LINEAGE POWER

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NX400 -48V Power System

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Notice:
The information, specifications, and procedures in this manual are subject to change without notice. Lineage Power assumes no responsibility for any errors that may appear in this document.

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1 Introduction

NX400 -48 Volt Power System

Overview

The NX400 is a 530A -48V power system combining low profile switch mode rectifiers, a microprocessor-based system controller with integrated network capability and battery management features, battery input connections, and modular dc distribution in a 10U tall configuration. The assembly can be flush-front mounted in a 19-inch equipment cabinet, or mid-mounted in a 19-inch or 23-inch open framework.

Key Features

Sixteen rectifier slots for CP1800 33A rectifiers

Thirty two output distribution circuit breaker positions

- 3-bus system with independent load disconnects
- Primary/Secondary/Critical busses
- Load disconnects operated by low voltage, low voltage and/or time delay, remote command, or external control signal
- Twenty 50A circuit breakers included

Controller

- Front access LCD with control pad and password access
- Rear Ethernet LAN connection for Network remote monitoring (SNMP)
- Front Ethernet port for Craft interface
  - Compatible with standard browsers (MS Explorer)
  - Utilizes Dynamic Host Configuration Protocol (DHCP) – IP address assignment
- Event history log
- Rectifier Group Standby/ Hold-off mapping (generator load minimization)
- Customer specific factory defaults
- Single command return to defaults

Battery Management

- Battery disconnect operated by voltage threshold, voltage threshold and/or time, remote command, or Emergency Power Off (EPO) signal
- Battery recharge current limit
- Connections for up to five strings of batteries
- Battery disconnect breaker per string (alarm on disconnect)
- 1-Wire monitoring
  - Mid-string voltage monitoring
  - Battery temperature monitoring

Figure 1-1: NX400 Power System

NX400 Frame-Mounted System

The standard NX400 system is configured in a 23-inch framework with four battery trays. Each battery tray includes a 200A battery disconnect breaker, QS873 thermal probe for battery management, and 2/0 cables pre-wired to the NX400 battery bus. Battery trays 1 and 3 also contain the ES771 Mid-string voltage modules.

Each battery tray is sized to mount Power Battery CSL12100 or East Penn 12AVR100-3ET batteries. Battery disconnects are mounted internally to the battery tray for these sized batteries as shown below. C&D TEL12-105F or Battery Corp BC-12V110FT batteries may also be used by moving the disconnect switch outside the battery tray.

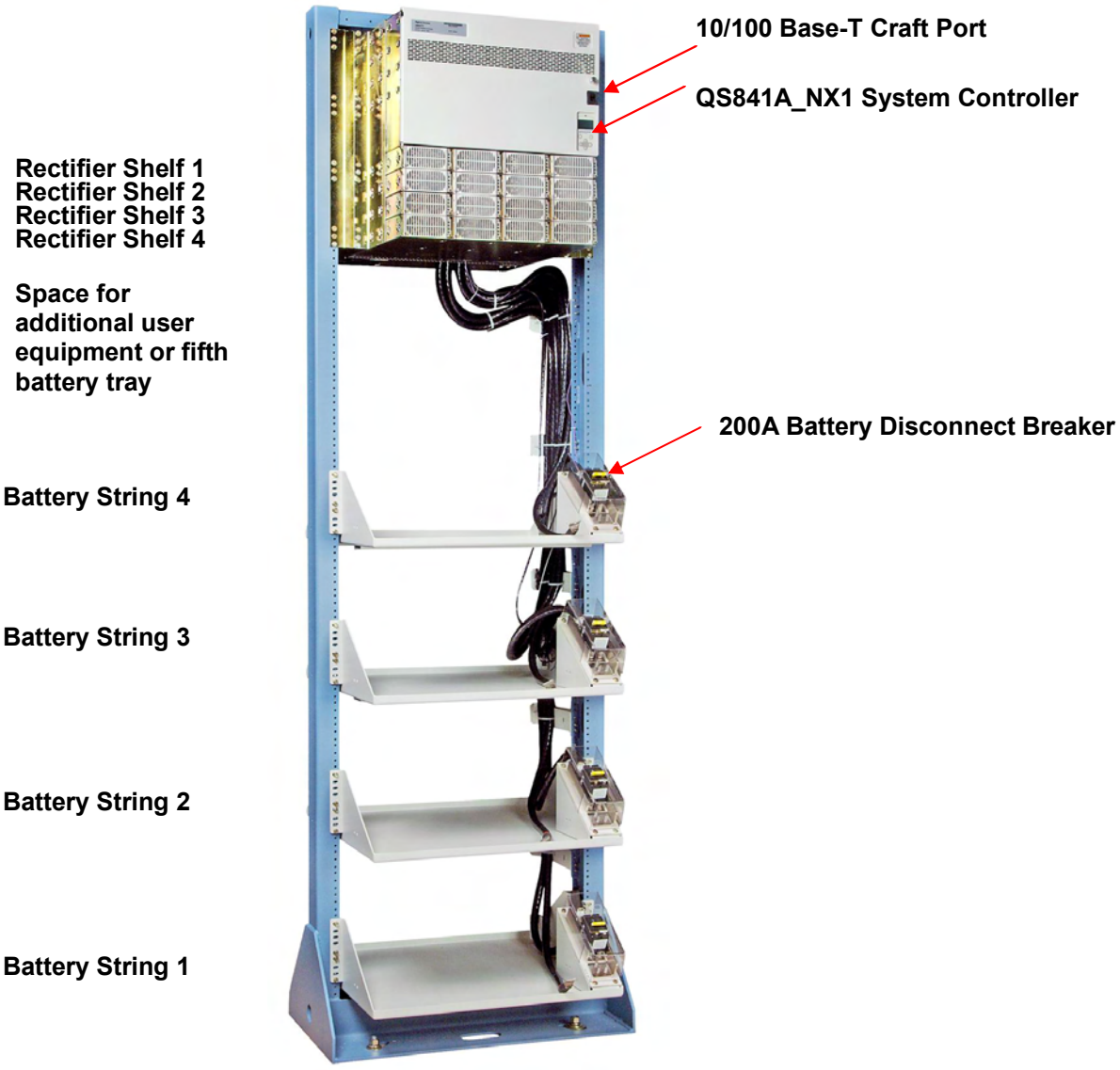


Figure 1-2: NX400 Frame-Mounted Power System

Customer Service Contacts

Customer Service, Technical Support, Product Repair and Return, and Warranty Service

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-THE-1PWR (1-800-843-1797). This number is staffed from 7:00 am to 5:00 pm Central Time (zone 6), Monday through Friday, on normal business days. At other times this number is still available, but for emergencies only. Services provided through this contact include initiating the spare parts procurement process, ordering documents, product warranty administration, and providing other product and service information.

For other customers worldwide the 800 number may be accessed after first dialing the AT&T Direct country code for the country where the call is originating, or you may contact your local field support center or your sales representative to discuss your specific needs.

Customer Training

Lineage Power offers customer training on many Power Systems products. For information call 1-972-284-2163. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

Downloads and Software

To download the latest product information, product software and software upgrades, visit our web site at http://www.lineagepower.com/

2 Product Description

NX400 System Overview

Introduction

The NX400 System rectifiers accept alternating current (ac) power and rectify it to produce direct current (dc) power for powering external equipment (loads). Batteries are used to provide backup dc power when ac is lost. They are connected in parallel with the rectifiers through appropriate breakers and a contactor disconnect that is controlled through by the controller and remote distribution control module. AC power is distributed to each rectifier through ac terminal blocks on the back of the NX400. The rectifiers convert the ac power to a regulated dc -48V nominal voltage distributed to float the batteries, power system controller and LVD boards, and power the loads through distribution circuit breakers.

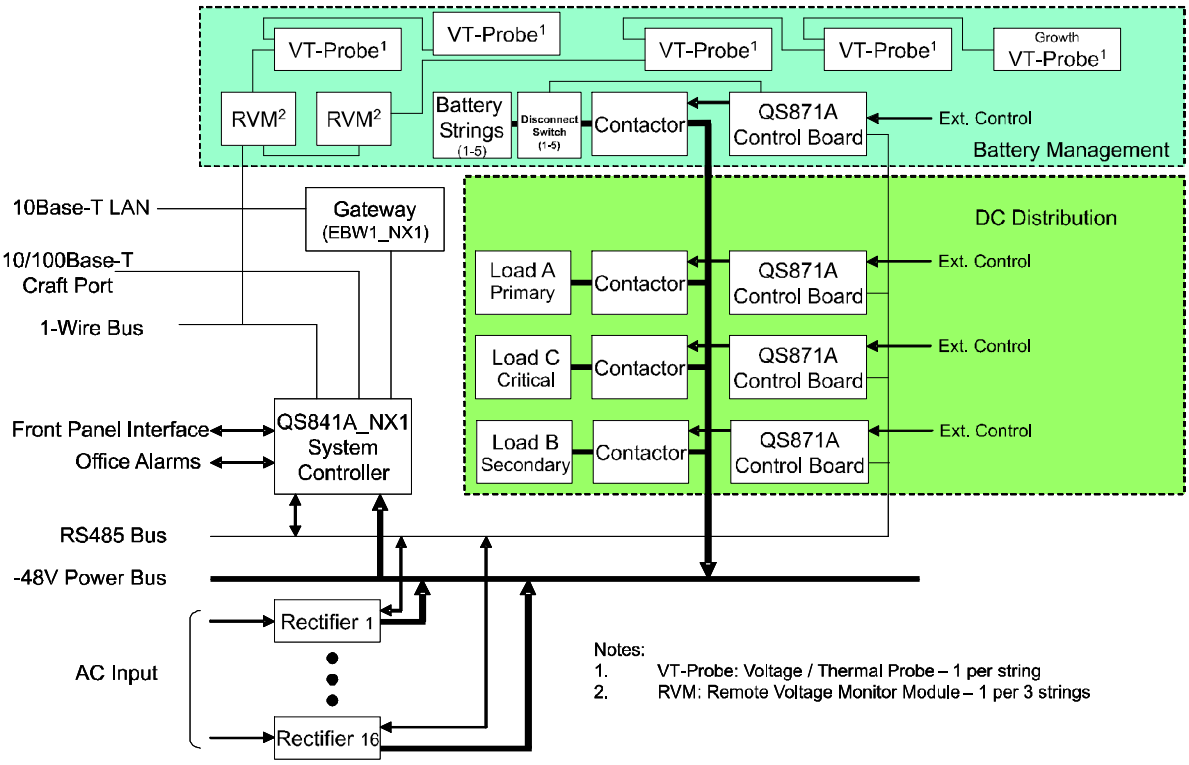


Figure 2-1: NX400 System Block Diagram

System Controller

The NX400 system is equipped with a QS841A_NX1 controller. The QS841A_NX1 is a standard QS841A with custom configuration defaults for the NX400. This controller provides system monitoring and control features as well as office system alarm outputs for rectifiers, LVD boards, and remote module conditions. It has integrated 10/100 Base-T connection which is used for the local craft port and provides a serial connection that is utilized by the EBW network interface card to provide a LAN connection at the rear of the system for an SNMP management system. The controller may be locally accessed using the intuitive front panel that is comprised of navigation buttons and a four-line LCD graphics display. The display's backlight changes with the power system's alarm status; green for normal, red for major alarms and amber for minor alarms. User-definable alarm inputs and alarm relays are accessed on a 32-position terminal block on the back of the system. The controller and its peripherals monitor for open protectors, current from battery and load shunts, and monitors and controls the low voltage disconnect contactors via the QS871 Control Board over a RS-485 communication bus.

The controller also performs various battery management functions to ensure peak performance and protection from thermal issues. Battery string voltage and temperature are monitored with QS873 Voltage/Thermal Probes (VT-Probes) and ES771 Remote Voltage Monitor (RVM) modules for slope thermal compensation and battery string-voltage imbalance detection. The VT-Probes connect in a daisy-chain fashion with one probe mounted to the negative post of each mid-string battery. The RVM and VT-Probe communicate with the controller using the serial 1-Wire® bus from Maxim Integrated Products, Inc.

A PC with a standard web browser can be used to access the NX400 System through a local 10/100Base-T craft port utilizing a RJ-45 connection located on the front of the system. The system may also be accessed remotely through the SNMP LAN that also utilizes a standard RJ-45 connection located at the rear of the unit.

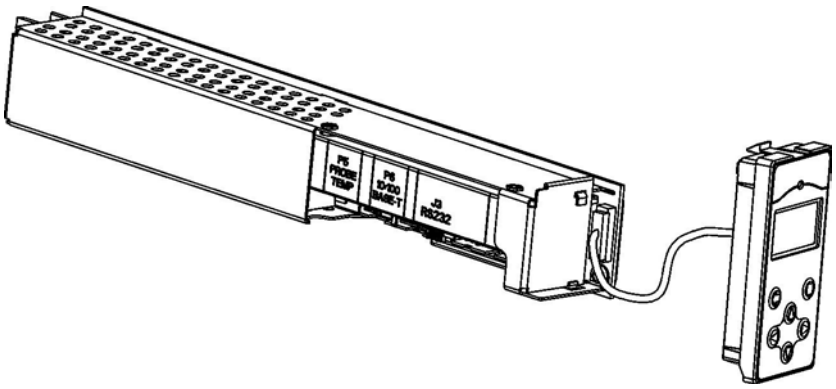


Figure 2-2: QS841A_NX1 NX400 System Controller And Display

Rectifiers

The CP1800 constant power rectifier features automatic load-share circuits that force all rectifiers to apportion the plant load equally, reducing the stress on individual units. These power units are self-protected so that short circuits and system overloads are handled automatically; i.e., if a short circuit is removed or a system overload reduced, the power units will automatically resume normal operation. See Section 6 for detailed feature descriptions.

Figure 2-3: CP1800 Rectifier

Currently Available Rectifiers			
Output Volts	**Output Amps**	**VAC Input**	**Apparatus**
-54.5V	22A 33A	100/120 VAC 200/208/240 VAC	CP1800

AC Input

AC Termination to NX400

An ac termination box equipped with terminal blocks is located at the rear of the system. Three knockouts are provided for ¾", 1", and 1-1/4-inch conduits. See Table 4B and Figures 4-8 for AC input wiring options.

DC Distribution

The output distribution is where load equipment is connected to the system. Twenty 50A circuit breakers are shipped with each system. However, other sizes are available.

NX400 has appropriate configuration parameters for three independently controlled Low Voltage Load Disconnects (LVLDs). All loads are connected to LVLDs. Non-critical loads and loads sensitive to low voltages may be disconnected at a user-defined set threshold during a battery discharge. This reduces drain on the batteries and extends reserve time available for critical loads. Disconnects are controlled by voltage thresholds, voltage and time thresholds, or an external input. The system controller monitors the shunts, circuit breakers and LVD contactors via the QS871 control board.

NX400

The NX400 DC Distribution is equipped with 32 distribution positions, 16 per row. Each row has a dual-bus functionality in which the top row is configured for LVD-A Primary Loads, the bottom row is configured for LVD-B Secondary Loads, and a Bus Adapter can be used on either row to connect loads to the LVD-C Critical Loads bus. The system is factory equipped with 12 loads on LVD-A Primary Bus, 12 loads on LVD-B Secondary Bus, and 8 loads on LVD-C Critical Bus. These bus configurations may be field modified as needed.

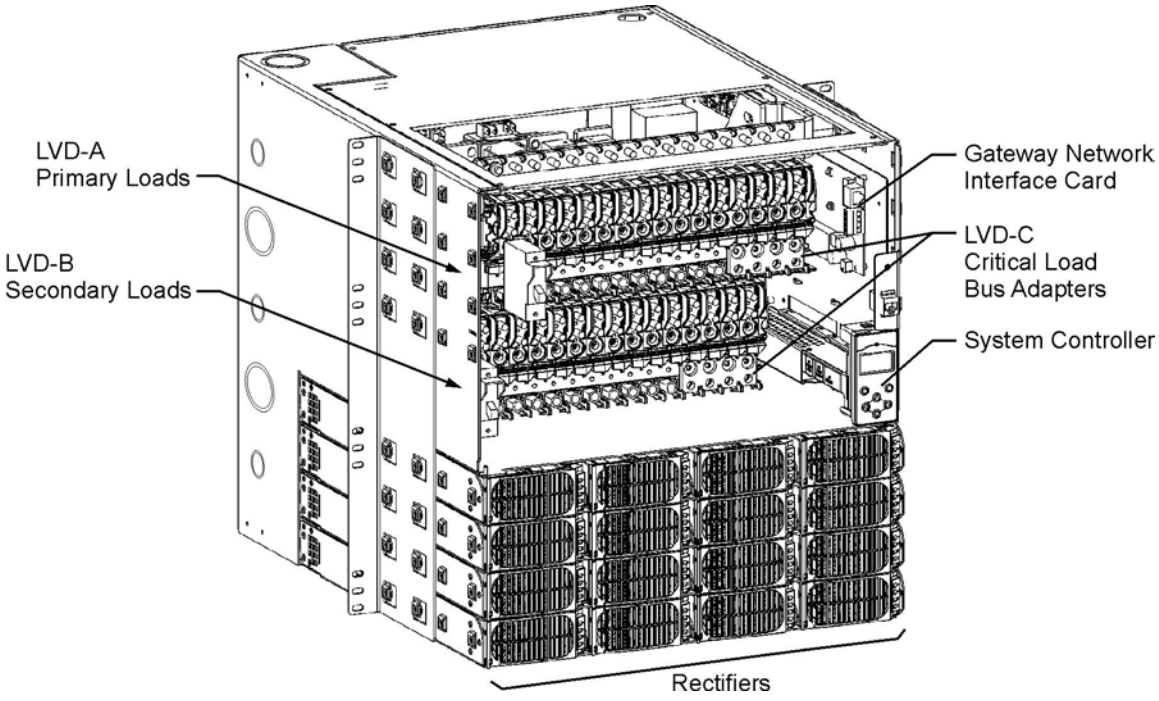


Figure 2-4: NX400 DC Distribution

Battery Reserve System

A Low Voltage Battery Disconnect (LVBD) contactor is used to connect the battery strings to the main power bus. Under ac fail conditions, the battery current will be flowing through the contactor to the output distribution to support the system load. To prevent deep discharge of batteries, the NX400 is configured to disconnect the batteries from the load by opening the LVBD contactor.

The frame mounted system includes four battery trays. Each battery tray includes a 200A battery disconnect breaker. The disconnect breaker allows battery strings to be taken off-line for maintenance or replacement.

The QS841A_NX1 system controller has the capability of storing up to twenty specific battery models. It has been factory pre-configured with the specific battery models shown below. The battery model, its respective eight hour Amp-Hour rating, and general battery classification are permanently stored in the controller.

The factory default battery model set in the QS841A_NX1 is the CSL-12100 Valve-Regulated Lead-Acid (VRLA). Following are the specific battery models stored in the controller.

- BC-12V110FT 105AH (VRLA)
- CSL-12100 100AH (VRLA)
- CSL-12170 170AH (VRLA)
- SLF-12105 91AH (VRLA)
- TEL12-105F 100AH (VRLA)
- SE48S63 63AH (Li-LMP)
- SE48S80 80AH (Li-LMP)
- L48V60FTX 60AH (Li-ELiTE)

Specific battery models are associated in the controller to one of the following technologies:

- Valve-Regulated Lead Acid (Valve-Reg)
- Flooded Lead Acid (Flooded)
- Lithium Metal Polymer (Li-LMP)
- Lithium ELiTE (Li-ELiTE)
- Nickel-Cadmium (Ni-Cd)

A battery technology can be selected through the front panel or craft port as the battery model if the system contains a battery that is not listed in one of the preset battery models. Once a generic battery type is selected, the controller will apply the appropriate pre-configured defaults for that specific technology. Each battery technology has a set of standard controller operation and threshold factory defaults. A specific battery model has the same default settings as its respective battery technology. These defaults, as well as those for the individual battery models, have been pre-configured but can be individually modified in the field. A user can also configure a new battery type using the craft port. See Appendix B for detailed descriptions of battery related functions; float and boost charging, thermal compensation, and system battery test functions.

Specifications

Table 2-A: NX400 Battery Plant Electrical Specifications

AC Input	
Input Voltage Ranges	150-275 VAC (High Line operation) shuts down below 150 VAC 85 to 140 VAC (Low line operation)
Input Distribution	Individual or Dual AC rectifier feeds (See Table 4-B)
Wire Size	8/10/12 AWG options available (See Table 4-B)
Lug Termination to M4 screws	406338145 (WP91412 L93) 10/12 AWG 405347402 (WP91412 L1) 8 AWG
System Output	
System Voltage	-48V
Maximum Number Of Power Units	16
Maximum Output Currents (54.5 VDC Output)	530A @ 208/240 VAC 368A @ 120 VAC
Maximum Recharge Current	Installed shelf -48V rectifier capacity minus plant -48V load
Boost Voltage	48 to 58 VDC
Load Share Accuracy	10%
Low-Voltage Disconnect	39 to 50 VDC – user programmable
Low-Voltage Reconnect	39 to 55 VDC – user programmable
Safety / Standards Compliance	
Safety Agency Approvals	Underwriters Laboratories (UL) Listed per Subject Letter 1801: Power Distribution Center for Communications Equipment, and cUL Certified (CSA 22.2 950): Safety of Information Technology Equipment
	Rectifiers are individually UL Recognized (UL1950), cUL Certified (CSA 22.2 234) or evaluated to EN60950 by an EC Notified Body, as appropriate.
European Economic Community (EEC) Directives	EMC Directive 89/336/EEC, Low Voltage Directive 73/23/EEC as amended by Marking Directive 93/68/EEC
Radiated and Conducted Emissions	FCC Part 15, Class A EN55022 (CISPR22), Class A
Harmonics	EN61000-3-2 (IEC61000-3-2)
Voltage Fluctuations	EN61000-3-3 (IEC61000-3-3)
Electromagnetic Immunity	Meets Telcordia GR-1089-CORE
Electrostatic Discharge	EN61000-4-2 Level 3
RF Immunity	IEC61000-4-3 Level 3, 10 V/m
EFT	IEC61000-4-4 Level 3, No Error; Level 4, No Damage
Surge	IEC 61000-4-5 Level 3, No Error; Level 4, No Damage
Conducted Immunity	IEC 61000-4-6 Level 3, 10V
Voltage Dips, Interruptions, and Variations	IEC 61000-4-11, EN55024 (CISPR24)

Installation Category

NX400 is suitable for connection to ac utility systems where the expected level of lightning surges complies with ANSI C62.41 Category B or IEC 60664-1 Overvoltage Category II.

A service entrance surge protector is required in applications where the installation categories can not be classified as being compliant to either ANSI C62.41 Category B or IEC 60664-1 Overvoltage Category II.

NX400 rectifiers have been tested for repeated lightning surges typically found in an Overvoltage Category III installation; however, a service entrance surge protector is recommended in cabinet applications to bring the power feeds in compliance to the installation categories above. The service entrance protection should be coordinated with the protection provided in the power modules.

The power module provides common-mode protection via a 320V MOV in series with a 2500V gas-discharge device and differential-mode protection via a 320V MOV in series with a 3.5A fuse.

Environmental

Table 2-B: NX400 Battery System Environmental Specifications

Operating Ambient Temperature	-40 to 149 °F, see Note 1 -40 to 65 °C, see Note 1
Storage Temperature	-40 to 185 °F -40 to 85 °C
Relative Humidity	0% to 95% non-condensing
Altitude	-200 to 13,000 feet (-61 to 3962 meters) See Note 2
Audible Noise	< 60 dBA
Earthquake Rating	Zone 4, upper floors , see Note 3

Note 1: CP1800 rectifiers operate at full power to 55C, derated above 55C by 3%/C up to 65C.

Note 2: For altitudes above 5000 feet, derate the temperature by 3.6 °F per 1000 feet. For altitudes above 1524 meters, derate the temperature by 0.656 degrees Celsius per 100 meters.

Note 3: Standard system complies with Zone 2 requirements. Zone 4 requires either overhead bracing to framework or an external bracing kit.

Rectifiers

Table 2-C: CP1800 Rectifier Specifications

Nominal Output Voltage	48/52/54.5 VDC
Operating Output Voltage Ranges	44 to 58 VDC
Boost Voltage	48 to 58 VDC
Output Current (54.5 VDC Output)	0 to 33A @ 208/240 VAC; 0 to 23A @ 120 VAC
Nominal Input Voltage	100/120/200/208/240 VAC
Input Voltage Ranges	150 to 275 VAC (High Line operation) shuts down below 150 VAC , 1800W configuration 85 to 140 VAC (Low line operation) , 1200W configuration
Input Current	8.2A at 240 VAC; 11.2A @ 120 VAC
Power Factor	> 0.99 for loads > 60% of full load @208VAC, > 0.98 for load > 50% of full load other line conditions
Operating Frequency Range	47 to 63 Hz
Efficiency	93% typical at 230VAC Vout>52V and Pout >50%
Output Voltage Regulation	±2%
Output Noise: **Ripple** **Wideband Noise**	 250 mVrms maximum, 10 Hz to 20 MHz < 500 mV pk-pk over the range dc to 100 MHz
Load Share Accuracy	±5% maximum deviation between rectifiers for loads > 50%
Rectifier heat Dissipation at Full Load Watts (BTU)	**120 VAC** 131 (447) **240 VAC** 187 (638)
Selective High-Voltage Shutdown	Above 58 VDC
Backup High-Voltage Shutdown	Above 60 VDC for 1 millisecond

Control Units

Table 2-D: QS841A_NX1 Control Unit Specifications

Operating Input Voltage Range	38 to 60 VDC
Input Power	6.0 watts maximum
Plant Parameter Setting	Through front panel LCD display and menu keys, 10/100 Base-T Craft port, SNMP LAN port, or with IBM compatible PC with RS-232 port;
Alarm Contact Ratings	60 VDC, 0.5A, Form-C
Terminal Block	Wire size: 28-16 AWG stranded or solid

3 Safety

Safety Statements

Please read and follow all safety instructions and warnings before installing, maintaining, or repairing the system:

- The NX400 platform is Underwriters Laboratories (UL) Listed per Subject Letter 1801, DC Power Distribution Centers for Telecommunications Equipment.
- Install only in restricted access areas (dedicated equipment rooms, equipment closets, or the like) in accordance with articles 110-16, 110-17, and 110-18 of the U.S. National Electric Code (NEC), ANSI/NFPA No. 70, and pursuant to applicable local codes.
- This equipment is to be used in controlled environments (an area where the humidity is maintained at levels that cannot cause condensation on the equipment, the contaminating dust is controlled, and the steady-state ambient temperature is within the range specified).
- This equipment has been evaluated for continuous use in ambient temperature from -40°C to 65°C when used with the CP1800 rectifier.
- This equipment must not be installed over combustible surfaces.
- For installations in the United States, Listed compression connectors are to be used to terminate Listed field-wired conductors where required. For all installations, the appropriate connector is to be applied only to the correct size conductor as specified by the connector manufacturer, using only the connector manufacturer's recommended tooling or tooling approved for that connector.
- If the proper connector for the country of installation is not provided, obtain appropriate connectors and follow manufacturers and all local requirements for proper connections. All national and local rules and regulations should be followed when making field connections.
- The main output voltage (48V) meets SELV requirements.
- Insulation on field-wired conductors should be rated no less than 90° Celsius. Wire conductor size should be sized per electrical codes for 75° Celsius wire, and based on the ampacity of the associated protection device.
- Torque electrical connections to the values specified on labels or in the product documentation.
- Battery input cables must be dressed to avoid damage to the conductors (caused by routing around sharp edges or routing in areas where wires could get pinched) and undue stress on the connectors.
- Alarm contacts on the office alarm connector (J1) are not fused within the distribution panel; therefore, current limiting protection for these contacts must be provided by external

circuits. Maximum ratings for alarm connections are 60Vdc and 0.5 amperes. Exceeding these maximum ratings could result in fire or damage to the unit.

- Circuit breaker loads must **not** exceed 80% of the current rating. Distribute loads across the panel.

- The short circuit current capability of the battery input to the distribution panel must not exceed 10,000A.

- AC branch circuits to this equipment must be protected with circuit breakers sized as required by the National Electric Code (NEC) and/or local codes. The maximum size of the over-current protector is based on the type of shelf. Refer to the equipment ratings to assure rating of equipment will not exceed 80% of the value of the protector chosen.

- High leakage currents are possible due to contribution from simultaneous multiple AC input connections. Earth ground connection is essential before connecting the ac source to the shelf. This connection must be achieved by ensuring that the C.O. grounding stud is connected per the installation instructions or quality service personnel shall ensure that the rack system is bonded per the provision below.

- An accessible AC disconnect/protection device to remove power from the equipment in the event of emergency must be provided. Disconnect all AC branch circuits prior to making AC connections.

- Installing circuit breakers not specified for use in these distribution modules may result in injury to service personnel or equipment damage. Use only replacement parts listed in this manual and on the equipment drawings.

- While installing batteries, follow all safety precautions outlined in the appropriate battery product manuals.

Warning Statements and Safety Symbols

The symbols may sometimes be accompanied by some type of statement; e.g., “Hazardous voltage/energy inside. Risk of injury. This unit must be accessed only by qualified personnel.” Signal words as described below may also be used to indicate the level of hazard.

DANGER	Indicates the presence of a hazard that will cause death or severe personal injury if the hazard is not avoided.
WARNING	Indicates the presence of a hazard that can cause death or severe personal injury if the hazard is not avoided.
CAUTION	Indicates the presence of a hazard that will or can cause minor personal injury or property damage if the hazard is not avoided.
	This symbol identifies the need to refer to the equipment instructions for important information.
	These symbols (or equivalent) are used to identify the presence of hazardous ac mains voltage.
	This symbol is used to identify the presence of hazardous ac or dc voltages. It may also be used to warn of hazardous energy levels.
	One of these two symbols (or equivalent) may be used to identify the presence of rectifier and battery voltages. The symbol may sometimes be accompanied by some type of statement, for example: “Battery voltage present. Risk of injury due to high current. Avoid contacting conductors with non-insulated metal objects. Follow safety precautions.”
	One of these two symbols may be used to identify the presence of a hot surface. It may also be accompanied by a statement explaining the hazard. A symbol like this with a lightning bolt through the hand also means that the part is or could be at hazardous voltage levels.
	This symbol is used to identify the protective safety earth ground for the equipment.
	This symbol is used to identify other bonding points within the equipment.
	This symbol is used to identify the need for safety glasses and may sometimes be accompanied by some type of statement, for example: “Fuses can cause arcing and sparks. Risk of eye injury. Always wear safety glasses.”

Precautions

When working on or using this type of equipment, the following precautions should be noted:

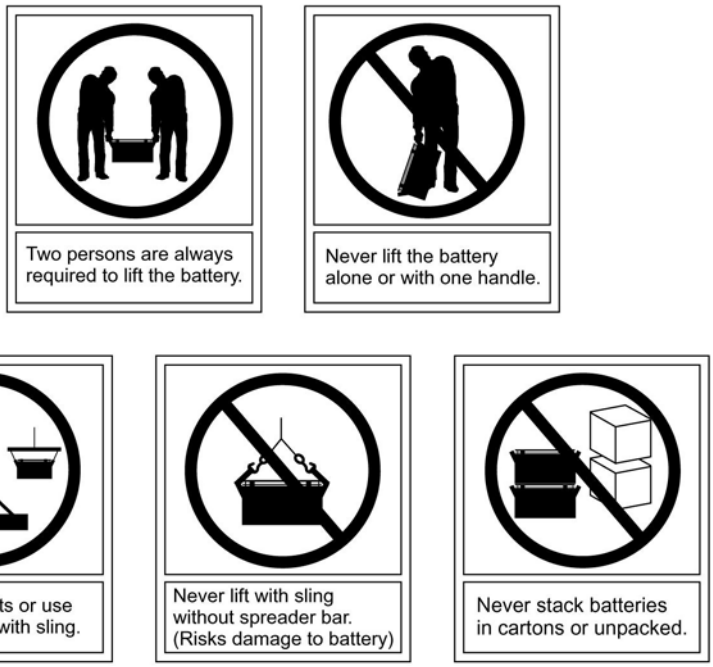
- This unit must be installed, serviced, and operated only by skilled and qualified personnel who have the necessary knowledge and practical experience with electrical equipment and who understand the hazards that can arise when working on this type of equipment.
- The equipment could be powered by multiple ac inputs. Ensure that the appropriate circuit protection device for each ac input being serviced is disconnected before servicing the equipment. Do not disconnect permanent bonding provisions unless all ac inputs are disconnected.
- High leakage currents may be possible on this type of equipment. Make sure the equipment is properly safety earth grounded before connecting power.
- Batteries may be connected in parallel with the output of the rectifiers. Turning off the rectifiers will not necessarily remove power from the bus. Make sure the battery power is also disconnected and/or follow safety procedures while working on any equipment that contains hazardous energy/voltage.
- Hazardous energy and voltages are present in the unit and on the interface cables that can shock or cause serious injury. Follow all safety warnings and practices when servicing this equipment. When equipped with ringer modules, hazardous voltages will be present on the ringer output connectors.

In addition to proper job training and safety procedures, the following are some basic precautions that should always be used:

- Use **only** properly insulated tools.
- Remove all metallic objects (key chains, glasses, rings, watches, or other jewelry).
- Wear safety glasses. Fuses can produce sparks. High energy levels on busses and distribution components can produce severe arcing.
- Test circuits before touching.
- Lock out and tag circuit breakers/fuses when possible to prevent accidental turn on.
- Be aware of potential hazards before servicing equipment.
- Identify exposed hazardous electrical potentials on connectors, wiring, etc. (note the condition of these circuits, especially wiring).
- Use care when removing or replacing covers; avoid contacting circuits.

Handling Batteries

- To direct attention to the possible source of danger from battery gases, post one or more warning signs, lettered in large characters, in a conspicuous location near the battery. For example:



- Fully brief anyone who is permitted access to battery areas on the hazards of handling lead-acid batteries. Make it clear to anyone handling, unpacking, or installing lead-acid batteries that they contain electrolyte (sulfuric acid and water). Everyone must wear protective equipment such as rubber gloves, rubber aprons, full face mask, and splash-proof goggles when performing any activity involving handling of batteries or cells containing electrolyte.

- A storage battery gives no indication by its appearance of the potential energy stored in it. All lead-acid storage cells/batteries have enormous short circuit capability which can result in serious burns. Use extreme care to avoid shorting out cell and/or battery terminals. Shorting a cell or battery with a non insulated tool can vaporize or throw the tool.

- All lead-acid batteries generate hydrogen gas, even under open circuit conditions. If not permitted to escape, this gas can build up to explosive concentrations. NEVER tamper with or block the vent caps of the 12IR125 battery modules. A damaged gas vent cap could become clogged, resulting in an explosion due to internal pressure. Such an explosion could short circuit other battery modules and result in a fire. ALWAYS place batteries in a well-ventilated area. NEVER place battery modules in a sealed environment.

- In case of electrolyte contact with the skin, remove the electrolyte **immediately** by flushing the affected area with large amounts of plain tap water. In case of electrolyte in the eye, pour water into the inner corner of the eye and allow at least one quart of water to run over the eye and under the eyelid. Eye injuries should be treated by a physician **immediately**.

Special Installation Notes

Deutsch

Installationsanleitung

Eingangsspannung (Voltage) :150-275VAC
Eingangsstrom (Current) : Max 530A
Eingangsleistung (Watts) :
Nennfrequenz (Frequency) : 50 / 60 Hz

Seriennummer (Assembly No.):--

Modellnummer (Model No.) : NX400

Abmessungen sind nur zur Referenz : 660mm x 533.4mm x 2133.6mm
(Dimensions are for reference only)

Max. Umgebungstemperatur : max. 65 deg. C
(Max. Operation temperature)

Achtung: Für kontinuierlichen Feuerschutz sollte die Sicherung nur mit einer des gleichen Types ersetzt werden.
Sicherungswert :
(Warning : For continued protection against fire replace with same type and rating of fuse)

Das System ist ein Gerät der Schutzklasse I / Überspannungs Kategorie II
(Power Supply is a Class I equipment / overvlotage category II)

Ausgangsspannungen und -stöme: DC 58 V / SELV
(Output Voltage and Current)

--Das Gerät darf nur in Räumen mit beschränktem Zutritt aufgestellt werden.
(Nur ausgebildetes Personal)

--Nur für Aufstellung auf Boden oder einer anderen brennbaren Oberfläche geeignet.

