1
TS1	Sense	(RED)	2
TS1	Common	(WHT)	3
Shield			4
TS2	Source	(RED)	5
TS2	Sense	(RED)	6
TS2	Common	(WHT)	7



Note:
Terminal nr 4 is used for the connection of the cable shielding of both sensors

Load current measurement.
(Connect the Current transformer to terminals 26 and 27. The cable shielding can be connected to terminal 28)

The load current is measured via an optional Current transformer (CT). The transformation ratio of this device is 100 to 0.1A.



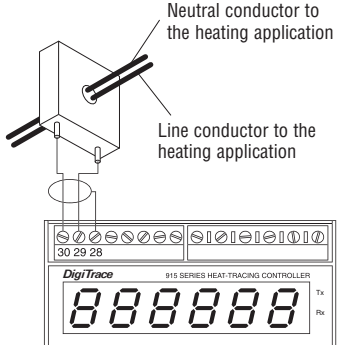
- Shielded cable should be used for the extension between the current transformer and the controller input. In order to avoid ground loops the shield of the cable shall be earthed on the controller side only.

Note that the POWER limit function of the controller will measure the current level via this transformer and will use this value to calculate power.

Ground fault current measurement.
(Connect the Current transformer to terminals 29 and 30. The cable shield can be connected to terminal 28)

Via a separate current input, the controller can be configured to measure ground fault current. The ground fault current is measured via an optional Current transformer (CT). The transformation ratio of this device is 1 to 0.001A.

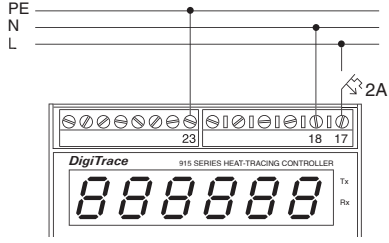
- Shielded cable should be used for the extension between the current transformer and the controller input. The shield of the cable shall be earthed on the controller side only.



CAUTION: This function cannot be used for personnel protection. Only use correctly dimensioned ELCB (RCD) for this purpose.

Power supply connection.

(power connections are made L = 17, N = 18, PE = 23)



The controller is designed to operate on voltages ranging from 100 to 250 Vac (+10/–10%), 50/60Hz.

Note that the POWER limit function of the controller will measure the voltage level and use this value to calculate power. This implies that the controller and the load should be powered from the same power source. If this is not the case, the voltage correction factor VTR (VTR = voltage turns ratio) is to be used.

Outputs

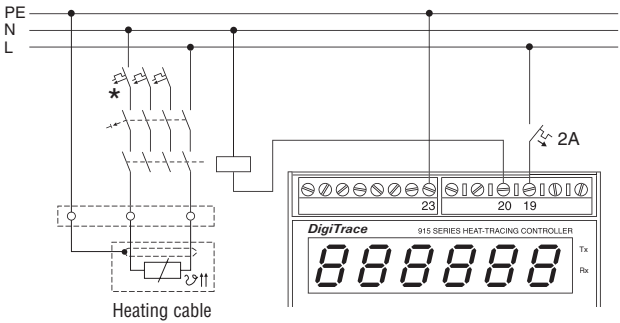
Control output

2 type of control outputs are available:

- Relay output via potential free contact (250V/3A)
  Terminals 19 and 20

Note that some specific features such as power limiting, soft start, etc. are only available when the controller is used in conjunction with a solid-state relay.

Relay output for driving power contactors:



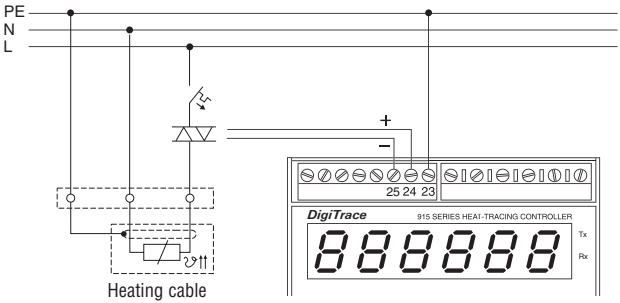
- Solid state output (logic 0 or 12Vdc)

Terminals 24 (+) and 25 (–)

Note that the switching element used must be in accordance with the design in order to cope with the current and voltage levels as specified.

Note that when solid-state relays are used at elevated temperatures power de-rating should be applied. Refer to the product data sheets of the elements used for details. Relay output for driving power contactors:

Solid state output (12VDC) for driving SSR:



Alarm Output

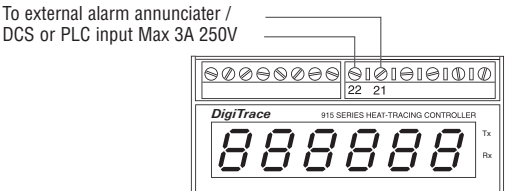
Terminals 21 and 22

- Relay output via potential free contact (250V/3A)

In order to notify operators of a potential problem with the control system, the HTC-915 is equipped with an alarm output. This output is provided as a voltage free relay output. The single pole single throw alarm contact can be configured to operate either as a normally closed (NC) or normally open (NO) contact depending on the needs of the design.

The alarm output relay can be configured to change state when:

1. The actual measured temperature value is higher or lower than the value specified in the controller's set-up. (applicable for both TS)
2. The actual measured load current value is higher or lower than the value specified in the controller's set-up.
3. The actual measured voltage is higher or lower than the value specified in the controller's set-up.
4. The actual measured ground fault current is higher or lower than the value specified in the controller's set-up.
5. When reading open / short from the PT100 input.
6. When reading open / short from the ground fault CT input.
7. When communication with the optional limiter is disturbed or lost.
8. An internal problem with the HTC-915 controller electronics has occurred.



Note that all alarms must be programmed before being effective.

Depending on the application, temperature alarms can be configured to operate as latching or non-latching alarm.

6. CONNECTION DIAGRAM OF THE LIMITER

Limiter Current sensor input.

For specific installations the limiter can be configured such that it will allow for a temporary temperature overshoot. This would be the case in those occasions where the process or for instance steam cleaning of the pipes will cause a temperature in excess of the limiter set point. This feature should be used rather than forcing the limiter to trip or reprogramming the unit. In order to allow this function to be enabled, a current transformer measuring load current should be installed. Note that this CT is separate from the one used to calculate power by the controller. When the limiter does not detect any current flowing into the load and is configured as such it will allow the temperature to exceed the limiter set point.

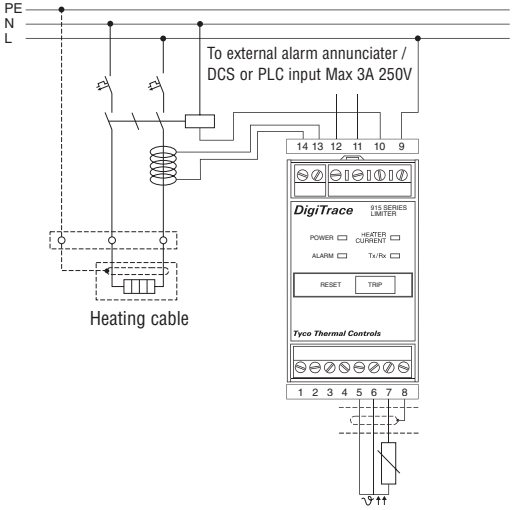
For safety reasons, the current transformer is monitored for short circuit and cable breakage. In case an open / short input is detected, the limiter will trip instantaneously.

Limiter Control output.

The relay output of the limiter is typically used to operate an electro mechanical relay (EMR). Once the limiter set point is exceeded the limiter will trip, the control output will change state switching the installation back to the safe condition. This is done by isolating the complete circuit from mains supply.

For safety reasons the EMR discussed above is wired “fail safe". Therefore the limiter output relay provided is of the “normally closed” type. As such the EMR will also release in the event of a cable breakage in the control wiring circuit.

The PT100 input of the limiter is continuously monitored for short circuit and cable breakage. In case an open / short input is detected, the limiter will trip instantaneously.



Limiter Alarm output.

The limiter alarm output relay will change state (from NC to NO) if :

1. The limiter set point is exceeded.
2. An RTD failure is detected
3. An internal memory failure is detected
4. A limiter current transformer failure (if the limiter CT is being used) is detected.

Note: In case the communication between the controller is disturbed or interrupted the limiter will not trip. However, the controller will generate an alarm indication there is a problem with the communication. If simultaneously to the communication failure the limiter set point temperature is exceeded the limiter will trip switching the installation to the safe condition.

Limiter reset.

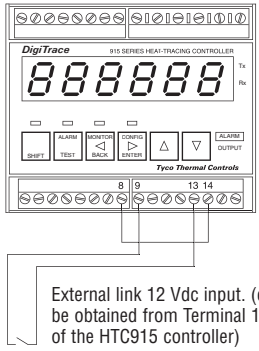
Once the limiter has tripped it has to be reset manually. Before being able to reset the limiter the actual temperature should have lowered to a safe level (below limiter set point).

Resetting the limiter will only be possible if the actual temperature measured is below the limit temperature.

The limiter can be reset using one of the methods described below:

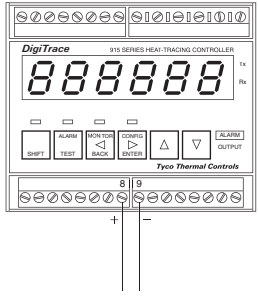
1. From the control panel on the HTC-915 (assuming the digital communication between controller and limiter had been installed and is working properly)
2. Via pushing and holding the RESET key on the limiter unit for t > 2 seconds.
3. Remotely via the external input on the HTC-915 controller and a remote contact
4. Remotely via DCS system. (5 to 24 Vdc)
5. Remotely via the serial interface and the optionally available DigiTrace supervisory software.

Wiring scheme to remotely reset the limiter via a dry contact closure.

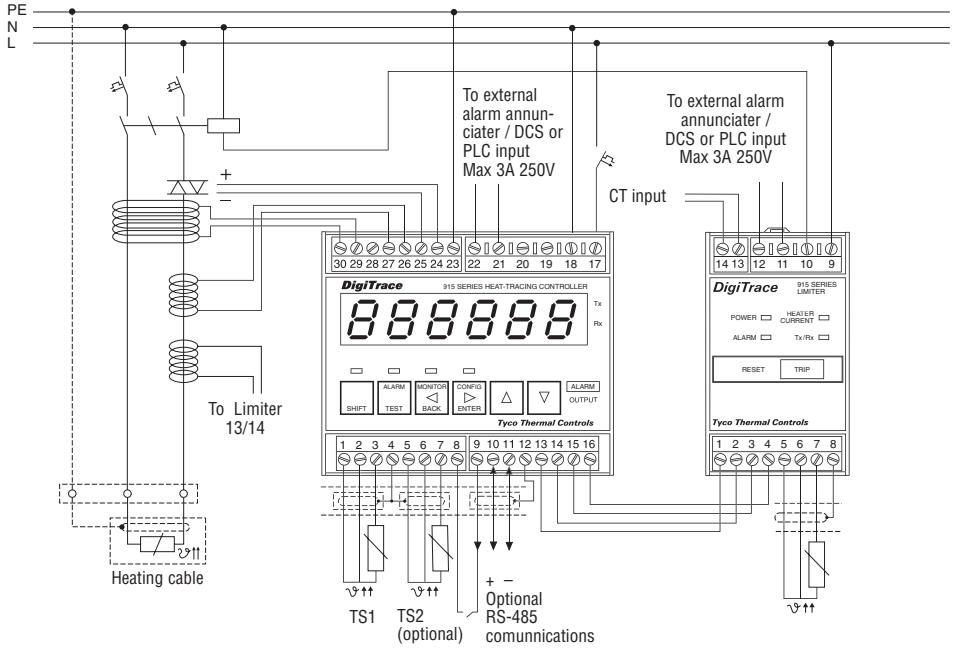


External dry contact. Close to reset the limiter (2 KOhm Max loop resistance).

Limiter reset via External DC signal.



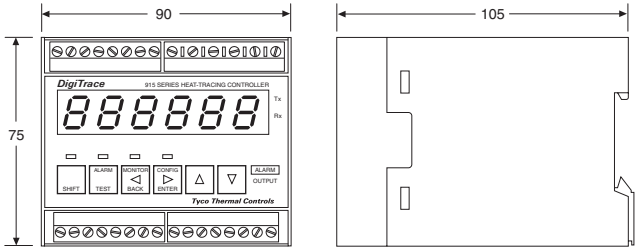
+5VDC to 24 VDC Nominal, 10mA Max.



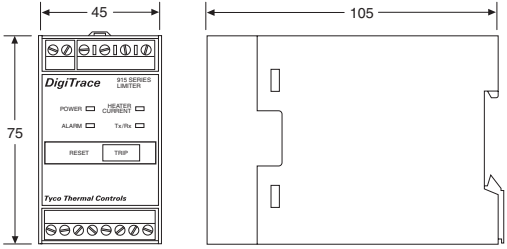
Preferred wiring diagram HTC-915 controller with over temperature limiter.

