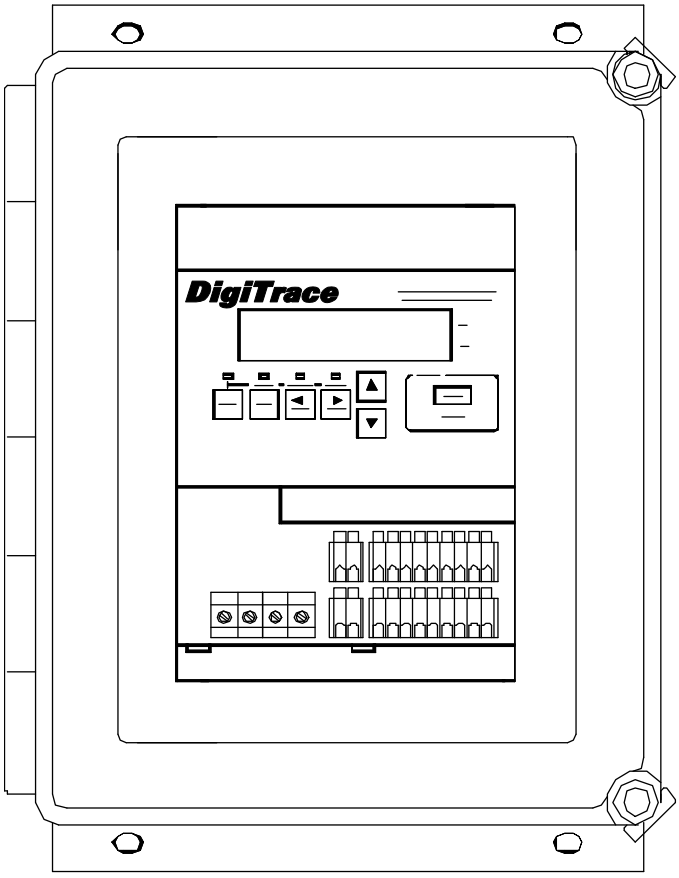
DigiTrace

DigiTrace® C910 Series Heat Trace Controller

Installation, Operation, and Maintenance Manual

Firmware versions up to V3.2X



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Section 1 Overview

1.1 Introduction

This manual provides information pertaining to the installation, operation, testing and maintenance of the Tyco Thermal Controls DigiTrace® C910 Series Heat Trace Controller.

Additional copies of this user manual may be ordered separately through your Tyco Thermal Controls representative or online at www.tycothermal.com.

This document covers the DigiTrace C910 Series Heat Trace Controllers and its available options. To ensure that you are using the correct documentation for your particular version of controller, please check the firmware version number of your DigiTrace C910 against the version number listed on the front of this manual. This may be displayed using the operator console or a communicating device.

1.2 Product Overview

1.2.1 Description

The DigiTrace C910 Series Electronic Heat Trace Controller controls, monitors, and communicates alarms and data for one heating cable circuit. It is available with a RS-485 communication module in the C910-485 for remote operation over Modbus® protocol if desired.

1.2.2 Features

A detailed description of available features may be found in Section 4 of this manual.

Highlights of specific features follow:

Keypad and Alphanumeric Display

A six character alphanumeric LED display provides the operator with large easy to read messages and prompts, eliminating complex and cryptic programming. Six individual keys are provided to quickly access alarming and operational information.

–40°F to 140°F (–40°C to 60°C) Operation

Extended temperature operation permits installation in all but the harshest environments.

Single or Dual Temperature Sensor Inputs

The ability to utilize one or two temperature sensor (TS) inputs allows the selection of one of eight control modes and programming of all temperature parameters.

High and Low Temperature Alarms

High and low temperature alarms are offered for both temperature sensor inputs of each control point.

Low Current Alarms

The DigiTrace C910 offers adjustment of the low alarm points over the entire current measurement range.

Electromechanical Relay (EMR) Output

The DigiTrace C910 is equipped with a 30 A rated electromechanical relay (EMR) output switch with device failure alarm.

Ground-fault Alarm and Trip

Ground-fault (GF) current levels are monitored and may be displayed in milliamperes. The adjustable ground-fault level gives the user the choice of both alarm and trip levels suitable for the particular installation.

Proportional Ambient Sensing Control (PASC)

The DigiTrace C910 includes the Proportional Ambient Sensing Control (PASC) mode to maximize the energy efficiency of the heat tracing system.

Minimum/Maximum Temperature Tracking

The controller maintains the minimum and maximum temperature values it has measured since the last reset of these values.

Temperature Alarms

The controller alarms on user selectable low and high temperature limits.

Auto-cycling

The controller will momentarily energize the circuit (for 10 seconds) at a programmable interval in order to test the heat tracing circuit during periods of non-use. This feature will detect issues with the heat-tracing circuit before it can lead to system damage.

Temperature Sensor Failure Alarm

Both open and shorted sensors are detected and alarmed by the controller.

Full Digital Communications

The DigiTrace C910-485 incorporates RS-485 serial communication for applications requiring direct interfacing to BMS systems using Modbus protocol.

Certification

Tyco Thermal Controls certifies that this product met its published specifications at the time of shipment from the factory.

Limited Warranty

This Tyco Thermal Controls product is warranted against defects in material and workmanship for a period of 18 months from the date of installation or 24 months from the date of purchase, whichever occurs first. During the warranty period, Tyco Thermal Controls will, at its option, either repair or replace products that prove to be defective. For warranty service or repair, this product must be returned to a service facility designated by Tyco Thermal Controls. The Buyer shall prepay shipping charges to Tyco Thermal Controls and Tyco Thermal Controls shall pay shipping charges to return the

product to the Buyer. However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to Tyco Thermal Controls from another country. Tyco Thermal Controls warrants that the software and firmware designated by Tyco Thermal

Controls for use with the DigiTrace C910 Controller will execute its programming instructions properly. Tyco Thermal Controls does not warrant that the operation of the hardware, or software, or firmware will be uninterrupted or error-free.

Warranty Exclusion/Disclaimer

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the specifications for the product, or improper installation. *No other warranty is expressed or implied. Tyco Thermal Controls disclaims the implied warranties of merchantability and fitness for a particular purpose.*

Exclusive Remedies

The remedies provided herein are the buyer's sole and exclusive remedies. Tyco Thermal Controls shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Conducted and Radiated Emissions—FCC/DOC Statement of Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. This equipment does not exceed Class A limits for radio emissions as set out in Schedule V to VIII of the Radio Interference Regulations of Communication Canada.

1.3 Product Specification

General	
Area of use	Nonhazardous locations
Approvals	**Nonhazardous locations** C SA US
Supply voltage	100 V to 277 V, +5/–10%, 50/60 Hz Common supply for controller and heat-tracing circuit
Enclosure	
Protection	NEMA 4X
Materials	FRP
Ambient operating temperature range	–40°F to 140°F (–40°C to 60°C)
Ambient storage temperature range	–40°F to 185°F (–40°C to 85°C)
Relative humidity	0% to 90%, noncondensing

Control		
Relay type	Double-pole, mechanical	
Voltage, maximum	277 V nominal, 50/60 Hz	
Current, maximum	30 A @ 104°F (40°C) derated to 20 A @ 140°F (60°C)	
Control algorithms	EMR: On/off, proportional ambient sensing control (PASC)	
Control range	0°F to 200°F (–18°C to 93°C)	
Monitoring		
Temperature	Low alarm range High alarm range	0°F to 180°F (–18°C to 82°C) or OFF 0°F to 200°F (–18°C to 93°C) or OFF
Ground fault	Alarm range Trip range 20 mA to 100 mA	20 mA to 100 mA
Current	Low alarm range	0.3 A to 30 A or OFF
Autocycle	Diagnostic test interval adjustable from 1 to 240 minutes or 1 to 240 hours	
Temperature Sensor Inputs		
Quantity	Two inputs standard	
Types	100 Ω platinum RTD, 3-wire, α= 0.00385 ohms/ohm/°C Can be extended with a 3-conductor shielded cable of 20 Ω maximum per conductor	
Alarm Outputs		
AC relay	Isolated solid-state triac, SPST, 0.75 A maximum, 100 V to 277 V nominal	
Dry contact relay	Pilot duty only, 48 V/dc, 500 mA maximum, 10 VA maximum resistive switching	
Note: Outputs are configurable as “open on alarm” or “close on alarm”		
Programming and Setting		
Method	Programmable keypad	
Units	Imperial (°F, in.) or Metric (°C, mm)	
Digital display	Actual temperature, control temperature, heating cable current, ground fault, programming parameter values, alarm values	
LEDs	Current mode, heating cable on, alarm condition, receive/transmit data	
Memory	Nonvolatile, restored after power loss, checksum data checking	
Stored parameters (measured)	Minimum and maximum temperature, maximum ground-fault current, maximum heating cable current, contactor cycle count, time in use	
Alarm conditions	Low/high temperature, low current Ground-fault alarm, trip RTD failure, loss of programmed values, or EMR failure	
Other	Password protection	
Connection Terminals		
Power supply input	Screw terminals, 22–8 AWG	
Heating cable output	Screw terminals, 22–8 AWG	
Ground	Two box lugs, 14–6 AWG	
RTD/alarm/communications	28–12 AWG spring clamp terminals	
Mounting		
FRP enclosure	Surface mounting with four fixing holes on 6.0 in x 11.0 in (152 mm x 279 mm) centers Hole diameter: 0.31 in (8 mm)	
Communications with C910-485		
Protocol	Modbus RTU / ASCII	
Topology	Multidrop, daisy chain	
Cable	Single shielded twisted pair, 26 AWG or larger	
Length	1.7 miles (2.7 km) maximum @ 9600 baud	
Quantity	Up to 32 devices without repeater	
Address	Programmable	

Section 2 Installation and Wiring

2.1 Introduction

This section includes information regarding the initial inspection, preparation for use, and storage instructions for the DigiTrace C910 and DigiTrace C910-485 Heat Trace controllers.

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 and the equipment has been checked mechanically and electrically. 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 Installation Location

The wide ambient operating temperature range of the controller permits installation in most locations. Considerations should include accessibility for maintenance and testing and the location of existing conduits.

2.4 Mounting Procedures

The mounting template is shown in Figure 1.

Drill conduit entry holes prior to mounting. Conduit entries should be made in the bottom of the enclosure if possible to reduce the possibility of water entry from condensation or leakage. Conduit entries must be drilled or punched using standard industry practices. Use bushings suitable for the environment and install such that the completed installation remains waterproof. Grounding hubs and conductors must be installed in accordance with Article 501-4(b) of the National Electrical Code and Part I of the Canadian Electrical Code.

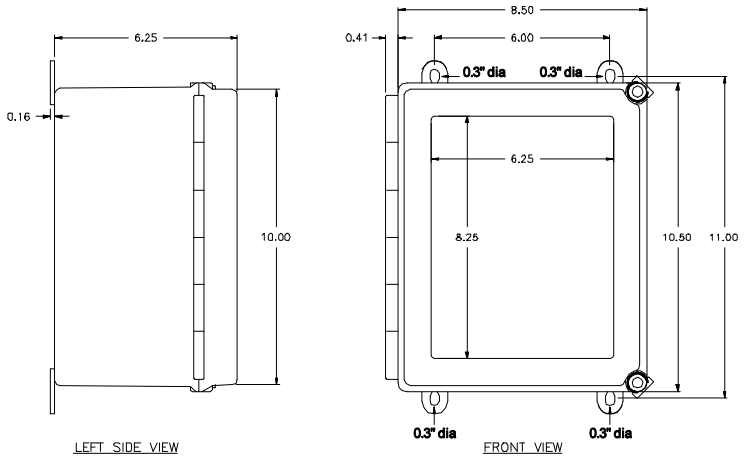


Figure 1 – Mounting Hole Template

2.5 Wiring

The following drawings provide sample wiring diagrams for the DigiTrace C910 Series control products and optional accessories. Please contact your local Tyco Thermal Controls representative for information regarding other available options.

2.5.1 Power Connections

The DigiTrace C910 controller may be powered directly from a 100 V to 277 V supply.

All of the power terminals are labeled for easy identification. Do not attempt to use wire sizes that exceed the marked terminal ratings and avoid terminating two wires on the same terminal whenever possible.

Note: Make sure that power terminals are retightened several days after installation. Stranded wire will tend to compress when initially installed; therefore, these terminals should be checked for tightness several times after the system is installed to ensure that a good connection is maintained.

Note: Follow the industry standard grounding practices do not rely on conduit connections to provide a suitable ground. Grounding terminals/screws are provided for connection of system ground leads.

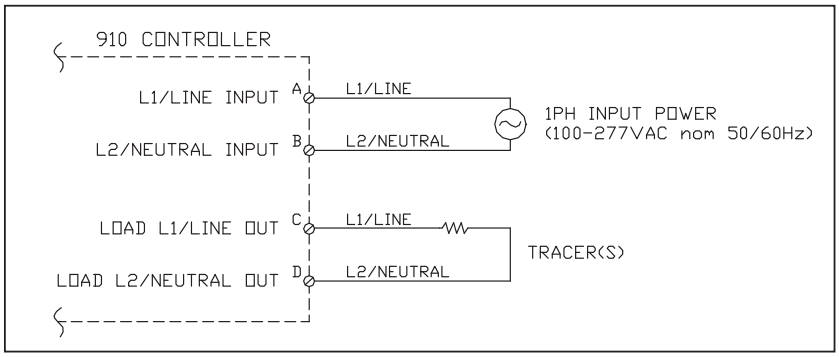


Figure 2 – Power Connection

2.5.2 Temperature Sensor and Extension Cables

The C910 has two (2) RTD inputs, use only 3-wire 100 Ω Platinum RTDs (DIN 43760, α=0.00385 Ω / Ω /°C)

Note: The DigiTrace C 910 default is set for one RTD in position one. If a second RTD is installed in position two, the controller must be power cycled to recognize the RTD.

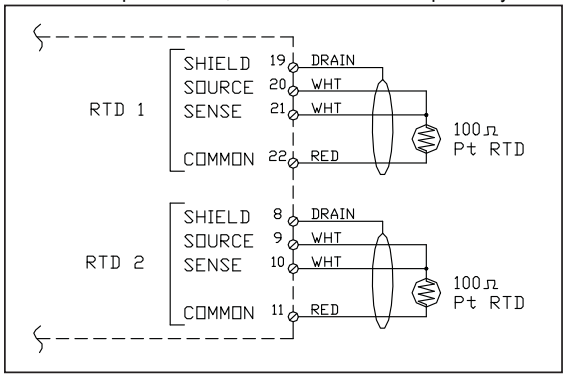


Figure 3 – Temperature Sensor Wiring

Use shielded, twisted, three-conductor wire for the extension of RTD leads. The wire size should ensure that the maximum allowable lead resistance is not exceeded (20 Ω/lead). RTD wiring should be grounded at the controller end only, using the terminals provided.

2.6 Alarm Relay Connections

Two types of alarm relays are provided: One is a DC contact and can be connected as dry contact (Fig. 4) or as a 12 Vdc contact (Figure 5). The second is an AC relay (triac) and can be connected as an alarm relay (Figure 6) or a powered alarm relay (Figure 7). Both may be programmed for normally open (N.O.) or normally closed (N.C.) operation.

Note: Both alarm relays are controlled by the DigiTrace C910 using the same signal.

Note: The dry contact alarm relay is intended to be used for switching low-voltage, low-current signals. Do not use this relay to directly switch line voltages.

Alarm Output Wiring

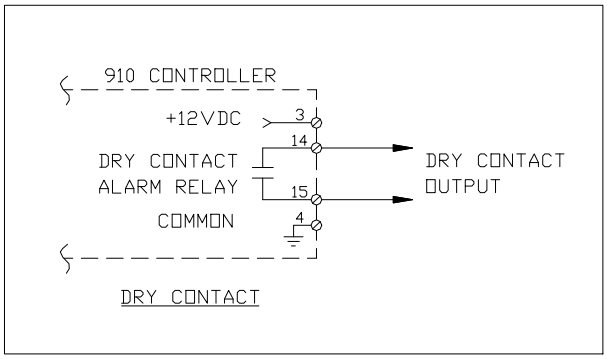


Figure 4 – Used As a Dry Contact

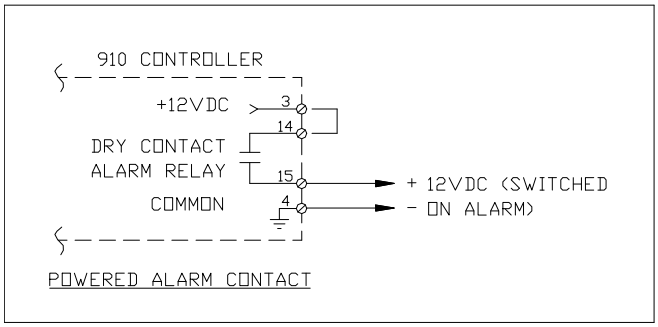


Figure 5 – Used As a Switched DC Contact

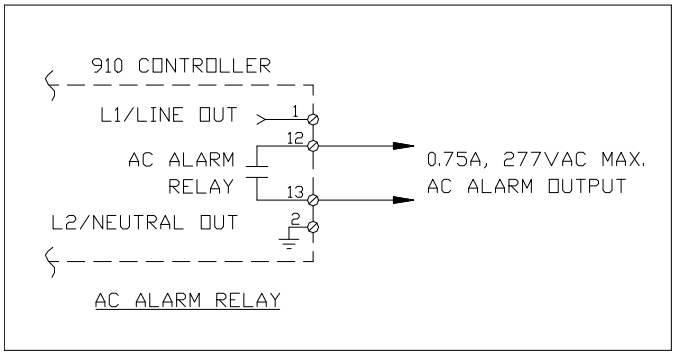


Figure 6 – Used As an AC Alarm Relay

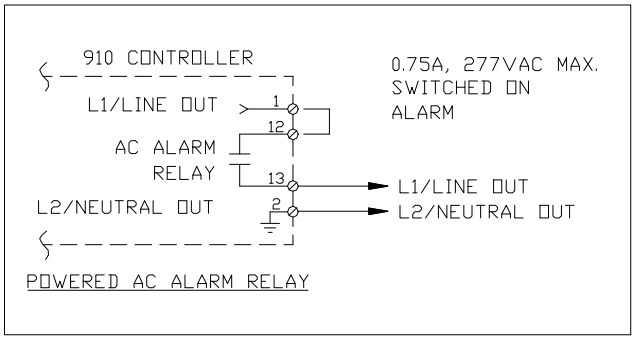


Figure 7 – Used as a Powered AC Alarm Relay

2.6.1 Communication Signal Connections

The DigiTrace C910-485 controller includes a RS-485 communications interface. Use twisted pair, shielded cable communication wiring. Ground the shield on communications wiring at one end only, using the terminals provided.

