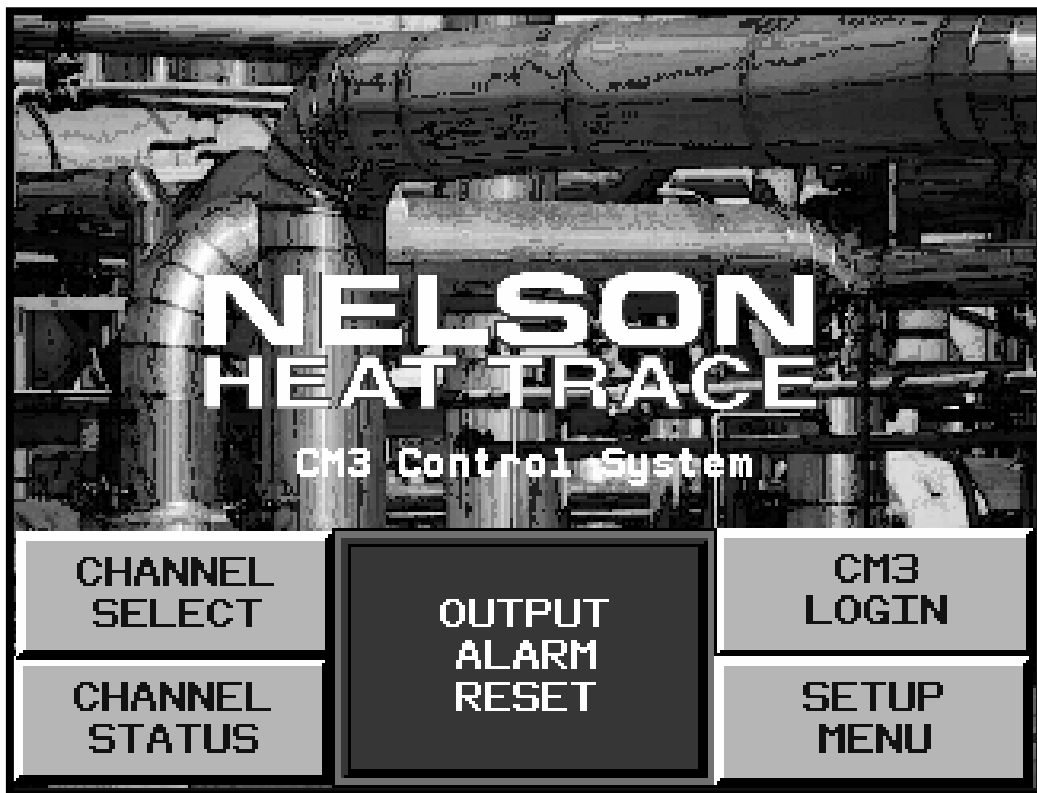


CM-3-R2



HEAT TRACE CIRCUIT MANAGEMENT SYSTEM INSTALLATION AND OPERATIONS MANUAL

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I. FEATURES

Control & Monitoring

The CM-3 circuit management system is a microprocessor based control and monitoring system based on standard industrial automation products specifically integrated for use with electric heat tracing systems. The system provides temperature and current monitoring for each heat tracing circuit while communicating additional information to operations personnel such as temperature alarms, circuit faults, sensor failure and communications failures.

The CM-3 circuit management system is mounted in a NEMA 12, 4 or 4X enclosure that can be wall or rack mounted. The system is available in standard configurations of 4, 8, 12 and 16 circuits. Additional configurations can be custom designed in multiple counts of 4. The CM-3 is designed utilizing standard PLC automation platform component modules and specialized current transformers for accurate current readings. Individual CM-3 systems can be connected through several standard communication protocols. The standard system is provided with Modbus® communications protocol.

Color Touch Screen Operator Interface – 5.7” LCD with analog touch pad, resolution (1024 x 1024) with optimum viewing angle

Process Temperature Display – actual pipe/vessel temperature is displayed with alarm indication by animation and/or color change

Setpoint Display – programmed channel set point is displayed for operator reference

Load Current Display - – actual heater load current is displayed with alarm indication by animation and/or color change

Ground Fault Leakage Display - – actual ground fault leakage is displayed with alarm indication by animation and/or color change

Heater Active, Status and Alarm Displays – real time status of individual channel control is displayed by animated light bars, On = Red, Off = Green

Programmable Set Point – maintain temperature set point is selectable based on probe sensing range, standard RTD unit range = -328°F to +1392 °F (-200 °C to +756 °C)

Programmable Deadband – control deadband is selectable between ±1 to 10 units

Programmable Alarm/Control Values – each channel can be programmed for the following features:

- High Temperature
- Low Temperature
- High Load Current
- Low Load Current
- Ground Leakage Level
- Ground Leakage Trip Level

Sensor Failure Alarm with Output Selection – activates in the event of a shorted or open sensor and/or its connection wiring, this option can be selected to either energize or de-energize the heater circuit in the event of sensor failure, this allows customization of the control mode to meet a particular applications requirements

Processor Failure Alarm – an alarm is triggered in the event of CPU Processor failure

Modbus® Communications Standard – one software selectable RS232/RS485 serial port

Global Programming – allows programming of all control channels to the same parameters with a single input