7. PRODUCT DIMENSIONS

Controller dimensions:



Limiter dimensions:



8. OPERATOR CONSOLE & OPERATION

ALPHA-NUMERIC DISPLAY

The Console incorporates a 6 character 14 segment plus decimal LED display. Messages and prompts that are greater than 6 characters long are scrolled, allowing more meaningful, non-cryptic messages to be used.

KEYPAD

The local keypad consists of 6 keys that allow you to select the console mode function that you are interested in. For certain keys, the **SHIFT** key selects an alternate function, as shown by the text above that key.

Key	Function
SHIFT	• press to activate a SHIFT function -- the next key pressed uses the alternate (shifted) function • pressing SHIFT again cancels the alternate (shifted) function
TEST [shift ALARM]	• turns on tracing for 30 seconds • when prefixed by the SHIFT key, this key switches the console to the Alarm mode
← BACK [shift MONITOR]	• exits the current menu (or cancels the new setting when editing a parameter) • moves the cursor to the left when editing an alpha-numeric parameter • when prefixed by the SHIFT key, this key switches the console to the Monitor mode
→ ENTER [shift CONFIG]	• selects the item in the display (or accepts the setting when editing a parameter) • moves the cursor to the right when editing an alpha-numeric parameter • when prefixed by the SHIFT key, this key switches the console to the Configure mode
↑	• moves to the previous item in a menu • increments the value when editing
↓	• moves to the next item in a menu • decrements the value when editing

LED INDICATORS

The console includes eight LED indicators:

Four LEDs indicate the Console operating mode. (SHIFTed function, ALARM, MONITOR, or CONFIGure modes).
There are two status LEDs which indicate the alarm and control output status of the controller:

1. The output LED, when illuminated, indicates that the output of the controller is turned on and is allowing current to flow into the load. A flashing LED indicates that the controller is pulsing its output on and off to

maintain the set point temperature and/or control the average amount of current/power allowed to “flow” into the load.

2. The alarm LED will flash (approximately once per second) when the controller has detected an alarm condition.

The two additional LEDs are used to indicate external communications activity and are only used when an optional communications interface is installed. The “**Rx**” LED flashes to show that the Controller is receiving information via its communications port. The “**Tx**” LED flashes when the Controller is transmitting information via its communications port.

9. OPERATIONAL BASICS

9.1. Operating Modes

The console operates in one of four modes and is related to the basic function the operator selects. These modes are:

Mode	Function
Scan	• This is the default mode. In this mode, the console sequentially displays load current, temperature and set point readings.
Alarm	• Invoked when you press the SHIFT key followed by ALARM key. This mode allows you to examine or reset any alarms that may exist. The LED above the ALARM key is illuminated while in this mode.
Monitor	• Invoked when you press the SHIFT key followed by MONITOR key. In this mode, you may examine any of the controller readings such as temperature, load current, ground fault current, etc. The LED above the MONITOR key is illuminated while in this mode.
Configure	• Invoked when you press the SHIFT key followed by CONFIG key. In this mode, you may examine or alter the controller configuration. The LED above the CONFIG key is illuminated while in this mode.

Menus
Each of the operating modes has a list of data items associated with it. For example, in the **Monitor** mode you may view temperatures, load current, resistance, ground fault current, voltage, or power information. This collection of data items is referred to as a menu.

Only one menu item may be viewed at a time. The ↑ (↓) keys move to the next (previous) item in the menu. When you reach the end of the menu (indicated by ---- END ---), ↓ wraps you to the first item in the menu; conversely, ↑ wraps you to the last item in the menu.

Some of the items within a menu are actually entry points to sub-menus -- these entries are indicated with "..." at the end of the message. To enter a sub-menu, press the → key. To move around in the menu, use the ↑ and ↓ keys move to the next and previous items respectively. The ← key exits the current menu and returns to the previous menu.

After approximately five minutes of keypad inactivity, the current menu and mode will be exited and the console will revert back to the Scan mode.

Note: Some menus are dynamic, that is, some items appear or disappear depending on the configuration. For example, if you disable the Low Voltage Alarm, then the corresponding Low Voltage Set point is not available and will not be displayed.

Changing the Configuration
To change the Controller configuration:
- Position the desired parameter (menu item) in the display.
- Press the → key to initiate an edit session.
- If the console is "locked" you are prompted to enter the passcode.
- The present setting will flash on the display to indicate that you are editing the parameter.
- Use the ↑ and ↓ keys to change the value.
- The operation of the → and ← varies depends on the type of data being editing. See the following sections for details.

Note: Once you have initiated an edit session, you must end it before switching to another mode or invoking another function. An edit session ends when you enter a new value (using the → key) or you back out of it (using the ← key).

Changing a Non-numeric Parameter
To change a non-numeric parameter (e.g.: an alarm mask setting):
- Position the appropriate parameter in the display.
- Press the ➔ key to initiate the edit session.
- If the console is "locked" you are prompted to enter the passcode.
- The present setting will flash on the display to indicate that you are editing the parameter.
- Use ↑ or ↓ until the desired value appears in the display.
- Pressing ➔ saves the new value.
- Pressing ← ends the edit session without altering the parameter.

Changing a Numeric Parameter
To change a numeric parameter (e.g. the control set point):
- Position the appropriate parameter in the display.
- Press the ➔ key to initiate the edit session.
- If the console is "locked" you are prompted to enter the passcode.
- The present value is displayed and the last (rightmost) digit blinks.
- The blinking digit identifies the digit that you are editing.
- Use ↑ or ↓ to set the desired value.
- Use ← or ➔ to move to a different digit.
- To enter a negative value, scroll to the first (leftmost) digit until a "-" appears in the display.
- Pressing ➔ while on the last (rightmost) digit saves the new value.
- Pressing ← while on the first (leftmost) digit ends the edit session without altering the parameter.

Passcode Protection
The 915 Series Controller provides a passcode for protection of its configuration. You may view any portion of the configuration with the console "locked", however, when you attempt to initiate an edit session by pressing ➔, you are prompted to enter the passcode. Entering the passcode is just like entering any other numeric value
Once the console is "unlocked", you may edit any configuration parameter. The console will automatically re-lock after approximately five minutes of keypad inactivity, or until the user explicitly locks it.

Note: Setting the programmed passcode to "0" disables passcode protection.
The console does not have to be unlocked to reset alarms.

Feature Modes
There are two types Configuration Menus in the 915 Series Controller:

1. a “Basic” Configuration Menu which only contains seven parameters, and
2. an “Advanced” Configuration Menu which contains all of the parameters.

Both types of Configuration Menus contain a “Feature Mode” parameter which allows the user to select which type of Configuration Menu is most desirable.

10. OPERATOR CONSOLE MODES

ALARM MODE
The Alarm mode is invoked when you press the SHIFT key followed by the ALARM key. This mode allows you to examine and reset any alarms that may exist. Use ↑ (↓) to examine the next (previous) active alarm.

10.1. Resetting One Alarm

To reset an alarm, press →. You are prompted for confirmation -- answering “YES” resets the alarm and advances you to the next alarm.

10.2. Resetting All Alarms

To reset all active alarms, press →. You are prompted for confirmation -- press ↑ to select “ALL” and press → to accept.

Monitor Mode Tracking
The Monitor mode “tracks” the Alarm mode. If the Monitor mode is selected while viewing an alarm, the controller will enter the MONITOR menu and display an appropriate reading.

For example, if you are examining a High Load Current Alarm and then select the Monitor mode, the starting point within the MONITOR menu will be the load current reading. Once the Monitor mode has been selected, you may move around in the menu using ↑ and ↓.

10.3. Resetting the LIMITER TRIP ALARM

Limiter alarms should be handled more carefully than other temperature alarms. Once the limiter has tripped, one should carefully examine the root cause for this tripping. In order to avoid resetting the limiter alarm in error, the limiter reset procedure differs from the procedure to be followed for all other alarms. The limiter trip alarm can only be reset after the temperature has dropped below the limit setpoint.

The limiter can be reset in different ways:

1. From the control panel on the HTC-915 by simultaneously pressing the SHIFT and the ENTER key in the ALARM reset menu (assuming the digital communication between controller and limiter had been installed and is working properly).
2. Via pushing and holding the RESET key on the limiter unit for t > 2 seconds.
3. Remotely, via the external input and a remote contact (see wiring diagram).
4. Remotely, via DCS system. (5 to 24 Vdc)
5. Remotely via the serial interface and the optionally available DigiTrace supervisory software.

11. MONITOR MODE

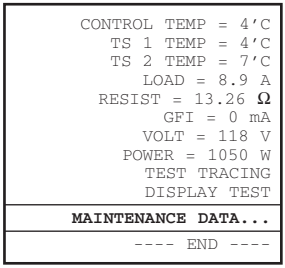
The **Monitor** mode is invoked when you press the **SHIFT** key followed by the **MONITOR** key.

This mode allows you to test the heat tracing and examine any of the analog readings. The data is updated in real-time, providing the user with a method of viewing tracer information as it occurs.

Main Menu

Monitor Mode Main Menu

```
          CONTROL TEMP  = 4'C
             TS 1 TEMP  = 4'C
             TS 2 TEMP  = 7'C   (only if TS2 is being used)
Limiter Avg temperature = 0 °C  (only if limiter is installed.)
                 LOAD   = 8.9 A
   Limiter load current = No    (only if limiter is installed)
               RESIST   = 13.26 Ω
                  GFI   = 0 mA
                 VOLT   = 228 V
                POWER   = 2030 W (or POWER = 10.4 kW)
         TEST TRACING            (turn on tracing for 30 seconds)
         DISPLAY TEST            (to abort DISPLAY TEST, press any key)
  MAINTENANCE DATA...            Note the "..." indicating a sub-menu.
       ---- END ----
```



"MAINTENANCE DATA..." Sub-Menu

This sub-menu is used to view minimum and maximum temperatures, total accumulated power, hours in use, and the number of hours since the last time the Controller was reset. These parameters may be reset by the user.

Maintenance Data Sub-Menu

```
          MIN CTL TEMP  = -2'C
          MAX CTL TEMP  = 65'C
        TS 1 MIN TEMP   = -2'C
        TS 1 MAX TEMP   = 65'C
        TS 2 MIN TEMP   = -1'C
        TS 2 MAX TEMP   = 61'C
  Limiter TS min temp   = -1°C   (only if limiter is installed)
  Limiter TS Max temp   = 65°C   (only if limiter is installed)
          POWER ACCUM   = 145.9 kW-h
CONTACTOR CYCLE COUNT   = 1234   (only if Deadband or Prop. Amb.
                                  Contactor modes are being used)
              IN USE    = 2896 h
TIME SINCE LAST RESET   = 675 h
        ---- END ----
```

12. CONFIGURE MODE

The **Configure** mode is selected when the operator presses the **SHIFT** key followed by the **CONFIG** key. This mode allows you to examine or alter the Controller's configuration. There are two types of configuration modes each presenting different features: Basic and Advanced.

The Basic Configuration Mode will limit the display to seven of the most commonly modified parameters, while the Advanced Configuration Mode presents all of the available parameters.

Note: All parameters that are enabled are active with their corresponding settings even if the Basic Configuration Mode is currently active. Selecting the Basic Configure mode of operation simply hides the display of certain parameters, but does not disable them.

Basic Configure Mode Menu

Basic Configure Mode Menu	
CONTROL SET POINT =	{-60 to 570}'C
LO TS 1 =	{-60 to 570}'C
LO LOAD =	{0.3 to 100.0} A
SWITCH CONTROL MODE =	{PROPORTIONAL, PROP AMB. SSR, DEADBAND, or PROP AMB. CONTACTOR}
CIRCUIT BREAKER =	{0.3 to 100.0} A (only if SSR is being used)
TEMP UNITS =	{'C or 'F}
FEATURE MODE =	{BASIC or ADVANCED}
LOCK DATABASE	(only if passcode is not 0 and database is unlocked)
UNLOCK DATABASE	(only if passcode is not 0 and database is locked)
---- END ----	

Advanced Configure Mode Main Menu

Menu items with a trailing "..." indicate an entry point to a sub-menu. To enter a sub-menu, use ↑ and ↓ to position the menu item in the display and then press →. Note that the controller "remembers" where you are in the Configure mode if you temporarily switch to a different mode (such as the Monitor mode). Switching back to the Configure mode will return you to the same menu item.

Note: A few of the controller parameters that are often used have been duplicated in the Advanced Configure mode main menu for quick access. These parameters (Lo TS 1, Lo Load, Hi GFI, GFI Trip) may also be accessed using their respective sub-menus.