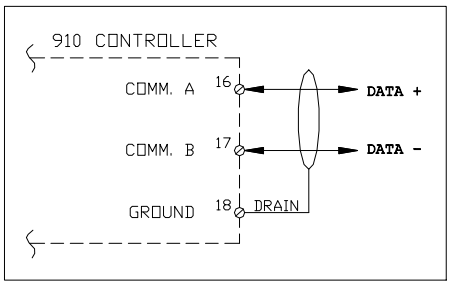


Figure 8 – Communication Wiring (C910-485 only) RS-485 (2-Wire) Connections

2.7 Initializing the Controller

2.7.1 Initial Cable Test

To minimize the risk of damage to the controller due to a cable fault, the integrity of the heating cable should be verified by performing the commissioning tests detailed in the appropriate product installation and operating manual. These manual can be found on www.tycothermal.com

These tests must be performed with the controller output disconnected. Once the cable has been checked, it may be reconnected to the controller and power applied.

Section 3 Operator Console

3.1 Alphanumeric Display

The console incorporates a six characters, fourteen segment, plus decimal LED display.

Messages and prompts that are greater than six characters long are scrolled, allowing more meaningful, non-cryptic messages to be used.

3.2 Keypad

The local keypad consists of six 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.

Refer to Figure 9

Key	Function
SHIFT	Press to activate a shifed function; the next key pressed uses the alternate (shifted) function (ALARM, MONITOR and CONFIG). The SHIFT LED illuminates, indicating the next key uses the alternate (shifted) function. Pressing SHIFT again cancels the alternate (shifted) function.
TEST	Turns on heating cable circuit for 30 seconds. SHIFT + TEST Switches the console to the Alarm/reset mode.
BACK	Exits the current menu (or cancels the new setting when editing a parameter) Moves the cursor to the left when editing an alphanumeric parameter. [SHIFT + MONITOR] Switches the console to the Monitor mode.
ENTER	Selects the item in the display (or accepts the setting when editing a parameter). Moves the cursor to the right when editing an alphanumeric parameter. [shift + CONFIG] Switches the console to the CONFIG 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.

3.3 LED Indicators

The console includes eight LED indicators:

Four LEDs indicate the console operating mode (SHIFTed function, ALARM, MONITOR, or CONFIGure modes).

Two status LEDs indicate the alarm and control output status of the controller:

The output LED, when illuminated steadily, indicates that the output of the controller is turned on and is allowing current to flow into the heating cable circuit.

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

Two additional LEDs are used to indicate external communications activity and are only used with the DigiTrace C910-485 with the optional RS-485 communications interface.

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.

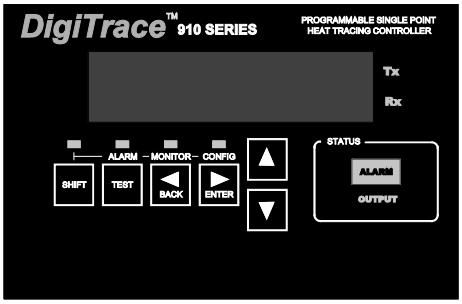


Figure 9 – Operator Console

Section 4 DigiTrace C910 Operation

4.1 Operating Modes

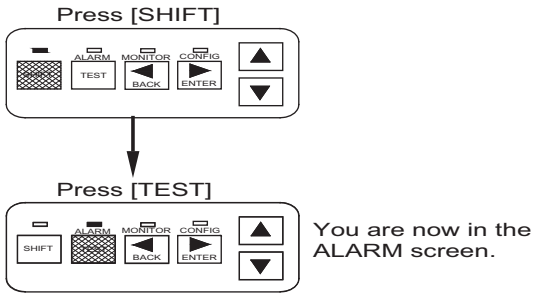
4.1.1 Four Modes of Console

Scan

This is the default mode displayed during normal operation. In this mode, the console sequentially displays load current, temperature, and setpoint readings.

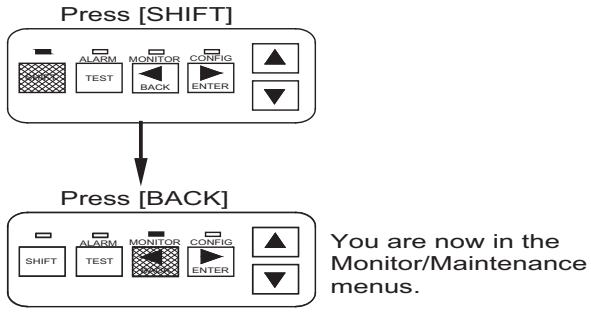
Alarm

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. To enter this mode:



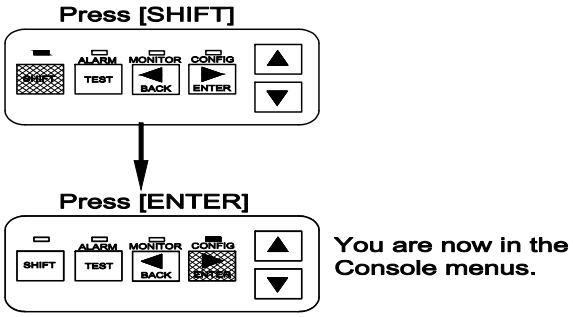
Monitor

This mode allows you to examine any of the controller readings such as temperature, load current, etc. The LED above the MONITOR key is illuminated while in this mode. To active this mode:



Configure

This mode allows you to access the console menus to examine or alter the settings. The LED above the CONFIG key is illuminated while in this mode. To access the operational menus:



4.2 Console Mode Menus

The Console Mode Menu Index below shows all user interface parameters. This menu shows the factory default along with the associated range. The section column refers to the section in this manual that illustrates the actual keystrokes required to input the parameters.

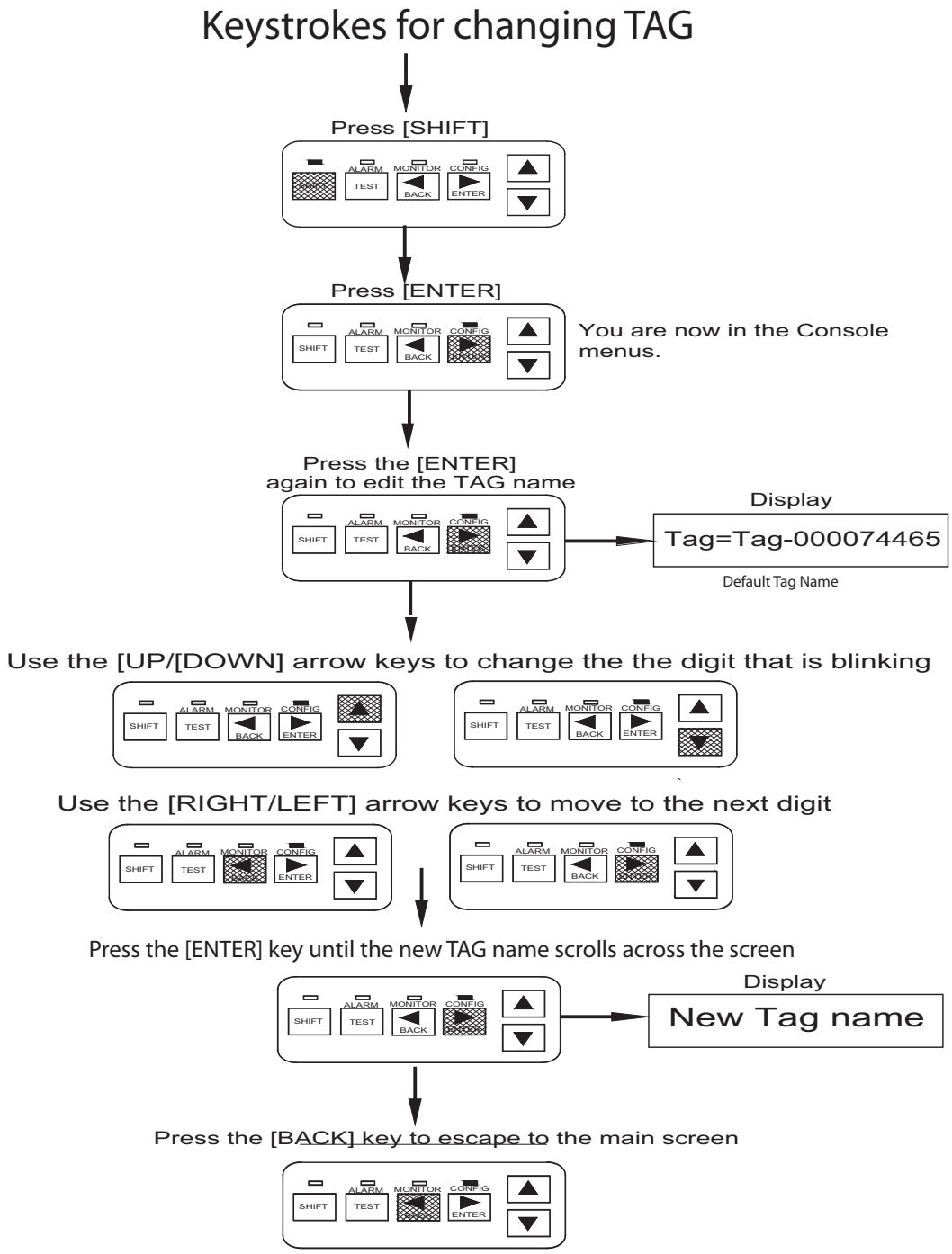
Console Mode Menu Index

Section	Parameter	Factory Default	Range
4.2.1	Tag	Factory ID	See details in section
4.2.2	Units	Imperial	Imperial / Metric
4.2.3	Switch Control Mode	ON/OFF	PASC or on/off Control
4.2.4	Proportional Ambient Sensing Control (PASC) Setup	See details	See details in section
4.2.5	Control Setpoint	40°F (4°C)	0°F to 200°F
4.2.6	Deadband	5°F (3°C)	1°F to 10°F (1°C to 6°C)
4.2.7	Temp Sensor Failure Alarm (TS2 Fail)	Disable	Enable / Disable
4.2.8	Low Temp Alarm Enable (Lo TS 1 / Lo TS 2)	Enable	Enable / Disable
4.2.9	Low Temp Alarm Setting (Lo TS 1 / Lo TS 2)	35°F (2°C)	0°F to 180°F (-18° to 82°C)
4.2.10	High Temp Alarm Enable (Hi TS 1 / Hi TS 2)	Disable	Enable / Disable
4.2.11	High Temp Alarm Setting (Hi TS 1 / Hi TS 2)	180°F	0°F to 200°F (-18° to 93°C)
4.2.12	Low Load Alarm Enable (Lo Load)	Enable	Enable/ Disable
4.2.13	Low Load Alarm Set Point (Lo Load)	1 A	0.3 A to 30 A or OFF

4.2.14	Factory Default Settings	NA	See details in section
4.2.15	Ground-fault Current Alarm level (Hi GF Alarm)	20 mA	20 mA to 100 mA
4.2.16	Ground-fault Current Trip level (GFI Trip)	30 mA	20 mA to 100 mA
4.2.17	Temperature Sensor Failure (TS Fail Mode)	On	On/Off
4.2.18	Temperature sensor control mode (TS CTL)	TS1-Fail On	See details in section
4.2.19	Firmware Version		N/A
4.2.20	Password	0000	4 digit numerical entry
4.2.21	Alarm Output Normal State	N.C.	Normally open (NO) / Normally closed (NC)
4.2.22	Communications Setup	HTCBus	See details in section
4.2.23	Auto-Cycle: Enabling	Enable	Enable / Disable
4.2.24	Auto-Cycle: Interval	8	1 to 240
4.2.25	Auto-Cycle: Units	Hours	Minutes / Hours
4.2.26	Contactor Count	200,000	0 to 999,999
4.2.27	Monitor and Maintenance	N/A	See details in section
4.2.28	Alarm: Acknowledge and reset mode.	N/A	See details in section

4.2.1 Alphanumeric Tag Assignment

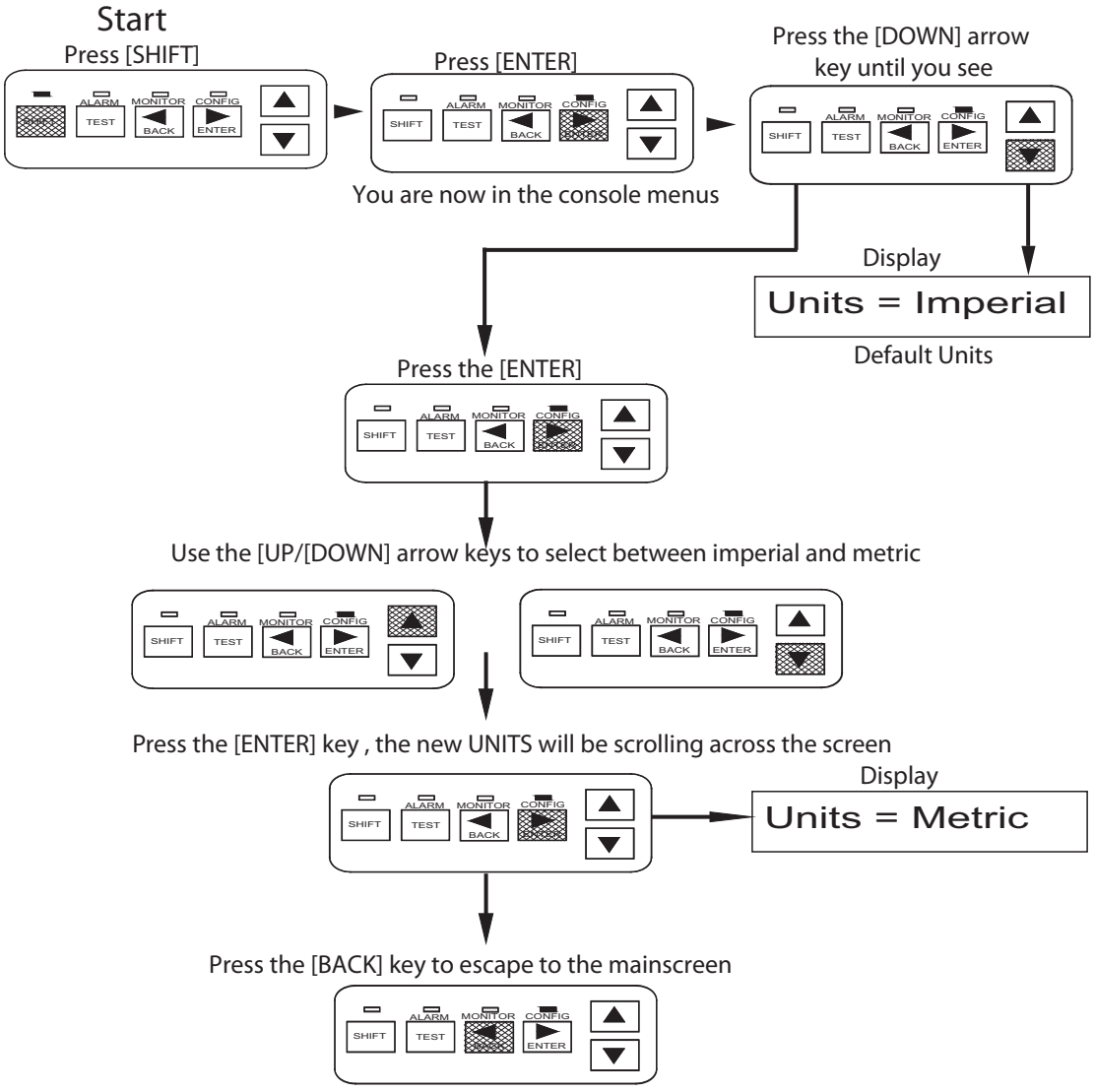
Purpose	A 19 character alphanumeric TAG may be assigned to a control point to allow it to be easily associated with a pipe, vessel, process, circuit, drawing name, or number.
Setting	Any combination of 19 characters from A–Z, 0–9, /, -, ., (,), or #.



