nrg600BT10 & nrg600BT20S

Power :: 600A load center with nrgSMART remote monitoring

Installation Guide

Amphenol
NETWORK SOLUTIONS™

Installation Guide, Part Number 147728-6 A0

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About

Amphenol Network Solutions is a global innovative original equipment manufacturer that serves the data and communications markets. We design, manufacture, and distribute products for customers who need an end to end solution for network connectivity, fiber, power distribution and rack management. We collaborate with our customers to deliver product solutions that exceed expectations with innovative designs and world class quality. Amphenol Network Solutions is the industry thought leader on network cable management.

Telect, Inc. has been a market leader in secondary DC power distribution for over 36 years. Through our acquisition by Amphenol and our merger with All Systems Broadband, to become Amphenol Network Solutions, we have continued to deliver reliable, high-quality solutions to power, protect, and monitor today's network servers and equipment. We are proud to be an Amphenol company that will continue to be Powered by Telect.

Technical Support

Email: support@amphenol-ns.com
Phone: 509.926.6000

About nrgSMART

The Amphenol Network Solutions nrgSMART™ family of products monitors your equipment at the circuit level.

nrgSMART comprises distributed network monitoring products from high- and low-current secondary panels to the 8,000A nrgBDFB.

nrgSMART provides monitoring at the individual circuit level, not at the feed level like most other monitoring panels on the market. Circuit-level monitoring enables powerful trend analysis and insights into equipment performance to identify issues before they become a problem.

Overview

The Amphenol Network Solutions nrg600BT10 600A dual-feed 10/10 circuit breaker load center features -48V operating voltage to fit in legacy and “next generation” network applications. The panel has advanced circuit-level monitoring features engineered into a compact 2RU footprint. Each of the 600A dual feeds contains 10 positions for bullet-style breakers. The nrg600BT20S is a single-feed version that supports 20 positions for bullet-style breakers.

The panel provides total front access to fuses and LED status. All terminals, inputs, outputs, ground and alarms are on the rear of the panel. The open frame design allows easy access while the clear cover provides added protection after installation is complete.

NOTE: Load straps are required for each position a breaker is installed. A fully loaded version is available; see ordering guide information at the end of this document.

Primary Benefits

- Individual circuit-level monitoring
- High accuracy, 100% passive monitoring, modular sensor modules
- Collect feed voltage, circuit current and temperature
- Network data collection:
    - Data is collected and sent to a customer’s enterprise management system via SNMP

Applications

- Central office
- Co-location sites
- Head ends, hubs and huts
- Data centers

Specifications

Inputs	
Voltage range, nominal voltage	-40V to -60V, nominal -48V VDC
Maximum input load rating	600A per feed
Short circuit withstand rating	5000A
Nominal power loss at full load	Less than 7W per side @ 28,000W full load (600A x -48V)
Percentage of full power dissipation at nominal voltage	Less than 1%
Input terminal studs (with nuts, flat washers and spring washers) for dual-hole compression lugs	• 3/8-16 studs on one-inch centers per terminal (max. lug width of 1.94-in. [49.2 mm] per pair) • Torque nut (using 9/16-in. or 15 mm wrench) to 150-in.lb (~17 N•m), max.
Input wire size	#1 AWG to 750 MCM
Outputs	
Max. output circuit breaker or fuse holder	Single-pole: 100A Double-pole: 175A
Max. output load – continuous	Single-pole: 80A Double-pole: 140A
Minimum short circuit interrupt rating	5000A
Max. total output load	550A per side
Output terminal studs (with KEPS nuts and washers) for dual-hole compression lugs	• 1/4-20 studs on 5/8-in. centers (max. lug width of 0.625-in. [15.8 mm] for a BATT terminal and 0.70-in. [17.7 mm] for a RTN terminal). • Torque bolts (using 7/16-in. or 12 mm wrench) to 50-in./lb (5.5 N•m), max.
Output wire size	• #10 AWG (min.) for a 25A single-pole interrupter to #2 AWG (max.) for a 100A single-pole interrupter • #2 AWG (min.) for double-pole interrupters from 100A to 175A • 2/0 AWG (min.) for triple-pole interrupter
Circuit breakers*	Carling, symmetrical alarm breakers**
*Amphenol Network Solutions suggests avoiding use of different types of circuit breakers in the same load center. Alarm contacts may vary among interrupter manufacturers and may incapacitate the alarm system **Circuit breakers for this load center are designed and manufactured by Airpax Corporation and Carling Industries to meet the Amphenol Network Solutions symmetrical pin specifications. Order circuit breakers only from Amphenol Network Solutions	
Grounding	
Earth GND terminal bolts (with washers) for dual-hole compression lug	• Two pairs of 1/4-20 threaded holes on 5/8-in. centers • Torque bolts (using 7/16-in. or 12 mm wrench) to 50-in./lb (5.5 N•m), max.
Input wire size	#2 AWG (min.) for any input interrupt device 400A or more
Alarm	
Alarm wire size	#30 to #16 AWG
Alarm terminals	Removable 6-pin connector with screw down terminal
Relay contact ratings	Dry Form-C contacts (1A @ 30 VDC; 0.5A @ 60 VDC; 0.3A @ 125 VAC)
Max. alarm power rating	@24V: 72mA (1.73W) @48V: 147mA (7.06W)
Voltage Sensor	
Sensor accuracy	0 to -19.99V: ±0.3V -20V to -60V: ±0.1V
Voltage measurement range	0 to -60VDC
Feed voltage detection	0 to -19.99V: ±0.3V -20V to -60V: ±0.1V
NOTE: • Voltage measurement may be slightly different than at input terminal blocks due to the voltage drop within the panel. • Sensors are factory calibrated and do not require user adjustment.	
Communication	
nrgNET sensor and alarm card power (via nrgNET cabling connection to an nrgCONTROL-BT controller)	-48 VDC nominal ***NOTE:*** The nrg600BT10 & nrg600BT20S chassis' MUST BE connected to an nrgCONTROL-BT controller via nrgNET cabling and LED Alarm Indicators to function
nrgNET data communication	RS-485
nrgNET connector	Removable 5-pin connector with screw down terminals
nrgNET connector functions	nrgNET IN from the nrgCONTROL or nrgSMART panel, nrgNET OUT to next in-line nrgSMART panel
LED Alarm Indicators (requires nrgNET & controller for power)	A/B bus power A/B fuse alarms nrgNET Comms active
Supported protocols	Proprietary nrgNET used to communicate between panels and controller
Fit and Finish	
Material	Cold-rolled steel
Color	Pewter grey powder coat
Mechanical	
Dimensions (L x W x H)	19"L x 15"W x 3.5"H (483 mm x 305 mm x 88 mm)
Rack space	2RU
Weight, without packaging and accessories	29.4 lbs. (13.3 kg)
Weight, shipping	33.8 lbs. (15.3 kg)
Environmental	
Operating temperature	-10°C (14°F) to 53°C (127°F)
Humidity	90% and non-condensing
Feed voltage detection	0 to -19.99V: Alarm -20V to -60V: Normal
Warranty	
Standard one-year warranty on all parts.	