Advanced Configure Mode Main Menu	
CONTROL SET POINT =	{-60 to 570}'C
LO TS 1 =	{-60 to 570}'C
LO LOAD =	{0.3 to 100.0} A
SWITCH CONTROL MODE =	{PROPORTIONAL, PROP AMB. SSR, DEADBAND, or PROP AMB. CONTACTOR}
CIRCUIT BREAKER =	{0.3 to 100.0} A (only if SSR is being used)
TEMP UNITS =	{'C or 'F}
FEATURE MODE =	{BASIC or ADVANCED}
TS ALARMS CONFIG...	Note that the menu items with a trailing "..."
OTHER ALARMS CONFIG...	indicate the entry point to a sub-menu.
POINT SETUP...	
MISC. SETUP...	
COMMUNICATIONS SETUP...	
LOCK DATABASE	(only if passcode is not 0 and database is unlocked)
UNLOCK DATABASE	(only if passcode is not 0 and database is locked)
---- END ----	

13. CONFIGURATION PARAMETER DETAILS

INTRODUCTION

The Sections that follow explain the various functions of the 915 controller and limiter and describe how they may be accessed. The first line of each Section identifies the function to be described. Each Section goes on to explain the Purpose of the function, the Range over which it may be set, the Procedure for setting or enabling the feature, and finally any Notes or Cautions that pertain to the particular function.

Setting and using the alarming functions of the 915 controller is a two step procedure:

1. The alarm must be enabled or disabled as desired. When using the Operator Console, access to all alarming functions is available using the ADVANCED CONFIGURE mode sub-menus.

2. The corresponding alarm point value may be modified appropriately for the application. When using the Operator Console, access to the alarm points is also available using the ADVANCED CONFIGURE mode sub-menus.

Note: The DigiTrace supervisory software WILL NOT allow modification of an alarm point value if the alarm has been disabled (DIS) with the exception of the HIGH TS ALARM temperature settings. These may still be modified if the corresponding HIGH LIMIT CUTOUT has been enabled (ENA).

14. POINT SETUP PARAMETERS

14.1. Control Set point Temperature

Purpose: The CONTROL SET POINT temperature is the value at which the heat trace controller maintains the circuit temperature. The CONTROL SET POINT temperature is compared to the temperature measured by the control temperature sensor (TS). A decision is then made to turn on or turn off the output to control power to the tracer.

Range: –60 to 570°C

14.2. Alpha-numeric TAG Assignment

Purpose: A 19 character alpha-numeric TAG may be assigned to a control point to allow it to be easily associated with a pipe, vessel, process, circuit, drawing name or number.

Setting: Any combination of 19 characters from A-Z, 0-9, "/", "-", ".", "(", ")" or "#".

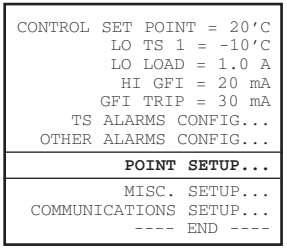
14.3. Switch Control Mode

Purpose: This allows selection of the type of control algorithm to be used by the HTC to maintain the CONTROL SET POINT temperature. There are four different control algorithms available: proportional, proportional ambient SSR, proportional ambient contactor and deadband.

Setting: PROPORTIONAL, PROPORTIONAL AMBIENT SSR , PROPORTIONAL AMBIENT CONTACTOR or DEADBAND

Procedure: Select the desired control technique. Note that deadband control and proportional ambient contactor should be selected when using contactors or when precise control and advanced current handling functions are not required.

Note: If deadband is selected, a DEADBAND setting will be available in the HTC configuration menu, otherwise, a PROPORTIONAL BAND setting will be available. No MAXIMUM POWER, SWITCH CURRENT RATING or CIRCUIT BREAKER CURRENT RATING settings are available when the controller is set to operate in either contactor mode. If proportional ambient contactor is selected, the CYCLE TIME setting will also be available.



"POINT SETUP..." Sub-Menu

The "Point Setup" sub-menu is used to configure parameters that relate directly to the specific control point.

Included in this menu are control mode settings, circuit breaker and switch ratings, auto-cycle set up parameters, etc.

Point Setup Sub-Menu

```
                  TAG = {19 ALPHA-NUMERIC CHARACTERS}
 SWITCH CONTROL MODE = {PROPORTIONAL, PROP AMB. SSR,
                        DEADBAND, OR PROP AMB. CONTACTOR}
             DEADBAND = {1 TO 350}'C  (only if SWITCH CONTROL MODE
                                       is DEADBAND)
            PROP BAND = {1 TO 350}'C  (only if SWITCH CONTROL MODE
                                       is not DEADBAND)
           CYCLE TIME = {10 TO 255} MIN (only if SWITCH CONTROL MODE
                                         is PROP AMB. CONTACTOR)
       SWITCH RATING = {0.3 TO 100.0} A  (only if SSR is being used)
     CIRCUIT BREAKER = {0.3 TO 100.0} A  (only if SSR is being used)
   OUTPUT LIMIT TYPE = {DISABLE OR POWER  (only if SSR is being used)
                       OR CURRENT}
           MAX POWER = {3 W TO 33,000} W (only if SSR is being used)
         MAX CURRENT = {0.3 TO 100.0} A  (only if SSR is being used)
       3 PH PWR CALC = {NO}
        TS FAIL MODE = {OFF OR ON}
         TS CTL MODE = {TS 1-FAIL OFF(ON) OR
                        TS 1-FAIL TO TS 2 OR
                        TS 2-FAIL OFF(ON) OR
                        TS 2-FAIL TO TS 1 OR
                        AVERAGE-FAIL OFF(ON) OR
                        AVERAGE-FAIL TO GOOD OR
                        LOWEST-FAIL OFF(ON) OR
                        LOWEST-FAIL TO GOOD}
      TS 1 HI LIMIT = {ENA OR DIS} (only if 915 Series Limiter is not installed)
      TS 2 HI LIMIT = {ENA OR DIS} (only if 915 Series Limiter is not installed)
    VOLT TURNS RATIO = 1.00 TO 1
 CURRENT TURNS RATIO = 1.00 TO 1
         AUTO-CYCLE = {ENA OR DIS}
AUTO-CYCLE INTERVAL = {1 TO 240}          (only if AUTO-CYCLE = ENA)
   AUTO-CYCLE UNITS = {HOURS OR MINUTES} (only if AUTO-CYCLE = ENA)
    OVERRIDE SOURCE = {REMOTE OR EXT. INPUT}
      LOAD SHEDDING = {ENA OR DIS}
 LIMITER CUTOUT TEMP = {20 TO 450'C} (only if 915 Series Limiter is installed)
LIMITER CURRENT SENSE = {DIS}          (only if 915 Series Limiter is installed)
          ---- END ----
```

14.4. Proportional Band Setting

(For use with the three proportional control modes only).

Purpose: When an HTC equipped with SSRs is used to control a heating circuit, proportional or proportional ambient SSR modes are normally used, allowing for more precise temperature control. When using contactors, the proportional ambient contactor mode should be selected.

This programmable proportional band acts to vary the on to off time of the output based on the difference between the measured control temperature and the desired CONTROL SET POINT temperature.

Range: 1 to 350°C (2 to 630°F)

Procedure: Adjust the PROPORTIONAL BAND setting to the desired differential from the CONTROL SET POINT temperature.

Note: When using heating cables in an ambient temperature control application, significant energy savings may be realized by setting the PROPORTIONAL BAND to match the expected range of operating ambient temperatures. Tracer design is normally done assuming worst-case conditions, where 100% of the design output power is required to maintain the desired minimum temperature. When the ambient temperature is above the design minimum, but some heat is still required, adjusting the PROPORTIONAL BAND width accordingly will allow only the amount of power required by the application to be consumed, while maintaining the minimum required temperature.

14.5. Deadband Setting

Purpose: When an HTC equipped with a contactor is used to control a heating circuit, it is necessary to use deadband rather than proportional control. This is done to prevent the contactor from switching on and off rapidly and being worn out prematurely. This deadband acts as an on/off control where the decision to turn the output off or on is based upon a window of difference between the measured control temperature and the desired CONTROL SET POINT temperature.

Range: 1 to 350°C (2 to 630°F)

Procedure: Adjust the DEADBAND setting to the desired differential from the desired CONTROL SET POINT temperature. When the control temperature is above the set point + deadband value, the controller will turn off the output to the tracer. If the control temperature drops down below the set point, the output will be turned back on. Note that the smaller the DEADBAND setting, the more often the contactor will cycle on and off, decreasing its operational life.

14.6. Cycle Time Setting

(For proportional ambient contactor control mode only).

Purpose: This parameter determines the minimum amount of time it will take for a complete contactor ON-OFF-ON cycle.

Range: 10 to 255 Minutes

Procedure: Adjust the CYCLE TIME setting to yield the desired contactor ON+OFF time for a particular duty cycle. For instance, if the contactor should remain on for 5 minutes with a 50% duty cycle, then the CYCLE TIME should be 10 minutes. A new duty cycle (based on measured control temperature, PROPORTIONAL BAND and CONTROL SET POINT) is calculated every time the contactor is required to change state.

Note: If the calculated duty cycle is 0% or 100%, then the contactor will not change state and the duty cycle will not be calculated again for a time period = CYCLE TIME/30.

Note: The minimum cycle time setting is 10 minutes, and the minimum controller output duty cycle is 3%. This results in a minimum contactor ON time of 18 seconds.

14.7. Switch Current Rating Setting (SSR Only)

Purpose: The SWITCH CURRENT RATING setting defines the current rating of the output switch (SSR only). It is used by the controller to limit the maximum average current that will be allowed to flow to the load before it begins to adjust the output duty cycle, limiting the amount of current to an acceptable level.

Range: 0.3 to 100.0 Amps
(CURRENT TURNS RATIO = 1.00)

Procedure: Adjust the SWITCH CURRENT RATING setting to the match the current rating of the output device. Note that the SWITCH CURRENT RATING setting is affected by the CURRENT TURNS RATIO setting. The absolute maximum adjusted SWITCH CURRENT RATING setting is 300.0 Amps. The absolute minimum adjusted SWITCH CURRENT RATING setting is 0.1 Amps. See elsewhere in this manual to read more about the CURRENT TURNS RATIO function.

14.8. Circuit Breaker Current Rating Setting (SSR Only)

Purpose: The CIRCUIT BREAKER CURRENT RATING setting helps prevent in-rush induced nuisance tripping of the circuit breaker immediately upstream of the controller. The HTC evaluates the square of the current related to time (I2t) and adjusts the output duty cycle accordingly, limiting the amount of current to an acceptable level.
Range: 0.3 to 100.0 Amps
(CURRENT TURNS RATIO = 1.00)

Procedure: Adjust the CIRCUIT BREAKER CURRENT RATING setting to the heating circuit breaker size (i.e. 30.0 Amps).

Important: This feature SHOULD NOT be used to reduce the size of a circuit breaker or increase the maximum heating cable length. It can be quite effective in preventing nuisance trips due to incorrect design or factors outside those considered by the design.

14.9. Output Limit Mode (SSR only)

Purpose: This feature allows the user to limit the maximum amount of power or current that is available to the load.

Setting: DISABLE or POWER or CURRENT

Procedure: Select disable to disable this feature. To have the 915 Control Module limit the average maximum power available to the load, select POWER. To limit the average amount of current available to the load, select CURRENT.

Note: When POWER or CURRENT is selected, the 915 control module will use either the MAX POWER or the MAX CURRENT setting to determine its output duty cycle. See the following sections for details.

14.10. Maximum Power Setting (SSR only)

Purpose: This user selectable level limits the maximum amount of power applied to a heat trace circuit. This is an average power calculated by the controller using the average current and applied voltage. The HTC switches the output on and off rapidly to limit the average power to an appropriate level. The MAXIMUM POWER level may be adjusted to eliminate step-down transformers, lower the effective output wattage of a cable, or implement energy management of the heat trace circuit.

Range: 3 to 33,000 Watts

Procedure: Adjust the MAXIMUM POWER level to the desired value (watts). Use the TEST TRACING function to observe the power limiting operation.
Note: This function may be set within reasonable limits for the particular tracer being powered. The effective resolution of the setting is limited to 1/30th of the calculated full on power.

Note: Do not set the maximum power below full output for applications that do not require power limiting.

14.11. Maximum Current Setting (SSR only)

Purpose: This user selectable level limits the maximum amount of current applied to a heat trace circuit. This is the average current calculated by the controller. The HTC switches the output on and off rapidly to limit the average current to an appropriate level.

Range: 0.3 to 100.0 amps

Procedure: Adjust the MAXIMUM CURRENT level to the desired value (amps). Use the TEST TRACING function to observe the current limiting operation.

