EM4x Energy Manager

Installation and Operation Manual

Product Compliance

CE

RoHS

Manual Version 1.0

Release Date: 21 April 2023

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.

= restricted access area

= access for children prohibited.

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.

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

3   GLOSSARY

BMS = Battery management system. The electronics built into a battery module, that controls the battery behavior.

SoC = State of Charge. A percentage figure that designates the relative amount of energy stored in a battery in reference to its maximum capacity.

SoH = State of Health. A percentage figure that represents the current battery capacity as a percentage of its maximum optimum capacity.

DoD = Depth of Discharge. A percentage figure that indicates the amount of energy discharged from a battery during use relative to it being 'fully charged' (100% SoC). Note the system is designed to never discharge completely to 0 and in many applications the recommended maximum discharge level to assist battery life is <50%.

C Rate = The C-rate is a measure of the rate at which a battery is being discharged. It is defined as the discharge current divided by the theoretical current draw under which the battery would deliver its nominal rated capacity in one hour. A 1C discharge rate would deliver the battery's rated capacity in 1 hour. A 2C discharge rate means it will discharge twice as fast (30 minutes). A 1C discharge rate on a 1.6 Ah battery means a discharge current of 1.6 A. A 2C rate would mean a discharge current of 3.2 A.

.xml = is a file type used to describe data (Extensible Markup Language). This file type can be opened in an Excel spreadsheet.

4   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.

4.1   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.

4.2   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.

4.3   Handling

Handle the equipment with care. Do not drop. Keep away from moisture.

4.4   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.

5 SCOPE

This manual covers essential information for the installing, commissioning, and operation of the Newmar energy manager (EM4x). The manual covers both the EM4x-01 touchscreen and EM4x-02 keypad versions of the energy manager.

6 FEATURES

The EM4x microcontroller-based DC system supervisory module provides the control and monitoring functions for the Commander II series systems. These include Newmar's RM series rectifiers and DC/DC converters. Lead-acid batteries are managed natively from the EM4x controller. More advanced battery monitoring with individual monobloc voltage and string current measurement can be attained with Newmar's ancillary BMS boards. With an appropriate communications connection third party lithium batteries and other Modbus enabled devices can also be managed.

The EM4x monitors all power system conditions including DC voltage, rectifier current, battery current, battery temperature, and distribution failure. 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 external batteries
- Support for 48V AC-DC rectifiers
- Support for DC-DC converters (12V and 24V Outputs)
- Low voltage disconnect (magnetically latched contactors)
- Network connectivity (web access)
- System voltage metering for primary system DC supply.
- Load, battery and rectifier current metering and alarms
- Active rectifier and converter current share
- Automatic system voltage control
- Effectively unlimited alarm thresholds as standard, for use with multiple DC outputs
- 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*
- HTTPS / TLS 1.3 internet security
- Encrypted firmware files

7   SPECIFICATIONS

Operating supply voltage:	18V to 80V
Operating ambient temperature range:	-20°C to 70°C
Storage ambient temperature range:	-25°C to 80°C
Relative humidity range:	5% to 95%
Altitude:	less than 3500m

7.1   Protocols Supported

- IPv4
- 10/100 Base TX
- SNMP V2/V3
- Modbus
    - Modbus TCP server (via Ethernet)
    - Modbus RTU master and server
- USB 2.0

8   DEFINITIONS

The energy manager EM4x consists of three main components:
1. A front panel with user interface
2. The EM4x motherboard
3. An I/O board

9   INTERFACE

9.1 EM4x-01 User Interface
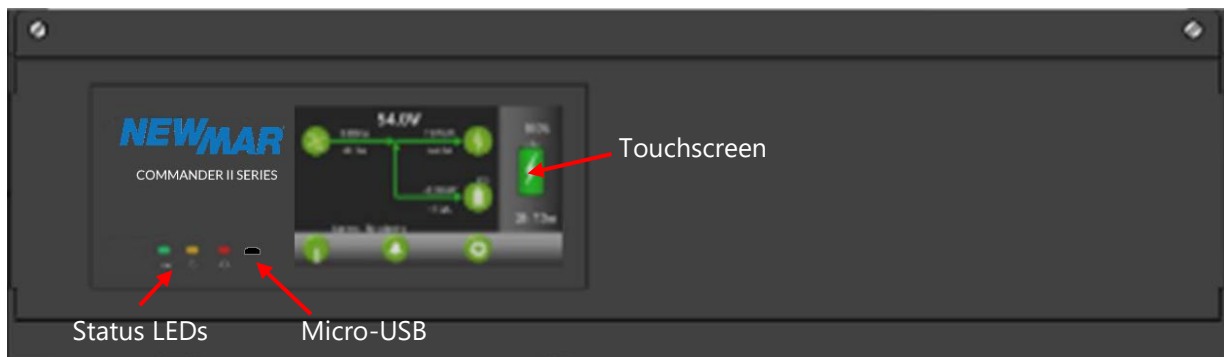
IMPORTANT: all system and module documentation can be accessed via the micro-USB port on the front panel of the energy manager.