--Das Gerät hat keinen eigenen Ausschalter, es muß daher mit einem Ein- und Ausschalter im Versorgungskreis versehen sein.

--Das Gerät ist für den Einbau in IT- Geräte in einem Rahmen bestimmt (siehe weitere Anleitung)

--Beim Einbau des Gerätes ist daraf zu achten das alle Anforderungen gemäß EN60950 eingehalten werden.

ACHTUNG: HOHER ABLEITSTROM
VOR ANSCHLUSS AN DEN VERSORGUNGSSTROMKREIS
UNBEDINGT ERDUNGSVERBINDUNG HERSTELLEN

Español

Notas especiales para instalaciones en países de habla hispana

- Instrucciones de instalación
  (Installation Instructions)
- Voltaje (Voltage):
  Vea tabla 2-A
- Corriente (Current):
  Vea tabla 2-A
- Frecuencia (Frequency):
  50/60Hz
- Voltaje y corriente de salida (Output Voltage and Current):
  Vea tabla 2-A
- Temperatura máxima de operación (Maximum Operation Temperature):
  65°C (149°F)
- Sin cabina contra incendios, suelo no combustible
  (No fire enclosure, non-combustible floor)
- Evaluado en EN60950
  (Evaluated to EN60950)

4 Installation and Testing

Preparation

This section outlines the sequence for installing the NX400 System along with rectifiers, batteries and circuit breakers.

Safety

Please review all safety warnings in Section 3 before beginning the installation process. Observe all warnings and labels on the equipment.

Caution	Due to the possibility of working on energized circuits during these procedures, all tools and test equipment must be insulated in an approved manner. Proper ESD protection is required in order to prevent ESD damage to the equipment.
Warning	Only qualified personnel should install and service the power system and plug-in modules. Hazardous energy and voltages are present in the unit and on the interface cables and will shock or cause serious injury or death if safety precautions are ignored. Follow all safety warnings and practices when servicing this equipment.

Installation Tools

You will need the following tools to install and test the NX400 System:

- Wire cutters and strippers
- Heat shrink gun
- 5/16-inch (8 mm) hex driver
- 1/4-inch hex driver
- Digital meter with an accuracy of ±0.02%
- Screw drivers (flat-blade and Phillips)
- ESD wrist strap
- 48V test load

- Socket wrenches:
  - 7/16” for all load and battery connections;
  - 19 mm for anchor bolts;
  - 12" extension for socket
- Masonry drill kit as required
- Compression for installation of various compression lugs
- Test cable
- Protective canvas
- Insulating rubber mat

Ship Loose Materials

QTY	COMCODE	DESCRIPTION
8	901281444	Phillips flat head screws 10-32 x 3/8
130	901352617	Nut ¼ - 20
12	406954222	Cable ties for securing battery cables
1	CC848777037	This product manual
1	CC848795385	Drill template
4	---- *	24” 2/0 battery cable
20	407998228	50A Circuit breakers
10	CC848781534	Rectifier slot fillers
12	848466884	Battery separators
4	CC848768201	Front battery bracket
4	CC408574420	200A battery disconnect breaker
4	CC848770248	Clear cover for battery breaker
8	845143858	Screw 6-32 x 1/4
2	801256165	¼-20 x ¾-inch HH bolt
2	801829557	¼-inch lockwasher
2	802841577	¼-inch flat washer

* A comcode does not exist for this cable. It is factory created per J5694770. Consult factory for cable if needed.

Wiring Guidelines

All electrical connections should be made using the proper crimping tools and dies and should be torqued to values specified.

All building wiring should comply with the NEC and other applicable local codes. The temperature rating of the wire must be no less than 90° Celsius and may be sized using the 90° Celsius ampacity table in the NEC handbook. Wiring internal to enclosed equipment cabinets must be rated no less than 105° Celsius.

Packaging

All packages should be opened with a box cutter with the blade minimally exposed so that only the sealing tape is cut. Save all packaging material until the system has been powered up and all parts are operating within specifications. The shipping package may be used to return defective parts.

Torque Requirements

Torque (in-lb)	Connection
20	AC terminal block screws
10	#6-32 nuts on QS871 Boards
35	10-32 screw for ac and dc rear covers
35	12-24 frame-mounting screws
65	M6 nuts on LVLD contactors
65	1/4-20 nuts for load, battery and LVBD connections
240	3/8-16 nuts for 3-pole adapter bus

Installation and Turn Up Sequence

Frame Anchoring

Figure 4-1 shows the frame footprint. A floor template is provided to locate holes for frame anchoring. Anchors like the one listed below are recommended. Place one anchor in each of the four outer slots for zone 2. Zone 4 requires additional floor anchors as shown along with top bracing for the framework or an external bracing kit.

Anchor Bolts					
Seismic Zone	**Comcode**	**Anchor Type (Hilti)**	**Hole Size**	**Wrench**	**Torque**
0, 1, 2, 3, 4	847135688	(4) 12 mm Cap Bolts	18 mm 100 mm Deep	19 mm	720 in·lb 60 ft·lb 81.6 N·m

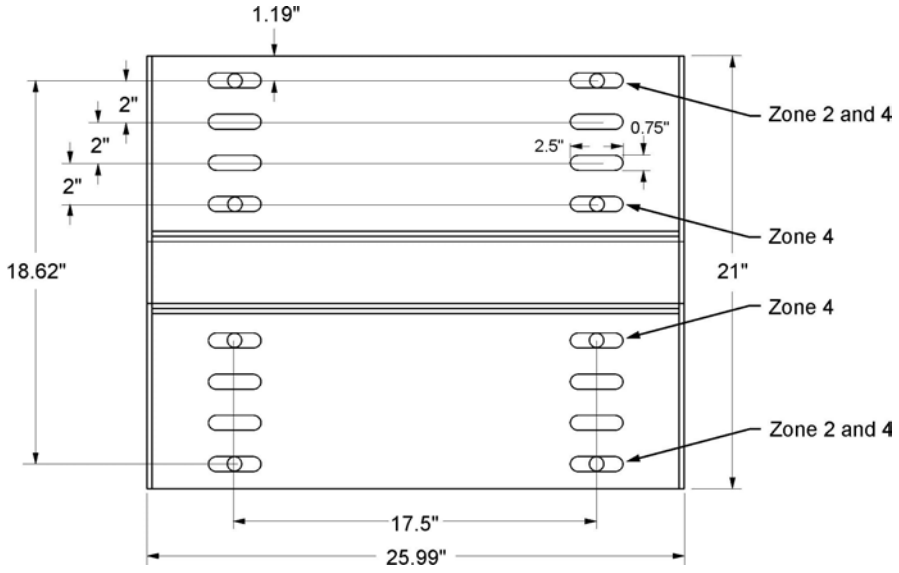


Figure 4-1: Frame Mounting Locations

Frame Ground Connection

Figure 4-1 shows the Frame Ground connection locations on the top surface equipment framework. Landings are provided for two-hole lugs with 5/8-inch hole spacing and for 1/4-20 hardware. 1/4-20 hardware is provided with the frame as follows

- (2) 801256165 1/4-20 x 3/4-inch HH bolt
- (2) 801829557 1/4-inch lockwasher
- (2) 802841577 1/4-inch flat washer

The landings are suitable for direct connection of plated lugs without use of an oxidation inhibitor.

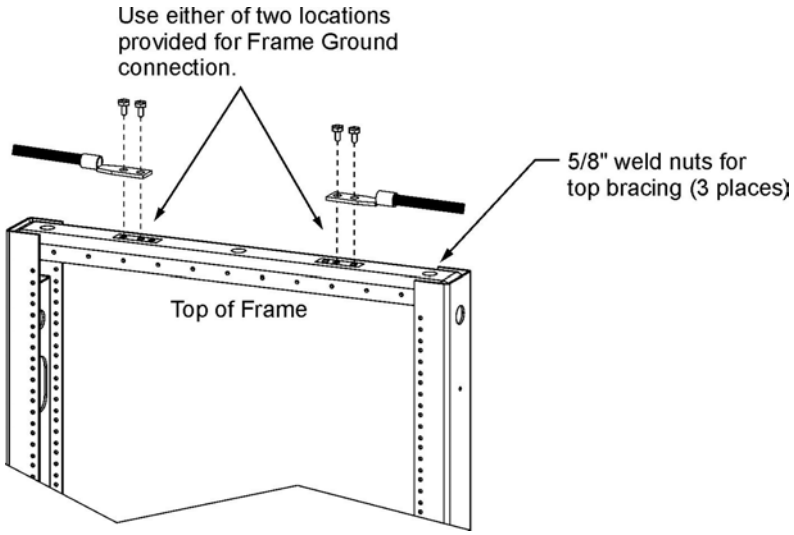


Figure 4-2: Frame Ground Locations

C.O. Ground Connection

Figure 4-3 shows the C.O. Ground connection locations on the NX400 system. Landings are provided for two-hole lugs with 5/8-inch hole spacing and for 1/4-20 hardware. 1/4-20 nuts are provided for these connections.

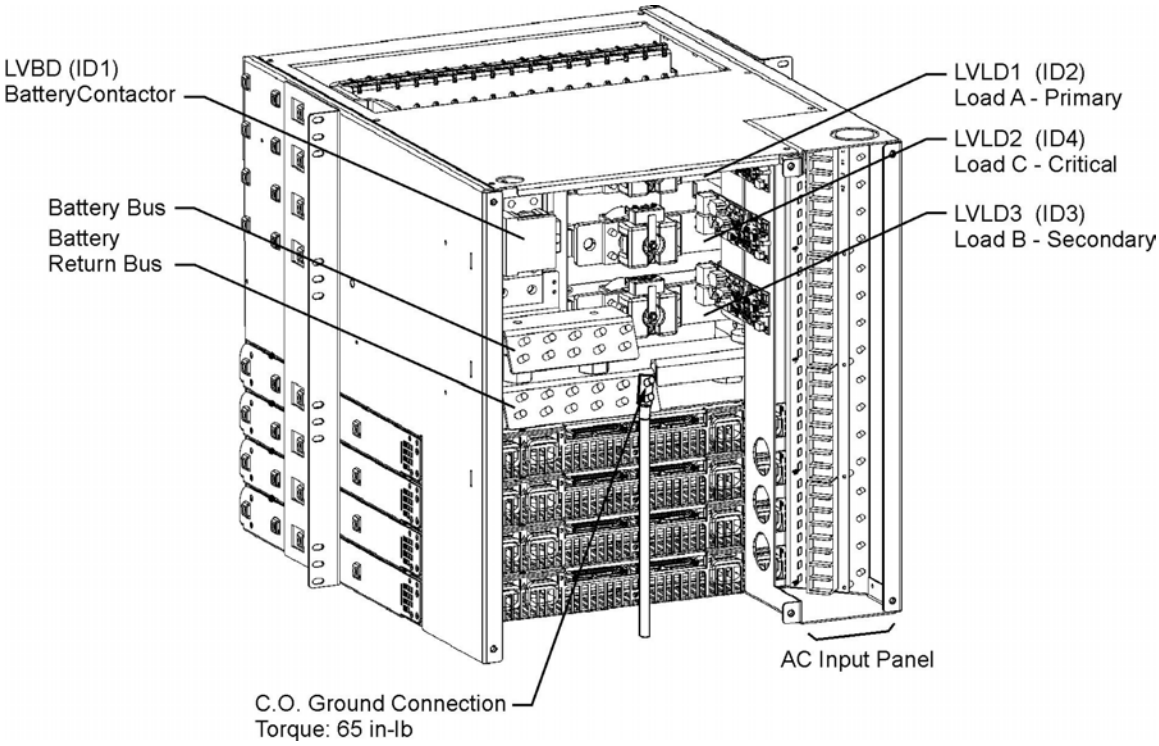


Figure 4-3: C.O. Ground Connection to NX400

Installing Rectifiers

Rectifiers are installed or removed with the rectifier Faceplate in the open position as shown.

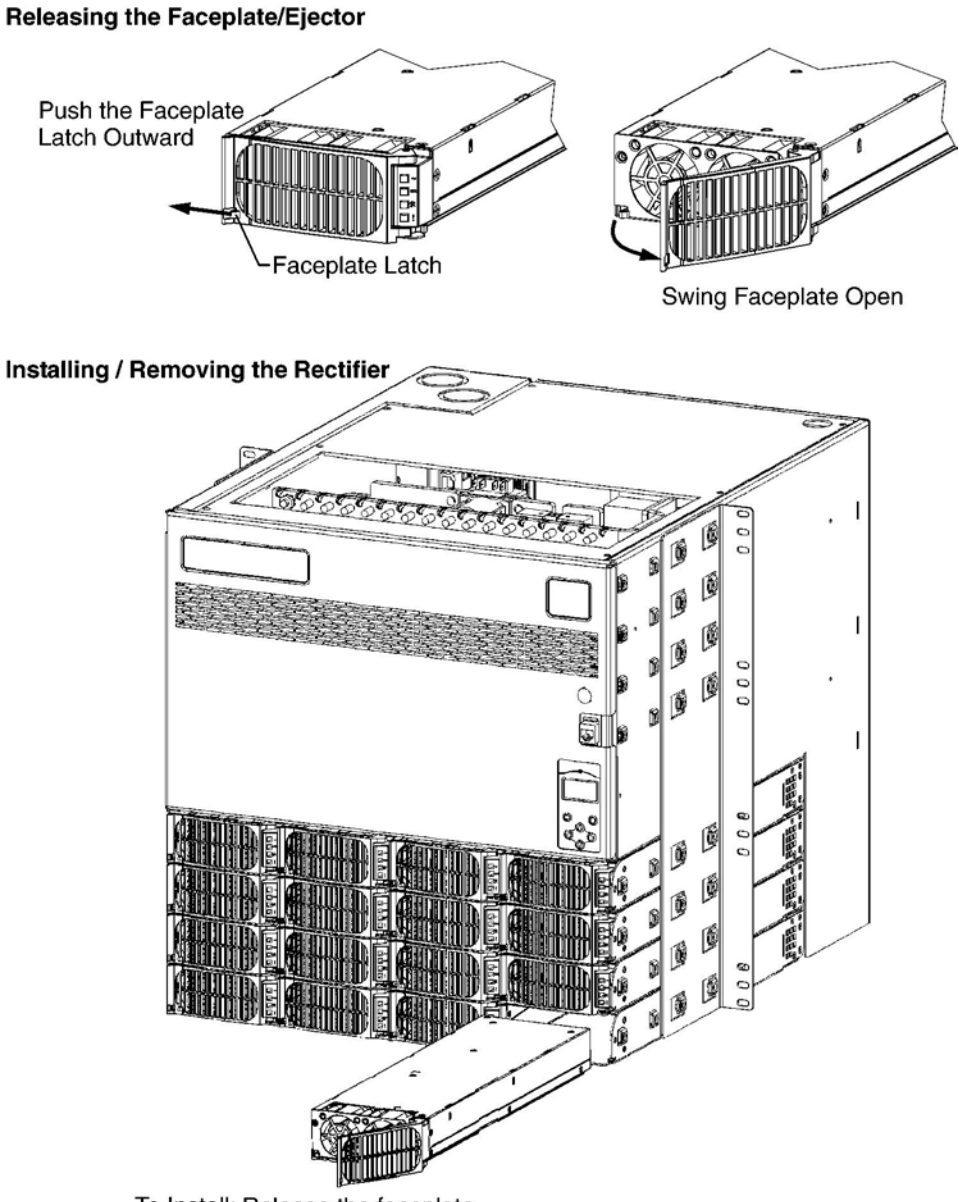


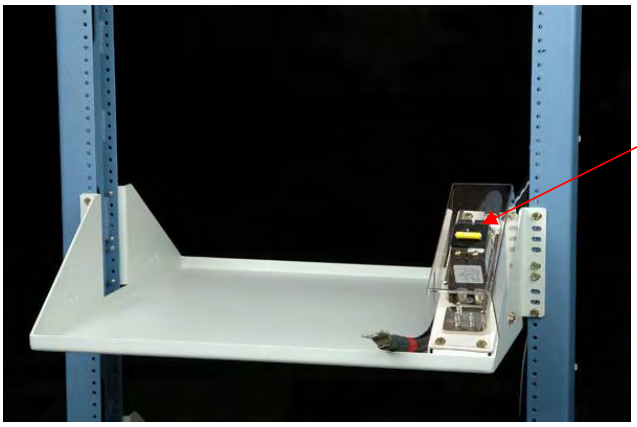
Figure 4-4: Rectifier Installation

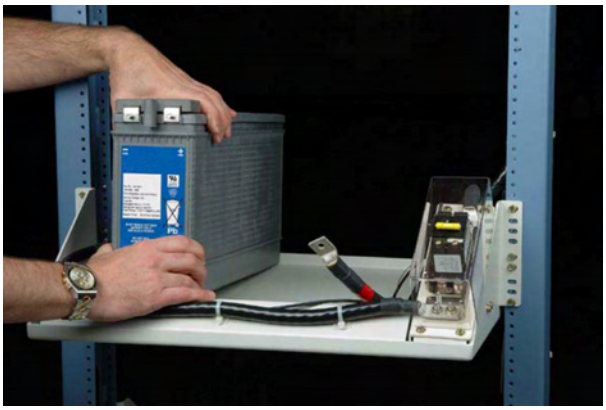
Installing Batteries

WARNING

All batteries contain hazardous electrical energy. Lead-acid batteries contain sulfuric acid and explosive hydrogen gas. Follow all precautions noted in the literature accompanying the batteries. Use only insulated tools.

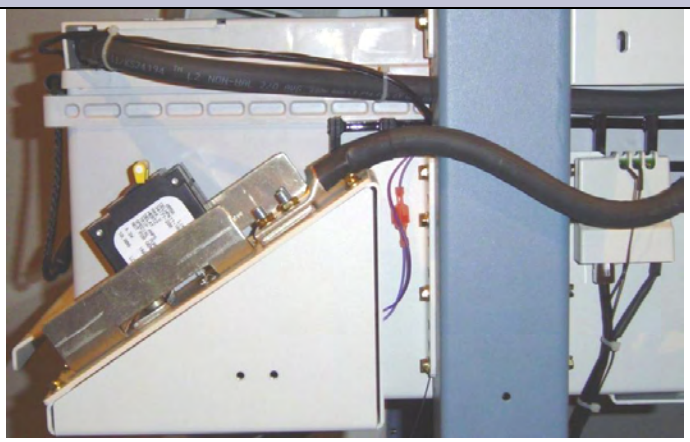
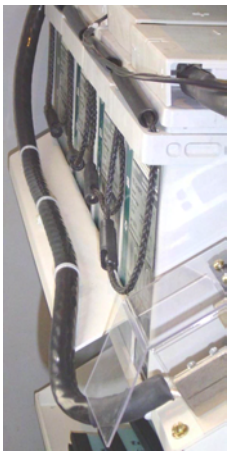
The NX400 Frame-Mounted System comes equipped with four battery trays. Each battery tray includes a 200A battery disconnect breaker for disconnecting a string of Power Battery CSL-12100, SLF-12105, or equivalent 100 AH front-terminal batteries such as Lineage Power East Penn 12AVR100-3ET. The frame is factory-wired with battery mid-string voltage and temperature monitoring units and cables. Refer to Figure 4-5 for the following procedures.

Step	Action
1	Ensure disconnect switch is in the OFF position (*Downward*) prior to making any connections. Remove the two 6/32 screws to remove the Lexan Cover.  **Disconnect Switch**
2	Place front bracket on battery tray. Connect one end of the 2/0 cable to the input bus of the disconnect switch. Secure with 1/4-20 hex nuts (901352617) provided. Torque to 65 in-lb.  **Input Bus Connections**

Step	Action
3	Place four 100 Ah batteries on each battery tray. Position a Battery Spacer as required between each battery, and interconnect three inter-cell bus bars per manufacturer's instructions so as to create a 48V string. Attach the battery securing top rail.   Connect the 2/0 cable between the V- post of the left-most battery and the input bus of the disconnect switch. Secure with 1/4-20 hex nuts (901352617) provided. Torque to 65 in-lb.
4	Attach the factory-wired QS873 VT thermal probe to the inter-cell connection located at the V- post of the battery located at the mid-string voltage and cable-tie to Front Bracket along with the 2/0 cable. 

Step	Action
	
4	Re-attach clear Lexan cover to battery breaker and secure with 6-32 screws.
5A	Connect the 2/0 factory-wired cable to the V+ post of the right-most battery. Torque to battery manufacturer's specification. Move to the next section.  

Step	Action
5B	Note: the battery disconnect switch and the front battery tray spacing/cabling bracket will need to be repositioned when using larger batteries such as C&D TEL12-105F or Battery Corp BC-12V110FT. Use (2) 901281444 flathead Phillip screws 10-32 x 3/8" provided to reposition the disconnect. After making these battery tray adjustments, a user should following the basic battery installation instructions previously outlined. The figures below illustrate the tray configuration difference when the larger battery format is utilized.  Side view of repositioned battery disconnect switch. Note position and connection to ES771 module.

Step	Action
	 Front view of 2/0 cable run across repositioned front battery tray spacing/cabling bracket. The bracket is secured to the tray with 1/4-20 hex nuts (901352617) provided. Torque to 65 in-lb.  

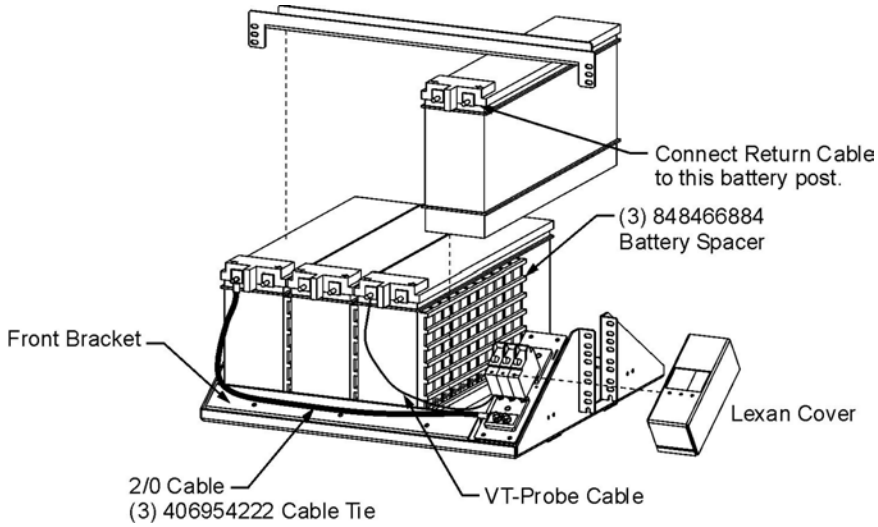


Figure 4-5: Installing Batteries

Battery Cable Connection

For frame mounted systems, 2/0 battery cables are factory installed to the battery busses. For other applications attach battery cables as shown in Figure 4-6.

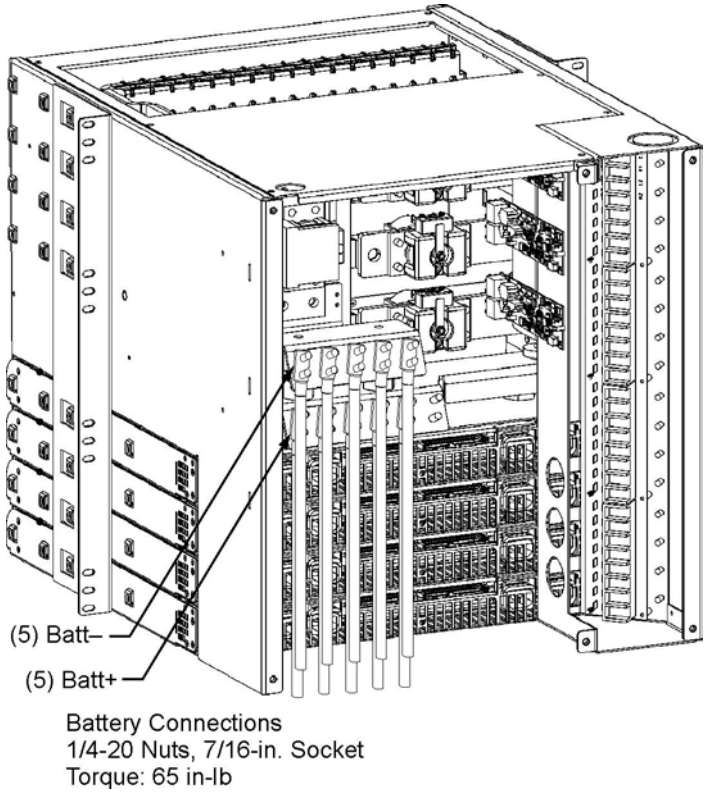
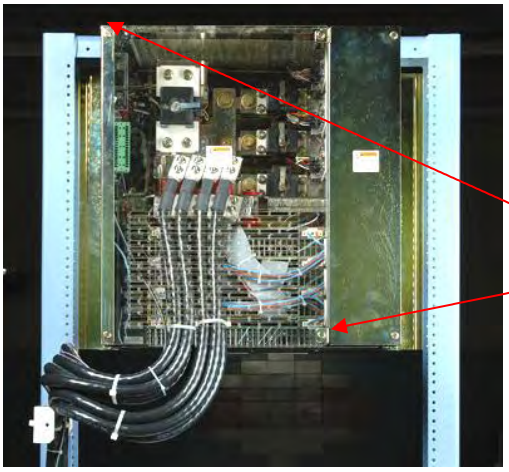
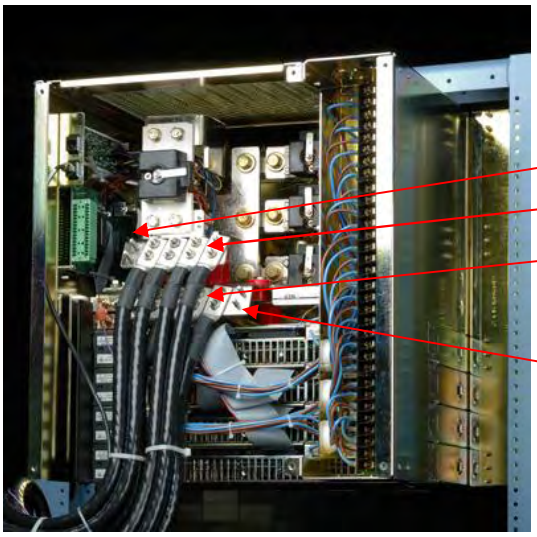


Figure 4-6: Battery Connections

Follow the procedures below if there is need to add (or remove) a new battery string connection to the system.

Step	Action
1	Using a 5/16" nut driver, locate and remove the four corner "10-32" screws securing the protective Lexan cover to the back of the system.  **Screws**
2	Place the battery disconnect into the off position. Appropriately route and dress the 2/0 battery return cable to the first unused return position from the left. Repeat for the -48V battery connection. Using a 7/16" socket torque the ¼ -20 nuts to 65 in-lbs. Return the Lexan cover to the system and turn the battery disconnect on.  **Open position reserved for fifth battery shelf** *(May be on right)* **-48V** **Return** **Central Office Ground**

Load Cable Connection

Figure 2-4 depicts the NX400 DC Distribution. The system is equipped with 32 distribution positions, 16 positions per panel. The top panel is configured for LVD-A Primary Loads, and the bottom panel is configured for LVD-B Secondary Loads. A single four position bus adapter is used on both panels to connect loads to the LVD-C Critical Loads bus. The system is factory equipped with 12 loads available on the LVD-A Primary Bus, 12 loads on the LVD-B Secondary Bus, and 8 loads on the LVD-C Critical Bus which are marked accordingly.

Twenty 50A circuit breakers (407998228) are shipped with each system. Other sizes are available. Attach load cables starting from the left most available position on the LVD-A Primary and LVD-B Secondary load bus. Critical Loads should be connected from the right. Terminal lugs should be sized for ¼-20 on 5/8" centers. Table 4-A lists some orderable options.

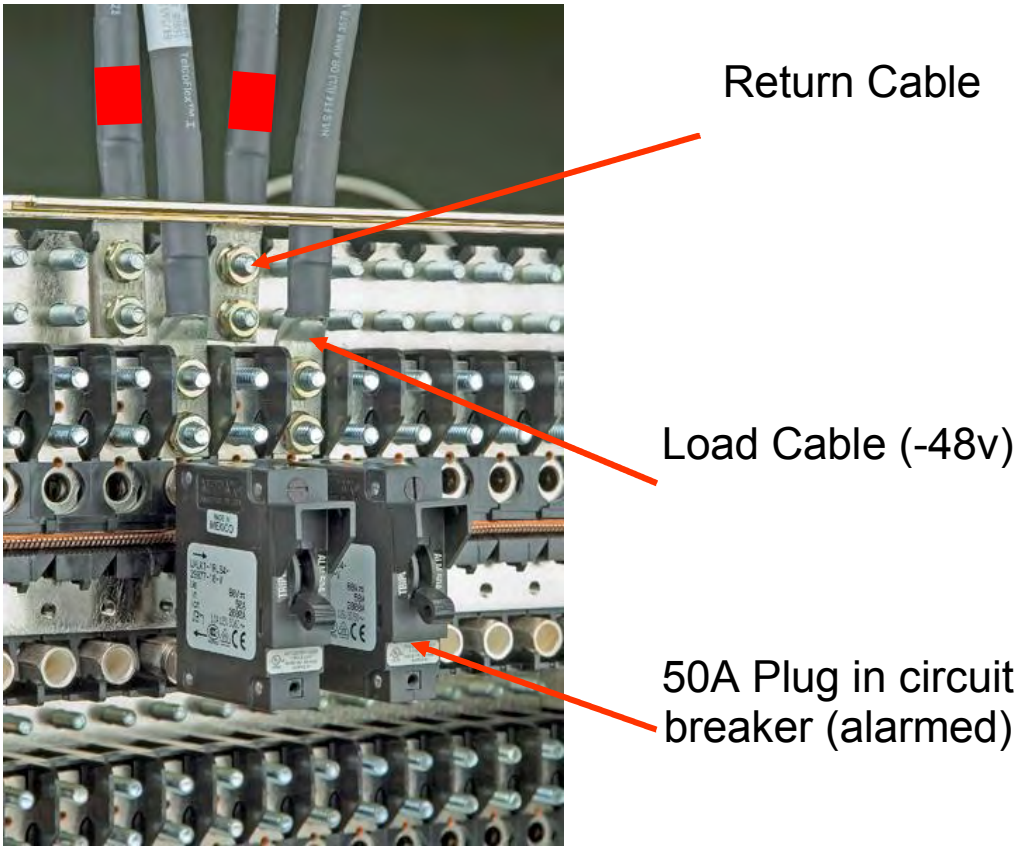


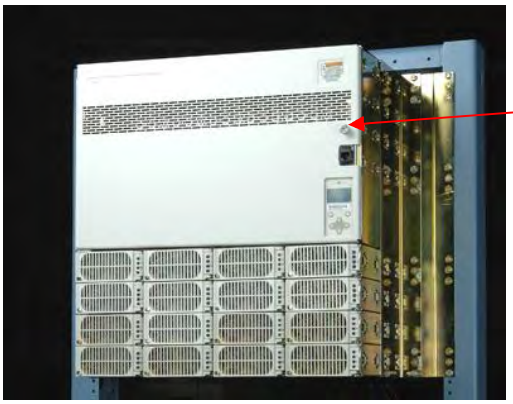
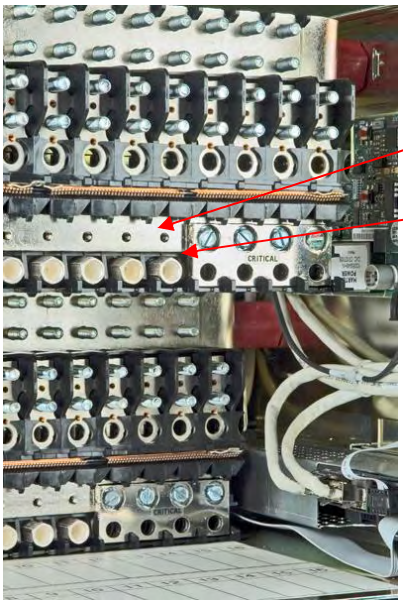
Figure 4-7: Load Connections to NX400 Distribution Panel

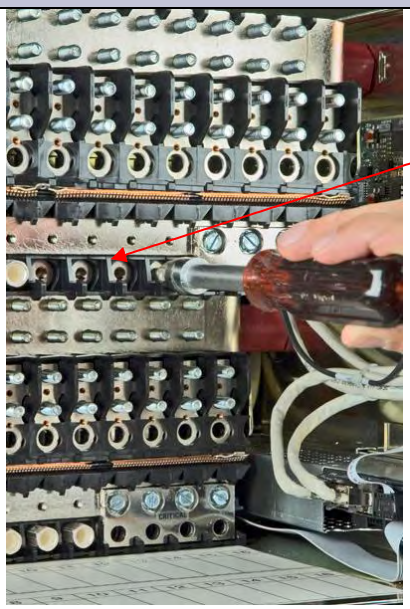
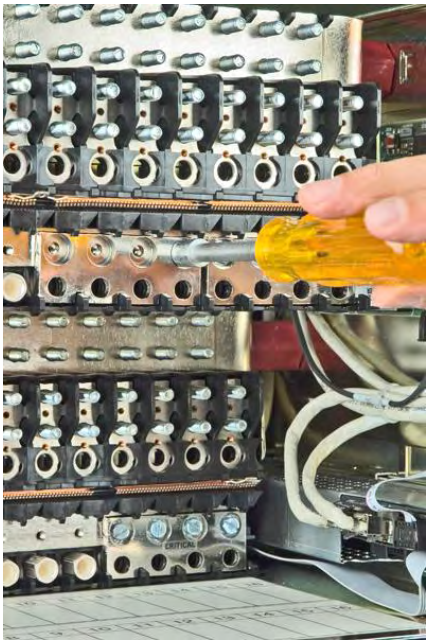
Table 4-A: Load And Return Lugs

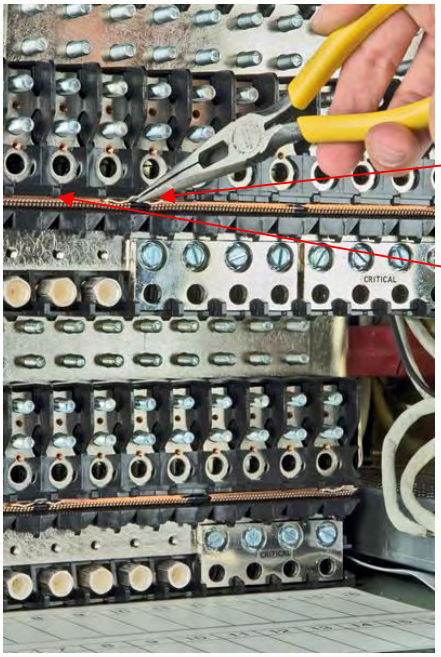
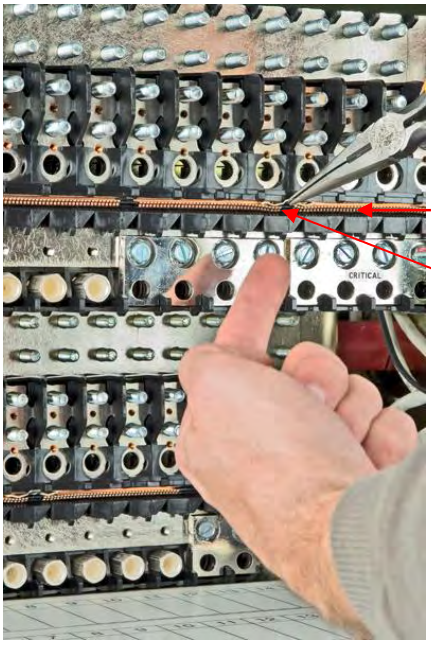
Comcode	STD Wire AWG Class B	FLEX Wire AWG Class I
406021626	8	8
405347519	6	6
405347576	4	4
405348202	2	-
405347683	-	2

Adding Critical Bus Positions

The DC bus configuration may be modified as needed to add or remove Critical bus positions.

