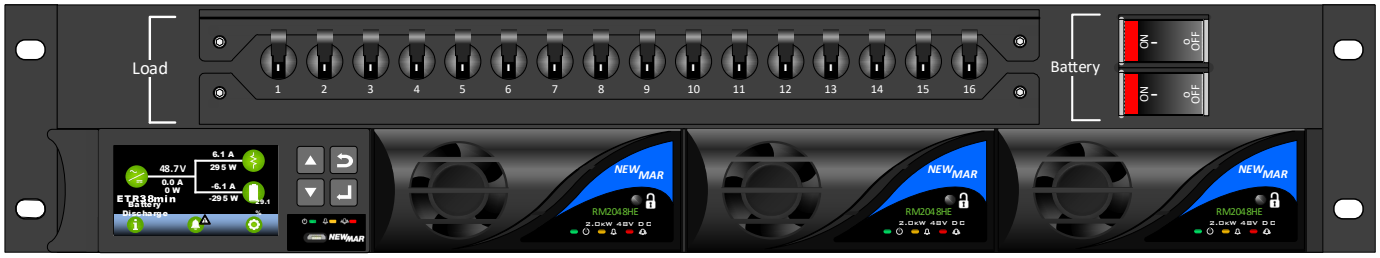
NEWMAR
A MISSION CRITICAL ELECTRONICS BRAND

POWERING THE NETWORK
www.poweringthenetwork.com | 800.854.3906
Costa Mesa, CA



Centurion II Power System

DC Power System

Installation / Operation Manual

Model:

C2RS (-48VDC and +24VDC)

Product Compliance

CE

RoHS

Copyright © NewMar 2021 All rights reserved.

Manual Version 1.0
Release Date: 24 May 2022

Disclaimer: NewMar reserves the right to make changes to the information within this document without notice

TABLE OF CONTENTS

1. ADMONISHMENTS

The admonishments are the symbols and wording used in this manual to alert readers to specific dangers and instructions. The meanings of the various admonishments are explained as follows:

Warning = risk to life or personal injury and equipment damage

Caution = risk of equipment damage.

 = risk of electrical shock potentially causing death or injury.

 = alert of risk potentially causing death or injury.

 = risk of burn injury from hot surfaces

 = an alert that must be understood and undertaken.

 = instruction of mandatory reading of product manual.

  = risk of electrostatic damage to components. Proper precautions must be taken.

 = access for children prohibited.

 = restricted access area.

 = tip over hazard.

2. SAFETY

  All installation and maintenance must be carried out by suitably qualified personnel.

  For your protection, the product manual should be read and thoroughly understood before unpacking, installing, and using the equipment.

  The energy manager contains static sensitive components that require careful handling and proper precautions to be taken. A grounding strap should be worn.

  The equipment is intended only for use in a restricted access area. The equipment is not suitable for use in locations where children are likely to be present.

3. Receiving Instructions

Newmar provides all equipment to the delivering carrier securely packed and in perfect condition. Upon acceptance of the package from Newmar, the delivering carrier assumes responsibility for its safe arrival. Once the equipment is received, it is the recipient's responsibility to document any damage the carrier may have inflicted, and to file the claim promptly and accurately.
NOTE: the period to make a claim against damage by a transport carrier can be short, a matter of days, and varies by transport method, the transport contract, and local laws.

3.1. Package Inspection

Examine the shipping crate or carton for any visible damage: punctures, dents, and any other signs of possible internal damage.
Describe any damage or shortage on the receiving documents and have the carrier sign their full name.

3.2. Equipment Inspection

Open the crate or carton and inspect the contents for damages. While unpacking, be careful not to discard any equipment, parts, or manuals. If any damage is detected, call the delivering carrier to determine the appropriate action. They may require an inspection.
NOTE: Save all the shipping materials for the inspector to see.
After the inspection has been made, if damage has been found, contact Newmar. We will determine if the equipment should be returned to our plant for repair or if some other method would be more expeditious. If it is determined that the equipment should be returned to us, ask the delivering carrier to send the packages back at the delivering carrier's expense.
If repair is necessary, we will invoice you for the repair so that you may submit the bill to the delivering carrier with your claim forms.
It is your responsibility to file a claim with the delivering carrier. Failure to properly file a claim for shipping damages may void warranty service for any physical damages later reported for repair.

3.3. Handling

Handle the equipment with care. Do not drop or lean on front panel or connector. Keep away from moisture.

3.4. Identification Labels

Model number and serial number are clearly marked on all equipment. Please refer to these numbers in all correspondence with Newmar. Ideally provide a photograph of the product label for reference.

4. Scope

This manual covers essential information for the installing and commissioning of the Newmar Power System Centurion II.
Note: System set-up for the controller, power modules and other ancillary devices are provided in separate manuals. Where appropriate these are supplied with the system.
Note: The Centurion II System is available with Positive Earth (-48Vdc, -60Vdc) or Negative Earth (+24Vdc). The installation manual covers both Positive and Negative Earth systems. The standard system is assumed to be a Positive Earth system. Where parameters and settings differ between systems, the Negative Earth system parameters are specified within parenthesis i.e. ().

5. System Overview

The system is intended to be a complete power system in a box, so no connections need to be made internally.
All the AC, DC (Load and Battery) connections are made at the rear of the unit.
Alarm connections are accessible from the front by pulling the Energy Manager forward.
The system is designed to be extremely simple to install and set up.

Note: This system is supplied with the AC and DC earths connected unless chassis DC isolation is specified when ordering. The standard -48 VDC system output has the DC Common in the positive side of the circuit (+ve earth system). On +24 VDC systems, the DC Common has the negative side of the circuit (-ve earth system) connected to system chassis/earth. The earth link can be removed from the system to isolate earths

5.1. Power System

Standard Features
The base unit is supplied with the following standard options:

- AC Input: Three sets of single-phase input terminals: A-L1, B-L1, C-L1 & A-L2, B-L2, C-L2 plus Earth are provided to allow several input wiring options.
- DC Output: maximum power output of 6.0kW (+24V rated to 3.0kW @ 24V, 3.3kW @ 27V), producing a maximum current output of 125A/-48V (125A/ +27V).
- Up to 3 x 37-amp (-48V or +24V) C2R-2000 or C2RX-2048 rectifiers 41.7A max (may be packaged separately) or 3 x 18-amp (-48V) C2R-1000 rectifiers
- EM4x energy manager system controller (fully integrated in the system)
- Battery Low Voltage Disconnect 125A rating
- 2x 100A Battery Circuit Breaker.
- 8x 10A, 4x 20A, 4x 30A default Load Circuit Breakers, these may be specified as different values (from 2A to 30A) at time of order.

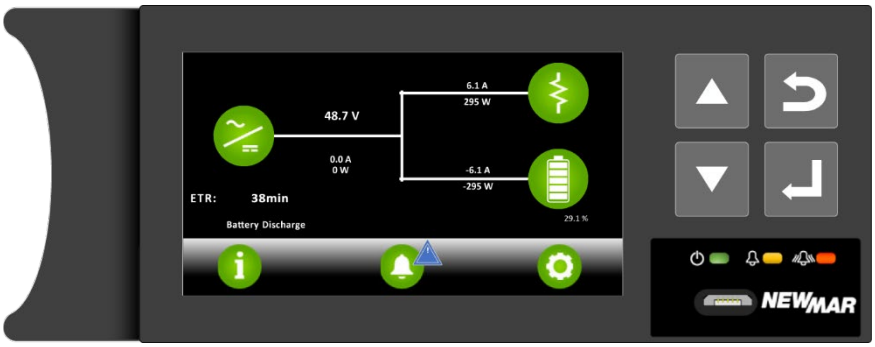
Note: **Two 3 position terminal block links/jumpers are provided (in manual bag) to allow one two wire AC input.**

5.2. Physical Dimensions and Weights

Model	Centurion II
Depth (Total)	350mm
Width (Total)	483mm (19” mount)
Height	88.9mm (2U)
Weight without rectifiers	8.4kg
Weight with max. rectifiers	13.2kg

Table 1

Energy Manager



5.3. Alarms and Status Indicators

- Status LEDs:
  - Red LED Urgent alarm state.
  - Orange LED Non-Urgent alarm
  - Green LED DC power is connected to the unit; Energy Manager is functioning

    NOTE: The LED mapping can be user modified.
- The energy manager is fitted with an audible buzzer which can be configured to alert to any alarm depending on the alarm mapping.
  NOTE: To disable the buzzer when active, tap any button.
- Micro-USB Connector: can independently power the EM4x and provides access to the Web UI

  Note: when there are multiple alarms raised the Active Alarm display cycles through the list. The complete list can be viewed by tapping Alarms.
- Tap the buttons to navigate through the menus.

  Note: the EM4x-01 has the option to PIN lock function change through the front screen interface. See the EM4x manual for details.

5.4. EM4x Features

The EM4x microcontroller-based DC system energy manager provides the control and monitoring functions for all Newmar Energy's power systems. With an appropriate communications connection third party lithium battery can also be managed.
The EM4x monitors all power system conditions including DC voltage, rectifier current, battery current, battery temperature, distribution failure and battery pack status. It has an in-built web-based configurator allowing setup of system parameters, monitoring, updating and download of logs using a web browser as well as a front panel interface through which key parameters are also configurable. Visual notification of alarm conditions is given by LEDs and a display mounted on the front of the EM4x, with remote notification being enabled by relay contacts, RS232 or TCP/IP (using SNMP).
The EM4x utilizes a USB communications port which allows for local monitoring of system operations as well as pre-commission and power down configuration of the Web UI.
The EM4x also incorporates the following features:

- Support for third-party external batteries, both lead-acid and lithium based
- Support for AC-DC rectifiers (24V and 48V Outputs)
- Network connectivity (web access)
- System voltage metering for primary system DC supply. (e.g., 48V primary DC output)
- Load, battery and rectifier current metering and alarms
- Active rectifier current share
- Automatic system voltage control
- Effectively unlimited alarm thresholds as standard, for use with multiple DC outputs
- Advanced monitoring, display and logging of battery packs, and system performance data
- Advanced hybrid site control and monitoring with patented anti-stall feature for generators.
- Phase balance controls for multi-phase and single-phase AC input management
- Sophisticated programmable logic control
- For lead-acid external batteries -
  - Battery and room temperature metering and alarms (when fitted with optional temperature sensors)

- Temperature compensation of float voltage (when fitted with optional temperature sensors)
- Manual equalize charging to prolong the life of the batteries
- Periodic equalize charging to prolong the life of the batteries
- Fast charging after battery discharge
- Battery capacity remaining indication
- Battery testing facility
- Battery current limit

- Six user defined General Purpose Inputs ("GPIPs") which can be software configured as either digital or analogue inputs* (up to 10 may be made available under special circumstances)
- Six relay outputs*

5.5. Rectifier Modules

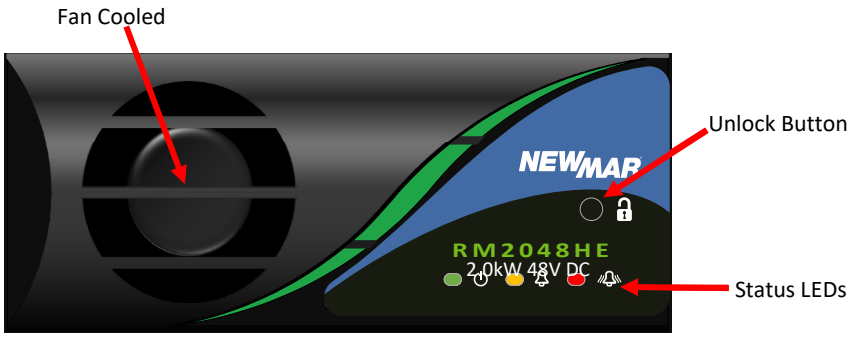


Figure 4: RM2048HE Rectifier

The RM2048HE is a telecommunications grade rectifier with the following features:

- High efficiency
- Hot pluggable
- Forced air cooled
- Thermally protected
- Power factor corrected
- Wide input AC voltage
- Constant power output limit
- Input/Output voltage and current protected
- Active load sharing
- Serial alarm and control interface
- Microprocessor controlled

There are 3 LED indicators on the front panel which indicate the operational state of the rectifier:

Red LED	Urgent alarm state.
Yellow LED	Non-Urgent alarm.
Green LED	DC power is connected to the unit. This LED flashes during power save mode.