9.1.1   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 the screen.
- Micro-USB Connector: can independently power the EM4x and provides access to the Web UI

9.1.2   Energy Manager 3U Touchscreen

Figure 3: energy manager 3U Touchscreen
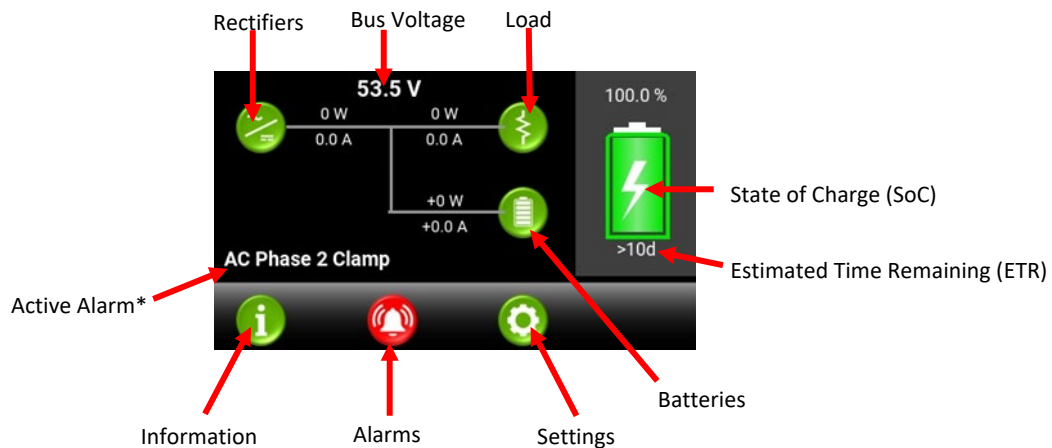
*NOTE: when there are multiple alarms raised the Active Alarm display cycles through the list. The complete list can be viewed by tapping Alarms.

Tap the touchscreen to navigate through the menus.

See 12.3 3U Touchscreen Menu Navigation for further information.

NOTE: the EM4x-01 has the option to PIN lock function change through the front screen interface. See 11.4.5 PIN Locking the EM4x-01 for details.

9.2   1U EM4x-02 Interface

Figure 4: 1U EM4x-02 Front Panel Interface
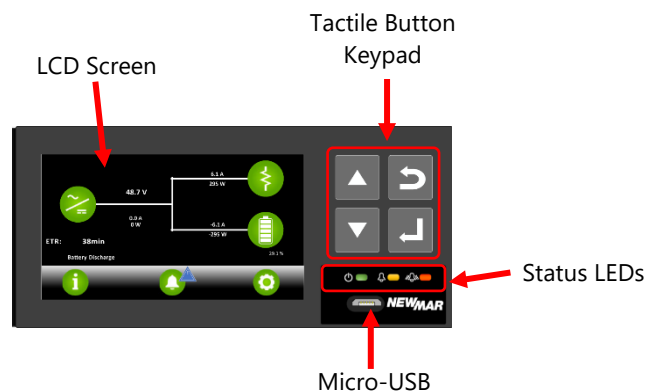
- Keypad tactile buttons for navigation through the menu. Local adjustments to operating parameters and alarm functions can be made using the menu options.

- 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 red and orange 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, press any key.