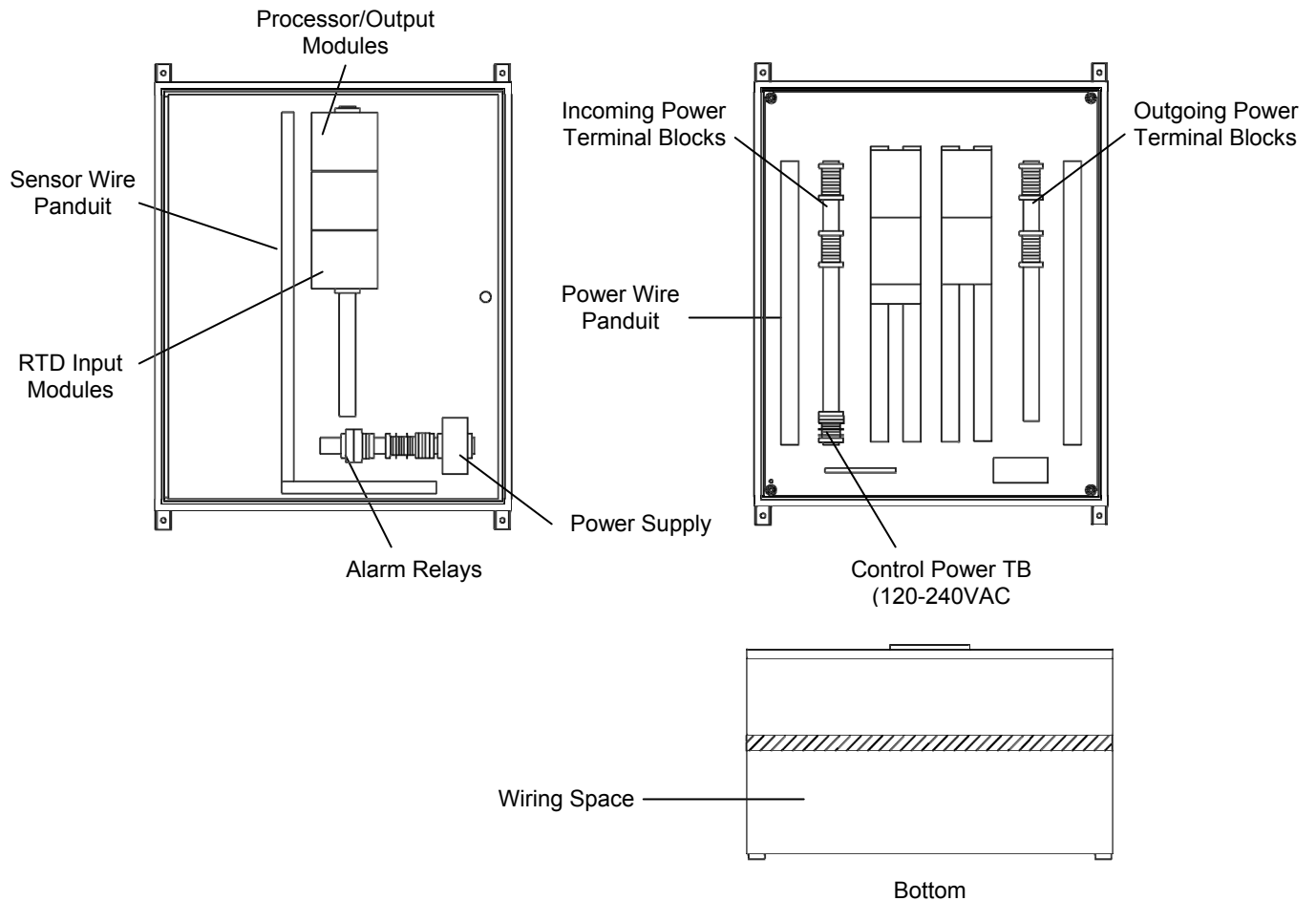
Auto Test-Cycle Feature – unit can be programmed to switch heaters on periodically and check for developing problems, this feature is selectable between 1 and 720 hours, only channels that have been enabled will be energized with this feature

II. INSTALLATION

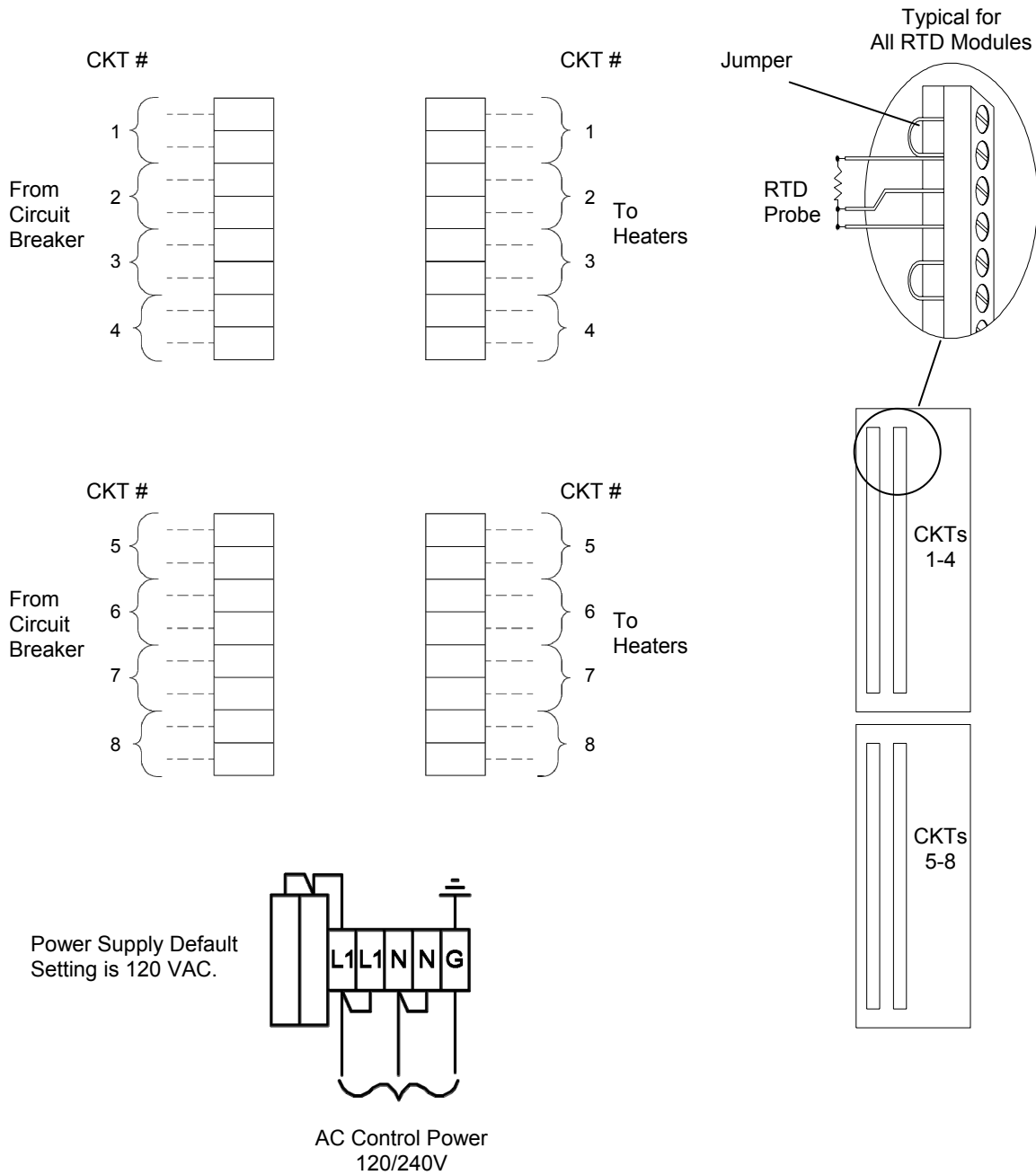
When routing conduit to the panel, avoid top entry into the CM-3 enclosure. Top conduit entry provides a potential moisture path to the electronics and interconnecting wiring. Bottom conduit entry is recommended. If top entry cannot be avoided, avoid the area directly over any exposed electrical equipment. Drip loops are recommended for left side and top entry when they cannot be avoided. A drip loop is a dip or bend in the wiring to block or shed moisture that may follow a wire to the connections.