Note: This function may be set within reasonable limits for the particular tracer being powered. The effective resolution of the setting is limited to 1/30th of the calculated full on current.

Note: This feature will not limit the instantaneous current in the circuit, only the average current. Do not set the MAXIMUM CURRENT below full output for applications that do not require current limiting.

14.12. 3 Phase Power Calculation

Purpose: This parameter selects the type of power calculation that the HTC is to perform.

Setting: NO or YES

Procedure: If an automatic 3 phase power calculation is desired, select YES. If a normal power calculation is desired, select NO.

Note: For the total 3 phase power calculation to be accurate the following conditions must be met:

- All 3 phases must be balanced and star ("Y") connected
- the measured (corrected) current is one of the phase currents
- the measured (corrected) voltage is the line to line voltage

The formula used to calculate this total power is:

$P_{total} = \sqrt{3} \times I_{phase} \times V_{line\text{-}line}$

14.13. TS Fail Mode

Purpose: This parameter determines whether the HTC turns the output switch ON or OFF if all selected temperature sensors fail to provide a valid control temperature.

Setting: OFF or ON

Procedure: If the HTC should turn the output switch off when it cannot read a valid control temperature, then select OFF, otherwise if the output switch should turn on then select ON.

14.14. Temperature Sensor Control Mode

Purpose: The TS CONTROL MODE allows the selection of one of eleven possible temperature control modes for the controller. The different modes allow redundant fail-safe temperature sensing, averaging, or minimum maintain temperature control.

Setting: Select one of the following eight possible modes:

CONTROL TS & DESCRIPTION

CONTROL USING TS 1, FAIL OFF/ON
CONTROL USING TS 1, FAIL TO TS 2
CONTROL USING TS 2, FAIL OFF/ON
CONTROL USING TS 2, FAIL TO TS 1
CONTROL ON AVERAGE, FAIL OFF/ON
CONTROL ON AVERAGE, FAIL TO GOOD
CONTROL ON LOWEST, FAIL OFF/ON
CONTROL ON LOWEST, FAIL TO GOOD

Where OFF/ON = Controllers' output switch turned OFF or ON as determined by the TS FAIL MODE.

Example: With a TS CONTROL MODE of CONTROL ON AVERAGE, FAIL TO GOOD, the controller will measure both sensors (TS 1 and TS 2), averaging the two temperature values, display the results and cycle the heater ON or OFF to maintain the CONTROL SET POINT temperature. This is the primary control mode. If either sensor should fail, the controller will transfer control to the remaining "good" sensor and generate the appropriate TS 1 or TS 2 FAILURE ALARM (assuming that the alarm is enabled). The temperature will now be maintained based on this measured value. If the remaining "good" sensor fails, the controller will turn the heater OFF or ON as determined by the TS FAIL MODE setting. The appropriate TS 1 or TS 2 FAILURE ALARM will be also be generated.

Procedure: Select the control mode that best suits the application.

Note: Ensure that TS FAILURE ALARMS are enabled. See Section 16 for a complete explanation of RTD failure detection in the HTC.

14.15. Voltage Turns Ratio Adjustment

Purpose: The VOLTAGE TURNS RATIO adjusts voltage readings for applications where a controller is switching a load through a step-up or step-down transformer, or is being powered from a source with a different voltage level than the trace voltage, as is the case for most three phase installations..

Range: 0.10 to 9.90 (TO 1)

Procedure: Adjust the VOLTAGE TURNS RATIO to equal the ratio of the circuit voltage to the controller input voltage. Adjust VTR until the two readings are as close as possible.

e.g.: Heating Circuit Voltage: 480 Volts
Module Input Voltage: 120 Volts
VOLTAGE TURNS RATIO Setting: 4.00

Note: When the VOLTAGE TURNS RATIO has been set appropriately, the HTC will calculate the circuit power using the adjusted current and voltage readings. Voltage alarms also use the adjusted circuit voltages.

14.16. Current Turns Ratio Adjustment

Purpose: The CURRENT TURNS RATIO adjusts current readings for applications where a controller is monitoring a load through an external step-up or step-down current transformer that differs from the standard 100 A to 0.1 A ratio.

Range: 0.10 to 60.00 (TO 1)

Procedure: Adjust the CURRENT TURNS RATIO to equal the ratio of the primary to secondary windings of the external current transformer. After setting of the CURRENT TURNS RATIO adjust until the two readings are as close as possible.

Note: When the CURRENT TURNS RATIO has been set appropriately, the HTC will calculate the circuit power using the adjusted current and voltage readings. Current alarms, as well as the switch and circuit breaker limiting functions also use the adjusted circuit currents.

14.17. Auto-Cycle Enabling

Purpose: The auto-cycle function momentarily (approximately 10 seconds) applies power to the heating circuit at the selected interval. It is used to test the integrity of the heating circuit. Alarms present at the time of auto-cycle then become latched and remain active after the completion of the auto-cycle function. Auto-cycling effectively eliminates the need for preventive maintenance by automatically verifying the heating circuit integrity.

Setting: ENABLE or DISABLE

Procedure: Enable or disable the auto-cycling feature as desired. If the feature is disabled, you will not be prompted to enter the AUTO-CYCLE INTERVAL or AUTO-CYCLE UNITS.

Note: Auto-cycling should always be enabled for normal operation. Disabling this feature should only be required where the HTC system is monitoring a circuit exercised by some other device or means. Although this function defeats temperature control and forces output on, the controller will continue to adjust the output for protection purposes or power limiting (SSR option only).

Note: If auto-cycling is enabled, the HTC will always auto-cycle for 10 seconds when power is initially applied.

Note: If auto-cycling is enabled, and TS FAIL MODE = OFF and all the control temperature sensors have failed, the HTC will still perform an auto-cycle.

Note: If an alarm condition, with an alarm filter time greater than 0, appears during the auto-cycling, then the auto-cycle will be extended (past the 10 seconds) until the alarm filter time has expired.

14.18. Auto-Cycle Time Interval

Purpose: AUTO-CYCLE INTERVAL is the number of hours/minutes between successive heating circuit integrity tests depending on the AUTO-CYCLE UNITS specified.

Range: 1 to 240

Procedure: Set the AUTO-CYCLE INTERVAL to the desired time period.

Note: When using proportional ambient contactor mode, the CYCLE TIME setting should be less than the AUTO-CYCLE INTERVAL otherwise auto-cycling could affect the duty-cycle.

Note: If an AC ALARM becomes active during an auto-cycle, but the AUTO-CYCLE INTERVAL expires prior to the corresponding ALARM FILTER time, then auto-cycling will continue until the ALARM FILTER time has elapsed.

Note: For the earliest possible alarming of heating circuit problems the AUTO-CYCLE INTERVAL should be set to a small value.

14.19. Auto-Cycle Time Units

Purpose: The Auto-cycle time units parameter allows selection of minutes or hours for the AUTO-CYCLE INTERVAL setting.

Setting:
HOURS or MINUTES

Procedure: Set the AUTO-CYCLE UNITS to the desired time units.

14.20. Override Source

Purpose: An override signal can be sent to the HTC from one of two sources. This override signal can be used to override the controller's temperature control and force the output switch OFF or ON or to remotely RESET the limiter. This is especially useful when the user wishes to turn a controller or a group of controllers off over the summer months, during maintenance, or when a line is flowing and does not require heating.

Setting: REMOTE or EXT. INPUT

Procedure: If the override signal will be generated remotely and received by the HTC via the optional communications interface, select REMOTE as the OVERRIDE SOURCE. If the override signal will be received by the HTC via the external input terminals on the 915 Terminal Board, select EXTERNAL INPUT as the OVERRIDE SOURCE.

Note: If the EXTERNAL INPUT is not configured as either INHIBIT or FORCE ON then OVERRIDE SOURCE will always automatically be set to REMOTE.

Note: If the auto-cycle feature is enabled, it will continue to function even when an INHIBIT override signal is being received.

Note: Fail safe mode is inactive if an INHIBIT override signal is being received.

Note: Load shedding and fail safe modes are inactive if a FORCE ON override signal is being received.

Note: Only the LOW TS ALARMS for temperature sensors used by the TS CONTROL MODE are inactive if an INHIBIT override signal is being received.

14.21. Load Shedding Enabling

Purpose: The load shedding function allows the controller output to be forced OFF by way of a command sent from a remote communications device. It may be used to turn OFF the output of one or more controllers in order to reduce energy consumption to avoid peak demand surcharges, remove power from unused circuits, or remove power from circuits which may be subjected to steam cleaning.

Setting: ENABLE or DISABLE

Procedure: Enable or disable the load shedding control mode as desired.

Note: Fail safe mode is not supported when using proportional ambient SSR or proportional ambient contactor modes.

Note: For fail safe mode to operate, at least one LOW TS ALARM of the controlling temperature sensor(s) must be enabled and the corresponding LOW TS ALARM temperature setting must be less than the CONTROL SET-POINT temperature.

14.22 Limiter Cutout Temperature

(This parameter is only available when a 915 Limiter module is connected to the 915 Control Module).

Purpose: this feature sets the 915 Limiter cutout temperature. Under normal operating conditions, the limiter's control output relay is closed, allowing power to be applied to the heating cable. When the limiter's measured temperature exceeds the cutout temperature, the limiter will 'trip', disconnecting power to the heating cable.

Range: –20 to 450°C (–4 to 842°F)

Procedure: Adjust the Limiter Cutout Temperature to the desired value.

Note: The minimum limiter cutout temperature value is dependant upon the 915 HTC's Control Temperature. This minimum temperature is the 915 Control Temperature +10°C. For example, if the 915 Control Temperature is 50°C, the minimum allowed limiter cutout temperature is 60°C.

14.23. Limiter Current Sense

(This parameter is only available when a 915 Limiter module is connected to the 915 Control Module).

Purpose: This setting enables the 915 Limiter Current Sense feature. If enabled, the limiter will not trip even if an over-temperature condition exists when no current is flowing in the heater cable. If limiter current sense is disabled, the limiter will ALWAYS trip when an over-temperature condition is detected.

Setting: ENABLE or DISABLE

Procedure: Enable or disable the Limiter Cutout Temperature feature as desired.

Note: The 915 Control Module LOW LOAD CURRENT alarm must be enabled to access this parameter (see Section 17.1).

Caution: Do NOT enable this feature if the minimum heater load is less than that defined in the limiter's specifications (see Appendix A-2).

15. MISCELLANEOUS SETUP

15.1. Temperature Display Units

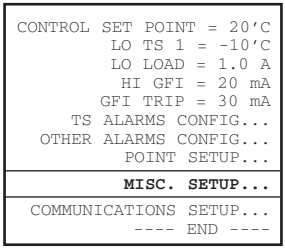
Purpose: This allows selection of the type of temperature units to display when using the Operator Console. All temperature related values will be displayed in the selected units.

Setting: DEGREES C or DEGREES F

Procedure: Adjust the setting to the desired temperature units (°C or °F).

15.2. External Input Port

Purpose: This input port may be used as an OVERRIDE SOURCE to remotely turn the output OFF (INHIBIT), Force the output ON (FORCE ON), or the remotely RESET the limiter (RESET LIMITER). The external input can be provided as a dry contact (NO). This will override the controller's temperature control and force its output to a defined state as configured in the programming.



"MISC. SETUP..." Sub-Menu
The "Misc. Setup" sub-menu is used to configure miscellaneous parameters.

Misc. Setup Sub-Menu

```
          TEMP UNITS =  {'C or 'F}
             VERSION =  V3.16.3
    LIMITER VERSION =  V1.01.28  (only if limiter installed)
         EXT. INPUT =  {NOT USED, INHIBIT, FORCE ON or
                        RESET LIMITER ALARMS}
 FLASH ALARM OUTPUT =  {YES or NO}
       ALARM OUTPUT =  {N.C. or N.O.}
           LANGUAGE =  {ENGLISH, FRANCAIS, DEUTCH, ESPANOL}
           PASSCODE =  {0000 to 9999}
                        (only if 0 or database is unlocked)
       SCROLL DELAY =  {0.07 to 0.25} S
        LOAD DEFAULTS
  Limiter installed =  {NO}
        ---- END ----
```

Setting: NOT USED, INHIBIT, FORCE ON or RESET LIMITER

Note: EXTERNAL INPUT must be set to INHIBIT or FORCE ON before OVERRIDE SOURCE can be set to EXT. INPUT; or INHIBIT CONTROL can be edited.

15.3. Flash Alarm Output Setting

Purpose: Programs the alarm output relays for flashing or steady output in case of an alarm condition.

Setting: YES (Flash) or NO (Steady)

Procedure: Set the alarm output relay to flash or not to flash on an alarm condition, whichever suits the application.

Note: If a pilot light is used for indication of alarms, normally closed operation provides a steady illumination of the lamp when the circuit is operating correctly. A light that is flashing or out indicates a fault condition.