- Micro-USB Connector: can independently power the EM4x and provides access to the Web UI

9.2.1 Energy Manager 1U Front LCD

The energy manager front LCD menus are simple and intuitive to browse. The front screen description is as follows:

Figure 5: energy manager 1U LCD Screen
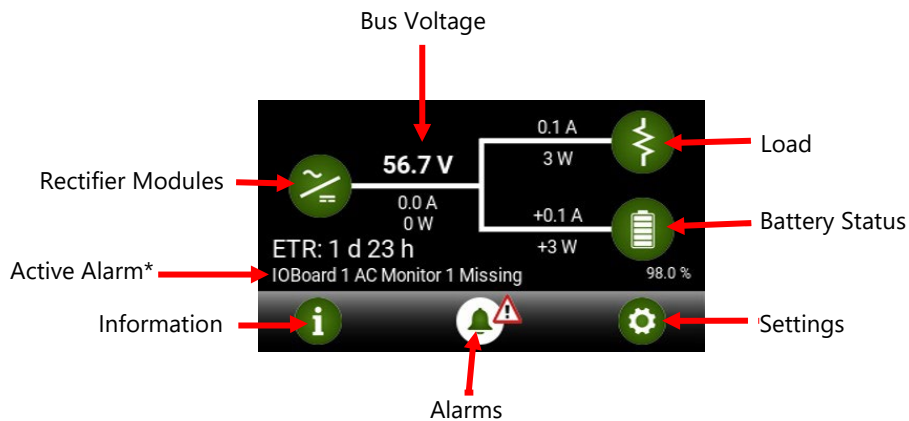
*NOTE: when there are multiple alarms raised the Active Alarm display cycles through the list. The complete list can be viewed in the Alarms menu.

NOTE: ETR = Expected Time Remaining which is the estimated back-up time in days (d) and hours (h) of the batteries given their state of charge and the active load.

Use the keypad to navigate through the menus.

▲	Up
▼	Down
⊃	Go back
↵	Enter

See 12 Using the EM4x Controller Front Panel Interface for further information.

10 CONNECTIVITY

Figure 6: EM4x Connectivity

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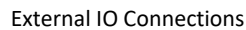
The energy manager is configured via a web browser-based user interface (Web UI). There are two methods to access the Web UI:

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

10.1.1 Access Levels

There is 1 default access level for the energy manager Web UI from firmware version 10.0:

enaadvanced   : this user has normal full control access of the system
The default password = W7h!GJ28KG

NOTE: it is strongly recommended that the default access level has its password changed on commissioning. See 19 EM4x and DC System Cybersecurity for more information and further recommendations to assist protect against cyber threats.

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

10.1.2 Ethernet Port Connection

The energy manager contains static sensitive components that require careful handling and proper precautions to be taken.

Figure 7: energy manager Ethernet Port (front panel open)
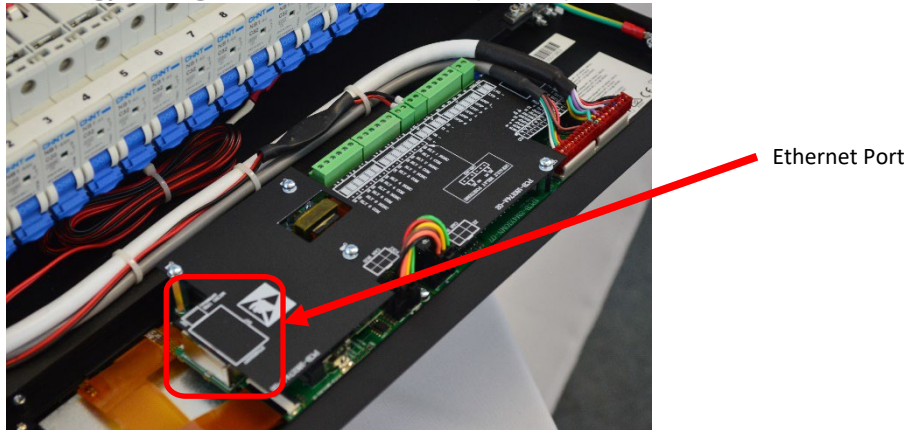
Ethernet Port

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 system log in page appears.

b

5. Enter the username and password.

10.1.3 USB Connection

1. Connect the communicating device to the micro-USB port on the front of the energy manager. See Figure 4.
   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.

7. Enter the username and password.

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:

10.1.4 energy manager Web UI

Figure 8: Web UI Overview Page

The energy manager Web UI has a wide range of functions and features. Some of which are access level dependent while others are license locked. For further information please refer to the energy manager manual or your Newmar sales representative.

10.2 Terminations to the EM4x

10.2.1 Communications Bus

SBI (J1)

Explanatory Note

The EM4x can communicate over two serial busses to various peripheral devices (I/O cards, rectifier modules etc.). Please refer to the diagram in Figure 9 below.