⚠ WARNING:

Moisture intrusion can damage the CM-3 electronics. Do not place conduit entry directly over the control modules, relays or control wiring.



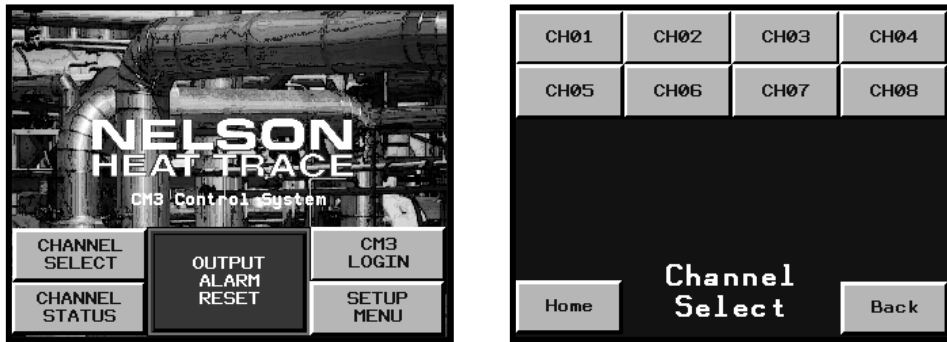
CM-3-R2 Conduit / Wiring Entry for Enclosure
Figure 1



CM-3-R2 Field Wiring Diagram
Figure 2

III. OPERATION

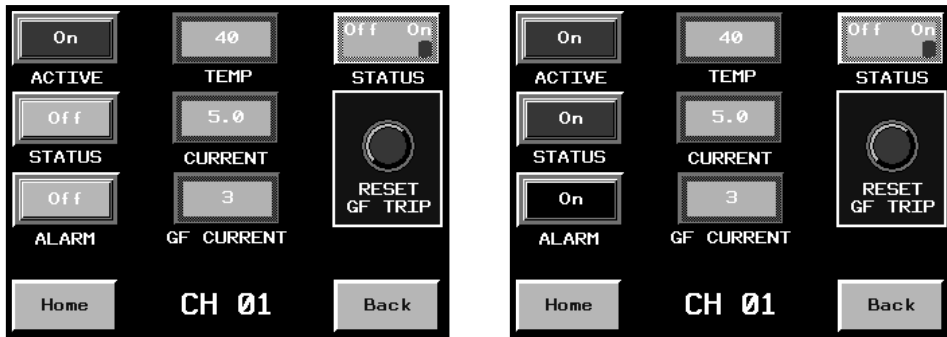
Channel Select



To view the current status of each individual control channel, press < **CHANNEL SELECT** > found in the lower left corner of the **Home** page screen. This action will access the **Channel Select** page allowing the direct selection of each individual channel. Press the < **CH** > number to access the specific channel page required.

Press < **Home** > on any displayed page to return to the **Home** page screen.

Channel Display



Individual channel pages display the current status of all operational conditions. Actual values are compared to programmed values and indicated by color and/or animation.

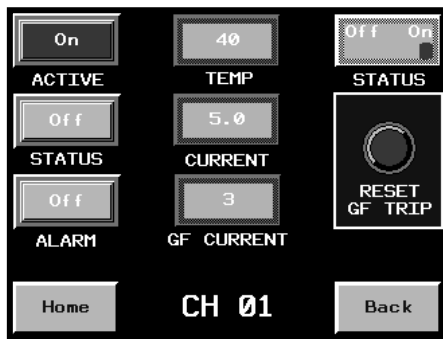
When actual conditions are within programmed parameters, the specific value will be shown in **steady-white**. If the current condition is outside of the programmed parameters, the specific value will **flash slow off-and-on**. If the current condition exceeds the programmed value for Ground Fault Trip, the specific value will change to **flash fast off-and-on**.

The current status of each heater output control is show by the bar light labeled **ACTIVE**. **Red** indicates that the output is in the **ON** condition; **Green** indicates that the output is in the **OFF** condition. This indication will notify the operator as to whether the heat tracing is currently on or off with the **Status** switch in the < **ON** > position.

To view a different channel, press < **Back** > to access the **Channel Selection** page.

Press < **Home** > on any displayed page to return to the **Home** page screen.

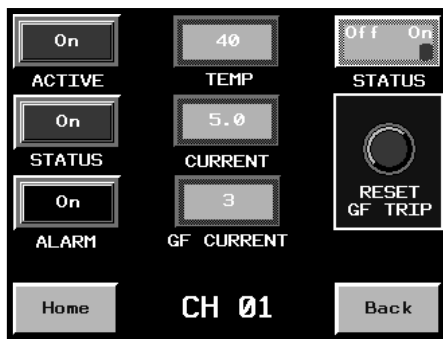
Individual Channel Enable/Disable



Press < **ON** > side of the **STATUS** switch to automatically control the individual channel by set point maintain temperature. Press < **OFF** > side of the **STATUS** switch to disable the current channel. When the **STATUS** switch is in the **OFF** position, the channel will not be cycled through the Auto Test-Cycle feature and all alarms will be disabled.

Press < **Home** > on any displayed page to return to the **Home** page screen.

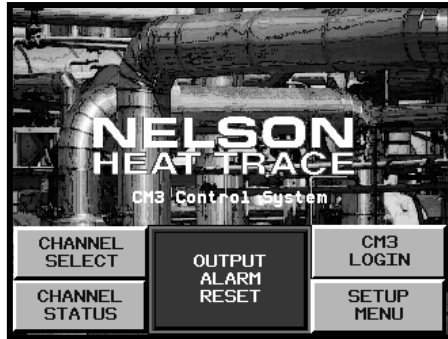
Trip Reset Function



Ground Fault Trip function, if programmed **ON**, must be manually reset. These functions will disable the heater output device until the condition is corrected and the appropriate reset button is pressed. To reset the tripped function, press < **RESET GF TRIP** >.

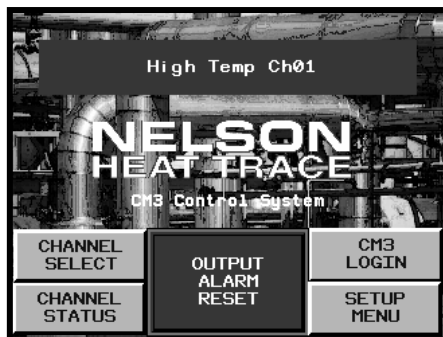
Press < **Home** > on any displayed page to return to the **Home** page screen.

Output Alarm Reset



The CM-3 is equipped with two separate alarm outputs, one for Ground Fault Leakage and the other for all remaining alarm conditions. To clear the alarm outputs, press < **OUTPUT ALARM RESET** >. Additional alarm conditions will energize these alarm outputs accordingly. These contacts are used for external indication of alarm status.

