1.1 INTRODUCTION

This manual provides information pertaining to the installation, operation, testing and maintenance of the nVent RAYCHEM C910-485 Heat Trace Controller.

Additional copies of this user manual may be ordered separately through your nVent representative or online at nVent.com

This document covers the C910-485 Heat Trace Controller 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 C910-485 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 C910-485 Electronic Heat Trace Controller controls, monitors, and communicates alarms and data for one heating cable circuit. It comes with a RS-485 communication module for remote operation over Modbus® protocol or in conjunction with the nVent RAYCHEM ACS-30 control system, 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.

- **High Temperature Cut-out**
  High temperature cut-out is provided for both temperature sensor inputs.

- **Low Current Alarms**
  The C910-485 offers adjustment of the low alarm points over the entire current measurement range.

- **Electromechanical Relay (EMR) Output**
  The C910-485 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 are 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 C910-485 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 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 C910-485 incorporates RS-485 serial communication for applications requiring direct interfacing to BMS systems using Modbus protocol or used as a single circuit extension to the ACS-30 control system.

Certification
nVent certifies that this product met its published specifications at the time of shipment from the factory.

Limited Warranty
This nVent 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, nVent 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 nVent. The Buyer shall prepay shipping charges to nVent and nVent 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 nVent from another country. nVent warrants that the software and firmware designated by nVent for use with the C910-485 Controller will execute its programming instructions properly. nVent 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. nVent 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. nVent 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

<table>
<thead>
<tr>
<th>Area of use</th>
<th>Nonhazardous locations</th>
</tr>
</thead>
</table>

Approvals

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>100 V to 277 V, +5/–10%, 50/60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Common supply for controller and heat-tracing circuit</td>
</tr>
</tbody>
</table>

Enclosure

<table>
<thead>
<tr>
<th>Protection</th>
<th>NEMA 4X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>FRP/Polycarbonate</td>
</tr>
<tr>
<td>Ambient operating temperature range</td>
<td>–40°F to 140°F (–40°C to 60°C)</td>
</tr>
<tr>
<td>Ambient storage temperature range</td>
<td>–40°F to 185°F (–40°C to 85°C)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0% to 90%, noncondensing</td>
</tr>
</tbody>
</table>

Control

<table>
<thead>
<tr>
<th>Relay type</th>
<th>Double-pole, mechanical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage, maximum</td>
<td>277 V nominal, 50/60 Hz</td>
</tr>
<tr>
<td>Current, maximum</td>
<td>30 A @ 104°F (40°C) derated to 20 A @ 140°F (60°C)</td>
</tr>
<tr>
<td>Control algorithms</td>
<td>EMR: On/off, proportional ambient sensing control (PASC)</td>
</tr>
<tr>
<td>Control range</td>
<td>0°F to 200°F (–18°C to 93°C)</td>
</tr>
</tbody>
</table>
### Monitoring

<table>
<thead>
<tr>
<th></th>
<th>Low alarm range</th>
<th>High alarm range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>0°F to 180°F (−18°C to 82°C) or OFF</td>
<td>0°F to 200°F (−18°C to 93°C) or OFF</td>
</tr>
<tr>
<td>Ground fault</td>
<td>Alarm range</td>
<td>20 mA to 100 mA</td>
</tr>
<tr>
<td></td>
<td>Trip range</td>
<td>20 mA to 100 mA</td>
</tr>
<tr>
<td>Current</td>
<td>Low alarm range</td>
<td>0.3 A to 30 A or OFF</td>
</tr>
<tr>
<td>Autocycle</td>
<td>Diagnostic test interval adjustable from 1 to 240 minutes or 1 to 240 hours</td>
<td></td>
</tr>
</tbody>
</table>

### Temperature Sensor Inputs

<table>
<thead>
<tr>
<th></th>
<th>Two inputs standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types</td>
<td>100 Ω platinum RTD, 3-wire, α = 0.00385 ohms/ohm/°C</td>
</tr>
<tr>
<td></td>
<td>Can be extended with a 3-conductor shielded cable of 20 Ω maximum per conductor</td>
</tr>
</tbody>
</table>

### Alarm Outputs

<table>
<thead>
<tr>
<th></th>
<th>Isolated solid-state triac, SPST, 0.75 A maximum, 100 V to 277 V nominal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry contact relay</td>
<td>Pilot duty only, 48 V/dc, 500 mA maximum, 10 VA maximum resistive switching</td>
</tr>
</tbody>
</table>