6. INSTALLATIONS

WARNING - All upstream AC, Load and Battery breakers must be switched OFF prior to installation. The system must be completely de-powered.
All circuit breakers in a Newmar power system must be in their OFF position prior to installation.

WARNING - Use extreme care when fitting batteries & their connections. Remove all conductive materials from yourself such as watches, jewelry, and rings prior to

commencing the installation. DO NOT short terminals when working on them.

CAUTION - Avoid resting cables on sharp edges (cold-creep)

The energy manager contains static sensitive components that require careful handling and proper precautions to be taken. A grounding strap should be worn.

6.1. Unpacking & Installing in Frame

Upon unpacking, check that the unit is not damaged, and that you have the required number of rectifiers.
The unit flush mounts into a standard 19" mounting frame. The mounting screws should be #12-24; however, #10-32 may be used with washers. Be sure to mount the unit in the 19" frame squarely if #10-32 screws are used.
Please note the complete system weight is 13.2kg. (29 lbs.). Ensure the 19" mounting rails can withstand mounting of the system.

A 5/32" (4mm) wide slotted screwdriver has been provided to allow ease of accessing some of the smaller recessed DIN style terminal block screws.

Note: Do not fit rectifier modules until the Centurion II DC power system has been installed into the rack.

6.2. AC Cabling

The AC terminals are clearly marked at the rear of the system as shown in Fig 1.0 & 1.1. The terminals can accept up to 8 AWG/10mm^2 cables.
Once cables are connected, ensure cable clamps are secured. Refer to appendix 5 for AC junction box cover removal (page 24)
The AC earth terminal earths the System chassis. The AC earth is also internally bonded to the System chassis by earth stud as shown in Fig 1.1. The AC earth terminal can accept several small cables or up to a single 2 AWG cable.
DC Common (+ve) is connected to the AC earth as shown in Fig 1.1 but can be removed if output is required to be isolated.

Note: Refer Appendix 3 for AC Input Transient Protection

CAUTION: For 3 phase operation remove the Single-Phase link fitted between the phases.

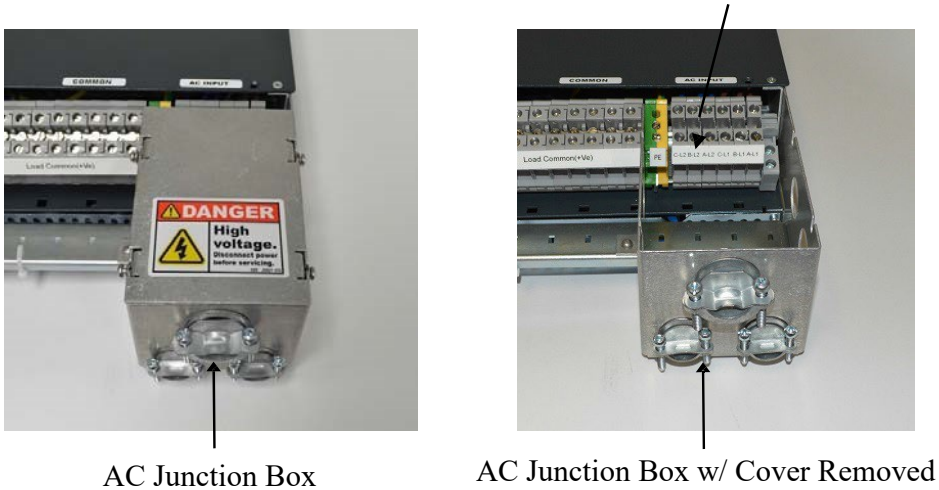
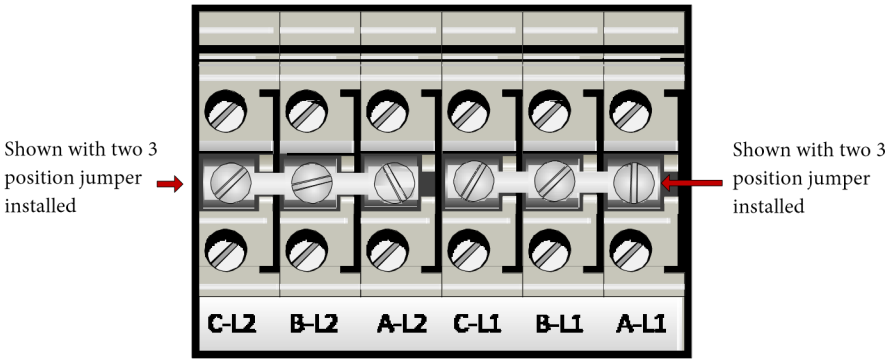


Figure 1 AC Input



AC Input Terminal

Note: See Appendix 5 for information regarding the AC junction box.

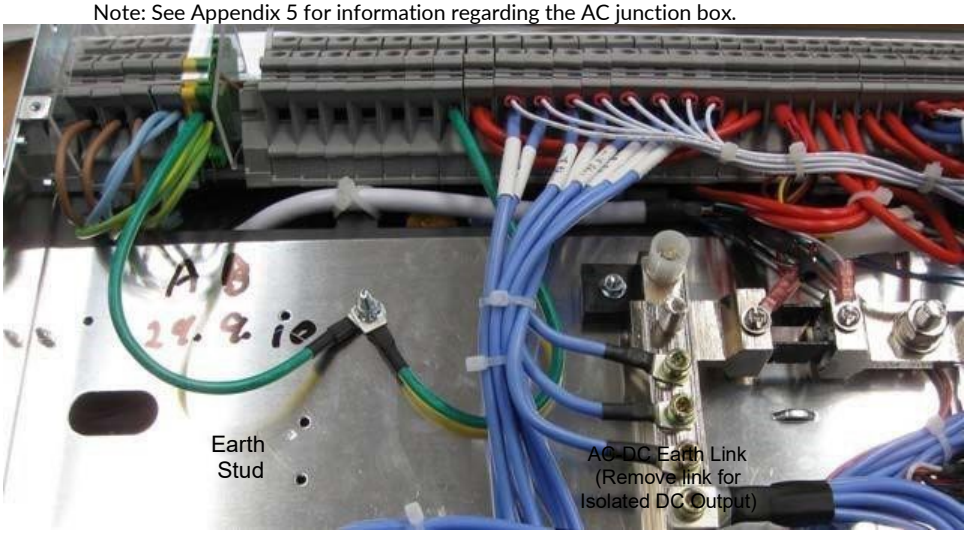


Fig.1.1 AC – DC Earth Link

6.3. Upstream Over-current Protection

There are two considerations to consider when selecting an appropriate fuse/circuit breaker.

- The upstream protection should protect the downstream cable from overload situations.
- Discrimination should be maintained with the downstream device fuses.

Cable Rating

The maximum current drawn by the DC power system is 12.5A per 2kW rectifier (6.2A for 24V system and 48 VDC/1 kW rectifier modules), or 37.3A (18.7A for 24V system and 48 VDC/1 kW rectifier modules) per fully populated rectifier shelf at a minimum input voltage of 175V AC and full output power. The upstream protection device must be able to supply this load under all conditions without tripping. Therefore, typically at least 20% headroom is allowed for the protection device, making its minimum rating 15A/per 2kW rectifier (7.5A) or 44.8A (22.5A) for fully populated rectifier shelf.

Note: The current carrying capacity of cables is dependent on the type of cable used. Please check with your local supplier and local regulations for appropriate sizing.

6.4. Discrimination

Discrimination ensures that the upstream circuit breaker or fuse does not blow if a rectifier input fails (short circuit). Therefore, it is important to ensure the upstream protection discriminates with the internal fuse of the rectifier. The fuse used in the RM2048/24, C2R-2000, and C2RX- 2048 rectifiers is a slow-blow 15A fuse. The tripping curve for this is shown in Appendix 4 at the rear of this manual.

A minimum circuit breaker to use for this system is a 20A, D-curve (note, a 20A C-curve breaker will **not** discriminate with the rectifier fuse). Therefore, when used with the 2.5mm^2 cable supplied, a 20A, D-curve breaker should be used.
Alternatively, a 32A C-curve breaker, or greater, can be used. However, AC cable provided may have to be replaced for a larger cable[1].

If a fuse is used upstream, then any BS88 or NH g style fuse, of 20A or greater rating will discriminate.

6.5. DC Cabling

CAUTION: Use extreme care when fitting batteries & their connections. Remove all jewelry and rings from oneself prior to commencing the installation. Always use insulated tools when fitting batteries and take extreme care not to short terminals when working on them.

6.5.1. Terminal Block Labeling

Note: Your Centurion II Load & Battery Terminal Blocks maybe labeled differently than shown in photos on the following page. Some Centurion II shelves' terminal blocks are identified by Numbers which are the **Live or Hot** terminals and the words **Batt. Common** or **Load Common** which are the **Return** or **Ground** terminals – see polarity table below.

System Voltage	"Numbered' (AKA: Live or Hot)	'Common' (AKA: Return or Ground)
-48 VDC	-	+
+24 VDC	+	-

6.5.2. Terminal Block Max Wire Size/Recommended Torque Specification

Connection	Max AWG	Recommended Torque
AC Input	8	10.5 in/Lbs.
AC Earth	2	22 in/Lbs.
Loads 1 – 8	8	10.5 in/Lbs.
Loads 9 - 16	10	10.5 in/Lbs.

Note: A larger breaker may be used even though in theory it may appear that the 2.5mm wire is not fully protected. In fact, it is protected on two accounts. Firstly, it is protected by the rectifier input fuse (which is only a short distance away). Secondly, the rectifiers are power limited on their input. Therefore, they can never be overloaded. As a result, the wire can never be over-loaded by the rectifier – it can only see fault current. As a result, depending on local authorities, only fault current protection may be catered for by the upstream protective device.