Alarm Indication



When an alarm is triggered by the CM-3, a bar will appear at the top of the **Home Page** and begin scrolling each current alarm condition. This indication gives the operator the current active alarm(s) and channel number(s). **New alarms** are indicated in **Red**. When the alarm is acknowledged, the alarm will change to **Green**. To acknowledge an alarm, access the **Alarm Log** display feature below.

Alarm Log Display



	ACTIVE	STATUS	ALARM
CH01	On	On	On
CH02	Off	Off	Off
CH03	Off	Off	Off
CH04	Off	Off	Off
CH05	Off	Off	Off
CH06	Off	Off	Off
CH07	Off	Off	Off
CH08	Off	Off	Off

Home Alarm Log

To view all current alarms, press < **CHANNEL STATUS** > in the lower left corner of the page. This will display the Channel Summary page. Press < **Alarm Log** > to directly access the current List of Alarms.

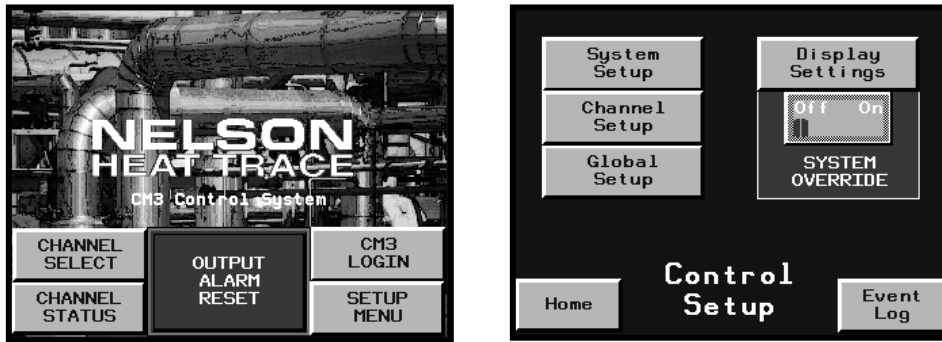


This page will show all current alarms and their status. You can acknowledge all alarms or individual alarms from this page. You may scroll up and down using the scroll bar at the right of this screen.

All alarms are stamped with the Date and Time.

IV. START-UP

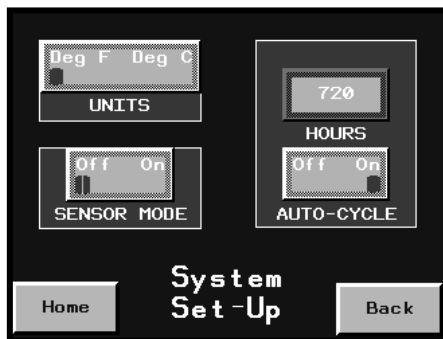
Turning the System On



Using the branch breaker providing control power to the internal power supply, energize the CM-3 system and allow the unit to complete its self-check sequence and display the **Home** page. On initial start-up, the unit will require programming of the System Parameters and the Channel Parameters for the specific application. To access the **Control Setup** page, press < **SETUP MENU** >. From this page you can access the all Application pages required to completely program the CM-3.

The **System Override** switch is also located on the **Control Setup** page. By selecting the **ON** position, all channels that are currently enabled will be forced **ON** regardless of process conditions. For safety reasons, this switch will return to the **OFF** position after any loss of system control power.

Programming System Parameters



To access the System Set-Up Parameters, press < **System Setup** > from the **Controller Set-Up** page. Access to this page requires a PROG user name and password.

To select the CM-3 operation to either Fahrenheit or Celsius, press the < **Deg F** > or < **Deg C** > on the **Units** switch.

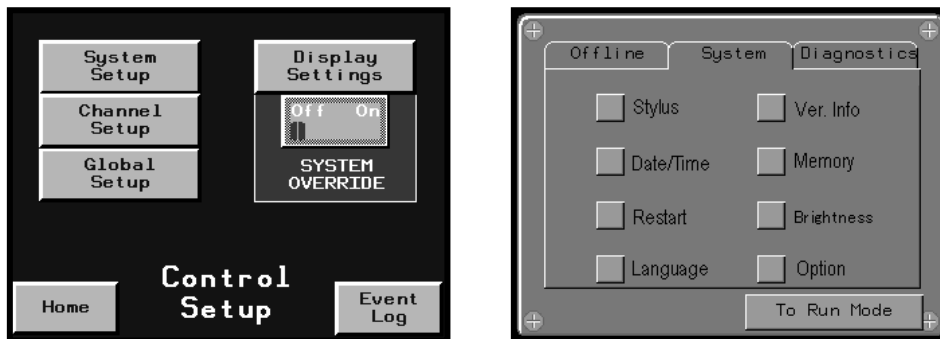
When a shorted or open sensor is detected, you can select the heater output to the **ON** or **OFF** state. This will override the temperature sensing portion of the CM-3 during fault conditions. The current and ground fault features remain in operational mode. Press the < **ON** > side of the **SENSOR MODE** switch if you want the heater to be energized, press the < **OFF** > side of the switch if you want the heater to be de-energized.

The CM-3 can be programmed to operate an Auto Test-Cycle function for periodic maintenance for seasonal heating applications. This feature will energize all enabled channels at programmed intervals and report any alarm conditions that may have developed during the systems idle period. To turn this feature ON, press the < **ON** > side of the **AUTO-Cycle** switch. Next, select the **Cycle Hours** to determine the length of time between test cycles. The CM-3 can be programmed up to 720 hours (30 days) between cycles. To change the cycle time, select the new value and press < **Enter** > to input this value in to the operational program.

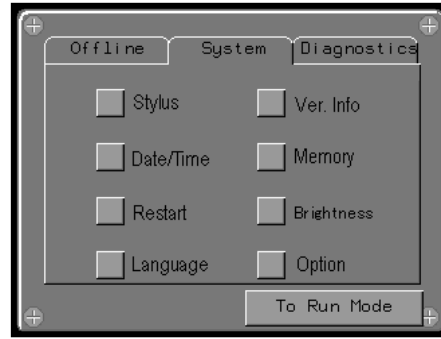
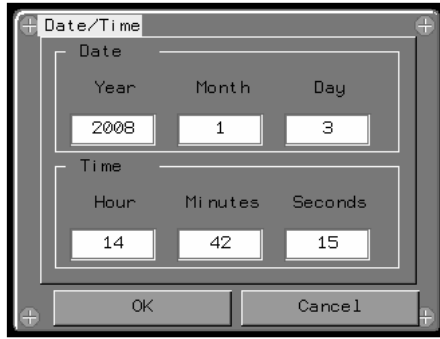
To continue programming the CM-3, press < **Back** > to return to the **Control Setup Parameters** page.

Press < **Home** > on any displayed page to return to the **Home** page screen.