Note: Outputs are configurable as “open on alarm” or “close on alarm”
<table>
<thead>
<tr>
<th><strong>Programming and Setting</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method</strong></td>
<td>Programmable keypad, or ACS-30 user interface network</td>
</tr>
<tr>
<td><strong>Units</strong></td>
<td>Imperial (°F, in.) or Metric (°C, mm)</td>
</tr>
<tr>
<td><strong>Digital display</strong></td>
<td>Actual temperature, control temperature, heating cable current, ground fault, programming parameter values, alarm values</td>
</tr>
<tr>
<td><strong>LEDs</strong></td>
<td>Current mode, heating cable on, alarm condition, receive/transmit data</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>Nonvolatile, restored after power loss, checksum data checking</td>
</tr>
<tr>
<td><strong>Stored parameters (measured)</strong></td>
<td>Minimum and maximum temperature, maximum ground-fault current, maximum heating cable current, contactor cycle count, time in use</td>
</tr>
<tr>
<td><strong>Alarm conditions</strong></td>
<td>Low/high temperature, low current Ground-fault alarm, trip RTD failure, loss of programmed values, or EMR failure</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>Password protection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Connection Terminals</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply input</strong></td>
<td>Screw terminals, 22–8 AWG</td>
</tr>
<tr>
<td><strong>Heating cable output</strong></td>
<td>Screw terminals, 22–8 AWG</td>
</tr>
<tr>
<td><strong>Ground</strong></td>
<td>Two box lugs, 14–6 AWG</td>
</tr>
<tr>
<td><strong>RTD/alarm/communications</strong></td>
<td>28–12 AWG spring clamp terminals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Mounting</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FRP/Poly carbonate enclosure</strong></td>
<td>Surface mounting with four fixing holes on 7.25 in x 11.7 in (184 mm x 297 mm) centers Hole diameter: 0.31 in (8 mm)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Communications</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protocol</strong></td>
<td>Modbus RTU / ASCII</td>
</tr>
<tr>
<td><strong>Topology</strong></td>
<td>Multidrop, daisy chain</td>
</tr>
<tr>
<td><strong>Cable</strong></td>
<td>Single shielded twisted pair, 26 AWG or larger</td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>4,000 ft. (1.3 km) maximum @ 9600 baud</td>
</tr>
<tr>
<td><strong>Quantity</strong></td>
<td>Up to 32 devices without repeater</td>
</tr>
<tr>
<td><strong>Address</strong></td>
<td>Programmable</td>
</tr>
</tbody>
</table>
2.1 INTRODUCTION
This section includes information regarding the initial inspection, preparation for use, and storage instructions for the 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 nVent representative. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as your nVent 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 2.1.
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 250 of the National Electrical Code and Part I of the Canadian Electrical Code.

Figure 2.1 – Mounting Hole Template
2.5 WIRING

The following drawings provide sample wiring diagrams for the C910-485 control products and optional accessories. Refer to Figure 2.2 for wiring terminal locations. Please contact your local nVent representative for information regarding other available options.

![Figure 2.2 – Power Connection](image)

2.5.1 Power Connections

The C910-485 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 2.3 – Power Connection](image)
2.5.2 Temperature Sensor and Extension Cables

The C910-485 has two (2) RTD inputs. Use only 3-wire 100 Ω Platinum RTDs (DIN 43760, \(\alpha=0.00385\) Ω/°C)

**Note:** The RAYCHEM C910-485 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.

![Temperature Sensor Wiring](image)

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.

2.5.3 External Device Control/Override

The C910-485 controller can be forced on or off using an external device with a dry contact.

![Wiring for External Device Control/Override](image)

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. 2.6) or as a 12 Vdc contact (Figure 2.7). The second is an AC relay (triac) and can be connected as an alarm relay (Figure 2.8) or a powered alarm relay (Figure 2.9). Both may be programmed for normally open (N.O.) or normally closed (N.C.) operation.

**Note:** Both alarm relays are controlled by the C910-485 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 2.6 – Used As a Dry Contact

Figure 2.7 – Used As a Switched DC Contact

Figure 2.8 – Used As an AC Alarm Relay
2.6.1 Communication Signal Connections

The 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.
2.7 INITIALIZING THE CONTROLLER

2.7.1 Initial Heating Cable Test

To minimize the risk of damage to the controller due to a heating 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 manuals can be found on nVent.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. When connected to the ACS-30 control system, the keypad is locked out and will display “Remote Control”.

![Keypad Image]

Figure 3.1 – Keypad

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHIFT</td>
<td>Press to activate a shifted 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.</td>
</tr>
<tr>
<td>TEST</td>
<td>Turns on heating cable circuit for 30 seconds. SHIFT + TEST Switches the console to the Alarm/reset mode.</td>
</tr>
<tr>
<td>BACK</td>
<td>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.</td>
</tr>
<tr>
<td>ENTER</td>
<td>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.</td>
</tr>
<tr>
<td>Up/Down Arrow Keys</td>
<td>Once the main menu has been entered, use the Up/down arrow keys to navigate the program options.</td>
</tr>
</tbody>
</table>
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 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 3.2 – Operator Console](image)
4.1 OPERATING MODES

4.1.1 Four Modes on 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:

- Press [SHIFT]
- Press [TEST]

You are now in the ALARM screen.

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:

- Press [SHIFT]
- Press [BACK]

You are now in the Monitor/Maintenance menus.

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:
Press [SHIFT]

Press [ENTER]

You are now in the Console 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.