1. Installation

1.1 Important Installation Guidelines

- **Elevated Operating Ambient Temperature:** If you install the rack in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Take care to install the equipment in an environment compatible with the maximum operating temperature.
- **Reduced Air Flow:** Maintain the amount of air flow required for safe operation when installing the equipment in a rack.
- **Mechanical Loading:** Ensure mechanical loading is even to prevent hazardous conditions.
- Circuit Overloading: Overloading circuits may affect your overcurrent protection and supply wiring. Use equipment nameplate ratings.
- **Reliable Earthing:** Maintain reliable earthing of rack-mounted equipment. Pay attention to supply connections other than direct connections to the branch circuit (e.g., use of power strips).
- **Disconnect Device:** Incorporate a readily accessible disconnect device in the building installation wiring.

1.2 Inspection

Please read and understand all instructions before installation. If you have questions, contact Amphenol Network Solutions Technical Support at support@amphenol-ns.com or call 509-926-6000.

When you receive the equipment, carefully unpack it and compare it to the packaging list. Please report any defective or missing parts to Amphenol Network Solutions Quality at quality@amphenol-ns.com or call 509-926-6000.

Amphenol Network Solutions is not liable for transit damage. If the product is damaged, please report it to the carrier and contact Amphenol Network Solutions Quality.

NOTE: The nrg600BT10 is suitable for installation as part of a Common Bonding Network (CBN) for installation in Network Telecommunication Facilities and OSP.

2. Mounting and Wiring

ALERT

ALERT! It is recommended this product is installed within a restricted access location where access is through the use of a tool, lock and key, or other means of security and is controlled by the authority responsible for the location. This product must be installed and maintained only by qualified technicians.

Verify all connections meet requirements specified in local electric codes or operating company guidelines before supplying power. Unit shall be protected by a listed circuit breaker or branch-rated fuse sufficient to interrupt power levels specified in the specifications.

2.1 Rack Mounting

- The nrg600BT10 panel can be mounted in a 19-inch EIA rack or 23-inch rack with optional bracket.
- Assign interrupter positions and install load straps for these positions (if necessary) before installing the load center in a rack.

1. Choose interrupter position for breakers.

   You may mix interrupter ratings and single- and multi-pole interrupters in the same load center.

   - Avoid mixing non-mid-trip and mid-trip breakers.
   - Do not use multiple, single-pole breakers with multi-pole load straps.

2. Record interrupter position(s) and amperage of each intended interrupter.

3. Remove bottom screw holding circuit breaker cover to selected interrupter position. See Fig. 1.

   a. Retain screw and cover
   b. Install interrupter into bullet terminals.
   c. Re-install cover and attach to interrupter using
      6-32 screws provided.

4. Locate an unused rack position and mount the load center using four fasteners per side for 19”, as shown in Fig. 2-1, and six fasteners for 23.”, as shown in Fig. 2-2.

   Mount the panel as high as possible on the rack, leaving adequate access space above the load center. Tighten screws to 35-in./lb (4.29 N•m).

   Amphenol Network Solutions recommends using a seismic rack for best rigidity.

