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SECTION 1 – OVERVIEW

1.1 INTRODUCTION

The DigiTrace NGC-40 is a fully functional, self-contained control and monitoring system used with electric heat-tracing systems. It is designed for installation requiring minimal wiring on site. This manual provides information pertaining to the installation, operation, testing, adjustment, and maintenance of all components of the DigiTrace NGC-40 Control System. For information about how to program the DigiTrace NGC-40 Control System, see the DigiTrace NGC-40 Control System with DTS User Guide (H58269).

A typical DigiTrace NGC-40 Control System consists of at least a one Power and Termination module (NGC 40 PTM), one Bridge module (NGC-40-BRIDGE), one or more Heat-Trace Controllers (NGC-40-HTC or HTC3) and one IO module (NGC-40-IO). Additional IO modules (NGC-40-IO) are optional and may be used. The system is intended to provide configuration and component flexibility so that it may be optimized for a customer’s specific needs.

The information in this document coincides with the specific releases of firmware (listed in the table below) for the Heat-Trace Controllers (NGC-40-HTC or HTC3) and Bridge module (NGC-40-BRIDGE) components. As Pentair Thermal Management releases new firmware to significantly modify or enhance any of these components, new documentation will accompany these releases. To ensure that the correct documentation is being used for your particular version of the NGC-40-HTC/HTC3 and NGC-40-BRIDGE, compare the firmware version number of each component against the number listed in the table below. As subsequent changes are made, supplements to this document will be included in manuals shipped after the firmware is released. Supplements will make specific reference to the operation or functional change.

Copies of this manual and updates may be downloaded from the Literature section of www.thermal.pentair.com.

<table>
<thead>
<tr>
<th>Component</th>
<th>Version number</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGC-40-HTC</td>
<td>4.x</td>
</tr>
<tr>
<td>NGC-40-HTC3</td>
<td>4.x</td>
</tr>
<tr>
<td>NGC-40-IO</td>
<td>3.x</td>
</tr>
<tr>
<td>NGC-40-BRIDGE</td>
<td>5.x</td>
</tr>
</tbody>
</table>

IMPORTANT WARNINGS AND NOTES

The following icons are used extensively throughout this manual to alert you to important warnings ▶️ that affect safety and to important notes 📝 that affect the proper operation of the unit. Be sure to read and follow them carefully.
SECTION 2 – INSTALLATION AND WIRING

2.1 INTRODUCTION

**WARNING:**
Electrical Hazard! Ensure all personnel involved in installation, servicing, and programming are qualified and familiar with electrical equipment, its ratings, safe electrical practices and national and local electrical codes. Multiple voltages and signal levels may be present during the installation, operation, and servicing of this product. Do not power the NGC-40 until the safety provisions specified in this manual have been observed.

This section includes information regarding the initial inspection, preparation for use, and wiring instructions for the components of the DigiTrace NGC-40 Control System.

2.2 INITIAL INSPECTION

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been verified for completeness and the equipment has been checked mechanically and electrically. Procedures for installing the DigiTrace NGC-40 Control System are given in this section. If the shipment is incomplete, mechanically damaged, defective in any way, or does not pass the electrical performance tests, notify the nearest Pentair Thermal Management representative. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as your Pentair Thermal Management representative. Keep the shipping materials for the carrier’s inspection.

2.3 OPERATING ENVIRONMENT

There are three types of enclosures available with the DigiTrace NGC-40 panel, as shown below.

<table>
<thead>
<tr>
<th>Enclosure Type</th>
<th>Area Classification</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE-12</td>
<td>Nonhazardous (Unclassified) Locations</td>
<td>Indoors</td>
</tr>
<tr>
<td>TYPE-4/3R</td>
<td>Nonhazardous (Unclassified) Locations</td>
<td>Outdoors, painted steel</td>
</tr>
<tr>
<td>TYPE-4/3R with Z purge option</td>
<td>Hazardous Locations • Class I, Division 2, Groups A, B, C, D • Class I, Zone 2, Group IIC</td>
<td>Outdoors, painted steel with mechanical relays</td>
</tr>
<tr>
<td>TYPE-4X</td>
<td>Hazardous Locations • Class I, Division 2, Groups A, B, C, D • Class I, Zone 2, Group IIC</td>
<td>Outdoors, stainless steel with solid-state relays</td>
</tr>
</tbody>
</table>

**WARNING:**
Shock Hazard. Some wiring configurations will use more than one power source. All power sources must be de-energized prior to performing any maintenance on a module or its heating circuit. The operating environment should be within the limitations specified for the DigiTrace NGC-40 components as outlined in Appendix A.

2.4 INSTALLATION LOCATION

The wide ambient operating temperature range of the DigiTrace NGC-40 Control System permits installation in almost any convenient location. Considerations should include: expected atmospheric conditions (weather), accessibility for maintenance and testing, the location of existing conduits, and hazardous location rating. Ambient temperature conditions may affect load current ratings.

**WARNING:**
Fire Hazard. Always be sure that the intended location is classified as an area that the product is approved for use in as defined by Article 500 of the National Electrical Code and/or Part I, Section 18 of the Canadian Electrical Code.
2.5 MOUNTING PROCEDURES

Each DigiTrace NGC-40 panel includes a set of "As Built" drawings that have been engineered, designed, and drafted based upon the model number and any special requirements that were requested when ordering. The "As Built" drawings include an elevation/layout (with bill of materials) and schematics. If these drawings are not included, contact your Pentair Thermal Management Representative and request the "As Built" drawings for your panel. Upon request, an electronic copy of these drawings can be provided.