Step	Action
1	Locate the distribution door entry knob and turn it counter clockwise to open.  **Door Knob**
2	Determine the appropriate position for the bus modification. This example is putting in a bus adaptor to add more critical load positions attached to the Primary load panel.  **Adapter Plate Location** **Standoff**
3	Using a 7/16” nut driver carefully remove four standoffs where the load adapter plate will be eventually be located.

Step	Action
	
4	Place the new adapter plate into position and secure it using the 10/32” bolts and a 5/16” nut driver. 
4	Locate and remove the alarm strip connecting tab. This tab will be re-attached to allow the proper alarm to be generated for the additional Critical Load positions.

Step	Action
	 **Alarm Tab** **Primary Alarm Strip**
5	Re-attach the alarm tab into the portion of the alarm strip dedicated for the Critical load. The new breaker positions are now available for connection. The process can be reversed to remove a Critical bus adapter and provide additional Primary or Secondary load positions.  **Critical Alarm Strip** **Repositioned Alarm Tab**

AC Utility Connection

NX400

Commercial AC power input wiring enters a termination box at the right rear of the power system. Knockouts located at the top and side of the AC termination blocks are provided for three ¾-inch conduits, 1-inch conduits and 1-1/4-inch conduits. Shelves are factory pre-wired at the terminal blocks feeding two rectifiers per AC input. This configuration is for a Line to Neutral connection for 120VAC or Line to Line connection for 208/240VAC.

It is permissible to provide individual AC feeds to rectifiers by rearranging the spade connections on the AC termination board so that each rectifier is individually fed. The lower pictorial in Figure 4-8 shows how to rewire a dual-AC feed to an individual AC feed connection for rectifiers 1 and 2. Repeat for all rectifiers. Table 4-B provides the different AC wiring options and breaker size for the selected wire configuration. Conduit sizing is based on applications utilizing a ground connection per AC feed.

Table 4- B: AC Wiring Options

Number Of Rectifiers Per AC Feed	Wire Size (AWG)	Number/Size Of Conduits	AC Breaker Size	
			120VAC	208/240VAC
1	12	Two 1- inch	15A	15A
1	10	Two 1-¼ - inch	15A or 20A	15A or 20A
2	10	Two 1- inch	-	25A
2	10	Three ¾ - inch	30A	20A - 30A
2	8*	Three 1- inch	30A	20A - 30A

*Retrofit applications where 8AWG is all ready installed at that site

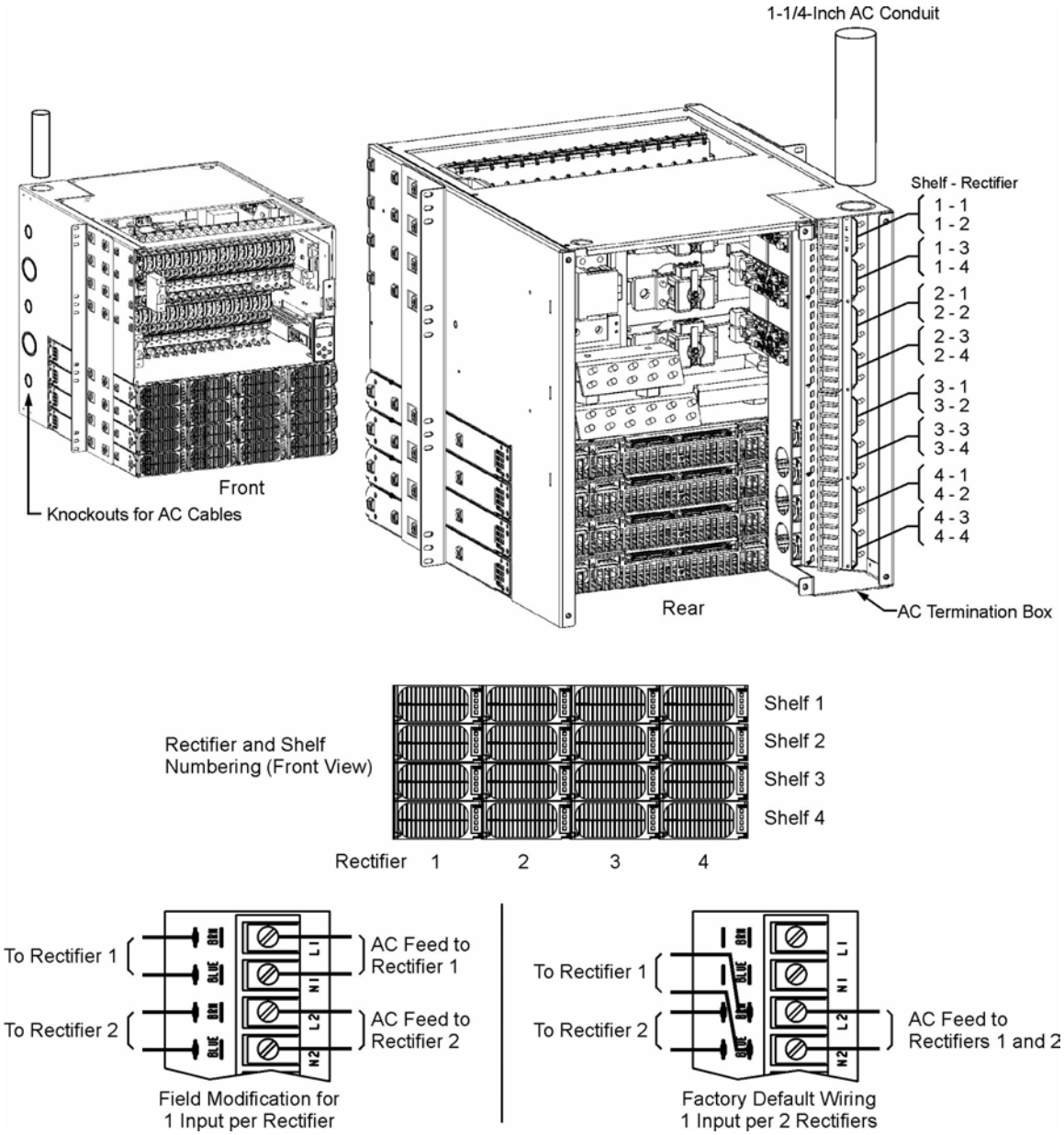
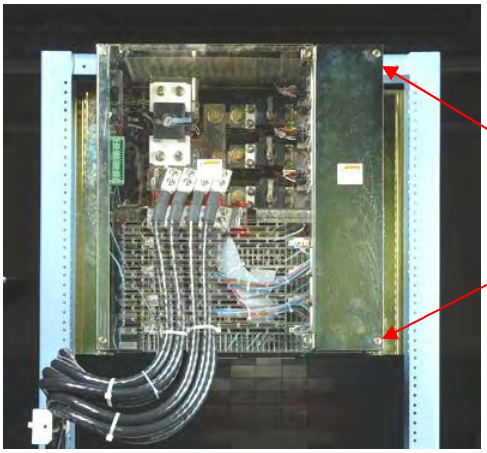
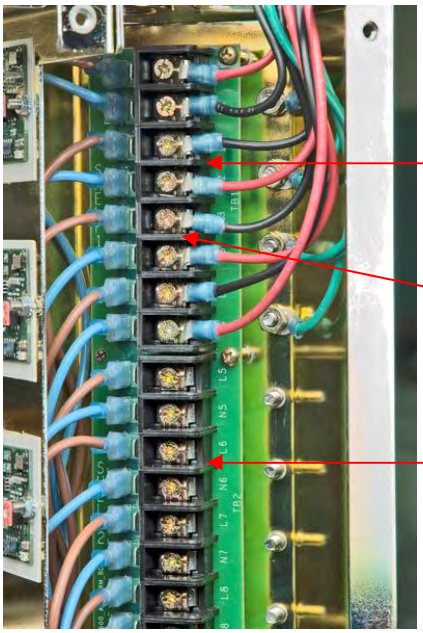
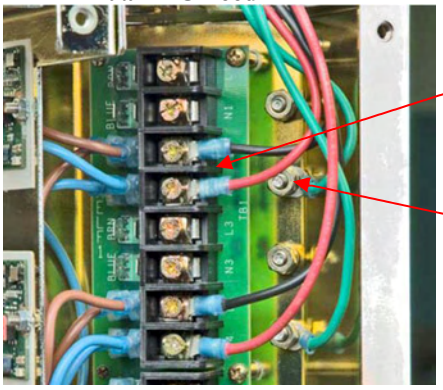


Figure 4-8: AC Input Connections

Wiring

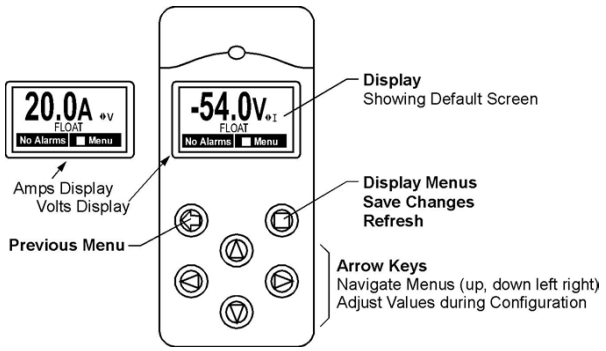
Standard AC wiring practices for AC/DC power systems should be adhered to when connecting AC to the NX400. Following are some general procedures to be used in conjunction with the previous information.

Step	Action
1	***Caution***- Disconnect all AC branch circuits prior to making AC connections to the NX400 system.
2	Ensure AC power is OFF to the NX400 system before continuing with AC connections to the utility source. Ensure all local and national wiring rules are being complied with when wiring.
3	Using a 5/16" nut driver locate and remove the two 10/32" screws securing the metal cover to the AC termination box.  **Cover Screws**
4	Using the information in Figure 4-8 and Table 4-B attach the appropriate conduit size to the desired conduit entrances located at the top or side of the AC termination box. Shown below are AC input wiring examples for single and dual-feed AC inputs to the rectifiers. **Single Feed AC** **Individual Feeds for Four Rectifiers**  **Terminal Block For Shelf 1 (Rectifiers 1-4)** **Rewired shelf input Fastons for individually feeding rectifiers. (Wires paralleled and same color)** **Terminal Block For Shelf 2 (Rectifiers 5-8)**

Step	Action
	Dual -AC Feed  **Single AC feed** **Ground Connections For AC Input** Note: Each terminal block on the AC termination strip contain the AC inputs for one rectifier shelf. The top terminal block has the AC inputs for the top or first rectifier shelf. The top two positions of each terminal block feed the first rectifier in each shelf. Each AC feed to the input terminal blocks has its own ground termination. These connections are 10-32” nuts.
5	Return the cover to the AC termination box when all internal AC wiring has been completed.

Initial Start-up

The system is ready to be powered up.

Step	Action
1	Verify all AC and DC connections are as described previously before applying AC power.
2	Place all external battery disconnect switches into their ON positions prior to applying AC power.
3	Turn on the AC service circuit breakers to apply power to the NX400 power system.
4	After approximately 30 seconds verify that all LEDs on all components including rectifiers, the controller, LVD control boards, and remote voltage monitor modules should be green. If this is not the case, initiate the "Clear Events" and "Uninstall Equipment" operations found under **Menu►Control/Operations** menu. Non-existent alarm conditions should clear. If all LEDs still aren't green, review the installation procedure and refer to the troubleshooting section. The controller display should indicate "NO ALARMS. The system float voltage, total load current, and system operating mode should be observable. The LED and back-light shall be illuminated green for no alarms.  Contrast can be adjusted for the site ambient condition by using the up and down arrow keys at the default menu show. Contrast adjust is also available at **Menu►Configuration►System Settings Display►Contrast** *The display has a protective transparent covering over the LCD portion. Make sure this covering has been removed for optimum viewing before adjusting the contrast.
5	Check the voltage reading on the controller display to verify that it complies with the system float voltage setting. By default, it should be **54.0Vdc**. Note: Slope thermal compensation being active and not fully charged batteries can cause a discrepancy in the front panel reading. If the connected batteries are not fully charged, the voltage may be lower. To eliminate this effect, open the external battery disconnect switches or activate the disconnect switches prior to making measurements. Slope thermal compensation can be manually turned off **Menu►Configuration►Batteries►Batt Temp Management►Temp Comp.** If this is done, **be sure** to **Enable** the feature before leaving.
6	Remove a rectifier from its slot to verify a simple alarm. The controller should illuminate its LED and back-light in amber signaling a missing rectifier condition. The alarm will also show up on the web pages if using a browser the Craft or LAN port connections. Initiate the "Uninstall Equipment" operation found under the **Menu►Control/Operations** menu. The alarm condition should clear and correct rectifier status should show up under **Menu►Status►Rectifiers.** Replace the rectifier. The controller shall update the rectifier status. If the above conditions did not yield the proper results, refer to the troubleshooting section.

Controller And Network Interface Card

Basics

NX400 Power systems are factory equipped with micro-processor based system controllers that have been factory preconfigured with application specific default settings for all features and thresholds. Installation of the system controller is not required. Customer specific defaults can also be made available and assigned a unique apparatus code for ordering and management as the need presents itself. Lineage Power predefined industry standard factory defaults are utilized when customer preferences are not known. All configurable parameters and thresholds can also be reconfigured or modified as needed in the field. These items are then stored in non-volatile memory.

The default system float voltage setting and alarm thresholds are configured assuming the power system contains VRLA batteries that require an uncompensated float voltage of 54.0V as observed during the power-up procedure on the previous page. The QS841A_NX1 has been factory pre-configured with the CSL-12100 VRLA battery as the standard configured battery model. This can be reconfigured in the field from the front panel or craft port if the battery model needs to be different. In addition the Date, Time, and site ID may also want to be checked and modified appropriately. These parameters are set in the factory but may need modification for the local time zone. To change these items do the following:

Step	Action
1	Change the battery type to another battery model in the list the CSL-12100 is not the battery installed at the site. From the front panel go to **Menu►Configuration►Batteries►Type** and select a battery model from the list. If the battery model is unique, select a generic technology class for the installed battery or use the Craft port to enter a specific battery model. • BC-12V110FT 105AH • CSL-12100 100AH • CSL-12170 170AH • SLF-12105 91AH • TEL12-105F 100AH • SE48S63 63AH • SE48S80 80AH • L48V60FTX 60AH Generic Battery technologies: • Valve-Regulated Lead Acid (Valve-Reg) • Flooded Lead Acid (Flooded) • Lithium Metal Polymer (Li-LMP) • Lithium ELiTE (Li-ELiTE) • Nickel-Cadmium (Ni-Cd) Press “save” once the correct battery is selected. If a generic battery type is selected select “Yes” to load the standard defaults.
2	Set system date by going to: **Menu►Configuration►System Settings►Date** and set to current date. Set system time by going to: **Menu►Configuration►System Settings►Time** and set to present time.
3	A site ID consisting of 21 or less characters may also be configured. However, remote configuration means are required. Refer to using the Craft Port to configure the site ID.

Controller I/O

All standard controller connections that require wiring that permanently remains attached in the system are available from the rear of the NX400. These connections are made through terminal block positions, standard RJ45 jacks, or a Faston as depicted in the Figure below.

NX400

All six controller Form-C power system office alarm relay outputs and the alarm and control inputs are available at the removable terminal block headers. The thirty two position terminal block has been pre-assigned in the NX400 with the signals shown below. A 25-foot alarm cable (CC848804773) is factory installed to the terminal block headers. Table 4-D shows the wire colors for alarm and control connections.

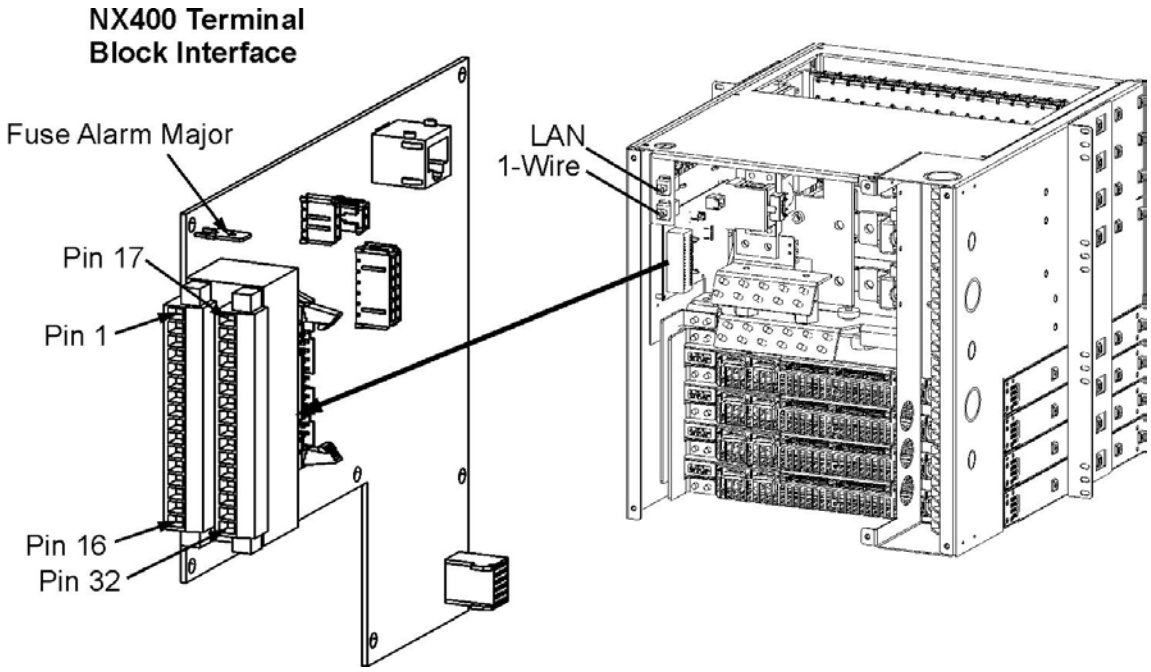


Figure 4-9: NX400 Terminal Block Pin Locations needs picture updated

Table 4- C: NX400 Input/Output Alarms And Control

	Form-C Alarm Outputs (Rating: 60 VDC @ 0.5A)								
	Alarm Relay 1 Default: High Voltage - HV			Power Minor Alarm			Power Major Alarm		
Pin	19	20	21	22	23	24	25	26	27
Signal	RLY1-C	RLY1-R	RLY1-O	PMN-C	PMN-R	PMN-O	PMJ-C	PMJ-R	PMJ-O
	Alarm Relay 4 Default: Voltage Imbalance			Alarm Relay 3 Default: Fuse Major - FAJ			Alarm Relay 2 Default: Battery Discharge - BD		
Pin	3	4	5	6	7	8	9	10	11
Signal	RLY4-C	RLY4-R	RLY4-O	RLY3-C	RLY3-R	RLY3-O	RLY2-C	RLY2-R	RLY2-O

	Alarm and Control Inputs							
	Group Standby-TR Plant Battery Test		**Remote LVLD C Open**		**Remote LVLD A Open**		**Emergency Power Off**	
Pin	17	18	28	12	29	30	31	32
Signal	GSTR_RTN	GSTR	RO4_RTN	RO4	RO2	RO2_RTN	EPO_RTN	EPO
	Aux. PMJ Alarm Input				**Remote LVLD B Open**		**Remote LVBD Open**	
Pin	1	2			13	14	15	16
Signal	AUX_PMJ_RTN	AUX_PMJ			RO3	RO3_RTN	RO1	RO1_RTN

The "-R" extensions in the Form-C output table represent the return or common lead of the Form-C alarm contact. "-O" is opened on alarm contact with respect to "-R". "-C" is closed on alarm contact with respect to "-R". Alarm Relays 1-4 are asserted based upon controller configuration. Severity relays Power Minor and Power Major are also assigned to events defined in controller configuration. Note: the controller has an alarm test feature located in the control/operations menu of the front panel that allows the form-c alarm contacts to be asserted one at a time. This feature can be used to test the physical alarm connections between the NX400 controller and the site monitoring system.

Inputs "RO1 – RO4" and their associated returns are used to accept a dry contact closure. Upon receiving a dry contact closure the associated LVD will open and remain open as long as the contact closure is present. Once the contact closure is removed, the state of the contactor will be determined by the system controller.

"EPO" and its associated return are used to provide a Remote Emergency Power-Off feature. Upon receiving a dry contact closure, the system controller will open the LVBD disconnecting the batteries from the system. The batteries will remain disconnected as long as the contact closure is present. Once the contact closure is removed, the system controller will determine the state of the battery contactor. Note: This lead can be run to RO1 to provide a redundant EPO function in case of a controller failure.

"GSTR" and its associated return are used to perform the Remote Rectifier Group Standby feature. A dry contact closure applied on this signal will place the assigned rectifiers into standby. These rectifiers will remain in Standby until the contact closure is released or the system DC bus voltage falls below the Rectifier On Threshold which assumes the system is in a deep discharge. Note: The Group Standby feature must be enabled for this rectifier feature to work. If it is not enabled, these signal leads revert to the traditional Plant Battery Test (PBT) feature. The QS841A_NX1 has the feature enabled but no rectifiers assigned. It is left to the user to define the rectifiers to be placed in standby when this feature is asserted.

When wiring to the terminal block can be any solid or multi-strand wire between 16 to 28 AWG. All Form-C contacts are rated for 60VDC at .5A. All inputs require a dry contact closure or a closure to the negative DC system bus potential, Vbus-, on each respective non-Return lead of the appropriate signal.

RJ45 connector P2 is utilized for connectivity to the QS873A One-Wire temperature probes and ES771A Remote Mid-string Voltage Modules.

Figure 4-9 also shows a spade lug identified as Fuse Alarm Major. External distribution or an alarm that assert a contact to battery (the negative battery voltage) may be monitored using an appropriate connection to this lug. A Major fuse alarm shall be generated.

Table 4- D: NX400 Input/Output Alarms And Control

PIN	Alarm I/O	Alarm I/O Description	Wire Color
1	Aux_PMJ_Rtn	External Contact to generate Power Major alarm	Green/Black Stripe
2	Aux_PMJ	External Contact to generate Power Major alarm return	Black/Green Stripe
3	RLY4-C	Relay #4, Normally Closed contact	Orange/White Stripe
4	RLY4-R	Relay #4, Common/Return contact	Orange/Red Stripe
5	RLY4-O	Relay #4, Normally Open contact	Orange/Black Stripe
6	RLY3-C	Relay #3, Normally Closed contact	White/Orange Stripe
7	RLY3-R	Relay #3, Common/Return contact	White/Brown Stripe
8	RLY3-O	Relay #3, Normally Open contact	White/Slate Stripe
9	RLY2-C	Relay #2, Normally Closed contact	Brown/White Stripe
10	RLY2-R	Relay #2, Common/Return contact	Brown/Red Stripe
11	RLY2-O	Relay #2, Normally Open contact	Brown/Black Stripe
12	RO4	External Contact to Open LVLD3	Yellow/Blue Stripe
13	RO3	External Contact to Open LVLD2	Black/Blue Stripe
14	RO3_Rtn	External Contact to Open LVLD2 return	Blue/Black Stripe
15	RO1	External Contact to Open LVBD	White/Blue Stripe
16	RO1_Rtn	External Contact to Open LVBD return	Blue/White Stripe
17	GSTR_Rtn	External Contact to place rectifier group in standby	Green/Red Stripe
18	GSTR	External Contact to place rectifier group in standby return	Red/Green Stripe
19	RLY1-C	Relay #1, Normally Closed contact	Red/Orange Stripe
20	RLY1-R	Relay #1, Common/Return contact	Red/Brown Stripe
21	RLY1-O	Relay #1, Normally Open contact	Red/Slate Stripe
22	PMN-C	Power Minor Relay, Normally Closed contact	Black/Orange Stripe
23	PMN-R	Power Minor Relay, Common/Return contact	Black/Brown Stripe
24	PMN-O	Power Minor Relay, Normally Open contact	Black/Gray/Strip
25	PMJ-C	Power Major Relay, Normally Closed contact	Slate/White Stripe
26	PMJ-R	Power Major Relay, Common/Return contact	Slate/Red Stripe
27	PMJ-O	Power Major Relay, Normally Open contact	Slate/Black Stripe
28	RO4_Rtn	External Contact to Open LVLD3 return	Blue/Yellow Stripe
29	RO2	External Contact to Open LVLD1	Red/Blue Stripe
30	RO2_Rtn	External Contact to Open LVLD1 return	Blue/Red Stripe
31	EPO_Rtn	External EPO Contact to Open LVBD	Green/White Stripe
32	EPO	External EPO Contact to Open LVBD return	White/Green Stripe

Thermal Compensation/1-Wire Connections

The NX400 frame system is factory equipped with external battery temperature monitoring, slope thermal compensation, mid-string voltage monitoring and other battery management features. This equipment includes QS873A VT-Probes and ES771A Remote Mid-String Voltage Monitoring Modules.

Figure 4-10 depicts the NX400 with four battery shelves wired for mid-string voltage imbalance detect and thermal compensation features. A single temperature is measured from each battery string for thermal compensation features. The negative post of the battery located at the "voltage" center of the string contains the single QS873 thermal probe which provides the mid-string voltage and temperature measurement information to the system controller.

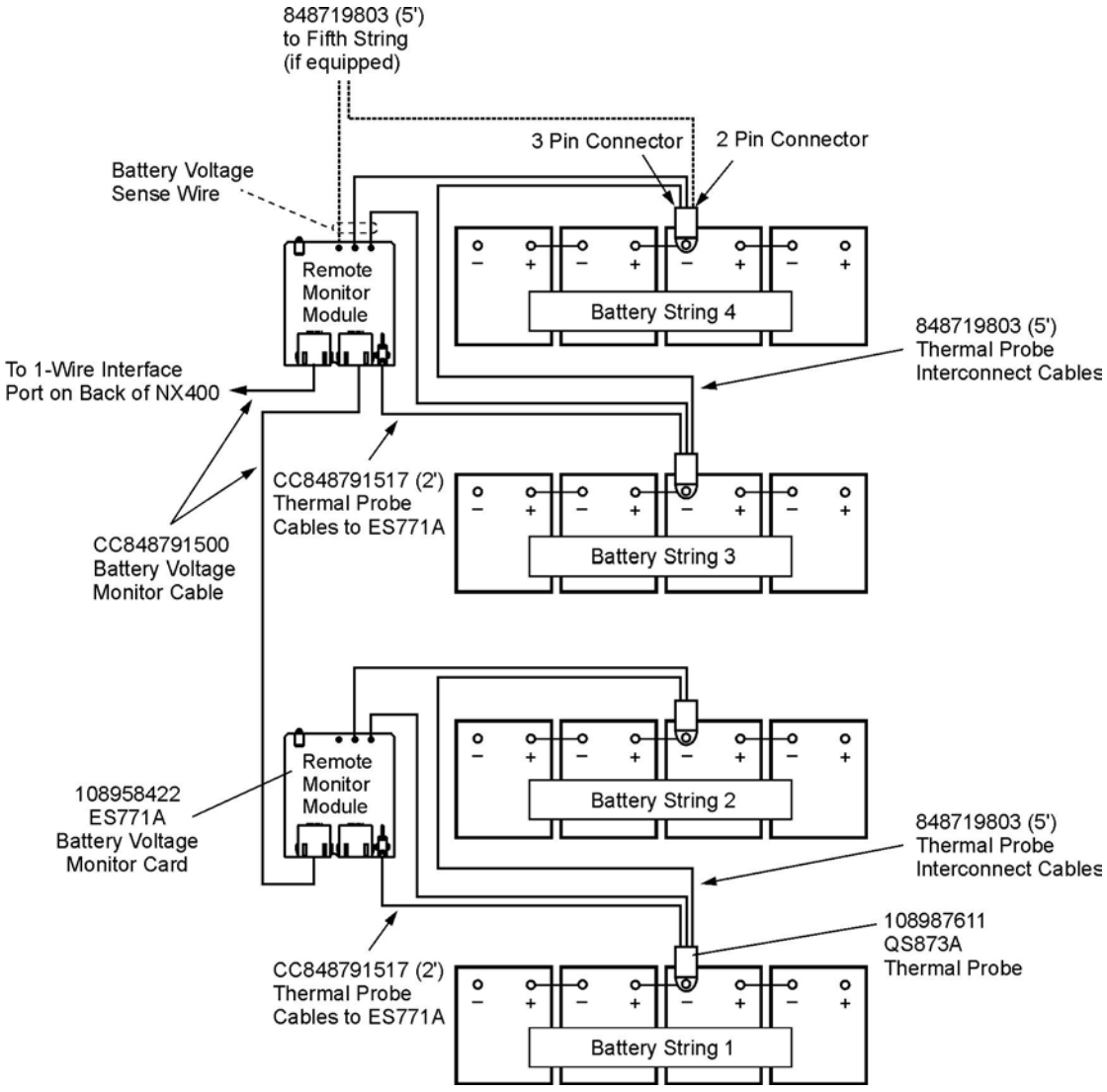


Figure 4-10: Standard NX400 Frame System VT-Probe/Battery Voltage Monitor Connections to Controller, 1 Probe per String

Installation Of QS873A VT Probes And ES771A Mid-String Voltage Monitoring Modules

Although QS873A VT temperature probes are factory installed, probes can be added or replaced in the field. The following information is applicable to installations utilizing the NX400 in a customer specific frame or when a fifth battery shelf is added to the NX400 and battery temperature or mid-string voltage monitoring is required.

Figure 4-10 depicts the components and cable assemblies required to measure a single temperature and a mid-string voltage per battery string for a four string reserve backup. Additional 1-Wire probes and mid-string voltage modules can be added as shown in Section 7. It is left up to the end-user to determine the number of battery temperature probes required in custom systems. Only one is required for thermal compensation features. The controller automatically recognizes the VT-probes and Mid-string voltage modules. The number of registered temperature probes and the highest battery temperature monitored may be checked from the front panel by scrolling down the menu at *Menu*►*Status*►*Batteries*. The fields are "Temp Probes ()" and Highest Temp () where () contains the number of devices communicating in the system as well as the highest battery temperature. The number of registered mid-string voltage modules and the voltages being measured can also be found at *Menu*►*Status*►*Batteries* and *Menu*►*Status*►*Batteries Mid-String Monitor*, respectively**.** Thermal management parameters may be modified using the controller's interfaces.

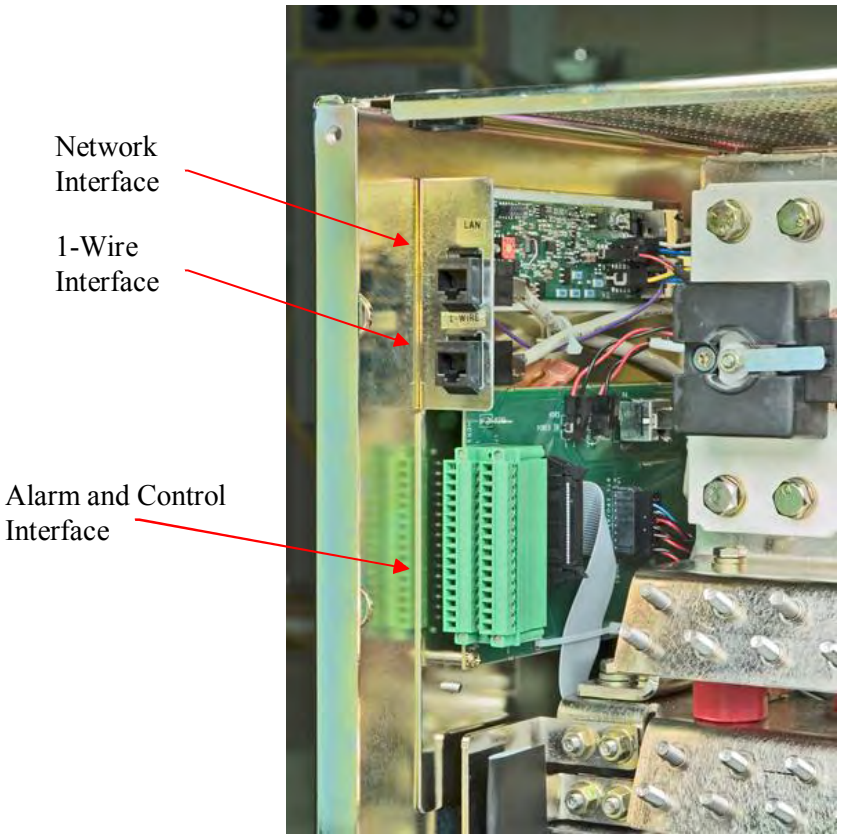


Figure 4-11: Standard NX400 Frame System Network, 1-Wire, and Input/Output Alarm And Control Interface

Network Connectivity

NX400

Figure 4-14 depicts the network interface and Craft port implementation. A Network Interface Card (NIC) works with the QS841A_NX1 system controller to provide two separate Ethernet connections. One connection is accessed from the rear of the system and is dedicated to remote SNMP network management. This connection is 10Base-T. The second port is accessible from the front of the system and serves as the local Craft port. This connection is 10/100Base-T.

LAN Port

The NIC is the standard EBW Gateway card with custom application and web page software for operation in the NX400 system. This card communicates with the QS841A over an asynchronous serial port and converts the information to appropriate SNMP data over a 10Base-T port RJ-45 connection located at the rear of the system. This network management connection supports standard protocols like SNMP, TCP/IP, FTP and Telnet. The NIC also has the ability to serve up web pages to a remote PC using a standard web browser. Connectivity between the NIC and the QS841A system controller is achieved through a RS232 connection made between standard DB-9 connectors J2 on the NIC and J3 on the QS841A. The ANSI standard T1.317 protocol is utilized as the communication protocol between the devices.

Connection to the LAN is made by attaching standard Cat-5 cable at the RJ-45 LAN connector at the rear of the unit. The cable should be dressed up and out of the system to the appropriate 10Base-T LAN connection.

Craft Port

The QS841A_NX1's 10/100Base-T Ethernet capability is utilized for the Craft port in the NX400. This craft port is supported by the operating in DHCP (Dynamic Host Configuration Protocol) Server mode. This mode of operation allows a user to connect an external PC directly to the port and use the PC's standard Web browser to access the system. While operating in DHCP Server mode, the controller should **never** be plugged into the building or surrounding LAN.

To access the system using the Craft Port follow the following basic procedure:

Step	Action
1	Find and take note of the controller's Working IP (WIP) on the front panel display by going to ***Menu►Status►Network Settings► Port 1***
2	Attach the LAN cable between the Craft port RJ45 on the front of the system to appropriate Ethernet port on the Craft PC.
3	Open the PC's browser and enter the controller's WIP as the destination address. This address should be http://192.168.2.1. The QS841A_NX1 has HTTP capabilities and should begin to return appropriate system representative web pages.
4	Using a standard browser, a login page similar to that depicted below should be served up by the QS841_NX controller. There are three levels of access through the Craft port; Read-Only, Read/Write, and Read/Write with password management privileges. Passwords defaults for the Craft port as well as other remote access means default as follows: **Access** — **Default Password** User (Read-Only) — usernx400 Super-User (Read/Write) — super-user Administrator (Read/Write/Password Administration) — adminnx400

These defaults can be changed by a user of administrator privileges.

Figure 4-12: Login Web Page

After the controller has granted access through the Craft port, the controller serves up a Home page similar to that shown below. Front panel access and capabilities are a super-set of the functions and features available through the Craft port. Configuration of individual parameters and features can be performed by using the items located in the "Settings" tab or a general quick configuration of the system can be performed through the "Installation" tab.