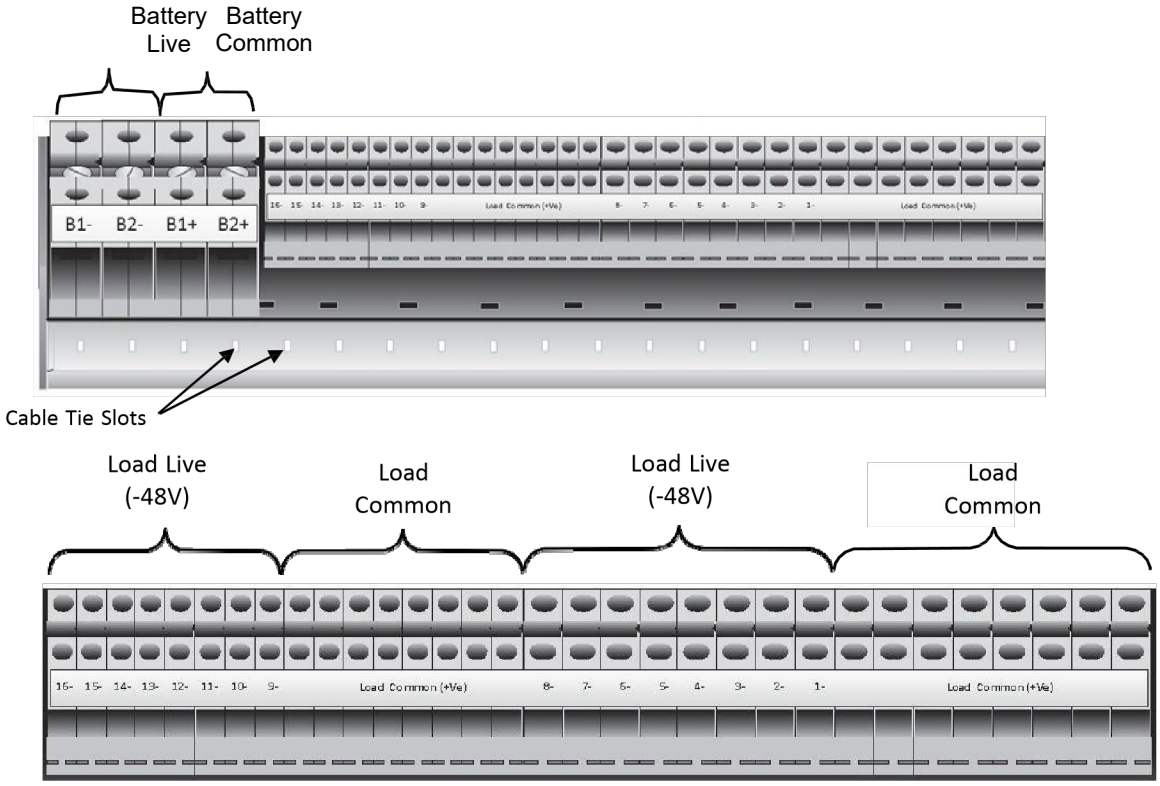


Fig. 2 Battery & DC Output Terminals (+ve Earth System, -48V or -60V)

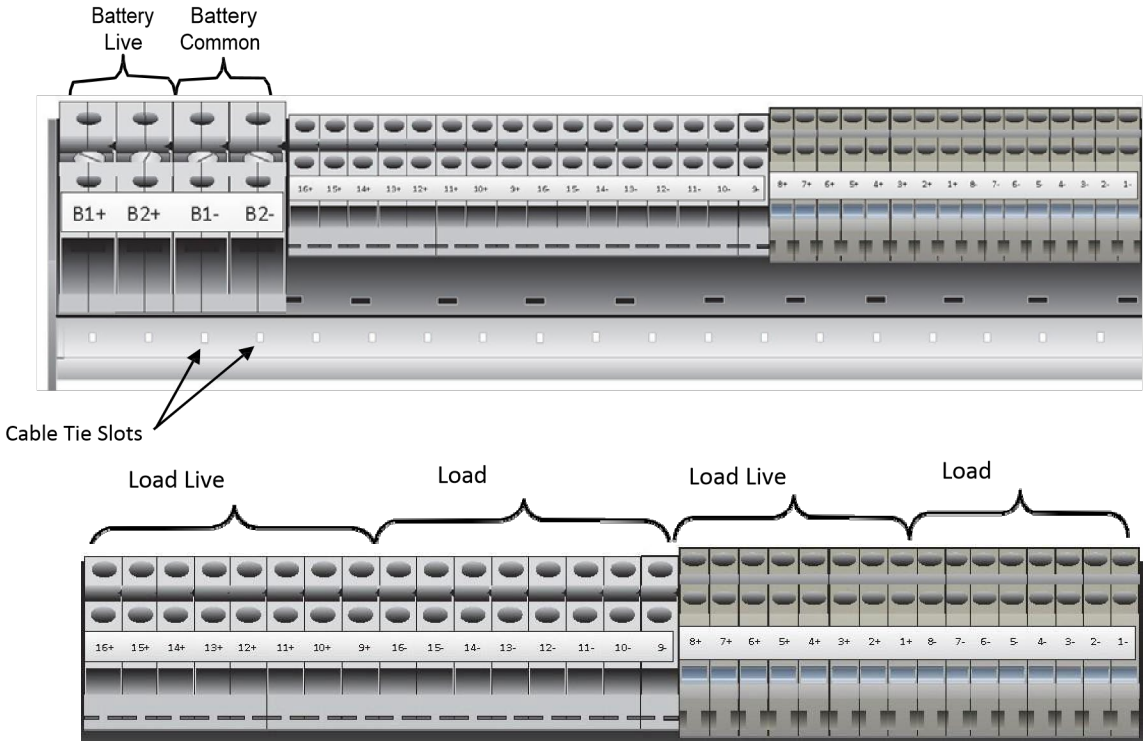


Fig 2.1 Battery & DC Output Terminals (-ve Earth System, +24V)

All live DC and Common connections are made to the connectors at the rear of the unit as shown in Fig 2 and Fig 2.1.
For 1-8 load breakers 8Awg/10mm^2 terminals are used whereas for 9-16 load breakers, 10 Awg/6mm^2 terminals as shown in Fig 2 and Fig 2.1.

The battery terminals shown can accept cables up to 2 Awg/35mm^2.

The internal battery cabling goes directly to the circuit breaker, then via a Low Voltage Disconnect relay and current shunt to the internal live bus. This can be seen on the wiring diagram at the rear of this manual & in Fig 5.

Ensure cables are strain relieved by utilizing the cable tie slots provided as shown in Fig 2.

6.6. Alarm/Ancillary Cabling

Alarm and communication cables terminate directly into the terminals of the Energy Manager. These terminals are accessible by pulling the monitor forward to expose connections as shown in Fig 3, Fig 3.1, Fig 3.2 & Fig 3.2a. When routing the cables, ensure they are kept away from the AC and DC power cables when possible.

6.7. Temperature Sensors

Uncoil the battery temperature sensor tie wrapped to rear of shelf and place in the middle of the middle battery string. If the lead is not long enough, ordinary 2-core copper (approx. 18 AWG/0.75mm^2) wire can be used as an extension. The purpose of the battery temperature sensor is to monitor the ambient temperature of the batteries over long periods of time and adjust the rectifier output (float) voltage accordingly. As a result, it is not necessary to have the temperature sensor touching the batteries. If the Battery Temperature Sensor is removed a “battery temp fault” alarm is generated.
The “Ambient” temperature sensor (optional) can be used to monitor the temperature in another location if required. Temperature sensors from the older Sm3x controllers are not compatible with the EM4x controller.

7. Energy Manager Connectivity and the Web UI

The energy manager is configured via a web browser-based user interface (Web UI).
There are two methods to access the Web UI:

- Ethernet connection from the J305 ethernet connector
- Front panel micro-USB local connection

7.1. Access Levels

There are 3 access levels for the Energy Manager Web UI:

enaguest : can only view status of system

enabasic : reduced privilege, can view settings and system status

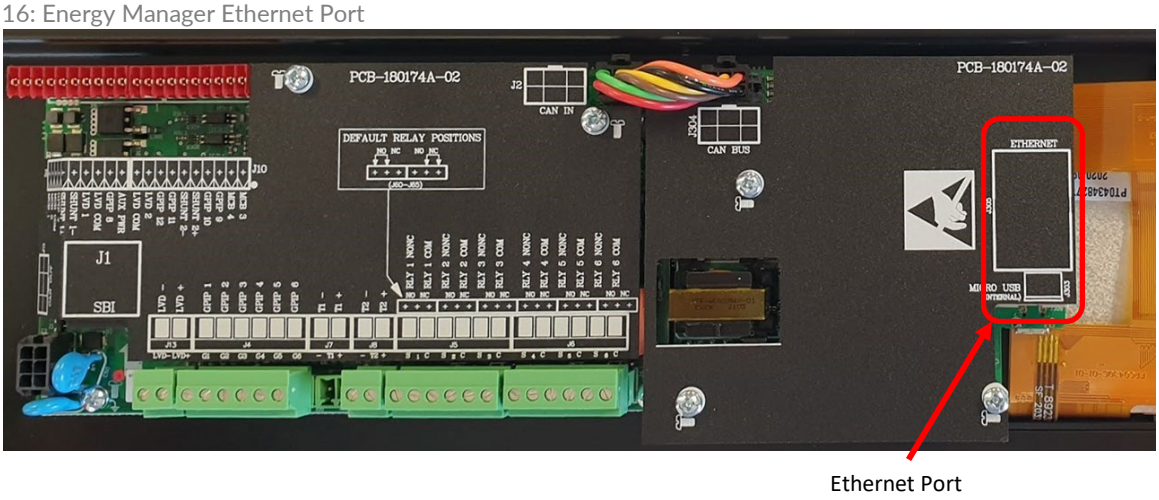
enaadvanced : this user has normal full control access of the system

The default password for all levels = ena123

7.2. Ethernet Port Connection

The energy manager contains static sensitive components that require careful handling and proper precautions to be taken – an electrostatic discharge protection device must be worn.

Figure 16: Energy Manager Ethernet Port



1. Connect the communicating device to the J305 Ethernet port inside the energy manager.
2. Open an internet browser such as Edge, Chrome, Firefox or similar on the device.
3. Enter the Ethernet default IP address into the internet browser.

Note: the energy manager IP address can be located from the front panel LCD menu under: Settings>Networking>Ethernet.

4. The energy manager log in page appears.
5. Enter the username and password. See 7.1 Access Levels.

7.3. USB Connection

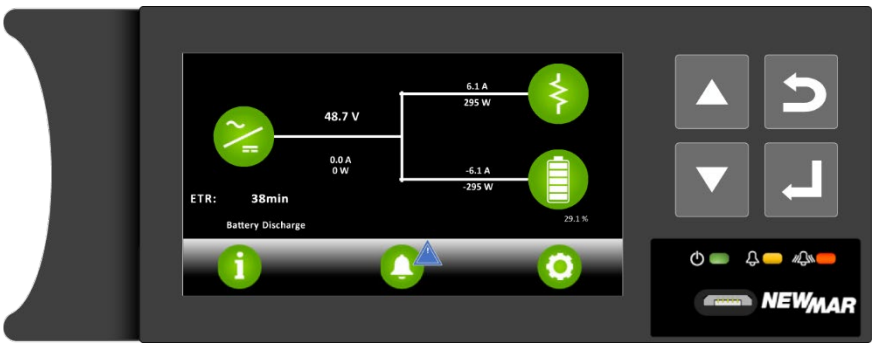
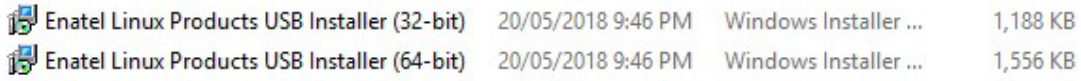


Figure 17: 1U EM4x-01 Front Panel micro-USB

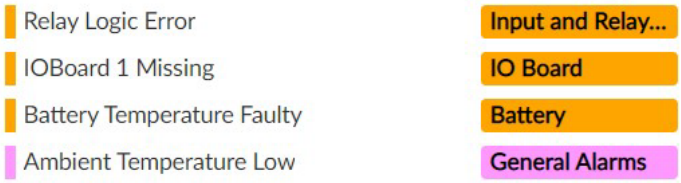
1. Connect the communicating device to the micro-USB port on the front of the energy manager. See Figure 17.
   A driver installation prompt appears.