4.2.2 Setting Units

Purpose	This allows selection of the type units (temperature or size) to display on the operator.		
Setting	Metric or Imperial	**Factory default**	Imperial

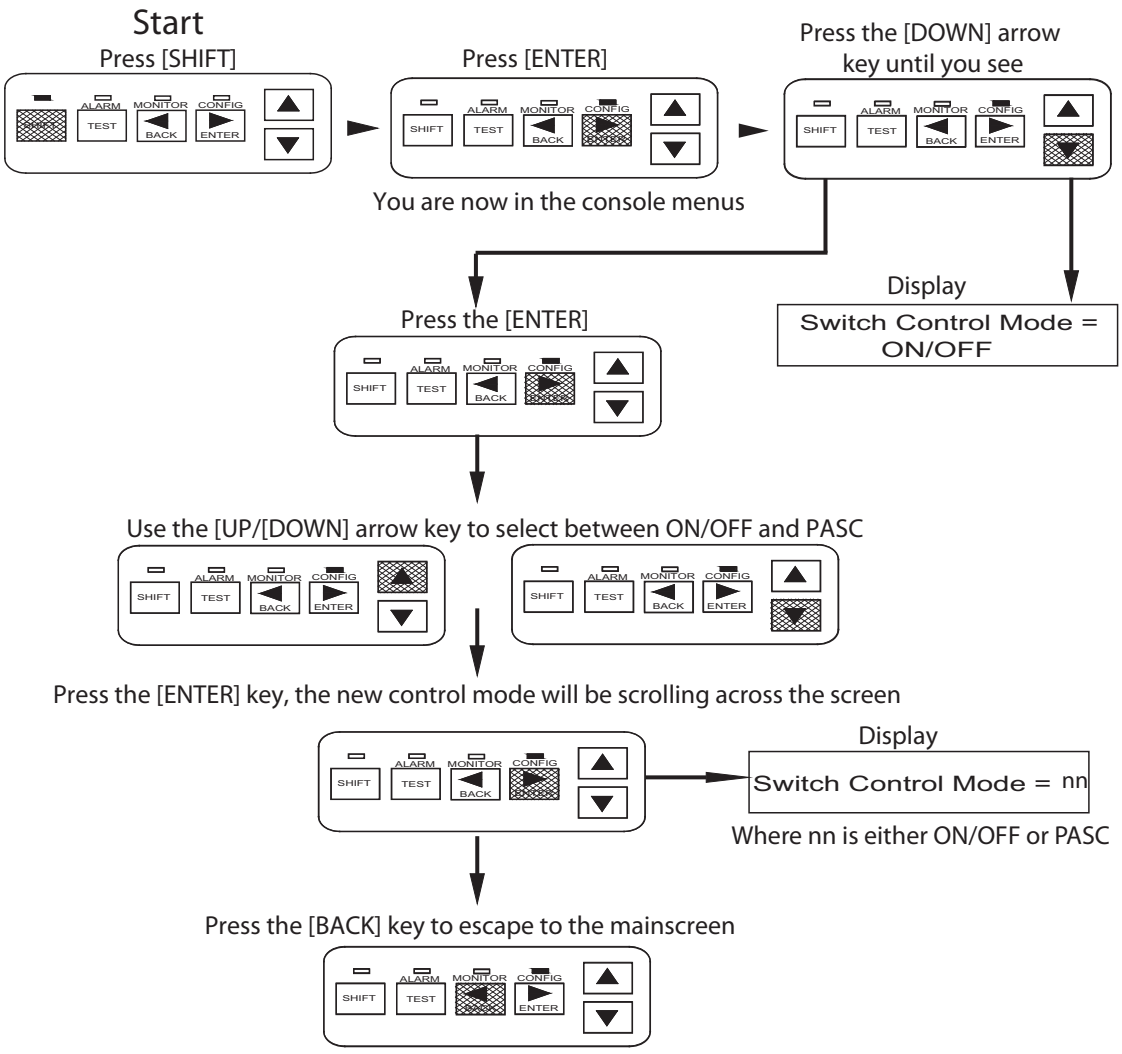
Keystrokes for Changing Units



4.2.3 Switch Control Mode

Purpose	This allows selection of the type of algorithm to be used to maintain the control setpoint temperature.		
Setting	On/Off or Proportional Ambient Sensing Control (PASC)	**Factory default**	On/off

Keystrokes for changing Switch Control Mode



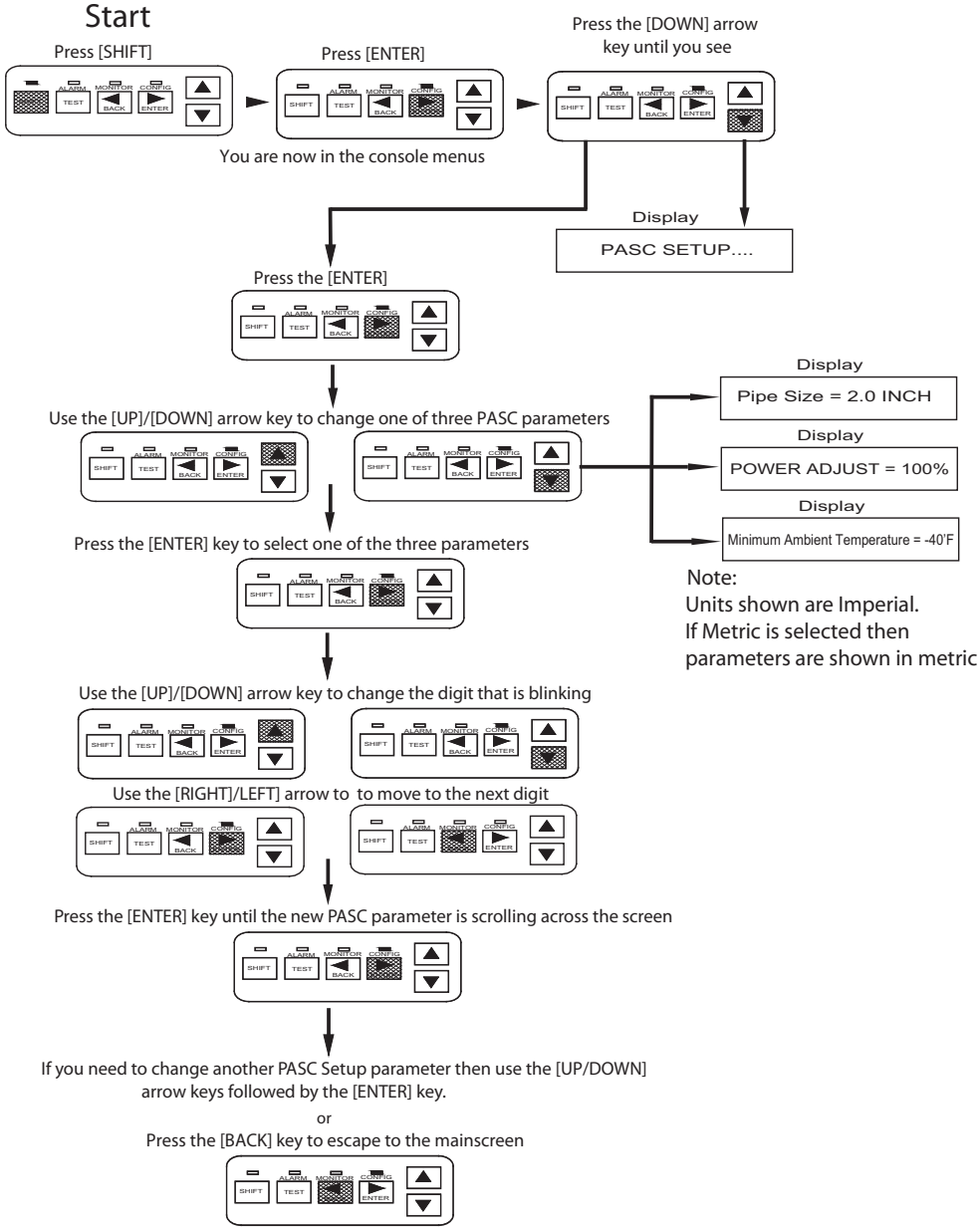
4.2.4 Proportional Ambient Sensing Control (PASC)

Purpose This control mode sets Proportional Ambient Sensing Control (PASC). See Appendix A for more details.

Settings

	Range	Factory Default
Pipe Size (inch):	½, 1 or, ≥ 2	½-
Control Setpoint:	0 to 200°F (–18 to 92°C)	40°F (4°C)
Min. Design Ambient:	–99 to 125°F (–73 to 52°C)	–40°F (–40°C)
Power Adjust Factor:	10 – 200%	100%

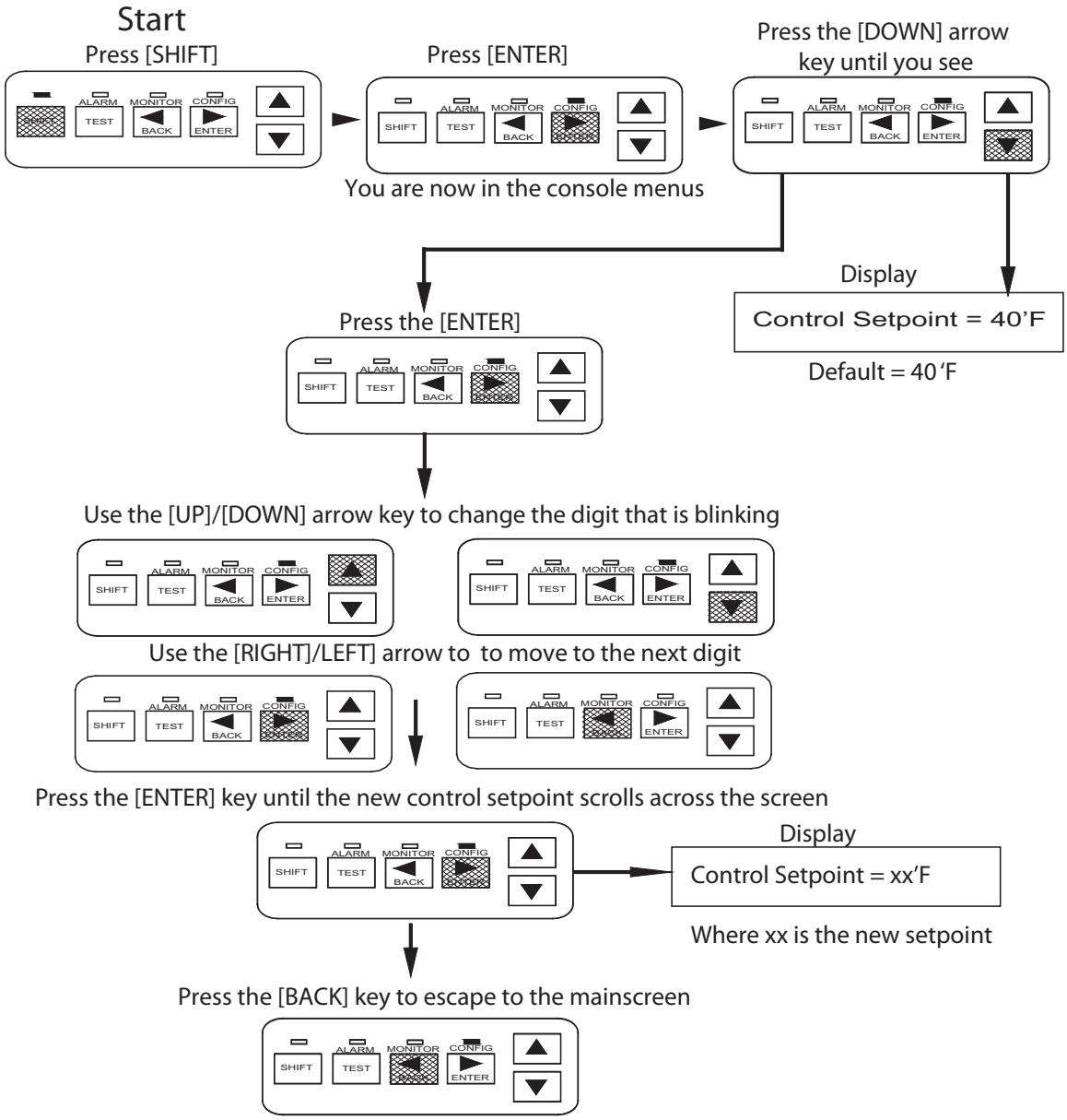
Keystrokes for Entering PASC Setup Parameters



4.2.5 Control Setpoint

Purpose	This is the temperature that the controller uses to determine whether its output switch should be on or off.		
Setting/Range	0°F to 200°F (–18°C to 93°C)	**Factory default**	40°F (4°C)

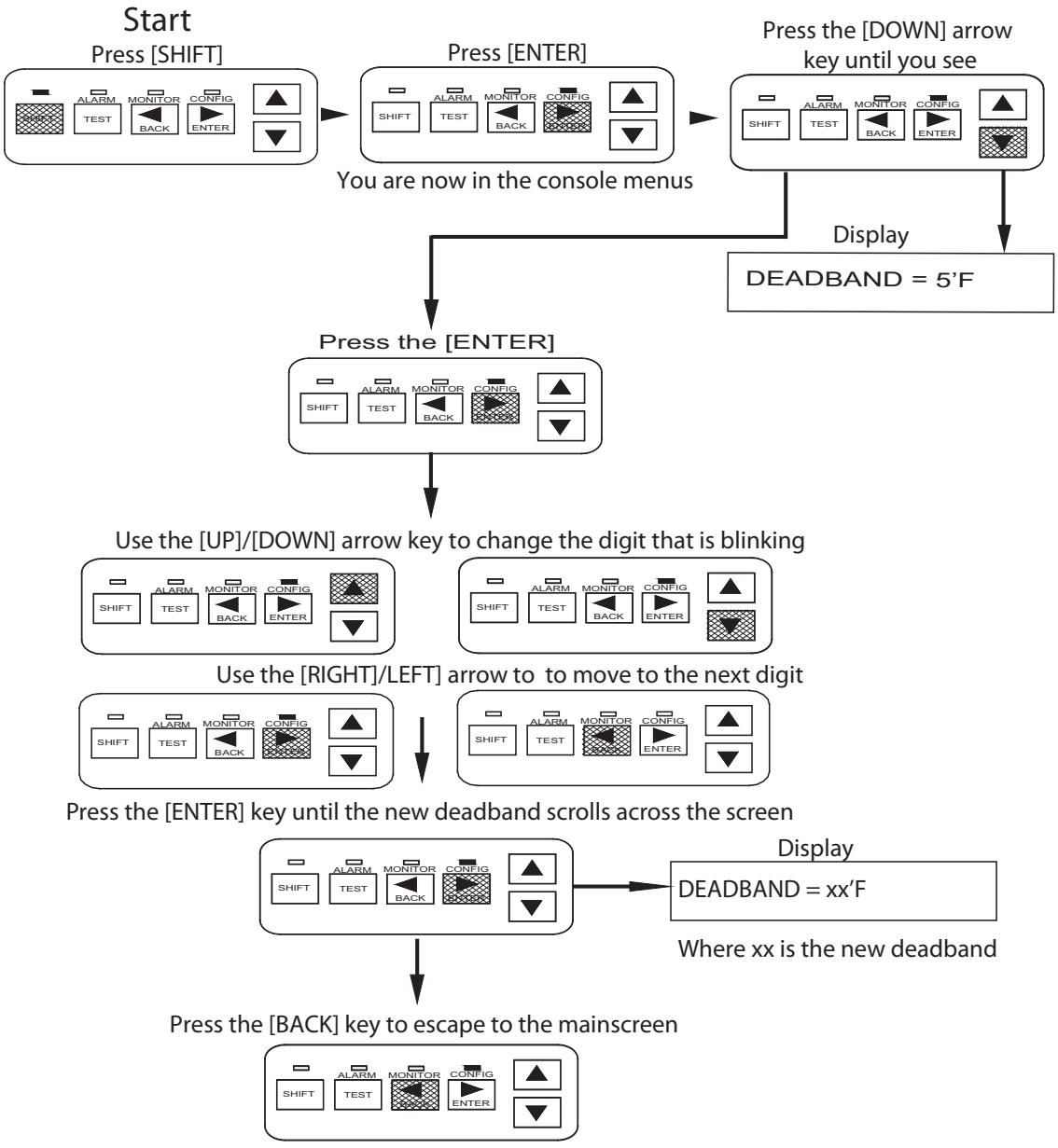
Keystrokes for Changing the Control Setpoint



4.2.6 Deadband

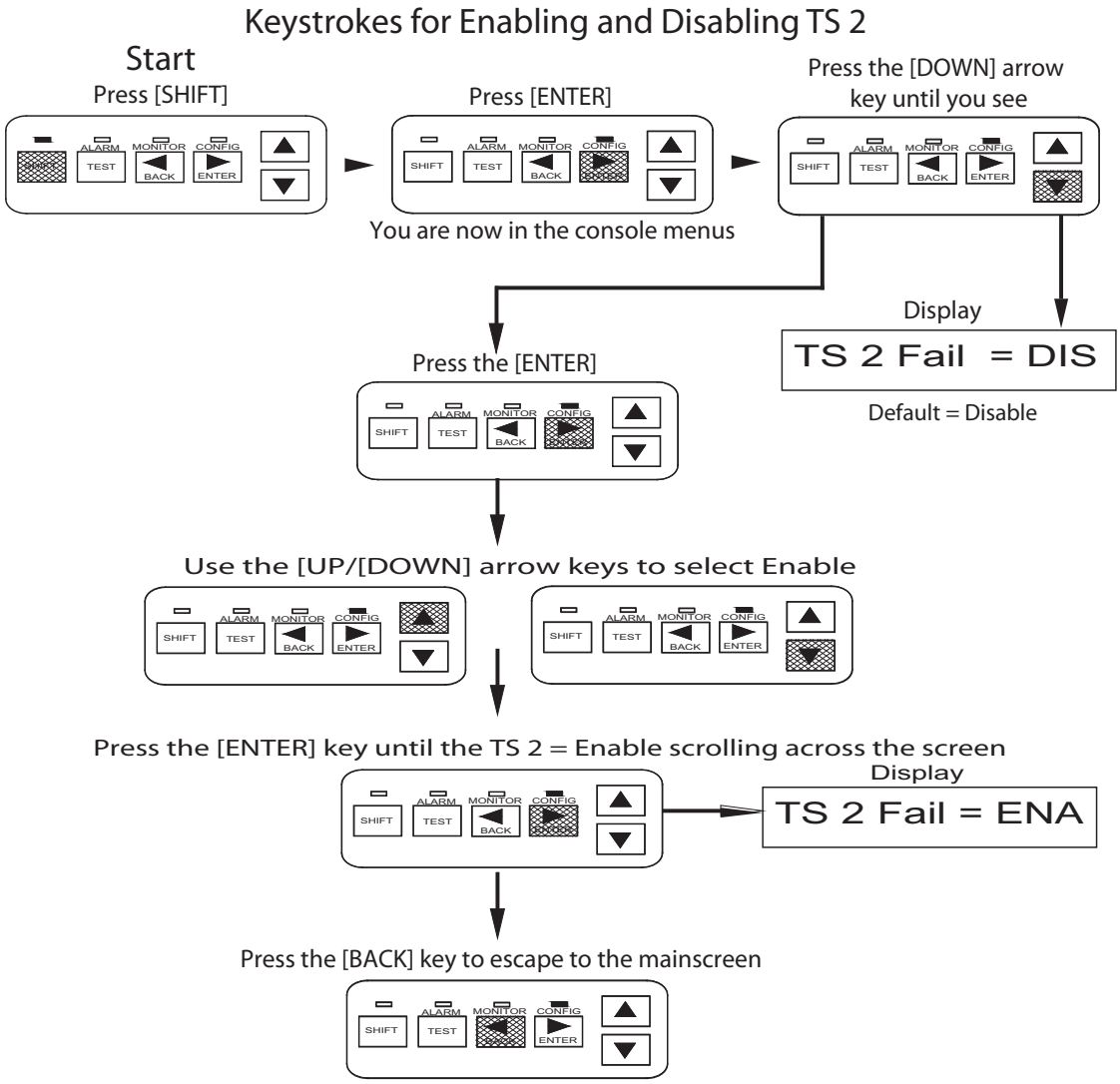
Purpose	The deadband is a window of difference between the measured control temperature and the desired **control setpoint** temperature and provides the decision to turn the output off or on		
Setting/Range	1°F to 10°F (1°C to 6°C)	**Factory default**	5°F (3°C)