For mounting the panel, locate the elevation and layout drawing which includes a bill of materials. The enclosure mounting information will be provided on the "As Built" drawings.

2.6 WIRING PROCEDURES

Refer to the "As Built" drawings for wiring of incoming/outgoing power and incoming RTD connections. The DigiTrace NGC-40 panel can be purchased with, or without, a distribution panel board.

2.6.1 INCOMING POWER WITH DISTRIBUTION SYSTEM

Main Circuit Breaker

Locate the main circuit breaker in the panel by using the supplied elevation/layout drawing, and connect per the associated schematic drawings. Depending upon the size and type of main circuit breaker and voltage loss calculations, use the appropriate size and number of wires to connect directly to the main circuit breaker, and panel board neutral and ground bus in the panel.

Branch Circuit Breakers

The branch circuit breakers are pre-wired to the contactors or solid-state relays in the panel, so no further incoming power wiring is required.
2.6.2 OUTGOING POWER WITH DISTRIBUTION SYSTEM

Load Power Terminal Blocks

Locate the outgoing heater terminal blocks using the supplied elevation/layout drawing, and connect per the associated schematic drawings. Depending upon the size of the branch circuit breaker and voltage loss calculations, use the appropriate size and number of wires to connect from the panel's Load Power Terminal Blocks to the heat-trace power junction box.

**Single pole C.B.**

![Single pole C.B. diagram]

**Two pole C.B.**

![Two pole C.B. diagram]

**Three pole C.B. (Three-phase, 3-wire)**

![Three pole C.B. (Three-phase, 3-wire) diagram]

**Three pole C.B. (Three-phase, 4-wire)**

![Three pole C.B. (Three-phase, 4-wire) diagram]

Fig. 2.2 Heat-trace power wiring diagram
2.6.3 INCOMING/OUTGOING POWER WITHOUT DISTRIBUTION PANEL BOARD

**Line Power Terminal Blocks**
Locate the incoming power terminal blocks in the panel using the supplied elevation/layout drawings and connect per the associated schematic drawing. Depending upon size and type of the remotely located branch circuit breakers, use the appropriate size and number of wires to connect directly to the Line Power Terminal Blocks.

**Load Power Terminal Blocks**
Locate the outgoing power terminal blocks in the panel using the supplied elevation/layout drawings and connect per the associated schematic drawing. Depending upon size and type of the remotely located branch circuit breakers, use the appropriate size and number of wires to connect from the Load Power Terminal Blocks to the heater’s power connection box.

---

**Single pole C.B.**

---

**Two pole C.B.**

---

**Three pole C.B. (Three-phase, 3-wire)**

---

**Three pole C.B. (Three-phase, 4-wire)**

---

Fig. 2.3 Load power terminal block configurations
2.6.4 INCOMING RTD WIRING

Nonhazardous and Hazardous Location Installations Wired to Terminal Block in Panel

Each DigiTrace NGC-40-HTC/HTC3 module has one RTD input. The RTD wiring from the NGC 40-HTC/HTC3 have been pre-wired to RTD terminals. The field RTD wiring (3-wire with shield) will be terminated by the installer at the RTD terminal blocks. Refer to the “As Built” Drawings for the RTD Termination Schedule. Refer to Section 3.1 for additional NGC-40-HTC/HTC3 wiring information.

RTD Connections - North American Installation Technique

<table>
<thead>
<tr>
<th>Control Panel</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS COMM</td>
<td>WH</td>
</tr>
<tr>
<td>TS SENSE</td>
<td>R</td>
</tr>
<tr>
<td>TS SOURCE</td>
<td>BK</td>
</tr>
<tr>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2.4 Typical RTD installation from the NGC-40-HTC/HTC3 module in a North American style panel

RTD Connections - European Installation Technique

<table>
<thead>
<tr>
<th>Control Panel</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS COMM</td>
<td>WH</td>
</tr>
<tr>
<td>TS SENSE</td>
<td>R</td>
</tr>
<tr>
<td>TS SOURCE</td>
<td>BK</td>
</tr>
<tr>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2.5 Typical RTD installation from the NGC-40-HTC/HTC3 module in an European style panel

Optional RTD inputs via the NGC-40-IO module

One NGC 40 IO module is mandatory. The digital output of this module is used for activating the Common Alarm Light on the DigiTrace NGC 40 panel door. Additional NGC 40 IO modules are optional components that may or may not be included in a panel depending on its design. If used, each DigiTrace NGC-40-IO module provides up to four additional RTD inputs. The RTD wiring from the NGC-40-IO have been pre-wired to RTD terminals. The field RTD wiring (3-wire with shield) will be terminated by the installer at the RTD terminal blocks. Refer to the “As Built” Drawings for the RTD Termination Schedule. Refer to Section 3.3 for additional NGC-40-IO wiring information.