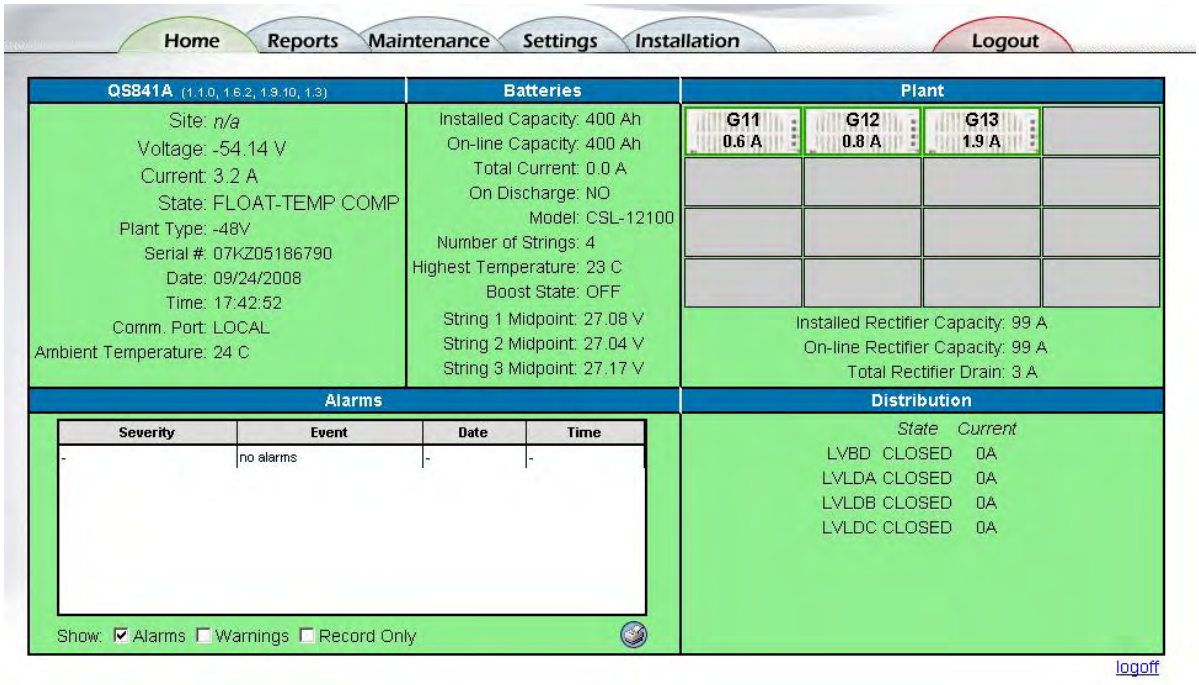
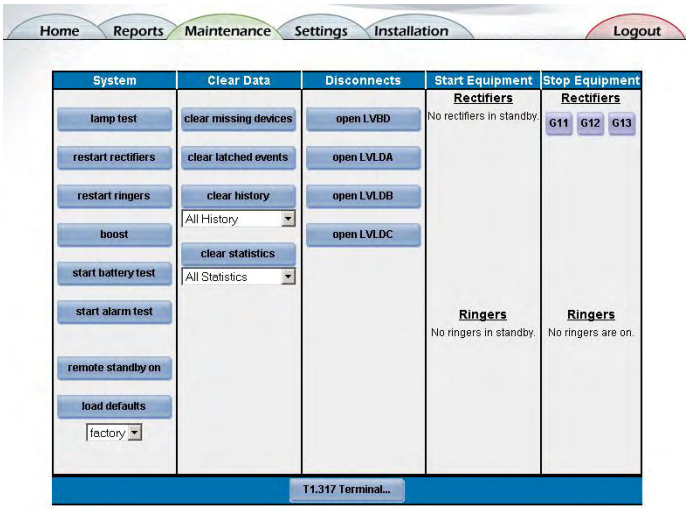
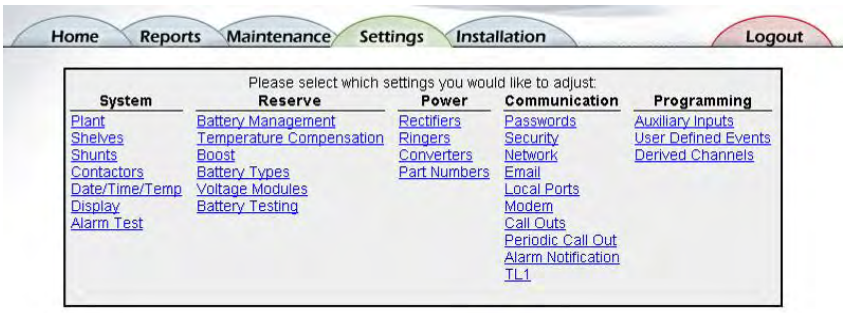
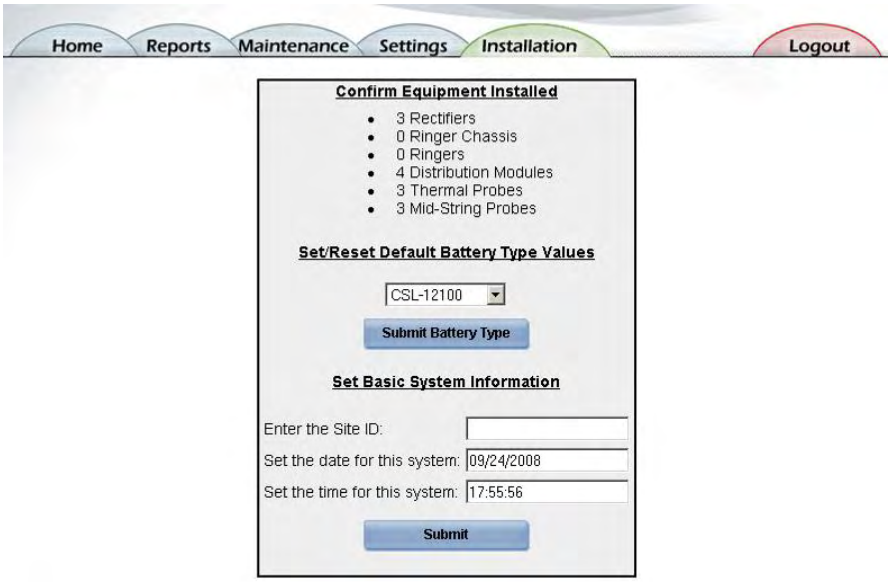


Figure 4-13: Craft Port Home Page

The Home Page has tabs that are partitioned as the following:

Home	Main login page that shows representative graphic of the plant. The graphic will depict the number of shelves, rectifiers in place with their appropriate outputs, empty slots, and indicate which rectifiers are in alarm. High-level summary for the Batteries, Distribution, Alarms present, and controller summary are shown. There are also quick link tabs that take you to specific features. These tabs are the Home, Reports, Maintenance, Settings, and Installation.
Reports	The reports tab displays reports that the system controller can display through web pages. These reports include Event History, Inventory, Statistics, Trends, and Battery on Discharge.
Maintenance	Allows remote access to Control/Operation commands assessable through the front panel. These include restarting rectifiers/ringers, starting alarm or battery tests, asserting boost, clearing history and statistics, clearing latched events and missing equipment, placing rectifiers/ringers in and out of Standby. 
Settings	Items in this menu are used to configure all the individual system parameters, features, and thresholds. These fields are arranged by System, Reserve, Communication and Programming. 

Installation	This tab allows a quick configuration of the primary items that need to be set for a site. These items include selecting the battery type, date, time, and the site ID mentioned during the front panel configuration start-up section.



Web pages will be improved for usability as well as for features. The best method of understanding the functions and features available through the Craft port is by clicking on the individual items and exploring to become more familiar with the items. More details on the front panel capabilities and Craft port web pages are found in the controller section.

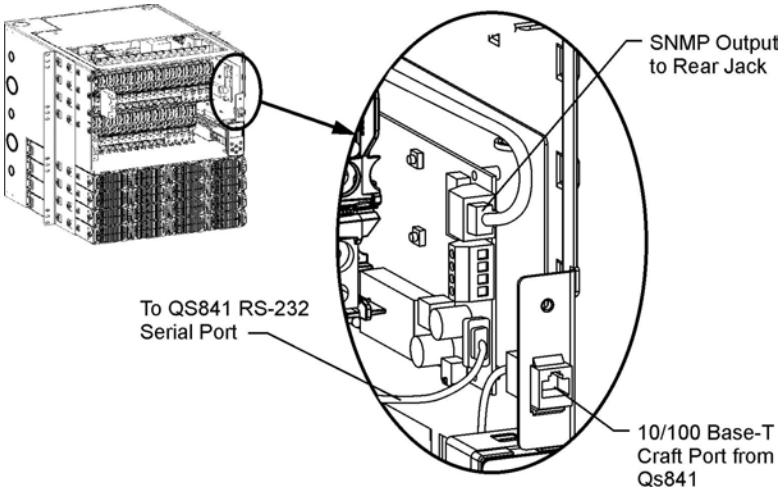
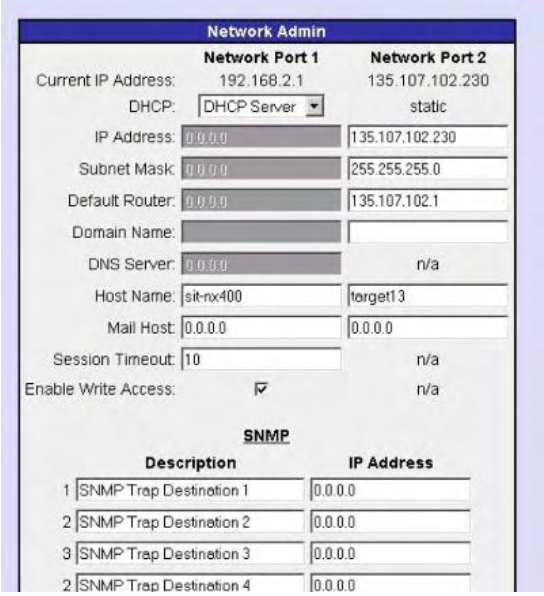


Figure 4-14: Gateway Communication Connectors

Gateway Network Management Port Configuration

In order to utilize SNMP or other network management protocols through the LAN connection located to the rear of the system, the EBW NIC has to be configured with the appropriate network parameters including a static IP address. Additional details concerning the functionality of the EBW1 can be found in its respective product manual.

Step	Action
1.	Obtain network parameters from the corporate network administrator. The following Network Configuration Parameters must be obtained from your Network Administrator before starting: Note: Host and Gateway may be optional. • Static IP address for the power system • Subnet mask • Host Gateway/Router IP address • Host name
2	Connect a PC or Laptop to the craft port using administrator privileges. Go to **Settings►Communication►Network** to configure Network Port 2 parameters shown above. 
3	Press the "submit" button to enter and save the configuration. Verify that the configuration was saved as desired.
4	Once configuration has been completed and approximately 1 minute of time has elapsed, observe the LEDs on the EBW Gateway • Yellow Status LED: OFF • Green Status LED: ON • Link LED: ON • XMIT/RCV: May be blinking The NX400 is ready to communicate over the network.

More Advanced Configuration

The NX400 system has been factory programmed with customer specific or industry standard defaults. These default configurations can be modified using the front panel Craft interface, the network connection protocols, or locally through the front panel. Although not recommended for the NX400 system, a temporary terminal connection to DB-9 connector J3 as shown in Figure 16 below along with Lineage Power's Windows based EasyView program can be used to easily view and modify system configurable parameters and features. Configuring in this manner requires temporary disconnection of the NIC from the system since it utilizes J3. Once local terminal activities are complete, the NIC connection to the system controller must be re-established. Details on the functions and alarms of the system controller can be found in section 5 and in Appendix B.

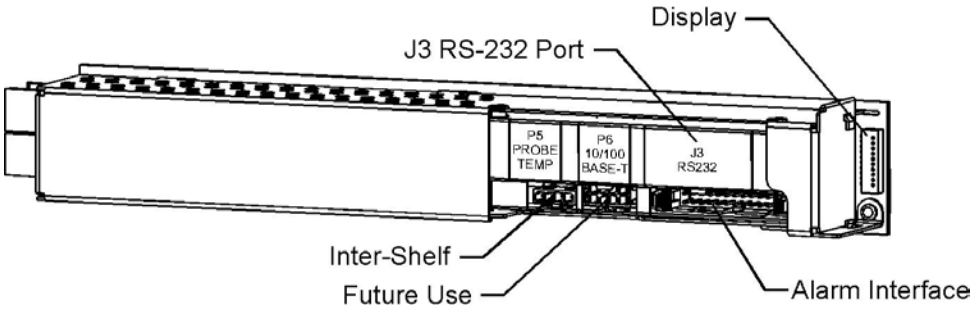


Figure 4-15: System Controller Local Terminal Interface

5 QS841A_NX1 System Controller

Overview

The QS841A_NX1 controller is a custom configured QS841A for NX400 system. It provides system monitoring and control features, as well as office alarm outputs from rectifiers, LVD boards, and remote modules. This section describes the controller features, functions and alarms from perspective of a user utilizing the front panel display. All these features are available through Web pages accessible from the craft port. The controller content in the web pages is arranged differently due to the available large space that comes with a screen. However, the majority of the information content, commands, and configurable items remain the same as those on the front panel. This section focuses on describing the controller from the front panel perspective which is applicable to respective feature implementation in the web pages.

Controls and Display

Figure 5-1 shows the front panel controls and display of the controller.

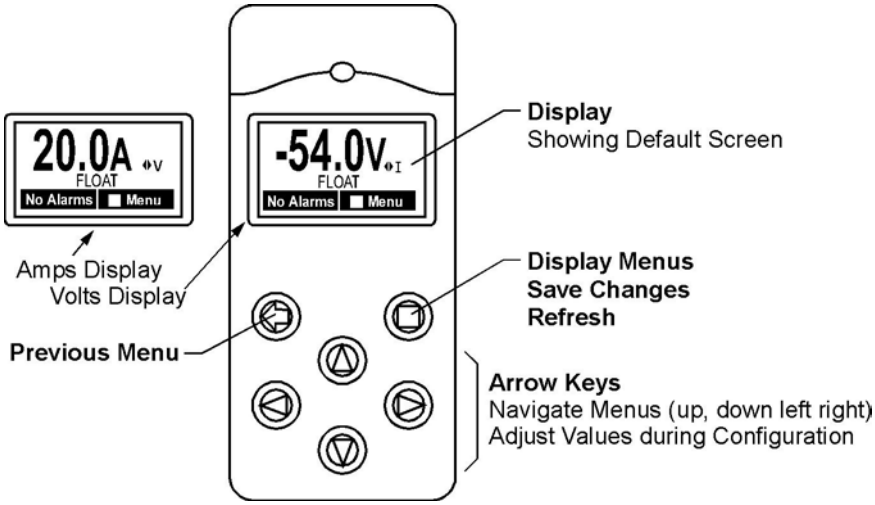


Figure 5-1: QS841A Controller Faceplate

The backlight of the four-line LCD display as well as the status LED located above the LCS changes color to reflect the system alarm status as follows:

Green Normal

Amber Minor Alarms Present

Red Major Alarms Active

The up and down arrow keys can be used to adjust screen contrast when the controller is displaying the default screen. Contrast adjustment is also available through the menus at *Menu►Configuration►System Settings*. At the default menu, the left and right arrows are also used to toggle the display from displaying the system voltage or the system load current.

Otherwise, the left and right arrow keys are used to navigate the menus and the up and down arrow keys are used to change values when configuring the system. A black box highlighting a menu item indicates that the item has sub-menus.

Connectors

Figure 5-2 shows a side view of the controller unit.

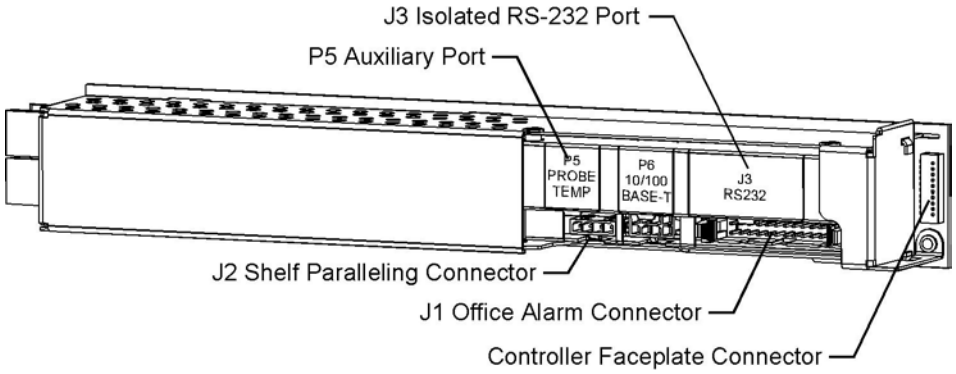


Figure 5-2: QS841A_NX1 Controller Unit Side View

A ground referenced RS-232 connector (J3) is utilized in the NX400 to communicate with the EBW Network Interface Card known as the Gateway to provide a second Ethernet port for SNMP or remote power systems management. This port is compatible with Lineage Power Galaxy Manager or other SNMP based programs used for web-based remote access and network management. This serial port can also be used to provide local access or for a connection to an external modem in non-NX400 systems.

Connector P6 is brought out to the RJ45 attached at the front of the unit. This port serves as the Ethernet Craft port and allows standard Web browsers to be used for accessing the controller. Connector P5 is routed to the bottom RJ45 attached to the rear of the unit. This port is used for the 1-Wire battery management options. J1 provides all the office alarms that are brought out to the rear terminal blocks of the unit. Included in this alarm interface are six Form-C alarm relays. Two are pre-assigned as Power Major (Impaired) and Power Minor (degraded) alarm relays. The four remaining relays are available as user-definable alarms and have been predefined for this NX400 application.

Front Panel Menu Structure

The software is functionally divided on the Main Menu into the following categories:

Alarms

Warnings

Status

Control/Operations

History

Configuration

PIN

The QS841_NX1 has the ability to restrict certain access from the front panel of the unit. It incorporates a four-digit Power Identification Number (PIN) on the front panel for certain control/operations and configurable items. The default PIN password is **2006**. Each position of the password is configurable between 0-9. The password can be configured from the remote interfaces by a user with Administrator privileges. The front panel PIN feature can be Enabled or Disabled through the remote interface by a user with Administrator privileges.

The PIN is required for items that generally are not functions of a typical maintenance routine. It is assumed that the majority of the configured thresholds and system operational features will not be changed through a maintenance routine. Thus, they require entering the correct PIN in order for the parameter or feature to be modified in the field. These same rules are implemented when accessing through the Craft port. There are some Control/Operations that also require the PIN shown below.

1. Clear History
2. Clear Statistics
3. Disconnects – Manual disconnect/reconnect of any LVLD/LVBD
4. Enter Boost

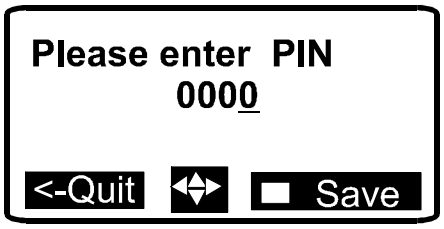
Other Control/Operations features listed below do not require PIN access.

1. Lamp Test
2. Restart Rectifiers
3. Uninstall Equipment
4. Start Battery Test
5. Start Alarm Test
6. Load Factory Defaults

All configuration items from the front panel require PIN access except for the following:

1. Battery Type
2. String Battery Capacity (AH)
3. Number Of Battery Strings
4. Manual Discharge Test Type
5. Manual Test Duration
6. Manual Test Check Battery Alarm Voltage Threshold
7. Battery Test Rectifier Voltage
8. System Date Format
9. System Date
10. System Time Format
11. System Time
12. Automatic Daylight Savings Feature
13. Display Contrast
14. Temperature Display Units
15. Alarm Test Feature
16. Alarm Test Relay Duration and Relay

The QS841_NX1 is programmed to associate the necessity of a PIN to the specific operation or configurable parameter. A sample screen like that following is required for PIN access.



The up, down, left and right arrows are used to enter the appropriate password. Upon entering a correct PIN the following momentary screen shows up and then disappears leaving the user at the menu location prior to entering the PIN. The QS841A_NX1 has a factory default of **2006** for the PIN.

Once a user enters the PIN, total front panel access is allowed for:

- As long as the user remains in menus other than the default menu and/or
- The default display has remained on the front panel for more than user configurable time-out value. The QS841A_NX1 has a factory configured default of 120 minutes. This time is adjustable between 1-120 minutes in 1 minute increments. 120 minutes is the factory default for the QS840A_NX1.
- An internal counter shall be kept and reset if the user leaves the default menu and returns to others menus before the time-out period is reached.

The following figures show a menu flow map for each primary category along with the settings and operations found in each. , and are followed by brief descriptions of the menu items. **Alarms** and **Warnings** are not hierarchal mapped and are presented in chronological order of occurrence when they are present. “No Active Alarms” or “No Active Warnings” will be displayed when they are no alarms or warnings detected by the controller.

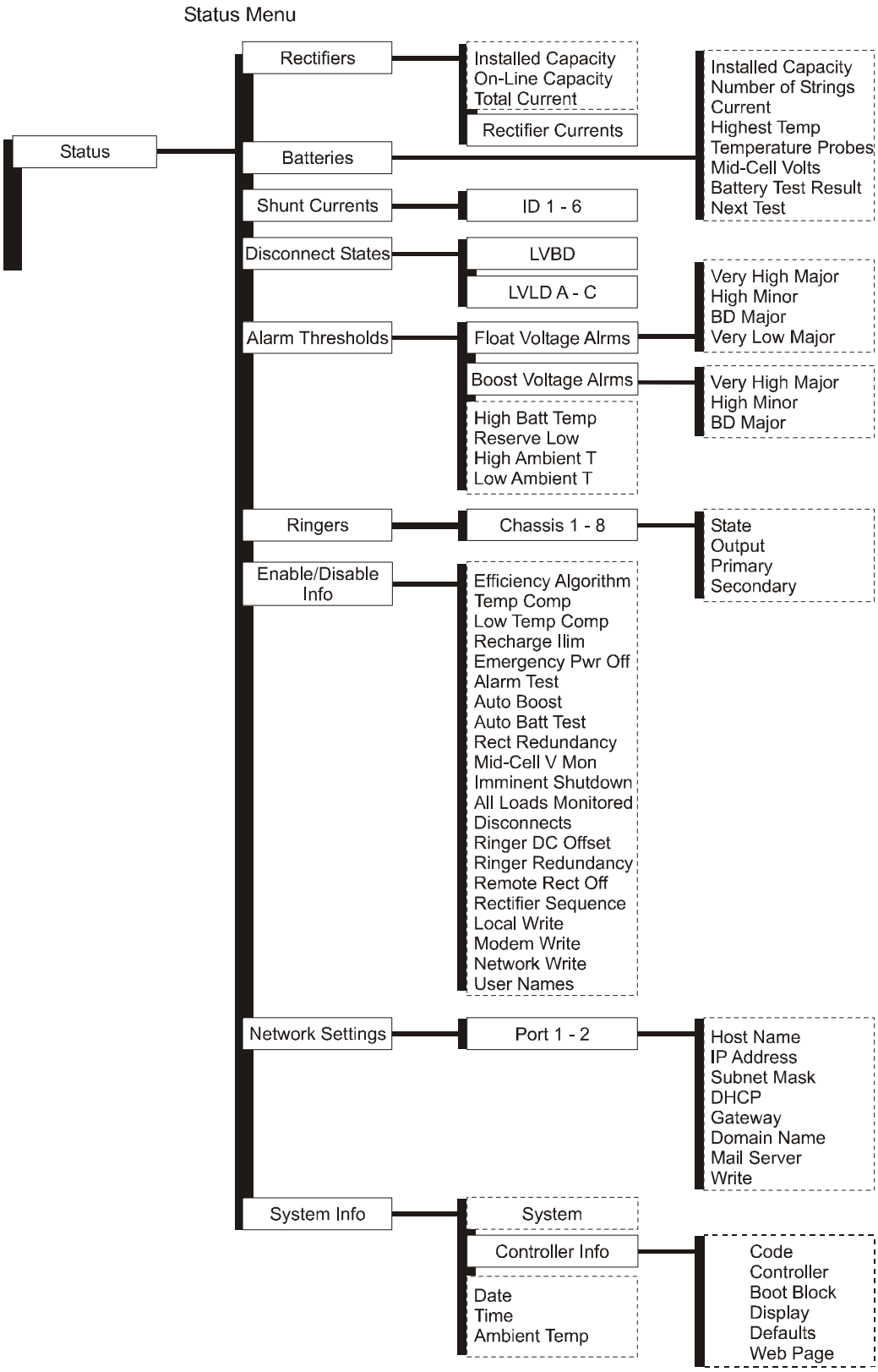


Figure 5-3: Status Menu

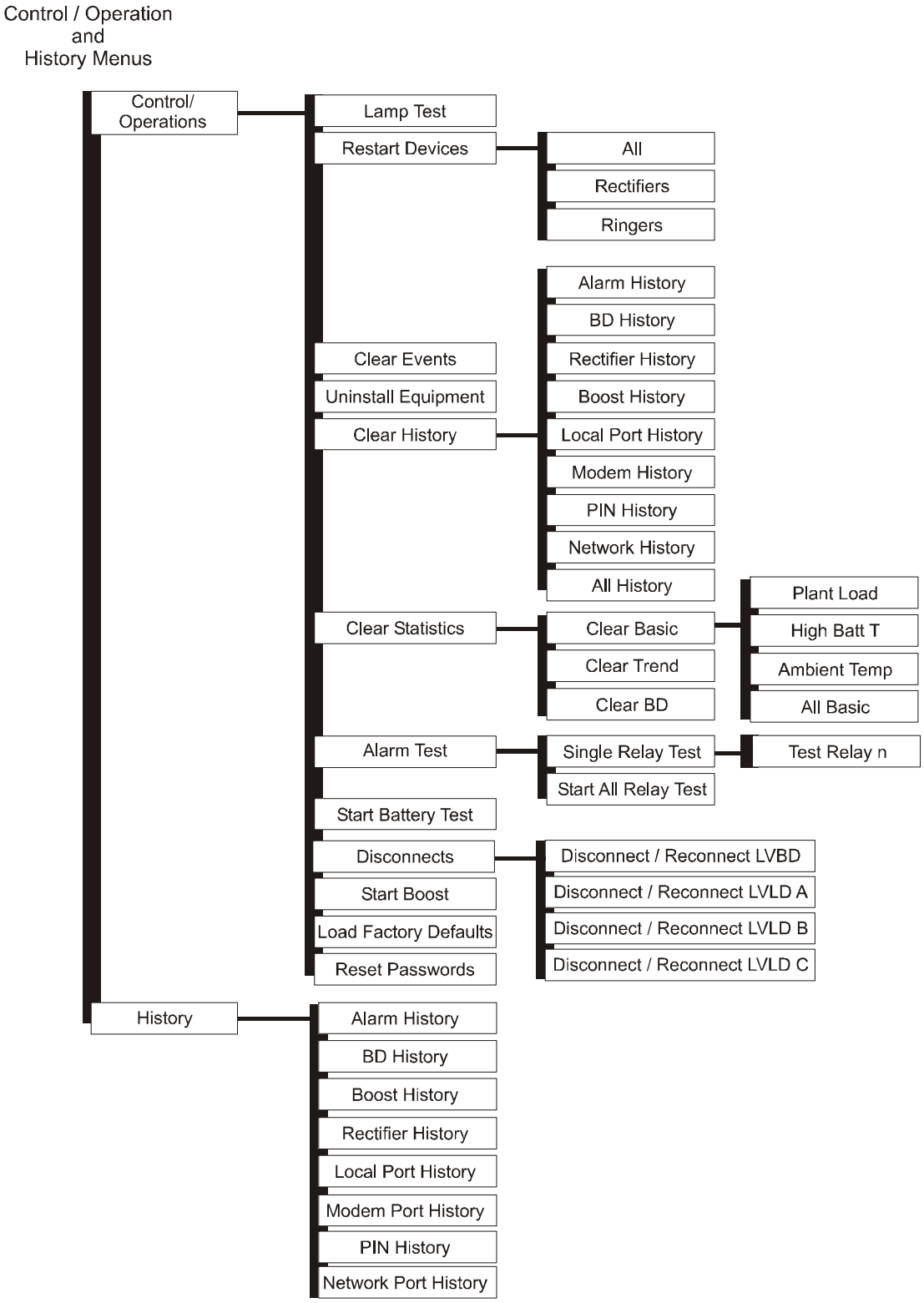


Figure 5-4: Control / Operations and History Menus

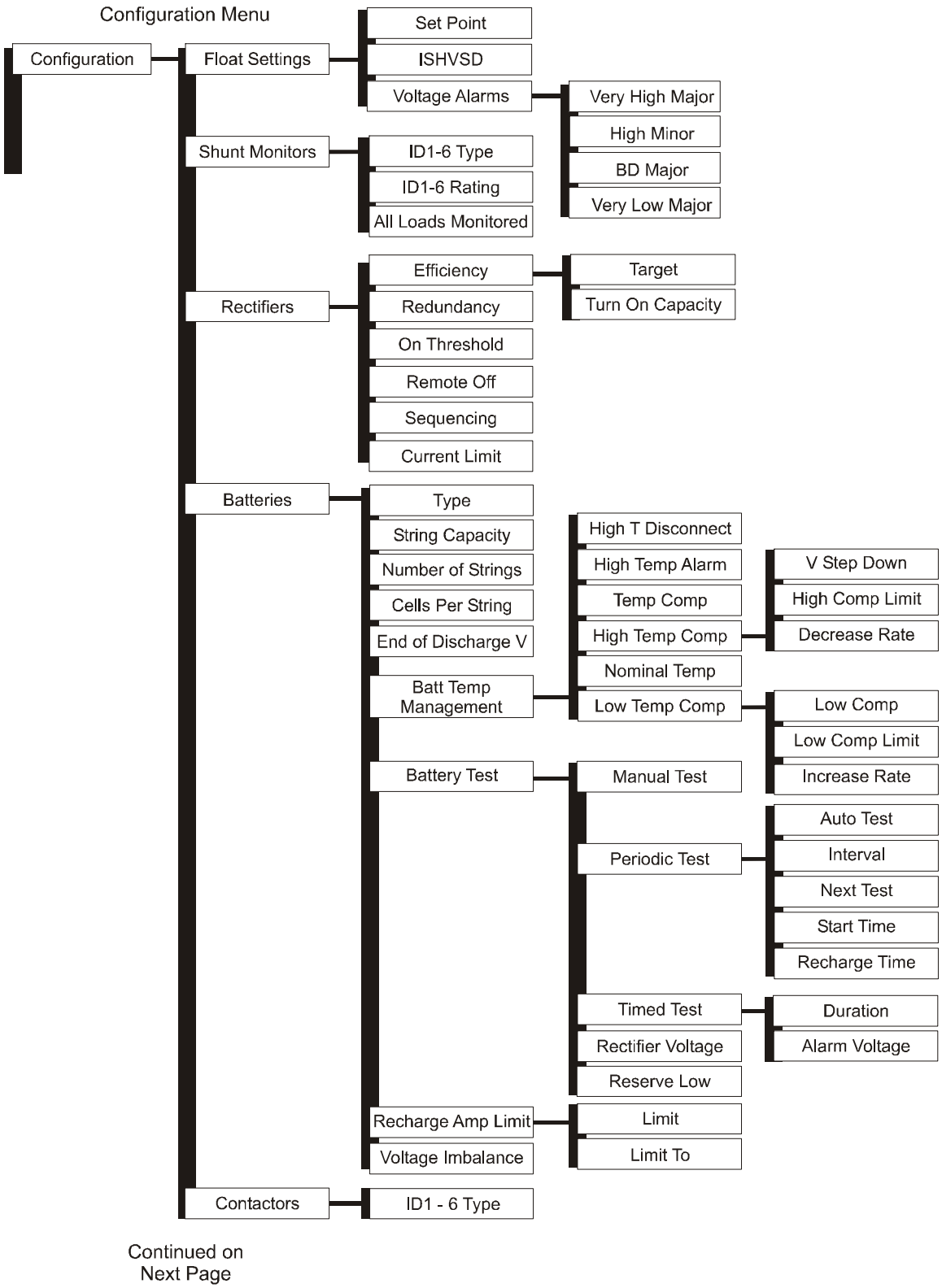


Figure 5-5: Configuration Menu (part 1)

Configuration Menu
(continued)

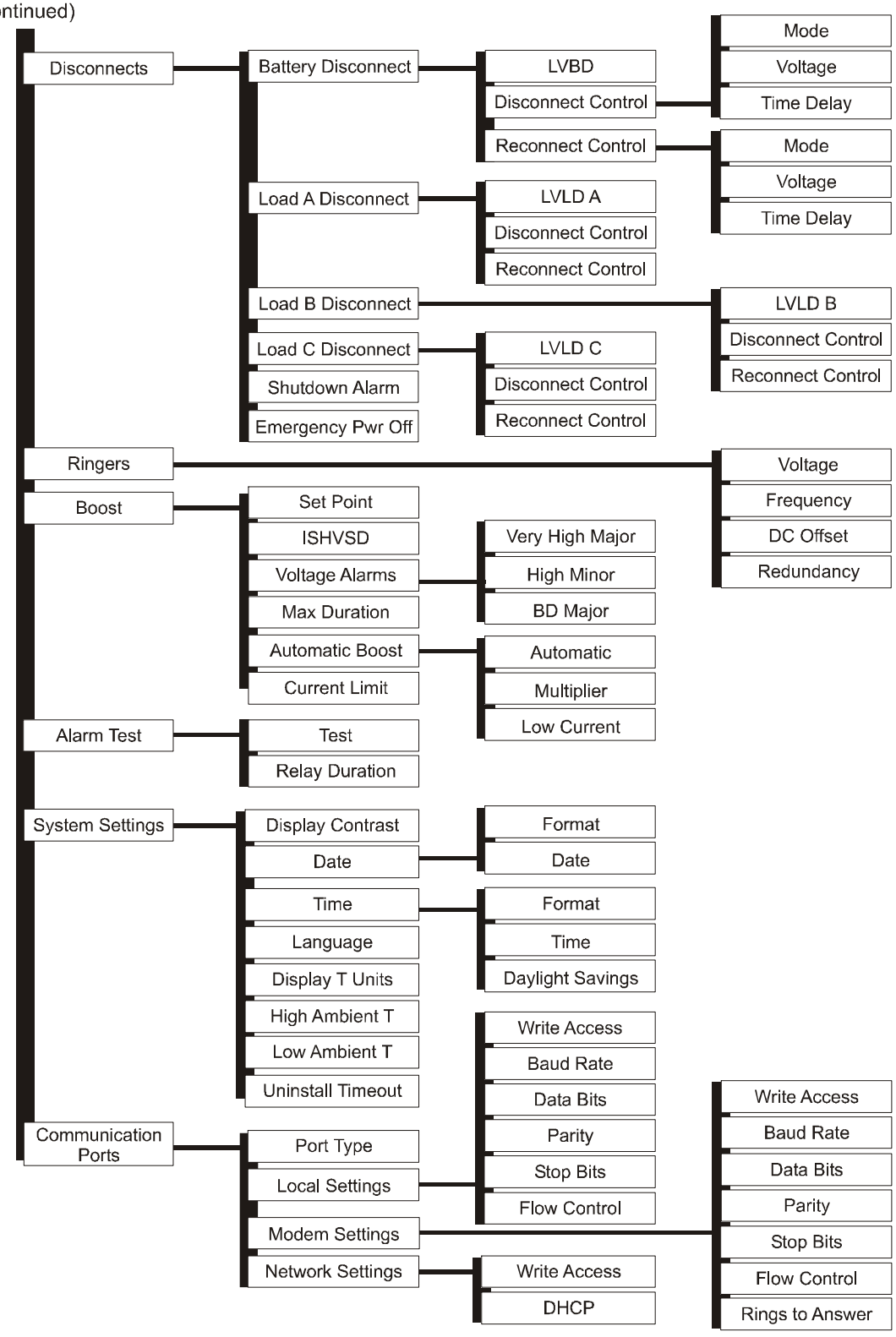


Figure 5-6: Configuration Menu (part 2)

Status

This area of the menu system provides an overview of system components, threshold settings, and feature configuration. No configuration is possible from the status portion of the menu system. Equivalent items are available through the craft or remote port web pages.