<table>
<thead>
<tr>
<th>Menu #</th>
<th>Section</th>
<th>Menu</th>
<th>Defaults</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.2.1</td>
<td>Tag =</td>
<td>00261439</td>
</tr>
<tr>
<td>2</td>
<td>4.2.2</td>
<td>Units =</td>
<td>Imperial</td>
</tr>
<tr>
<td>3</td>
<td>4.2.3</td>
<td>Switch Control Mode</td>
<td>ON /OFF</td>
</tr>
<tr>
<td>4</td>
<td>4.2.4</td>
<td>Control Setpoint =</td>
<td>40°F</td>
</tr>
<tr>
<td>5</td>
<td>4.2.5</td>
<td>Deadband =</td>
<td>5°F</td>
</tr>
<tr>
<td>6</td>
<td>4.2.6</td>
<td>PASC Setup</td>
<td>…</td>
</tr>
<tr>
<td>7</td>
<td>4.2.7</td>
<td>LO TS 1 =</td>
<td>DIS</td>
</tr>
<tr>
<td>8</td>
<td>4.2.8</td>
<td>LO TS 1 =</td>
<td>35°F</td>
</tr>
<tr>
<td>9</td>
<td>4.2.9</td>
<td>HI TS 1 =</td>
<td>DIS</td>
</tr>
<tr>
<td>10</td>
<td>4.2.10</td>
<td>HI TS 1 =</td>
<td>180°F</td>
</tr>
<tr>
<td>11</td>
<td>4.2.11</td>
<td>TS 2 Fail =</td>
<td>DIS</td>
</tr>
<tr>
<td>12</td>
<td>4.2.12</td>
<td>TS 1 HI LIMIT =</td>
<td>DIS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TS 1 HI LIMIT Setpoint =</td>
<td>200°F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TS 1 HI LIMI Alarm =</td>
<td>DIS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TS 2 HI LIMIT =</td>
<td>DIS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TS 2 HI LIMIT Setpoint =</td>
<td>DIS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TS 2 HI LIMI Alarm =</td>
<td>DIS</td>
</tr>
<tr>
<td>13</td>
<td>4.2.13</td>
<td>LO Load =</td>
<td>ENA</td>
</tr>
<tr>
<td>14</td>
<td>4.2.14</td>
<td>LO Load =</td>
<td>1.0 A</td>
</tr>
<tr>
<td>15</td>
<td>4.2.15</td>
<td>Load Defaults</td>
<td>No</td>
</tr>
<tr>
<td>16</td>
<td>4.2.16</td>
<td>HI GFI =</td>
<td>20 mA</td>
</tr>
<tr>
<td>17</td>
<td>4.2.17</td>
<td>GFI Trip =</td>
<td>30 mA</td>
</tr>
<tr>
<td>18</td>
<td>4.2.18</td>
<td>TS Fail Mode =</td>
<td>ON</td>
</tr>
<tr>
<td>19</td>
<td>4.2.19</td>
<td>TS CTL Mode =</td>
<td>TS 1 ~ FAIL ON</td>
</tr>
<tr>
<td>20</td>
<td>4.2.20</td>
<td>OVERRIDE Source =</td>
<td>Remote</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ext. Input =</td>
<td>Not Used</td>
</tr>
<tr>
<td>21</td>
<td>4.2.21</td>
<td>Version</td>
<td>V4.04.3</td>
</tr>
<tr>
<td>22</td>
<td>4.2.22</td>
<td>Passcode =</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>4.2.23</td>
<td>Communication Setup</td>
<td>HTCbus</td>
</tr>
<tr>
<td>24</td>
<td>4.2.24</td>
<td>Auto-Cycle =</td>
<td>DIS</td>
</tr>
<tr>
<td>25</td>
<td>4.2.25</td>
<td>Auto-Cycle Interval =</td>
<td>8</td>
</tr>
<tr>
<td>26</td>
<td>4.2.26</td>
<td>Auto-Cycle Units =</td>
<td>Hours</td>
</tr>
<tr>
<td>27</td>
<td>4.2.27</td>
<td>Contactor Count =</td>
<td>200000</td>
</tr>
<tr>
<td>28</td>
<td>4.2.28</td>
<td>Alarm Output =</td>
<td>N.C.</td>
</tr>
<tr>
<td>29</td>
<td>4.2.29</td>
<td>Acknowledging/Resetting Alarms</td>
<td>N/A</td>
</tr>
<tr>
<td>30</td>
<td>4.2.30</td>
<td>Alarm Output Normal State</td>
<td>Normally Closed</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Metric or Imperial</th>
<th>Factory Default</th>
<th>Imperial</th>
</tr>
</thead>
</table>

Keystrokes for Changing Units

Start
Press [SHIFT]

Press [ENTER]
You are now in the console menus

Press the [DOWN] arrow key until you see
Display
Units = Imperial
Default Units

Use the [UP]/[DOWN] arrow keys to select between imperial and metric

Press the [ENTER] key, the new UNITS will be scrolling across the screen
Display
Units = Metric

Press the [BACK] key to escape to the mainscreen
4.2.3 Switch Control Mode

**Purpose**
This allows selection of the type of algorithm to be used to maintain the control setpoint temperature. Reference Figure 2.5 for the External Direct wiring schematic.

<table>
<thead>
<tr>
<th>Setting</th>
<th>On/Off or Proportional Ambient Sensing Control (PASC), External Direct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory Default</td>
<td>On/off</td>
</tr>
</tbody>
</table>

Keystrokes for changing Switch Control Mode

Start
Press [SHIFT]

Press [ENTER]
You are now in the Console menus.

Press the [DOWN] arrow key until you see
Switch Control Mode = ON/OFF

Use the [UP]/[DOWN] arrow key to select between ON/OFF, PASC or Ext Direct

Press the [ENTER] key, the new control mode will be scrolling across the screen

Display
Switch Control Mode = “NN”
Where “NN” is either ON/OFF, PASC or Ext Direct

Press the [BACK] key to escape to the main screen

nVent.com | 21
4.2.4 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**

1. **Start**
   - Press [SHIFT]

2. **Press [ENTER]**
   - You are now in the console menus

3. **Press the [DOWN] arrow key until you see**
   - Display
   - Control Setpoint = 40°F
   - Default = 40°F

4. **Use the [UP]/[DOWN] arrow key to change the digit that is blinking**

5. **Use the [RIGHT]/[LEFT] arrow to move to the next digit**

6. **Press the [ENTER] key until the new control setpoint scrolls across the screen**
   - Display
   - Control Setpoint = xx°F
   - Where xx is the new setpoint

7. **Press the [BACK] key to escape to the mainscreen**
4.2.5 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**

1. **Start**
   - Press [SHIFT]

2. **Press [ENTER]**
   - You are now in the console menus

3. **Press the [DOWN] arrow key until you see**
   - Display: **DEADBAND = 5°F**

4. **Use the [UP]/[DOWN] arrow key to change the digit that is blinking**

5. **Use the [RIGHT]/[LEFT] arrow to move to the next digit**

6. **Press the [ENTER] key until the new deadband scrolls across the screen**
   - Display: **DEADBAND = xx°F**
   - Where xx is the new deadband