RTD Connections - North American Installation Technique

<table>
<thead>
<tr>
<th>Control Panel</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O – – – – –</td>
<td>WH</td>
</tr>
<tr>
<td>TS COMM</td>
<td>R</td>
</tr>
<tr>
<td>TS SENSE</td>
<td>BK</td>
</tr>
<tr>
<td>TS SOURCE</td>
<td></td>
</tr>
<tr>
<td>Not Used</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2.6 Typical RTD installation from the NGC-40-IO module in a North American style panel

RTD Connections - European Installation Technique
2.6.5 NGC-40-BRIDGE SWITCH SETTINGS

User Interface – Configuration Switch

A slide switch is provided on the front of the module to allow the user to set the RS-232 (COM 3) into a known state, as shown in the following table:

<table>
<thead>
<tr>
<th>Bridge module settings</th>
<th>Switch position</th>
<th>SET (Configuration) mode</th>
<th>RUN (Normal operating)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local RS-232 (COM 3) parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modbus address</td>
<td>1</td>
<td>Settings based on the user parameters of the Bridge</td>
<td></td>
</tr>
<tr>
<td>(The default user parameters are the same as those in the SET mode)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protocol</td>
<td>RTU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data rate</td>
<td>9600 baud</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data bits</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop bits</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parity</td>
<td>none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tx delay</td>
<td>0 ms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If the present user parameters of the communications port of an NGC-40-BRIDGE are not known, the NGC-40-BRIDGE can be placed in the SET mode by its Configuration Switch and the DigiTrace Supervisor or any other device that needs to communicate with the NGC-40-BRIDGE, can then be used to establish communications. The user parameters (including those of the communications port) can then be read.

While in the SET mode, modifications to the NGC-40-BRIDGE user parameters of the communications port will be saved but will not take effect until the Configurations Switch is moved to the RUN mode.

The parameters of the two RS-485 ports (COM 1 and COM 2) and the ethernet port are not affected by the position of the Configuration Switch.

For firmware upgrades only: When in SET mode, the NGC-40-BRIDGE 10/100 LAN (Ethernet) port settings are those defined by the Boot loader.

In the RUN mode, these port settings are defined by the user parameters of the Bridge (the default user parameters are the same as those in the table above).
2.6.6 OPTIONAL RMM2 CONNECTION

When using the field mounted RMM2 for RTD input, it must be connected to the COM2 In as shown below.

**Fig. 2.9  RMM2 Connection**

**Digital Input**
- Multi-purpose input for connection to external dry (voltage free) contact or DC voltage

**Rating**
- 100 Ω max loop resistance or 5-24 Vdc @ 1mA max.
2.6.7 OPTIONAL TOUCH 1500R CONNECTIONS

When using the Touch 1500R (Remote User Interface Terminal) with the NGC-40 system, the user must connect main power to the Touch 1500R and communication cable from the NGC-40-BRIDGE to the Touch 1500R.

Fig. 2.10 Touch 1500R

Connecting Main Power to the Touch 1500R

Use only copper conductors for field wiring. A close-up of the power connection terminals is shown below. This connection energizes the DigiTrace TOUCH 1500 electronics only; it does not provide power to the heat tracing or contactor coils.

IMPORTANT: If the DigiTrace TOUCH 1500R controller has a different source of power than the heat tracing, it may be worthwhile to install an uninterruptible power supply (UPS) so the unit can continue to control and/or monitor the heat tracing in the event of a localized power failure.

Fig. 2.11 Touch 1500R Main Power Terminal Block
Connecting RS-485 Field Port Communication

The NGC-40-BRIDGE communicates with the TOUCH 1500R over an RS-485 network, which can have a total cable length of no more than 1200 m (4000 ft), as required.

The RS-485 communicating cable shall be a shielded, two conductor (twisted pair) cable.

Refer to “As Built” drawings for connection details.

For RS-485 cable type, reference Belden #8761 or Carol #C2514.

Fig. 2.12 Touch 1500R RS-485 Terminal Block

Fig. 2.13 Touch 1500R Wiring Diagram
2.6.8 OPTIONAL DIGITAL INPUTS

Both the DigiTrace NGC-40-HTC/HTC3 and the Digitrace NGC-40-IO modules have a digital input which is programmable and may be used for various functions such as forcing outputs on and off. The field wiring for these connections will be wired directly to the module as shown below.

North American Installation Technique

European Installation Technique

Fig. 2.14 Digital Inputs
2.6.9 OPTIONAL ALARM RELAY

Both the DigiTrace NGC-40-HTC/HTC3 and the Digitrace NGC-40-IO modules have an alarm relay which can be used to control an external annunciator. The field wiring for these connections will be wired directly to the module as shown below.

**WARNING: Shock Hazard.** Disconnect from live voltage prior to accessing terminals.

- Multi-purpose. Alarm relay energized in normal state.
- The alarm relay is configured as Fail Safe.
- The alarm relay connections provide a form C dry contact:
  - 250 V / 3A 50/60 Hz (CE)
  - 277 V / 3A 50/60 Hz (cCSAus)
- The NO (normally open) contact is open in non-energized condition. When energized, it closes during normal conditions and will open upon an alarm condition or power failure.
- The NC (normally closed) contact is closed in non-energized condition. When energized, it opens during normal conditions and will close upon an alarm condition or power failure.
- Relay contact rated

Fig. 2.15 NGC-40-HTC/HTC3 Alarm Relay

**WARNING: Shock Hazard.** Disconnect from live voltage prior to accessing terminals.

- The common alarm provides a form C contact:
  - 250 V / 3A 50/60 Hz (CE)
  - 277 V / 3A 50/60 Hz (c-CSA-us)
- The alarm relay is configured as Fail Safe.
- The NO (normally open) contact is open in non-energized condition. When energized, it closes during normal conditions and will open upon an alarm condition or power failure.
- The NC (normally closed) contact is closed in non-energized condition. When energized, it opens during normal conditions and will close upon an alarm condition or power failure.
- Relay contact rated

Fig. 2.16 NGC-40-IO Alarm Relay
2.6.10 CONNECTING TO REM PC W/ DIGITRACE SUPERVISOR OR CUSTOMER DCS SYSTEM

The Digitrace NGC-40-BRIDGE must communicate with a host computer using Digitrace Supervisor in order to load set point information and monitor the HTCs through the NGC-40 BRIDGE’s external communication ports. The NGC-40-BRIDGE provides ports for RS 232, RS 485, and Ethernet communications. The RS-485, RS-232 and Ethernet ports could also communicate with a distributed control system (DCS).