Rectifiers

Information such as the total installed rectifier capacity in the system, total on-line rectifier capacity in the system (those producing power), total output current of all rectifiers, and the individual rectifier output currents by rectifier number (Gmn) are available. "m" represents the shelf number and "n" represents the rectifier position number in that shelf.

Batteries

The following battery information is available under Status:

Installed Capacity	User entered system battery capacity in AH for a string. AH rates are 8-hour rates. This data is automatically entered for specific battery models included in the controller configuration.
Number Of Strings	The total number of battery strings installed in the system.
Current	Current flowing into or out of the batteries.
Highest Temp	Highest battery temperature being measured by the thermal probes.
Temp Probes	Number of installed thermal probes.
Mid-Cell Volts	Number of installed Mid-cell voltage measurement modules.
Battery Test Result	Shows whether the most recent battery test was completed, and the last reserve time.
Next Test	The date of the next automatic battery discharge test. The automatic discharge test feature must be enabled for this to work.

Shunt Currents

Up to six shunt measurements can be displayed through appropriate Distribution Control and Monitoring modules. The NX400 is equipped with four QS871 distribution control and monitoring modules. These modules are used to monitor one total battery current and each of the three Load bus currents.

Disconnect States

The status of the LVBD (Low Voltage Battery Disconnect) and LVLDA-C (Low Voltage Load) disconnects are displayed in this menu. "None" is displayed for each contactor that is not configured to be present in the system. In the normal NX400 system state, all contactors should show "Closed". A state of "Open" will be showed for contactors that have been disconnected.

Alarm Thresholds

This section of the menu shows the present alarm threshold settings in xx.xV format. These values are set by factory default but can be individually configured in the field. Appendix B and C provide additional details on factory settings.

Float Voltage Alarms	Very High Major, Very High Minor, BD Major and Very Low Major
Boost Voltage Alarms	Very High Major, High Minor, and BD Major
High Batt Temp	Highest temperature being measured by the thermal probes
Reserve Low	Low battery reserve time alarm
High Ambient Temp	High ambient temperature alarm
Low Ambient Temp	Low ambient temperature

Ringers

The NX400 does not contain ringers. However, the QS841A has the capability of managing eight ringer chassis in a system. The ringer states and output VA would be available when ringers are present in the system.

Enable-Disable Info

This section of the menu displays the enable/disable status of some of the QS841A_NX1 features. These values are set by factory default but can be individually configured in the field. Appendix B and C provide additional details on factory settings.

Efficiency Algorithm	Adaptive Rectifier Efficiency algorithm
Temp Comp	Temperature compensation
Low Temp Comp	Low temperature compensation
Recharge Ilim	Recharge current limit
Emrgncy Pwr Off	Emergency Power Off (Remote Emergency Battery Disconnect). Enabled when contact closure is applied to the EPO inputs.
Alarm Test	Form-C Alarm Test Feature
Auto Boost	Automatic boost charge
Auto Batt Test	Automatic battery test
Rect Redund	Rectifier redundancy
Mid-Cell V Mon	Mid-cell voltage monitoring
Imminent Shutdn	Imminent system shutdown alarm (LVBD)
All Loads Monitored	All Loads are monitored using external shunts and external monitoring boards
Disconnects	LVBD (Low Voltage Battery Disconnect) and LVLDA-C (Low Voltage Load Disconnects)
Ringer DC Offset	Ability to reference the output of the ringer to a DC offset
Ringer Redund	Ringer Redundancy Alarm feature
Remote Rect Off	Remote Rectifier Off – Individual Remote Rectifier Standby
Rectifier Sequencing	Group Standby feature for selected rectifiers
Local Write	Whether or not the system can be configured through the local port.

Modem Write	Whether or not the system can be configured through the modem port.
Network Write	Whether or not the system can be configured through the network.
Usernames	Whether or not usernames and password identification has been enabled

Network Settings

This section of the menu displays the settings of the Network parameters for the two Ports. Port 1 is the Craft port and Port 2 is the LAN port.

Host Name	Network name assigned and configured for the QS841A since it acts as a repository for data and services such as e-mail, FTP, HTTP, etc that are accessed remotely by other equipment or users on the network.
IP Address *	Internet Protocol address assigned to the QS841A that identifies the unit on the network. The format for the IP address field is a 32-bit numeric address written as four numbers separated by periods (ddd.ddd.ddd.ddd). Each number, ddd, can be 0 to 255. When in the server mode, a user shall use 192.168.2.1 to access the controller through the craft port.
Subnet Mask *	Internal network address assigned for identifying an internal network mask that the QS841A has been assigned to by a network administrator. The mask selectively includes or excludes certain equipment on a Host. The format for the Subnet Mask field is a 32-bit numeric address written as four numbers separated by periods (ddd.ddd.ddd.ddd). Each number, ddd, can be 0 to 255.
DHCP	This field indicates the operational mode of the integrated Ethernet port. The port can be operating as a DHCP Client, Static Client, or a DHCP Server. DHCP Server is the default mode of operation for NX400 Craft port and Static is the default for the LAN port.
Gateway *	This address is for the address of the Gateway or node on the network that will serve as the entrance to another network for the QS841. This address should be the address of the equipment or computer that routes the traffic from and to the QS841 to the outside network. It is generally the proxy server. The format for the Gateway address field is a 32-bit numeric address written as four numbers separated by periods (ddd.ddd.ddd.ddd). Each number, ddd, can be 0 to 255.
DNS *	Address of the Domain Name Server that translates domain names into IP addresses. This field is of the format ddd.ddd.ddd.ddd.
Mail Server	The address for the computer or equipment within the network that will manage the QS841 e-mails. The format for the Gateway address field is a 32-bit numeric address written as four numbers separated by periods (ddd.ddd.ddd.ddd). Each number, ddd, can be 0 to 255. If configured as 0.0.0.0, the controller will use the hostname “mail host”.
Write Access	This field shows whether the port has bee configured to allow Read/Write access or Read Only access. Read/Write access is available when the feature has been enabled.

* This field is automatically assigned when using the DHCP server or Client mode of operation.

System Info

This section of the menu displays various high level system statuses.

Controller Info	Provides software versions for overall controller, boot block, display, and web pages. It also provides the file used for factory defaults along with its version number. For the NX400, the display is of the format (vNX.d.d).
Date	System controller present date using configured format.
Time	System controller present time using configured format.
Ambient Temperature	System controller present temperature of its on-board sensor using configured format.

Control/Operations

The following are the system control and operation functions that can be performed from the front panel. These operations are generally used in post installation and maintenance modes.

Start Lamp Test	Temporarily illuminates all status indicators of attached rectifiers, distribution monitoring and control modules and the system controller.
Restart Devices	Provides the ability to restart "All" system serial controlled rectifiers and/or ringers at once. Also provides the ability to individually reset only rectifiers or ringers at a time. Does not affect rectifiers, ringers, and other system devices that are already functioning.
Clear Events	Used to clear momentary events or alarms. It clears the following system alarms: Check Battery, Reserve Time Low, Battery Voltage Imbalance
Uninstall Equipment	Clears alarms related to the removal of a system component such as a rectifier, thermal probe, or voltage monitoring module.
Clear History	This area of the menus system can be used to clear the various items that the controller maintains history records. Once cleared the controller begins to keep history of new events. **Alarm History** Operation to only clear alarm event history. **BD History** Operation to only clear BD network access history. **Rectifier History** Operation to only clear rectifier event history. **Boost History** Operation to only clear Boost event history. **Local Port History** Operation to only clear local port access history. **Modem History** Operation to only clear Modem port access history. **PIN History** Operation to only clear PIN access history. **Network History** Operation to only clear network access history. **All History** Allows a single command operation to clear all history records from the QS841.
Clear Statistics	This area of the menus system can be used to clear the various items that the controller maintains statistical records. Once cleared the controller begins to keep new statistical data. **Clear Basic -** This operation allows the user to clear individually or as a group the Basic statistical data kept on Plant Load, the highest battery temperature, and ambient.

	Clear Trend - This operation allows the user to clear the trend data kept on the plant load. **Clear BD -** This operation allows the user to clear the Battery on Discharge (BD) statistics kept on the plant load and voltage during discharge.
Alarm Test	Initiates the Form-C alarm test by asserting each of the configured Form-C alarms at the configured alarm interval.
Start Battery Test	Initiates the manual battery test feature. A stop battery test operation is displayed to interrupt the testing and return the unit to normal operation. The manual battery test utilizes the configured test duration and a system bus voltage threshold to represent the end of reserve.
Disconnects	Provides individual manual control of the four Low Voltage Disconnects (LVBD, LVLDA-C) for maintenance purposes.
Enter Boost Mode	Initiates the manual battery Boos feature. A stop battery Boost operation is displayed to interrupt the Boost operation mode and return the unit to normal operation.
Load Factory Defaults	This operation allows a user to bring back all factory defaults with a single operation. Caution should be used when applying this command. Previous configuration changes will be overwritten.
Reset Passwords	Resets user, super-user and administrator passwords back to standard defaults.

History

This area of the menu system contains event history information. The controller works on a first record in first record out once the record size of a specific field is reached. The following system history logs are available:

Alarm History	Chronological view of the last 256 alarms and events that have occurred since the last time the history log was cleared.
BD History	Chronological view of the last 16 battery on discharge (BD) events since the last time the history log was cleared.
Boost History	Chronological view of the last 16 times the system entered boost mode since the last time the history log was cleared.
Rectifier History	Chronological view of the last 256 rectifier alarms and events that have occurred since the last time the history log was cleared.
Local Port History	Chronological view of the last local terminal logins that have occurred since the last time the history log was cleared. The number of these events counts towards the total number of Modem, Network, PIN, and Local port events which can be up to 48 events.
Modem Port History	Chronological view of the last Modem port logins that have occurred since the last time the history log was cleared. The number of these events counts towards the total number of Modem, Network, PIN, and Local port events which can be up to 48 events.
PIN History	Chronological view of the last Front Panel access that required password entry. The number of these events counts towards the total number of Modem, Network, PIN, and Local port events which can be up to 48 events.
Network Port History	Chronological view of the last Network access events that have occurred since the last time the history log was cleared. The number of these events counts towards the total number of Modem, Network, PIN, and Local port events which can be up to 48 events.

Configuration

This area of the menu system is where system operational parameters, system device information, and alarm thresholds are set up. These items have been pre-configured for the NX400 applications. Factory defaults provided are for the QS841A_NX1 controller. ***Note***: The controller requires time to update sectors in its flash memory when changes are made. Please allow approximately 2 minutes for the controller to accept and place the modifications in non-volatile memory before removing power to the unit.

Float Settings

Set the system float voltage and the thresholds for the following alarms:

Set Point	System Float Voltage set-point adjustable from -42.0V to -56.5V with a factory default of -54.0V.
ISHVSD	Value for Rectifier Internal High Voltage Shutdown threshold during the Float mode of operation. Value is configurable between 52.00 and 60.00 volts. Factory default is 56.50V. This feature is compatible to specific rectifiers. It is not valid with the CP1800 rectifiers.
Very High Voltage Major	Alarm occurs and the unit is shut down when the system detects voltage above its set threshold. The threshold can be set from -50V to- 60V in 1V increments. The factory default setting is -58V.
High Voltage Minor	Alarm indicates an abnormally high output voltage but does not shut the unit down. The alarm threshold can be set from -50V to -60V in 1V increments. The factory default setting is -56V.
BD (Battery on Discharge) Major	Alarm occurs when the system is operating either completely or partially on battery power. The alarm threshold can be set from -46V to -55V in 0.1V increments. The factory default setting is -51.0V.
Very Low Voltage Major	Alarm indicates an imminent system shutdown due to discharging batteries or low output voltage. The alarm threshold can be set from -40V to -51V in 0.1V increments. The factory default setting is -46.0V.

Shunt Monitors

The QS841A_NX1 utilizes RS485 serial communication to external distribution monitoring and control boards for shunt measurements and contactor control. Up to six external boards can be controlled by the controller. The NX400 utilizes four external QS871A control and monitoring modules to monitor distribution currents and control low voltage disconnect contactors. These boards are identified by assigning them an address and an appropriate operation. Four shunt currents are measured in the NX400; 1 battery and 3 loads.

Each individual QS871A is uniquely addressed by an appropriate ID setting and assigned to an operation Type. The available Types are: Battery, Load, and None. Shunt sizes for each assigned battery or load type must also be configured. All shunts are assumed to have a voltage rating of 50mV. The current rating of each shunt is programmable between 0 to 9999A. The QS841A_NX1 has been appropriately pre-configured in the factory for the right shunt values and assignments for the NX400. Following are the fields that need to be programmed.

ID1-6	The operation "Type" of each shunt monitoring circuit on system distribution boards 1-6 must be assigned based upon actual system implementation. The operational Type may be: None (For no shunt), Battery (Monitoring battery currents), and Load (for load currents). The factory default is Battery.
ID1-6 Rating	The current rating of each shunt being monitored by the system distribution boards 1-6 must be configured based upon actual system implementation. All shunts are assumed to be 50mV. The current rating may be from 0-9999 Amps. The factory default is 600A for load shunts and 800A for the battery.
All Loads Monitored	This is a feature used if all load shunts are monitored. Enabling this feature displays the sum of all assigned load shunts to the system load. The factory default for this feature is Disabled.

Defaults

The NX400 with its four LVDs and associated QS871As come factory configured as:

ID1	Type: Battery	Shunt: 800A
ID2	Type: Load (Primary or Load A)	Shunt: 600A
ID3	Type: Load (Secondary or Load B)	Shunt: 600A
ID4	Type: Load (Critical or Load C)	Shunt: 600A

Note: ID5 and ID6 are defined as "None". With "None" no currents are displayed and shunt configuration has no affect.

Rectifiers

The following features pertaining to rectifiers can be configured:

Efficiency	An algorithm that when enabled automatically manages the number of rectifiers in the system to meet the needs of the load while using configured rectifier efficiency targets to place rectifiers into Standby as well as an capacity exceed threshold that will put a rectifier in service that is in Standby when the load increases. The Efficiency Target capacity has a range of 20-95% with a default of 70% and a Efficiency rectifier Turn On threshold with a configurable range of 25-100% and a default of 76%. The feature is Disabled from the factory.
Redundancy	An alarm is automatically generated when the rectifier capacity On-line in the system falls below N+1 based on the present system load. The factory default for this feature is Enabled.
Rectifier On Threshold	The system DC bus threshold that rectifiers placed into Standby will automatically be turned on. This value can be set between -40 and -50V. The factory default is -44.0V
Remote Standby	Provides the ability to disable or enable the capability of placing a rectifier into Standby operation through remote means such as the network, modem, or local terminal. The factory default for this feature is Disabled.
Rectifier Sequencing	A function when enabled that allows a group of user defined rectifiers to be placed into Standby at one time. Factory default is Disabled.
Current Limit	Adjustable from 30-110%. At 100% or greater the rectifier will output its nameplate rating and truly act as constant power rectifiers. Settings below 100% will be current limited to that percentage of the rectifier's name plate current rating. The CPL1800 does not recognize this setting and runs at full capacity.

Batteries

This section provides all the configurable items associated with batteries and battery management. Configuration of these items have been customized and tailored in the QS841A_NX1 for NX400 applications.

Battery Type	The type of batteries used in the system and can be set for the following battery types: • BC-12V110FT • TEL12-105F • SLF-12105 • CSL-12170 • CSL-12100 • SE48S63 • SE48S80 • L48V60FTX 60AH (Li-ELiTE) • Generic VRLA (Valve Regulated Lead Acid) • Generic FLOODED (flooded lead acid) • Generic NiCd (Nickel Cadmium) • Generic Li-LMP (Lithium Metal Polymer) • Generic Li-ELiTE (Lithium ELiTE) Once selected the user has the opportunity to automatically accept the standard defaults for all battery Type related features. Parameters such as float voltage, float alarms, thermal compensation parameters, etc. are automatically adjusted if defaults are accepted. The system factory default is CSL-12100.
String Capacity	Capacity of an individual battery string in the system which is used to derive the total installed system battery capacity. This value has to be entered for "Generic" battery types but is automatically configured for specific battery models. The available range is 0-9999 AH. The system factory default is 100 AH corresponding to the CSL-12100.
Battery Strings	The total number of battery string installed in the system entered by the user for inventory purposes and initial reserve time calculations. This value is automatically configured when using smart lithium batteries. Available range is 0-16. The NX400 system factory default is four strings of CSL-12100 batteries.
Cells Per String	Value that defines the number of internal battery cells that comprise a string. This value is configurable between 1 and 75 and has a factory default of 48. The value is used for Slope Thermal Compensation.
End of Dchrg	The user defined system bus voltage at which the batteries are considered to be at the end of their reserve capability for manual battery testing (End of Discharge). This end-of-discharge voltage is used for automatic and opportunistic reserve time calculations. It has a range of -36.00 to -48.00V. The system factory default is -44.00V.
Battery Temp Management*	This section includes all the parameters required for thermal management of the batteries. These items include the ability to enable/disable thermal compensation for high and low temperatures and set the slope decrease and increase rates, respectively. There is also a "High Temperature alarm threshold", "High Temperature Disconnect" feature. Thermal compensation features are factory defaulted Enabled. This corresponds to the CSL-12100 application.
Batt Test*	This section includes all the parameters required for battery testing through manual or automatic means. Configuration for manual test duration and the system test end-voltage for manual battery test are here along with the interval,

	start date, start time, time from last battery on discharge BD, and enable/disable for periodic battery test. The rectifier voltage during battery discharge testing and system reserve time low alarm threshold are also available. Automatic battery testing is factory disabled.
Recharge Amp Limit	Enable or disable battery recharge limiting and set recharge current limit. Recharge current limit is factory Enabled at 50A. Range 5-1000A
Voltage Imbal	User defined voltage threshold for a mid-string voltage imbalance alarm. Range 1.4 - 3.0 Volts. Factory default is 1.7V. This alarm is only generated after batteries have been sitting on float for a minimum of 12 hours and the total battery current is less than 3A.

*See Appendix A for detailed descriptions of the Thermal Compensation and Battery Test features and parameters.

Contactors

QS871A boards are assigned to LVD contactor control by appropriately configuring a unique board ID to a specific contactor function. The QS841A_NX1 assigns board to IDs 1-5 to LVDs. Each unique ID number is assigned as follows: ID 1 to LVBD (Low Voltage Battery Disconnect), ID2 to LVLDA (Low Voltage Load Disconnect A-Primary Load A), ID3 to LVLDB (Low Voltage Load Disconnect B – Secondary Load B), and ID4 to LVLDC (Low Voltage Load Disconnect C – Critical Load C). Each of these assignments has its own unique programmable parameters. ID4-ID6 have been assigned to "NONE". Selecting NONE removes the ability of that particular QS871A to control and external LVD.

Disconnects

This section of the configuration menu contains the parameters associated with the individual function assignments made in the previous section. Each LVD type (LVBD and LVLDA-C) can individually be enabled or disabled. All are enabled in the QS841A_NX1. The LVD's disconnect and reconnect method of operation used by the controller can be configured for each assignment. The method of disconnect or reconnect can be based on the traditional means of reaching a system bus voltage threshold (***Voltage***) or based on both reaching the system bus voltage threshold and an elapsed time from once the system has been placed on discharge (BD) and at least two or more rectifiers are reporting AC failures (***Voltage/Time***). The same Voltage and Voltage/Time mode of operation can also be selected for reconnecting LVDs. In this case the elapsed time configured is the time from once the reconnect voltage threshold has been reached. Note: selecting "None" for a reconnect mode will require manual intervention to shut the contactor. Selecting "None" for the disconnect mode will not allow a LVD to open. ***The NX400 System*** has factory defaults of the following:

LVBD (Enabled)	Disconnect Mode (**Voltage**); Range: Voltage, Voltage/Time, None Disconnect Voltage (**-41.5V**); Range: -39 to -50V Time Delay (**0 min**); Range: 0-300min Reconnect Mode (**Voltage**); Range: Voltage, Voltage/Time, None Reconnect Voltage (**-48.0V**); Range: -39 to -55V Time Delay (**0 sec**); Range: 0-300sec

LVLDA (Enabled)	Disconnect Mode (**Voltage/Time**); Range: Voltage, Voltage/Time, None Disconnect Voltage (**-43.9V**); Range: -39 to -50V Time Delay (**0 min**); Range: 0-300min Reconnect Mode (**Voltage/Time**); Range: Voltage, Voltage/Time, None Reconnect Voltage (**-49.0V**); Range: -39 to -55V Time Delay (3**0 sec**); Range: 0-300sec
LVLDB (Enabled)	Disconnect Mode (**Voltage/Time**); Range: Voltage, Voltage/Time, None Disconnect Voltage (**-45.0V**); Range: -39 to -50V Time Delay (**15 min**); Range: 0-300min Reconnect Mode (**Voltage/Time**); Range: Voltage, Voltage/Time, None Reconnect Voltage (**-49.0V**); Range: -39 to -55V Time Delay (**60 sec**); Range: 0-300sec
LVLDC (Enabled)	Disconnect Mode (**Voltage/Time**); Range: Voltage, Voltage/Time, None Disconnect Voltage (**-42.0V**); Range: -39 to -50V Time Delay (**0 min**); Range: 0-300min Reconnect Mode (**Voltage/Time**); Range: Voltage, Voltage/Time, None Reconnect Voltage (**-49.0V**); Range: -39 to -55V Time Delay (**15 sec**); Range: 0-300sec

Imminent Shutdown Alarm
The Imminent Shutdown Alarm is generated prior to opening the LVBD. Once the LVBD threshold has been reached, the alarm is generated. The alarm is issued 15 seconds prior to opening the contactor to provide an indication that system shutdown is imminent due to a system battery disconnect. The alarm is based on the configured LVBD battery disconnect threshold.

Remote Emergency Power Off (EPO)
Included in the Disconnect menu is the ability to Enable/Disable the remote Emergency Power Off (EPO) feature. If enabled, the controller will interpret a contact closure on the alarm terminal block interface to open the battery contactor. The battery contactor will open five seconds after the contact has been asserted. Once the contact is removed, the battery contactor will be re-asserted to its previous operational state.

Ringers

Although the NX400 is not equipped with ringers, the QS841A can manage up to eight ringer chassis. Ringer operation parameters: ringer output voltage (65-100VAC), output frequency (15-50Hz), whether it has remote DC Offset (Enabled/Disabled), and if the ringer chassis is operating in the redundant mode (Enabled/Disabled) are defined in this configuration menu.

Boost

The Boost function allows battery charging to be expedited by raising the system voltage to Boost level for a set time. The following boost mode parameters are set in this area of the menu system:

Set Point	Boost voltage (set point) is adjustable from -48.0V to -58.0V in 0.1V increments. The factory default setting is -54.0V.
ISHVSD	Value for Rectifier Internal High Voltage Shutdown threshold during the Boost mode of operation. Value is configurable between 52.00 and 60.00 volts. Factory default is 56.50V. This feature is compatible to specific rectifiers. It is not valid with the CP1800 rectifiers.

Voltage Alarms	High voltage alarm thresholds in effect while the system is in boost mode. The Very High Major alarm triggers shutdown of the faulty rectifier(s). This threshold can be set from -50V to -60V. The factory default setting is -58.0V. The High Minor alarm does not force rectifiers to shut down. The threshold can be set from -50 to -60V. The factory default setting is -56V. The Battery On Discharge alarm is low voltage alarm setting while in Boost that operates similar to that on Float. The threshold can be set from -46 to -55V. The factory default setting is -51V.
Max Duration	Duration the system can remain in boost mode can be set from 1 to 80 hours. The factory default setting is 5 hours.
Automatic	Enabled or Disabled the automatic boost feature. The factory default setting is Disabled.
Current Limit	The rectifier output current limit setting during the Boost mode of operation. This value is configurable between 30 and 100% with a factory default of 100%.

System Settings

Located here are the menus for configuring general system level settings.

Display Contrast	Allows display backlight intensity to be adjusted for contrast in local ambient light. Factory default is 50%.
System Date and Time	Sets system date and format. The format for date can be selected from: mm/dd/yyyy, dd/mm/yyyy, yyyy/mm/dd, mm-dd-yyyy, yyyy-mm-dd, dd-mm-yyyy, mm/dd/yy, yy/mm/dd, dd/mm/yy, mm-dd-yy, yy-mm-dd, or dd-mm-yy and the format for time can be 12HR/24HR format. The factory default is Date: mm/dd/yyyy and Time: 24HR.
Daylight Savings	Enable or disable. The factory default is Enabled.
Display T Units	°C or °F. The factory default is °C.
Language	Allows the selection of language displayed at the front panel. The selection is between English and a second programmed second language. Reserved for future implementation.
High Ambient T	High temperature alarm threshold that can be set from 35°C to 75°C. The factory default setting is 75°C.
Low Ambient T	Low temperature alarm threshold that can be set from -40°C to 10°C. The factory default setting is -40°C.
Uninstall Timeout	A time range to display the pop-up quick removal front panel screen that occurs when a rectifier is removed from the system. This field has a range of 0 to 60 seconds and a factory default of 15 seconds.

Communication Ports

Menus for configuring the following communication parameters:

Port Type	Set the communication port to either Local or Modem. Factory default is Local. This connection setting is required by the EBW in the NX400 system in order to provide the SNMP management port.
Local Port Settings	Provides the ability to Enable or Disable Write access to the controller, the ability to change system settings through the SNMP management or local port. The factory default setting is enabled. The baud rate, number of data bits, parity, number of stop bits, and flow control parameters for the port is also configurable. These parameters have been factory set to 9600, 8, none, 1, none, respectively, to facilitate communication between the QS841A_NX1 and the EBW NIC.
Modem Port Settings	Provides the ability to Enable or disable Write access, the ability to change system settings through the modem. The factory default setting is Enabled. The baud rate, number of data bits, parity, number of stop bits, and flow control parameters for the port is also configurable. Note: the initialization string of the external MODEM must be set in the controller. Factory default for the string is "AT&FEV&C1S0=0H". This string can be modified by utilizing EasyView or T1.317 commands through a local terminal connection. Consult technical field support if further assistance is required. Thee number of rings to be detected by the modem before it answers (Rings to Answer) can be set from 1 to 9. The factory default setting is 1.
Network Settings	The access type and the Dynamic IP addressing mode are set in this section. The Dynamic IP address mode sets the IP address operation mode of the Ethernet port on the QS841A. This port has been set to act in DHCP (Dynamic Host Configuration Protocol) ***Server*** mode in the NX400 in order to provide the Craft port located at the front of the system. The QS841A_NX serves up ***192.168.2.1*** which should be used as the destination address on the Craft. This configuration should not be changed in the NX400. The Static and Client modes of operation allow the QS841A's port to be configured to operate plugged into the network. Note: once this parameter is changed, the controller must be re-booted by removing power from the unit by removing and re-inserting the unit into the shelf. In addition, there is the ability to Enable or disable Write access for someone who is attached to the Craft port. The factory default setting is Enabled.

10/100 Base-T Craft Port

The Ethernet 10/100Base-T Craft port located at the front of the system is the other primary local user interface. All the Status, Control/Operation, Configuration, and other items described previously are valid for the respective items shown in the web pages. In addition to providing a top level Home view of the system depicted in section 4, additional information or configuration is available that is not available through the front

panel. Unlike the front panel interface which is limited structurally, the Web pages are more dynamic and will be enhanced over time. Thus, what is depicted here may not be exactly what is shown. Consult factory for latest upgrades.

Security Levels/Passwords

The QS841A_NX1 supports three levels of security from the craft port and other remote interfaces. The security levels are described in general below.

User security level:

- Can view almost every parameter in the system
- Can change only a few parameters
- Default password: ***usernx400***

Super-user security level:

- Can do everything the user can do
- Can change any configuration parameter in the system (except passwords)
- Default password: ***super-user***

Administrator security level:

- Can do everything the super-user can do
- Can change passwords
- Can upgrade controller software
- Default password: ***adminnx400***

Section 4 introduced local access using an Ethernet connection to the NX400 system's Craft port. The QS841A_NX1 supports many different features through its web interface. Following are a few other screen shots of features available through the craft port. Web pages will continually be enhanced. Consult appropriate Lineage Power personnel for additional details. Selecting the "Reports" tab produces the following screen.

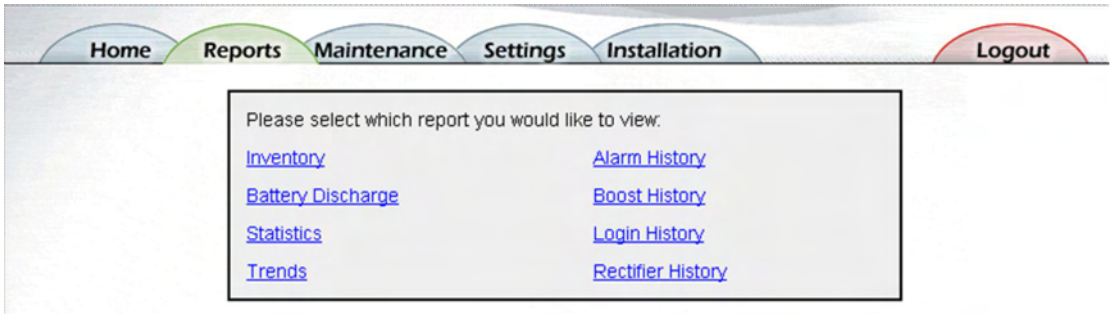


Figure 5-7: Reports Main Web Page

As an example, selecting "Inventory" from the "Reports" screen produces the following page.

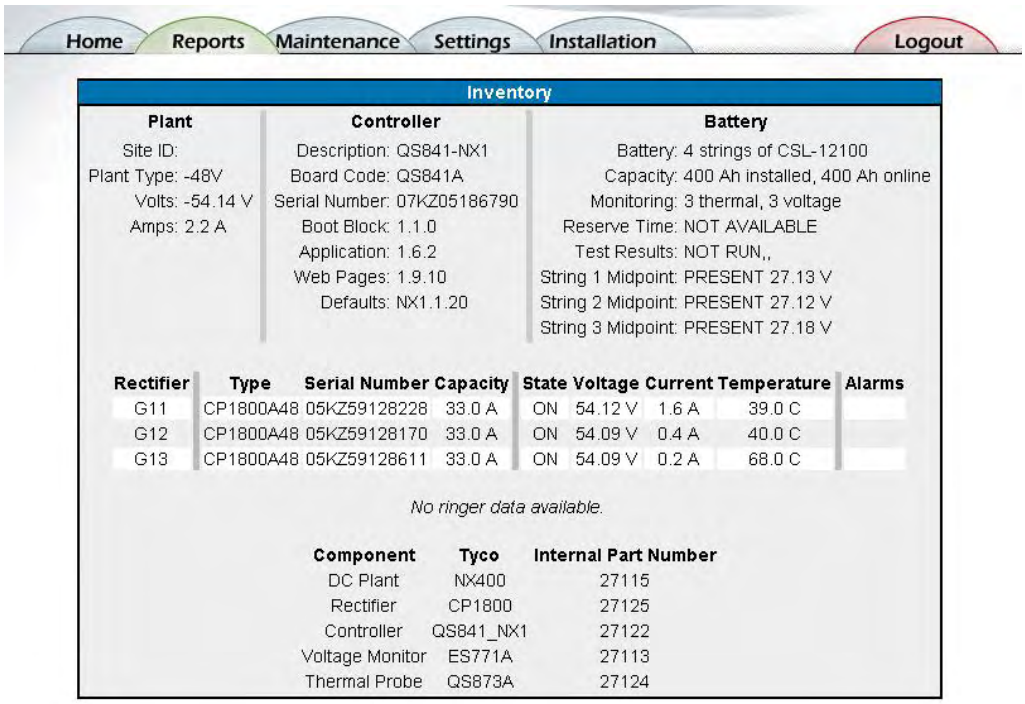


Figure 5-8: Report Inventory Web Page

Obtaining a chronological view of the alarm events is also available by selecting "Event History" from the reports screen produces the following page.

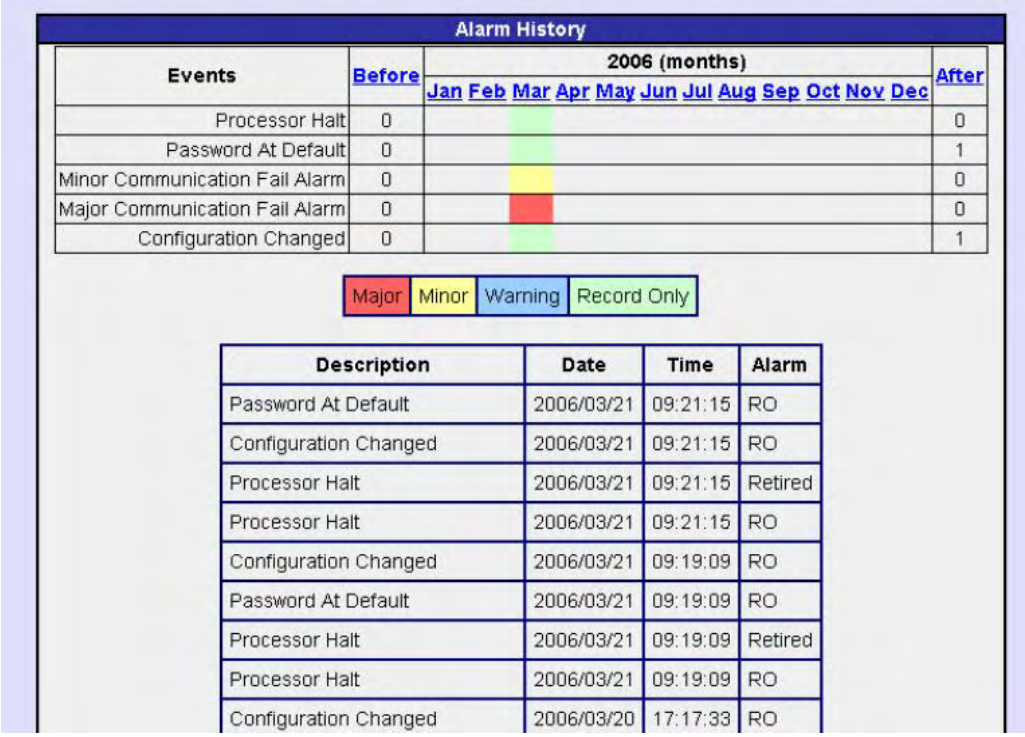


Figure 5-9: Report Event History Web Page

Selecting the "Maintenance" tab produces the following web page which allows various remote operations to be carried out.