Keystrokes for Changing Deadband



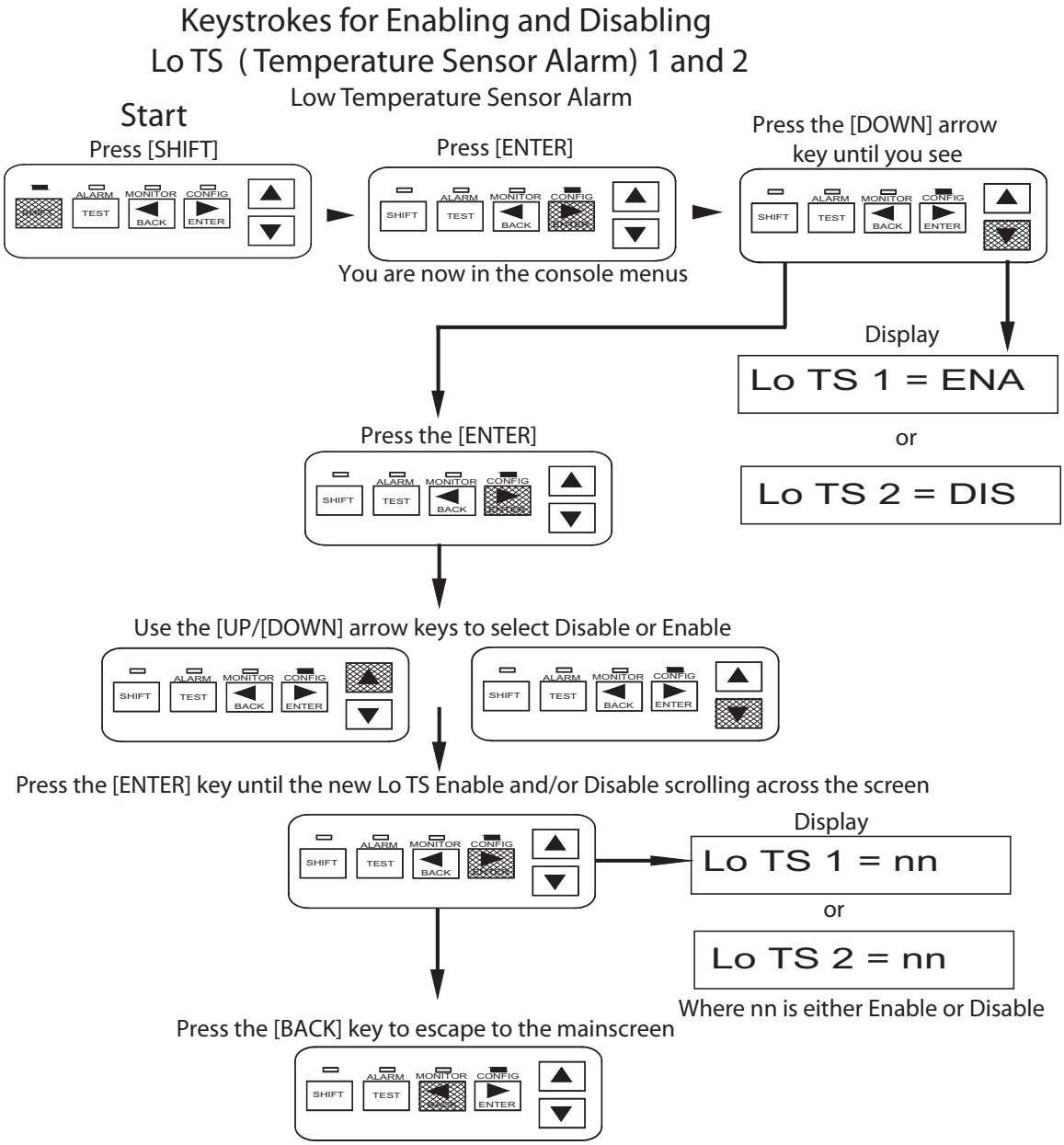
4.2.7 Temperature Sensor Failure Alarm

Purpose	This allows the user to enable or disable the temperature sensor failure alarm.		
	Alarm time delay filter is factory set < 2 minutes.		
Setting/Range	Enable or disable	Factory default	Enable



4.2.8 Low Temperature Alarm: Enable (Lo TS 1 and Lo TS 2)

Purpose	This allows the user to enable or disable the low temperature alarm for temperature sensor number 1 and 2.		
	Alarm time delay filter is factory set at 15 minutes.		
Setting/Range	Enable or disable	Factory default	Enable

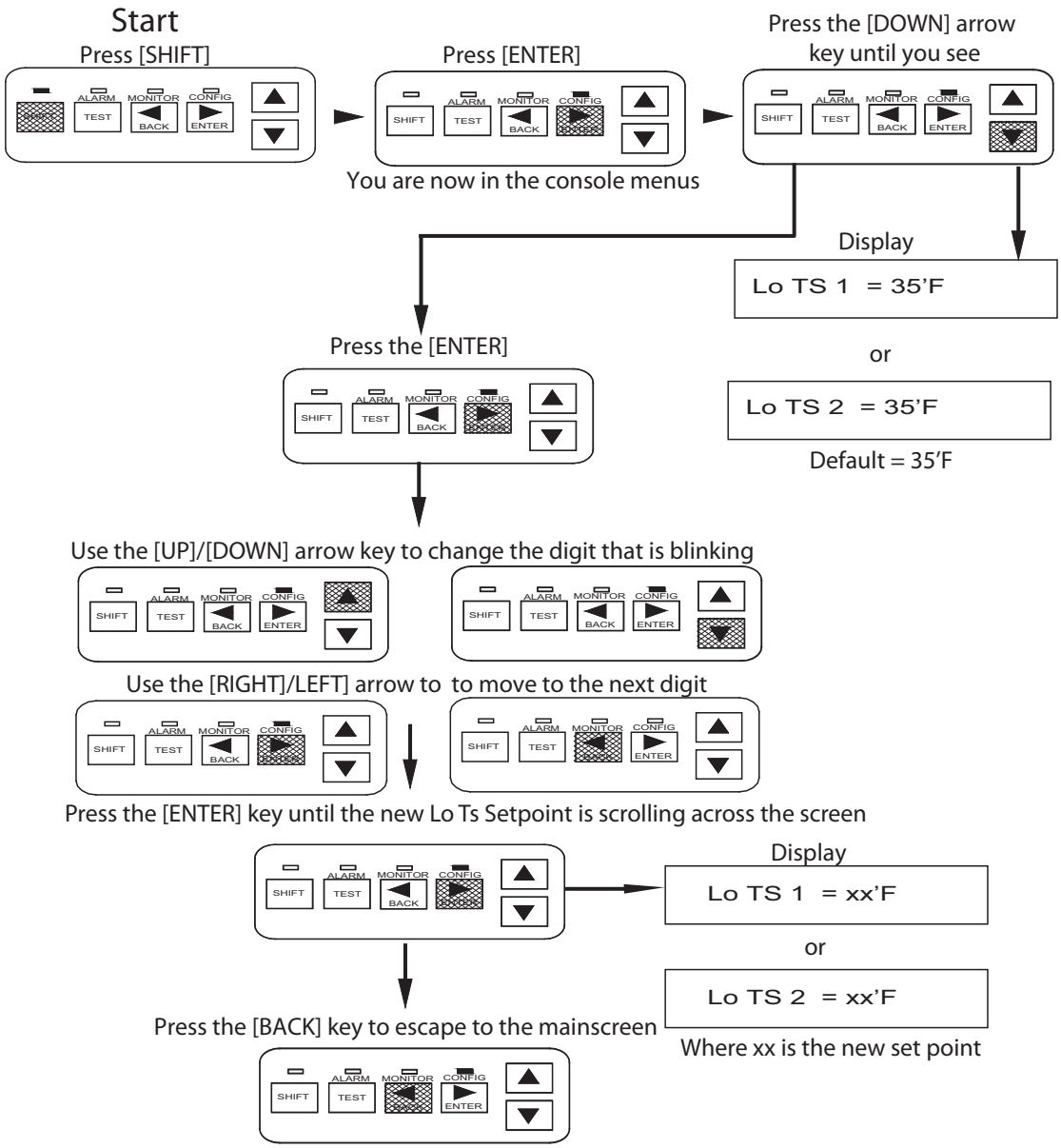


4.2.9 Low Temperature Alarm: Setting (Lo TS 1 and Lo TS 2)

Purpose	This allows the user to set the low temperature alarm setting for temperature sensor number 1 and 2.		
	Alarm time delay filter is factory set at 15 minutes.		
Setting/Range	0°F to 180°F (–18 to 82°C)	Factory default	35°F (2°C)

Keystrokes for Entering the Setpoint for Lo TS (Temperature Sensor) 1 and 2

Low Temperature Sensor Setpoint

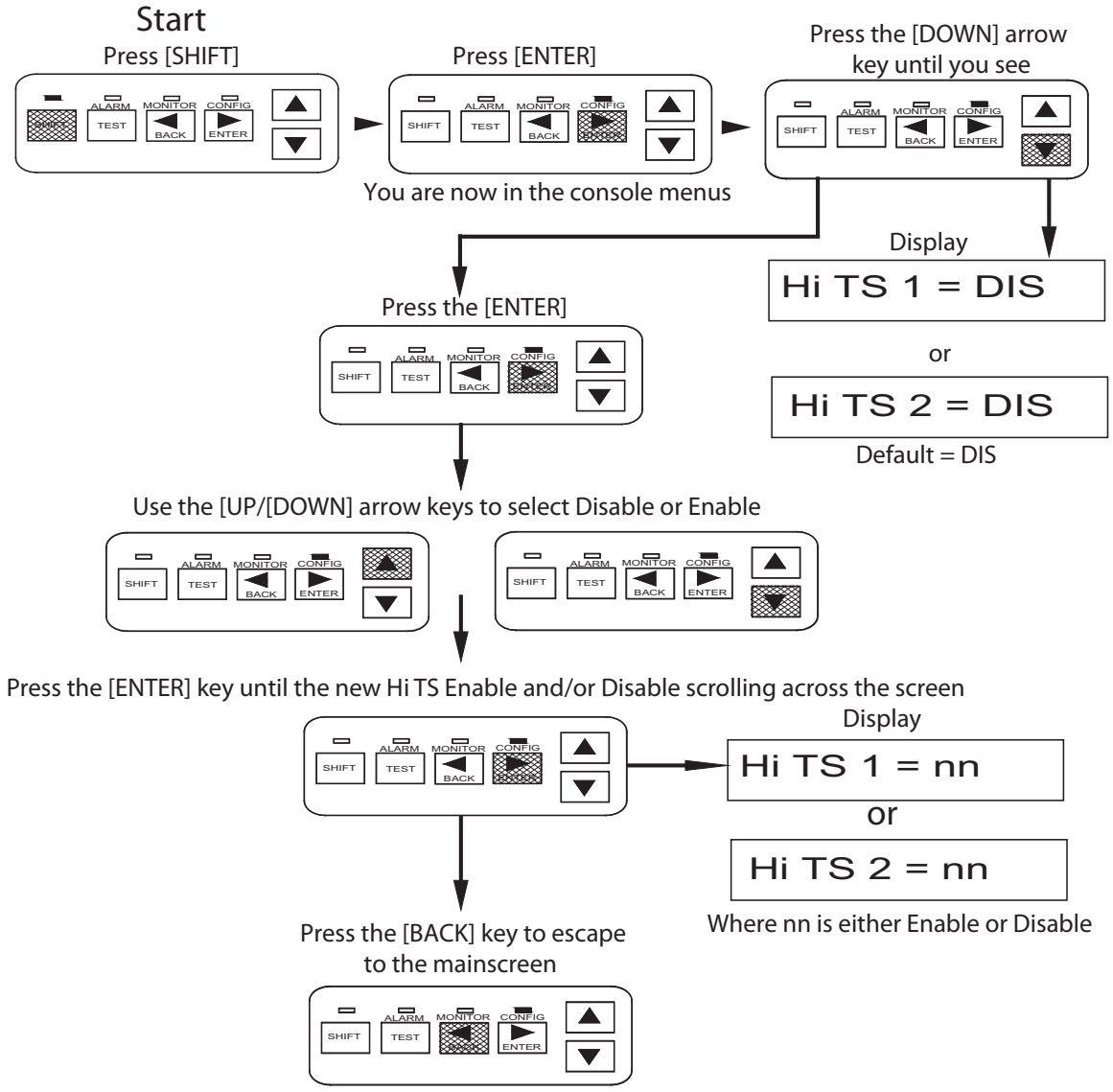


4.2.10 High Temperature Alarm: Enable (Hi TS 1 and Hi TS 2)

Purpose	This allows the user to enable or disable the high temperature alarm for temperature sensor number 1 and 2. When enabled, high limit cutout feature will force the controller output off if the temperature reading exceeds the HIGH ALARM temperature setting. This is a non-latching condition, so once the reading drops below the HIGH temperature ALARM setting, the controller will resume normal operation.		
	Alarm time delay filter is factory set at 15 minutes.		
Setting/Range	Enable or disable	Factory default	Enable

Keystrokes for Enabling and Disabling Hi TS (Temperature Sensor Alarm) 1 and 2

High Temperature Sensor Alarm

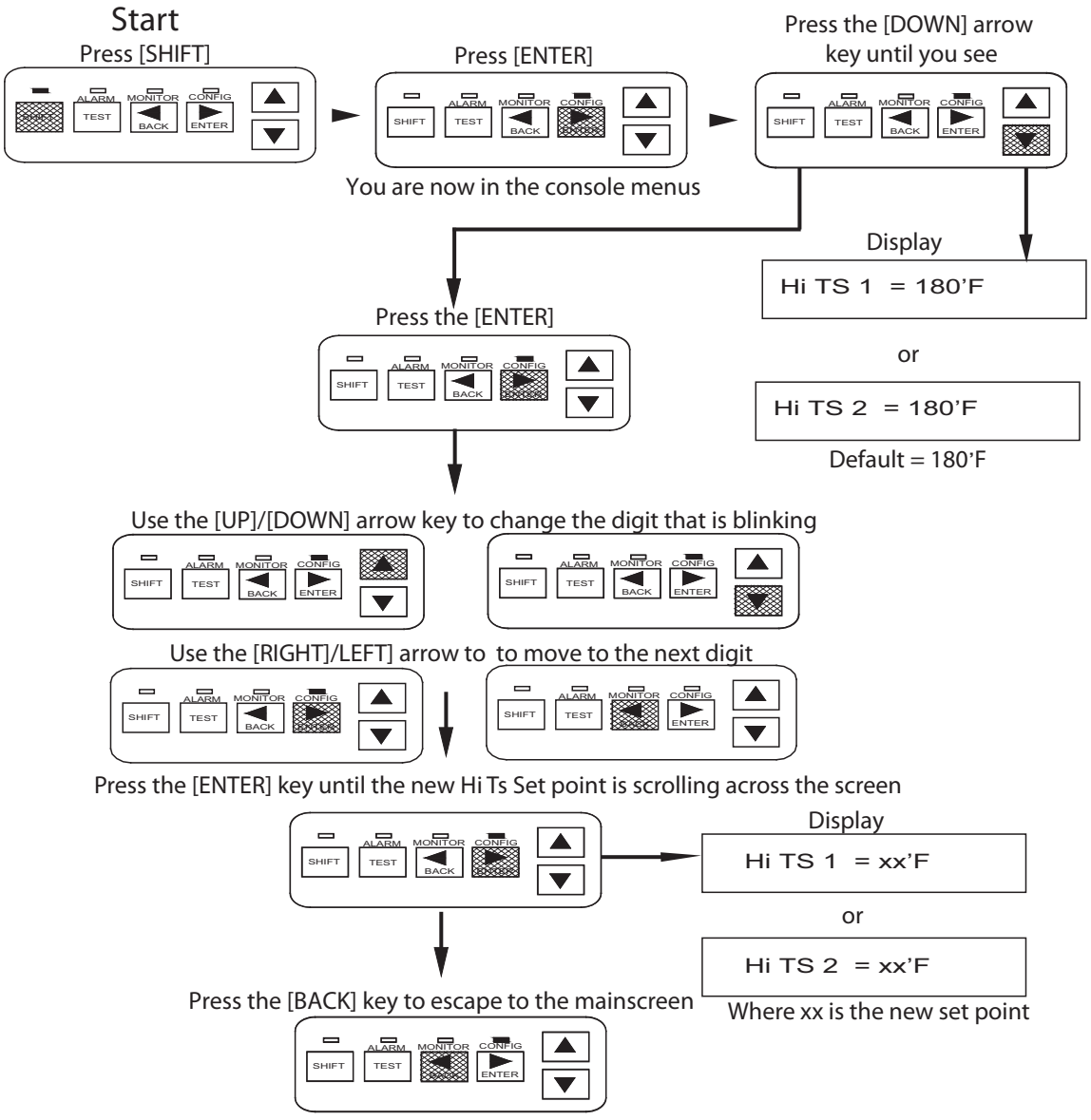


4.2.11 High Temperature Alarm: Setting (Hi TS 1 and Hi TS 2)

Purpose	This allows the user to set the high temperature alarm setting for temperature sensor number 1 and 2.		
	Alarm time delay filter is factory set at 15 minutes.		
Setting/Range	0°F to 200°F (–18° to 93°C)	Factory default	180°F (82°C)