RS-232 Serial Connection

The RS-232 port can be used as a direct connection to a single PC located within 50 ft of the panel. For an RS-232 connection, a 3 ft long RJ-11 to 9 pin female D-connector (NGC part number 10332-005) has been provided with the NGC-40 panel. Plug the RJ-11 connector into the RS-232 connector on the NGC-40-BRIDGE and the other end into the 9-pin connector on the user’s computer.

![Fig. 2.17 RS-232 Serial Connection](image-url)
RS-485 Serial Connection

Use the RS-485 port when multiple NGC-40-BRIDGE modules are to be connected to a host computer. If the connection is longer than 1,220 m (4,000 ft), a repeater is required. An RS-485 to RS-232 or an RS-485 to USB converter may be required to make the connection to the user’s PC.

Connection Diagram – North American Installation Technique

![Fig. 2.18 North American RS-485 Serial Connection - COM1](image)

Connection Diagram – European Installation Technique

![Fig. 2.19 European RS-485 Serial Connection - COM1](image)
Ethernet Connection
The Ethernet port can be used to connect multiple NGC-40-BRIDGE modules to a host computer by connecting to the user’s LAN system.

Fig. 2.20 Ethernet Connection
2.6.11 CONNECTING MULTIPLE NGC-40 PANELS (BRIDGES) USING RS-485 (COM 1)

A termination resistor is required at the beginning and the end of the RS-485 communication network. In each panel a termination resistor has been provided on COM 1 (Out). If multiple panels are connected together on an RS-485 network, the COM 1 (Out) termination resistor needs to be removed from all panels except for the last panel.

CONNECTION DIAGRAM - NORTH AMERICAN INSTALLATION TECHNIQUE

Fig. 2.21 North American termination resistor layout
Fig. 2.22 European termination resistor layout
SECTION 3 – DIGITRACE NGC-40 COMPONENTS AND OPERATION

The DigiTrace NGC-40 heat-trace system is comprised of a number of modular components, allowing the ultimate in design flexibility. This section describes the NGC-40 control and monitoring components (excluding the optional distribution section).

3.1 NGC-40-HTC AND HTC3

The NGC-40-HTC (for single-phase heaters) and NGC-40-HTC3 (for three-phase heaters) modules are used to control either a solid-state relay or contactor within the NGC-40 control and monitoring system. This module also has one alarm output and one digital input. The alarm output can be used to control an external annunciator. The digital input is programmable and may be used for various functions such as forcing outputs on and off. Other features of this module include ground-fault and line current sensing for both HTC and HTC3. The front panel of the HTC module has LED indicators for various status conditions. The front panel also provides a ground-fault and heater test button.
A. Wiring Terminals

1 △ Alarm relay N.O. 7 Digital In + 13 TS COM (Wht)
2 △ Alarm relay COM 8 Digital In – 14 TS Sense (Red)
3 △ Alarm relay N.C. 9 △ Line In 15 Not used
4 Not used 10 △ Line Out 16 Not used
5 SSR Out + 11 △ Coil Out
6 SSR Out – 12 Not Used

WARNING:
Shock Hazard. Disconnect from live voltage prior to accessing terminals

B. CAN/BUS MODULE POWER

C. RESET

D. STATUS LEDS
<table>
<thead>
<tr>
<th>STATUS:</th>
<th>Indicates status of HTC/HTC3 module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No power</td>
</tr>
<tr>
<td>Green</td>
<td>Normal operation, no internal faults</td>
</tr>
<tr>
<td>Yellow</td>
<td>In Factory mode</td>
</tr>
<tr>
<td>Red</td>
<td>HTC/HTC3 operating status</td>
</tr>
<tr>
<td>Flash R</td>
<td>Internal Fault: Factory status</td>
</tr>
<tr>
<td>Flash R/G</td>
<td>Internal fault detected</td>
</tr>
<tr>
<td>Flash R/Y</td>
<td>Internal fault detected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INPUT:</th>
<th>Shows status of digital input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Input is inactive (open)</td>
</tr>
<tr>
<td>Green</td>
<td>Input is active (shorted)</td>
</tr>
<tr>
<td>Flash R</td>
<td>Ext. input source failure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TS:</th>
<th>Indicates the temperature alarm status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No alarm</td>
</tr>
<tr>
<td>Red</td>
<td>High or low temperature alarm</td>
</tr>
<tr>
<td>Flash R</td>
<td>Temperature sensor failure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OUTPUT:</th>
<th>Shows status of contactor or SSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Output off</td>
</tr>
<tr>
<td>Green</td>
<td>Follows output state</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GFI:</th>
<th>Indicates ground-fault status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No alarm</td>
</tr>
<tr>
<td>Red</td>
<td>High or low ground-fault alarm</td>
</tr>
<tr>
<td>Flash R</td>
<td>Ground-fault trip alarm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NETWORK:</th>
<th>Indicates CAN network activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No network activity</td>
</tr>
<tr>
<td>Green</td>
<td>Flicker on receipt of network data</td>
</tr>
<tr>
<td>Yellow</td>
<td>Flicker on transmission of network data</td>
</tr>
<tr>
<td>Flash R</td>
<td>Network communication failure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HEATER:</th>
<th>Indicates the heater’s alarm status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No alarm</td>
</tr>
<tr>
<td>Red</td>
<td>High or low current or resistance alarm</td>
</tr>
<tr>
<td>Flash R</td>
<td>Overcurrent trip alarm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SWITCH:</th>
<th>Indicates contactor/SSR switch status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No alarm</td>
</tr>
<tr>
<td>Red</td>
<td>Contactor cycle count alarm</td>
</tr>
<tr>
<td>Flash R</td>
<td>Switch failed shorted on</td>
</tr>
</tbody>
</table>
General