Note: If multiple alarm outputs from different controllers are wired in series (i.e.: multi-point panels), set this parameter to NO (steady).

15.4. Alarm Output Normal State

Purpose: Configures the alarm output relay for normally open or normally closed operation. The normal condition is assumed to be when the HTC is powered and no alarms exist.

Setting: N.O. (Normally Open) or N.C. (Normally Closed)

Procedure: Set the alarm output relays to normally open or normally closed to suit the application.

15.5. Language

Purpose: Defines which language the optional 920 Operator Console is to use when prompting the user for input and/or displaying messages and status.

Setting: ENGLISH, DEUTCH, FRANÇAIS or ESPANOL

15.6. Passcode

Purpose: The four digit, numeric PASSCODE feature stops unauthorized users from modifying the controller's configuration parameters using the Operator Console.

Range: 0000 to 9999

Procedure: Enter the desired PASSCODE (in the "Miscellaneous Setup" sub-menu) using the Operator Console keypad. A PASSCODE of 0000 disables the lockout feature and allows all configuration parameters to be modified using the Operator Console without requiring a passcode. Setting the PASSCODE to any other value will require the database to be unlocked, by entering the correct PASSCODE, prior to modifying any of the controller's configuration parameters using the Operator Console.

Note: The PASSCODE can only be edited if it is set to 0 or the database has been unlocked by entering the proper PASSCODE.

15.7. Lock Database

Purpose: If the PASSCODE has been enabled (PASSCODE is not set to 0) and the user has unlocked console modification access to the controller's configuration parameters, the LOCK DATABASE feature allows the user to re-lock this modification access once programming has been completed.

Procedure: Select the lock database function (at the end of the "Configuration Mode Main Menu") to lock out Operator Console configuration modification access. The display will confirm the operation by displaying a "DATABASE LOCKED" message.

Note: Operator Console configuration modification access will automatically re-lock after approximately 5 minutes of keypad inactivity.

15.8. Unlock Database

Purpose: If a PASSCODE has been enabled (PASSCODE is not set to 0) and the user wants to modify any of the controller's configuration parameters using the Operator Console, then the database must first be unlocked.

Procedure: Try modifying any configuration parameter, or select the UNLOCK DATABASE function (at the end of the "Configuration Mode Main Menu"), and a prompt for the PASSCODE will appear. If the correct PASSCODE is entered then the display will confirm the operation by displaying a "DATABASE UNLOCKED" message.

15.9. Scroll Delay Setting

Purpose: Allows the user to modify the speed at which information is scrolled on the Operator Console for ease of viewing.

Range: 0.07 to 0.25 Seconds

Procedure: Decreasing the scroll delay value will cause the information on the display to scroll by faster. Increasing the scroll delay value will cause the information on the display to scroll by slower.

15.10. Limiter installed

Purpose: Allows the user to install an optional 915 Limiter Module.

Setting: Yes or No

Procedure: Set Limiter installed to yes if a 915 Limiter is connected to the 915 HTC. Once installed, the 915 Control Module will regularly poll the limiter for temperature and current data, making that data available for display on the operator console and to any Modbus Master connected to the communications port. Set Limiter Installed to no if there will be no 915 Series Limiter connected to the 915 HTC .

16. Temperature Alarms

This Section defines the temperature related alarming functions of the 915 controller. These parameters must be set up individually.

16.1. Temperature Sensor 1 Failure Alarm

Purpose: Enabling TS 1 FAILURE will provide indication of an open or shorted failure of TS 1.

Alarm Mask: ENABLE or DISABLE

Procedure: Enable or disable alarming of a failed temperature sensor connected to the TS 1 input as required.

Note: This failure alarm should be enabled if a temperature sensor is connected to the TS 1 input.

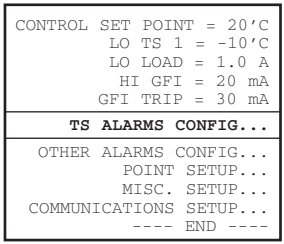
Note: This alarm is always latched and must be reset by the user.

16.2. Low Temperature Sensor 1 Alarm

Purpose: If enabled, the LOW TS 1 ALARM allows for alarming of low temperature conditions as sensed by the temperature sensor (TS 1).

Alarm Mask: ENABLE or DISABLE

Range: –60 to 570°C (–76 to 1058°F)



"TS ALARMS CONFIG..." Sub-Menu

This sub-menu is used to set up alarms that relate to any of the temperature sensors. Each alarm may be ENAbled or DISabled, and if the alarm is ENAbled, an alarm setting may be entered.

TS Alarms Configuration Sub-Menu

```
          TS 1 FAIL = {ENA or DIS}
            LO TS 1 = {ENA or DIS}
            LO TS 1 = {-60 to 570}'C
            HI TS 1 = {ENA or DIS)
            HI TS 1 = {-60 to 570}'C
          TS 2 FAIL = {ENA or DIS)
            LO TS 2 = {ENA or DIS)
            LO TS 2 = {-60 to 570}'C
            HI TS 2 = {ENA or DIS}
            HI TS 2 = {-60 to 570}'C
       LO TS FILTER = {0 to 999} MIN
                      (only if LO TS 1 or 2 are enabled)
       HI TS FILTER = {0 to 999} MIN
                      (only if HI TS 1 or 2 are enabled)
    LATCH TS ALARMS = {YES or NO}
        CTL TS FAIL = {ENA or DIS}
         ---- END ----
```

Procedure: Adjust the LOW TS 1 ALARM temperature set point to the desired value. Note that the LOW TS 1 ALARM must be enabled in order to adjust the LOW TS 1 ALARM temperature set point.

Note: This alarm should normally be enabled and the set point should be appropriate for the heating application. Maintaining a minimum 5 °C differential between low temperature alarming and the CONTROL SET POINT temperature will minimize nuisance alarming due to momentary dips in temperature. Another alternative to this is to configure the controller for non-latching temperature alarms.

Note: This alarm must be enabled and its set point must be below the CONTROL SET POINT temperature if fail safe mode uses the temperature reading from TS 1.

16.3. High Temperature Sensor 1 Alarm

Purpose: If enabled, the HIGH TS 1 ALARM allows for alarming of high temperature conditions as sensed by the first temperature sensor (TS 1).

Alarm Mask:
ENABLE or DISABLE

Range: –60 to 570°C (–76 to 1058°F)

Procedure: Adjust the HIGH TS 1 ALARM temperature set point to the desired value. Note that the HIGH TS 1 ALARM must be enabled in order to adjust the HIGH TS 1 ALARM temperature set point unless the TS 1 HIGH LIMIT CUTOUT feature is enabled.

Note: This alarm should only be used for applications where a product that is sensitive to over temperature is involved. General usage may result in nuisance alarms due to the flow of hot product or steam out. This may be a case where the alarm should be enabled and non-latching temperature alarming should be used. A high temperature condition resulting from a forced on failure of the heating circuit should first be alarmed by the SWITCH FAILURE ALARM. See Section 17.12 for more information.

16.4. Temperature Sensor 2 Failure Alarm

Purpose: Enabling TS 2 FAILURE will provide indication of an open or shorted failure of TS 2.

Alarm Mask: ENABLE or DISABLE

Procedure: Enable or disable alarming of a failed temperature sensor connected to the TS 2 input as required.

Note: If no second sensor is installed, this alarm should be disabled. This failure alarm should be enabled if a second temperature sensor is connected to the TS 2 input.

Note: This alarm is always latched and must be reset by the user.

16.5. Low Temperature Sensor 2 Alarm

Purpose: If enabled, the LOW TS 2 ALARM allows for alarming of low temperature conditions as sensed by the second temperature sensor (TS 2).

Same procedure to be applied as for Sensor 1 (TS 1).

16.6. High Temperature Sensor 2 Alarm

Purpose: If enabled, the HIGH TS 2 ALARM allows for alarming of high temperature conditions as sensed by the second temperature sensor (TS 2).

Same procedure to be applied as for Sensor 1 (TS 1).

16.7. LOW / HIGH Temperature Sensor Alarm Filter Time Setting

Purpose: The LOW / HIGH TS ALARM FILTER will prevent LOW / HIGH TS 1 and/or LOW / HIGH TS 2 ALARMS from being indicated until their corresponding alarm condition has existed for the duration of the LOW / HIGH TS ALARM FILTER time.

Range: 0 to 999 Minutes

Procedure: Adjust the LOW / HIGH TS ALARM FILTER time to the desired value. Note that either the LOW / HIGH TS 1 ALARM and/or the LOW / HIGH TS 2 ALARM must be enabled in order to adjust the LOW / HIGH TS ALARM FILTER time.

Note: If an alarm condition appears and then disappears before the alarm filter time has expired, the filter timer is reset and the alarm condition must exist again for the entire alarm filter time before the corresponding alarm will be indicated.

Note: If the user resets an alarm while the alarm condition is still exists, then the alarm will not be indicated again until the entire alarm filter time has expired.

16.8. Latch Temperature Sensor Alarms Setting

Purpose: This allows for the selection of automatic clearing of all HIGH and LOW TS ALARMS (non-latching) when a temperature alarm condition no longer exists or permanent alarming of such a condition (latching) until the alarm is manually reset.

Setting: YES (LATCHING) or NO (NON-LATCHING)

Procedure: Adjust the LATCH TS ALARMS setting to the desired mode (latching or non-latching).

Note: If your application is subject to periodic situations where cold or hot product is part of the process, it may be appropriate to configure the HTC for non-latching temperature alarms to avoid nuisance alarms. If it is important to be aware of any temperature alarm conditions that may have existed in a pipe, then the HTC should be configured for latching temperature alarms.

Note: This setting does not affect the TS FAILURE ALARMS -- these are always latching.

16.9. Control Temperature Sensor Failure Alarm

Purpose: CONTROL TS FAILURE ALARM indicates a failure of the temperature sensor designated as the control sensor.

One of eight TS CONTROL MODES may be selected. These modes determine which TS input(s) are designated to provide the control temperature.

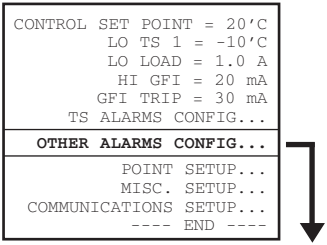
Alarm Mask: ENABLE or DISABLE

Procedure: Enable or disable the alarming of a failure of the designated control temperature sensor as required.

Note: This alarm should always be enabled. If the controller experiences a CONTROL TS FAILURE it will turn the output OFF or ON (as specified by TS FAIL MODE) until this alarm is cleared.

17. OTHER ALARMS

This Section defines the non-temperature related alarming functions of the 915 Control System (current, ground fault, voltage and resistance). Many of the alarms described below offer the possibility to declare an ALARM FILTER time. This setting helps to prevent nuisance alarms by requiring that alarm conditions be present for the complete duration of the value specified in the ALARM FILTER time setting.



"OTHER ALARMS CONFIG..." Sub-Menu

This sub-menu allows the user to set up all alarms that do not directly relate to the temperature sensors. These include all AC alarms (voltage current, ground fault, etc.) as well as protection settings such as power limiting, etc. Each alarm may be ENAbled or DISabled. If the alarm is ENAbled, an alarm setting and filter setting may be entered.

Other Alarms Configuration Sub-Menu

```
          LO LOAD = {ENA or DIS}
          LO LOAD = {0.3 to 100.0} A
   LO LOAD FILTER = {0 to 12} S
          HI LOAD = {ENA or DIS}
          HI LOAD = {0.3 to 100.0} A
   HI LOAD FILTER = {0 to 12) S
           HI GFI = {ENA or DIS}
           HI GFI = {20 to 250} mA
    HI GFI FILTER = {0 to 12} S
         GFI TRIP = {ENA or DIS}
         GFI TRIP = {20 to 250} mA
          LO VOLT = {ENA or DIS}
          LO VOLT = {10 to 330} V
   LO VOLT FILTER = {0 to 12} S
          HI VOLT = {ENA or DIS}
          HI VOLT = {10 to 330} V
   HI VOLT FILTER = {0 to 12} S
        LO RESIST = {ENA or DIS}
        LO RESIST = {1 to 100} %
 LO RESIST FILTER = {0 to 12} S
        HI RESIST = {ENA or DIS}
        HI RESIST = {1 to 250} %
 HI RESIST FILTER = {0 to 12} S
   NOMINAL RESIST = {2.00 to 2000.00} Ω
                                    (only if LO or HI is enabled)
 OVERCURRENT TRIP = {ENA or DIS}  (only if SSR is being used)
      SWITCH FAIL = {ENA or DIS}
        HTC RESET = {ENA or DIS}
    C.B. LIMITING = {ENA or DIS}  (only if SSR is being used)
  OUTPUT LIMITING = {ENA or DIS}  (only if SSR is being used)
  SWITCH LIMITING = {ENA or DIS}  (only if SSR is being used)
  CONTACTOR COUNT = {ENA or DIS}  (only if Deadband or Prop. Amb.
                                   Contactor are being used)
  CONTACTOR COUNT = {0 to 999999}(only if Deadband or Prop. Amb.
                                   Contactor are being used)
  EEROM DATA FAIL = {ENA or DIS}
      ---- END ----
```

Note: If an alarm condition appears and then disappears before the alarm filter time has expired, the filter timer is reset and the alarm condition must exist again for the entire alarm filter time before the corresponding alarm will be indicated.