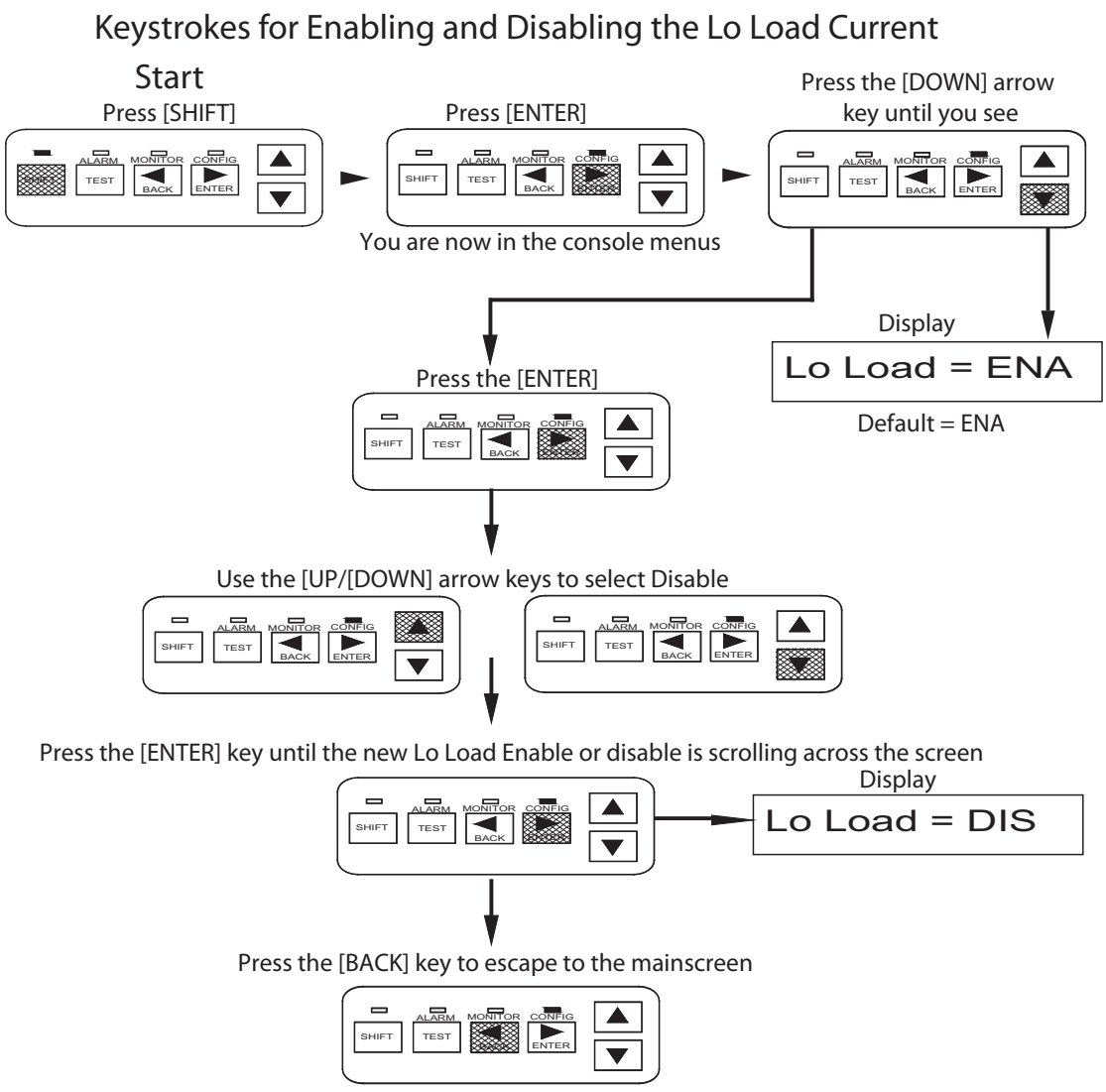
Keystrokes for Entering the Setpoint for Hi TS (Temperature Sensor) 1 and 2

High Temperature Sensor Setpoint



4.2.12 Low Load Current Alarm: Enable (Lo Load)

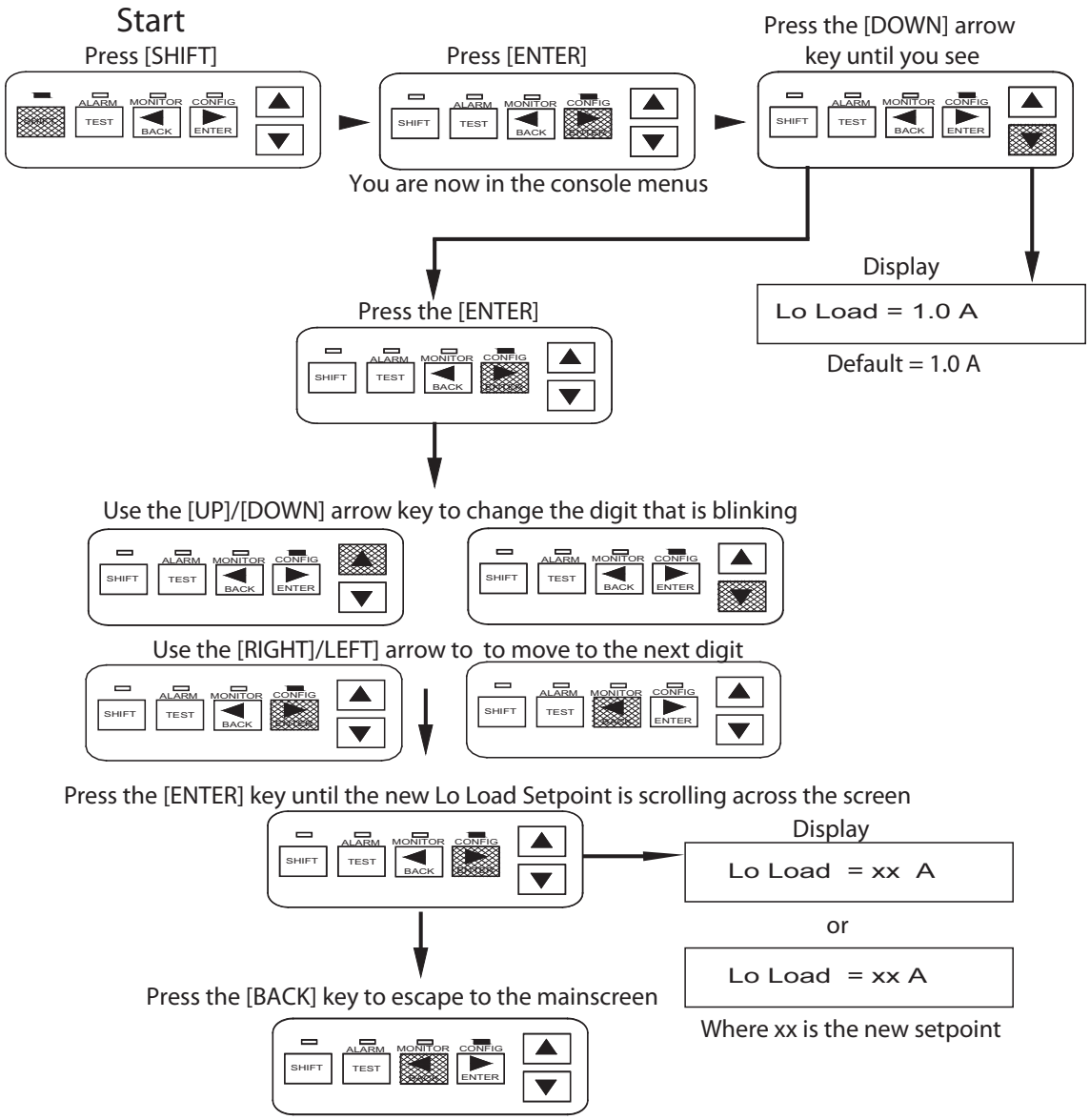
Purpose	This allows the user to enable or disable the low load current alarm to detect current levels which are lower than a preset limit for the application.		
	Alarm time delay filter is factory set at < 2 minutes.		
Setting/Range	Enable or disable	Factory default	Enable



4.2.13 Low Load Current Alarm: Setting (Lo Load)

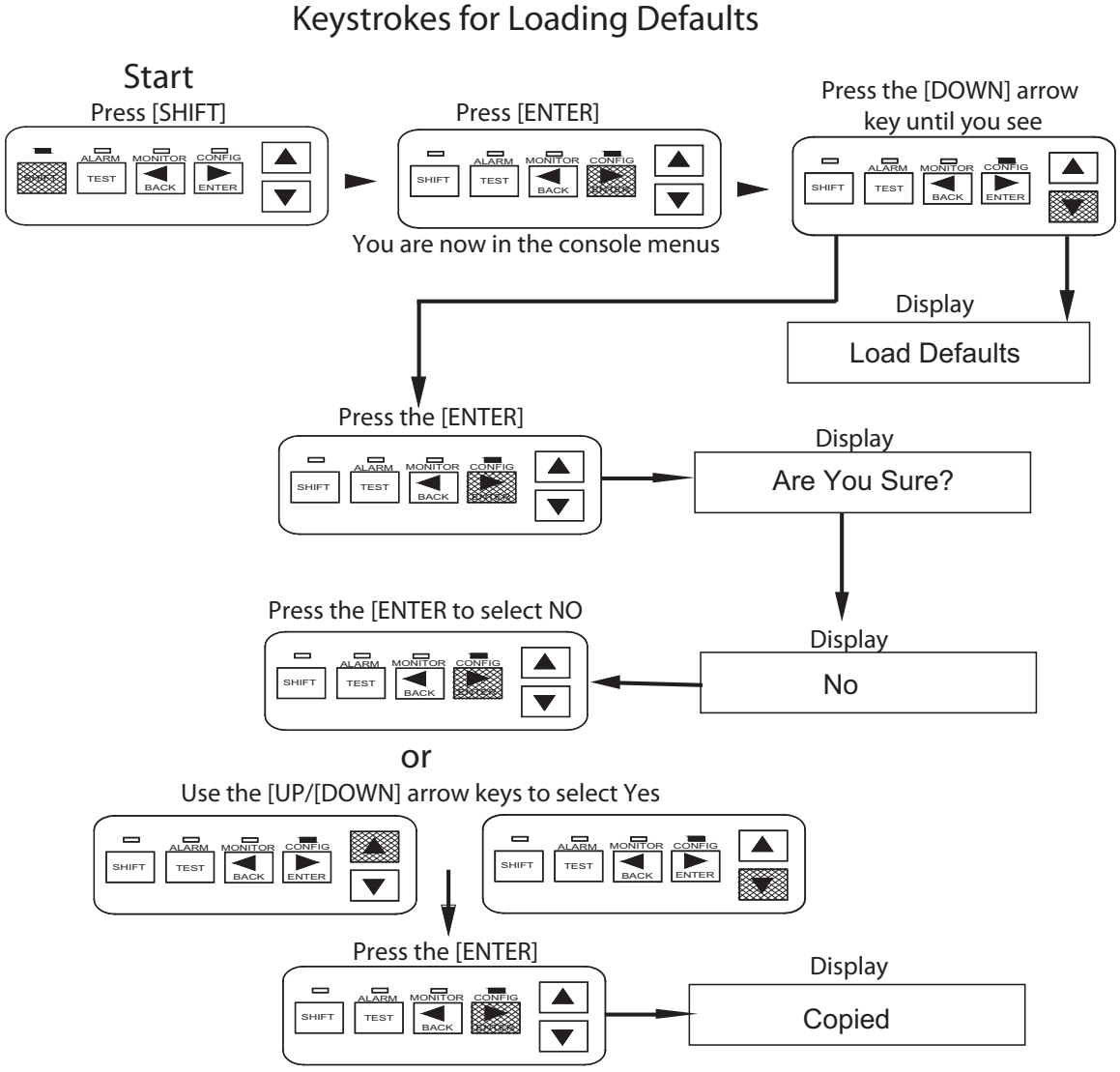
Purpose	This allows the user to set the low load current alarm level.		
	Alarm time delay filter is factory set at < 2 minutes.		
Setting/Range	0.3 A to 30 A or off	Factory default	1 A

Keystrokes for Entering the Lo Load Current Setpoint



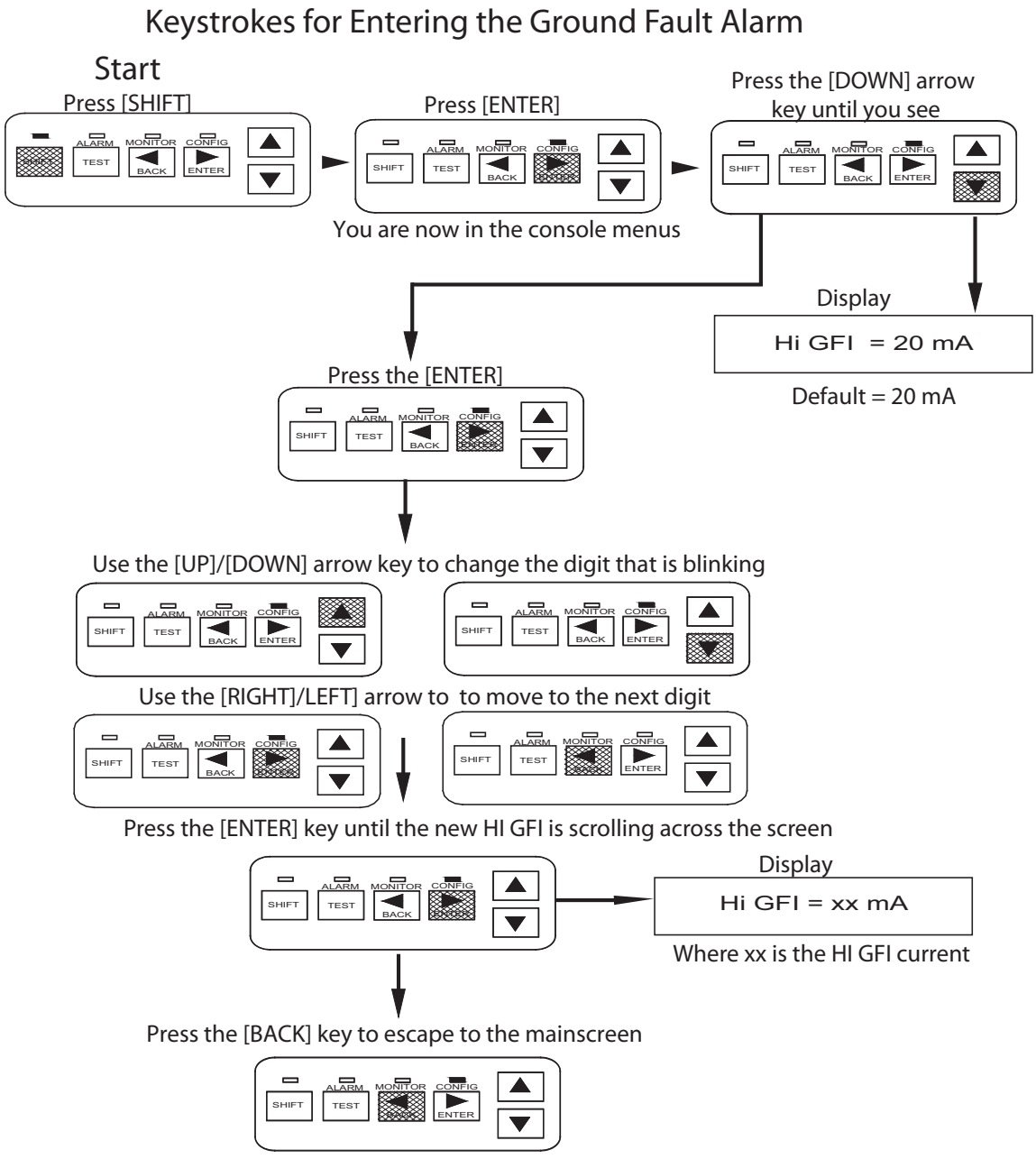
4.2.14 Factory Default Settings (Load Defaults)

Purpose	To provide a quick method of re-setting the controller's configuration parameters to the factory default parameters.		
Setting	N/A	Factory default	N/A



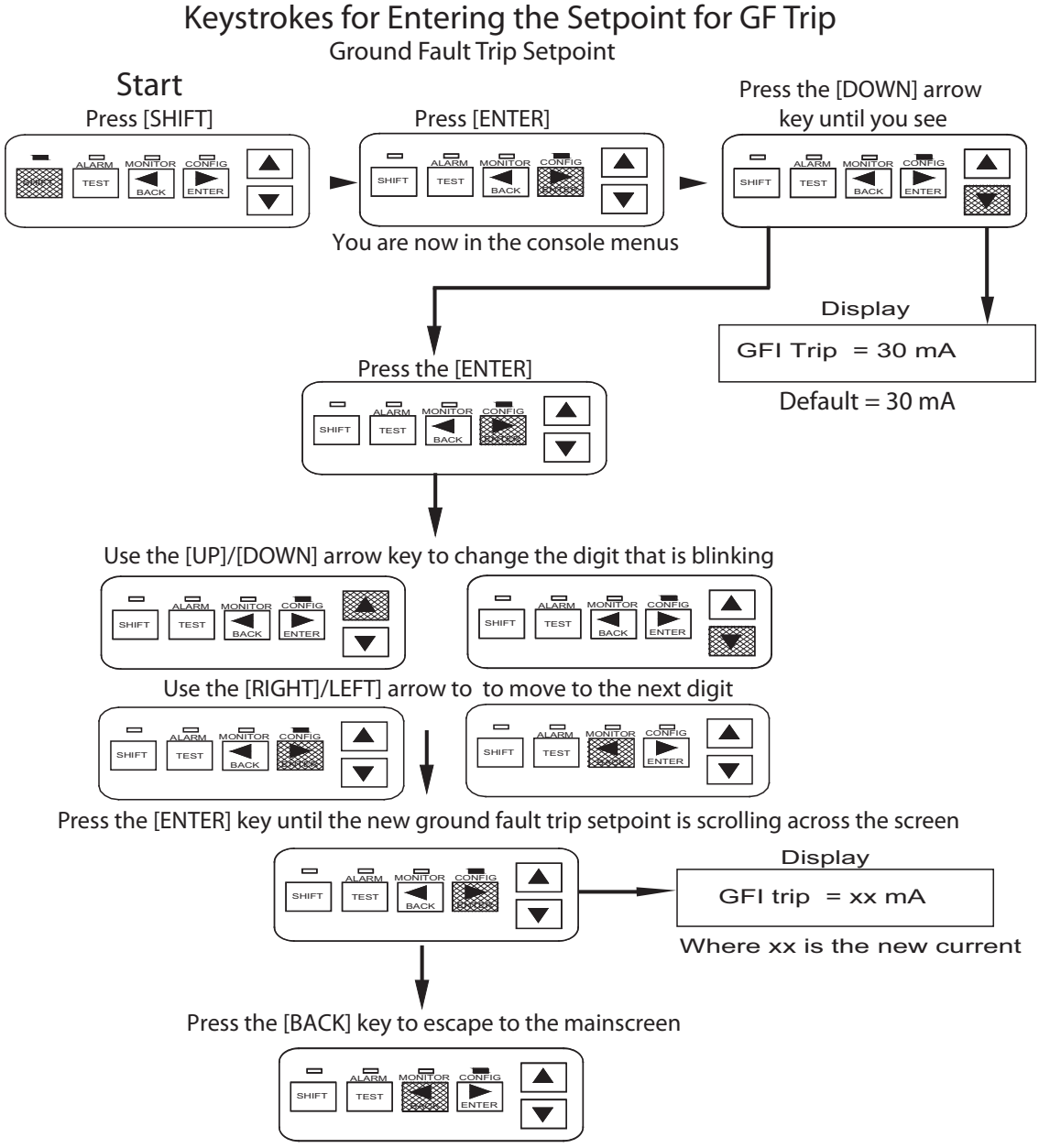
4.2.15 Ground-fault Current Alarm level (Hi GF Alarm)