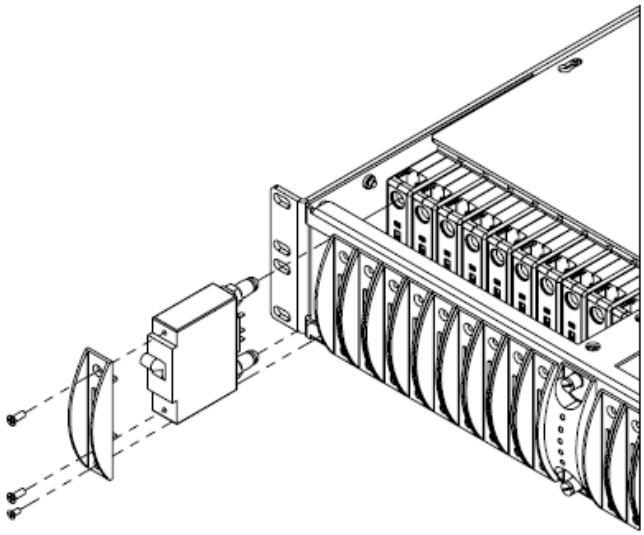


Fig. 1: Breaker mounting

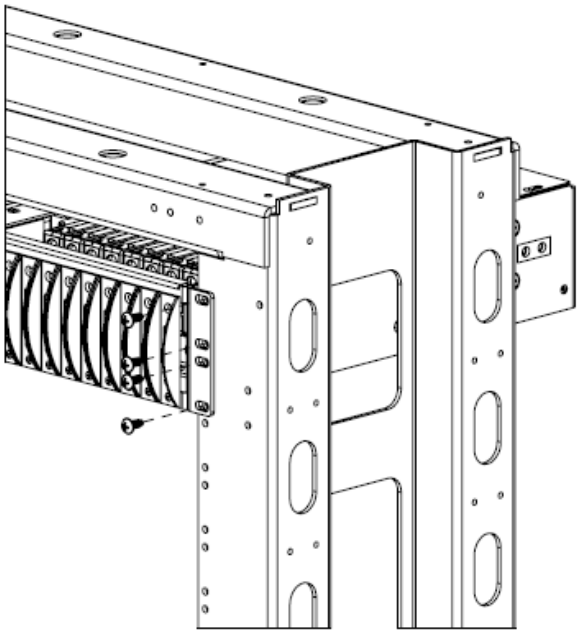


Fig. 2-1: 19” rack mounting

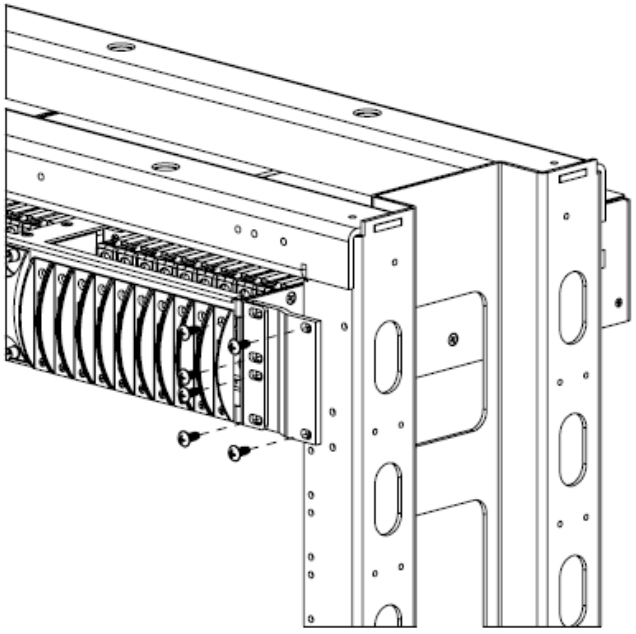


Fig. 2-2: 23” rack mounting
with optional adapter bracket

⚠ WARNING

WARNING! Failure to properly ground this equipment can create hazardous conditions to installation personnel and to the equipment.

ⓘ ALERT

ALERT! Only use components and crimping tools approved by agencies or certifying bodies recognized in your country or region such as Underwriter's Laboratories (UL), TUV, etc.

2.2 Grounding

1. Use an approved crimping tool to attach approved, dual-hole compression lug onto suitable grounding wire. (Size of ground depends on input interruption device.)

2. If required, lightly coat antioxidant on lug and grounding surface on side of panel. Connect the lug using ¼-20 bolts, flat washers and split washer provided, as shown in Fig. 3. Tighten bolt to 50-in./lb (5.5 N•m).

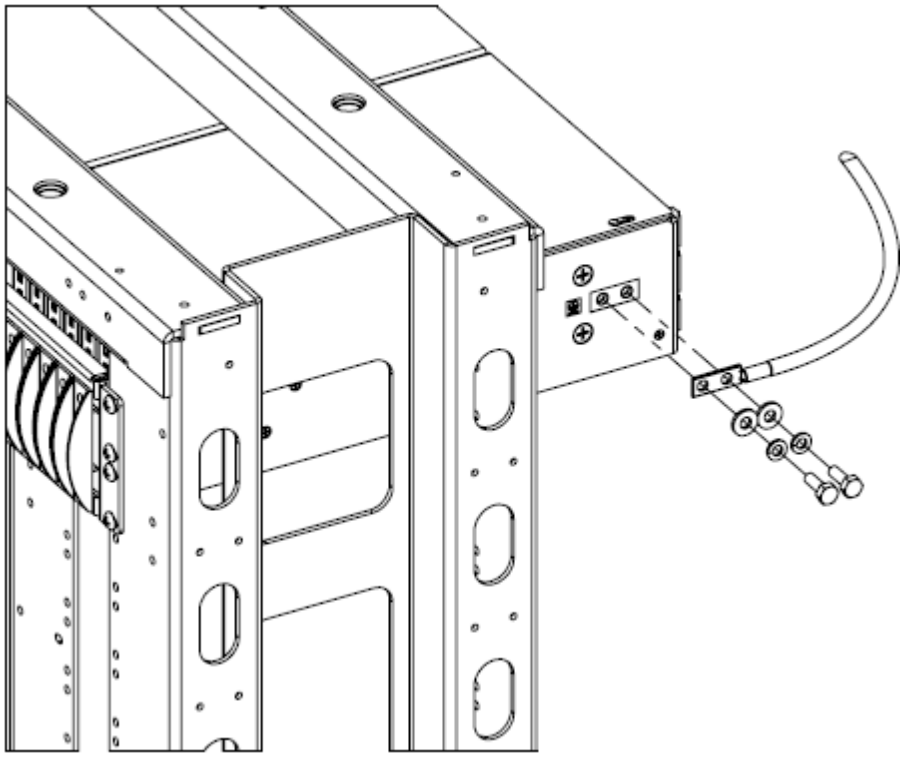
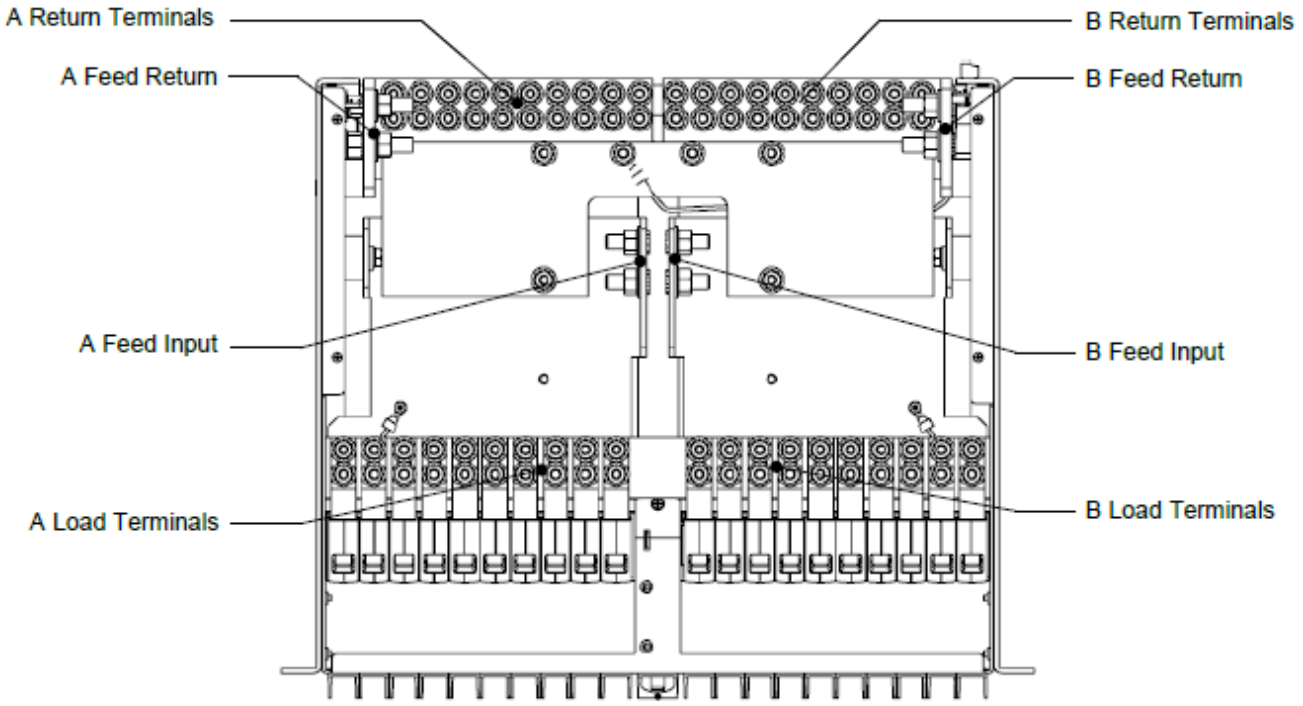