7. **Press the [BACK] key to escape to the mainscreen**
4.2.6 Proportional Ambient Sensing Control (PASC)

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

<table>
<thead>
<tr>
<th>Setting</th>
<th>Range</th>
<th>Factory Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Size (inch):</td>
<td>½, 1 or, ≥ 2</td>
<td>½</td>
</tr>
<tr>
<td>Control Setpoint:</td>
<td>0 to 200°F (–18 to 92°C)</td>
<td>40°F (4°C)</td>
</tr>
<tr>
<td>Min. Design Ambient:</td>
<td>–99 to 125°F (–73 to 52°C)</td>
<td>–40°F (–40°C)</td>
</tr>
<tr>
<td>Power Adjust Factor:</td>
<td>10 – 200%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Keystrokes for Entering PASC Setup Parameters**

**Start**
Press [SHIFT]

Press [ENTER]
You are now in the console menus

Press the [DOWN] arrow key until you see

**Display**

Press the [ENTER]

Use the [UP]/[DOWN] arrow key to change one of three PASC parameters

Press the [ENTER] key to select one of the three parameters

Use the [UP]/[DOWN] arrow key to change the digit that is blinking

Use the [RIGHT]/[LEFT] arrow to move to the next digit

Press the [ENTER] key until the new PASC parameter is scrolling across the screen

If you need to change another PASC Setup parameter then use the [UP/DOWN] arrow keys followed by the [ENTER] key.

or

Press the [BACK] key to escape to the mainscreen

**Note:**
Units shown are Imperial.
If Metric is selected then parameters are shown in metric.
4.2.7 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 |

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

Start
Press [SHIFT]

You are now in the console menus

Press the [ENTER]

Use the [UP]/[DOWN] arrow keys to select Disable or Enable

Press the [ENTER] key until the new Lo TS Enable and/or Disable scrolling across the screen

Display
Lo TS 1 = ENA
or
Lo TS 2 = DIS

Display
Lo TS 1 = nn
or
Lo TS 2 = nn

Where nn is either Enable or Disable

Press the [BACK] key to escape to the mainscreen
4.2.8 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**

1. **Start**
   - Press [SHIFT]

2. **Press [ENTER]**
   - You are now in the console menus

3. **Press the [DOWN] arrow key until you see**
   - Display
     - LO TS 1 = 35°F
     - LO TS 2 = 35°F
   - Default = 35°F

4. **Use the [UP]/[DOWN] arrow key to change the digit that is blinking**

5. **Use the [RIGHT]/[LEFT] arrow to move to the next digit**

6. **Press the [ENTER] key until the new Lo Ts Setpoint is scrolling across the screen**
   - Display
     - LO TS 1 = xx°F
     - LO TS 2 = xx°F
   - Where xx is the new set point

7. **Press the [BACK] key to escape to the mainscreen**
4.2.9 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.

<table>
<thead>
<tr>
<th>Setting/Range</th>
<th>Enable or disable</th>
<th>Factory Default</th>
</tr>
</thead>
</table>

**Keystrokes for Enabling and Disabling**

**HI TS (Temperature Sensor Alarm) 1 and 2**

**High Temperature Sensor Alarm**

**Start**
Press [SHIFT]

**Press [ENTER]**
You are now in the console menus

**Press the [DOWN] arrow key until you see**

**Display**

**HI TS 1 = DIS**

or

**HI TS 2 = DIS**

Default = DIS

**Use the [UP]/[DOWN] arrow keys to select Disable or Enable**

**Press the [ENTER] key until the new Hi TS Enable and/or Disable scrolling across the screen**

**Display**

**HI TS 1 = nn**

or

**HI TS 2 = nn**

Where nn is either Enable or Disable

**Press the [BACK] key to escape to the mainscreen**
4.2.10 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.

<table>
<thead>
<tr>
<th>Setting/Range</th>
<th>Factory Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°F to 200°F (-18° to 93°C)</td>
<td>180°F (82°C)</td>
</tr>
</tbody>
</table>

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

**High Temperature Sensor Setpoint**

1. **Start**
   - Press [SHIFT]

2. **Press [ENTER]**
   - You are now in the console menus

3. **Press the [DOWN] arrow key until you see**
   - Display
   - HI TS 1 = 180°F
   - or
   - HI TS 2 = 180°F
   - Default = 180°F

4. **Use the [UP]/[DOWN] arrow key to change the digit that is blinking**

5. **Use the [RIGHT]/[LEFT] arrow to move to the next digit**

6. **Press the [ENTER] key until the new Hi Ts Set point is scrolling across the screen**
   - Display
   - HI TS 1 = xx°F
   - or
   - HI TS 2 = xx°F
   - Where xx is the new set point

7. **Press the [BACK] key to escape to the mainscreen**
4.2.11 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 | Disable |

**Keystrokes for Enabling and Disabling TS 2**

1. **Start**
   - Press [SHIFT]

2. **Press [ENTER]**
   - You are now in the console menus

3. **Press the [ENTER]**
   - Use the [UP]/[DOWN] arrow keys to select Enable

4. **Press the [ENTER] key until the TS 2 = Enable scrolling across the screen**

5. **Press the [BACK] key to escape to the mainscreen**

**Display**
- TS 2 Fail = DIS
- Default = Disable

- TS 2 Fail = ENA
4.2.12 High Temperature Cut-out, Setpoint and Alarm
(HI Limit TS1/HI limitTS2)

**Purpose**
Set high temperature alarm and cut-out values.

**Settings/Ranges:**
- Enable/Disable HI Limit
- Set point: 0°F (-18°C) to 200°F (93°C)
- Enable/Disable Alarm

**Factory Defaults:**
- Disable
- 200°F (93°C)
- Disable

Keystrokes for Selecting TS HI Limit (ENA/DIS) Setpoint and Alarm

Note: these steps can apply to TS 2 (ENA/DIS), Setpoint and Alarm

**Start**
Press [SHIFT]

**Press the [ENTER] key until you see**

You are now in the Console menus.