2. Double-click the appropriate USB driver (32bit or 64 bit).
3. Follow the installation wizard instructions to install the driver.
4. Open an internet browser such as Edge, Chrome, Firefox or similar.
5. Enter the USB default IP address into the internet browser: 172.31.250.1
6. The energy manager log in page appears.

6. Enter the username and password. See 7.1 Access Levels.

Note: USB connection to the energy manager is possible without AC, battery or other external power supply. The EM4x operates drawing power through the USB port. However, USB supply does not power the IO Board. In this scenario there is a set of alarms that display depending on the system configuration relating to the nonoperation of the IO board.
For example:



For information on the use of the energy manager Web UI please refer to the Energy Manager Installation and Operation Manual.

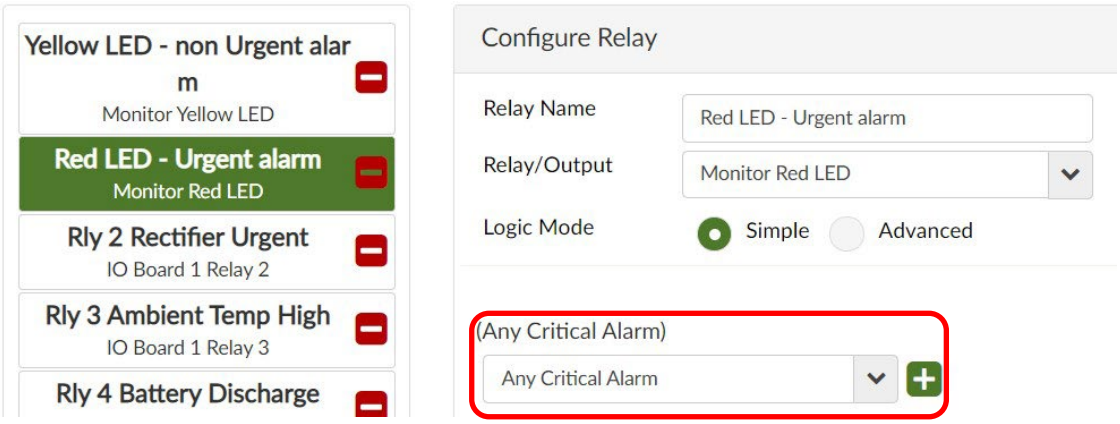
7.4. Energy manager & IO PCB Alarm Output Configuration

For full EM4x functionality and operation information, refer to the EM4x Installation and Operation Manual.

7.5. EM4x LED Alarm Mappings

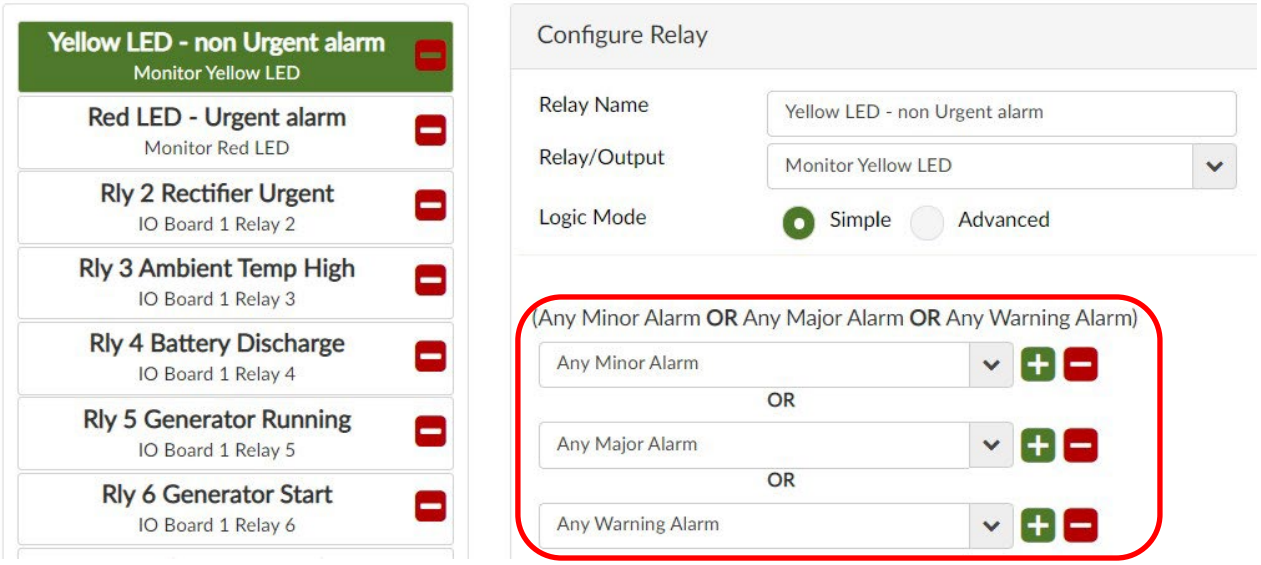
Refer to the Alarm Configuration>Alarm Configuration page of the Web UI to see the priority setting of each alarm.
Refer to the Relay/Output page Configure Relay section of the Web UI to understand the how the Alarm Configuration is mapped to the EM4x LEDs.

EM4x Red LED Urgent Alarm Mapping



(For reference only. Actual system alarm mapping may vary)

EM4x Yellow LED non-Urgent Alarm Mapping



(For reference only. Actual system alarm mapping may vary)

7.6. EM4x Main PCB Alarm Mappings

Alarms can be mapped to any of the voltage free output relays fitted to the EM4x. Output states of either Normally Open or Normally Closed can be selected (NO and NC states are for the de-energized relay). A jumper is fitted to nominate the required output state, ensure the jumper is placed in the correct configuration for installation requirements.

If an alarm is programmed for the relay to be normally energized (such as a low voltage alarm where loss of power will put the alarm into its “active” state), then be sure to connect the remote wiring appropriately.

Table 2 lists alarm assignment for the EM4x controller as matches the relay outputs shown in Figure 18.

Figure 18: EM4x Relay Outputs

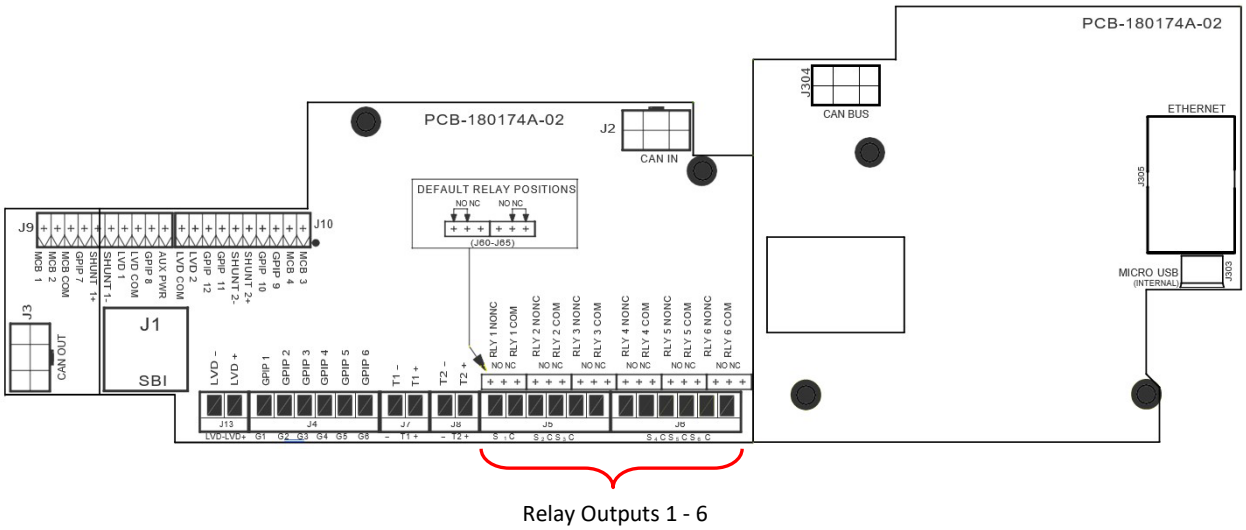


Table 2: IO Board 1 Relay Alarm Assignments

Relay Output	Relay Label (In NewMar Config.)	Alarms Mapped to Relay/Output (All multiple states "OR-ed")
Relay 1	CPU Fail	
Relay 2	Non-Critical Alarms	Orange LED
Relay 3	Critical alarms	Red LED
Relay 4	Spare	
Relay 5	Spare	
Relay 6	Spare	
Buzzer		Red LED

7.7. EM4x Main PCB Digital Input Alarm Mappings

General purpose inputs allow the Commander II & II+ system to monitor any external equipment that includes relay or auxiliary outputs. The GPIP inputs are activated by connecting the system positive (common) to the input terminal (configuration setup in the EM4x can allow activation by connecting to system live).
General purpose inputs can also be configured as analogue inputs for purposes such as battery midpoint monitoring and voltage monitoring.
These inputs may be assigned to contribute to alarm states within the monitor. The state mapping is defined in the configuration file. Alarm mapping should be completed using the EM4x software. Please refer to the EM4x manual for detailed information.
The inputs are normally activated by connecting system positive (usually system common) to the input.

7.8. Circuit Breaker Fail Monitoring

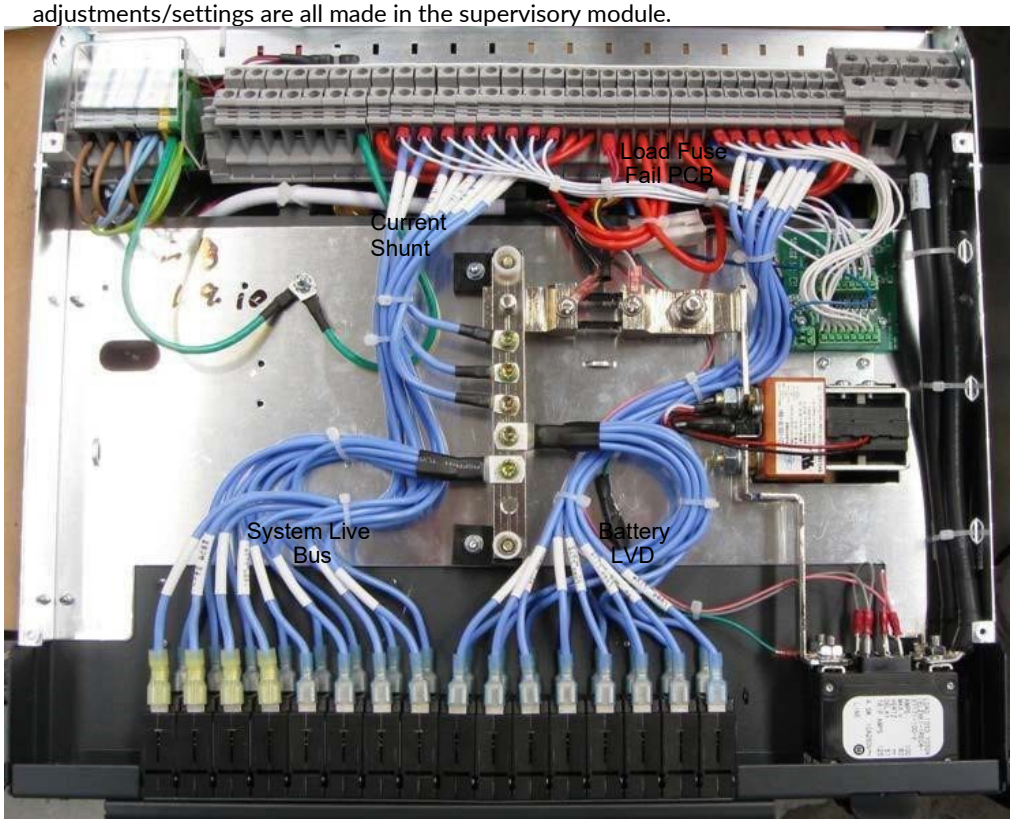
Comment: Main circuit breakers (MCBs) are monitored electronically via a diode to a digital input on the EM4x. The digital input will trigger an alarm when it is pulled to the system common (positive) rail. The Breaker Fail alarm will only operate if a load is connected to the output to provide a return circuit for the sense wire. Therefore, for breakers that do not have a load connected, the breaker can remain in an OFF position without causing a false alarm. The battery circuit-breakers, however, use voltage sense to detect tripping or whether they are turned off. This is because when a battery breaker is tripped, there may be very little voltage difference across the breaker, making electronic fail detection problematic. Hence, if no battery is connected, the breaker must be ON to clear the Battery Breaker Fail alarm.