Fig. 3: Grounding

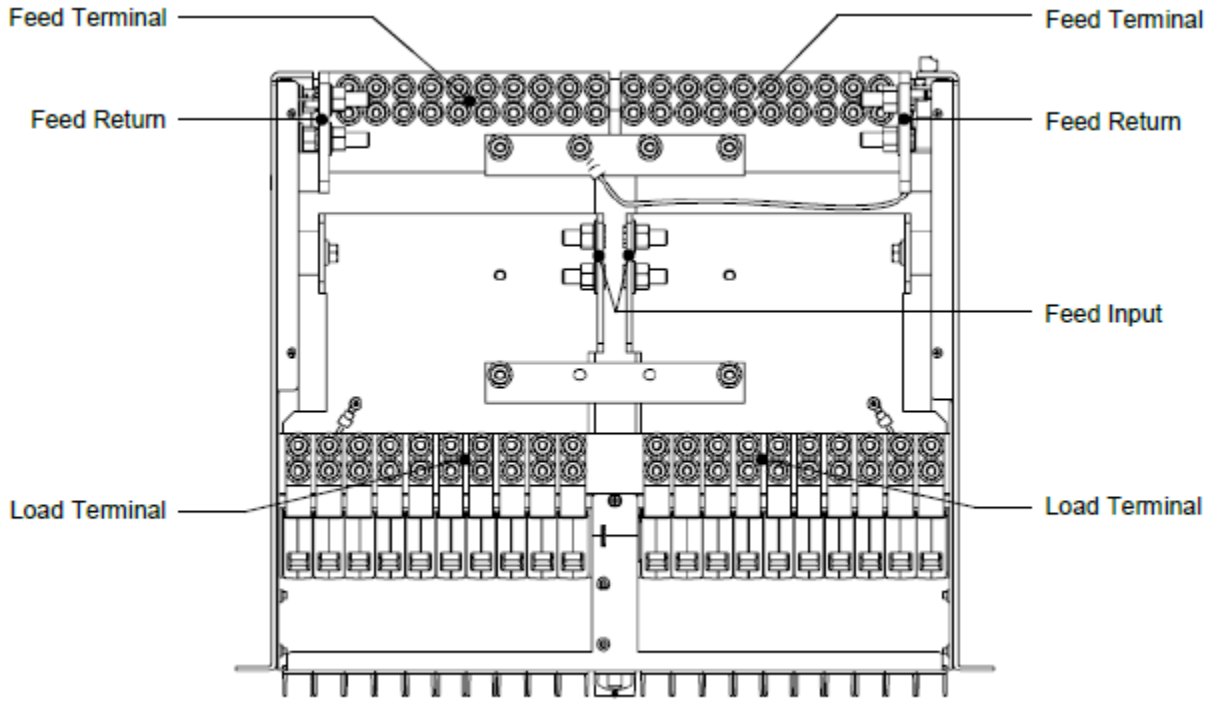
⚠ WARNING

WARNING! Before connecting input power cables, make sure the input power to the panel is turned off.

2.3 Wiring Diagram



nrg600BT10



nrg600BT20S

2.4 Input Wiring

1. For input wiring:
   a. Crimp dual-hole compression lugs onto #1 AWG to 750 MCM copper wires. The choice of input wiring depends on the following criteria:
      - Input interrupt device rating affects the size of input wiring.
      - Cable insulation temperature rating shall be 75° C minimum
2. Insulate lug barrels with UL 94V-0 rated heat-shrink tubing.
3. Clean terminals and lugs with nonabrasive, nonmetallic pad.
4. If required, lightly coat antioxidant on lugs and input BATT and RETURN terminals and then connect the lugs to input terminals on the back of the panel.
5. Tighten lugs to 150-in./lb. (~17 N•m), max.
6. Make sure all interrupter positions are either empty or off.

ALERT

ALERT! Only qualified service personnel should replace fuses. The installer must verify that a readily accessible protection device is incorporated in the building wiring feeding the panel: 750A (max.) protection device for a 600A panel.

ALERT! Only use components and crimping tools approved by agencies or certifying bodies recognized in your country or region such as Underwriter's Laboratories (UL), TUV, etc.