**Press the [DOWN] arrow key to select ENA**

**Press the [DOWN] key to enter a new TS 1 HI LIMIT SETPOINT**

Display

**TS 1 LIMIT =ENA**

Use the arrow keys to enter a new setpoint

Press the [ENTER] key until the screen scrolls with the new setpoint

Display

**TS 1 HI LIMIT SETPOINT = nnn°F**
Where nnn is the new setpoint

Press the [DOWN] arrow key and select ENA followed by the [ENTER] key.

Press the [MONITOR] key to return to the main menu

Display

**TS 1 HI LIMIT ALARM = DIS**
4.2.13 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 |

Keystrokes for Enabling and Disabling the Lo Load Current

**Start**
Press [SHIFT]

**Press [ENTER]**

Press the [DOWN] arrow key until you see

You are now in the console menus

Press the [ENTER]

Use the [UP]/[DOWN] arrow keys to select Disable

Press the [ENTER] key until the new Lo Load Enable or disable is scrolling across the screen

Display

**Lo Load = ENA**
Default = ENA

Press the [BACK] key to escape to the mainscreen
4.2.14 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

1. Start
   - Press [SHIFT]

2. Press [ENTER]
   - You are now in the console menus

3. Press the [DOWN] arrow key until you see
   - Display
     - LO Load = 1.0 A
     - Default = 1.0 A

4. Use the [UP]/[DOWN] arrow key to change the digit that is blinking

5. Use the [RIGHT]/[LEFT] arrow to move to the next digit

6. Press the [ENTER] key until the new Lo Load Setpoint is scrolling across the screen
   - Display
     - LO Load = xx A
     - or
     - LO Load = xx A
     - Where xx is the new setpoint

7. Press the [BACK] key to escape to the mainscreen
4.2.15 Factory Default Settings (Load Defaults)

**Purpose**
To provide a quick method of re-setting the controller’s configuration parameters to the Factory Default parameters.

<table>
<thead>
<tr>
<th>Setting</th>
<th>N/A</th>
<th>Factory Default</th>
<th>N/A</th>
</tr>
</thead>
</table>

**Keystrokes for Loading Defaults**

1. **Start**
   - Press [SHIFT]

2. **Press [ENTER]**
   - You are now in the console menus

3. **Press the [DOWN] arrow key until you see**
   - Load Defaults

4. **Press the [ENTER]**
   - Are You Sure?

5. **Press the [ENTER] to select NO**
   - No

6. **Use the [UP]/[DOWN] arrow keys to select Yes**

7. **Press the [ENTER]**
   - Copied
4.2.16 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. To protect against the risk of fire or shock, ground-fault level should be set at the lowest level possible to allow normal operation of the cable.

Alarm time delay filter is factory set as immediate.

| Setting/Range | 20 mA to 100 mA | Factory Default | 20 mA |

Keystrokes for Entering the Ground Fault Alarm

Start
Press [SHIFT]

Press [ENTER]

Press the [DOWN] arrow key until you see

You are now in the console menus

Display

Hi GFI = 20 mA

Default = 20 mA

Use the [UP]/[DOWN] arrow key to change the digit that is blinking

Use the [RIGHT]/[LEFT] arrow to move to the next digit

Press the [ENTER] key until the new Hi GFI is scrolling across the screen

Display

Hi GFI = xx mA

Where xx is the Hi GFI current

Press the [BACK] key to escape to the mainscreen
4.2.17 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.

⚠️ **WARNING**: Fire Hazard. Ground-fault trip alarms must not be ignored. To prevent the risk of fire, do not re-energize heating cables until the fault is identified and corrected.

---

**Setting/Range**
20 mA to 100 mA

**Factory Default**
30 mA

---

**Keystrokes for Entering the Setpoint for GF Trip**

Start
Press [SHIFT]

Press [ENTER]

You are now in the console menus

Press the [DOWN] arrow key until you see

GFI Trip = 30 mA
Default = 30 mA

Use the [UP]/[DOWN] arrow key to change the digit that is blinking

Use the [RIGHT]/[LEFT] arrow to move to the next digit

Press the [ENTER] key until the new ground fault trip setpoint is scrolling across the screen

Display

GFI trip = xx mA
Where xx is the new current

Press the [BACK] key to escape to the mainscreen
4.2.18 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**

**Temperature Sensor Mode**

- **Start**
  - Press [SHIFT]

- **Press [ENTER]**
  - You are now in console menus

- **Press the [DOWN] arrow key until you see**
  - TS FAIL MODE = ON

- **Use the [UP]/[DOWN] arrow key to change from ON to OFF**

- **Press the [ENTER] key until the new TS FAIL MODE is scrolling across the screen**

- **Display**
  - TS FAIL MODE = OFF

- **Press the [BACK] key to escape to the mainscreen**
4.2.19 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.