Note: If the user resets an alarm while the alarm condition is still exists, then the alarm will not be indicated again until the entire alarm filter time has expired.

17.1. High and Low Load Current Alarm

Purpose: Alarms current levels which are out of the preset range suitable for the application.

Alarm Mask: ENABLE or DISABLE

Range: 0.3 to 100.0 Amps
(CURRENT TURNS RATIO = 1.00)

Procedure: Adjust the HIGH / LOW CURRENT ALARM level to the desired value. Note that the LOW / HIGH CURRENT ALARM must be enabled in order to adjust the CURRENT ALARM level. Also note that the CURRENT ALARM level is affected by the CURRENT TURNS RATIO setting. The absolute maximum adjusted LOW CURRENT ALARM level is 300.0 Amps. The absolute minimum adjusted LOW CURRENT ALARM level is 0.1 Amps

Note: For series type heating cables, adjusting the LOW CURRENT ALARM to 50% of full load current will properly alarm a problem and reduce nuisance alarms due to voltage dips. Parallel heaters should be adjusted to a level as close as possible to full load current but lower than the current at worst case voltage. The low current setting as a percentage of full load current will vary depending on the facility and its power system.

Note: A LOW CURRENT ALARM may also result from a switch failed open. The controller cannot detect a switch failure due to no current therefore, a no current condition would be identified by a LOW CURRENT ALARM (if enabled) and a reported valve of 0.0 A.

17.2. Load Current Alarm Filter Time Setting

Purpose: The CURRENT ALARM FILTER will prevent LOW /HIGH LOAD CURRENT ALARMS from being indicated until a LOW / HIGH current condition has existed for the duration of the LOW / HIGH CURRENT ALARM FILTER time.

Range: 0 to 12 Seconds

17.3. High Ground Fault Current Alarm

Purpose: Alarms ground fault current levels which are higher than a preset limit for the application.

Alarm Mask:
ENABLE or DISABLE

Range: 10 to 250 mAmps

Procedure: Adjust the HIGH GFI ALARM level to the desired value. Note that the HIGH GFI ALARM must be enabled in order to adjust the HIGH GFI level.

17.4. High Ground Fault Current Alarm Filter Time Setting

Purpose: The HIGH GFI ALARM FILTER will prevent HIGH GFI ALARMS from being indicated until a high GFI condition has existed for the duration of the HIGH GFI ALARM FILTER time.

Range: 0 to 12 Seconds

17.5. Ground Fault Trip Alarm

Purpose: This value sets the upper limit of allowable ground fault leakage current. Exceeding this limit will result in the output switch being latched off and the GFI TRIP ALARM activated to indicate a ground fault condition.

Procedure: If ground fault tripping is desired, enable the GFI TRIP ALARM and adjust the G.F. TRIP CURRENT to the desired value. To disable ground fault tripping, disable the alarm. Note that the GFI TRIP ALARM must be enabled in order to adjust the G.F. TRIP CURRENT level.

CAUTION: IN ORDER TO IMPLEMENT A GROUND FAULT TRIP FUNCTION, ALL NON-GROUNDED POWER CONDUCTORS MUST BE OPENED UPON DETECTION OF A GROUND FAULT CONDITION.

Range: 10 to 250 mAmps

Note: National Electrical Codes require that all legs of non-neutral based power sources be opened upon detection of a Ground Fault. Multi-pole switch configurations should be used on non-neutral based power systems. Check the requirements with your local Electrical Authority.

CAUTION: This function cannot be used for personnel protection. Only use correctly dimensioned ELCB (RCD) for this purpose.

17.6. Low and High Voltage Alarm

Purpose: Alarms voltage levels which are out of a preset band suitable for the application.

Procedure: Individually adjust the settings of the LOW and HIGH VOLTAGE ALARM level to the desired value. Note that the LOW / HIGH VOLTAGE ALARM must be enabled in order to adjust the LOW / HIGH VOLTAGE ALARM level. Also note that the LOW / HIGH VOLTAGE ALARM level is affected by the VOLTAGE TURNS RATIO setting.

17.7. Low and High Voltage Alarm Filter Time Setting

Purpose: The LOW / HIGH VOLTAGE ALARM FILTER will prevent VOLTAGE ALARMS from being indicated until an out of range voltage condition has existed for the duration of the LOW / HIGH VOLTAGE ALARM FILTER time.

Range: 0 to 12 Seconds

17.8. High and Low Resistance Alarm

Purpose: Alarms heater resistance levels which have increased / decreased from the NOMINAL RESISTANCE setting by more than the selected amount.

Procedure: Adjust the HIGH / LOW RESISTANCE ALARM deviation to the desired value. Note that the HIGH AND LOW RESISTANCE ALARM must be enabled in order to adjust the RESISTANCE deviation.

Note: This feature would not normally be enabled. It can be used effectively to guard against accidental paralleling of heating circuits. Care must be taken when using this alarm feature with heating cables that exhibit a variable resistance with temperature. Resistance alarming may not be practical when the load has an increasing resistance with temperature (such as self-regulating cables).

Note: Use of the RESISTANCE ALARM assumes that the controller power is derived from the same circuit as the tracing power (either by direct connection or through a step-down transformer).

Disable this alarm if the controller is powered from a separate circuit.

Note: No LOW RESISTANCE ALARMS will be generated if the measured voltage is below the LOW VOLTAGE ALARM set point, regardless if the LOW VOLTAGE ALARM is enabled. This stops an alarm from being generated when the circuit power is turned off. If the LOW VOLTAGE ALARM is disabled, ensure that the LOW VOLTAGE set point is set to a relevant level otherwise no LOW RESISTANCE ALARMS will occur.

Note: LOW RESISTANCE ALARMS will only be generated if the output switch is on.

17.9. High and Low Resistance Alarm Filter Time Setting

Purpose: The HIGH/LOW RESISTANCE ALARM FILTER will prevent RESISTANCE ALARMS from being indicated until a HIGH / LOW OR low resistance condition has existed for the duration of the RESISTANCE ALARM FILTER time.

17.10. Nominal Resistance Setting

Purpose: This parameter defines the nominal expected heater resistance. A value must be entered by the user to allow the HIGH and LOW RESISTANCE ALARMS to be used. In installations where the power source may experience periodic fluctuations (surges and/or brown-out conditions), alarming on resistance deviation offers an improved method of monitoring tracer integrity than simple LOW and HIGH CURRENT ALARMS. Since the ratio of voltage to current is monitored, the HIGH and LOW RESISTANCE ALARMS offer cable monitoring that is relatively immune to voltage fluctuations.

Procedure: The NOMINAL RESISTANCE value can only be set if either the LOW RESISTANCE and/or the HIGH RESISTANCE ALARMS are enabled. Once the controller and the heating cable have been installed, the following procedure should be used to determine the NOMINAL RESISTANCE setting:

- Adjust the CONTROL SET POINT temperature to turn on the output switch.
- Allow the load to come up to design temperature and its power consumption to stabilize.
- Read the current resistance value from the monitor menu
- Enter the recorded resistance value as the NOMINAL RESISTANCE setting.

Note: The setup procedure outlined above may have to be repeated a number of times to arrive at a correct nominal resistance setting. This value will be affected by the heating cable temperature, which in turn is affected by ambient temperature, insulation level, a full or empty pipe or vessel, etc.

17.11. Overcurrent trip alarm (SSR only)

Purpose: The overcurrent trip feature is always enabled when using an SSR output switch and is used to provide protection for the output switch. Enabling this alarm will only inform the user of an excessively high current condition and that the output switch has been latched OFF. During a high current condition, the controller attempts to soft start a heating cable using a technique involving measured in-rush current and the SWITCH CURRENT RATING. If the controller is unable to start the cable, it will eventually trip its output switch OFF and will not retry or pulse its output switch again. At this point the OVERCURRENT TRIP ALARM is latched ON.

Note: The controller is NOT a safety cutout or an overcurrent protective device as defined by the Electrical standards for protection. A protective device such as a circuit breaker or fuse must be included as part of a proper design and be selected in accordance with the requirements defined in the local standards.

Note: The controller cannot protect the SSR from short circuits or excessive overcurrent conditions. Always ensure that the power is off prior to performing any maintenance or troubleshooting of the heating circuit. Verify that no damage has occurred to the cable or the controller prior to re-energizing the circuit.

Procedure: Adjust the SWITCH CURRENT RATING setting to the actual current rating of the SSR. Enable or disable the alarm as required. Note that the OVERCURRENT TRIP ALARM does not have to be enabled in order to adjust the SWITCH CURRENT RATNG setting.

Note: It is highly recommended that this alarm be left enabled since an overcurrent trip condition would normally represent a serious problem. NOTE that this is a factory set alarm value and disabling the alarm does not disable the overcurrent trip function. In some applications the use of self-regulating cable will produce very high in-rush currents during cold startup. These currents may exceed the overcurrent trip limit and the controller will not be able to soft start the trace circuit.

17.12. Switch Failure Alarm

Purpose: The purpose of the SWITCH FAILURE ALARM is to indicate that an output switch failure has occurred. The controller determines that if the output switch is turned OFF and there is load current present, then the output switch has failed closed and the alarm is latched on.

Procedure: Enable or disable the alarming of an output switch that has failed in the closed position.

Note: The SWITCH FAILURE ALARM SHOULD ALWAYS BE ENABLED. A high temperature condition as a result of a failed circuit can only be caused if the output switch fails closed. When an output switch fails closed, the controller cannot turn the tracer power off, therefore no protection features are available (ground fault trip, power limiting, etc.). If a SWITCH FAILURE ALARM is detected, the unit should be serviced immediately.

17.13. HTC Reset Alarm

Purpose: The HTC RESET ALARM is used to indicate:

1. Power to the HTC has been interrupted and subsequently restored.
2. A transient has caused the HTC's micro- processor to restart.
3. An internal condition has caused the HTC's micro-processor to restart its program.

Procedure: Enable or disable alarming on reset as desired.

Note: Normally the HTC RESET ALARM is left disabled since powering the controller off and on for maintenance or trouble-shooting would require the user to reset this alarm every time. If the particular installation includes supervisory software, this alarm may be left enabled since resets are not considered normal occurrences and the software provides the capability to easily log and reset alarms such as these. The difference in time between when a COMMUNICATIONS FAIL ALARM and an HTC RESET ALARM are logged provide an indication of how long the circuit has been "OFF".

17.14. Circuit Breaker Limiting Status (SSR Only)

Purpose: The circuit breaker limiting feature is always enabled when using an SSR output switch and is intended to prevent the circuit breaker immediately upstream of the controller from tripping during a temporary overcurrent condition. Enabling this alarm will only inform the user that circuit breaker limiting is currently active.

Procedure: Adjust the CIRCUIT BREAKER CURRENT RATING setting to the heating circuit breaker size (i.e. 15.0 or 20.0 Amps). Enable or disable the alarm as required. Note that the CIRCUIT BREAKER LIMITING ALARM does not have to be enabled in order to adjust the CIRCUIT BREAKER CURRENT RATING setting.

Note: This is a non-latching alarm.

Note: This alarm may be considered an advisory alarm. If the measured current exceeds the level that would cause the upstream circuit breaker to release, the HTC will begin to switch the SSR ON and OFF rapidly to limit the average current to an acceptable level.

17.15. Output Limiting Status (SSR Only)

Purpose: The output limiting feature is intended to limit the average amount of power or current that is applied to the trace circuit. The controller measures the voltage and/or current of the tracing circuit and will vary its output switch to limit the amount of power or current applied to the trace to the value set by the MAXIMUM POWER or the MAXIMUM CURRENT settings. Enabling this alarm will only inform the user that output limiting is currently active.

Procedure: Adjust the MAXIMUM POWER or MAXIMUM CURRENT setting to the desired value. Enable or disable the alarm as required. Note that the OUTPUT LIMITING ALARM does not have to be enabled in order to adjust the MAXIMUM POWER or MAXIMUM CURRENT settings.

Note: This is a non-latching alarm.

Note: This alarm may be considered more appropriately an advisory alarm and is normally disabled. It will be active if the MAXIMUM POWER or MAXIMUM CURRENT setting is set below the power output level required for temperature maintenance. In other words, if the circuit demands the maximum power or CURRENT allowed and the alarm is enabled, then this alarm will be indicated.