2.5 Output Wiring

1. For circuit breaker output wiring, crimp dual-hole lugs onto one end of #6 to #2 AWG copper output wires for single-pole outputs or #6 2/0 AWG for double-pole circuit breaker outputs, as required by NEC. Work with one output wire at a time.
2. Insulate lug barrels with UL 94V-0 rated heat-shrink tubing.
3. Clean panel terminals and lugs with nonabrasive, nonmetallic pad.
4. If required, lightly coat antioxidant on lugs and output BATT and RETURN terminals and then connect lugs to terminals. (NEC specifies only one lug and load at each output terminal.)
5. Tighten the nuts to 50-in./lb. (~5.5 N•m), max.
6. Lastly, enable equipment loads one at a time to verify the proper operation of loads.

2.5.1 Alarm – Dry Contact Alarm States (Fig. 4)

- Alarm card is not installed.

  → All contacts will be open.

- Alarm card is installed but no power present on nrgNET.

  → All contacts will go to the alarm state (**NC** and **C** will be open, **NO** and **C** will be closed).

- Alarm card is installed and powered

  → All contacts operate as indicated (**NC** and **C** will be closed if no alarm present).

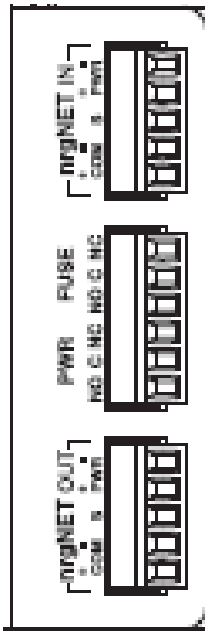


Fig. 4: Alarm wire wrap contacts

2.6 Boot loader Mode

The nrg600BT10 alarm card will receive remote firmware updates automatically from the nrgCONTROL-BT. The boot loader mode is indicated by a yellow **PWR A** LED. In this mode, the power and fuse LEDs are used for diagnostics and do not represent the power and fuse status. A blinking green **PWR B** LED in conjunction with the yellow **PWR A** LED indicates the firmware is actively being updated. The update process lasts approximately seven seconds.
See Fig. 5.

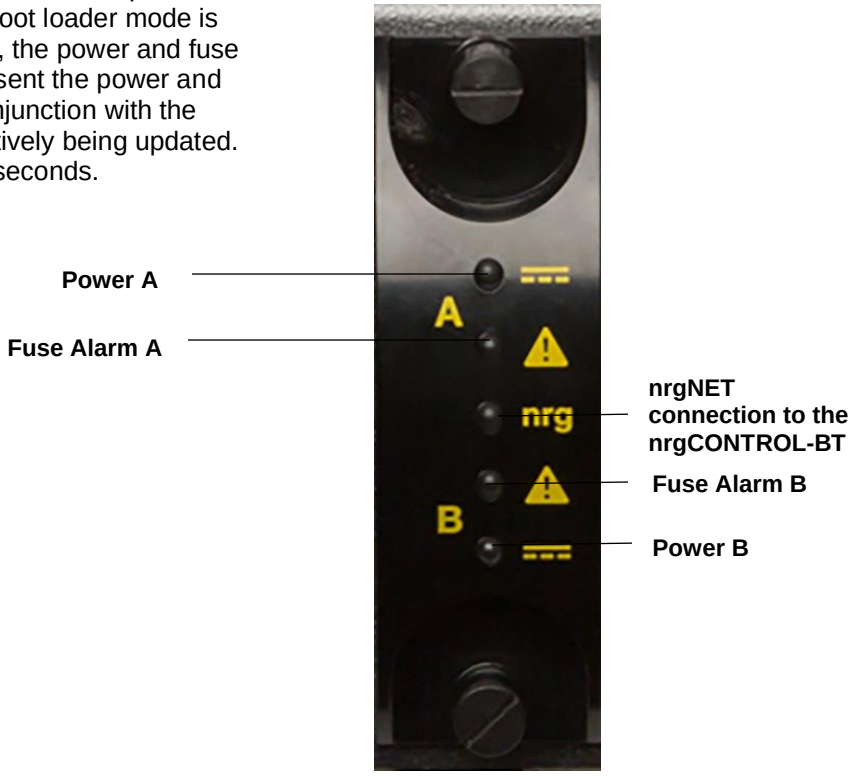


Fig. 5: nrg600BT10 alarm card indicators

Table 1: Alarm Card LED Status

LED State	PWR A/B	Fuse Alarm A/B	nrgNET Connection
Green	Operating normally	Operating normally	Active communication to nrgCONTROL-BT
Blinking green	PWR B, boot loader loading	N/A	Used for visual identification through controller command
Yellow	PWR A, boot loader mode	N/A	N/A
Red	PWR A or PWR B feed voltage alarm < -20 VDC	A feed or B feed fuse alarm	Connected to nrgCONTROL, but no communication to this specific panel within last three seconds
Red single blink	N/A	N/A	Defective panel. Contact Amphenol Network Solutions for replacement.
Red double blink	N/A	N/A	Invalid communication to nrgCONTROL. Check that COM+ and Com- did not get swapped.
No light	No power to feed	No alarm	No power on nrgNET IN connector

NOTE: The following steps require the nrg600BT10 is connected to an nrgCONTROL-BT controller via the nrgNET cable. The nrgCONTROL-BT provides power to the nrg600BT10's alarm card, which is required for the steps in this section.

1. Enable protection device (fuse or breaker) at primary PDU to turn on Feed A to side A of the panel and then check voltage and polarity at input connectors of the panel. Also, check:

    - **PWR A** LED on the front of the panel turns on (green).
    - **PWR B** LED is red.

2. With **PWR A** LED green (normal operation) – but with **PWR B** LED red – test power-fail relay and contacts at PWR alarm terminals on rear of panel:

    - Expect an open circuit (∞Ω) between Terminal **C** and **NC**.
    - Expect continuity (∞Ω) between Terminal **C** and **NO**.

3. Also, test fuse alarm relay contact at fuse (CB/Fuse Alarm) terminals on the rear of the panel:

    - Expect continuity (0Ω) between Terminal **C** and **NC**.
    - Expect an open circuit (∞Ω) between Terminal **C** and **NO**.

4. Repeat steps 1-3 in this section to power up side B. **PWR A** and **PWR B** LEDs must both be green.

5. With **PWR A** and **PWR B** lit green, test power-fail relay and contacts at PWR alarm terminal:

    - Expect continuity (0Ω) between Terminal **C** and **NC**.
    - Expect an open circuit (∞Ω) between Terminal **C** and **NO**.