8. LVD OPERATION

The primary Low Voltage Disconnect contactor is in the battery side of the DC distribution. A secondary Load Low Voltage Disconnect can be optionally included in a section of the load side of the DC distribution.

The LVD contactor is a bi-stable, magnetically latching contactor. This means that failure of power or removal of the EM4x from a live system will not cause the contactor to change state. Periodic pulsing of the LVD control signal allows the monitor to ensure the contactor remains in the correct state. The contactor is monitored by the EM4x to allow an alarm to be generated when the contactor is open.

The EM4x energy manager unit is powered from both the rectifier side of the LVD contactor and direct from the battery source. Following an extended AC outage and the low output voltage threshold being reached, the primary LVD disconnects the battery from the system live bus and the EM4x will lose voltage sense (as voltage sense is measuring system live bus voltage) yet still maintains operation for system monitoring. The LVD contactor will not re-engage until rectifier input supply is restored (i.e., until the DC bus voltage is re-established). LVD adjustments/settings are all made in the supervisory module.



9. MAINTENANCE

As Newmar power systems are state of the art electronic systems, little routine maintenance is required.

9.1. System

- During normal operation the cable entries to the MCBs may loosen over time due to movement in the cable strands. To avoid damage to the MCB's and cable entries due to heat build-up and arching, it is recommended that the retaining torque is periodically checked at least annually.
- MCB's should be maintained at a torque of 2Nm.
- All other connections should also be checked at this time.

9.2. EM4x Controller

- The controller can give a good indication of the condition of the system. Alarm logs can show issues with the system and rectifiers and should be regularly checked.
- As a minimum, check that the float voltage and load current is as expected.
- If the batteries are fully charged, check the battery current is zero or near to zero amps, and check that the amp-hours remaining is 100%.

9.3. Rectifiers and Converters

- During normal operation some dust will build-up on the front of the rectifiers. This should be kept to a minimum by regularly wiping the rectifiers to avoid accumulation within the rectifiers and blocking the airflow to the units. The positioning of the system and surroundings will determine the regularity of this requirement.
- In extremely dusty positions it is recommended that the units are removed and cleaned with compressed air to prevent airflow blockages.
- Check the air flow front and back to the rectifiers is unimpeded by cables or otherwise.
- Check nothing has entered the rectifiers such as insects or geckos.

9.4. Batteries

- Battery maintenance depends on the individual manufacturer's specification, please contact the battery supplier for recommendations.
- Periodic discharge tests may be beneficial to ensure reliable system operation and may be recommended by the battery manufacturer.

CAUTION - The user must be aware of the consequences of battery State of Health (SoH) with regards their specific load requirements and implement their own policy regards the end of life of the batteries.

9.5. Ventilation Maintenance

Check that there has been no change in the required airflow space or environment that impacts the ventilation.

10. TROUBLE-SHOOTING AND SERVICING

If the red LED is alight:

- Unplug the rectifier and re-engage.
- Check AC power to the rectifier.
- Check for rectifier alarms in the monitor Urgent Alarm list.
- If symptoms persist, contact a service agent.

If the yellow LED is alight:

- Check the monitor Non-Urgent Alarm list.

10.1. Servicing

DANGER - **Do not operate the rectifiers, converters, or other power modules if the covers are damaged or removed in any way.**

WARNING - **The rectifiers, converters or other power modules contain voltages that may be lethal even after the input supply has been removed.**

WARNING - **The rectifiers, converters or other power modules contain components at high temperature that may burn if touched**

To isolate a rectifier or converter from the power supply, unplug it from the shelf.
The power modules contain no user serviceable components. Do not disassemble the modules.
If a power module has an operational fault or is damaged in any way, an authorized service center should service it immediately.

11. ESSENTIAL SYSTEM SET-UP PARAMETERS

The following steps are system settings that must be checked at the time of commissioning for each system installed. You can print this section and fill it out for each site commissioned.
Note: these steps are battery chemistry dependent. Follow the appropriate section.

11.1. Systems with Lead Acid Batteries

Failure to correctly follow the items below may cause incorrect system functionality and, in some cases, ruin your battery (without the ability to claim battery replacement under warranty).

NOTE: Any values shown below are indicative only. If the values in your system differ from those shown here, write in the values relevant to your system.

Refer to the EM4x energy manager manual for more details.

Check the Battery Type
The system MUST be configured to the correct battery type.
EM4x Web UI page Battery>Battery Settings

✓ / ×

Check/Set Float Voltage
Consult battery manufacturer's data for proper setting.
The Float voltage is for 25°C reference temperature in NewMar systems.
EM4x Web UI page: Control
Example:

Site Setting:

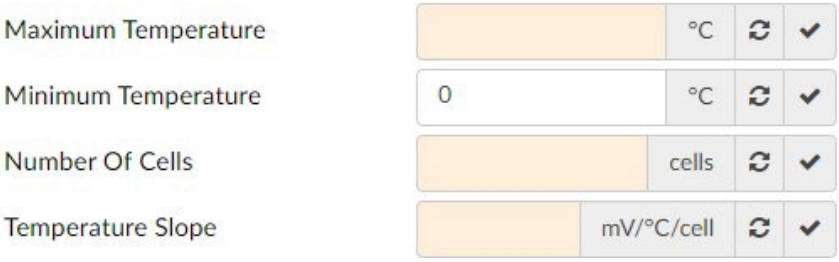
✓ / ×

Set Battery Temperature Compensation
Toggle temperature compensation On.
EM4x Web UI page: Battery>Battery Settings

You must consult the battery manufacturer's data to obtain the correct Slope setting.
Note that in many Hybrid applications where the battery is constantly being cycled, having temperature compensation enabled may not be necessary as the voltage on the battery is constantly changing anyway.
EM4x Web UI page: Battery>Battery Settings

Example:

Site



Settings:

✓ / ×

If you choose not to enable Temperature Compensation, then set the Rectifier Float Voltage to that required by the battery manufacturer for the average long-term temperature you anticipate your system to operate at.

Set Battery Capacity
Consult the battery manufacturer's data for correct battery capacity settings.
For the EM4x to set the correct Battery Current Limit current, it is essential that this is filled out correctly. These figures are also used for estimating the Battery Time Remaining during a discharge.

For Telecom applications, the 10-hour rate is usually the name-plate rating of the battery. However, once again, check the battery manufacturer's data sheets as some manufacturers state the 20-hour rate (which is usually a little more "optimistic").
The second rate is required specifically for the time-remaining algorithm. A 4-hour rate is usually a good one to use. This information is available from the battery manufacturer's data sheet.
The Battery SoC adjust can be used at the time of installation (or for testing purposes) in case the installed battery is not initially fully charged. If you think the battery is only 80% charged, then simply enter that value. The value displayed here will correct itself once the battery has been on charge for some time or gone through a few charge/discharge cycles.
Battery Recharge Efficiency considers the ohmic and any other losses in the battery charge/discharge cycle. The effect is that more energy (Ah) needs to be put back into the battery than was taken out. With the efficiency set to 96%, then 4% more Ah is needed to be returned to the battery before the EM4x will register that the battery is at 100% SoC (State of Charge).
The Battery Discharge Threshold is a buffer to prevent false triggering of discharge notification and is usually related to the size of the battery shunt. A larger shunt requires a larger discharge threshold.
EM4x Web UI page: Charge
Example:

10h Rate Battery Capacity	650	Ah	
Secondary Capacity Rate Time	4	h	
Secondary Capacity	500	Ah	
Battery Recharge Efficiency	96	%	
Battery State Of Charge	64.5	%	
Battery Discharge Threshold	-3	A	

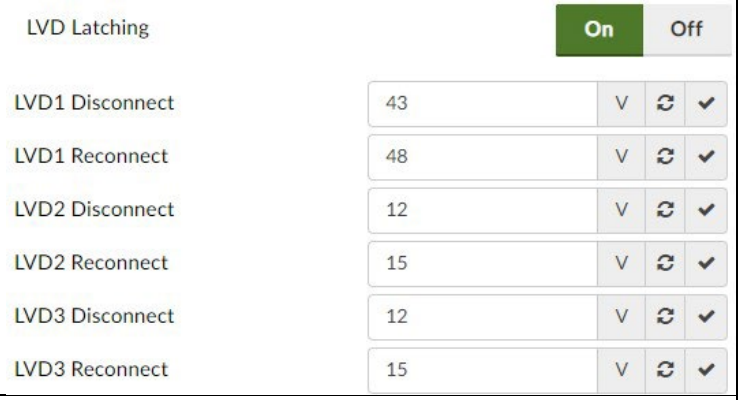
Site Settings:

10h Rate Battery Capacity		Ah	
Secondary Capacity Rate Time		h	
Secondary Capacity		Ah	
Battery Recharge Efficiency		%	✓ / ✖
Battery State Of Charge		%	
Battery Discharge Threshold		A	

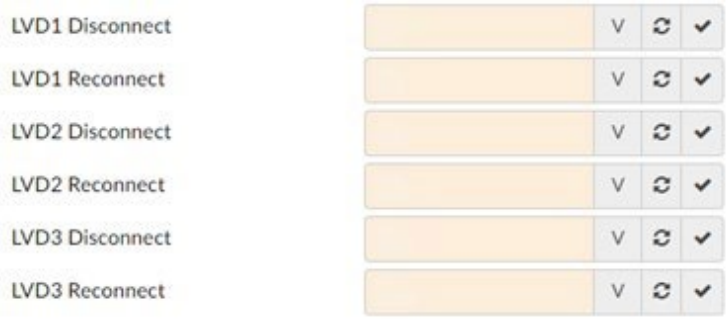
<table>
<tr><td>Set Battery Current Limit
Consult battery manufacturer’s data for maximum battery recharge current settings.
The Battery Current Limit is set as a percentage of the 10-hour rate entered above.
It is recommended this value is set at the highest rate allowable to ensure the battery is recharged as fast as possible.
In some systems, especially larger systems, this may require limiting further because of the number of rectifiers available, rather than the maximum setting.
EM4x Web UI page: Battery>Battery Settings
Enable Battery Current Limit by clicking on the tick icon beside the field.
 