Approvals and Certifications

Supply voltage
Internal power consumption
Ambient operating temperature
Ambient storage temperature
Environment
Max. altitude
Humidity
Mounting

Electromagnetic Compatibility

Emissions

Immunity

Temperature Sensors

Type

Quantity

Current Sensors (internal to the module)

Quantity per NGC-40-HTC/HTC3
Quantity per NGC-40-HTC
Quantity per NGC-40-HTC3
Maximum Line to Line Voltage

Alarm Relay

Dry contact relay (voltage free)

Contactor Output Relay

Digital Input

Multi-purpose input

CAN Networking Port

Type

Quantity

Connection

Protocol

Cable length
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity</strong></td>
<td>Up to 80 HTC/HTC3 and IO modules per network segment</td>
</tr>
<tr>
<td><strong>Address</strong></td>
<td>Unique, factory assigned</td>
</tr>
<tr>
<td><strong>Connection terminals</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Wiring terminals</strong></td>
<td>Cage clamp, 0.5 to 2.5 mm² (24 to 12 AWG)</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>45.1 mm (1.78 in) wide x 87 mm (3.43 in) high x 106.4 mm (4.2 in) deep</td>
</tr>
<tr>
<td><strong>Line Current Sensors</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Max current</strong></td>
<td>60 A</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>± 2% of reading</td>
</tr>
<tr>
<td><strong>Ground-Fault Sensor</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>Range 10 – 250 mA</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>± 2% of range</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td></td>
</tr>
<tr>
<td><strong>SSR output</strong></td>
<td>12 Vdc @ 45 mA max per output</td>
</tr>
</tbody>
</table>
The NGC-40-BRIDGE module provides the interface between a panel's internal CAN-based network and upstream devices. Multiple communications ports are supported, allowing serial and Ethernet connections to be used with external devices.

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Refer to Appendix A for licensing information.
### A. WIRING TERMINALS - RS-485 PORTS

<table>
<thead>
<tr>
<th></th>
<th>COM 1 + in</th>
<th>COM 2 + out</th>
<th>COM 2 – in</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COM 1 + in</td>
<td>COM 2 + out</td>
<td>COM 2 – in</td>
</tr>
<tr>
<td>2</td>
<td>COM 1 + out</td>
<td>COM 1 – in</td>
<td>COM 2 – out</td>
</tr>
<tr>
<td>3</td>
<td>COM 2 + in</td>
<td>COM 1 – out</td>
<td>Not used</td>
</tr>
</tbody>
</table>

### B. STATUS LEDs

**STATUS:** Indicates status of the module

- Off: No power
- Green: OK/Normal
- Yellow (flashing): Configuration mode
- Red (flashing): Internal fault

**NETWORK:** Indicates CAN network activity

- Off: No link detected
- Green: Link OK, receive data packets
- Yellow: Transmit data packets
- Red (flashing): Network error

**COM:** Indicates COM1 & 2 (RS-485) activity

- Off: No activity
- Green: (flashing) Receipt of data packet
- Green: (flashing) Transmit of data packet

### C. COMMUNICATION SLIDE SWITCH

**D. RS-232 PORT**

**STATUS:** Indicates status of RS-232 port

- Top LED: Off: No activity, Green: (flashing) Receipt of data packet

**Bottom LED:**

- Off: No activity
- Yellow: (flashing) Transmit of data packet

### E. ETHERNET PORT

**STATUS:** Indicates status of the LAN

- Top LED: Off: No LAN activity

**Bottom LED:**

- Off: No LAN detected
- Yellow: (flashing) LAN activity [data packet]

### F. CAN BUS / MODULE POWER
6. RESET BUTTON

General
Approvals and Certifications
Supply voltage 24 Vdc, ± 10%
Internal power consumption < 3.6 W per NGC-40-BRIDGE
Ambient operating temperature –40ºC to 65ºC (–40ºF to 149ºF)
Ambient storage temperature –40ºC to 75ºC (–40ºF to 167ºF)
Environment PD2, CAT III
Max. altitude 2,000 m
Humidity 5 – 90% noncondensing
Mounting Din Rail – 35 mm

Electromagnetic Compatibility
Emissions EN 61000-6-3
Emission standard for residential, commercial and light industrial environments
Immunity EN 61000-6-2
Immunity standard for industrial environments

Communications COM1, COM2
Type 2-wire RS-485
Cable One shielded twisted pair
Length 1,200 m (4,000 ft) maximum
Quantity Up to 255 devices per port
Data rate 9600, 19.2K, 38.4K, 57.6K, 115.2K baud
Data bits 7 or 8
Parity None, even, odd
Stop bits 0, 1, 2
Tx delay 0 – 5 sec.
Protocol Modbus RTU or ASCII
Connection terminals Wago cage clamp terminals

Communications COM1, COM2
Type RS-232
Cable Custom TTC# 10332-005
Length 15 m (50 ft) maximum
Data rate 9600, 19.2K, 38.4K, 57.6K, 115.2K baud
Data bits 7 or 8
Parity None, even, odd
Stop bits 0, 1, 2
Tx delay 0 – 5 sec.
Protocol Modbus RTU or ASCII
Connection terminals RJ-11