Display Settings and System Menu



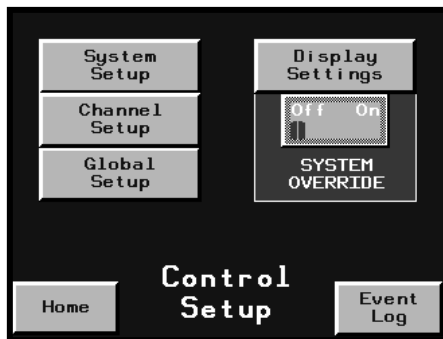
To set the functional parameters of the display, access the **System** menu by pressing < **Display Settings** > in the upper right hand corner of the screen. This will open the display function selection menu. To access the **System** menu, press < **SYST** >. On the **System** page, press < **Date/Time** >. The **Date/Time** page allows the user to set the Date and Time functions.



When programming the Date and Time, a data entry screen will appear. Enter the new value from the keyboard and continue until complete. Press < **OK** > when finished.

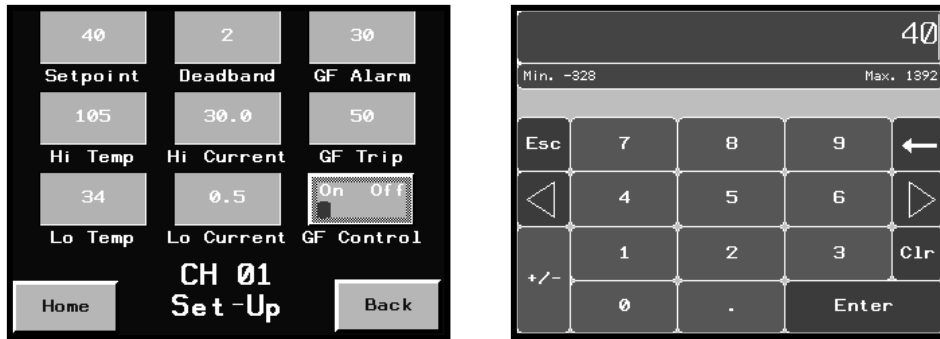
Pressing < **To Run Mode** > will return you to the area of the system you were using prior to accessing this section, pressing < **HOME** > will return you to the **Home** page.

Programming Individual Channels (Circuits)



To program individual control channels, press < **SETUP MENU** > found in the lower right corner of the **Home** page screen. This action will access the **Control Setup** page. Press < **Channel Setup** > to access the **Setup Channel Select** page allowing the direct selection of each individual channel. Access to this page requires a MAINT user name and password. Press the < **CH** > number to access the specific channel page required.

Press < **Back** > to return to the **Setup Channel Select** page. Press < **Home** > on any displayed page to return to the **Home** page screen.



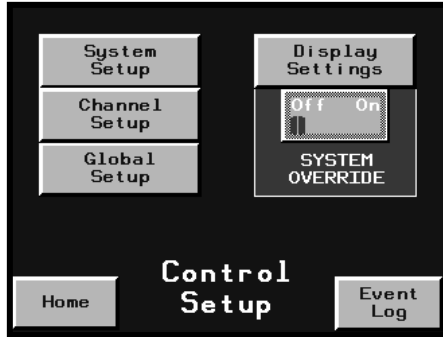
Program any displayed value by pressing directly on the value to be changed. A Data Entry screen will be displayed. Enter the new value from the keyboard. Press < **ENTER** > when finished. To enter a value less than 1, a zero must be entered before the decimal point. Example: 0.5

- Set point:** value range = -328°F to +1392 °F (-200 °C to +756 °C)
- Hi-Temp:** value range = -328°F to +1392 °F (-200 °C to +756 °C)
- Lo-Temp:** value range = -328°F to +1392 °F (-200 °C to +756 °C)
- Dead band:** value range = 1 to 10
- High Current:** value range = 0 to 50 amps
- High A Trip:** value range = 0 to 50 amps
- Low Current:** value range = 0 to 50 amps
- GF Alarm:** value range = 0 to 500 milliamps
- GF Trip:** value range = 0 to 500 milliamps

The Ground Fault Trip feature is used in applications where, for either process or safety reasons, the facility has elected to allow the heater to remain energized under fault conditions. The specific requirements for this features use can be found in the National Electric Code, Article 427-22.

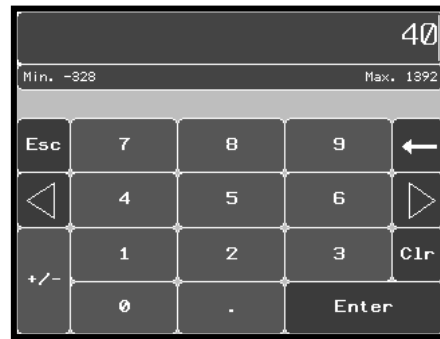
WARNING: By programming the **GF Trip** switch to the < **OFF** > position, the specific channel will alarm and show an indication that the ground leakage has exceeded the programmed trip value but **the heater will remain energized.**

Global Programming of Channels



To access the **Control Setup** page, press < **SETUP MENU** > on the **Home** page. To access the Global Program Setup Parameters, press < **Global Setup** >. Access to this page requires a MAINT user name and password..

Press < **Home** > on any displayed page to return to the **Home** page screen.



Program any displayed value by pressing directly on the value to be changed. A Data Entry screen will be displayed. Enter the new value from the keyboard. Press < **ENTER** > when finished. To enter a value less than 1, a zero must be entered before the decimal point. Example: 0.5

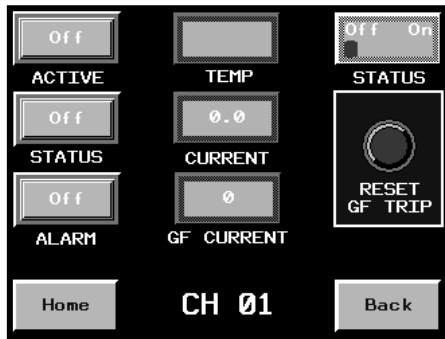
Set point: value range = -328°F to +1392 °F (-200 °C to +756 °C)
Hi-Temp: value range = -328°F to +1392 °F (-200 °C to +756 °C)
Lo-Temp: value range = -328°F to +1392 °F (-200 °C to +756 °C)
Dead band: value range = 1 to 10

High Current: value range = 0 to 50 amps
Low Current: value range = 0 to 50 amps
GF Alarm: value range = 0 to 500 milliamps
GF Trip: value range = 0 to 500 milliamps

The Ground Fault Trip feature cannot be programmed globally. This feature has safety related concerns and the programming conditions should be viewed on an individual basis.

When all displayed values have been programmed, enter all values by pressing < **Enter** >.