2.7 Alarm Card

⚠ WARNING

WARNING! Take ESD mitigation precautions when handling the alarm card. The alarm card is ESD sensitive.

The nrg600BT10 alarm card can be replaced if necessary by unscrewing the two screws on the alarm card's front bezel. Gently remove the card by pulling straight out. The card can be removed with the nrgNET power still connected (hot swapping) to the panel. The replacement part number for the nrg600BT10-X and nrg600BT20S-X is the 306308. See Fig. 6.

Fig. 6: Alarm card

2.8 Temperature Probes

Two temperature probe ports are available on the back of the nrg600BT10 and nrg600BT20S. Each port can accept the optional nrgTEMP probes. See Figs. 7 and 8.

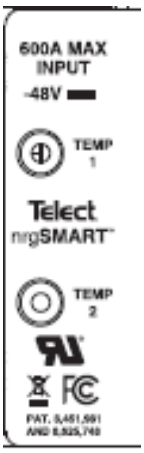
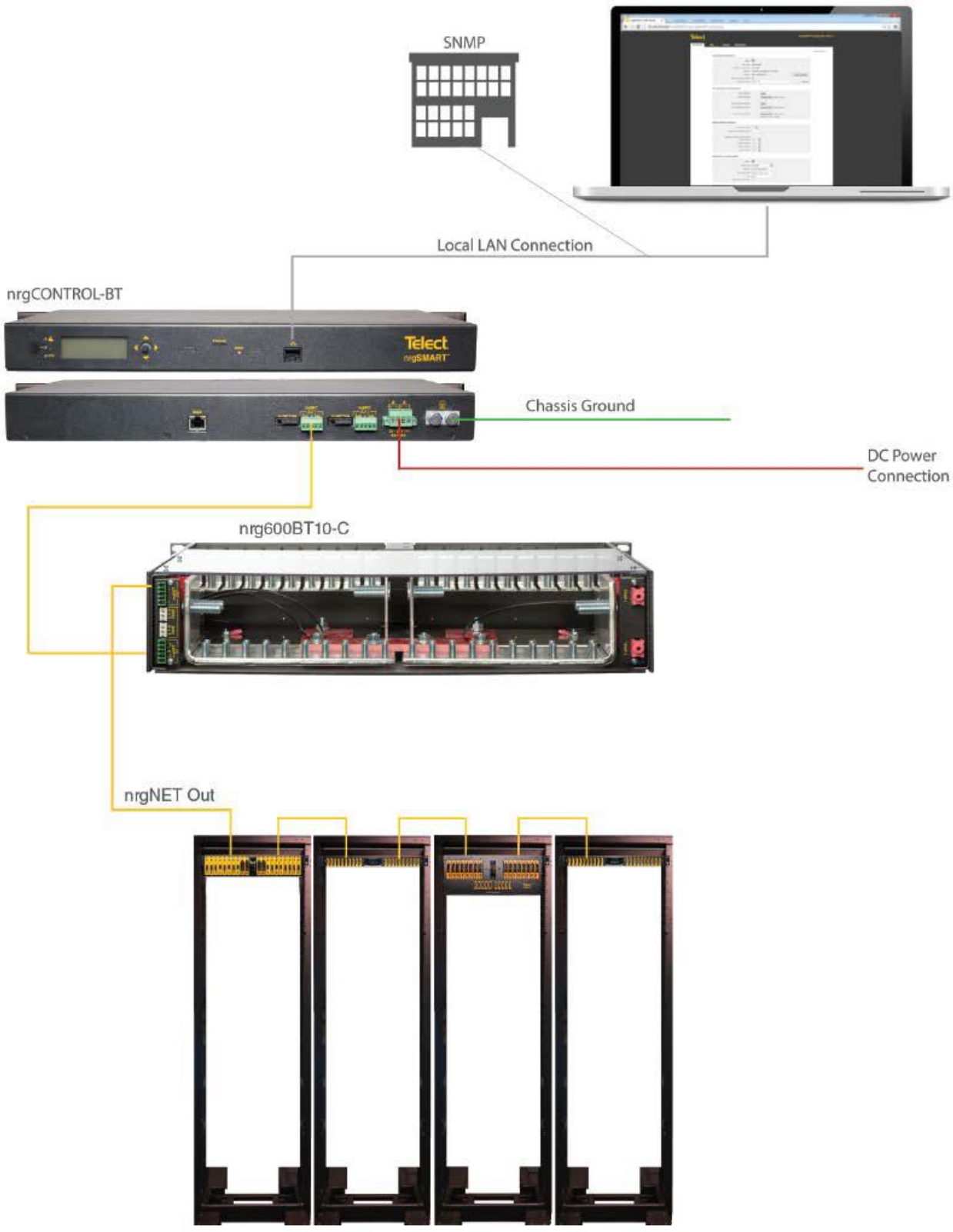