CAN Networking Port
Type 2-wire isolated CAN-based peer-peer network. Isolated to 300 V.
Connection Two 8-pin RJ-45 connectors [both may be used for Input or Output connections]
Protocol Proprietary NGC-40
Topology Daisy chain
Length 10 m (33 ft) maximum
| **Quantity** | Up to 80 CAN nodes per network segment |
| **Address** | Unique, factory assigned |

**Ethernet**
- **Type**: 10/100 BaseT Ethernet network
- **Length**: 100 m (328 ft)
- **Data rates**: 10 or 100 MB/s
- **Protocol**: Modbus/TCP
- **Connection terminals**: Shielded 8-pin RJ-45 connector on front of module

**Programming and Setting**
- **LED indicators**: RESET, Configuration lost, CAN communications fail
- **Configuration switch**: SET/RUN slide switch on front of module

**Connection terminals**
- **Wiring terminals**: Cage clamp, 0.5 to 2.5 mm² (24 to 12 AWG)
- **CAN networking and module power**: Two RJ-45s, one each IN and OUT. Provides CAN bus signals and +24 Vdc power.

**Housing**
- **Size**: 45.1 mm (1.78 in) wide x 87 mm (3.43 in) high x 106.4 mm (4.2 in) deep
3.3 NGC-40-IO

The NGC-40-IO provides up to four additional RTD inputs. These additional RTD inputs can be assigned to any NGC-40-HTC-HTC3. The NGC-40-IO also has one digital input and one alarm relay.
A. WIRING TERMINALS - RS-485 PORTS

- 1-3 Alarm relay
- 4-6 Not used
- 7-8 Digital input

**WARNING:** Shock Hazard. Disconnect from live voltage prior to accessing terminals

B. STATUS LEDS

- **STATUS:** Indicates status of IO module
  - Off: No power
  - Green: OK/Normal
  - Yellow: Configuration mode
  - Red: Internal fault

- **ALARM RELAY**
  - Off: No alarm
  - Red: Alarm condition

- **TS1 FAIL to TS4 FAIL**
  - Off: Normal, no fault
  - Red: TS fail (open, shorted, out of range)

- **NETWORK:** Indicates CAN network activity
  - Off: No link detected
  - Green: Link OK, receive data packets
  - Yellow: Transmit data packets

- **INPUT:**
  - Off: Shows status of digital input 
  - Green: Input is inactive (open)

- **GFI:**
  - Off: No alarm
  - Red: High or low ground-fault alarm
  - Flash R: Ground-fault trip alarm

C. CAN BUS / MODULE POWER

D. RESET BUTTON
### General

**Approvals and Certifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>24 Vdc, ± 10%</td>
</tr>
<tr>
<td>Internal power consumption</td>
<td>&lt; 2.4 W per NGC-40-IO</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-40ºC to 65ºC (-40ºF to 149ºF)</td>
</tr>
<tr>
<td>Ambient storage temperature</td>
<td>-40ºC to 75ºC (-40ºF to 167ºF)</td>
</tr>
<tr>
<td>Environment</td>
<td>PD2, CAT III</td>
</tr>
<tr>
<td>Max. altitude</td>
<td>2,000 m (6,562 ft)</td>
</tr>
<tr>
<td>Humidity</td>
<td>5 – 90% noncondensing</td>
</tr>
<tr>
<td>Mounting</td>
<td>Din Rail – 35 mm</td>
</tr>
</tbody>
</table>

**Electromagnetic Compatibility**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions</td>
<td>EN 61000-6-3</td>
</tr>
<tr>
<td>Immunity</td>
<td>EN 61000-6-2</td>
</tr>
</tbody>
</table>

**Temperature Sensors**

<table>
<thead>
<tr>
<th>Type</th>
<th>100 W, platinum RTD, 3-wire, a = 0.00385 ohms/ohm/ºC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Can be extended with a 3-conductor shielded cable of 20 W maximum per conductor</td>
</tr>
<tr>
<td></td>
<td>100 W, Ni-Fe, 2-wire</td>
</tr>
<tr>
<td></td>
<td>Can be extended with a 2-wire shielded cable of 20 W maximum per conductor</td>
</tr>
</tbody>
</table>

**Quantity**

Up to four wired directly to each NGC-40-IO module

**Alarm Relay**

<table>
<thead>
<tr>
<th>Type</th>
<th>Relay contact rated 250 V / 3 A 50/60 Hz (CE) and 277 V / 3 A 50/60 Hz (cCSAus).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Output is user programmable to flash. N0 and NC contacts available.</td>
</tr>
</tbody>
</table>

**Digital Input**

<table>
<thead>
<tr>
<th>Type</th>
<th>Multi-purpose input for connection to external dry (voltage-free) contact or DC voltage. May be user programmable for: not used / force off / force on functions. It can be configured to be active open or active closed.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max. input voltage 24 Vdc</td>
</tr>
</tbody>
</table>

**CAN Networking Port**

<table>
<thead>
<tr>
<th>Type</th>
<th>2-wire isolated CAN-based peer to peer network. Isolated to 300 V.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>Two 8-pin RJ-45 connectors (both may be used for Input or Output connections)</td>
</tr>
<tr>
<td>Protocol</td>
<td>Proprietary NGC-40</td>
</tr>
<tr>
<td>Topology</td>
<td>Daisy chain</td>
</tr>
<tr>
<td>Length</td>
<td>10 m (33 ft) maximum</td>
</tr>
<tr>
<td>Quantity</td>
<td>Up to 80 HTC/HTC3 and IO modules per network segment</td>
</tr>
<tr>
<td>Address</td>
<td>Unique, factory assigned</td>
</tr>
</tbody>
</table>