<table>
<thead>
<tr>
<th>Setting/Range</th>
<th>1. TS1-Fail ON</th>
<th>2. Lowest Fail to Good</th>
<th>3. Lowest Fail ON</th>
<th>4. Average Fail to Good</th>
<th>5. Average Fail ON</th>
<th>6. TS2 Fail to TS1</th>
<th>7. TS2 Fail ON</th>
<th>8. TS1 Fail to TS2</th>
</tr>
</thead>
</table>

**Factory Default**
TS1-Fail On

---

**Keystrokes for Changing the TS CLT Mode**

**Temperature Sensor Control Mode**

- **Start**
  - Press [SHIFT]
- **Press [ENTER]**
- **Press the [DOWN] arrow key until you see**
  - Display: **TS CTL Mode = TS 1 - FAIL ON**
  - Default mode shown
- **Use the [UP]/[DOWN] arrow keys to view the list of control modes**
- **Press the [ENTER] key until the new TS CTL MODE is scrolling across the screen**
  - Display: **TS CTL Mode = xx**
  - Where xx is one of eight mode
    1. TS 1-Fail ON
    2. Lowest Fail to Good
    3. Lowest Fail ON
    4. Average Fail to Good
    5. Average Fail ON
    6. TS 2 Fail to TS 1
    7. TS 2 Fail ON
    8. TS 1 Fail to TS 2
- **Press the [BACK] key to escape to the mainscreen**
4.2.20 External Input: Inhibit or Force on.

**Purpose**
Using an external input device to override sensor inputs: Force on or force off. Reference Figure 2.5 for the wiring connection schematic.

<table>
<thead>
<tr>
<th>Setting/Range</th>
<th>Factory Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext Input: Not used, Force on or Inhibit</td>
<td>Not used</td>
</tr>
<tr>
<td>Override: Remote or External input</td>
<td>Remote</td>
</tr>
</tbody>
</table>

**Keystrokes for Selecting Inhibit or Force ON Mode using the External Input**

**Start**
Press [SHIFT]

**Press [ENTER]**
You are now in the Console menus.

**Press the [DOWN] arrow key until you see**
Ext Input = Not Used

**Use the [DOWN] arrow key to select either Force ON or Inhibit**

**Press the [ENTER]**
Ext Input = nn
Where nn is either Force ON or Inhibit

**Press the [BACK] key to escape to the main screen**

**Use the [UP] arrow key to select OVERRIDE**

**Press the [ENTER]**
Use the [UP/DOWN] arrow keys and select Ext. Input. Press the [ENTER] key to save the selection. Use the [BACK] key to escape to the main menu.
4.2.21 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**

Start
Press [SHIFT]

Press [ENTER]
You are now in the console menus

Press the [DOWN] arrow key until you see

**VERSION = V 4.xx**
Where xx is the version number

Press the [BACK] key to escape to the mainscreen
4.2.22 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

Keystrokes for Entering a Password

Start
Press [SHIFT]

Press [ENTER]

Press the [DOWN] arrow key until you see

You are now in console menus

Display

Default Password = 0

Press the [ENTER]

Use the [UP]/[DOWN] arrow key to change the digit that is blinking

Use the [RIGHT]/[LEFT] arrow to move to the next digit

Press the [ENTER] key until the new password is scrolling across the screen

Display

Where xxxx is the new password

Press the [BACK] key to escape to the mainscreen
4.2.23 Communications Setup

**Purpose**
Defines the communications language used by the controller to communicate with other devices. The C910-485 only communicates using Modbus Protocol. The C910-485 automatically detects when it is connected to the ACS-30 network.

<table>
<thead>
<tr>
<th>Setting/Range</th>
<th>See C910-485 Communication Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory Default</td>
<td>HTCBus</td>
</tr>
</tbody>
</table>

Keystrokes for Communication Setup

Start
- Press [SHIFT]

Press [ENTER]
- You are now in the console menus

Press the [DOWN] arrow key until you see

Press the [ENTER]
- Use the [UP]/[DOWN] arrow key to select a communication parameter

Press the [ENTER] key to select the parameter
- Use the [UP]/[DOWN] arrow key to change the digit that is blinking

Use the [RIGHT]/[LEFT] arrow to move to the next digit
- Press the [ENTER] key until the new Communication Parameter is scrolling across the screen

If you need to change another Communication Setup parameter then use the [UP]/[DOWN] arrow keys followed by the [ENTER] key, or

Press the [BACK] key to escape to the main screen
### C910-485 Communication Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Settings</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol</td>
<td>HTCBus (default) Modbus RTU Modbus ASCII</td>
<td>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 C910-485 Heat Trace Controller.</td>
</tr>
<tr>
<td>Modbus Addr</td>
<td>1 - 247</td>
<td>Set the communications address as desired. Each controller on the serial communication bus must have its own unique address.</td>
</tr>
<tr>
<td>Modbus Baud Rate</td>
<td>Auto, 9600, 4800, 2400 1200, 600, 300. Default =Auto</td>
<td>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.</td>
</tr>
<tr>
<td>Parity</td>
<td>NONE, EVEN, ODD</td>
<td>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.</td>
</tr>
<tr>
<td>Hardware</td>
<td>RS-485</td>
<td>Identifies the type of communications interface installed in the C910-485.</td>
</tr>
<tr>
<td>Driver</td>
<td>Auto, RS-485, RS-232, Modem.</td>
<td>Defines the way in which the controller’s program communicates with the communications interface.</td>
</tr>
<tr>
<td>Profile</td>
<td>Auto, 3-wire RS232, RS485, 1200 BAUD Modem, 300 BAUD Modem</td>
<td>Defines the way in which the controller’s program supports communications handshaking and communication interface signals.</td>
</tr>
<tr>
<td>Tx Delay</td>
<td>0.00 to 2.50 seconds</td>
<td>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.</td>
</tr>
</tbody>
</table>