Purpose	This allows the user to set the ground-fault current alarm level. Exceeding this limit will trigger the alarm to indicate that a ground-fault condition exists in the heating cable circuit.		
	Alarm time delay filter is factory set as immediate		
Setting/Range	20 mA to 100 mA	Factory default	20 mA



4.2.16 Ground-fault Current Trip Level (Hi GF Trip)

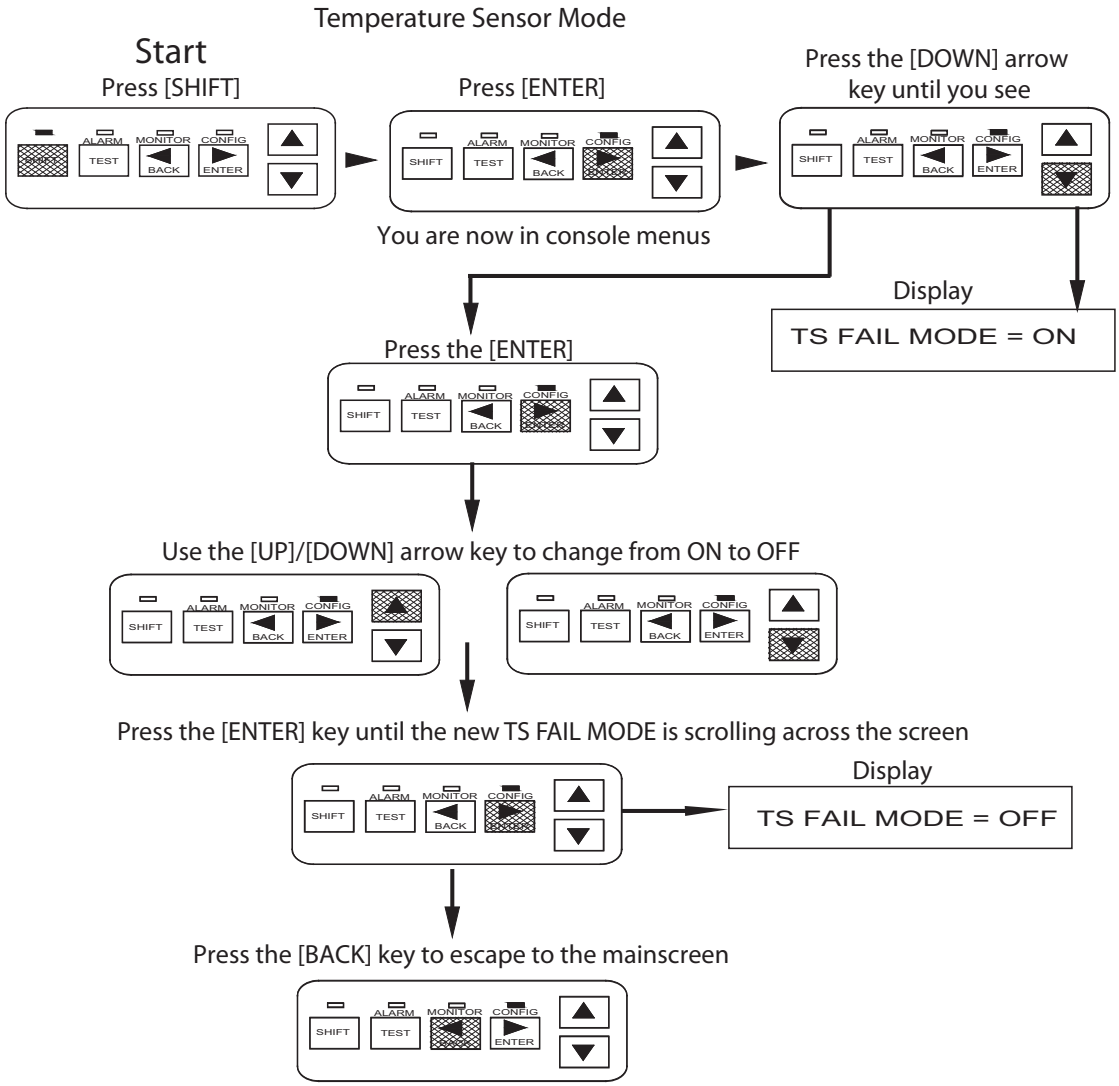
Purpose	This allows the user to set the ground-fault current trip level. Exceeding this limit will result in the output switch being latched off and the Ground-fault Level Trip Alarm activated to indicate a ground fault condition.		
	Alarm time delay filter is factory set as immediate		
Setting/Range	20 mA to 100 mA	Factory Default	30 mA



4.2.17 Temperature Sensor Failure Mode

Purpose	This mode sets the controller to turn the output switch ON or OFF if all selected temperature sensors fail.		
Setting/Range	On or off	Factory default	On

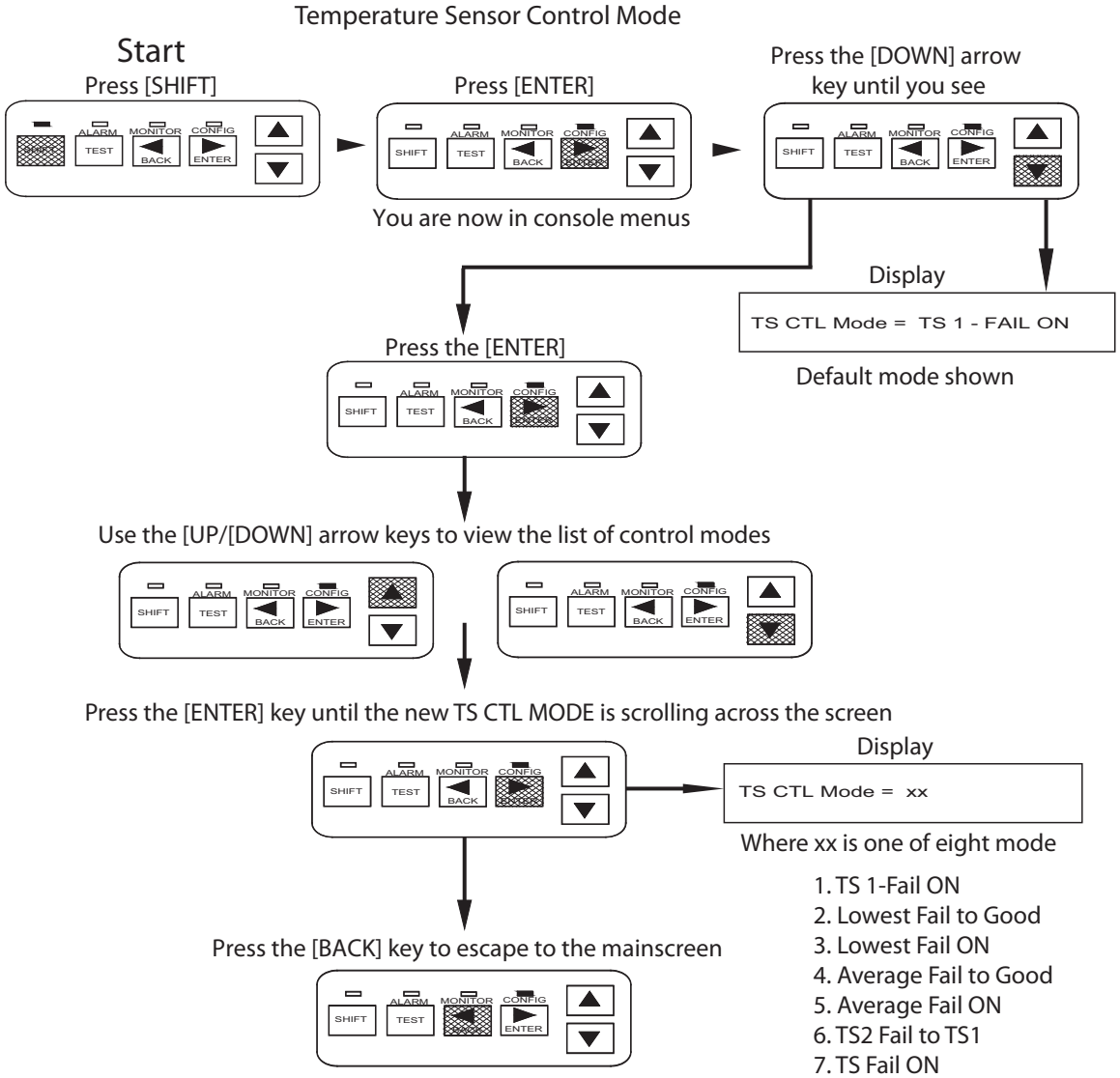
Keystrokes for configuring TS FAIL Mode ON or OFF



4.2.18 Temperature sensor Control Mode (TS CLT Mode)

Purpose	The TS CONTROL MODE allows the selection of one of eight possible temperature control modes for the controller. The different modes allow redundant fail-safe temperature sensing.	
Setting/Range	1. TS1-Fail ON	2. Lowest Fail to Good
	3. Lowest Fail ON	4. Average Fail to Good
	5. Average Fail ON	6. TS2 Fail to TS1
	7. TS Fail ON	8. TS1 Fail to TS
Factory Default	TS1-Fail On	

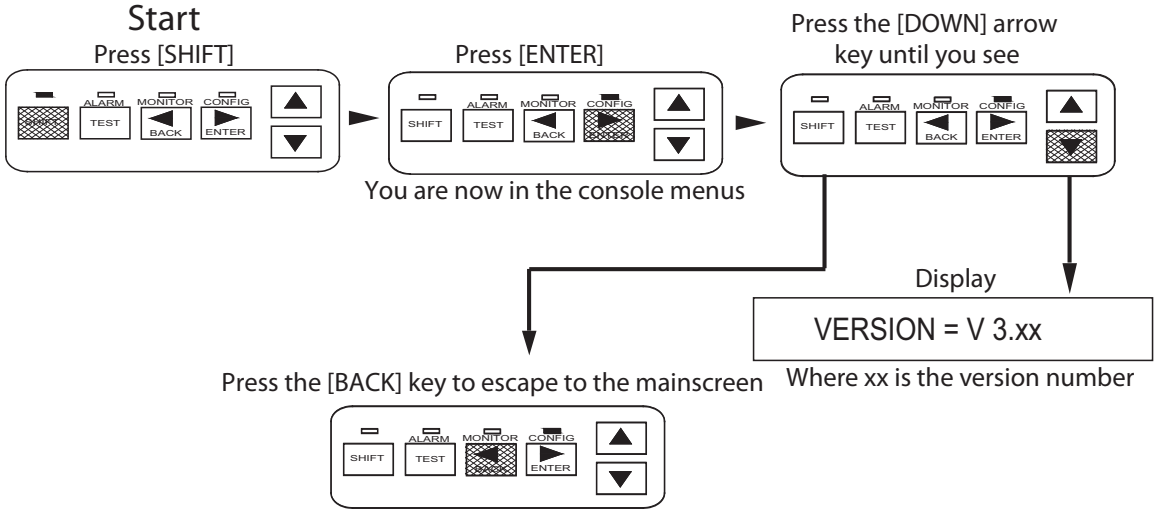
Keystrokes for Changing the TS CLT Mode



4.2.19 Firmware Version

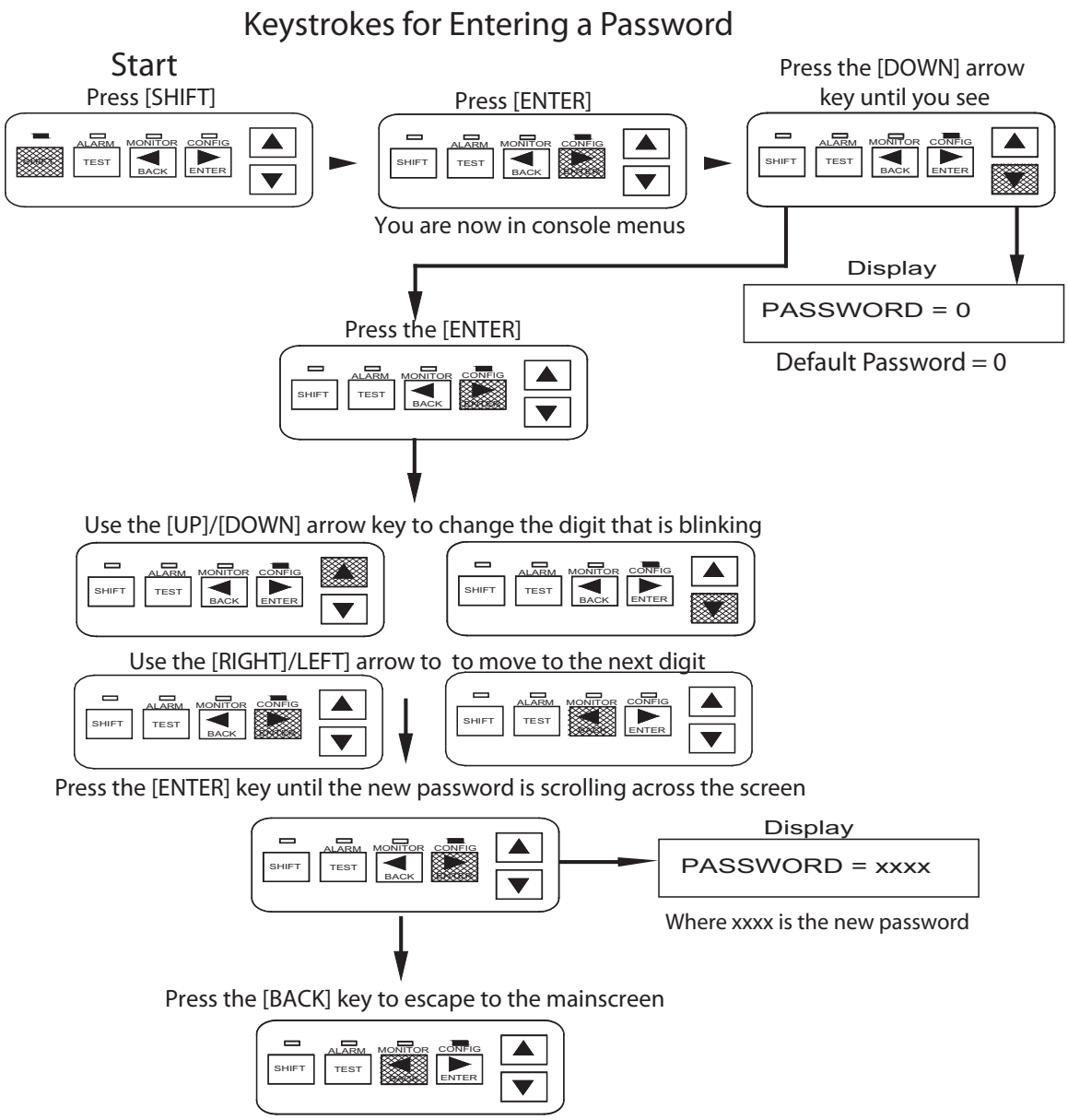
Purpose	This menu displays the revision level of the firmware programmed into the controller.		
Setting/Range	N/A	**Factory default**	N/A

Keystrokes for Viewing the Software Version



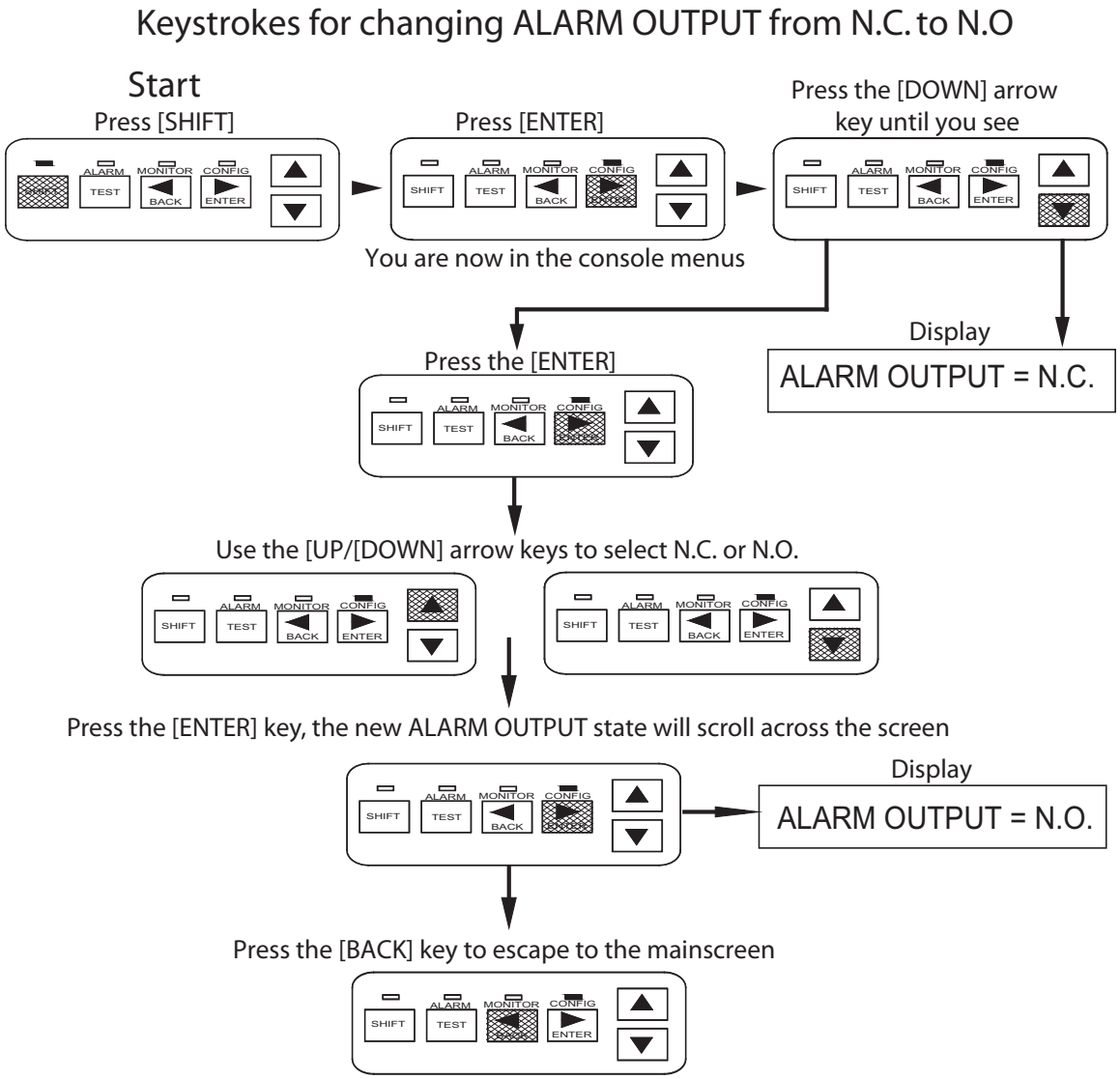
4.2.20 Passcode

Purpose	The four digit numeric PASSWORD stops unauthorized users from modifying the controller's configuration parameters using the Operator Console.		
Setting/Range	0000 to 9999	**Factory default**	0000