Example:
  </td><td></td></tr>
<tr><td>Site Settings:
  </td><td>✓ / ×</td></tr>
<tr><td colspan="2">For telecom settings, this limit is often set to 10% (or 0.1C10, i.e., a 10A current limit for a 100Ahr battery). This is more typical of a design parameter than the need for the setting to be at this level but a setting higher than this level should be considered to enable the fastest recharge possible without exceeding the battery manufacturer’s maximum value.
Ensure sufficient rectifier capacity is available to cover battery recharge and load requirements.</td></tr>
</table>

Low Voltage Disconnect Settings
The LVD disconnect set points are usually a customer generated setting.
As the discharge time increases, the higher the end voltage should be set. For a discharge of <1hr, this may be as low as 1.75Vpc (42.0V for a "48V" battery), or for an 8-hour discharge, it may be 1.85Vpc (44.4V for a "48V" battery).
Note: that if only one LVD is fitted, LVD2 and LVD3 thresholds are set outside of possible tripping voltages. This avoids any confusion over which LVD signal is being used by the EM4x energy manager.
EM4x Web UI page: IO Configuration>IO Boards
Toggle LVD latching On

Example:



Site Settings:



✓ / ×

11.2. DC System Lead Acid Battery Commissioning Checklist

This section is for a more detailed commissioning process than the Essential Set-up Parameters. It may be printed out separately and filed for record keeping.

DC System Lead Acid Battery Commissioning Checklist			
Site Name:			
Date:			
Tests Without Batteries Connected	Value	Results	
Check Float Voltage	Meter:	V	✓ / ×
Check Load Current	Meter:	A	✓ / ×
Voltage thresholds can either be checked using an external power supply, or by adjusting the EM4x float voltage 0.1V above (or below for the low voltage alarms). It is recommended to have the batteries disconnected. 1. Adjust the supply/float voltage to 55.7V & observe the "High Float" alarm. 2. Adjust the supply/float voltage to 57.7V & observe the "High Load" alarm. 3. Adjust the supply/float voltage to 52.7V & observe the "Low Float" alarm. 4. Adjust the supply/float voltage to 46.9V & observe the "Low Load" alarm.			
High Load Volts (urgent)	**57.6V**	V	✓ / ×
High Float Volts (non-urgent)	**55.6V**	V	✓ / ×

Low Float Volts (non-urgent)	**52.8V**	V	✓ / ×
Low Load Volts (urgent)	**47.0V**	V	✓ / ×
Depending on the test load available, it may be necessary to adjust the High Load Current alarm threshold down to suit. For example, with 40A test load, adjust the Load Current High Setpoint threshold (Web UI page Alarm Configuration>System Alarms) to 35A. Then simply apply the 40A load and observe the alarm change state. Once the test is complete, be sure to rest the Load Current High Setpoint to its previous value (or check with the customer for the correct value they require).			
Load Current High Setpoint		A	✓ / ×
Temperature alarm tests are performed by heating up (using a heat gun or other source) and cooling down (using an aerosol can of freeze, or a tub of ice) the temperature sensors			
Battery Temperature High (urgent)		°C	✓ / ×
Battery Temperature Low (non-urgent)		°C	✓ / ×
Room Temperature High (non-urgent)		°C	✓ / ×
Room Temperature Low (non-urgent)		°C	✓ / ×
When an AC Monitoring PCB is not fitted at system level (as in most cases), the AC Fail alarm is generated from the rectifiers. The rectifiers sense if AC is present, and extend an AC fail alarm to the EM4x. Therefore, to test this alarm, simply turn off the rectifier AC breakers. To allow the controller to continue to read alarms there must be DC present on the output of the system. As this causes the rectifier output to cease, a Rectifier Fail alarm is also generated. To generate the Urgent Rectifier Fail, turn off the required number to make this occur (usually set to 2, but check via the EM4x Web UI for the setting (Control page>Rectifier Urgent Fail Threshold).			
AC Fail (urgent)	Urgent/Non-Urgent		✓ / ×
Rectifier Fail (non-urgent)	Urgent/Non-Urgent		✓ / ×
Urgent Rectifier Fail (urgent)	# of Modules:		✓ / ×
To check Load MCB fail, connect a load, but with no load turned on. Then switch the breaker to its off position and turn on some load (any amount will do). This will cause the alarm to occur as the load side to the circuit will be taken to system common voltage. Turn off the load, and then return the breaker to its on position.			
Load MCB Fail (urgent)			✓ / ×
Tests with Batteries			
• Turn off Battery Breaker/s • Connect battery/batteries • Check the correct Battery Capacity (Ahrs) has been entered (EM4x Web UI Battery>Battery Settings). This is the total capacity, so for example 100Ahr strings in parallel, this should be 200. • Go to EM4x Web UI Battery>Battery Settings>Battery Charge Current Limit. Check Battery Charge Current Limit (BCL) is set to desired level (usually $0.25C_{10}$, (25%)). This means that for a single 100Ahr battery, the BCL will be 25A, or if two 100Ahr batteries are connected in parallel, the BCL will be 50A. • Connect load (but turn off). • Check V_f is set to 54.0V. (Web UI Control>Float Voltage) • Turn on Battery Breaker/s			
Check Battery current is positive if charging		%	✓ / ×
Battery Current Limit (BCL)			
Check that the battery recharge current is limited to the Battery Current Limit level (usually $0.25C_{10}$, (25%)). See Web UI Battery Settings>Calculated Charge Current Limit for Amp value.			%
Note: as the BCL is based on fine voltage control of the system bus, the BCL make take one or two minutes to "settle", i.e., you may observe a brief excursion of the battery recharge current beyond the BCL setting			
BCL functions			✓ / ×

Check Manual Equalize (if configured). Click the Start Manual Equalize button on the Charge page to initiate a battery equalization. Click the Stop button at the top of the Charge page to end.	✓ / ✗
A Battery MCB Fail alarm is generated from the voltage measured across the battery MCB. Therefore, to check a Battery MCB Fail alarm, simply open one of the battery MCB's. If batteries are connected to the system at this time, the alarm may take a few moments to activate. Once test is complete, turn breaker back on.	
Battery MCB Fail (urgent)	✓ / ✗
Temperature Compensation	
Check Temperature Compensation is enabled. Web UI Battery>Battery Settings>Rectifier Compensation>On.	✓ / ✗
Apply heat or cold to the Battery Temperature Sensor/s. Check the float voltage moves up or down as expected.	✓ / ✗
If actual measurement is required, apply a known heat or cold to the sensor. Allow it to fully come to temperature and record the amount of voltage movement.	°C V
Check Alarm Relay Contacts	✓ / ✗
To generate these alarms, refer to the procedures described earlier in the Commissioning Checklist. Spare relays will not be able to be tested unless an alarm is mapped to them. As these are tested in the factory, it is not essential to test them at time of commissioning.	
Relay 1 (Monitor Fail) (pull out the RJ45 lead connecting the monitor to the system rectifier shelf – this simply de-powers the monitor)	✓ / ✗
Relay 2 (Summary Non-urgent)	✓ / ✗
Relay 3 (Summary Urgent)	✓ / ✗
Relay 4 (Spare)	✓ / ✗
Relay 5 (Spare)	✓ / ✗
Relay 6 (Spare)	✓ / ✗
NOTE: *Prior to leaving the system after it has been commissioned, check all AC, DC and battery circuits are off. If it is required that the system is to be left on (to power load equipment, ensure rectifiers are left in their powered-up state, and batteries are in circuit. This will prevent anyone leaving the batteries only powering the load (in which case the batteries go flat).*	

11.3. Systems with Lithium Batteries

The term lithium batteries include a wide range of chemistry types. Regardless of the chemistry used the energy manager differentiates lithium (and other non-lead acid batteries) by whether the battery BMS can be communicated to via Modbus RTU or not. These 'smart' batteries are termed modular, where the energy manager is receiving information on alarms and status from the battery internal electronics.

Failure to correctly follow the items below may cause incorrect system functionality and, in some cases, ruin your battery (without the ability to claim battery replacement under warranty).

NOTE: Any values shown below are indicative only. If the values in your system differ from those shown here, write in the values relevant to your system. Refer to the EM4x energy manager manual for more details.

DC System Lithium Battery Commissioning Checklist	
Site Name:	
Date:	
Check the Battery Type	✓ / ✗

The system MUST be configured to the correct battery type. EM4x Web UI page Battery>Battery Settings		
Modular Smart Lithium Battery Selection If the system is connected via Modbus RTU to a battery BMS check the correct specific battery is selected from the Product drop down list and mapped to the correct address. EM4x Web UI page: IO Configuration>Modbus Master>Device Map 		✓ / ✖
Check/Set Float Voltage Consult the battery manufacturer's data for the proper setting. Note that the float voltage directly impacts the state of health of batteries after multiple cycles. The consequences of the float voltage setting must be understood. The Float voltage is for 25°C reference temperature in NewMar systems. EM4x Web UI page: Control Example: 		
Site Setting: 		✓ / ✖

APPENDIX 1 – AC INPUT TRANSIENT PROTECTION

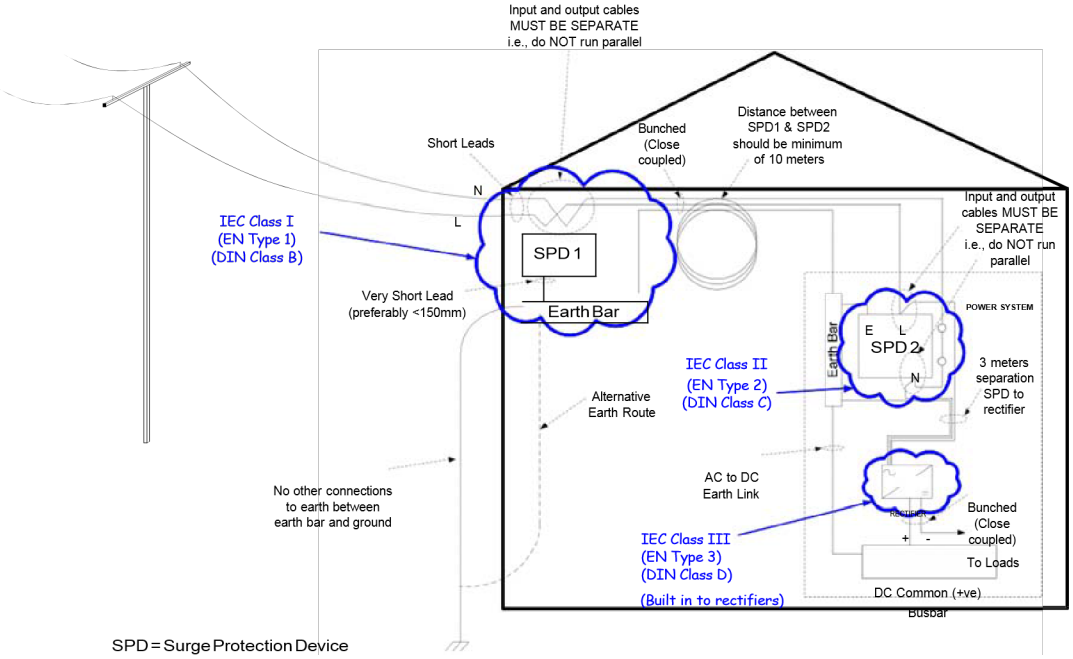
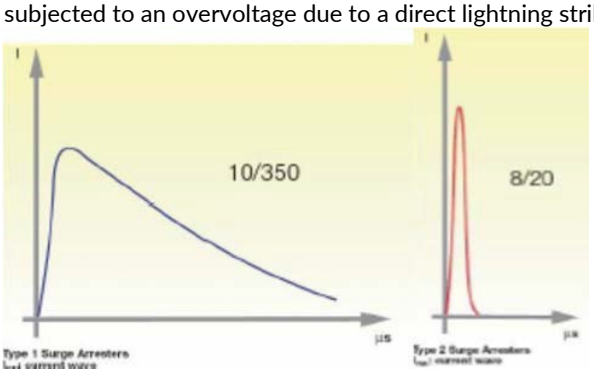


Fig 6.0 Illustrates the surge protection installation principles.