17.16. Switch Limiting Status (SSR Only)

Purpose: The switch limiting feature is always enabled when using an SSR output switch and is intended to provide protection for the output switch. Enabling this alarm will only inform the user that switch limiting is currently active and an excessively high current condition is present. The controller pulses its output switch for a small number of cycles and reads the resulting current. If the measured current exceeds the SWITCH RATING setting, then the duty-cycle of its output switch will be varied so that an average current not exceeding the SWITCH RATING setting is maintained.

Procedure: Adjust the SWITCH CURRENT RATING setting to the actual current rating of the SSR. Enable or disable the alarm as required. Note that the SWITCH LIMITING ALARM does not have to be enabled in order to adjust the SWITCH CURRENT RATING setting.

Note: This is a non-latching alarm.

Note: This alarm should normally be left enabled. Currents in this range cannot be considered normal and should be investigated.

17.17. Contactor Count Alarm

Purpose: Generates an alarm if the number of off-to-on transitions of a contactor reaches or exceeds the CONTACTOR COUNT ALARM setting. This serves as a method to perform preventative maintenance on the contactor before a failure is likely to occur.

Procedure: Adjust the CONTACTOR ALARM setting to the desired value. Note that the CONTACTOR ALARM must be enabled in order to adjust the CONTACTOR ALARM setting.

Note: The CONTACTOR ALARM is only available if the SWITCH CONTROL MODE is set to either DEADBAND or PROPORTIONAL AMBIENT CONTACTOR.

17.18. EEROM Data Failure Alarm

Purpose: The EEROM DATA FAILURE ALARM indicates that the controller has detected a failure in its non-volatile memory.

Procedure: Enable or disable alarming of a non-volatile memory failure as desired.

Note: The EEROM DATA FAILURE ALARM should always be enabled. This memory stores all of the controller's configuration and calibration settings and the alarm will only be generated if the microprocessor cannot bypass the failed area of its memory. This indicates an internal problem and the 915 Control Module should be replaced and returned to the Factory for repair.

18. COMMUNICATIONS SETUP

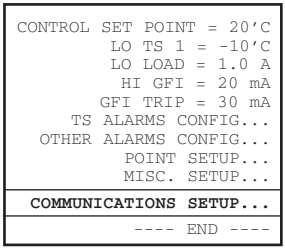
The following Section describes the setup parameters that relate to the way in which the controller is to communicate with another device usually a communications controller, a DCS system or a computer.

18.1. Protocol

Purpose: Defines the communications language used by the controller to communicate with other devices.

Setting: MODBUS ASCII or MODBUS RTU

For a detailed description of the controller's MODBUS mapping please refer to 915 Series Heat Trace Controller - Modbus Protocol Interface" document.



"COMMUNICATIONS SETUP..." Sub-Menu
The settings found in this sub-menu must be configured whenever an optional communications board is installed in the Control Module.

Communications Setup Sub-Menu

```
          PROTOCOL = {MODBUS ASCII or MODBUS RTU}
       MODBUS ADDR = {1 to 247}
   MODBUS SUB ADDR = {0 to 31}
         BAUD RATE = {AUTO or 9600 or 4800 or 2400 OR
                      1200 or 600 or 300}
            PARITY = {NONE or ODD or EVEN}
          TX DELAY = {0.00 to 2.50} S
       ---- END ----
```

18.2. MODBUS Address

Purpose: The MODBUS ADDRESS along with the MODBUS SUB ADDRESS define the communications address to be used by the controller when using either MODBUS protocol to communicate with a MODBUS compatible device.

Procedure: Set the communications address as desired. Together with the MODBUS SUB ADDRESS, this combination must be unique to the entire communications network to avoid messaging conflicts. Either MODBUS protocol must be selected in order to set the MODBUS ADDRESS.

18.3. MODBUS Sub Address

Purpose: The MODBUS SUB ADDRESS along with the MODBUS ADDRESS define the communications address to be used by the controller when using either MODBUS protocol to communicate with a MODBUS compatible device.

Procedure: Set the communications sub address as desired. Together with the MODBUS ADDRESS, this combination must be unique to the entire communications network to avoid messaging conflicts. Either MODBUS protocol must be selected in order to set the MODBUS SUB ADDRESS.

Note: Since a 915 controller does not use all 65,535 data registers that are available for each MODBUS ADDRESS, the data register range is sub divided to allow up to 32 HTCs to share the same MODBUS ADDRESS. This increases the number of HTCs allowed on a single Modbus port from 247 to 7,904 (= 247 x 32). This requires that any HTC sharing the same MODBUS ADDRESS as another HTC must have its own unique MODBUS SUB ADDRESS.

18.4. Baud Rate

Purpose: Defines the data rate at which communications occur.

Setting: 9600 or 4800 or 2400 or 1200 or 600 or 300

Procedure: Select the data rate to be compatible with other devices that will be connected to the controller for communications purposes.

18.5. Parity (Modbus)

Purpose: Defines the type of parity bit to be used with MODBUS communications.

Setting: NONE or ODD or EVEN

Procedure: Select the desired type of parity. Note that PARITY can only be selected when using either MODBUS protocol.

18.6. Tx Delay

Purpose: Allows a programmable delay between the receipt of a communications message and the controller's reply. In some applications, it may be necessary to delay the controller's response to an inquiry for a short period of time to allow external devices to start up, stabilize and/or synchronize.

Range: 0.00 to 2.50 Seconds

Procedure: Set the amount of delay between the receipt of a message and the controller's response as required.

19. MONITORED PARAMETER

INTRODUCTION

The following text provides a brief summary of each of the measured and calculated parameters that the 915 Series Control Module provides to the user. Detailed information regarding settings, alarms limits, etc. can be found elsewhere in this manual..

19.1. Control Temperature

This is the temperature that the controller uses to determine whether its output switch should be on or off, depending on the TS CONTROL MODE

19.2. TS 1 Temperature

This temperature is the value that the controller is reading from the RTD connected to its TS 1 input.

19.3. TS 2 Temperature

This temperature is the value that the controller is reading from the RTD connected to its TS 2 input.

19.4. Load Current

The LOAD CURRENT reading indicates the average current being drawn by the heating cable.

Note: The controller calculates the LOAD CURRENT using the current sensed by the CURRENT TRANSFORMER module multiplied by the CURRENT TURNS RATIO to yield an adjusted current value.

19.5. Resistance

Resistance is calculated using the average adjusted voltage reading divided by the average adjusted current reading to yield a load resistance in ohms. If the controller's output switch is on, but no current is present, the RESISTANCE will read "open circuit".

19.6. Ground Fault Current

If the controller detects any leakage current in the output circuit, it will indicate the level in milliamps.

Note: To minimize nuisance alarms, the controller will not report a leakage current of less than 10 mAmps.

19.7. Voltage

The voltage reading indicates the average circuit voltage being measured by the 915.

Note: The controller calculates this parameter using the voltage sensed by the 915 and multiplying it by the VOLTAGE TURNS RATIO to yield an adjusted voltage value.

19.8. Power

Load power provides an indication of the average power being consumed by the heat trace cable or the total 3 phase power being consumed by a balanced 3 phase star ("Y") connected load.

Note: The controller calculates load power by multiplying the average adjusted voltage reading by the average adjusted current reading.

Note: The controller may be set up to calculate total 3 phase power for a balanced star ("Y") connected load if the 3 PHASE POWER CALCULATION parameter is enabled. In this case, total 3 phase power is calculated using the following equation:

$P_{total} = \sqrt{3} \times I_{phase} \times V_{line\text{-}line}$

Where Iphase = the adjusted phase current being measured, and
Vline-line = the adjusted voltage reading being measured. The VOLTAGE and CURRENT TURNS RATIOS affect both calculations.

20. MAINTENANCE DATA

Max / Min Temperature Values
MAX CONTROL TEMP
MIN CONTROL TEMP
TS 1 MAX TEMP
TS 1 MIN TEMP
TS 2 MAX TEMP
TS 2 MIN TEMP
LIMITER TS MIN TEMP (only if limiter is installed)
LIMITER TS MAX TEMP (only if limiter is installed)

This feature indicates the maximum and minimum temperatures recorded by the HTC since the last time the values were reset The temperature values are written to the controller's non-volatile memory once every 24 hours or whenever any maintenance data is reset by the user

Power Accumulator
This feature indicates the total power consumption of the trace circuit since the last time the POWER ACCUMULATOR was reset The value of this accumulator is written to the controller's non-volatile memory once every 24 hours or whenever any maintenance data is reset by the user.

Note: The POWER ACCUMULATOR value will roll over to zero when the upper limit of the POWER ACCUMULATOR has been exceeded. This upper limit is 214,748,364.7 kW-hours.

20.1. Contactor Cycle Counter

This feature indicates the total number of off-to-on transitions a contactor has made since the last time the CONTACTOR CYCLE COUNTER was reset. This serves as a method to perform preventative maintenance on the contactor according to the manufacturer's specifications. This count value is written to the controller's non-volatile memory once every 24 hours or whenever any maintenance data is reset by the user.

Note: Once the CONTACTOR CYCLE COUNTER reaches 999,999,999 it will stop counting.

Note: The CONTACTOR CYCLE COUNTER is only indicated if the SWITCH CONTROL MODE is set to either DEADBAND or PROPORTIONAL AMBIENT CONTACTOR.

20.2. Time In Use

The purpose of this feature is to indicate the total hours in use of the controller since its initial operation The value of this accumulator is written to the controller's non-volatile memory once every 24 hours or whenever any maintenance data is reset by the user.

Note: The IN USE hours accumulator value will roll over to zero when the upper limit of the accumulator has been exceeded. This limit is 999,999,999 hours.

20.3. Time Since Last Reset

This feature indicates the total hours in use of the controller since the last reset.

Note: The TIME SINCE LAST RESET will roll over to zero when the upper limit of 65,535 hours has been exceeded.

20.4. Peak Load Current

This feature indicates the highest instantaneous load current measured since the last time the PEAK LOAD CURRENT was reset. This value is written to the controller's non-volatile memory once every 24 hours or whenever any maintenance data is reset by the user.

The PEAK LOAD CURRENT may only be reset to zero using a communicating device.

20.5. Peak Ground Fault Current

This feature indicates the highest instantaneous ground fault current measured since the last time the PEAK GROUND FAULT CURRENT was reset. This current value is written to the controller's non-volatile memory once every 24 hours or whenever any maintenance data is reset by the user.

Procedure: The PEAK GROUND FAULT CURRENT may only be reset to zero using a communicating device.

21. CONTROL MODES

INTRODUCTION

There are several different types of control modes in the controller. Some of these modes require further explanation in order to fully understand and implement their operation.

This Section describes the functionality of the control modes available in the HTC and how to set their associated parameters.

SWITCH CONTROL MODES

There are four different SWITCH CONTROL modes associated with the HTC. The following is an explanation of their implementation in the controller and the differences between them.

21.1. Proportional Control (for use with SSRs ONLY)

Proportional control on the HTC is implemented as follows:

- When using SSRs to directly control the power applied to a trace circuit, the output may be switched on/off very rapidly. The controller implements proportional temperature control on a cycle by cycle basis (50 or 60 Hz power line cycle).
- This algorithm monitors the temperature of the heating circuit and compares it to the CONTROL SET POINT temperature. If the temperature of the control sensor is at or below the CONTROL SET POINT temperature, then power is applied to the trace with a duty cycle of 100% -- the controller output is full on.
- If the temperature sensed by the control sensor is equal to or greater than the CONTROL SET POINT temperature + the PROPORTIONAL BAND setting, then the controller output will have a duty cycle of 0% -- the output will be off.
- The temperature of the control sensor is constantly monitored and the output duty cycle is adjusted proportionally according to where the temperature falls within the 0% - 100% band.

Proportional Control Temperature Band

Control Sensor Temperature	**Duty Cycle**
Setpoint + proportional band	0%
Setpoint + proportional band/2	50%
Set point	100%

21.2. Deadband Control (for use with external contactors)

Deadband control on the HTC is implemented as follows:

- When using the HTC in an application where the controller is used to open and close a contactor, proportional control cannot be used since this would cycle the contactor too quickly. In these situations, a deadband control algorithm is used. The output duty cycle is not controlled, instead the output is either fully on or completely off. The user may set the DEADBAND value.

- The controller monitors the temperature of the trace circuit and compares it to the CONTROL SET POINT temperature as in the proportional control mode. If the control sensor temperature is above the CONTROL SET POINT temperature by more than the DEADBAND value, the output is turned off.
- If the control sensor temperature falls below the CONTROL SET POINT temperature the output is turned on.

This is a very simple control algorithm but it works very effectively in heat trace applications where the temperature of a traced system changes relatively slowly.