Fig. 7: Temperature probe inputs

Fig. 8: Optional nrgTEMP temperature probe

2.8 nrgNET Connectivity



2.10 nrgNET Pinouts

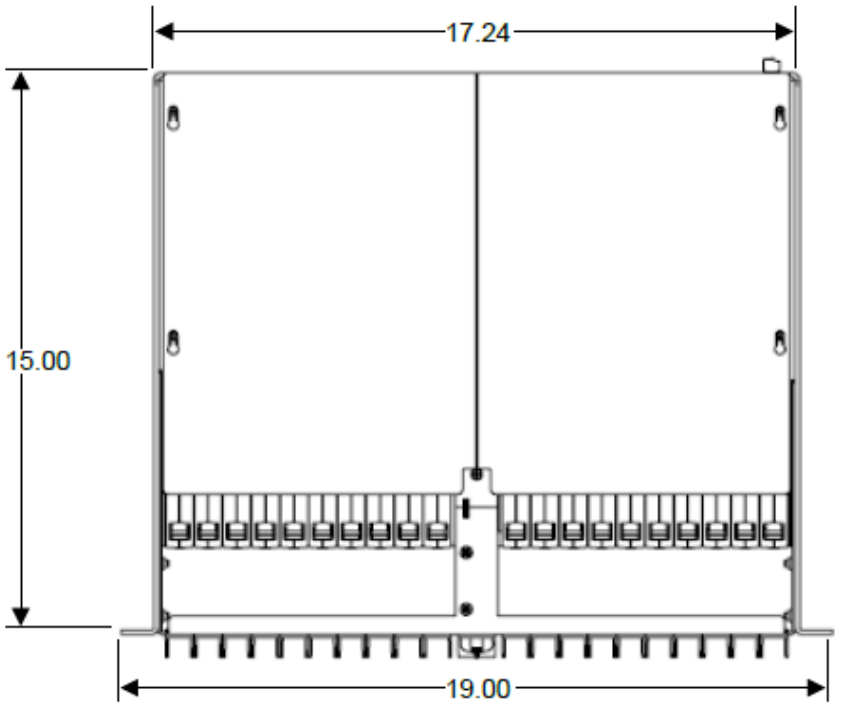
Table 2: nrgNET Pinouts

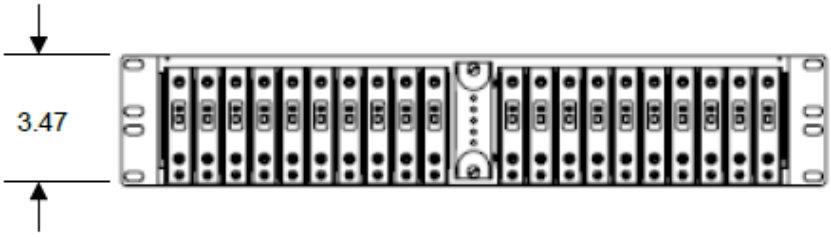
Pin Number	Label	Wire
Pin 1	COM +	White (22 AWG)
Pin 2	COM -	Blue (22 AWG)
Pin 3	S	Drain Wire (24 AWG)
Pin 4	PWR +	Black (18 AWG)
Pin 5	PWR -	Red (18 AWG)

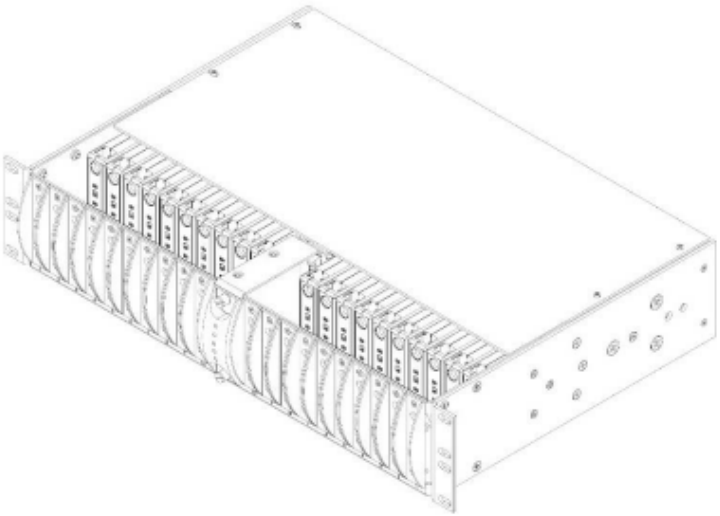
nrgCONTROL-BT

Fig. 9: nrgNET pinout connections

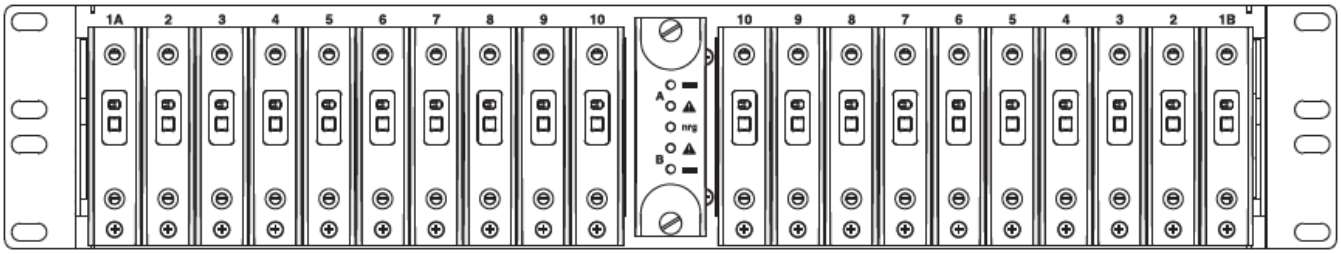
2.11 nrg600BT10 and nrg600BT20S Dimensional Drawings