The **Type 1** surge arrester, fitted in the installation's main incoming electrical switchboard, is capable of deviating the energy of a direct lightning strike. This is the first stage of the electrical network's protection. It is important that upstream Type 1 protection is provided on site.
10/350 wave as shown below is the current waveform which passes through equipment when subjected to an overvoltage due to a direct lightning strike.



A **Type 2** surge arrester should be used in coordination with the incoming surge arrester. This is the second stage of protection. Type 2 Surge arrester is designed to run-off energy caused by an overvoltage comparable to that of an indirect lightning strike or an operating overvoltage.
Some of the Newmar Power System models are provided with Type 2 Surge Protection Devices (SPDs) (as defined by IEC 61643-11). These devices are rated for repeated strikes of 20kA (8/20µs waveform as shown above), and single shot protection of 40kA.

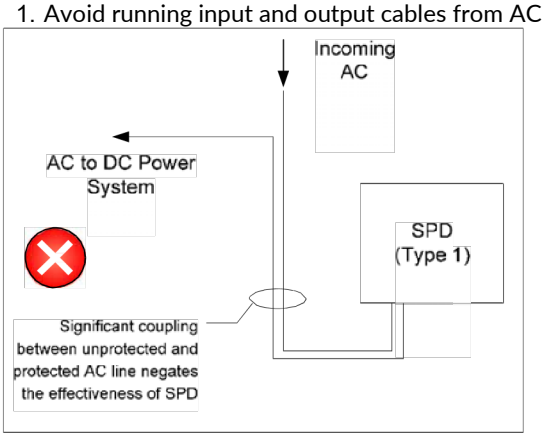
Note: Newmar Rectifiers are compliant with EN6100-4-5, Level 4 without any external/upstream surge suppression. To maintain a coordinated approach to surge suppression, Type 2 SPD should be installed upstream if not fitted in the system.

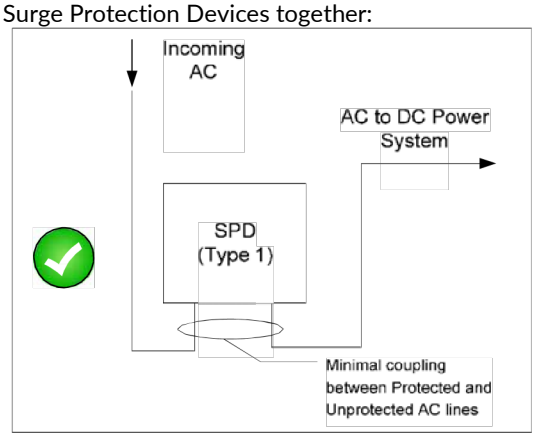
To ensure correct operation of the SPDs, at least 10m of AC feeder cable is fitted between the Type 1 and Type 2 protection. If the distance is less than 10m, then loop the cable until at least 10m of cable is used. This ensures correct de-coupling of the SPD devices.

Notes on AC cable installation and SPDs

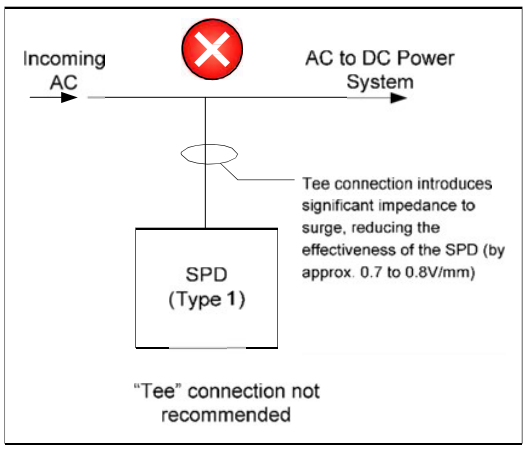
The following precautions must be adhered to when installing AC cabling.

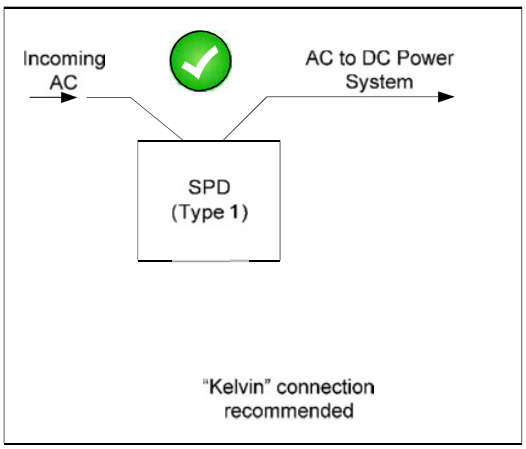
1. Avoid running input and output cables from AC Surge Protection Devices together:





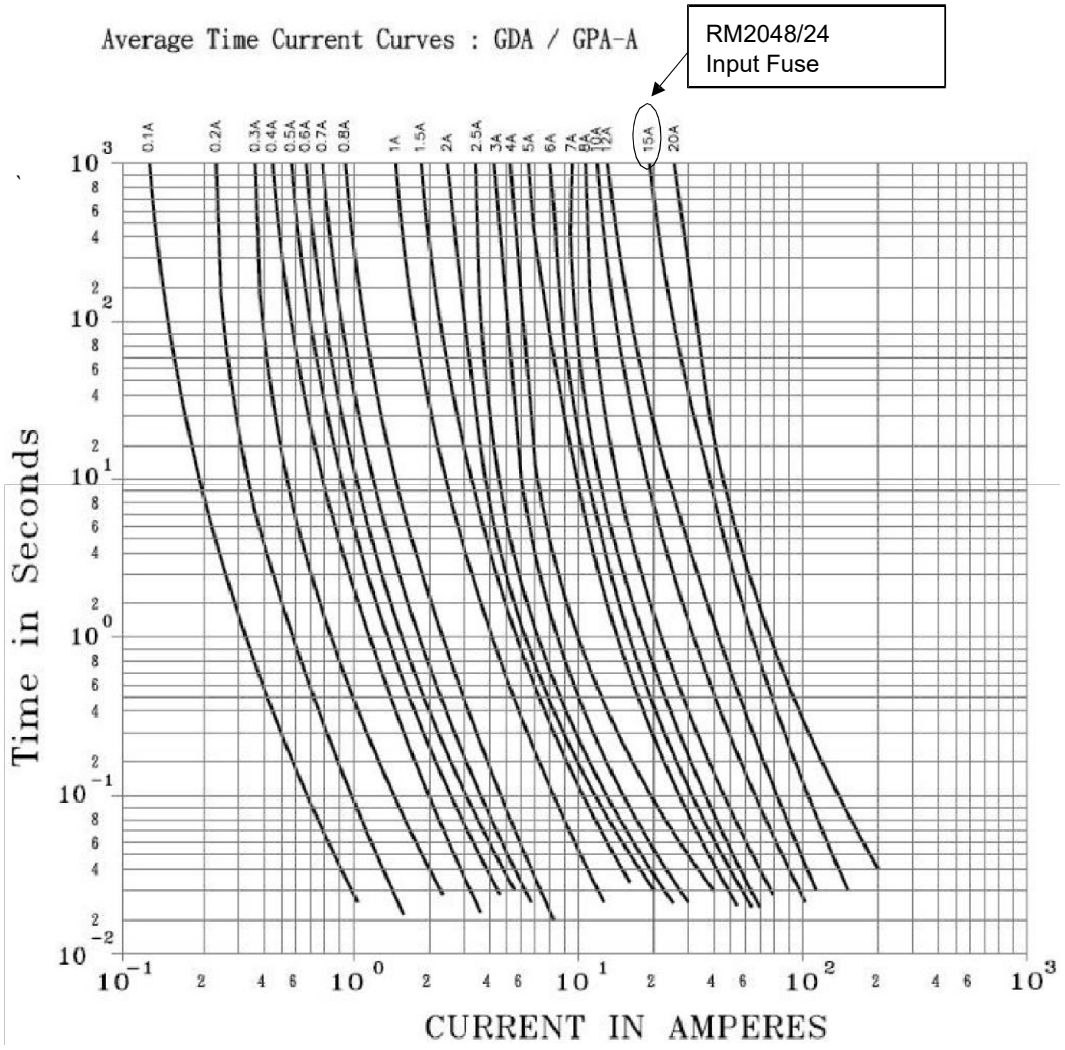
2. Avoid “Tee’d” Connections:


Incoming
AC
AC to DC Power
System
Tee connection introduces
significant impedance to
surge, reducing the
effectiveness of the SPD (by
approx. 0.7 to 0.8V/mm)
SPD
(Type 1)
"Tee" connection not
recommended

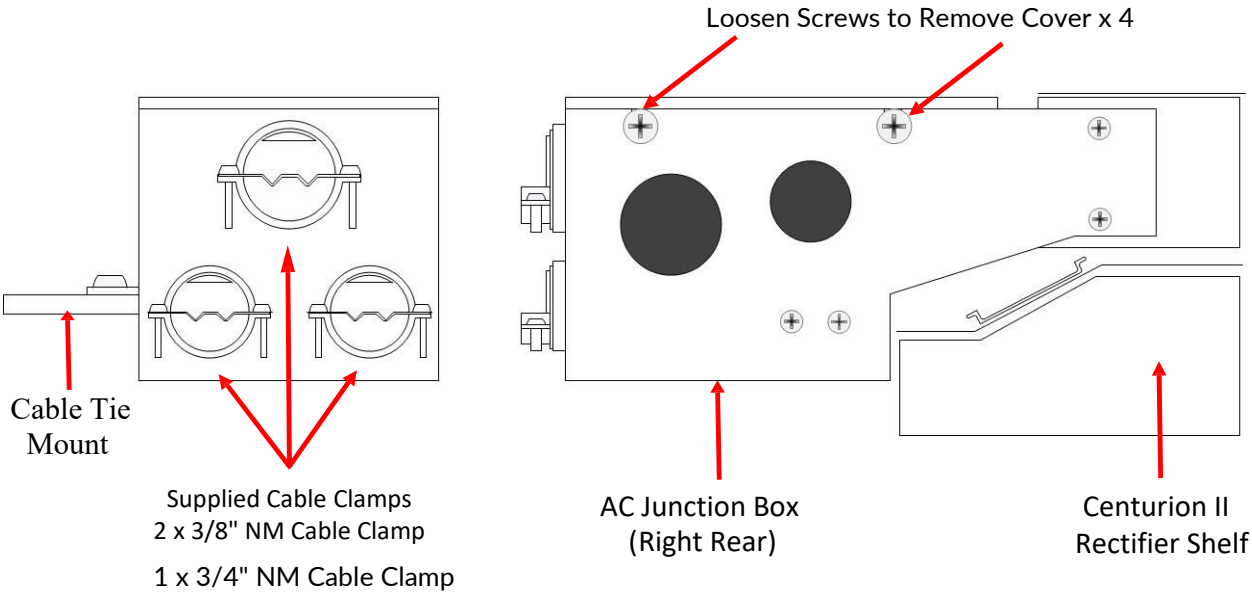

Incoming
AC
AC to DC Power
System
SPD
(Type 1)
"Kelvin" connection
recommended

APPENDIX 2 – RECTIFIER INPUT FUSE CURVES

* The curves are average value, for reference only *



APPENDIX 3 – INSTALLATION OF AC Junction Box



1. The above illustration shows the rear and side of the AC junction box.
2. To remove the junction box cover, loosen the four screws located at the top of the AC junction box.
3. Loosen cable clamp screws and route AC cables though cable clamps. Connect AC cables to AC input terminal block. (See Centurion II Input wiring options (M-C2ACOPT) drawings for wiring options)
4. Tighten cable clamp screws and confirm the cables are firmly secured.
5. Re-install top cover and tighten screws.