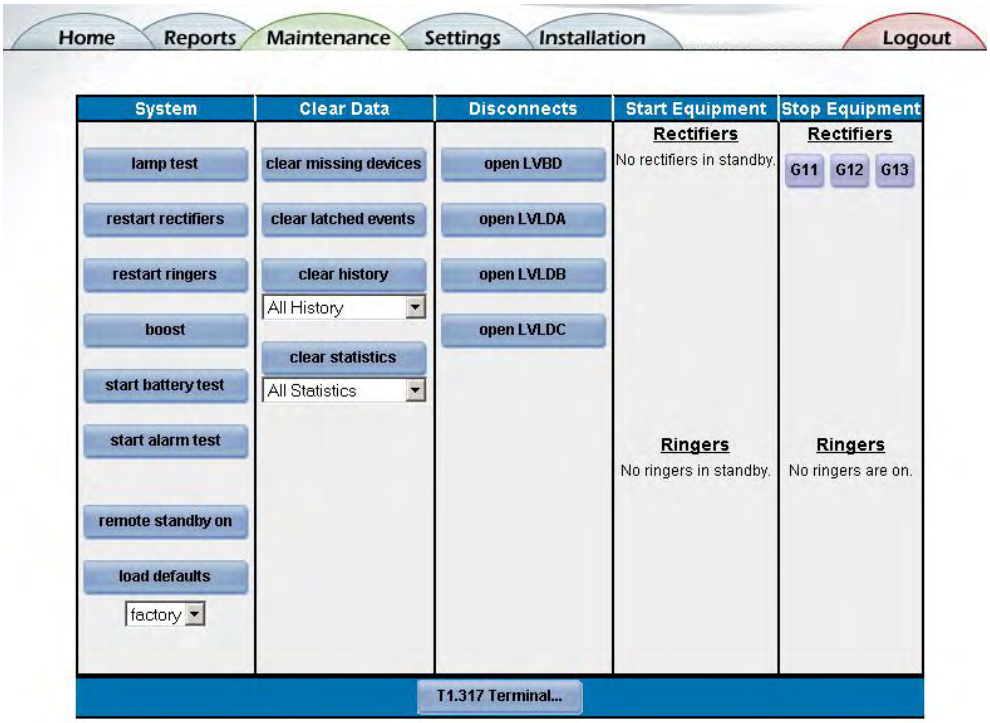


Figure 5-10: Maintenance Web Page

Selecting the "Settings" tab produces the web page from which configuration for all individual items can be performed.

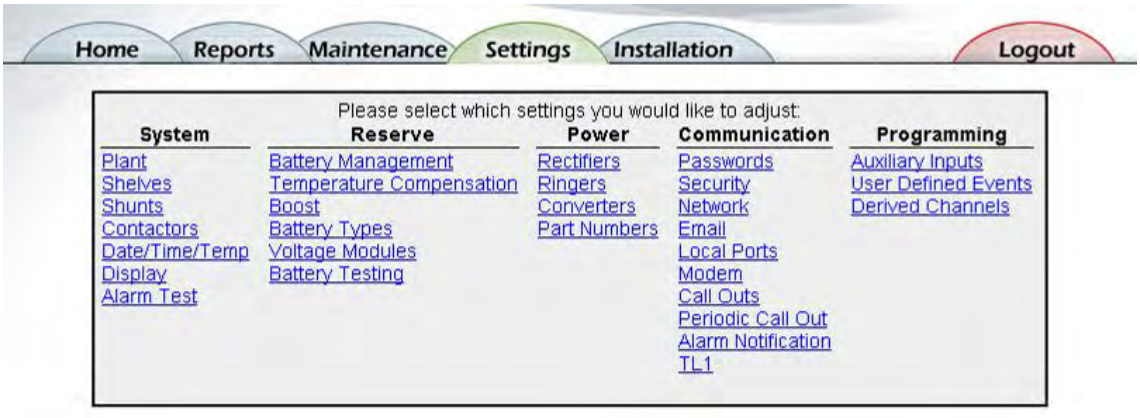


Figure 5-11: Settings (Configuration) Web Page

Selecting “Battery” in the “Settings” screen produces the following web page:

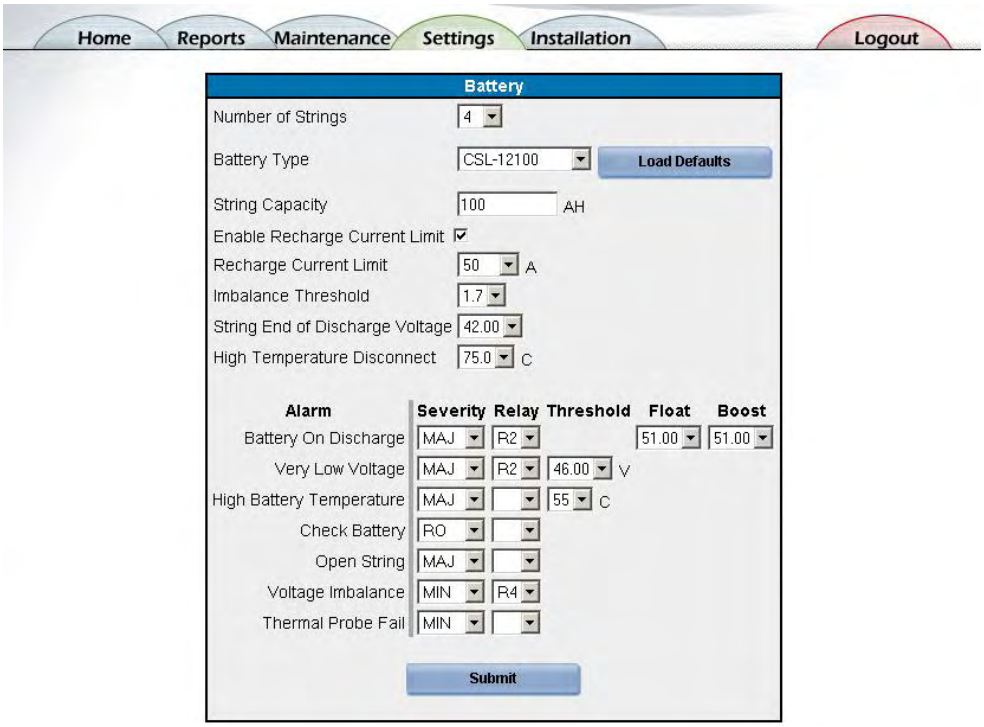


Figure 5-12: Battery Configuration Web Page

Selecting the “Installation” tab produces the web page from which a quick high level configuration can be performed. Configuring the battery type, site ID, date and time are generally the only configuration items required for the plant.

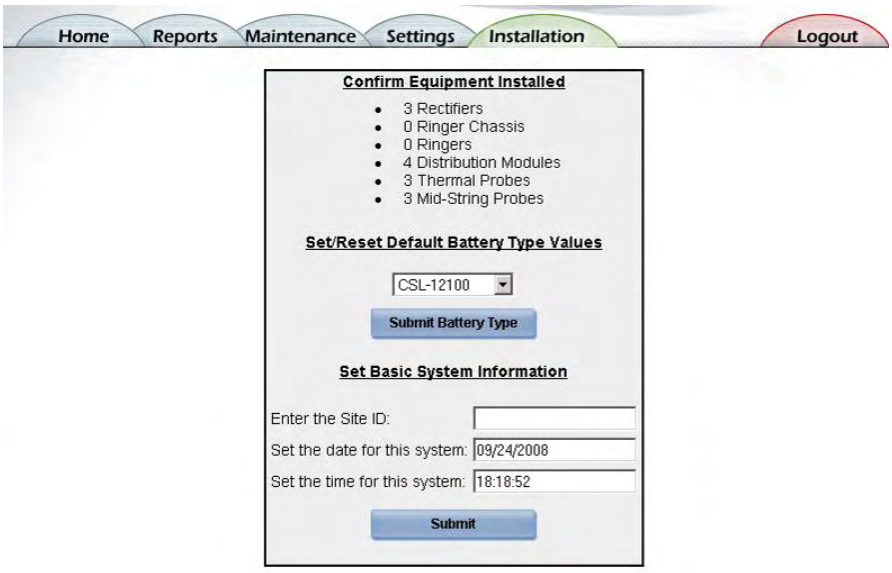


Figure 5-13: Installation Web Page

6 Rectifier

Overview

The rectifier converts ac to dc power for user equipment. This section describes the rectifier features, functions and alarms.

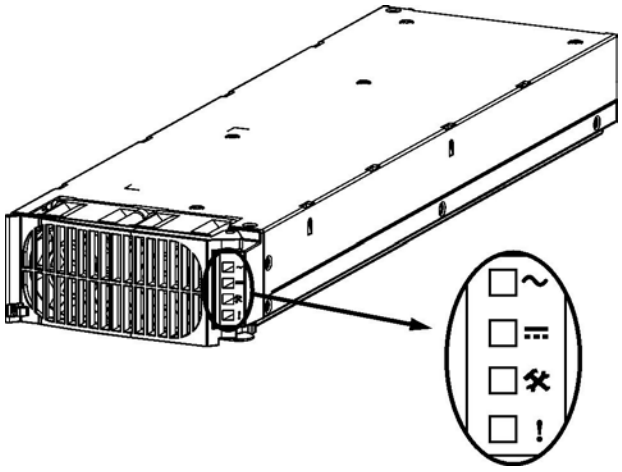


Figure 6-1: CP1800 Rectifier

The CP1800 rectifier produces 1800W from 180 to 275 VAC. It has two built-in fans and operates from -40°C to 55°C ambient temperature. It has an extended operating temperature range of -55°C to 75°C. There is a 3%/°C derating above 55°C in the NX400.

Alarms and Displays

Status LEDs

The four rectifier LED indications are listed below.

LED	Status
☐~	**ON:** Input ok **Blinking:** Input out of limits
☐⎓	**ON:** Output ok **Blinking:** Overload/Current Limit
☐🛠	**On:** Over-temperature warning
☐ !	**On:** Fault or Fan failed **Blinking:** Not communicating to controller

Status Descriptions

Normal Operation: When inserted into the shelf, each rectifier initializes and employs current-ramp up to full load over an 8 second period.

Start Up: Rectifier is inserted into the shelf, powered up and initializing. Output power is not yet available.

High Voltage Shutdown: The NX400 rectifiers will shut down if either of these conditions is true: If an individual rectifier's output voltage is above 58V.

If an individual rectifier's output voltage is greater than 59.9V for 1ms.

In both cases, the rectifier will attempt to restart up to three times. If after the third attempt the fault conditions prevail, the unit will be latched off and will require user intervention.

If the rectifier does latch off, the power supply must be power cycled. This may be accomplished by disengaging the power supply from its mating connector on the shelf, waiting until the front panel LEDs have stopped illuminating and then reinserting it back in the shelf.

Thermal Alarm (Power Limiting): The rectifier power limits itself to protect itself from thermal damage, yet at the same time, trying to support the load. An internal critical temperature is monitored. If the temperature exceeds 75°C, the rectifier begins to limit the output current. If the temperature exceeds the internal thermal safety temperature, the rectifier will shut down. It will restart when the temperature drops below 10°C below the threshold.

Prior to shutdown, the rectifier transmits a rectifier fail alarm to the system controller. While in the thermal shutdown mode, the rectifier front panel LEDs will illuminate as indicated in the Status LED table.

Hiccup: If the rectifier output is short-circuited or if its output voltage drops below 36V, the rectifier will go into a hiccup mode. In this mode, the rectifier will shutdown for 10s and attempt to restart. If the short circuit conditions exist, the rectifier will shutdown and perform another restart in 10 seconds. If the short / overload persists, the rectifier will shut down and attempt to restart a maximum of 3 times. After 3 restart attempts, the rectifier will shut down and lock out.

AC Fail: If the ac input voltage goes out of the operating range, the rectifier will issue an AC Fail alarm.

Current Limit: This is an indication that the rectifiers are delivering maximum current to the load. This is a situation that can occur after a battery on discharge event when the utility service comes back. The rectifiers will be powering the load as well as providing charging current to the batteries. Normal operation will resume and the blinking LED will stop blinking once the batteries are charged. See graph below for more details. While in the current limit mode, the rectifier front panel LEDs will illuminate as indicated in the Status LED table.

Remote Standby: These rectifiers may be placed in standby mode by the TI. When in standby, ac power is still provided to the rectifiers but the output is inhibited. When the controller is queried, it will report this rectifier's status as STANDBY. While in the standby mode, the rectifier front panel LEDs will illuminate as indicated in the Status LED table.

Communication Failure: If the rectifier loses communication with the system controller, it will blink its Alarm LED. Once communication is lost with the system controller, the rectifier output voltage will remain at the last voltage set by the system controller.

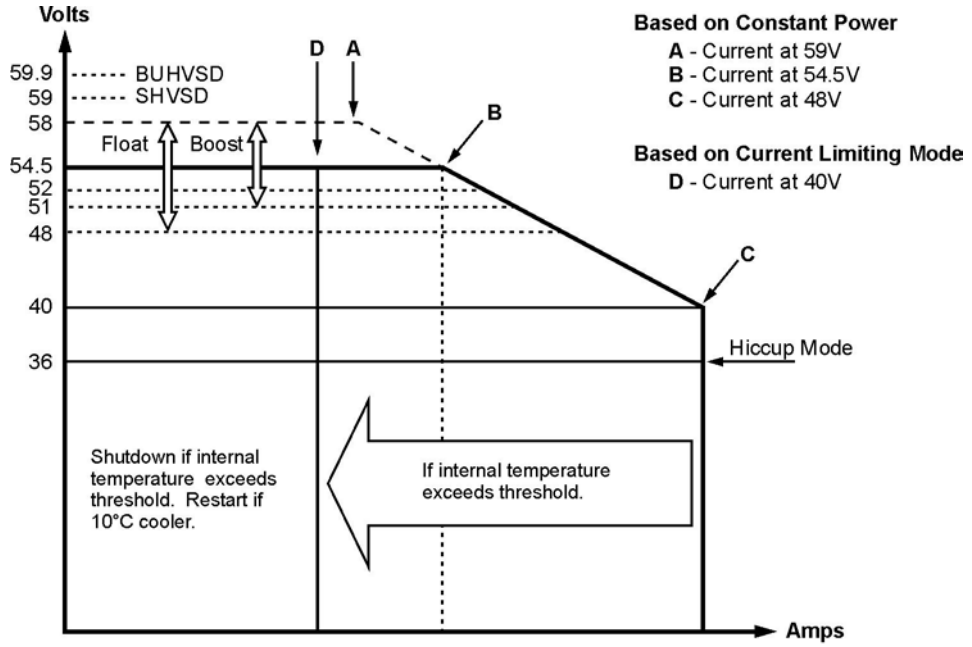
Features and Functions

CP1800 Output Power Curve

The following graph shows the CP1800 rectifier output power curve. This curve is valid for both low-line and high-line operation. Use the table following the curve for the current levels at key voltage levels. The rectifier can deliver constant power to approximately 48Vdc. Further loading of the rectifier will result in the rectifier operating in the constant-current mode. If the rectifier is loaded below approximately 36V, the rectifier enters the hiccup mode.

During start-up, the rectifier can deliver an increased amount of current as specified at point C. Point B is the nominal operating point.

Point D is the internal thermal threshold beyond which the rectifier shuts down to protect itself. Point D is not based on constant power.



Rectifier	Power	A	B	C	D
35A	1800W	30.5A	33.0A	37.5A	28A

Figure 6-2: CP1800 Power Curve

Output Voltage

The rectifier's output voltage is factory set to 52.0V. The voltage may be changed by the system controller. Note that the rectifier will remain at the last voltage it was set to should the system controller fail or be removed.

7 Peripheral Devices

Voltage/Thermal Probes

The QS873A Voltage/Thermal Probes (VT-Probes) are used to measure battery temperatures for slope thermal compensation, and to measure battery voltage for battery voltage imbalance detection. They convert temperature measurements into serial data and transmit them to the system controller using the Maxim's 1-Wire® bus. The QS841A system controller can handle up to 16 VT-probes. These probes route the mid-string voltage to the system controller via the ES771A remote mid-string voltage monitoring modules. All probes are provided with a PTC device to protect against accidental short circuit during voltage measurements.

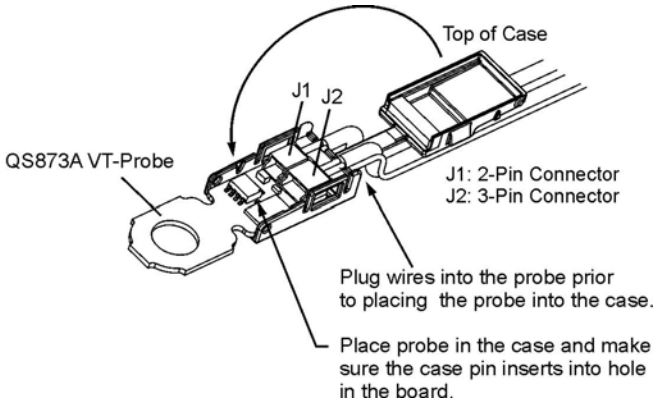


Figure 7-1: QS873A Voltage/Thermal Probe (VT-Probe)

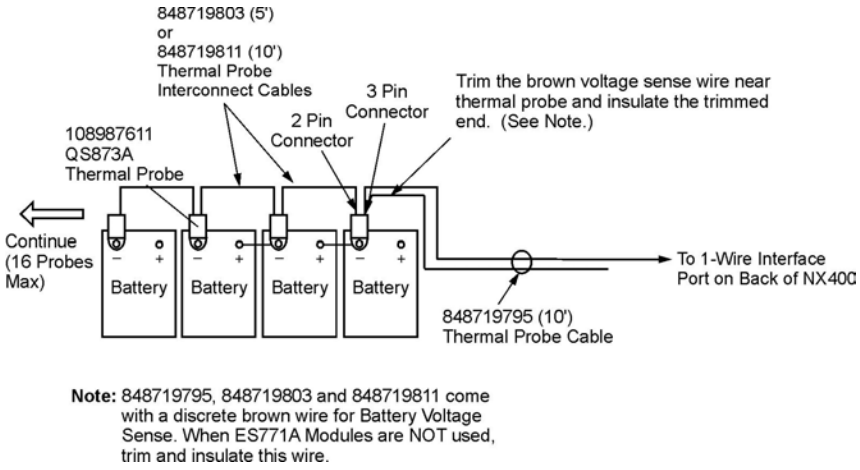


Figure 7-2: VT-Probe Connections To NX400

Following is a brief description of the interfaces on the QS873A VT-Probe.

J2

3-position connector connects the VT-Probe to the 1-Wire interface at the rear of the NX400 through cable 848719795. It may also connect directly to the ES771A with (CC848791517, 2.5') or (848719829, 10') or other VT-Probes in daisy chain fashion using either the (848719803, 5') or the (848719811, 10') cable.

J1

2-position connector serves to connect the VT-Probe to J2 on other VT-Probes in a daisy-chain fashion described above.

Remote Mid-String Voltage Monitor Module

The ES771A remote mid-string voltage monitoring module connects to the 1-Wire interface port at the rear of the NX400. This unit measures the mid-string voltages for up to three strings of batteries through an appropriate VT-Probe connection and serially transmits the information to the system controller which performs the voltage imbalance detection feature. It also transmits the thermal data from the VT-Probes for slope-thermal compensation. The QS841A_NX1 can monitor up to six ES771As. These devices are individually addressed so that specific mid-string voltages can be displayed and identified. The seven-position rotary ID switch located on the unit must be set to a unique address number otherwise an ID conflict alarm will be generated.

The NX400 system's two ES771As have been factory configured with ID settings of 1 and 2, respectively. The module with its ID set to 1 is residing on battery shelf 1. Positions J1 and J2 of module 1 are used to monitor batteries on the first and second battery shelf, respectively. J3 is reserved for the potential monitoring of an additional fifth battery shelf. The module with its ID set to 2 is residing on battery shelf 3. Positions J1 and J2 of module 2 are used to monitor batteries on the third and fourth battery shelf, respectively.

The number of Mid-string voltage modules actively hooked to batteries and being monitored by the system controller to batteries is displayed under Batteries in the Status menu. Note: VT-Probes must be connected to the batteries in order for the ES771 to be recognized.

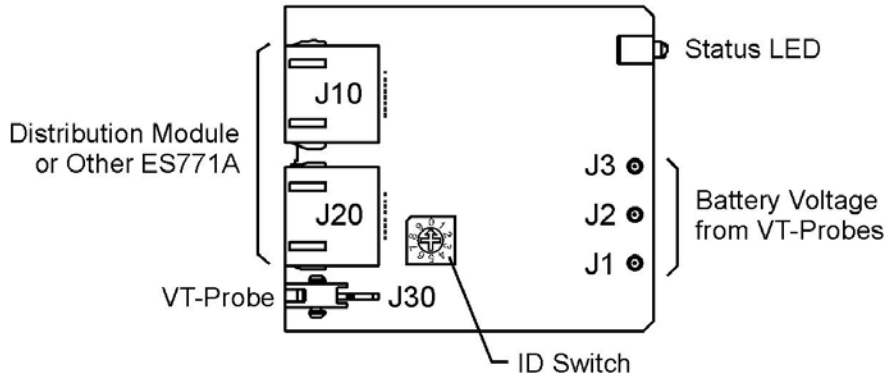


Figure 7-3: ES771A Remote Voltage Monitor Module

Although the NX400 utilizes two ES771As and four QS873 VT probes, systems may utilize the VT probes or ES771A modules alone or in conjunction with one another. It is up to the end-user to determine the number of battery temperature probes or voltage modules other applications may require. Figure 7-2 depicts every battery in the string being monitored for temperature. Figure 7-4 depicts mid-string voltage monitoring for all four battery strings along with every battery being monitored for temperature. The highest temperature measured will be used for battery thermal management. Only one temperature probe is required for thermal compensation features.

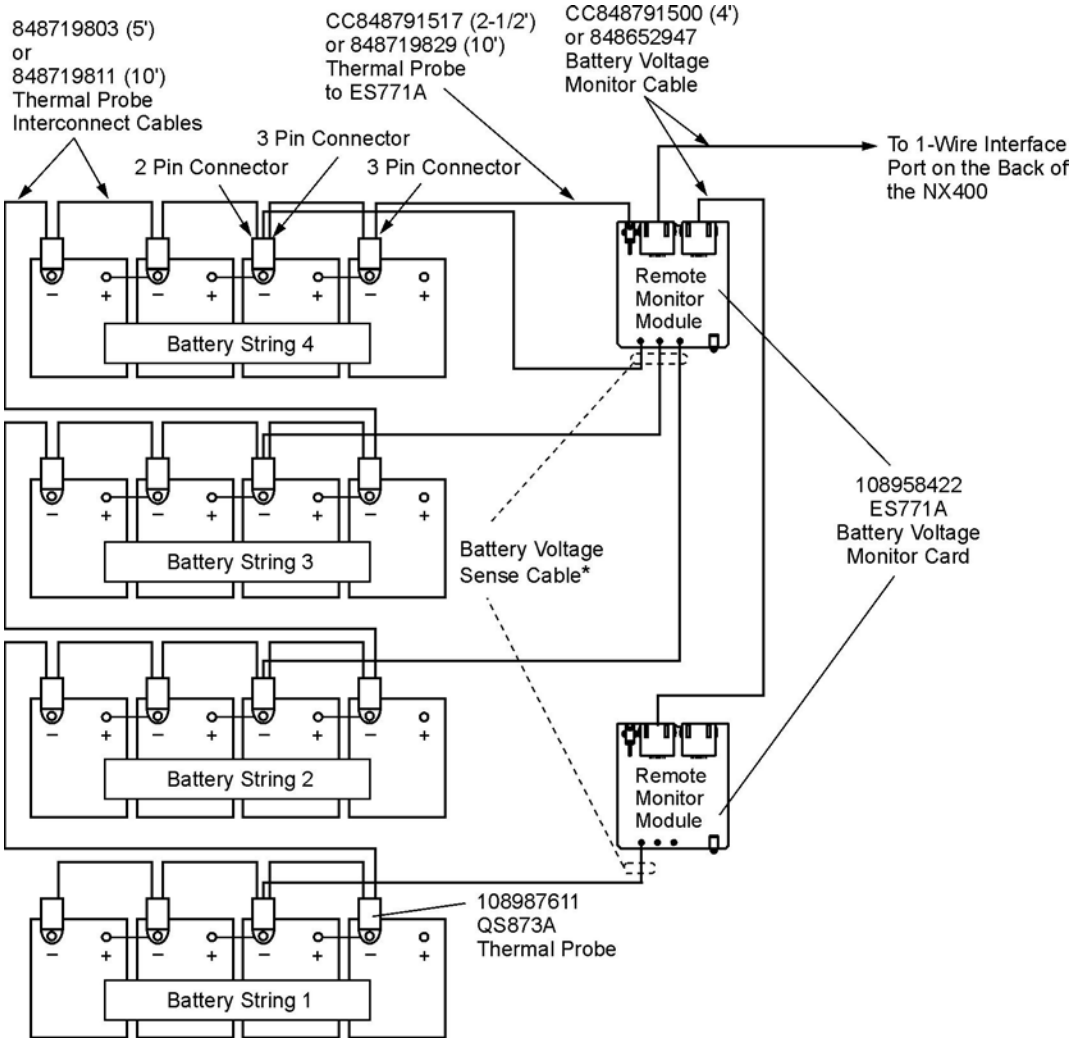


Figure 7-4: VT-Probe/Battery Voltage Monitor Connections to Controller, 1 Probe per Battery

J10, J20

RJ-45 connectors that connect the ES771A to other ES771As or the 1-Wire interface port at the rear of the NX400 using either the (CC848791500, 4") or (848652947, 10') cable.

J30

Connects the ES771A to the first QS873A VT-Probes using either the (CC848791517, 2.5') or the (848719829', 10') cables.

J1, J2, J3

Snap-fit connectors for the mid-string voltage signal wire (Brown) from the VT-Probes.

ID Switch

A seven-position rotary ID switch used by the QS841A_NX1 to uniquely address each ES771A in the system. A setting of "0" produces and invalid ID alarm. Valid ID settings are from 1 through 6.

Status LED

The module illuminates its green LED when plugged into the 1-wire network and with the VT-probe attached to negative battery terminal of the mid-string voltage. The LED will illuminate red when the controller determines that one or more of the strings from the unit has exceeded the Mid-String Voltage threshold and time considerations.

Following is a summary of the parts utilized in the 1-Wire management system

Probe And Cable Descriptions	Comcode
QS873A battery thermal probe	108987611
10-ft Probe to NX400 interconnect	848719795
5-ft Probe to probe interconnect	848719803
10-ft Probe to probe interconnect	848719811
ES771A Voltage Monitoring Module	108958422
2.5-ft Probe to ES771A interconnect	CC848791517
10-ft Probe to ES771A interconnect	848719829
4-ft ES771A to ES771A/NX400 interconnect	CC848791500
10-ft ES771A to ES771A/NX400 interconnect	848652947

8 QS871A Distribution Monitor and Control Module

Overview

The QS871A (CC109103371) allows the QS841A controller to obtain distribution data through serial communications. The system controller monitor alarms for open load or battery protectors, measures load or battery shunts, monitors the bus voltage, and controls and monitors a single load or battery LVD contactor. The NX400 utilizes four QS871As for its Low Voltage Battery Disconnect (LVBD) and its three individual Low Voltage Load Disconnects (LVLDs). Figure 8-1 shows the connections and interfaces for the QS871A.

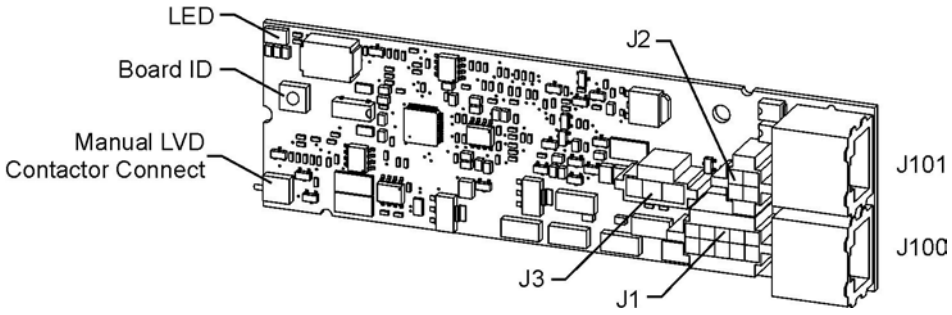


Figure 8-1: QS871A Remote Distribution Module

Module Features

The QS871A module has the following features:

- **Status LED**: This is a tri-colored LED and will illuminate accordingly for the conditions shown below.

LEDs (✹= On)			
Green	**Amber**	**Red**	**Condition**
✹			Normal
	✹		Minor Alarm
		✹	Major Alarm
		Flashing	Communication Loss with System Controller
Flash (5 sec)		✹	Manual Reconnect Command Accepting

In addition, the following alarms will be issued for the conditions noted. This assumes the external disconnect switch is used to open and close the battery charging path to the batteries.

Condition	Contactor Fail Alarm	Contactor Open Alarm	Open String Alarm	QS841A LED	QS871 LED
Open Integral QS871A Disconnect Switch			X	RED	Blinking AMBER
Battery reconnected in reverse polarity	X	X		RED	RED
System started w/ reverse battery polarity	X	X		RED	RED

The QS871A is referenced to VBus(-), therefore, all alarm inputs are either alarmed on an open or a closure to VBus(-) as described below.

- One input closure to VBus(-) for **Remote LVD Open** (RO) from external source (J3 pins 1 and 2)
- One input to **Fuse Input Major** alarm upon closure to VBus(-), for distribution protector open alarms (J1 pin 7)
- One input to **Open String** alarm upon closure to VBus(-) for battery circuit breaker open alarms (J1 pin8)

  Note: Only the RO input is provided at the rear terminal blocks of the NX400 System.
- ***Reverse Battery Protection***: The QS871A will prevent the closure of the battery contactor when it senses batteries have been connected in reverse polarity. The QS871A will keep the contactor disconnected and generate an appropriate alarm.

  When a battery disconnect breaker is used to take battery strings off-line for servicing, care must be taken to ensure battery connections are correct at the disconnect switch.

- **Manual LVD Contactor Connect:** This feature allows the NX400 system to resume powering the load after low voltage disconnect of batteries. Fully depleted battery strings can be replaced with fully charged strings. Once the strings have been installed, depressing the Manual LVD Cont switche on the front of the QS871A module will result in the LVBD contactor closing. Continue to depress the switch until the Green LED stops flashing and displays a continuous green color. This indicates acceptance of the command and permanent closure of the contactor. Releasing the switch prior to the continuous green LED will result in the contactor opening and removing power to the load.
- **External shunt monitoring input (J1 pins 4 and 5):** The shunt must be in the VBus(-) leg to maintain proper reference with the QS871A module. These inputs are for the system controller to read battery or load currents. The polarity of the connections should be positive during battery discharge.
- Controls and monitors one load or battery contactor
- Monitor system bus voltage for **backup LVD function** (in case of loss of communication to the QS871As or failed or removed controller). The configured disconnect and reconnect values assigned to a particular LVD function are sent from the controller to each respective

QS871A. In the advent of a controller failure the QS871As will utilize their individual voltage monitoring and these thresholds to disconnect and reconnect the contactor.

- **7-Position ID Switch:** Rotary 8-position switch that uniquely identifies up to seven remote distribution monitor and control modules. ID position 0 is invalid. The QS841A can address up to six unique distribution monitor and control modules. QS871A IDs have been factory pre-assigned in the NX400.

Module Connector Definitions

The QS871A module has five connectors: two RJ-45 connectors used for serial communication to ES773A VT-Probes, ES771A Remote Voltage Monitoring Modules, and the QS841A controller and three connectors for monitoring circuit breakers, contactors and shunts. Shunt and voltage monitoring, and contactor control are factory pre-wired.

The Remote LVD Open signals for up to four LVD contactors are available at the rear terminal block for the NX400 as mentioned in Section 4. These RO signals can be accessed by external dry-contact closures to the terminal block positions shown below.

		Terminal Block Pin Numbers
Signals	**LVD Assignment**	**NX400**
RO1	LVBD	15,16
RO2	LVLDA	29, 30
RO3	LVLDB	13, 14
RO4	LVLDC	12, 28

J1 provides the connections to external distribution module's bus voltage, shunt, and battery string open alarm signals.

J2 provides contactor control and monitoring

J3 provides connection to contactor control remote-off

J100 and **J101** serial ports used to connect the QS871A to the QS841A system controller auxiliary port connector (P5) and to other devices such as the QS873A VT-Probe and the ES771A Remote Voltage Monitor Module. Consult appropriate technical field support for additional details on QS871A connectors and signal assignments other than those described for the NX400.

9 Troubleshooting

Table 9-A: NX400 System Troubleshooting Table

Controller LED	User Interface Display	Rectifier LED	Distribution Module Board LED	Possible Problem(s)	Possible Solution(s)
AMBER	MIN, AC Fail	None	GREEN	Single Rectifier not receiving ac power. • AC input circuit breaker has opened. • AC input voltage is out of range.	1. Verify ac power to rectifier is available. 2. Verify rectifier input circuit breaker is closed. 3. If problem not corrected, replace rectifier.
RED	MIN, AC Fail MAJ, Multiple AC Fail MAJ, Battery on Discharge	None	GREEN	Multiple rectifiers not receiving ac power, batteries are powering load. • AC input circuit breakers have opened. • AC input voltage is out of range. • Internal rectifier fault.	1. Verify ac power to rectifiers is available. 2. Verify rectifier input circuit breakers are closed. 3. If problem not corrected, replace rectifier.
AMBER or RED	MIN, AC Fail MAJ, Multiple AC Fail	None	GREEN	A rectifier, multiple rectifiers, or the entire system has lost AC and one or more rectifiers have been removed from the system while under this condition.	1. Verify that ac power to all rectifiers is available. 2. Verify that rectifiers all report good AC 3. Issue the "uninstall equipment" under the operations menu for any rectifier that may have been removed during the AC fail.
RED	MAJ, Battery on Discharge	AC OK DC OK	GREEN	Rectifier output voltage has fallen below the battery on discharge threshold set by the user.	1. If commercial ac power is present but the system voltage remains low, call your local field representative. 2. Investigate other alarms that may be present such as rectifier related problems.
AMBER	MIN, Rectifier Fail (Note 1)	AC OK ALARM (Note 1)	GREEN	Rectifier output has dropped below 36V, rectifier has entered hiccup mode.	Replace rectifier.
RED	MIN, Rectifier Fail	AC OK ALARM (Note 1)	GREEN	All rectifier outputs have dropped below 36V, all rectifiers have entered hiccup mode. Defective controller.	Remove controller; if output voltage does not go to set-point previously set by user, call your local field representative.

Table 9-A: NX400 System Troubleshooting Table

Controller LED	User Interface Display	Rectifier LED	Distribution Module Board LED	Possible Problem(s)	Possible Solution(s)
RED	MAJ, Rectifier Fail (Note 1)	AC OK DC OK	AMBER (Blinking)	One or both of the LVD contactors is open; someone may have manually opened LVD contactor.	Place disconnect switch in ON position.
AMBER	MAJ, Contactor 1 Open	AC OK DC OK	GREEN	Batteries have exceeded temperature threshold set by user.	Call your local field representative.
None	No response.	RED (Blinking)	RED (Blinking)	Controller failure, all devices on the communication bus reporting loss of communication with controller.	Check controller to ensure it is properly inserted into its slot. If so, perform the following steps: 1. Remove the controller board for 1 minute and then reset. 2. If problem persists, replace controller with new controller board. 3. If problem still persists, call your local field representative.
AMBER	MIN, Thermal Probe Fail	AC OK DC OK	GREEN	Battery thermal probe failed.	1. Ensure thermal probe is properly connected to thermal probe cable. 2. Ensure cable is properly connected to the rear of the Distribution Module. 3. If problem persists, replace thermal probe per ensuing instructions. 4. If problem still persists, call your local field representative.
RED	MAJ, Fuse Major	AC OK DC OK	RED	One or more of the output circuit breakers or fuses have opened.	Reset circuit breakers or replace fuse.
AMBER	MIN, Rectifier Fail	AC OK ALARM	Normal	Single rectifier thermal alarm: Excessive ambient temperature Multiple rectifier failure	1. Verify that there is no obstruction of the vertical airflow path. 2. Reset the rectifier by removing the rectifier, waiting approximately 30 seconds, and replacing the rectifier. 3. If problem persists, replace the rectifier. 4. If problem still persists, call your local field representative.