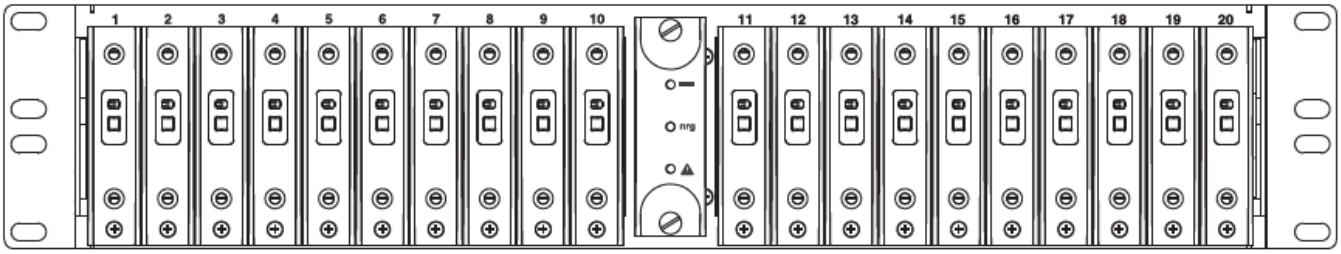




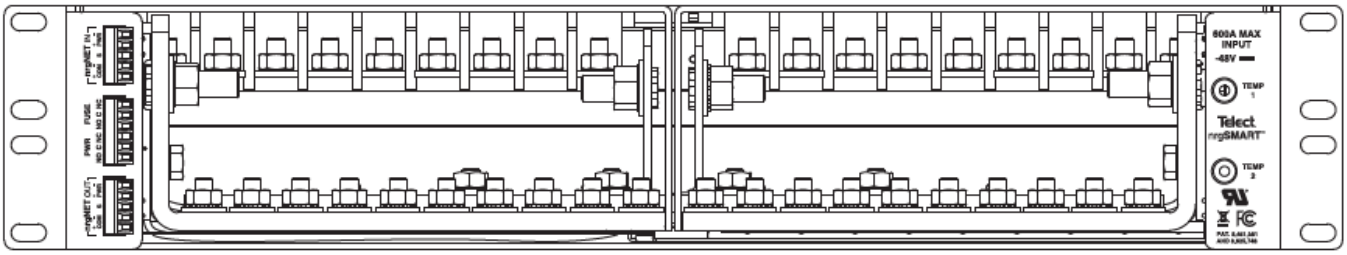
2.12 Markings



nrg600BT10 Front



nrg600BT20S Front



nrg600BT10 & nrg600BT20S Rear

3. Ordering Information

3.1 Related nrgSMART Products

Table 3: nrgCONTROL Products

Part Number	Description	Use
nrgCONTROL-BT	nrgSMART: CONTROLLER	nrgSMART Controller
143142	TERM BLOCK: RCPT, 1x4, 300V, 15A, 5.08 mm, MTG SCRW, 30-12 AWG, ROHS	Replacement power connector

Table 4: nrg600BT10

Part Number	Description	Use
nrg600BT10	nrgSMART: 600A, BULLET TERMINAL, DUAL-FEED 10/10, -48V, UN-POPULATED, NO LOAD STRAPS	
nrg600BT10-C	nrgSMART: 600A, BULLET TERMINAL, DUAL-FEED 10/10, -48V, WITH nrgBT/SINGLE POLE LOAD STRAPS	
nrg600BT20S	nrgSMART: 600A, BULLET TERMINAL, SINGLE-FEED 20, -48V, UN-POPULATED, NO LOAD STRAPS	
nrg600BT20S-C	nrgSMART: 600A, BULLET TERMINAL, SINGLE-FEED 20, -48V, WITH nrgBT/SINGLE POLE LOAD STRAPS	
nrg600BT1X-1PK	nrgSMART: LOAD STRAP KIT, 1 POLE, 1/4-20, 5/8 SPACING	Single-pole load strap
nrg600BT1X-2PK	nrgSMART: LOAD STRAP KIT, 2 POLE, 1/4-20, 5/8 SPACING	Double-pole load strap
306308	nrgSMART: AUX CARD, CIRCUIT BREAKER	Replacement card
nrgSMART Circuit Modules		
BT	nrgSMART: MOD, BT, PASS THROUGH, -48V	
nrgBT	nrgSMART: MOD, BT, CURRENT SENSOR, -48V	
System Level Components		
nrgNET-500	nrgSMART: ACC, nrgNET CABLE, SPOOL, 500FT	500-foot spool of cable
nrgNET-10	nrgSMART: ACC, nrgNET CABLE, UN-TERMINATED, 10FT	10-foot length of cable, untermindated
nrgBT-HEX	nrgSMART: ACC, BT, HEX WRENCH	
nrgTEMP	nrgSMART: ACC, TEMP SENSOR, 6FT	
141431	TERM BLOCK: RCPT, 1X5, 160V, 8A, 3.81 mm, 30-16 AWG, ROHS	NrgNET termination connector
02117-02+B7	ADPTR 1.75 RK to 1.75 PNL (2 SPC) – Includes 2 brackets	19” to 23” rack adapter kit

3.2 Accessories and Alarm Card

⚠ WARNING

WARNING! Use only UL-listed fuses or UL-recognized component secondary protection devices.

The following table describes the available input lugs for stranded copper conductors with straight dual-hole lugs for 3/8-in. studs on one-in. centers.

Table 5: Input Lugs

Source	#1/0 AWG	#2/0 AWG	#3/0 AWG	400MCM AWG	500MCM AWG	750MCM AWG
T & B	54209	54210	54211	54216	54218	
Panduit	LCD1/0-38D-X	LCD2/0-38D-X	LCD3/0-38D-X	LCD400-38D-6	LCD500-38D-6	LCD750-38D-6
Burndy				YA322TC38	YA342TC38	YA392NT38

The following table describes the available ground lugs for stranded copper conductors with 90° dual-hole lugs for 1/4-20 bolts on 5/8-in. centers.

Table 6: Ground Lugs

Source	#2 AWG	#4 AWG	#6 AWG	#8 AWG
T & B	54207	54206	54205	
Panduit	LCDN2-14A-Q	LCD4-14A-L	LCD6-14A-L	LCD8-14A-L
Burndy	YA2CL2NT14	YA4CL2TC14	YA6CL2TC14	YA8C2TC14

3.3 Circuit Breakers

Table 7: Single-Pole Breakers (Symmetric Alarm Pins)

Item	Amperage	Part Number
Single-Pole	5A	147604
	10A	147605
	15A	147606
	20A	147607
	25A	147608
	30A	147609
	40A	147610
	50A	147611
	60A	147612
	70A	147613
	80A	147614
	90A	147615
	100A	147616

Table 8: Double-Pole Breakers (Symmetric Alarm Pins)

Item	Amperage	Part Number
Double-Pole	125A	148038
	150A	148039
	175A	148040

4. Notices

4.1 FCC Class A Notice

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. **This device may not cause harmful interference**
2. **This device must accept any interference received, including interference that may cause undesired operation.**

NOTE: This equipment has been tested and found to comply with limits for Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide a 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 his own expense.

Modification

Any modifications made to this device that are not approved by Amphenol Network Solutions may void the authority granted to the user by the FCC to operate this equipment.

4.2 ICES-003 Class A Notice – Avis NMB-003, Classe A

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS! When handling any electronic component or assembly you must observe the following antistatic precautions to prevent damage. Always disconnect power from the server and wear a grounded wrist strap when working around the nrgCONTROL-BT. Always wear a grounded wrist strap when handling printed circuit boards. Treat all assemblies, components and interface connections as static-sensitive.