APPENDIX 4 – TROUBLESHOOTING

- **Measuring voltage on output: Load circuit breakers are off but I'm measuring DC voltage on the output terminal block.**

  This is normal. The load breakers are monitored electronically via a diode to a digital input on the EM4x. This is a high impedance residual voltage and does not present a hazard to the

- **AC Meter Shows Incorrect Voltage**

  Meter requires greater than a 2-amp load to measure correctly

- **EM4x Module does not stay in place**

  On the left side of the module is a small ball screw that can be adjusted to maintain proper holding force of the EM4x inside the chaise.

- **Rectifiers come out of shelf**

  Verify that the rectifier is fully inserted and using a small flathead screwdriver the green locking tab on the right side is pressed down.

- **No output from rectifiers**

  Verify correct AC input voltage:

  Confirm operation voltages between each set of Line inputs A, B, and C:
  A-L1 to A-L2 = 208 or 230 volts, B-L1 to B-L2 = 208 or 230 volts, C-L1 to C-L2 = 208 or 230 volts

  Check voltages between each set of Line inputs and ground:
  A-L1 to Ground = 208 or 230 volts, B-L1 to Ground = 208 or 230 volts, C-L1 to Ground = 208 or 230 volts
  A-L2 to Ground = 208 or 230 volts, B-L2 to Ground = 208 or 230 volts, C-L2 to Ground = 208 or 230 volts

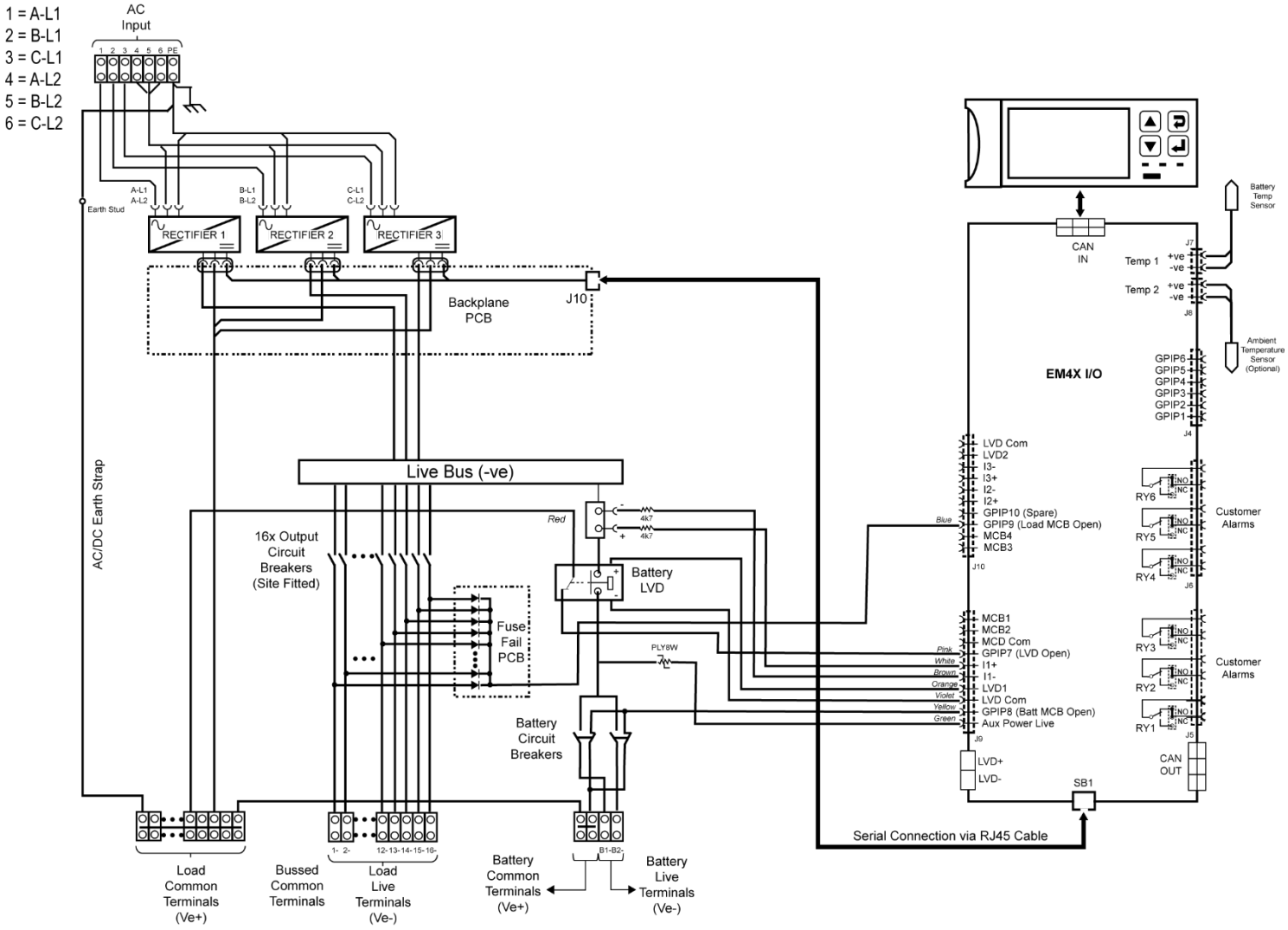
APPENDIX 5 – Field Replacement of Load Circuit Breakers

Instructions for field installation of load circuit breaker. To be performed by qualified electrical personnel only.

1. Remove the AC input and turn both battery breakers off. (If the unit is still powered on a live bus will be exposed creating a possible shock hazard).
2. Remove the top of the unit (there will be 1 screw in each corner and two screws located in the front center of the unit).
3. Remove the bottom circuit breaker toggle guard.
4. The output terminal block wires are labeled according to their position, locate the wire corresponding to the breaker position you are installing and connect it to the bottom contact of the circuit breaker.
5. Attach any hot wire from the bus to the top contact of the circuit breaker.
6. Insert a screw into the hole exposed by removing the bottom toggle guard and screw the breaker in place.
7. Re-install the toggle guard and top of the unit and reapply power.

Note: It is normal to measure output voltage on a Centurion II load circuit breaker when its toggle handle is in the OFF position. The Centurion II circuit breaker alarm circuit produces a very low current, high impedance signal that can be detected using a high impedance digital multi-meter (DMM). This is normal and does not present a hazard to the user.

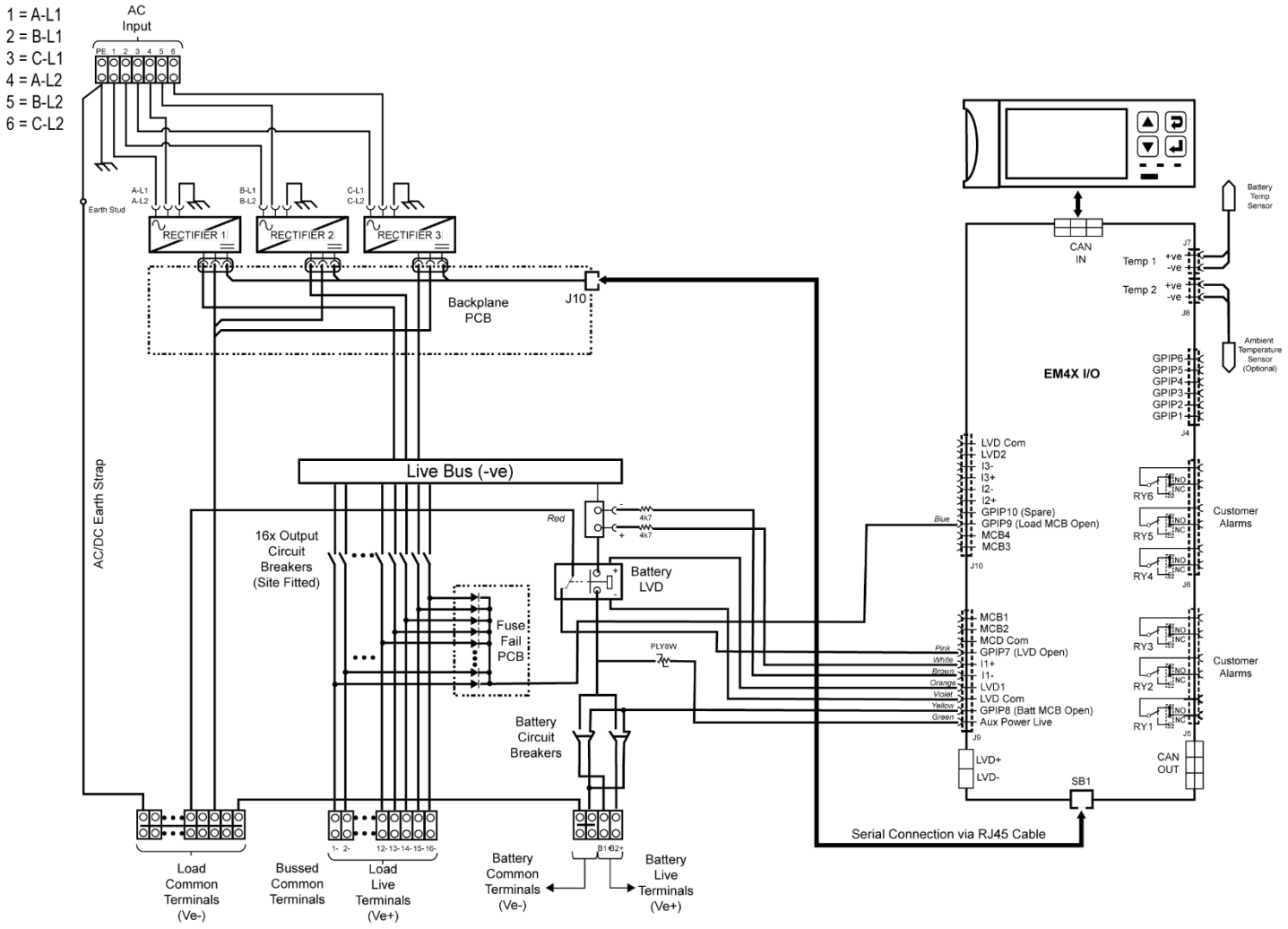
Appendix 6 – SYSTEM WIRING DIAGRAMS



Centurion II Power System, -48 (+Ve earth)

System Ratings:

Nominal Output Voltage:	-48VDC
Max. Output Current (RM2048HE):	125A/-48, 111A/-54V
AC Input (total):	
3Ph, 175V_{in} (Ph-N) & 230V_{in} (Ph-N)	12.5A_{max} & 9.45A
1Ph, 175V_{in} (Ph-N) & 230V_{in} (Ph-N)	37.3A_{max} & 28.35A
Output Power (total):	
RM2048:	6kW



Centurion II Power System, +24 (-Ve earth)

System Ratings:

Nominal Output Voltage:	+24VDC
Max. Output Current (RM2048HE):	125A/+48, 27V

AC Input (total):

3Ph, 175V_{in} (Ph-N) & 230V_{in} (Ph-N)	6.2A_{max} & 4.7A
1Ph, 175V_{in} (Ph-N) & 230V_{in} (Ph-N)	18.7A_{max} & 14.2A

Output Power (total):

RM2048:	3kW