**Note:** HTCBus is for factory use only.
4.2.24 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.

<table>
<thead>
<tr>
<th>Setting/Range</th>
<th>Enable or disable</th>
<th>Factory Default</th>
<th>Disable</th>
</tr>
</thead>
</table>

Keystrokes for Enabling and Disabling Auto-Cycling

Start

Press [SHIFT]

Press [ENTER]

You are now in the console menus

Press the [DOWN] arrow key until you see

Auto-Cycle = DIS

Default = DISABLE

Use the [UP]/[DOWN] arrow keys to select ENAble

Press the [ENTER] key until the new Auto-Cycle (enable or disable) is scrolling across the screen

Display

Auto-Cycle = ENA

Press the [BACK] key to escape to the mainscreen
4.2.25 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

---

**Keystrokes for Entering Auto Cycling Interval**

**Start**
Press [SHIFT]

**Press [ENTER]**

You are now in the console menus

**Press the [DOWN] arrow key until you see**

**Display**
Auto-Cycle Interval = 8

**Default = 8 hours**

Use the [UP]/[DOWN] arrow key to change the digit that is blinking

Use the [RIGHT]/[LEFT] arrow to move to the next digit

Press the [ENTER] key until the new auto-cycle interval is scrolling across the screen

**Display**
Auto-Cycle Interval = xxx

Where xxx is the new interval time

Press the [BACK] key to escape to the mainscreen
4.2.26 Auto-Cycle: Units

**Purpose**
Select the Autocycle interval time units.

<table>
<thead>
<tr>
<th>Setting/Range</th>
<th>Minutes or hours</th>
<th>Factory Default</th>
</tr>
</thead>
</table>

**Keystrokes for Changing Auto-Cycle Units**

**Start**
Press [SHIFT]

Press [ENTER]
You are now in the console menus

Press the [ENTER]
Default Hours

Use the [UP]/[DOWN] arrow keys to select between hours or minutes

Press the [ENTER] key, the new units will be scrolling across the screen

Display
Auto Cycle Units = nnnnn
Where nnnn is either hours or minutes

Press the [BACK] key to escape to the mainscreen
4.2.27 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**

1. **Start**
   - Press [SHIFT]
2. **Press [ENTER]**
3. **Press the [DOWN] arrow key until you see**
   - You are now in the console menus
4. **Press the [ENTER]**
5. **Use the [UP]/[DOWN] arrow keys to select between hours or minutes**
6. **Use the [RIGHT]/[LEFT] arrow keys to move to the next digit hours or minutes**
7. **Press the [ENTER] key**, the new contactor count is scrolling across the screen
   - **Display**
   - **Contactor Count = XX...**
   - Where XX... is the new contactor count
8. **Press the [BACK] key to escape to the mainscreen**
Purpose
The Monitor menu displays the measured and stored readings. You can also reset counters from this menu.

Setting/Range
See C910-485 Monitoring and Maintenance Parameters table.

Factory Default
N/A

Keystrokes for Entering Monitor and Maintenance Menus

START
Press [SHIFT]

Press [BACK]
You are now in the Monitor/Maintenance menus

Use the [DOWN] arrow key to view the following parameters

Control Temp =
TS 1 Temp
TS 2 Temp
Load Current
GFI Current

Use the [DOWN] arrow key to access the ST Tracing and Display Test

Use the [DOWN] arrow key to access the Maintenance Data

Press [ENTER] key

Resetting

Min CTL Temp
Max CTL Temp
TS 1 Min Temp
TS 1 Max Temp
TS 2 Min Temp
TS 2 Max Temp
Contactor Cycle Count
In Use (hours)
Time Since last RESET (Hours)

Use the [DOWN] arrow key to select Yes

Press [ENTER] key

Press the [BACK] key to escape to the mainscreen
<table>
<thead>
<tr>
<th>Monitored variables</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTL temp</td>
<td>Control Temp</td>
</tr>
<tr>
<td>TS1 temp</td>
<td>This temperature is the value that the controller is reading from the RTD connected to its TS 1 input.</td>
</tr>
<tr>
<td>TS2 temp</td>
<td>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.</td>
</tr>
<tr>
<td>Load current</td>
<td>Displays the current being drawn by the heating cable. (A)</td>
</tr>
<tr>
<td>GFI current</td>
<td>Displays the ground-fault current being drawn by the heating cable. (mA)</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Temperature values</th>
<th>This feature indicates the maximum and minimum temperatures recorded by the C910-485 since the last time the values were reset:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max Control temp</td>
</tr>
<tr>
<td></td>
<td>Min Control temp</td>
</tr>
<tr>
<td></td>
<td>TS 1 Max Temp</td>
</tr>
<tr>
<td></td>
<td>TS 1 Min Temp</td>
</tr>
<tr>
<td></td>
<td>TS 2 Max Temp</td>
</tr>
<tr>
<td></td>
<td>TS 2 Min Temp</td>
</tr>
<tr>
<td>Contactor cycle count</td>
<td>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)</td>
</tr>
<tr>
<td>Time in use</td>
<td>Indicates the total hours in use of the controller since its initial operation or since it was last reset.</td>
</tr>
<tr>
<td>Time since last reset</td>
<td>This feature indicates the total hours in use of the controller since the last reset.</td>
</tr>
<tr>
<td>Peak ground-fault current</td>
<td>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.</td>
</tr>
</tbody>
</table>
4.2.29 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.