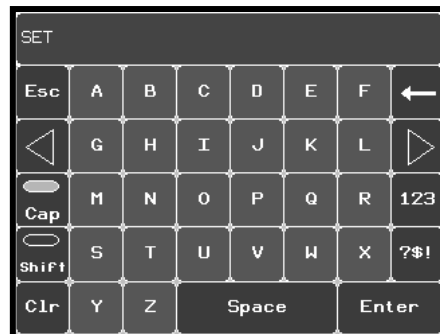
Deactivation of Unused Channels



For any channel that is unused in the current application, the **STATUS** switch should be placed in the **OFF** position. Press < **OFF** > side of the **STATUS** switch to disable the current channel. When the **STATUS** switch is in the **OFF** position, the channel will not be cycled through the Auto Test-Cycle feature and all alarms will be disabled.

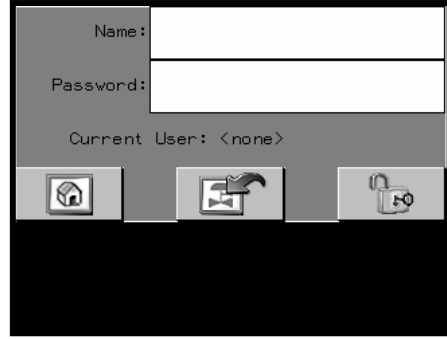
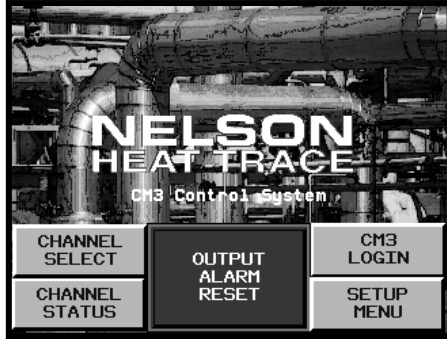
Press < **Home** > on any displayed page to return to the **Home** page screen.

Data Entry

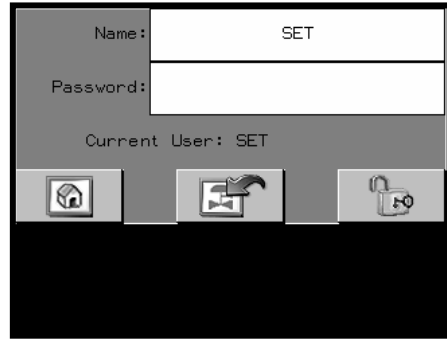
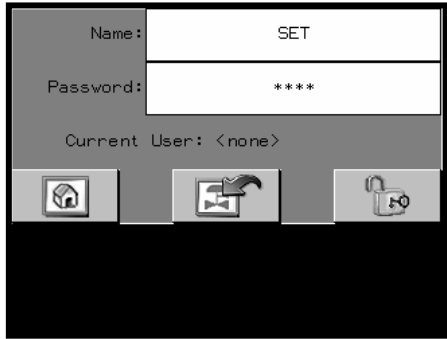


The operator terminal will display one of the above keyboards when either a value is directly pressed or operator input is required. Enter the new value from the keyboard. Press < **ENTER** > when finished. To enter a value less than 1, a zero must be entered before the decimal point. Example: 0.5

User Login and Passwords



To enter a user name and password, access the **User Login** screen by pressing < **CM3 LOGIN** > in the lower left hand corner of the screen. The **Login** page allows the user to enter a user name and password allowing access the desired programming pages. MAINT user name and password allows the operator to access all Channel and Global programming pages. PROG user name and password allows the operator to access all System programming pages.