4.2.21 Alarm Output Normal State

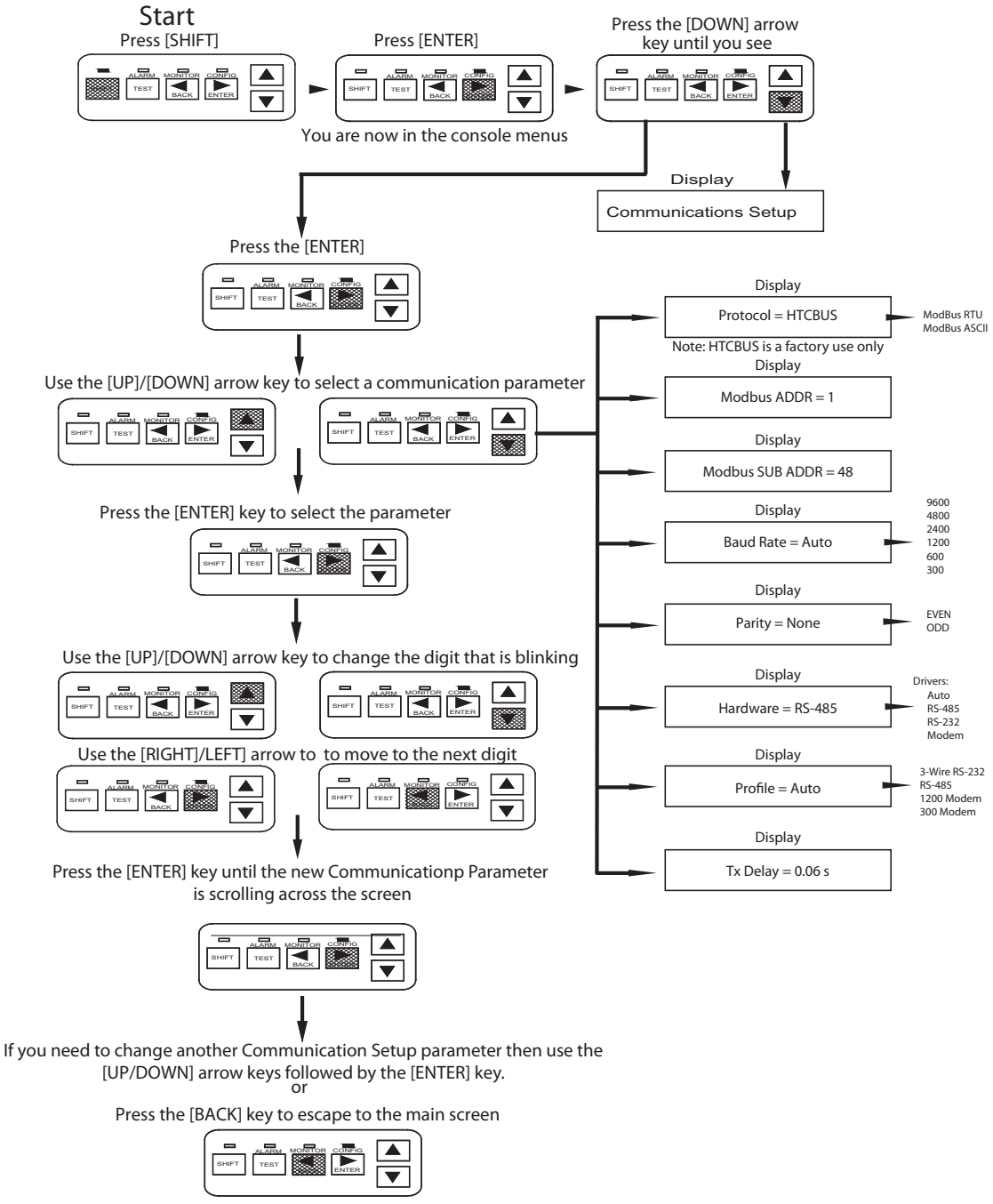
Purpose	Configures both the alarm output relays (dry contact and AC alarm) for normally open or normally closed operation. The normal condition is assumed to be when the HTC is powered and no alarms exist.		
Setting/Range	Normally Open (N.O.) or Normally Closed (N.C.)	Factory default	Normally closed



4.2.22 Communications Setup

Purpose	Defines the communications language used by the controller to communicate with other devices. The DigiTrace C910-485 only communicates using Modbus Protocol.		
Setting/Range	See DigiTrace C910-485 Communication Parameters Table	Factory default	HTCBus

Keystrokes for Communication Setup

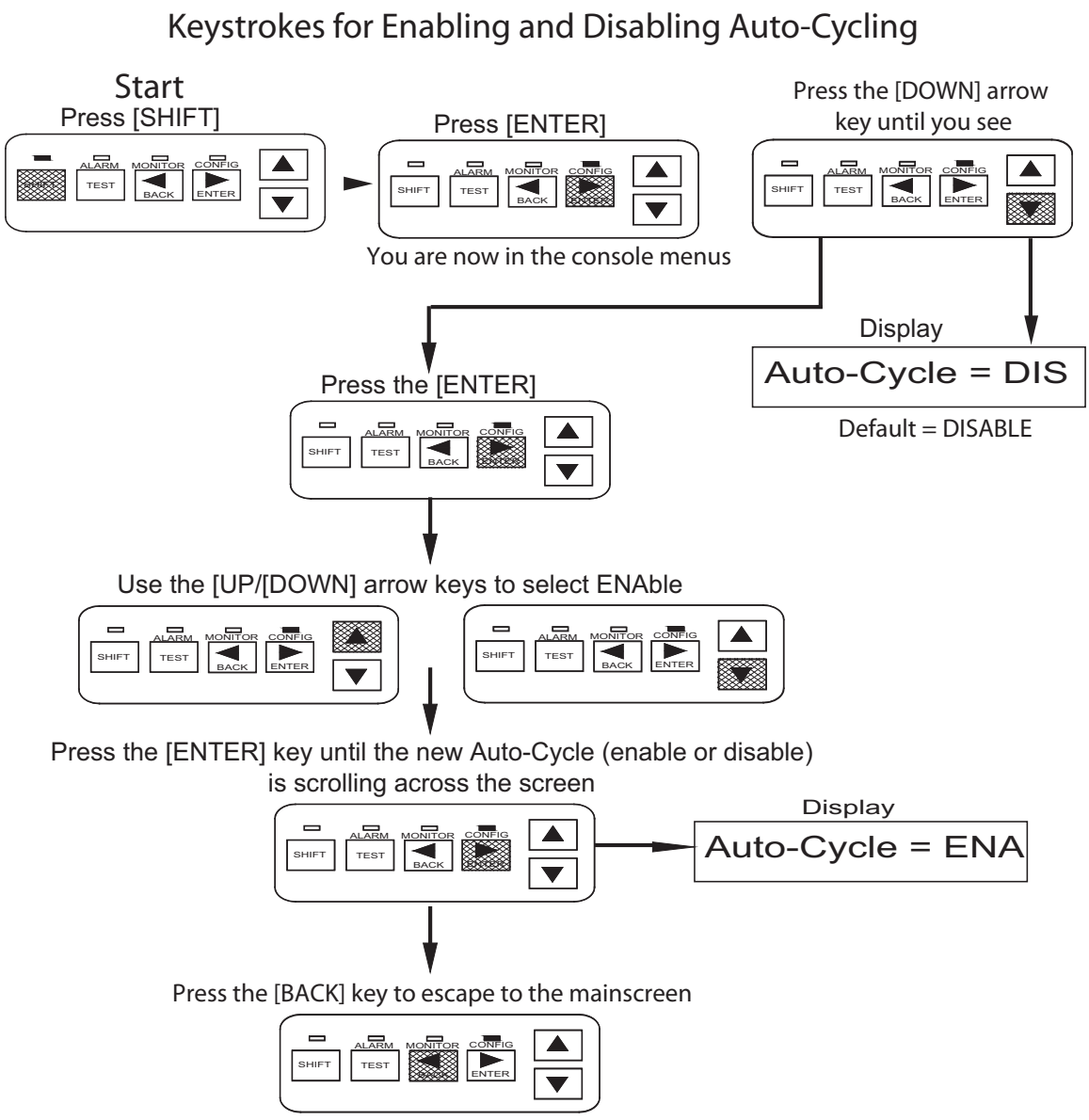


DigiTrace C910-485 Communication Parameters

Parameter	Settings	Notes
Protocol	HTCBus (default) Modbus RTU Modbus ASCII	If you are communicating directly with the controller using a different device, select the MODBUS protocol. For a detailed description of the controller's MODBUS mapping please refer to DigiTrace C*910 Series Heat Trace Controller.* Note: HTCBus is for factory use only.
Modbus Addr	1 - 247	Set the communications address as desired. Each controller on the serial communication bus must have its own unique address.
Modbus Baud Rate	Auto, 9600, 4800, 2400 1200, 600, 300. Default =Auto	Select the data rate to be compatible with other devices that will be connected to the controller for communications purposes. It is recommended that the setting be set to AUTO. The controller will automatically select a BAUD RATE that is compatible with the communications interface installed.
Parity	NONE, EVEN, ODD	Defines the type of parity bit to be used with MODBUS communications. Select the desired type of parity. Note that PARITY can only be selected when using MODBUS protocol.
Hardware	RS-485	Identifies the type of communications interface installed in the C910.
Driver	Auto, RS-485, RS-232, Modem.	Defines the way in which the controller's program communicates with the communications interface.
Profile	Auto, 3-wire RS232, RS485, 1200 BAUD Modem, 300 BAUD Modem	Defines the way in which the controller's program supports communications handshaking and communication interface signals.
Tx Delay	0.00 to 2.50 seconds	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.

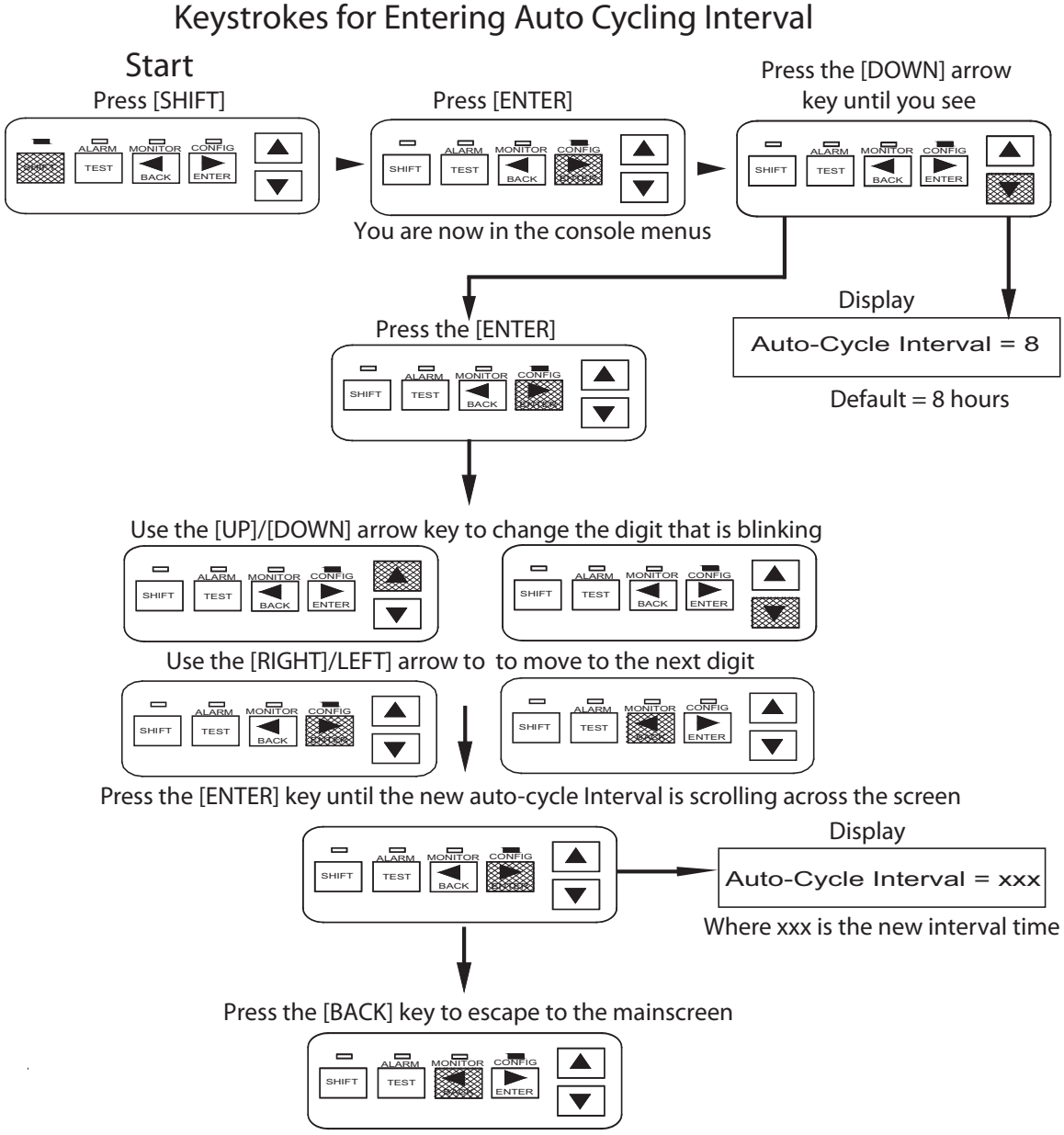
4.2.23 Auto-Cycle: Enabling

Purpose	The autocycle function applies power to the heating cable circuit for approximate 10 seconds at the selected interval. It is used to test the integrity of the heating cable circuit. Note: Although the autocycle function helps monitor the functionality of the heating cable circuits it does not eliminate the need for preventive maintenance as detailed in the heating cable operating manuals.		
Setting/Range	Enable or disable	**Factory default**	Disable



4.2.24 Auto-Cycle: Interval

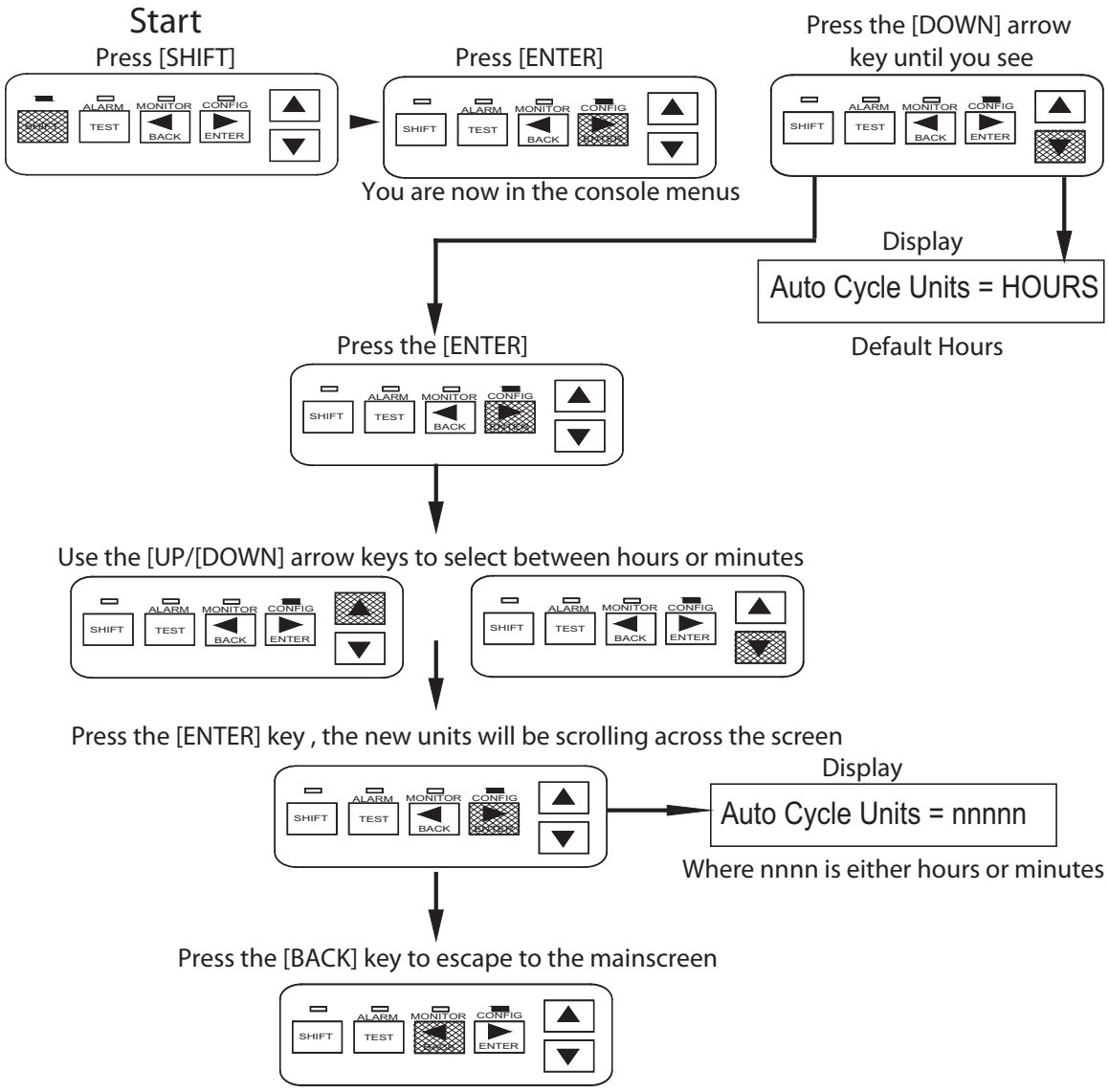
Purpose	Set the interval for running the autocycle procedure		
Setting/Range	1 to 240 [minutes or hours, selected in the Auto-cycle units menu.]	Factory default	8



4.2.25 Auto-Cycle: Units

Purpose	Select the Autocycle interval time units.		
Setting/Range	Minutes or hours	Factory default	Hours