<table>
<thead>
<tr>
<th>Setting/Range</th>
<th>See Alarm Filter Times</th>
<th>Factory Default</th>
<th>N/A</th>
</tr>
</thead>
</table>

**Keystrokes for Acknowledging and RESETTING Alarms**

1. **Start**
   - Press [SHIFT]

2. **Press [TEST]**
   - You are now in the alarm screen

3. **Use the [UP]/[DOWN] arrow keys to view multiple alarms**

4. **Press [ENTER] key to RESET the alarm scrolling across the screen**

5. **Use the [UP]/[DOWN] select YES, NO or ALL**

6. **Press [ENTER] to select your either YES, NO or ALL alarms**

   **Note:** If all alarms are cleared then you will see the following message scrolling across the screen

   **Display**
   - No Alarms

   If there are more alarms to clear then you will need to use the [UP/DOWN] arrow keys and repeat the process.

**Alarm Filter Times**

<table>
<thead>
<tr>
<th>Alarm Type</th>
<th>Filter Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lo TS 1 and 2</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Hi TS 1 and 2</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Lo load current</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Hi ground-fault alarm</td>
<td>10 seconds</td>
</tr>
<tr>
<td>Hi ground-fault trip</td>
<td>&lt; 1 second</td>
</tr>
<tr>
<td>OPEN / SHORTED TS 1 and 2</td>
<td>10 seconds</td>
</tr>
<tr>
<td>Contactor count</td>
<td>&lt; 1 seconds</td>
</tr>
<tr>
<td>Switch failure</td>
<td>2 minutes</td>
</tr>
</tbody>
</table>
4.2.30 Alarm Output Normal State

**Purpose**
Confirms 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.

<table>
<thead>
<tr>
<th>Setting/Range</th>
<th>Normally Open (N.O.)</th>
<th>Factory Default</th>
<th>Normally Closed (N.C.)</th>
</tr>
</thead>
</table>

**Keystrokes for changing ALARM OUTPUT from N.C. to N.O**

**Start**
Press [SHIFT]

Press [ENTER]

Press the [DOWN] arrow key until you see

You are now in the console menus

Press the [ENTER]

**Display**

ALARM OUTPUT = N.C.

Use the [UP]/[DOWN] arrow keys to select N.C. or N.O.

**Press the [ENTER] key, the new ALARM OUTPUT state will scroll across the screen**

**Display**

ALARM OUTPUT = N.O.

Press the [BACK] key to escape to the mainscreen
The C910-485 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.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Probable Cause</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD failure alarm</td>
<td>RTD is not a 3-wire 100 Ω Platinum</td>
<td>Install correct RTD</td>
</tr>
<tr>
<td></td>
<td>Damaged RTD sensor or extension cable</td>
<td>Install new RTD and/or cable</td>
</tr>
<tr>
<td></td>
<td>Incorrectly wired</td>
<td>Re-install RTD connections</td>
</tr>
<tr>
<td>Seemingly incorrect</td>
<td>Damaged RTD sensor or connection cable</td>
<td>Install new RTD and/or cable</td>
</tr>
<tr>
<td>temperature</td>
<td>C910-485 not functioning correctly</td>
<td>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).</td>
</tr>
<tr>
<td>Unstable or bouncing</td>
<td>Bad, damaged or incorrectly installed RTD extension wire.</td>
<td>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.</td>
</tr>
<tr>
<td>temperature</td>
<td>Terminal connections are not tight</td>
<td>Verify tightness of connections</td>
</tr>
<tr>
<td></td>
<td>RTD or extension cable damaged</td>
<td>Install new RTD and/or cable</td>
</tr>
<tr>
<td>High temperature TS 1/TS 2</td>
<td>Alarm temperature setting too close to maintain temperature</td>
<td>Increase setting</td>
</tr>
<tr>
<td></td>
<td>Flow of hot water through pipe</td>
<td>Verify heating cable wiring</td>
</tr>
<tr>
<td>LOW temperature</td>
<td>Incorrect heating cable wiring</td>
<td>Decrease setting</td>
</tr>
<tr>
<td>TS 1/TS 2</td>
<td>Alarm temperature setting too close to maintain temperature</td>
<td>Refer to the appropriate heating cable design guide for correct product selection</td>
</tr>
<tr>
<td></td>
<td>Heating cable not sized properly for the application</td>
<td>Replace or install correct thermal insulation</td>
</tr>
<tr>
<td>Control TS failure</td>
<td>Failure of the RTD designated as the controlling sensor.</td>
<td>Check setting for TS FAIL MODE the output switch may be latched off or on until this failure is corrected</td>
</tr>
<tr>
<td></td>
<td>Incorrect or damaged field wiring</td>
<td>Re-install RTD connections</td>
</tr>
<tr>
<td></td>
<td>Damaged temperature sensors</td>
<td>Install correct RTD.</td>
</tr>
<tr>
<td>Ground-fault alarms</td>
<td>Incorrect installation, wet system components or damaged cables.</td>
<td>Incorrect neutral return wiring</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td></td>
<td>Perform heating cable commissioning tests outlined in the heat cable operation manuals.</td>
<td>Check that the heating cable circuit neutrals return to the controller and are not connected directly to the distribution panel.</td>
</tr>
</tbody>
</table>

⚠️ WARNING: Fire Hazard. Ground-fault trip alarms must not be ignored. To prevent the risk of fire, do not re-energize heating cables until the fault is identified and corrected.

<table>
<thead>
<tr>
<th>Low current</th>
<th>Low or no source voltage</th>
<th>Damaged or inoperative heating cable</th>
<th>Open connection—wiring problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Verify correct power distribution</td>
<td>Repair or replace heating cable</td>
<td>Verify correct power distribution wiring</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Switch failure</th>
<th>Output switch has failed “closed”</th>
<th>Replace or repair controller</th>
</tr>
</thead>
</table>

| 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. |
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 C910-485 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).