Table 9-A: NX400 System Troubleshooting Table

Controller LED	User Interface Display	Rectifier LED	Distribution Module Board LED	Possible Problem(s)	Possible Solution(s)
RED	MIN, Rectifier Fail MAJ, Multiple Rectifier Fail MAJ, Battery on Discharge	AC OK ALARM	Normal	Multiple rectifier thermal alarm: Excessive ambient temperature Multiple rectifier failure	1. Verify that there is no obstruction of the vertical airflow path. 2. Reset rectifies by removing them, waiting approximately 30s and replacing them. 3. If problem persists, replace the rectifiers. 4. If problem still persists, call your local field representative.
RED	MAJ, High Voltage	AC OK ALARM	Normal	High output voltage from rectifier(s) Rectifier(s) high voltage shutdown Internal rectifier(s) failure	1. Reset the rectifier(s) by removing the rectifier(s), waiting approximately 30s and replacing the rectifier(s). 2. If problem persists, replace the rectifier. 3. If problem still persists, call your local field representative.
Amber	MIN, Clock Battery Low	AC OK DC OK	Normal	Internal Lithium Battery Is Low	1. The battery is not designed to be easily field replaced. The controller unit needs to be replaced. 2. Obtain all desired information such as alarm history, statistics, and any field configuration that is different than the standard.
AMBER	MIN, Minor Communication Fail	RED Blinking Single rectifier	GREEN	Rectifier lost communication with controller.	1. If a rectifier has been removed from an installed/operational system, go to the Control/Operations menu and execute Uninstall Equipment. 2. Reset the rectifier by removing the rectifier, waiting approximately 30 seconds, and replacing. 3. If problem persists, replace the rectifier. 4. If problem still persists, call your local field representative.
RED	MAJ, Major Communication Fail	GREEN	RED (Blinking)	LVD Board lost communication with the controller.	1. Replace Distribution Module Board. (Note 2) 2. If problem persists, call your local field representative.

Table 9-A: NX400 System Troubleshooting Table

Controller LED	User Interface Display	Rectifier LED	Distribution Module Board LED	Possible Problem(s)	Possible Solution(s)
GREEN	No Alarm, Individual Shunt Currents displayed at or above their maximum display values (≥600A for loads, ≥800A for battery)	AC OK DC OK	Normal	One or both of the QS871A shunt inputs is open-circuit.	1. Verify that the respective shunt has its green and yellow wire connections attached used for the current measurements. 2. Verify the shunt connection to the QS871A is good by verifying the green and yellow wire connections from the shunt follows through to the 10-pin connector at the respective QS871A.

Note 1: While in hiccup mode, the rectifier will attempt to restart every 10 seconds for a maximum of 3 times.

Note 2: Refer to Section 5, LVD board Removal for removal details. Note that the power system will continue to power the load while the LVD board is out of the system; however, there will be no possibility of battery backup until the LVD board is replaced.

Checking for Defective VT-Probes

1. Disconnect the first probe from its RJ-45 terminal block.
2. Run the CLE function. If the system controller illuminates its LED in green color, the probe is defective. Alternatively, the number of registered probes may be known from the terminal interface (TI) by running the Number of Temperatures present command, see Appendix B. If the registered number of probes is equal to the total number of probes connected, remember you've removed a probe, so the total number should be one less than that during installation, and then the first probe is defective. Replace the probe with a different probe and follow the above procedure to ensure it is operational.
3. If the system controller LED remains green or the number of registered probes is still incorrect, replace the first probe and remove the second probe and repeat Step 2. Continue this procedure until the defective probe has been found.

10 Product Warranty

A. Seller warrants to Customer only, that:

1 As of the date title to Products passes, Seller will have the right to sell, transfer, and assign such Products and the title conveyed by Seller shall be good;

2 During the warranty period stated in Sub-Article B below, Seller's Manufactured Products (products manufactured by Seller), which have been paid for by Customer, will conform to industry standards and Seller's specifications and shall be free from material defects;

3 With respect to Vendor items (items not manufactured by Seller), Seller warrants that such Vendor items, which have been paid for by Customer, will be free from material defects for a period of sixty (60) days commencing from the date of shipment from Seller's facility.

B. The Warranty Period listed below is applicable to Seller's Manufactured Products furnished pursuant to this Agreement, commencing from date of shipment from Seller's facility, unless otherwise agreed to in writing:

Warranty Period

Product Type	New Product	Repaired Product*
Central Office Power Equipment**	24 Months	6 Months

** The Warranty Period for a repaired Product or part thereof is six (6) months or, the remainder of the unexpired term of the new Product Warranty Period, whichever is longer.*

C. If, under normal and proper use during the applicable Warranty Period, a defect or nonconformity is identified in a Product and Customer notifies Seller in writing of such defect or nonconformity promptly after Customer discovers such defect or nonconformity, and follows Seller's instructions regarding return of defective or nonconforming Products, Seller shall, at its option attempt first to repair or replace such Product without charge at its facility or, if not feasible, provide a refund or credit based on the original purchase price and installation charges if installed by Seller. Where Seller has elected to repair a Seller's Manufactured Product (other than Cable and Wire Products) which has been installed by Seller and Seller ascertains that the Product is not readily returnable for repair, Seller will repair the Product at Customer's site.

With respect to Cable and Wire Products manufactured by Seller which Seller elects to repair but which are not readily returnable for repair, whether or not installed by Seller, Seller at its option, may repair the cable and Wire Products at Customer's site.

D. If Seller has elected to repair or replace a defective Product, Customer shall have the option of removing and reinstalling or having Seller remove and reinstall the defective or nonconforming Product. The cost of the removal and the reinstallation shall be borne by Customer. With respect to Cable and Wire Products, Customer has the further responsibility, at its expense, to make the Cable and Wire Products accessible for repair or replacement and to restore the site. Products returned for repair or replacement will be accepted by Seller only in accordance with its instructions and procedures for such returns. The transportation expense associated with returning such Product to Seller shall be borne by Customer. Seller shall pay the cost of transportation of the repaired or replacing Product to the destination designated by Customer.

E. Except for batteries, the defective or nonconforming Products or parts which are replaced shall become Seller's property. Customer shall be solely responsible for the disposition of any batteries.

F. If Seller determines that a Product for which warranty service is claimed is not defective or nonconforming, Customer shall pay Seller all costs of handling, inspecting, testing, and transportation and, if applicable, traveling and related expenses.

G. Seller makes no warranty with respect to defective conditions or nonconformities resulting from actions of anyone other than Seller or its subcontractors, caused by any of the following: modifications, misuse, neglect, accident, or abuse; improper wiring, repairing, splicing, alteration, installation, storage, or maintenance; use in a manner not in accordance with Seller's or Vendor's specifications or operating instructions, or failure of Customer to apply previously applicable Seller modifications and corrections. In addition, Seller makes no warranty with respect to Products which have had their serial numbers or month and year of manufacture removed, altered, or experimental products or prototypes or with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like. Seller's warranty does not extend to any system into which the Product is incorporated. This warranty applies to Customer only and may not be assigned or extended by Customer to any of its customers or other users of the Product.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S SOLE AND EXCLUSIVE REMEDY SHALL BE SELLER'S OBLIGATION TO REPAIR, REPLACE, CREDIT, OR REFUND AS SET FORTH ABOVE IN THIS WARRANTY.

Appendix A: Software Upgrades Through Craft Port

Software can be upgraded through the Craft Port. There are four program files that can be upgraded on the QS841A_NX: The boot block, the factory defaults, application, and web pages. Each of these items has a specific file name. FTP is used for upgrading controller software. Each file goes in a certain directory on the controller:

Item	File	Directory
Boot Block	qs841-boot.bin	/
Defaults	qs841-dflts.bin	dflts
Application	qs841-app.bin	code
Web pages	qs841-pages.web	web
Backup Configuration	config.gal	config

These files must be uploaded to the QS841 using FTP. To use FTP, the user must first initiate a Telnet session through the Craft port. The Craft port should be at its factory default of DHCP Server operation for the NX400. DHCP Server operation can be validated at Menu→Status→Network Settings and scrolling down to view the present configuration.

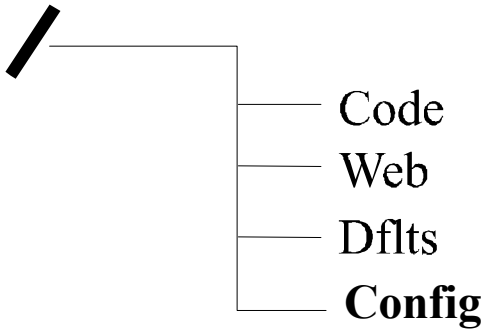
If it is not in DHCP Server mode, make sure the Craft port is not plugged into a LAN connection and re-configure the DHCP setting from the front panel to be Server. This is parameter is found in Menu→Configuration→Communication Ports→Network Settings→DHCP. Note: the controller should automatically reboot to accept the new Ethernet port configuration. This process takes approximately two minutes.

Common FTP commands used when performing file operations are:

- **ftp** – Initiate the ftp session.
- **cd** – Change directories in the controller.
- **put** – Copy files from the PC running FTP to the controller (The present working directory of the PC will be the source directory for the file being copied.)
- **get** – Copy files from the controller to the PC running FTP (The present working directory of the PC will be the destination directory for the file being copied.)
- **bye** – Exit the FTP session
- **pwd** – Display the path of the current directory
- **rm** – Remove a file from a directory
- **ls** – List all files in a directory

Note: The QS841 has a file/directory structure as shown below: Where "/" is the root directory. Each subdirectory contains files that are necessary for the Application Software and web pages . Thus, using an FTP client, shown previously, files may be transferred to/from these controller

directories. The exact path to the upgrade file may be used in the "put" command to update the software. Note: software upgrades require administrator level privilege. Thus, the password required is adminnx400.



Boot Block Software

Using any FTP client, perform the following steps to load Application Software:

1. Change your directory to the PC directory where the Application code is stored.

2. Type: *FTP x.x.x.x (The controller should have a Working IP Address of 192.168.2.1).*
   ftp 192.168.2.1
   Connected to 192.168.2.1
   220 QS841 FTP Ready

3. Login as "guest" using the network administrator password (administrator).
   User (192.168.2.1:(none)): ***guest***
   331 User name okay, need password
   Password: ***adminnx400***
   230 Logged in

4. Change directory (cd) to the main **boot block** directory by typing: *cd /.*
   ftp> ***cd /***
   250 CWD command successful

5. Use the "put" command to copy the application software to the controller.
   ftp> put ***qs841-boot.bin***
   200 Port command okay
   150 Opening data connection for STOR (192.168.2.1,1576)

6. Wait until the message indicating a successful file transfer is displayed.
   226 File sent OK
   ftp: 917504 bytes sent in 2.31Seconds 396.50Kbytes/sec.

7. Type "bye" to exit/logout of the FTP session.
   ftp> ***bye***
   221 Goodbye!
   The controller should automatically reboot

Factory Defaults

Using any FTP client, perform the following steps to load default web pages:

1. Type: *FTP x.x.x.x (The controller should have a Working IP Address of 192.168.2.1).*
   ftp 192.168.2.1
   Connected to 192.168.2.1
   220 QS841 FTP Ready

2. Login as "guest" using the using the network administrator password (administrator).
   User (192.168.2.1:(none)): ***guest***
   331 User name okay, need password
   Password: ***adminnx400***
   230 Logged in

3. Change directory (cd) to the **dflts** directory by typing: *cd dflts.*
   ftp> ***cd dflts***
   250 CWD command successful

4. Use the "put" command to copy the web pages to the controller.
   ftp> put ***qs841-dflts.bin***
   200 Port command okay
   150 Opening data connection for STOR (192.168.2.1,1576)

5. Verify the transfer by a message displayed indicating a successful file transfer.
   226 File sent OK
   ftp: 917504 bytes sent in 2.31Seconds 396.50Kbytes/sec.

6. Type "bye" to exit the FTP session.
   ftp> ***bye***
   221 Goodbye!

   The controller should automatically reboot

Application Software

Using any FTP client, perform the following steps to load Application Software:

1. Change your directory to the PC directory where the Application code is stored.

2. Type: *FTP x.x.x.x (The controller should have a Working IP Address of 192.168.2.1).*
   ftp 192.168.2.1
   Connected to 192.168.2.1
   220 QS841 FTP Ready

3. Login as "guest" using the network administrator password (administrator).
   User (192.168.2.1:(none)): ***guest***
   331 User name okay, need password
   Password: ***adminnx400***
   230 Logged in

4. Change directory (cd) to the **code** directory by typing: *cd code.*
   ftp> ***cd code***
   250 CWD command successful

5. Use the "put" command to copy the application software to the controller.
   ftp> put ***qs841-app.bin***
   200 Port command okay
   150 Opening data connection for STOR (192.168.2.1,1576)

6. Wait until the message indicating a successful file transfer is displayed.
   226 File sent OK
   ftp: 917504 bytes sent in 2.31Seconds 396.50Kbytes/sec.

7. Type "bye" to exit/logout of the FTP session.
   ftp> ***bye***
   221 Goodbye!
   The controller should automatically reboot

Web Pages

Using any FTP client, perform the following steps to load default web pages:

1. Type: *FTP x.x.x.x (The controller should have a Working IP Address of 192.168.2.1).*
   ftp 192.168.2.1
   Connected to 192.168.2.1
   220 QS841 FTP Ready

2. Login as "guest" using the using the network administrator password (administrator).
   User (192.168.2.1:(none)): ***guest***
   331 User name okay, need password
   Password: ***adminnx400***
   230 Logged in

3. Change directory (cd) to the **web** directory by typing: *cd web.*
   ftp> ***cd web***
   250 CWD command successful

4. Use the "put" command to copy the web pages to the controller.
   ftp> put ***qs841-pages.web***
   200 Port command okay
   150 Opening data connection for STOR (192.168.2.1,1576)

5. Verify the transfer by a message displayed indicating a successful file transfer.
   226 File sent OK
   ftp: 917504 bytes sent in 2.31Seconds 396.50Kbytes/sec.

6. Type "bye" to exit the FTP session.
   ftp> ***bye***
   221 Goodbye!

   The controller should automatically reboot

Backup/Restore Configuration File

Using any FTP client, perform the following steps to load default web pages:

1. Type: *FTP x.x.x.x (The controller should have a Working IP Address of 192.168.2.1).*

   ftp 192.168.2.1

   Connected to 192.168.2.1

   220 QS841 FTP Ready

2. Login as "guest" using the using the network administrator password (administrator).

   User (192.168.2.1:(none)): ***guest***

   331 User name okay, need password

   Password: ***adminnx400***

   230 Logged in

3. Change directory (cd) to the **config** directory by typing: *cd config.*

   ftp> ***cd config***

   250 CWD command successful

Backing Up/Retrieving

4. To retrieve a backup of a site's configuration use the "get" command to get a copy of the configuration file (config.gal).

   ftp> get ***config.gal***

   200 Port command okay

   150 Opening data connection for STOR (192.168.2.1,1576)

   226 File sent OK

Restoring

4. To restore a backup of a site's configuration use the "put" command to load a copy of the configuration file (config.gal) to the site.

   ftp> put *filename* ***config.gal***

   Note: The full path of to the file with the name "filename" must be provided. It is OK just to use the same name with a command like the following:

   ftp> put ***config.gal***

   200 Port command okay

   150 Opening data connection for STOR (192.168.2.1,1576)

5. Verify the transfer by a message displayed indicating a successful file transfer.

   226 File sent OK

   ftp: 917504 bytes sent in 2.31Seconds 396.50Kbytes/sec.

6. Type "bye" to exit the FTP session.

   ftp> ***bye***

   221 Goodbye!

The controller should automatically reboot

Appendix B: Battery Functions

Float Mode

Float mode is the default mode of operation of the battery plant. The plant voltage, while in float mode, is determined by the configuration parameter Rectifier Float Set point (fsp) and may be adjusted by the Battery Thermal Compensation circuit, if active. No individual adjustment of plant rectifiers is necessary and load sharing among plant rectifiers is automatic in all plant modes and will take effect within several seconds of a new rectifier being added to the system.

The fsp should be set per the battery manufacturer's recommendations. Note that the actual fsp measured on the plant may differ from the value set by the user if thermal compensation is enabled. See Slope Thermal Compensation (next topic) for more details.

Slope Thermal Compensation

The following is a list of slope thermal compensation parameters that can be configured in the controller.

High Temperature Alarm

Alarm threshold can be set from 30°C to 85°C. The alarm retires when the temperature drops to 10°C below the set threshold. The factory default setting is 55°C.

High Temperature Compensation

The system controller automatically enables high temperature compensation if a VT thermal probe is detected. The feature can be disabled by disconnecting all thermal probes and updating the serial links using the Lamp Test function. Settings for this feature are as follows.

V Step Down: Battery step temperature can be set from 45°C to 85°C. The factory default setting is 75°C.

High Comp Limit: The upper temperature thermal limit can be set from 30°C to 55°C. The factory default setting is 45°C.

Decrease: The upper temperature slope setting (rate of decrease) can be set from -1mV to -10mV in -1mV steps. The factory default is -3mV.

Nominal Temperature: Temperature above or below which Slope Thermal Compensation is enabled. The stable range is 15 to 30°C. The factory default setting is 25°C.

Low Temperature Compensation

This feature is disabled by default, and can be enabled only if Temperature Slope Thermal Compensation is enabled. The following are the associated parameters.

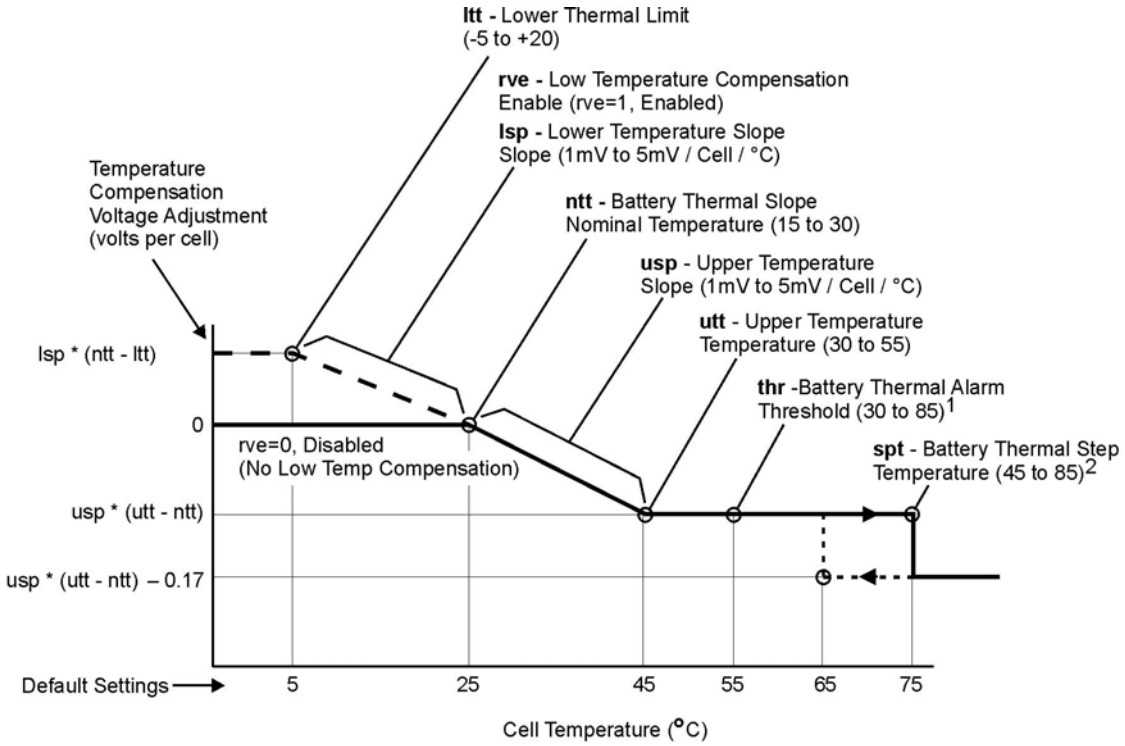
Low Comp Limit: Low temperature thermal compensation can be set from -5°C to 20°C. The factory default setting is 0°C.

Increase: The low temperature slope (rate of increase) can be set from 1mV to 10mV in 1mV increments. The factory default setting is 3mV.

The QS841A has a flexible Thermal Compensation feature which provides voltage compensation from that level established by the Plant Float Set-Point (fsp) or Boost Set-Point (bsp), dependent on the highest temperature monitored by the QS873A VT-Probes located at the plant batteries. Thermal Compensation should be used in a plant containing "sealed" or valve regulated "maintenance free" batteries. Note that Thermal Compensation is automatically enabled if the system controller detects the presence of a VT-Probe. Refer to the Installation Instructions for more details on wiring and configuring this feature.

Thermal Compensation lowers plant voltage from the fsp for monitored battery temperatures which are above the ideal temperature established during configuration as the Battery Thermal Slope Nominal Temperature (ntt). (The items in parenthesis are the user configurable points referred to in the graph shown below.) Lowering the plant voltage helps to keep the batteries at their optimum state of charge while protecting them from thermal runaway. Thermal runaway is a complex sealed battery phenomenon where, for one or more of a number of reasons, one or more cells in a string are unable to dissipate the internal heat generated by their charging current and experience an increase in internal temperature. By lowering the float voltage as cell temperature increases, the float current is lowered to a point where this destructive behavior can be avoided. If a cell failure is imminent and the cell temperature continues to rise above the threshold configured for Battery Thermal Step Temperature (stp), plant voltage drops in a single step to a level which keeps the remaining cells in the string from overcharging and being damaged. Refer to Figure 6-2 for a graphical view of Battery Thermal Compensation and the relationship of its various set points.

The QS841A can also increase plant voltage above that set by the fsp or bsp for colder environments, again seeking to keep batteries at their optimum charge state. Batteries will lose capacity as the battery temperature drops below their optimal operating temperature. Increasing the plant voltage with decreases in battery temperature will cause more current to flow into the batteries. This results in electrolysis of the water in the batteries. Since this reaction is exothermic, it also serves to keep batteries warm. This feature results in an increase in plant voltage, and is required to be enabled during controller configuration.



1. The Battery Thermal Alarm occurs when the temperature rises above the thr set point. It retires when the temperature decreases to 10°C below the thr set point (45°C default).

2. Plant voltage decreases an additional 0.17 volts per cell when the temperature increases above the spt set point. It is increased 0.17 volts per cell when the temperature decreases to 10°C below the spt set point, as indicated by the dashed line (65°C default).

Figure B-1: Slope Thermal Compensation

The following describes the configuration parameters which may be activated or altered by the user. Refer to Appendix B for the ranges of values the parameters may take and their factory default settings.

Lower Thermal Limit (ltt): The lower temperature where, if Low Temperature Compensation is enabled, the controller will increase plant voltage to a level corresponding to (lsp * (ntt - ltt)* 24)V above the fsp. Plant voltage will be increased proportionally at any temperature between this point and the Battery Thermal Slope Nominal Temperature (ntt).

Low Temperature Compensation Enable (rve): A 0 disables and 1 enables the Low Temperature Thermal Compensation feature. Since rve increases plant voltage rather than decreasing it based on temperature, the option is provided to disable it separately from the entire feature so that equipment loads sensitive to high voltages can be protected.

Lower Temperature Slope (lsp): The slope rate for the voltage increase per cell when the battery temperature is below the ntt (Battery Thermal Slope Nominal Temperature).

Battery Thermal Slope Nominal Temperature (ntt): The zero compensation temperature point. Temperatures monitored between this point and the Upper Temperature Limit (utt) will result in a proportional decrease of plant voltage to a level corresponding to (usp*(utt-ntt)*24)V below the

fsp at the utt. If Low Temperature Compensation is enabled, temperatures monitored between this point and the Lower Thermal Limit (ltt) will result in a proportional increase of plant voltage to a level corresponding to (lsp*(ntt-ltt)*24)V above the fsp at the ltt.

Upper Temperature Slope (usp): The slope rate for the voltage decrease per cell when the battery temperature is above the ntt (Battery Thermal Slope Nominal Temperature).

Upper Temperature Limit (utt): The upper temperature where Battery Thermal Compensation will have reduced plant voltage to a level corresponding to (usp*(utt-ntt)*24)V below the fsp. Plant voltage will be reduced proportionally at any temperature between this point and the Battery Thermal Slope Nominal Temperature (ntt).

Battery Thermal Alarm Threshold (thr): A monitored battery temperature above this threshold results in a Battery Thermal alarm with a PMN severity.

Battery Thermal Step Temperature (spt): A monitored battery temperature above this threshold results in an additional 4.08V "step" decrease in plant voltage.

Plant Battery Test

The following is a list of plant battery test parameters that can be configured in the controller. The result of the Plant Battery Test is available in the "Batteries" sub-menu of the "Status" menu.

Manual Test: Permits manually starting a battery discharge test. The test can be set to end on either of the following two parameters.

Duration: The duration of the test can be set from 0.1 hours to 99.9 hours.

Cutoff Cell V: The test can be set to end when battery cell voltage reaches this cutoff voltage. Cutoff voltage can be set from 1.5V to 2.0V.

Automatic Test: This utility offers the flexibility of running pre-programmed battery tests at specific times and days, and for specific durations.

Automatic Test: Enable or disable automatic periodic running of the battery test. The factory default setting is disabled.

Interval: The test interval (time between tests) can be set from 1 to 18 months in 1 month increments. The factory default setting is 12 months.

Next Test: Enter a particular day in dd-mm-yy format to automatically run the battery test on that day.

Start Time: Enter a particular time in hh-mm format to automatically run the battery test at that time. The setting can be configured from 0 to 23 hours. 00:00 is midnight.

Hours from BD: Time interval needed to elapse since the last Battery on Discharge alarm before a battery test can be performed. This can be set from 0 to 240 hours in 1 hour increments. The factory default setting is 72 hours.

Recharge Amp Limit: This section contains the settings for battery recharge current limit.

Limit: Enable or disable battery discharge current limiting.

Limit To: Current limit setting, from 5A to 1000A. The factory default setting is 50A.

During this test, the controller lowers the rectifier voltage to 44V. (This value was chosen to be higher than 1.2V plus the highest possible LVD contactor disconnect threshold so as not to accidentally open the LVD contactor.) Lowering the rectifier output voltage to 44V creates a battery on discharge condition. If the batteries are present and healthy, the plant voltage will remain above 48V and the batteries will support the load. If the batteries are not present or are not able to support the load, the plant voltage will immediately drop to approximately 44V without any consequence to the load. The Battery on Discharge alarm is masked during this test.

The test is terminated by the occurrence of any of the following conditions:

- Initiating another Plant Battery Test. That is, once the test has been initiated, the test may be stopped by initiating another test either through the controller or by shorting pins 19 and 20 of the host interface connector.
- An alarm condition occurring. Any alarm condition that occurs during this test will result in the test being aborted regardless of whether the contact-closure exists between pins 19 and 20 of the host interface connector.
- The test has continued for over 100 minutes.
- The plant voltage has dropped below 44V. In this case, the system will abort the test and resume rectifier operation.

After the test has stopped, the plant will revert to the float mode. It may go to boost mode if the auto-boost feature has been enabled.

Boost Mode

Boost charging is a feature of the QS841A controller, which allows the user to temporarily raise the plant voltage to a higher, predetermined level, reducing the time needed to charge batteries. The system may manually be placed in the boost-mode through the front panel.

Note that the measured boost voltage may not exactly match the value chosen by the user if the thermal compensation feature is enabled. This is because the QS841A performs thermal compensated boost charging and will adjust the boost value based on the battery temperature per the slope chosen by the user.

The plant will exit the boost mode and enter the float mode if any of the following occurs:

- The current flowing into the battery string(s) is less than 5A
- The duration of boost mode charging has reached 8 hours
- The controller receives either a High-Voltage, Rectifier Fail alarm, or High-Battery Temperature alarms
- User sets the plant state to Float via the TI.

Once initiated, the boost mode may be exited by placing the Plant State to Float.

Auto-Boost Charge

This feature may be enabled from the TI. See Appendix B for details. When enabled, the plant enters the boost-charging mode of operation following a battery discharge once the BD alarm has been retired, provided the duration of the discharge was greater than 4 minutes. The controller will not enter the auto-boost-charging mode if the discharge duration was less than 4 minutes.

When in auto-boost mode, the controller raises the plant voltage to the value selected by the user. The controller keeps the plant in this mode of operation for a minimum of 5 minutes.

The exit conditions for the Auto-Boost Charge are the same as those for Boost Charge.

Redundancy Loss Function

This feature must be enabled from the front panel. The controller determines the number of rectifiers present and compares the actual currents being drawn by the load to that produced by the total number of rectifiers less one. If the measured load current exceeds the N rectifier's capacity for over 1 min, the alarm condition is activated. The alarm condition is latched on until the Clear Events command is activated from the front panel.

This feature may be used by customers to determine if the load being served is greater than N rectifiers worth, in an N+1 system. That is, the load requirements have changed such that the power system is no longer operating as a redundant power system. An additional rectifier may be required to ensure continuous redundant operation.

If enabled, this feature will be disabled during battery discharge and recharge conditions. It will be enabled when the battery charging current falls below 5A.

Battery Voltage Imbalance Detection

This feature requires the use of the ES771A Remote Voltage Monitoring Module. Note that this feature is automatically enabled if the controller detects the presence of the ES771A module. This module is to be placed in the electronics cabinet and utilizes the QS873A VT-Probes to measure the voltage of the battery string being monitored. The VT-Probe is to be placed on a battery terminal in the middle of the battery string. The NX400 controller has data on the plant voltage; the half-string voltage measured from each monitored battery string is compared to the plant voltage minus the measured half-string voltage. If the comparison results in a difference of greater than 1.7V for longer than 12 hours, the alarm is asserted. The alarm may be retired by initiating the Clear Events command from the front panel.

After this feature has been enabled, the system waits for 12 hours to ensure the battery strings are stable. A battery string is considered to be stable if the charging current is less than 3A. If a stable battery string yields a difference measurement greater than 1.7V for over 12 continuous hours, a Battery Voltage Imbalance alarm is generated.

When the alarm is issued, the Float Set-Point (fsp) and the Battery On Discharge (BD) threshold values are reduced by 1/24th. Once the alarm has been cleared by the CLE command, the plant reverts to its normal fsp; however, the BD threshold is maintained at the new threshold for up to four minutes before reverting back to the old threshold. This is done to ensure the batteries have had enough time to charge up to the nominal fsp and to prevent any spurious BD alarm conditions.

This feature may be used by customers as part of their overall battery maintenance program in determining the health of battery strings. A voltage imbalance of 1.7V between half-string voltages may mean a shorted-cell somewhere in the string. A service person should be sent out to the site and determine if the string should be replaced.

Battery Recharge Current Limit

This feature must be enabled from the front panel. The battery recharge current limit feature enables the QS841A controller to limit the recharge current flowing into a battery section during the charge cycle. The recharge current flowing into the battery section can be limited to any value between 5A and 1000A.

Note that this feature will not have any impact on the current being delivered to the load. Further, there will be no effect on the discharge current flowing from the battery strings to the load during an ac fail condition. The controller will maintain the recharge current within 10% of the set level.

Battery Parameter Defaults

The QS841_NX1 Controller has been configured with battery specific defaults. The following information correlates the batteries and battery default information.

The QS841A shall be custom configured with the Battery Types defined for NX400 applications. These battery types are shown in the top portion of Table B-1. Two additional batteries, one specific battery model and one generic battery class, will/can be added as they become available. These are listed at the bottom of the table. The CSL-12100 shall be the default battery type for this controller configuration. It is understood that other battery models can be added in the field.

Table B-1: Supported Battery Types

Vendor	Battery Type	String Or Battery Capacity (AH)
Battery Corp	BC-12V110FT	105
C&D	TEL12-105F	100
Power Battery	CSL-12100 (VRLA)	100
Power Battery	CSL-12170 (VRLA)	170
Power Battery	SLF-12105 (VRLA)	91
Avestor	SE48S63 (Li-LMP)	63
Avestor	SE48S80 (Li-LMP)	80
Generic	Flooded	0
Generic	Li-LMP	63
Generic	Ni-Cd	0
Generic	Valve-Reg (VRLA)	100
	None	NA
Future Generic	Li-ELiTE	60
Lineage Power	L48V60FTX (Li-ELiTE)	60

Appendix C: Default Configurations

Table C-1 provides the default settings for the configurable parameters and features that are associated in the QS840A_NX1. Also listed are the generic battery technologies. Specific battery models assume the configuration defaults for their generic technology class except for a specific capacity and model name. The CSL-12100 will be the factory default Battery Type selected and configured for the QS841_NX1 configuration. The CSL-12100 will have the exact defaults as its generic class, VRLA, except for model number and capacity. Changes to individual features, parameters, and thresholds for each battery type will be allowed in the field. These changes will be stored in non-volatile memory. However, if the "Load Factory Defaults" control/operation command is initiated, all assigned values shown in Table B-1 and Table C-1 will be restored. The configurations made in the field will be lost.

Note: not all parameters are associated to battery technology classes. Only battery related features are associated with configurable battery technology classes. For completeness, all the information for the specific battery types has been repeated in each column. Alarm events assigned RO (Record Only) will not have any alarm relays assigned to them.