Deadband Control Temperature Band

Control Sensor Temperature	**Output State**
Setpoint+deadband	Off
Set point	On

When the control sensor temperature is within the deadband, the output does not change its state. Also, when using deadband control, a contactor is not allowed to toggle faster than every 2 seconds. If an AC alarm with an alarm filter time greater than 0 is detected, the contactor will not toggle until the alarm filter time has expired.

21.3. Proportional Ambient SSR Control (for use with SSRs ONLY)

When an HTC using an SSR is used to control the output using the ambient temperature, this control mode should be used.

Proportional ambient SSR control on the HTC is implemented as follows:

- When using SSRs to directly control the power applied to a heating circuit, the output may be switched on/off very rapidly. The controller implements proportional temperature control on a cycle by cycle basis (50 or 60 Hz power line cycle).
- This algorithm monitors ambient temperature and compares it to the CONTROL SET POINT temperature. If the temperature of the control sensor is at or below the CONTROL SET POINT temperature minus the PROPORTIONAL BAND setting, then power is applied to the trace with a duty cycle of 100% -- the controller output is fully on.

- If the temperature sensed by the control sensor is equal to or greater than the CONTROL SET POINT temperature, then the output will have a duty cycle of 0% -- the controller output will be off.
- The temperature of the control sensor is constantly monitored and the output duty cycle is adjusted proportionally according to where the temperature falls within the 0% - 100% band.

Proportional Ambient SSR Control Temperature Band

Control Sensor Temperature	**Duty Cycle**
Set point	0%
Set point-proportional band/2	50%
Set point-proportional band	100%

Note: The load shedding "fail safe mode" is not supported when using proportional ambient SSR control, since ambient temperature is being monitored rather than pipe temperature.

21.4. Proportional Ambient Contactor Control (for use with external contactors)

When an HTC using a contactor is used to control the output based on the ambient temperature, this control mode should be used.

Proportional ambient contactor control on the HTC is implemented as follows:

- The output may not be switched on/off rapidly when using a contactor, so proportional temperature control is implemented by applying the required duty cycle over the selected CYCLE TIME.
- The output is fully on for a portion of the CYCLE TIME as determined by the calculated duty cycle, and it will be completely off for the remainder of the CYCLE TIME.
- The duty cycle is calculated each time the output toggles, based on the ambient temperature, PROPORTIONAL BAND setting and the CONTROL SET POINT temperature setting.
- The controller monitors the ambient temperature and compares it to the CONTROL SET POINT temperature as in proportional ambient SSR control. If the temperature of the control sensor is at or below the CONTROL SET POINT temperature minus the PROPORTIONAL BAND setting, then power is applied to the trace with a duty cycle of 100%. The controller output will be fully on for 1/30th of the CYCLE TIME setting before the duty cycle is calculated again.

- If the temperature sensed by the control sensor is equal or greater than the CONTROL SET POINT temperature, then the output will have a duty cycle of 0%. The controller output will be off for 1/30th of the CYCLE TIME setting before the duty cycle is calculated again.

Proportional Ambient Contactor Control Temperature Band

Control Sensor Temperature	**Duty Cycle**
Set point	0%
Set point - proportional band/2	50%
Set point - proportional band	100%

Note: The load shedding “fail safe mode” is not supported when using proportional ambient contactor control, since ambient temperature is being monitored rather than pipe temperature.

Also note that if an AC alarm, with an alarm filter time greater than 0, is detected the contactor will not toggle until the alarm filter time has expired.

Appendix A - Specifications

Specifications are @ 25ºC unless otherwise noted and are subject to change without notice.

A-1 Control Module Specifications

General	
Area of use Installation category II	Ordinary area locations, indoors
Approvals	CE - Meets EMC and low-voltage directives EN50081-1 Emissions EN61000-6-2 Immunity EN61010-1 Safety
Supply voltage	100 to 250 VAC nom., ±10%, 50/60hz, 0.15A to 0.06 A.
Power output (for limiter)	12 vdc, 200 ma max.
Enclosure	
Protection	Housing: IP40, terminals: IP20
Materials	Asa-pc, color: green
Flammability class	V0 (UL94)
Ambient operating temperature range	–40°C to +50°C
Ambient storage temperature range	–40°C to +85°C
Relative humidity	0% to 90% Non condensing
Controller Module Dimensions	107,5 mm x 75 mm x 90 mm (4.23" x 2.95" x 3.54") when mounted to DIN 35 rail.
Control	
Contactor control output	Electromechanical relay rated 250V/3A 50/60hz
Solid-state relay control output	12Vdc, 75 ma. Max. To drive normally open solid state relays. Depending on the application, one, two or three phase switching may have to be used.
Maximum control Voltage/ Current	Depends on the type of switch element used.
Control algorithms	Line sensing on/off, proportional, proportional ambient, power/current limiting.
Control temperature range	–60°C to 570°C in steps of 1°C

Monitoring		
Temperature	Low / High alarm range	–60°C to 570°C or OFF
Ground fault (via optional external 1000:1 ct)	Alarm / Trip range	10 mA to 250mA or OFF
Load current (via optional external 1000:1 ct)	Low / High alarm range Current limit	0.3A to 100A or OFF 0.3A to 100A or OFF
Voltage	Low / High alarm range	10 V to 330V or OFF
Resistance	Low resistance range High resistance range	1 to 100% deviation 1 to 250% deviation
Power	Power limit	3 W to 33KW or OFF
Auto cycle	Diagnostic test interval adjustable from 1 to 240 minutes or 1 to 240 hours	
Temperature sensor inputs		
Quantity	2 RTD inputs available	
Type	100 Ohm platinum RTD, 3-wire, α = 0.00385 Ohms/ohm/°C. Can be extended with a three core shielded cable of maximum 20 Ohm lead resistance per conductor.	
Alarm output		
Dry contact relay (voltage free)	Relay contact rated 250V/3A 50/60Hz. Output is user programmable to open or to close on alarm.	
External input		
Function	Multi-purpose digital input. May be used to inhibit or force the controller output on, or to reset limiter Alarms.	
Rating	5 to 24 VDC @ 10 mAmps max.	
Programming and setting		
Method	Programmable keypad	
Units of measure	°F or °C	
Digital Display	Actual temperature, Control temperature, Heater current, load power, voltage, resistance, ground fault level, alarm status, programming parameter values.	
LED indicators	LEDs available for: Display mode, heater ON, alarm condition, receive/transmit data.	
Memory	Nonvolatile, restore after power loss.	
Stored parameters (measured)	Minimum and maximum process temperature. Maximum ground fault current, maximum heater current. Power accumulator. Contactor cycle counter. Time in use clock.	

Alarm conditions	Low/High temperature, low/high current, low/high voltage. Low/High resistance. Ground fault alarm/trip. RTD failure, loss of programmed values, switch failure.
Other	Multi language support, password protection.
Connection terminals	
Power supply input (terminals 17, 18)	Screw terminals, 0.5 to 2.5 mm^2 (24 to 12 AWG)
Control relay output	
Alarm relay output	
Temperature and current sensors	Screw terminals, 0.5 to 2.5 mm^2 (24 to 12 AWG)
Solid state control output	
Communications	
Limiter link	
Mounting	
Panel mounting	On 35 mm x 7.5 mm rail per EN50022
Communications	
Protocol	Modbus RTU or ASCII
Topology	Multidrop / daisychain
Cable	Single shielded twisted pair, 0.5 mm^2 (24 AWG) or larger.
Length	2.7 km max @ 9600 Baud
Quantity	Up to 32 devices without repeater
Address	Programmable

A-2 Limiter Module Specifications

General	
Area of use	Ordinary area locations, indoors, Installation category II
Approvals	CE - Meets EMC and low-voltage directives EN50081-1 Emissions EN61000-6-2 Immunity EN61010-1 Safety
Supply voltage	12 to 24 VDC, 100 mA to 50 mA, Max. (may be powered from a DigiTrace 915 controller)

Enclosure	
Protection	Housing: IP40, Terminals: IP20
Materials	ASA-PC, color: green
Flammability class	V0 (UL94)
Ambient operating temperature range	–40°C to +50°C
Ambient storage temperature range	–40°C to +85°C
Relative humidity	0% to 90% non condensing
Limiter module dimensions	107,5 mm x 75 mm x 45 mm (4.23" x 2.95" x 1.77") when mounted to din 35 rail.
Control	
Output relay (voltage free)	N.C. Relay contact rated 250V/3A 50/60Hz
Limit temperature range	20 to 450°C in steps of 1°C
Monitoring	
LED indicators	LEDs available for: power, presence of heater current, limiter trip, Transmit/Receive, alarm
Load current (via optional external 1000:1 CT)	Presence of heater current 0.2 to 100A
Temperature sensor inputs	
Quantity	1 RTD input available
Type	100 Ohm platinum RTD, 3-wire, α = 0.00385 Ohms/ohm/°C. Can be extended with a three core shielded cable of maximum 20 Ohm lead resistance per conductor. Open, shorted or out-of-range RTD resistance is detected.
Alarm output	
Dry contact relay (voltage free)	Relay contact rated 250V/3A 50/60Hz
Programming and setting	
Method	Via the keypad of the DigiTrace 915 controller or supervisory software
Units of measure	°C or °F, depending on the units setting of the programming device
Alarm conditions	Over-temperature, RTD failure, CT failure, loss of programmed values, limiter reset.

Connection terminals	
Relay outputs	Screw terminals, 0.5 to 2.5 mm^2 (24 to 12 AWG)
Load current sensor, communications,RTD input, 12V power input	Screw terminals, 0.5 to 2.5 mm^2 (24 to 12 AWG)
Mounting	
Panel mounting	On 35 mm x 7.5 mm rail per EN50022
Communications (to DigiTrace 915 controller)	
Topology	Point-point
Cable	Four conductor cable, 0.5 mm^2 (24 AWG)
Length	3 m max.

A-3 Ordering Details

Ordering details		
Controller	not defined yet	not defined yet
Limiter	not defined yet	not defined yet
1000:1 rail mount Load Current Sensing Transformer	not defined yet	not defined yet
1000:1 rail mount Ground Fault Current Sensing Transformer	not defined yet	not defined yet
RTD for hazardous area zone 1	MONI-P100-EXE	967094-000
RTD for non hazardous area	MONI-PT100-NH	140910-000
Communication cable	MONI-RS485-WIRE	549097-000

België / Belgique
Electrical Tracing
Geestbeekweg 5
3210 Lubbeek
Tel. (016) 35 39 90
Fax (016) 25 27 26

Česká Republika
Raychem HTS s.r.o.
Novodvorská 82
14200 Praha 4
Phone 241 009 215
Fax 241 009 219

Danmark
Tyco Thermal Controls Nordic AB
Stationsvägen 4
S-430 63 Hindås
Tel. 80 88 29 92
Fax 80 88 29 91

Deutschland
Tyco Thermal Controls GmbH
Grazer Strasse 24-28
63073 Offenbach am Main
Tel. 069 98953-0
Fax 069 896544

France
Tyco Thermal Controls SA
B.P. 738
95004 Cergy-Pontoise Cedex
Tél. (01) 34 40 73 30
Fax (01) 34 40 73 33

Italia
Tyco Electronics Raychem SPA
Centro Direzionale Milanofiori
Palazzo E5
20090 Assago, Milano
Tel. (02) 57 57 61
Fax (02) 57 57 6201

Nederland
Raychem b.v.
Van Heuven Goedhartlaan 121
1181 KK Amstelveen
Tel. (020) 6400411
Fax (020) 6400469

Norge
Tyco Thermal Controls Norway AS
Malerhaugveien 25
Postboks 6076 - Etterstad
0602 Oslo
Tel. +47 66 81 79 90
Fax +47 66 80 83 92

Österreich
Tyco Electronics Austria Ges.m.b.H.
Tyco Thermal Controls
Brown-Boveri Strasse 6/14
2351 Wiener Neudorf
Tel. (0 22 36) 86 00 77
Fax (0 22 36) 86 00 77-5

Schweiz / Suisse
Tyco Thermal Controls N.V. Lubbeek
Haldenstrasse 5
Postfach 2724
6342 Baar
Tel. (041) 766 30 80
Fax (041) 766 30 81

Suomi
Tyco Thermal Controls Nordic AB
Stationsvägen 4
S-430 63 Hindås
Puh. 0800 11 67 99
Telekopio 0800 11 86 74

Sverige
Tyco Thermal Controls Nordic AB
Stationsvägen 4
S-430 63 Hindås
Tel. 0301-228 00
Fax 0301-212 10

United Kingdom
Tyco Thermal Controls
Faraday Road
Dorcan, Wiltshire SN3 5HH
Tel. (01793) 572 663
Fax (01793) 572 189

tyco

Flow Control

Tyco Thermal Controls

We manage the heat you need

www.tycothermal.com