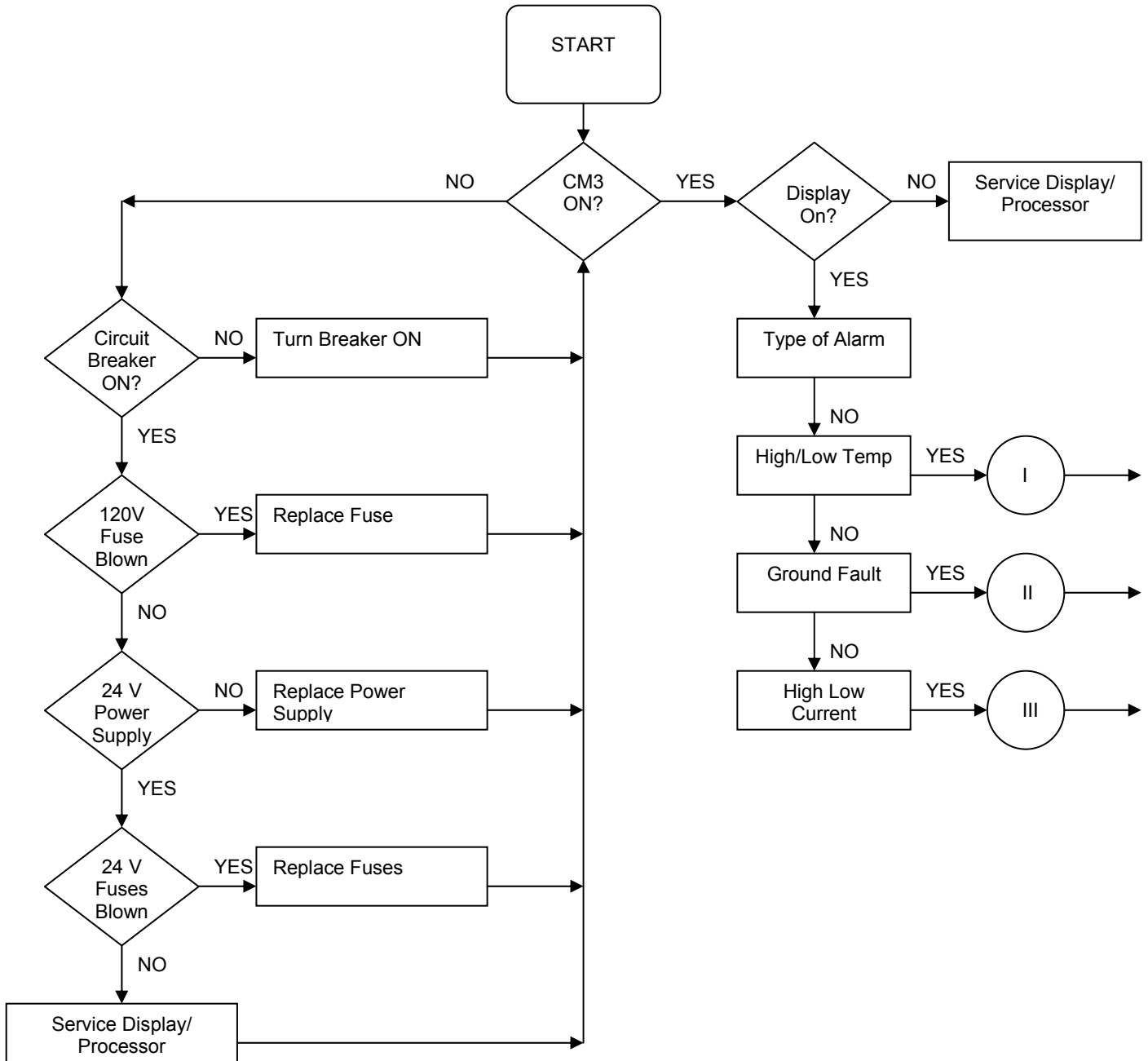
User Name

Password

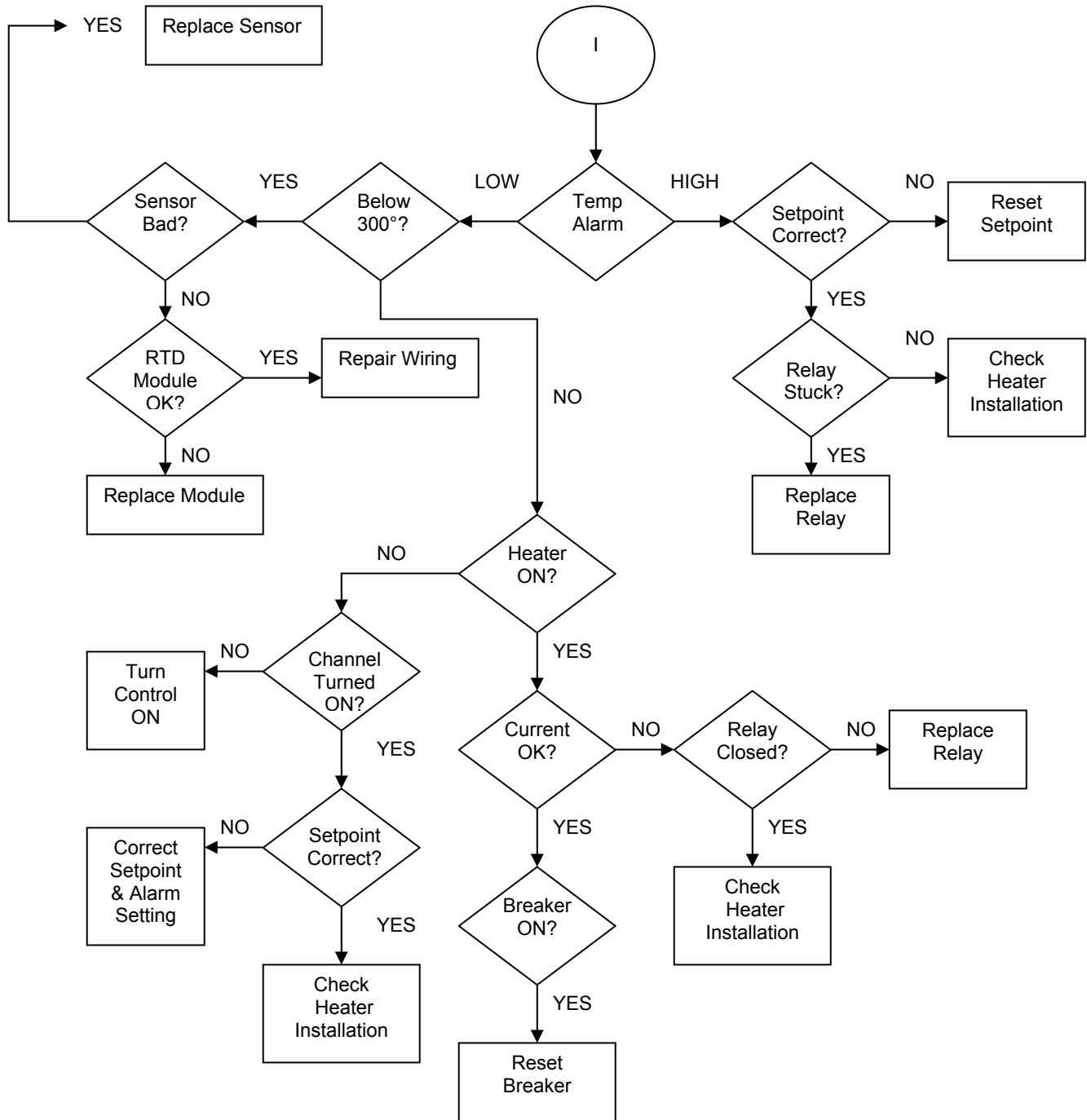
MAINT
PROG

V. TROUBLESHOOTING

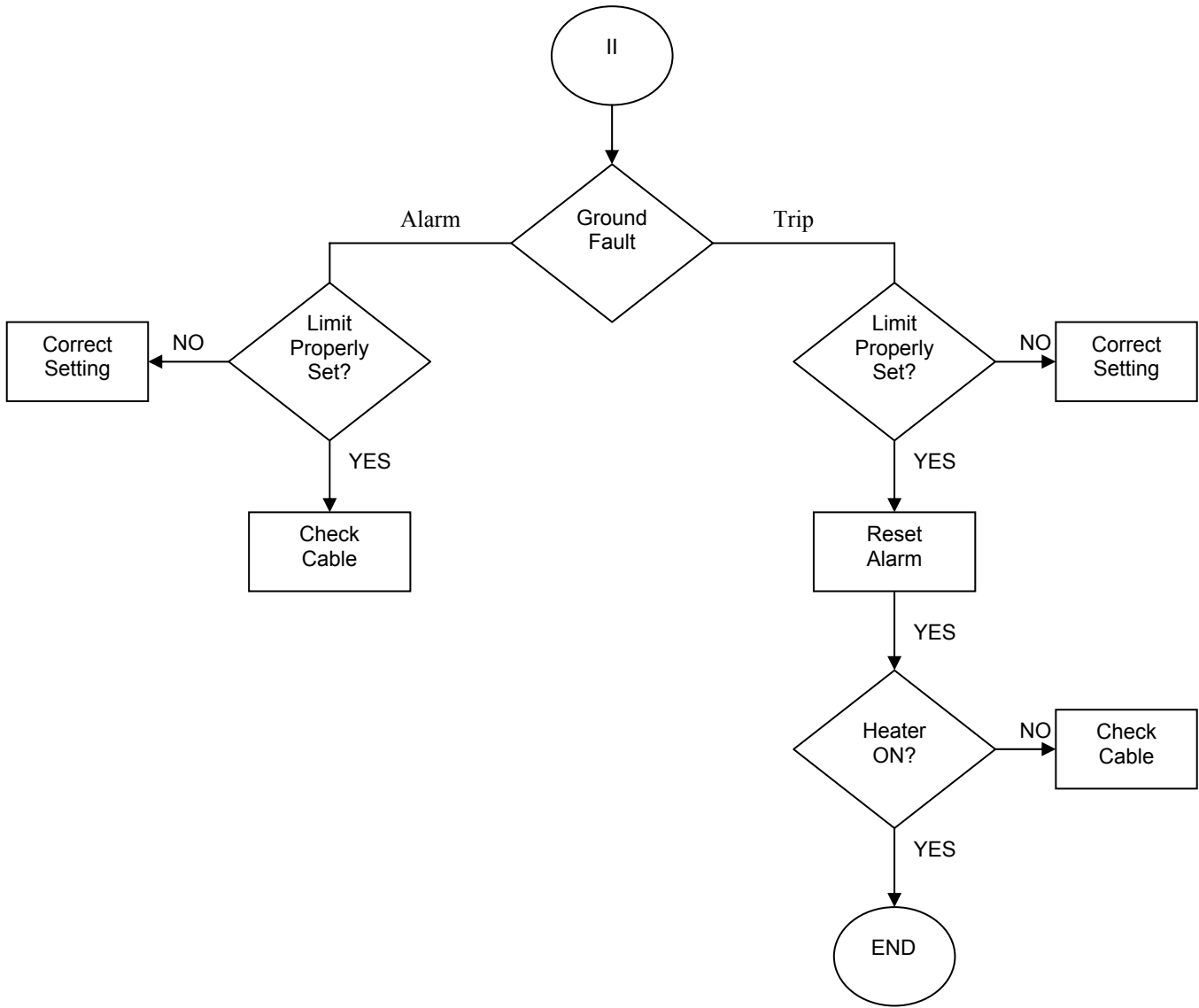
System Operation



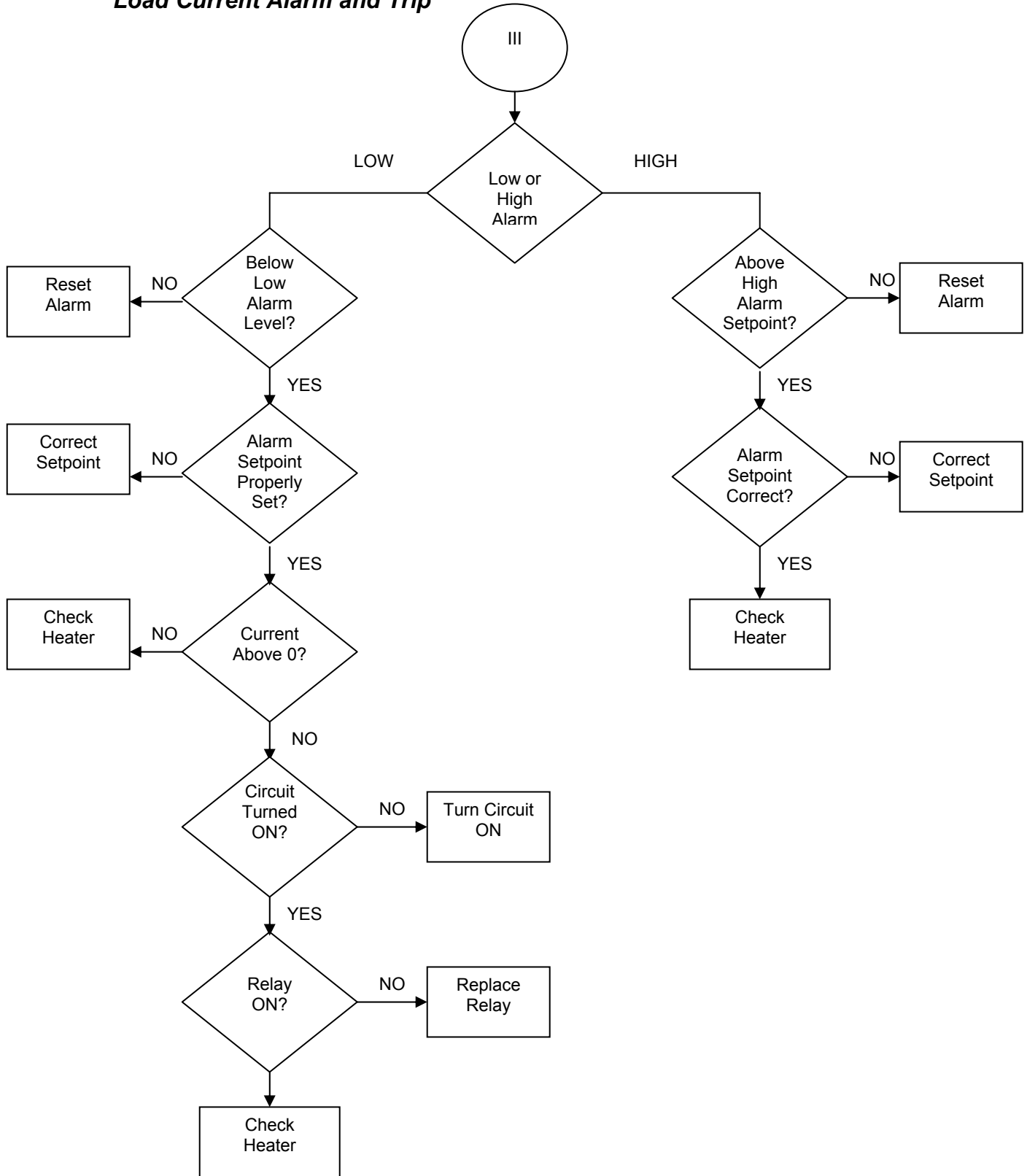
Temperature Alarms



Ground Fault Current Alarm and Trip



Load Current Alarm and Trip



VI. SPECIFICATIONS

Supply Voltage	120VAC, 60Hz
Power Input	5.0A @ 120VAC Maximum
Operating Environment	+32°F to 104°F (0-40°C)
Relative Humidity	0-95% Non-Condensing
Input	RTD, 100Ω, Platinum, 3-Wire
▶Accuracy	1% of Range
Maximum Current	30 Amps
▶Accuracy	± 10%
Ground Fault Range	1-500mA, Adjustable
▶Accuracy	± 10%
Display	Color Touch Screen
Operator Interface	Analog Touch Pad
Programming Options	Individual Channel, Global
Auto-Test Cycle	1-720 Hours
Sensor Failure Output	On/Off
Control Mode	On/Off with Adjustable Dead band
Channel Enable/Disable	Yes
High Temperature Alarm	Adjustable
Low Temperature Alarm	Adjustable
High Current Alarm	Adjustable
Low Current Alarm	Adjustable
Ground Fault Alarm	Adjustable
Ground Fault Trip	Adjustable
Sensor Failure Alarm	Yes
Alarm Output Type	Separate Common and Ground Fault
Alarm Output	Form C, 7.0A @ 120/240VAC

Nelson Heat Tracing Systems products are supplied with a limited warranty. Complete Terms and Conditions may be found on Nelson's website at www.nelsonheaters.com.