**Connection terminals**

<table>
<thead>
<tr>
<th>Wiring terminals</th>
<th>Cage clamp, 0.5 to 2.5 mm2 (24 to 12 AWG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAN networking and module power</td>
<td>Two RJ-45s, one each IN and OUT. Provides CAN bus signals and +24 Vdc power.</td>
</tr>
</tbody>
</table>

**Housing**

<table>
<thead>
<tr>
<th>Size</th>
<th>45.1 mm (1.78 in) wide x 87 mm (3.43 in) high x 106.4 mm (4.2 in) deep</th>
</tr>
</thead>
</table>
The NGC-40-PTM accepts a primary and redundant power supply input, accepts the CAN bus inputs, and provides for termination of the CAN bus. Each NGC-40-PTM can provide power for a maximum of 10 NGC-40 modules.

NGC-40-PTM Components
NGC-40 PTM MODULE

24 VDC PRIMARY
24 VDC REDUNDANT

Front Top Bottom Back

45.1 mm (1.78")

87 mm (3.43")

106.4 mm (4.2")

A. WIRING TERMINALS - RS-485 PORTS

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Primary 24 Vdc In (+)</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Primary 24 Vdc In (–)</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Primary 24 Vdc Out (+)</td>
<td>6</td>
</tr>
</tbody>
</table>

B. STATUS LEDs

<table>
<thead>
<tr>
<th>STATUS: 24 Vdc Primary</th>
<th>24 Vdc Redundant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off No power</td>
<td>Off No power</td>
</tr>
<tr>
<td>Green Power on</td>
<td>Green Power on</td>
</tr>
</tbody>
</table>

C. CAN/TERM

D. CAN/24 VDC
NGC-40-PTM Specifications

General
Approvals and Certifications
Supply voltage 24 Vdc, ± 10%
Internal power consumption 1 W per NGC-40-PTM
Output current 1.5 Amps @ 24 V
Ambient operating temperature –40ºC to 65ºC (–40ºF to 149ºF)
Ambient storage temperature –40ºC to 75ºC (–40ºF to 167ºF)
Environment PD2, CAT III
Max. altitude 2,000 m (6,562 ft)
Humidity 5 – 90% noncondensing
Mounting Din Rail – 35 mm

Electromagnetic Compatibility
Emissions Residential/Commercial (Class B) Environment

CAN Networking Port
Type 2-wire isolated CAN-based peer to peer network. Isolated to 300 V.
Connection Two 8-pin RJ-45 connectors (both may be used for Input or Output connections)
Topology Daisy chain
Length 10 m (33 ft) maximum
Quantity Up to 10 CAN nodes per PTM module

Connection terminals
Wiring terminals Cage clamp, 0.5 to 2.5 mm2 (24 to 12 AWG)
CAN networking and module power Two RJ-45s, one each IN and OUT. Provides CAN bus signals and 24 Vdc power.

Housing
Size 45.1 mm (1.78 in) wide x 87 mm (3.43 in) high x 106.4 mm (4.2 in) deep

System Power Supply Requirements
Output voltage 24 Vdc ±10%
Approval NRTL approved device for use in nonhazardous or hazardous locations as appropriate
Overcurrent protection Must have an automatic disconnect upon a single fault condition

<table>
<thead>
<tr>
<th>Number of modules per power supply</th>
<th>Min. steady-state current rating (A)</th>
<th>Min. inrush current rating (A)</th>
<th>Min. size wire (AWG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 5</td>
<td>0.550</td>
<td>0.550</td>
<td>18</td>
</tr>
<tr>
<td>6 – 10</td>
<td>1.050</td>
<td>1.050</td>
<td>18</td>
</tr>
<tr>
<td>11 – 20</td>
<td>2.050</td>
<td>2.050</td>
<td>18</td>
</tr>
</tbody>
</table>
3.5 TOUCH 1500 AND TOUCH 1500R TOUCH SCREENS

The Touch 1500 and Touch 1500R are panel mounted touch screen displays used in conjunction with DigiTrace NGC-40 and NGC-20 (Europe only) control and monitoring devices and are approved for nonhazardous indoor locations. The TOUCH 1500 is rated IP 65 (NEMA 4) and is intended to be mounted on the door of an NGC-40 panel containing NGC-40 modules. The Touch 1500R comes in an IP 65 (NEMA 4) wall-mounted enclosure and is intended to be mounted remotely from the NGC-40 panel containing the NGC-40 modules.
**General**

**Touch 1500 Approvals / Certifications**

**Touch 1500R Approvals and Certifications**

**Area of use**

- Nonhazardous, Indoors [IP65, TYPE 4]

<table>
<thead>
<tr>
<th>Supply Voltage Touch 1500</th>
<th>120-240 VAC ± 10% 50/60 Hz 96 VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage Touch 1500R</td>
<td>120-240 VAC ± 10% 50/60 Hz 96 VA</td>
</tr>
</tbody>
</table>

| Current rating | Steady state 1.8 A | Surge current 16 A |

**Operating temperature**

- 0°C to 50°C (32°F to 122°F) w/o space heater, -30°C to 50°C [-22°F to 122°F] using space heater and screen cover

**Storage temperature**

- -20°C to 60°C [-4°F to 140°F]

**Dimensions**

- 449.9 mm W X 315.6 mm H X 141.7 mm D
- (17.74 in. W X 12.44 in. H X 5.58 in. D)