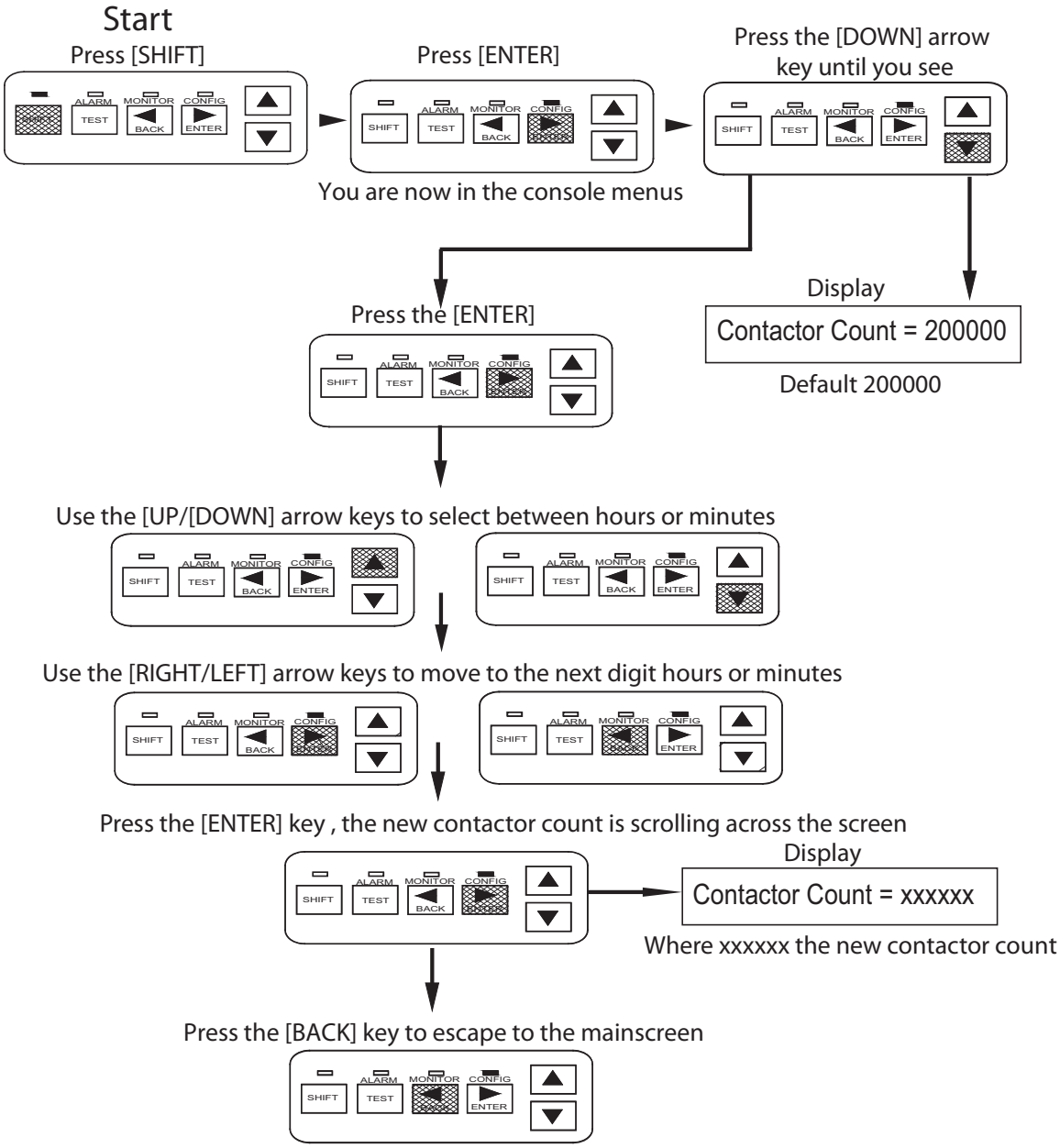
Keystrokes for Changing Auto-Cycle Units



4.2.26 Contactor Count

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.		
Setting/Range	0 to 999,999	**Factory default**	200,000

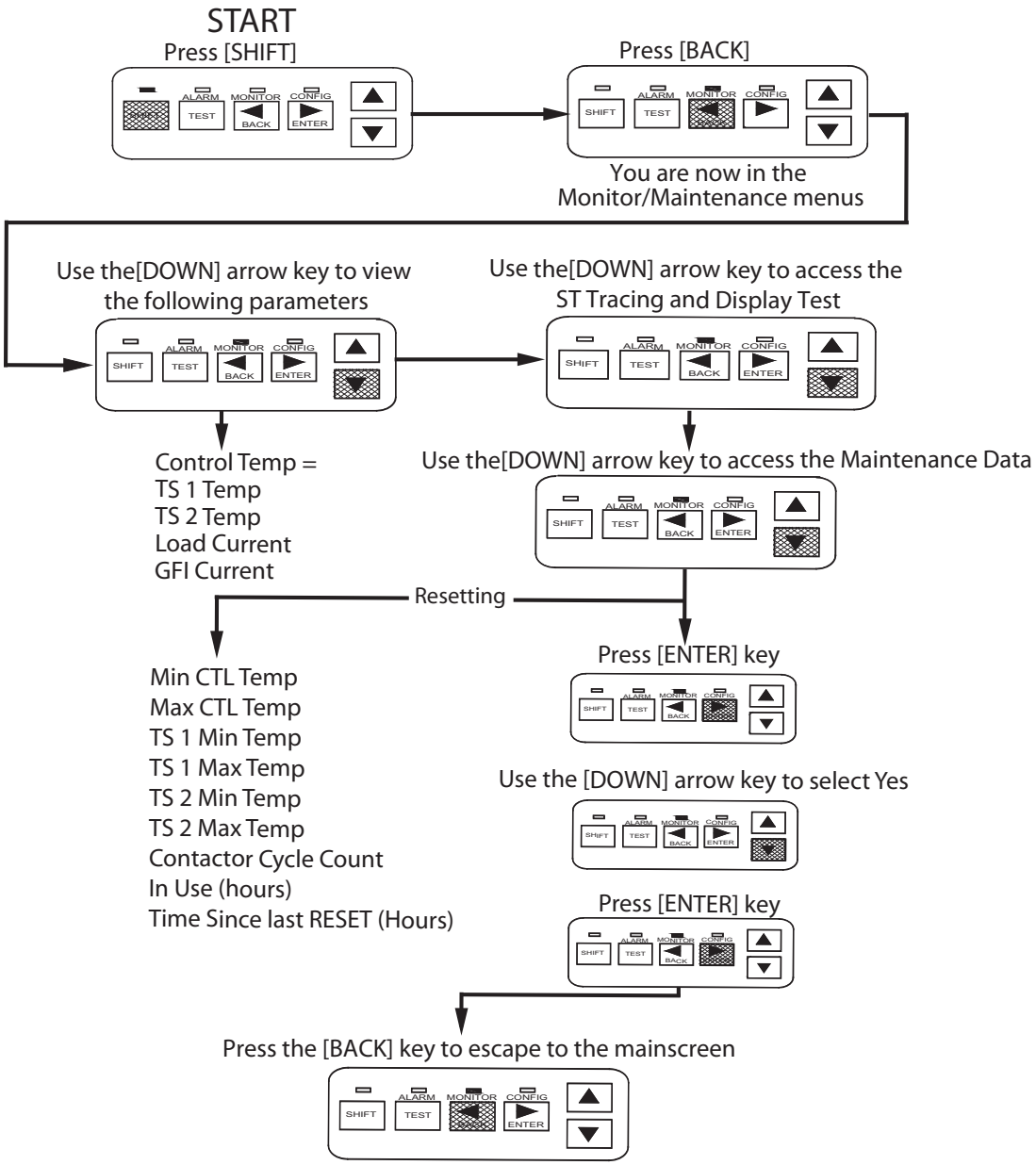
Keystrokes for Changing Contactor Count



4.2.27 Monitor and Maintenance Menus

Purpose	The Monitor menu displays the measured and stored readings. You can also reset counters from this menu.		
Setting/Range	See DigiTrace C910 Monitoring and Maintenance Parameters table.	Factory default	N/A

Keystrokes for Entering Monitor and Maintenance Menus



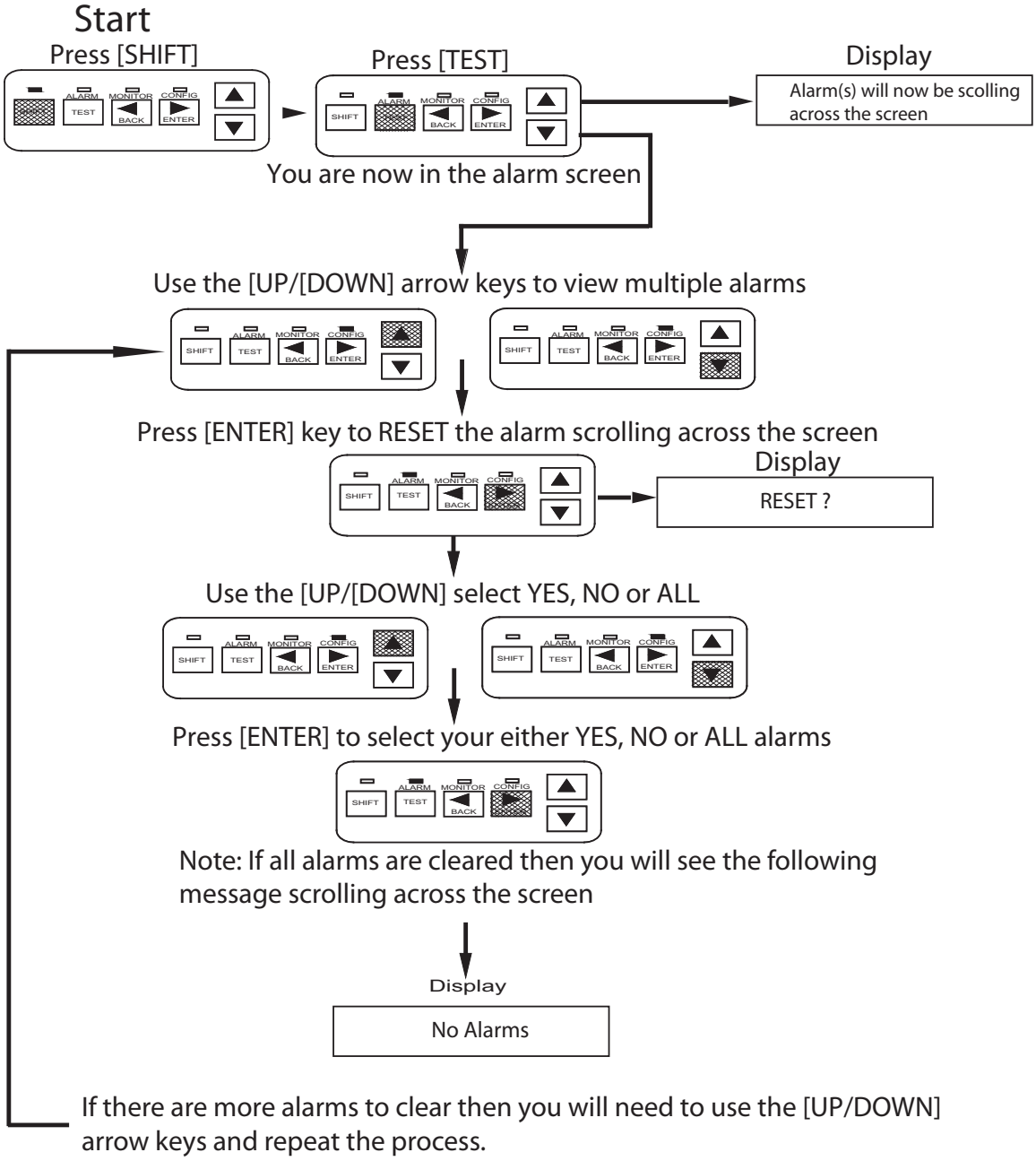
DigiTrace 910 Monitoring and Maintenance Parameters

Monitored variables	Description
CTL temp	Control Temp
TS1 temp	This temperature is the value that the controller is reading from the RTD connected to its TS 1 input.
TS2 temp	This temperature is the value that the controller is reading from the RTD connected to its TS 2 input, if the sensor is being used.
Load current	Displays the current being drawn by the heating cable. (A)
GFI current	Displays the ground-fault current being drawn by the heating cable. (mA)
Maintenance Tests	
Trace testing	The TEST TRACING feature temporarily overrides the temperature control, and powers the heating cable circuit for 30 seconds without having to modify the CONTROL SETPOINT temperature or any other configuration parameter.
Display test	The DISPLAY TEST feature provides an easy method of illuminating each display segment and all the LEDs of the Operator Console to ensure that they are functioning properly.
Recorded Values	
Temperature values	This feature indicates the maximum and minimum temperatures recorded by the C910 since the last time the values were reset: Max Control temp Min Control temp TS 1 Max Temp TS 1 Min Temp TS 2 Max Temp TS 2 Min Temp
Contactor cycle count	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. (See keystroke procedure for resetting)
Time in use	Indicates the total hours in use of the controller since its initial operation or since it was last reset.
Time since last reset	This feature indicates the total hours in use of the controller since the last reset.
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.

4.2.28 Acknowledging and Resetting Alarms

Purpose	To acknowledge and reset any alarm conditions that may exist. Use the Up / Down Arrow keys to examine the next/previous active alarms.		
Setting/Range	See Alarm Filter Times	Factory default	N/A

Keystrokes for Acknowledging and RESETING Alarms



Alarm Filter Times

Alarm Type	Filter Time
Lo TS 1 and 2	15 minutes
Hi TS 1 and 2	15 minutes
Lo load current	2 minutes
Hi ground-fault alarm	10 seconds
Hi ground-fault trip	< 1 second
OPEN / SHORTED TS 1 and 2	10 seconds
Contactor count	< 1 seconds
Switch failure	2 minutes

Section 5 Troubleshooting

The DigiTrace C910 may be used as an effective troubleshooting tool to pinpoint problem areas of heating cable circuits. Described below are a few of the more common problem areas, their symptoms, and parameters to check to determine the actual faulty portion of the heating cable circuit.

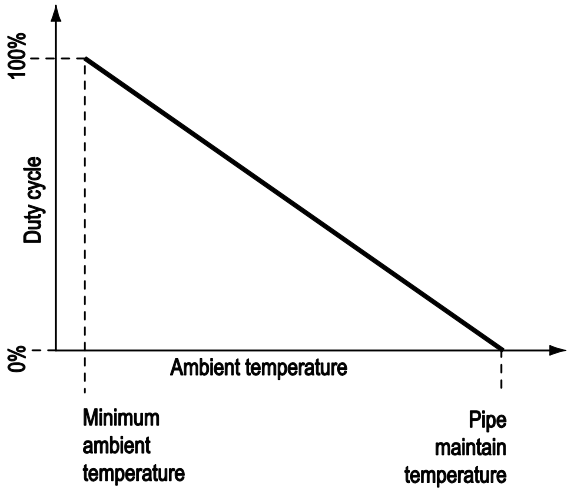
Symptom	Probable Cause	Corrective Action
RTD failure alarm	RTD is not a 3-wire 100 Ω Platinum	Install correct RTD
	Damaged RTD sensor or extension cable	Install new RTD and/or cable
	Incorrectly wired	Re-install RTD connections
Seemingly incorrect temperature	Incorrect RTD used	Install correct RTD
	Damaged RTD sensor or connection cable	Install new RTD and/or cable
	C910 not functioning correctly	Verify correct reading input Connect a 100 Ω resistor across the source or sense terminal and common. Insert a jumper between the source and sense terminals. Apply power to the controller. The indicated or displayed temperature should be about 32°F (0°C).
Unstable or bouncing temperature	Bad, damaged or incorrectly installed RTD extension wire.	Wire used for extension of the RTD should be three-wire, twisted and shielded with the shield grounded at the controller only. Each of the three lead wires must be of the same gauge.
	Terminal connections are not tight	Verify tightness of connections
	RTD or extension cable damaged	Install new RTD and/or cable
High temperature TS 1/ TS 2	Alarm temperature setting too close to maintain temperature	Increase setting
	Flow of hot water through pipe	
	Incorrect heating cable wiring	Verify heating cable wiring
LOW temperature TS 1/TS 2	Alarm temperature setting too close to maintain temperature	Decrease setting
	Heating cable not sized properly for the application	
	Damaged, wet, or missing thermal insulation	

Control TS failure	Failure of the RTD designated as the controlling sensor.	Check setting for TS FAIL MODE the output switch may be latched off or on until this failure is corrected
	Incorrect or damaged field wiring	Re-install RTD connections
	Damaged temperature sensors	Install correct RTD.
Ground-fault alarms	Incorrect installation, wet system components or damaged cables.	Perform heating cable commissioning tests outlined in the heat cable operation manuals.
	Floating ground	Check that the heating cable circuit neutrals return to the controller and are not connected directly to the distribution panel.
	Alarm setting too close to normal leakage current	
Low current	Low or no source voltage	Verify correct power distribution
	Damaged or inoperative heating cable	Repair or replace heating cable
	Open connection—wiring problem	Verify correct power distribution wiring
	contactor failed open	Replace or repair controller
Switch failure	Output switch has failed “closed”	Replace or repair controller
Contactor count	Number of off-to-on transitions of a contactor has exceeded the CONTACTOR COUNT ALARM setting and the contactor should be replaced.	Inspect contactor and replace if necessary.

Appendix A: Proportional Ambient Sensing Control (PASC)

PASC takes advantage of the fact that the heat loss from a pipe is proportional to the temperature difference between the pipe and the ambient air. This is true regardless of heating cable, insulation type, or pipe size. Once the heat tracing and insulation on a pipe has been designed to balance heat input with heat loss and maintain a particular temperature, the main variable in controlling the pipe temperature becomes the ambient air temperature.

The DigiTrace C910 has a control algorithm that uses the measured ambient temperature, desired maintain temperature, minimum ambient temperature assumption used during design, and size of the smallest pipe diameter to calculate how long the heating cable should be on or off to maintain a near-constant pipe temperature. The power to the heat tracing is proportioned based upon on the ambient temperature. If the ambient temperature is at or below the “minimum design ambient plus 3°F” the heating cable will be on 100%. If the measured ambient is at or above the “maintain temperature –3°F” the heating cable will be on 0%. For any measured ambient between “minimum design ambient” and “maintain temperature,” the heating cable will be on a percentage of the time equal to (maintain temperature – measured ambient) / (maintain temperature – minimum design temperature).



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