Table C-1: QS841A_NX1 CC# 1091105954 NX400 Configuration Items And Assignments

		Generic Battery Type						ALARM RELAYS [7]					
	Controller Event/Parameter	**Valve-Reg [1] Default Setting**	**Flooded Default Setting**	**Li-ELiTE Default Setting**	**NiCd Default Setting**	**Li-LMP Default Setting**	**Range**	**PMJ**	**PMN**	**RELAY 1**	**RELAY 2**	**RELAY 3**	**RELAY 4**
Rectifier Set-Points	Rectifier/System Float Voltage	-54.0V	-52.1V	-54.5V	-54.4V	-54.5V	-42.0 to -56.5V						
	Rectifier/System Boost Voltage	-54.0V	-52.1V	-54.5V	-54.4V	-54.5V	-48.0 to -58.0V						
	Low Voltage Rectifier On Threshold	-44.0V	-44.0V	-44.0V	-44.0V	-44.0V	-40.0 to -51.0V						
High Voltage	High Float Voltage Minor (HFV)	-56.0V	-56.0V	-57.0V	-56.0V	-56.0V	-50 to -60V		x	o			
	High Float Voltage Major (HFVS)	-58.0V	-58.0V	-58.0V	-57.0V	-57.0V	-50 to -60V	x		o			
Low Voltage	Battery on Discharge (BD)	-51.0V	-50.0V	-53.0V	-51.0V	-51.0V	-46 to -55V	x			o		
	Very Low Float Voltage (VLV)	-46.0V	-46.0V	-46.0V	-46.0V	46.0V	-40 to -51V	x			o		
[10] Low Voltage Disconnects / Contactor Interfaces	LV Battery Disconnect (LVBD)	Enabled	Enabled	Enabled[9]	Enabled	Enabled[9]	Enabled/ Disabled						
	LV Battery Disconnect Control Mode	Voltage	Voltage	Voltage	Voltage	Voltage	Voltage, None, Voltage/Time						
	LV Battery Disconnect Voltage	-41.5V	-41.5V	-41.5V	-41.5V	-41.5V	-39.0 to -50.0V	x					
	LV Battery Disconnect Time Delay	0 min	0 min	0 min	0 min	0 min	0 to 300 minutes						
	LV Battery 1 Reconnect Control Mode	Voltage	Voltage	Voltage	Voltage	Voltage	Voltage, None, Voltage/Time						
	LV Battery Reconnect Voltage	-48.0V	-48.0V	-48.0V	-48.0V	-48.0V	-39.0 to -55.0V						
	LV Battery Reconnect Time Delay	0 sec	0 sec	0 sec	0 sec	0 sec	0 to 300 sec						
	LV Load A Disconnect (LVLD A)	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled						
	LV Load A Disconnect Control Mode	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/None/ Voltage/Time						
	LV Load A Disconnect Voltage	-43.9V	-43.9V	-43.9V	-43.9V	-43.9V	-39.0 to -50.0V	x					
	LV Load A Disconnect Time Delay	0 min	0 min	0 min	0 min	0 min	0 to 300 minutes						
	LV Load A Reconnect Control Mode	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage, None Voltage/Time						
	LV Load A Reconnect Voltage	-49.0V	-49.0V	-49.0V	-49.0V	-49.0V	-39.0 to -55.0V						
	LV Load A Reconnect Time Delay	30 sec	30 sec	30 sec	30 sec	30 sec	0 to 300 sec						
	LV Load B Disconnect (LVLD B)	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled						
	LV Load B Disconnect Control Mode	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage, None, Voltage/Time						
	LV Load B Disconnect Voltage	-45.0V	-45.0V	-45.0V	-45.0V	-45.0V	-39.0 to -50.0V	x					
	LV Load B Disconnect Time Delay	15 min	15 min	15 min	15 min	15 min	0 to 300 minutes						
	LV Load B Reconnect Control Mode	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage, None, Voltage/Time						
	LV Load B Reconnect Voltage	-49.0V	-49.0V	-49.0V	-49.0V	-49.0V	-39.0 to -55.0V						
	LV Load B Reconnect Time Delay	60 sec	60 sec	60 sec	60 sec	60 sec	0 to 300 sec						
	LV Load C Disconnect (LVLD C)	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled						
	LV Load C Disconnect Control Mode	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage, None Voltage/Time						
	LV Load C Disconnect Voltage	-42.0V	-42.0V	-42.0V	-42.0V	-42.0V	-39.0 to -50.0V	x					
	LV Load C Disconnect Time Delay	0 min	0 min	0 min	0 min	0 min	0 to 300 minutes						
	LV Load C Reconnect Control Mode	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage/Time	Voltage, None, Voltage/Time						

		Generic Battery Type						ALARM RELAYS [7]					
	Controller Event/Parameter	**Valve-Reg [1] Default Setting**	**Flooded Default Setting**	**Li-ELiTE Default Setting**	**NiCd Default Setting**	**Li-LMP Default Setting**	**Range**	**PMJ**	**PMN**	**RELAY 1**	**RELAY 2**	**RELAY 3**	**RELAY 4**
	LV Load C Reconnect Voltage	-49.0V	-49.0V	-49.0V	-49.0V	-49.0V	-39.0 to -55.0V						
	LV Load C Reconnect Time Delay	15 sec	15 sec	15 sec	15 sec	15 sec	0 to 300 sec						
	Contactor Type For ID1	LVBD	LVBD	LVBD	LVBD	LVBD	LVBD/LVLDA/ LVLDB/LVLDC/ NONE						
	Contactor Type For ID2	LVLDA	LVLDA	LVLDA	LVLDA	LVLDA	LVBD/LVLDA/ LVLDB/LVLDC/ NONE						
	Contactor Type For ID3	LVLDB	LVLDB	LVLDB	LVLDB	LVLDB	LVBD/LVLDA/ LVLDB/LVLDC/ NONE						
	Contactor Type For ID4	LVLDC	LVLDC	LVLDC	LVLDC	LVLDC	LVBD/LVLDA/ LVLDB/LVLDC/ NONE						
	Contactor Type For ID5	None	None	None	None	None	LVBD/LVLDA/ LVLDB/LVLDC/ NONE						
	Contactor Type For ID6	None	None	None	None	None	LVBD/LVLDA/ LVLDB/LVLDC/ NONE						
	Imminent LVBD Shutdown	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled	x					
	LV Disconnect Contactor 1 Fail							x					
	LV Disconnect Contactor 1 Open							x					
	LV Disconnect Contactor 2 Fail							x					
	LV Disconnect Contactor 2 Open							x					
	LV Disconnect Contactor 3 Fail							x					
	LV Disconnect Contactor 3 Open							x					
	LV Disconnect Contactor 4 Fail							x					
	LV Disconnect Contactor 4 Open							x					
	LV Disconnect Contactor 5 Fail							x					
	LV Disconnect Contactor 5 Open							x					
	LV Disconnect Contactor 6 Fail							x					
	LV Disconnect Contactor 6 Open							x					
Rectifiers	Rectifier Redundancy Loss	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled		x				
	Remote Rectifier Standby	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled						
	Rectifier Current Limit	100%	100%	100%	100%	100%	30-100%						
	Remote Group Standby Feature	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled						
	Efficiency Enable	Disabled	Disabled	Disabled	Disabled	Disabled	Enabled/ Disabled						
	Efficiency Target	70	70	70	70	70	20% to 95%						
	Efficiency Rectifier Turn-On Threshold	76	76	76	76	76	25% to 100%						
	Single Rectifier Fail (RFA)								x				
	Multiple Rectifier Fail (MRFA)							x					
	Rectifier Fan Fail								x				
AC Power	Single AC Fail (ACF)								x				
	Multiple AC Fail (MACF)							x					
Battery Features And Alarms	Slope Thermal Compensation (STC)	Enabled	Enabled	NA Disabled	NA Disabled	NA Disabled	Enabled/ Disabled						
	High Temperature Voltage Step Down	75°C	75°C	NA 85°C	NA 85°C	NA 85°C	45 to 85°C						
	High Temperature Comp Stop Temperature	55°C	55°C	NA 55°C	NA 55°C	NA 55°C	30 to 55°C						
	High Temperature Decrease Rate	3mV/°C per cell	3mV/°C per cell	NA	NA	NA	1to 10mV/°C per cell						

		Generic Battery Type						ALARM RELAYS [7]					
	Controller Event/Parameter	**Valve-Reg [1] Default Setting**	**Flooded Default Setting**	**Li-ELiTE Default Setting**	**NiCd Default Setting**	**Li-LMP Default Setting**	**Range**	**PMJ**	**PMN**	**RELAY 1**	**RELAY 2**	**RELAY 3**	**RELAY 4**
				1mV/ºC per cell	1mV/ºC per cell	1mV/ºC per cell							
	Nominal Temperature (No Temp Comp)	25ºC	25ºC	NA 25ºC	NA 25ºC	NA 25ºC	15 to 30 ºC						
	Low Temperature Compensation Feature	Enabled	Disabled	NA Disabled	NA Disabled	NA Disabled	Enabled/ Disabled						
	Low Temperature Comp Stop Temperature	11ºC	0ºC	NA 0ºC	NA 0ºC	NA 0ºC	-5 to 20ºC						
	Low Temperature Decrease Rate	3mV/ºC per cell	3mV/ºC per cell	NA 1mV/ºC per cell	NA 1mV/ºC per cell	NA 1mV/ºC per cell	1 to 10mV/ºC per cell						
	String Battery Capacity (AH)[8]	100 AH	0 AH	60 AH	125 AH	63 AH	0 to 5000 AH						
	Number Of Battery Strings[8]	4	0	0	0	0	0 to 16 Strings						
	String End Of Discharge Voltage[11]	-42.00V	-42.00V	-42.00V	-42.00V	-42.00V	-36.00 to -48.00V						
	Manual Discharge Test Type	20%	20%	20%	20%	20%	Disabled/Timed/20%						
	Manual Test Duration	4:00:00 hrs	4:00:00 hrs	4:00:00 hrs	4:00:00 hrs	4:00:00 hrs	0:0:0 to 23:59:59						
	Manual Test Check Battery Alarm Voltage Threshold	-44.00V	-44.00V	-46.00V	-44.00V	-44.00V	-36.00 to -48.00V						
	Automatic Battery Test Feature	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled/Timed/20%						
	Automatic Test (AT) Interval	12 months	12 months	12 months	12 months	12 months	1 to 18 Months						
	Date For Next Automatic Test	12/31/2099	12/31/2099	12/31/2099	12/31/2099	12/31/2099	Displayed in Configured Date Format mm/dd/yyyy						
	Start Time For Automatic Test	00:00 (midnight)	00:00 (midnight)	00:00 (midnight)	00:00 (midnight)	00:00 (midnight)	Displayed in Configured Time Format 12Hr						
	Hours To Wait From Last BD Before AT	72 hrs	72 hrs	72 hrs	72 hrs	72 hrs	0 to 240 hours						
	Battery Test Rectifier Voltage	-42.0V	-42.0V	-42.0V	-42.0V	-42.0V	-42.0 to -52.0V						
	Reserve Time Low (Static)	0 hrs	0 hrs	0 hrs	0 hrs	0 hrs	0.0 to 99.9 hours						
	Real-time Reserve Low (During discharge)	0 hrs	0 hrs	0 hrs	0 hrs	0 hrs	0.0 to 99.9 hours						
	Recharge Current Limit Feature	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled						
	Recharge Current Limit Value	50A	50A	25A[2]	25A[4]	25A[3]	5 to 1000A						
	Automatic Boost Feature	Disabled	Disabled	NA Disabled	NA Disabled	NA Disabled	Disabled/Timed/ Current						
	Auto Boost BD Multiplication Factor	0.5	0.5	NA 0.5	NA 0.5	NA 0.5	0.1 – 9.0						
	Auto Boost Termination Current Threshold	5A	5A	NA 5A	NA 5A	NA 5A	1-999 A						
	Boost Maximum Duration	12	24	1	1	1	1to 80 Hours						
	High Boost Voltage Minor	-56.0V	-59.0V	-56.0V	-56.0V	-56.0V	-50 to -60V		**x**	**o**			
	High Boost Voltage Major	-58.0V	-60.0V	-57.0V	-57.0V	-57.0V	-50 to -60V	**x**		**o**			
	Boost Battery On Discharge Threshold	-51.0V	-50.0V	NA -53.0V	NA -51.0V	NA -51.0V	-46 to -55V	**x**			**o**		
	Voltage Imbalance Detect	1.7V	1.7V	NA 1.7V	2.0V	NA 1.7V	1.5 to 3.0V		**x**				**o**
	Battery High Temperature Disconnect	75ºC	NA 90ºC	NA 90ºC	NA 90ºC	NA 90ºC	30 to 90ºC	**x**					
	High Battery Temperature	55ºC	55ºC	55ºC	55ºC	85ºC	30 to 85ºC	**x**					
	Open String							**x**					
	Emergency Power Off (EPO)	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled	**x**					
	Manual Or Periodic Battery Test In Progress												
	Check Battery (Plant Battery Test Fail)												
	Defective Temp Probe								**x**				

		Generic Battery Type						ALARM RELAYS [7]					
	Controller Event/Parameter	**Valve-Reg [1] Default Setting**	**Flooded Default Setting**	**Li-ELiTE Default Setting**	**NiCd Default Setting**	**Li-LMP Default Setting**	**Range**	**PMJ**	**PMN**	**RELAY 1**	**RELAY 2**	**RELAY 3**	**RELAY 4**
Fuse/CB Alarms	Fuse Major							**x**				**o**	
	Fuse Minor								**x**				
	Auxiliary Major Alarm							**x**					
	Auxiliary 1 (QS872 P5 Aux Input 1)							**x**					
	Auxiliary 2 (QS872 P5 Aux Input 1)							**x**					
	Auxiliary 3 (QS872 P5 Aux Input 1)							**x**					
	Auxiliary 4 (QS872 P5 Aux Input 1)							**x**					
Controller	Site ID	""	""	""	""	""	≤ 21 characters						
	System Type	"NX400"	"NX400"	"NX400"	"NX400"	"NX400"	≤ 21 characters						
	Controller Type	"QS841A-NX1"	"QS841A-NX1"	"QS841A-NX1"	"QS841A-NX1"	"QS841A-NX1"	≤ 21 characters						
	System Date Format	mm/dd/yyyy	mm/dd/yyyy	mm/dd/yyyy	mm/dd/yyyy	mm/dd/yyyy	mm/dd/yyyy, dd/mm/yyyy, yyyy/mm/dd, mm-dd-yyyy , yyyy-mm-dd, dd-mm-yyyy, mm/dd/yy, yy/mm/dd, dd/mm/yy, mm-dd-yy, yy-mm-dd, dd-mm-yy						
	System Date	Config Date	Config Date	Config Date	Config Date	Config Date	Use Factor Configuration Date in default format						
	System Time Format	24 HR	24 HR	24 HR	24 HR	24 HR	12HR/24HR						
	System Time	Config Time	Config Time	Config Time	Config Time	Config Time	hh:mm AM/PM, hh:mm:ss						
	Automatic Daylight Savings Feature	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/Disabled						
	Display Contrast	50%	50%	50%	50%	50%	0 to 100%						
	Temperature Display Units	ºC	ºC	ºC	ºC	ºC	C or F						
	Controller Ambient Temperature High	75ºC	75ºC	75ºC	75ºC	75ºC	35 to 75 ºC						
	Controller Ambient Temperature Low	-40ºC	-40ºC	-40ºC	-40ºC	-40ºC	-40 to 10 ºC						
	Alarm Test Feature	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/Disabled						
	Alarm Test Relay Duration	60 sec	60 sec	60 sec	60 sec	60 sec	5 to 300 seconds						
	Front Panel PIN	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/Disabled						
	Front Panel PIN Default	2006	2006	2006	2006	2006	Four digits 0-9 each						
	Front Panel PIN Timeout	120	120	120	120	120	1-120 Minutes						
	User Password	usernx400	usernx400	usernx400	usernx400	usernx400	6-15 Characters						
	Super User Password	super-user	super-user	super-user	super-user	super-user	6-15 Characters						
	Administrator Password	adminnx400	adminnx400	adminnx400	adminnx400	adminnx400	6-15 Characters						
	Clock Battery Low								**x**				
	Controller Fail (Not user mappable)							**x**	**x**				
	Communication Loss Minor [5]								**x**				
	Communication Loss Major [6]							**x**					
	Un-powered Controller							**x**	**x**	**x**	**x**	**x**	**x**
	Sense Fuse								**x**				
	Voltage Monitoring Module Failure								**x**				
Shunt Monitors	ID1 Type	Battery	Battery	Battery	Battery	Battery	Battery/None /Load						
	ID1 Shunt Current Rating	800A	800A	800A	800A	800A	0 to 9999 Amps						
	ID2 Type	Load	Load	Load	Load	Load	Battery/None /Load						
	ID2 Shunt Current Rating	600A	600A	600A	600A	600A	0 to 9999 Amps						
	ID3 Type	Load	Load	Load	Load	Load	Battery/None /Load						
	ID3 Shunt Current Rating	600A	600A	600A	600A	600A	0 to 9999 Amps						

		Generic Battery Type						ALARM RELAYS [7]					
	Controller Event/Parameter	**Valve-Reg [1] Default Setting**	**Flooded Default Setting**	**Li-ELiTE Default Setting**	**NiCd Default Setting**	**Li-LMP Default Setting**	**Range**	**PMJ**	**PMN**	**RELAY 1**	**RELAY 2**	**RELAY 3**	**RELAY 4**
	ID4 Type	Load	Load	Load	Load	Load	Battery/None /Load						
	ID4 Shunt Current Rating	600A	600A	600A	600A	600A	0 to 9999 Amps						
	ID5 Type	None	None	None	None	None	Battery/None /Load						
	ID5 Shunt Current Rating	600A	600A	600A	600A	600A	0 to 9999 Amps						
	ID6 Type	None	None	None	None	None	Battery/None /Load						
	ID6 Shunt Current Rating	600A	600A	600A	600A	600A	0 to 9999 Amps						
	All Loads Monitored	Disabled	Disabled	Disabled	Disabled	Disabled	Enabled/ Disabled						
Ringers	Ringer Output Voltage Set-Point	100VAC	100VAC	100VAC	100VAC	100VAC	65-100 VAC						
	Ringer Output Frequency	20Hz	20Hz	20Hz	20Hz	20Hz	15-50Hz						
	Ringer DC Output Offset Feature	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled						
	Ringer Redundancy Loss Feature	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/ Disabled						
	Ringer 1 External Failure Minor								x				
	Ringer 2 External Failure Minor								x				
	Ringer 3 External Failure Minor								x				
	Ringer 4 External Failure Minor								x				
	Ringer 5 External Failure Minor								x				
	Ringer 6 External Failure Minor								x				
	Ringer 7 External Failure Minor								x				
	Ringer 8 External Failure Minor								x				
	Ringer 1 External Failure Major							x					
	Ringer 2 External Failure Major							x					
	Ringer 3 External Failure Major							x					
	Ringer 4 External Failure Major							x					
	Ringer 5 External Failure Major							x					
	Ringer 6 External Failure Major							x					
	Ringer 7 External Failure Major							x					
	Ringer 8 External Failure Major							x					
	Ringer 1 Module Fail								x				
	Ringer 2 Module Fail								x				
	Ringer 3 Module Fail								x				
	Ringer 4 Module Fail								x				
	Ringer 5 Module Fail								x				
	Ringer 6 Module Fail								x				
	Ringer 7 Module Fail								x				
	Ringer 8 Module Fail								x				
	Ringer Plant 1 Fail							x					
	Ringer Plant 2 Fail							x					
	Ringer Plant 3 Fail							x					
	Ringer Plant 4 Fail							x					
	Ringer Plant 5 Fail							x					
	Ringer Plant 6 Fail							x					
	Ringer Plant 7 Fail							x					
	Ringer Plant 8 Fail							x					
	Ringer 1 Fan Fail								x				
	Ringer 2 Fan Fail								x				
	Ringer 3 Fan Fail								x				
	Ringer 4 Fan Fail								x				

		Generic Battery Type						ALARM RELAYS [7]					
	Controller Event/Parameter	**Valve-Reg [1] Default Setting**	**Flooded Default Setting**	**Li-ELiTE Default Setting**	**NiCd Default Setting**	**Li-LMP Default Setting**	**Range**	**PMJ**	**PMN**	**RELAY 1**	**RELAY 2**	**RELAY 3**	**RELAY 4**
	Ringer 5 Fan Fail								x				
	Ringer 6 Fan Fail								x				
	Ringer 7 Fan Fail								x				
	Ringer 8 Fan Fail								x				
	Ringer 1 Redundancy Loss								x				
	Ringer 2 Redundancy Loss								x				
	Ringer 3 Redundancy Loss								x				
	Ringer 4 Redundancy Loss								x				
	Ringer 5 Redundancy Loss								x				
	Ringer 6 Redundancy Loss								x				
	Ringer 7 Redundancy Loss								x				
	Ringer 8 Redundancy Loss								x				
Communication Ports	Communication Port Type	Local	Local	Local	Local	Local	Local or MODEM						
	Local Port Write Access	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/Disabled						
	Local RS-232 baud rate	9600	9600	9600	9600	9600	300/1200/2400/4800/ 9600/19200/Auto						
	Local RS-232 handshaking (Flow Control)	None	None	None	None	None	None/SW/HW						
	Number of Data Bits	8	8	8	8	8	7 or 8						
	Parity	None	None	None	None	None	Odd/Even/None						
	Number Of Stop Bits	1	1	1	1	1	1 or 2						
	Modem Port Write Access	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/Disabled						
	Modem baud rate	2400	2400	2400	2400	2400	300/1200/2400/4800/ 9600/19200/						
	Local RS-232 handshaking (Flow Control)	None	None	None	None	None	None/SW/HW						
	Number of Data Bits	8	8	8	8	8	7 or 8						
	Parity	None	None	None	None	None	Odd/Even/None						
	Number Of Stop Bits	1	1	1	1	1	1 or 2						
	Modem initialization string	AT&FEV&C1S0= 0H	AT&FEV&C1S0= 0H	AT&FEV&C1S0= 0H	AT&FEV&C1S0= 0H	AT&FEV&C1S0= 0H	≤ 20 Characters						
	Modem number of rings before answering	1	1	1	1	1	1 to 9						
Network Settings	DHCP	Server	Server	Server	Server	Server	Static/Client/Server						
	Write Access	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled/Disabled						

x – Denotes LED ON condition

o – denotes factory default settings, user may select Relays 1 to 4 to be other than the default settings and the relays are to be asserted for the user function selected.

[1] *The VRLA battery CSL-12100 from power battery will be the factory default Battery Type selected. See Tables 2 and 3.*

[2] Value eventually read from the battery.

[3] Battery has an internal fuse rating of 40A. Using 80% rule and adding margin for overshoot and error decided to keep it same as NiCd. Note shunt monitoring in battery distribution required.

[4] A String of NCX-125 assumed with C/5 charge rate. Note shunt monitoring required.

[5] Communication loss with a single rectifier or any number of thermal probes shall be considered a PMN alarm. Communication loss with the either the LVD or Ringer cards shall be considered a PMJ alarm.

[6] Communication loss with multiple rectifiers or devices other than thermal probes shall be considered PMJ alarms.

[7] Alarms that are not marked PMJ or PMN shall be made RO. This alarm is only recorded in the history log.

[8] Default values for the Generic battery type correspond to equivalent battery models utilized by Nextel.
[9] Although default value is enabled, these batteries do not require a contactor disconnect since they disconnect or shut off by themselves.
[10] For reference LVLDA = Primary Load, Load A; LVLDB = Secondary Load, load B; LVLDC = Critical Load, Load C.
[11] May not be functionally used in the controller.

Notes: Events that are RO (Record Only) will not have any alarm relays assigned.

Appendix D: Alarms and Relays

Alarm Relays

The control unit is provided with six alarm relays; four to provide the actual alarm condition, and two to provide the severity associated with the alarm. The severity relays transmit the either PMJ or PMN. Each alarm is factory assigned a severity based on industry practices, however, they may be reassigned to MAJ, MIN, or RO (Record Only). An alarm condition with the RO severity results in the system controller transmitting the alarm without the severity but is stored in the history log. That is, neither MAJ (PMJ) nor MIN (PMN) is transmitted with the alarm.

The four selectable alarm relays are called Alarm Relay 1 (ALM1) through Alarm Relay 4 (ALM4). Relays are user definable in that the user may assign any combination of alarms from a given set of alarms. The following table shows which alarms may be assigned along with their factory default settings.

Alarms

Table D-1 shows a list of all alarms along with their descriptions, default settings, ranges and/or severity, and affected alarm relays and LEDs. The alarm settings are determined for the QS841A_NX1 controller. Events that are RO (Record Only) will not have any alarm relays assigned.

Table D-1: Alarms, Alarm Settings, Alarm Relays and LEDs

				Alarm Relays						LED			LED
Alarm / Event	**Description**	**Default Setting**	**Range / Severity**	**PMJ**	**PMN**	**Relay 1**	**Relay 2**	**Relay 3**	**Relay 4**	**PMJ**	**PMN**	**NORM**	**AUXMD**
										Red	Yellow	Green	Red
Auxiliary 1	Alarm asserted from a user configured event on this input. The alarm can be programmed to be asserted either on a closure or open to Vminus. P5.1 on the Distribution Module control board.	Major	Major/ Minor/RO	x						x			
Auxiliary 2	Alarm asserted from a user configured event on this input. The alarm can be programmed to be asserted either on a closure or open to Vminus. P5.2 on the Distribution Module control board.	Major	Major/ Minor/RO	x						x			
Auxiliary 3	Alarm asserted from a user configured event on this input. The alarm can be programmed to be asserted either on a closure or open to Vminus. P5.3 on the Distribution Module control board.	Major	Major/ Minor/RO	x						x			
Auxiliary 4	Alarm asserted from a user configured event on this input. The alarm can be programmed to be asserted either on a	Major	Major/ Minor/RO	x						x			

Alarm / Event	Description	Default Setting	Range / Severity	Alarm Relays						LED			LED
				PMJ	PMN	Relay 1	Relay 2	Relay 3	Relay 4	PMJ	PMN	NORM	AUXMD
										Red	Yellow	Green	Red
	closure or open to Vminus. P5.4 on the Distribution Module control board.												
Auxiliary Major Alarm	Alarm asserted when the controller detects a contact closure between pins 23 and 24 of the host-interface. The alarm is used to represent a failure in external equipment.	Major	Major/ Minor/RO	x						x			
Battery on Discharge	Voltage threshold generally used to indicate the system is completely or partially operating on battery power has been reached. System batteries are discharging.	-51.0V Major	-46 to -55V Major/ Minor/RO	x			o			x			
Battery High Temperature Disconnect	Temperature at which Battery contactors are forced open	75°C Major	30 to 90°C Major/ Minor/RO	x						x			
Check Battery	Alarm asserted when battery does not pass the manual, automatic or periodic discharge tests. Manual discharge tests must be user invoked.	RO	Major/ Minor/RO										
Circuit Pack Failure	External Modem Failure	RO	Major/ Minor/RO										
Clock Battery Low	The controller internal RAM backup battery is low and the controller needs to be replaced.	Minor	Major/ Minor/RO		x						x		
Comm Loss Major	Alarm asserted when controller loses communication with multiple serial rectifiers or the QS871 LVD board. This alarm is masked for the rectifier if the ACF or RFA alarms are detected prior to loss of communications in the failed rectifier.	Major	Major/ Minor/RO	x						x			
Comm Loss Minor	Alarm asserted when the controller can not detect a single serially connected rectifier or any number of thermal probes that was previously connected.	Minor	Major/ Minor/RO		x						x		
Controller Ambient Temperature High	Controller on-board ambient temperature measurement has reached the configured high ambient temperature threshold.	75°C RO	35-75 °C Major/ Minor/RO										
Controller Ambient Temperature Low	Controller on-board ambient temperature measurement has reached the configured low ambient temperature threshold.	-40°C RO	-40-10 °C Major/ Minor/RO										
Controller Fail	Controller has power and has failed. Implemented in hardware.	N/A	N/A	x	x					x	x		
Defective Temp Probe	Controller determines a "1-wire" probe to be defective.	Minor	Major/ Minor/RO		x						x		
Emergency	Input monitored for Emergency Power			x						x			

Alarm / Event	Description	Default Setting	Range / Severity	Alarm Relays						LED			LED
				PMJ	PMN	Relay 1	Relay 2	Relay 3	Relay 4	PMJ	PMN	NORM	AUXMD
										Red	Yellow	Green	Red
Power Off	Off conditions that opens all battery contactors.												
Fan Fail	One or more rectifiers has reported a failed fan	Major	Major/ Minor/RO		x					x			
Fuse Major	An input that has been properly configured and mapped as a Fuse Alarm Major has been detected.	Major	Major/ Minor/RO	x				o		x			
Fuse Minor	An input that has been properly configured and mapped as a Fuse Alarm Minor has been detected.	Minor	Major/ Minor/RO		x						x		
High Battery Temperature	Alarm asserted when the controller detects battery temperatures in excess of the configured threshold. Enabled with 1-wire temperature probes for slope thermal compensation.	55 ºC Major	30-85 °C Major/ Minor/RO	x						x			
High Boost Voltage Major	A High Voltage threshold during the Boost mode of operation used to indicate a possible damaging high output DC voltage level is present. The controller quits the Boost mode of operation.	-58V Major	-50 to -60V Major/ Minor/RO	x		o				x			
High Boost Voltage Minor	A high voltage threshold during the Boost mode of operation used to indicate an abnormally high output DC voltage level is present. The controller does not quit the Boost mode of operation.	-56V Minor	-50 to -60V Major/ Minor/RO		x	o					x		
High Float Voltage Major	A possible damaging Very High DC bus voltage threshold set for the normal Float mode of operation has been reached. The controller will issue a command to shut any offending rectifier/s off.	-58.0V Major	-50 to -60V Major/ Minor/RO	x		o				x			
High Float Voltage Minor	Voltage threshold during the normal Float mode of operation used to indicate an abnormally high output DC voltage level is present. The controller does not issue commands to shut rectifier/s down.	-56.0V Minor	-50 to -60V Major/ Minor/RO		x	o					x		
Imminent LVBD Shutdown	Alarm asserted when the DC buss voltages reach the disconnect threshold of the LVBD contactor. The controller will assert this alarm to indicate the batteries will be disconnected from the load in 15 seconds.This alarm must be enabled.	Disabled/ Major	Enabled/ Disabled (Major/ Minor/RO)	x						x			
LVBD	Low Voltage Battery Disconnect voltage threshold has been reached and associated contactor/s are being	-43.2V Major	-39 to -50V Major/ Minor/RO	x						x			

Alarm / Event	Description	Default Setting	Range / Severity	Alarm Relays						LED			LED
				PMJ	PMN	Relay 1	Relay 2	Relay 3	Relay 4	PMJ	PMN	NORM	AUXMD
										Red	Yellow	Green	Red
	opened.												
LV Disconnect Contactor LVBD Fail	Controller has determined that LVBD has failed. The contactor did not open or close when expected or is asserting an alarm in the closed state.	Major	Major/ Minor/RO	x						x			x
LV Disconnect Contactor LVBD Open	Low Voltage Disconnect Contactor LVBD is in the Open state either through manual intervention or LVD disconnect.	Major	Major/ Minor/RO	x						x			
LV Disconnect Contactor LVLDA Fail	Controller has determined that LVLD A has failed. The contactor did not open or close when expected or is asserting an alarm in the closed state.	Major	Major/ Minor/RO	x						x			x
LV Disconnect Contactor LVLDA Open	Low Voltage Disconnect Contactor A is in the Open state either through manual intervention or LVD disconnect.	Major	Major/ Minor/RO	x						x			
LV Disconnect Contactor LVLDB Fail	Controller has determined that LVD B has failed. The contactor did not open or close when expected or is asserting an alarm in the closed state.	Major	Major/ Minor/RO	x						x			x
LV Disconnect Contactor LVLDB Open	Low Voltage Disconnect Contactor LVLDB is in the Open state either through manual intervention or LVD disconnect.	Major	Major/ Minor/RO	x						x			
LV Disconnect Contactor LVLDC Fail	Controller has determined that LVLDC has failed. The contactor did not open or close when expected or is asserting an alarm in the closed state.	Major	Major/ Minor/RO	x						x			x
LV Disconnect Contactor LVLDC Open	Low Voltage Disconnect Contactor LVLDC is in the Open state either through manual intervention or LVD disconnect.	Major	Major/ Minor/RO	x						x			
LVLD A	Low Voltage Load Disconnect A voltage threshold has been reached and associated contactor/s are being opened.	-43.9V Major	-39 to -50V Major/ Minor/RO	x						x			
LVLD B	Low Voltage Load Disconnect B voltage threshold has been reached and associated contactor/s are being opened.	-45.0V Major	-39 to -50V Major/ Minor/RO	x						x			
LVLD C	Low Voltage Load Disconnect C voltage threshold has been reached and associated contactor/s are being opened.	-43.2V Major	-39 to -50V Major/ Minor/RO	x						x			

Alarm / Event	Description	Default Setting	Range / Severity	Alarm Relays						LED			LED
				PMJ	PMN	Relay 1	Relay 2	Relay 3	Relay 4	PMJ	PMN	NORM	AUXMD
										Red	Yellow	Green	Red
Manual Or Periodic Battery Test In Progress	Condition asserted to provide a remote indication that a battery test has been initiated either through automatic means. Automatic testing must be enabled. Factory default is disabled.	RO	Major/ Minor/RO										
Monitoring Module Failure	Controller has detected a failure in an attached remote monitoring module.	Minor	Major/ Minor/RO		x						x		
Multiple AC Fail	Detection of two or more rectifiers reporting ACF in the system.	Major	Major/ Minor/RO	x						x			
Multiple Rectifier Fail	Detection of two or more rectifiers failing in the system.	Major	Major/ Minor/RO	x						x			
Open String	Alarm issued when an external disconnect switch produces an open charge path to batteries in the Distribution Module. This alarm is only available when used with the QS871A Board is in the system (connector P4).	Major	Major/ Minor/RO	x						x			
Rectifier Fan Fail	Alarm asserted by a rectifier when one of its fans is deemed failing.	Minor	Major/ Minor/RO		x						x		
Rectifier Redundancy Loss	Alarm asserted when the total rectifier output current exceeds N rectifier capacity value. The feature must be enabled and assumes N+1 rectifiers are present in the system. Disabled by default.	Disabled/ Minor	Enabled/ Disabled (Major/ Minor/RO)		x						x		
Real Reserve Time Low	Reserve time low alarm threshold configured for systems calculated back-up reserve has been reached while system is on Discharge.	0 hours RO	0-99.9 hours Major/ Minor/RO										
Reserve Time Low	Reserve time low alarm threshold configured for systems calculated back-up reserve has been reached while system is on Float.	0 hours RO	0-99.9 hours Major/ Minor/RO										
Ringer # Ext Fail Minor	A minor external fault has occurred on Ringer Plant # (1-8).	Minor	Major/ Minor/RO		x						x		
Ringer # Ext Fail Major	A major external fault has occurred on Ringer Plant # (1-8).	Major	Major/ Minor/RO	x						x			
Ringer # Module fail	A ringer module has failed in Ringer Plant # (1-8)	Minor	Major/ Minor/RO		x						x		
Ringer Plant # Fail	Ringer Plant # (1-8) has failed.	Major	Major/ Minor/RO	x						x			
Ringer Plant # Fan Fail	Ringer Plant # (1-8) has a fan failure.	Minor	Major/ Minor/RO		x						x		
Ringer Plant # Redundancy	Ringer Plant # (1-8) no longer has a redundant ringer module.	Minor	Major/ Minor/RO		x						x		
Sense Fuse	Alarm that is automatically asserted when the controller senses the DC bus voltage to be lower than 35.5V +/-	Major	Major/ Minor/RO		x						x		

Alarm / Event	Description	Default Setting	Range / Severity	Alarm Relays						LED			LED
				PMJ	PMN	Relay 1	Relay 2	Relay 3	Relay 4	PMJ	PMN	NORM	AUXMD
										Red	Yellow	Green	Red
	0.5V.												
Single AC Fail	Detection of a single rectifier reporting ACF in the system.	Minor	Major/ Minor/RO		x						x		
Single Rectifier Fail	Detection of a single rectifier failing in the system.	Minor	Major/ Minor/RO		x						x		
Un-powered Controller	The controller is not receiving DC power from the shelf. All Form-C relays are de-energized to assert respective alarms.	N/A	N/A	x	x	x	x	x	x				
Very Low Float Voltage	The system DC output voltage has reached a low voltage threshold generally set below the BD threshold. This alarm is used to indicate that the battery reserve is depleting and the DC voltage is approaching a critically low output value.	-46.0V Major	-40 to -51V Major/ Minor/RO	x			o			x			
Voltage Imbalance Detect	Alarm asserted when the controller detects greater than 1.7V difference between two halves of each battery string for more than 24 hours. Feature is enabled through the use of 771 voltage modules.	Disabled/ Major	Enabled/ Disabled (Major/ Minor/RO)		x				o		x		
Voltage Monitoring Module Failure	Alarm asserted when a problem is detected with an ES771 voltage monitoring module	Minor	Major/ Minor/RO		x						x		

Note 1: Communication loss with a single rectifier or any number of thermal probes is considered a PMN alarm. Communication loss with the LVD card is considered a PMJ alarm.

Note 2: Communication loss with multiple rectifiers or devices other than thermal probes shall be considered PMJ alarms.

Note 3: An alarm can be triggered from an external event if a user has properly configured the input assignments. An alarm can be asserted either for closure or open to Vminus, depending on how user has configured alarm.

Note 4: Ringer features are not utilized with the NX400. However, they are part of the QS841A and are listed.

Note 5: Events that are RO (Record Only) will not have any alarm relays assigned.

All alarm relays are Form-C type and have the O, C, and R pins available on the controller connector J1. The relays are rated for a maximum contact voltage of 60Vdc and maximum contact current of 0.5A.

Issue History

Issue 8

Modified Table 4-C to match configuration, enhanced alarm test on figure 5-4.

Issue 7

Updated Tables C-1 and D-1, updated Figures 5-3 through 5-6, added few new menu items.

Issue 6

Rebranding.

Issue 5

Corrected figures 4-3, 4-10, 7-4, note on bottom figure p36, change 23A to 22A on p11, corrected default shunt values on p71, corrected ID#s on p72-73, fan failed on p82, and changed QS872 to QS871 on p121.

Issue 4

Added Table 4-D and removed Appendix E. Updated Figure 4-8 to show one input per two rectifiers as factory default. Updated Figure 1-2 to reverse battery string numbering.

Issue 3

Updated document with graphics and more details. Initial release to full production.

Issue 2

Added QS841A_NX and EBW material. Changed pictures to indicate Craft and rear access SNMP port. Pictures and text updated for AC.

Issue 1

Initial release.