**Alarm Outputs**

| Relay output | One Form C relay rated at 3 A @ 250 Vac. |

| LCD Display |

| Display | LCD is a 15-in XGA, color TFT transflective device with integral CCFL backlight |
| Touch Screen | 4-wire resistive touch screen interface for user entry |

**Network Connection**

<table>
<thead>
<tr>
<th>Local/Remote Port</th>
<th>* RS-232/RS-485 ports may be used to communicate with host computers DTS (DigiTrace Supervisor Software) or DCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local RS-232</td>
<td>A non-isolated, 9 pin D sub male</td>
</tr>
<tr>
<td>Remote RS-485</td>
<td>2-wire isolated, 9 pin D sub male</td>
</tr>
<tr>
<td>Data rate</td>
<td>9600 to 57600 baud</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>For RS-485 not to exceed 1200 m (4000 ft). Cable to be shielded twisted pair.</td>
</tr>
<tr>
<td>Field Port</td>
<td>RS-485, 2-wire isolated. Used to communicate with external devices, such as NGC-40-BRIDGE. Maximum cable length not to exceed 1200 m (4000 ft). Cable to be shielded twisted pair.</td>
</tr>
<tr>
<td>Signals</td>
<td>2-wire isolated, 9 pin D sub male</td>
</tr>
<tr>
<td>Data rate</td>
<td>To 9600 baud</td>
</tr>
<tr>
<td><strong>LAN</strong></td>
<td>10/100 Base-T Ethernet port with Link and Activity Status LEDs (X2)</td>
</tr>
<tr>
<td><strong>USB Ports</strong></td>
<td>USB 2.0 Host port Type A receptacle (X4)</td>
</tr>
</tbody>
</table>
Fig. 2.23  Touch 1500 Connection Diagram
Fig. 2.24 Touch 1500 Overview of Wiring
Alarm Light and optional Alarm Relay

RS-485 Field Port Com 3

RS-485 Remote Port Com 4

RS-485

100-240 Vac ±10%
Ø or N

G

Incoming Power Terminal Block

Fig. 2.25 Touch 1500R Overview of Wiring
3.6 TOUCH 1500-HAZ

The Touch 1500-HAZ is a panel mounted touch screen display and computer used in conjunction with DigiTrace NGC-40 and NGC-20 (Europe only) control and monitoring devices. The Touch 1500-HAZ display is rated NEMA 4X (IP65) and can be mounted indoors or outdoors in a hazardous location. For outdoor installation, a space heater will be required in the panel for low ambient conditions.
General
Touch 1500-HAZ
Approvals and Certifications
Hazardous Locations
Class 1, Division 2  Groups A, B, C, D
Area of use  Nonhazardous or hazardous locations, indoor or outdoor (Type 4X, IP66)
Supply Voltage - Touch 1500-HAZ-CPU:  10 – 36 Vdc
Supply Voltage - Touch 1500-HAZ-TS:  19 – 30 Vdc
Current rating - Touch 1500-HAZ-CPU:  2 A @ 24 Vdc
Current rating - Touch 1500-HAZ-TS:  2.62 A @ 24 Vdc
Operating temp (CE)* - Touch 1500-HAZ-CPU:  -20°C to 60°C (-4°F to 140°F)
Operating temp (CE)* - Touch 1500-HAZ-TS:  -20°C to 60°C (-4°F to 140°F)
Operating temp (UL)* - Touch 1500-HAZ-CPU:  -10°C to 60°C (14°F to 140°F)
Operating temp (UL)* - Touch 1500-HAZ-TS:  0°C to 50°C (32°F to 122°F)
Storage temperature -30°C to 80°C (–22°F to 176°F)
Dimensions (W x D x H)
  Touch 1500-HAZ-CPU:  85.5 mm x 139 mm x 152 mm (3.4 in x 5.5 in x 6 in)
  Touch 1500-HAZ-TS:  422 mm x 68 mm x 338 mm (16.61 in x 2.68 in x 13.31 in)
Alarm Outputs
Relay output  One Form C relay rated at 12 A @ 250 Vac.
  Relay is used as a common alarm.
Network Connection
Remote Port  RS-485 port may be used to communicate with host computers DTS (DigiTrace Supervisor Software) or DCS
RS-485  A non-insulated 9 pin D sub male
Data rate  To 9600 to 57000 baud
Maximum cable length  For RS-485 not to exceed 1200 m (4000 ft). Cable to be shielded twisted pair.
Field Port  RS-485, 2-wire isolated. Used to communicate with external devices, such as NGC-40-BRIDGE. Maximum cable length not to exceed 1200 m (4000 ft). Cable to be shielded twisted pair.
RS-485  A non-insulated 9 pin D sub male
Data rate  To 9600 baud
Maximum cable length  For RS-485 not to exceed 1200 m (4000 ft). Cable to be shielded twisted pair
LAN  10/100 Base-T Ethernet port with Link and Activity Status LEDs [X3]
USB Ports  USB 2.0 host ports [X4]
Alarm Outputs
Display  LCD is a 15-in XGA, color TFT transflective device with integral LED backlighting.
Touch Screen  5-wire resistive touch screen interface with enhanced ITO film for user entry.

*IMPORTANT: Temperature ratings are without space heaters
SECTION 4 – APPENDIX A

4.1 SOFTWARE LICENSE AGREEMENT

The NGC-40 family of Heat-Tracing Controllers contains software, including firmware, created by Pentair Thermal Management LLC. and its suppliers. Some of these products may contain open source software.

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4.1.1 SOFTWARE LICENSES

Schedule 1

Pentair Thermal Management

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