The first, "SBI" bus is Newmar's proprietary single wire "Serial Bus Interface". It is a robust, easy to deploy communications system proven to be resilient in noisy environments. The SBI comm's bus is the primary interface to Newmar's rectifier and converter modules. It was used exclusively in Newmar's SM3x range of system controllers.

The EM4x adds a CAN bus interface as well as the SBI. CAN bus makes an EM4x solution even more scalable than the SM3x controller. This gives customers/users the ability to create monitoring solutions that are virtually limitless.

NOTE: Do not confuse communications buses with DC buses. When DC buses are referenced, they are the main power buses, being usually (nominally) 48V, 24V, 12V, 60V etc. It is possible for modules on two DC power buses to communicate to the EM4x on a single communications bus.

SBI (J1)

RJ45 Connection between EM4x controller and the power system.

This connection provides voltage (power) supply to the EM4x as well as enabling communication between the controller and the power modules. The rectifiers/modules communicating on this bus are referred to as being on "Bus 1" (which relates to references such as "Bus 1 Volts", and Bus 1 voltage alarms). Bus 1 is used to communicate with the first 84 rectifiers (or modules) in the system.

Bus voltage can be measured through this connection by jumper setting on the power module backplane (see appropriate backplane manual for details).

CAN OUT (J3)

CAN connection between the EM4x controller and the power system and/or peripherals. Note that nominal 12V power is fed down the CAN bus to power peripheral devices.

This connection enables communication between the controller and multiple additional IO boards. Each individual IO board connects to other sets of power modules or peripheral devices.

NOTE: for implementation of CAN communication external to the DC system please consult your Newmar sales representative.

10.2.2 Internal Systems Connections

J9 - 10-way MTA connector for internal signals connecting to the power system.

This connector provides for most standard connections between the power system and the EM4x controller such as primary LVD control.

J10 - 10-way MTA connector for internal signals connecting to the power system.

This connection provides the connection for more advanced connections between the power system and the EM4x controller, such as secondary current shunt inputs & an extra LVD control.

10.2.3 External I/O Connection

GPIP 1-6 (J4)

6-way Minicobicon connector for external general purpose input signals to the EM4x providing six customer dedicated inputs.

TS1 (J7)

2-way Minicobicon connector for signal from the primary temperature sensor to the EM4x (usually configured as the Battery Temperature Sensor).

TS2 (J8)

2-way Minicobicon connector for signal from the secondary temperature sensor to the EM4x (if fitted, this is usually configured as the "Room" or "Ambient" Temperature Sensor).
Relay 1-3 (J5)
6-way Minicobicon connector for external volts free relay signals from the EM4x providing 3 of the 6 customer dedicated outputs.
Relay 4-6 (J6)
6-way Minicobicon connector for external volts free relay signals from the EM4x providing 3 of the 6 customer dedicated outputs.

10.2.4 Supply Voltage

The EM4x Controllers may be used in systems with nominal voltages 12V (secondary voltage only), 24V, or 48V. A controller can operate with input supply from 18V to 75V. It is not necessary to make physical adjustments to a controller when used in different voltage systems. It will, however, be necessary to alter the configuration parameters to suit the system voltage by loading a suitable configuration file.
Note that while the EM4x supply voltage is from 18V to 80V, all of the internal electronics is referenced to the negative supply. That is, all the current and voltage sensor input operational amplifiers are referenced to the –ve rail, which in a normal -48V telecommunications system (which is +ve earth), is actually the System live bus.

10.2.5 energy manager Communications

A controller communicates to rectifiers, converters, and auxiliary system modules using serial communications over RJ45 patch cables (this is the SBI – see 10.2.1 Communications Bus above). It communicates to additional EM4x IO Cards by CAN bus. The controller has two separate communication connections: a Serial Bus (SBI) connector (BUS1) which is connector J1 (RJ45 connector) and a CAN Bus Out which is connector J3. In smaller system all serial communications are generally done using the SBI only. However, in larger systems the capacity of the serial bus may be exceeded and additional IO boards require daisy chaining with the EM4x.
The capacity of the SBI bus on each EM4x I/O board is as follows:
- 84 combined HE Rectifier Modules, and DC-DC Converters
- 4 AC Metering Modules (ACM)
- 4 Battery Condition Monitors (BCM)
- 4 IO Expansion cards
- 2 DC Fan controllers

10.2.6 Voltage Sense

The Serial Bus connector allows for sense voltage (VS1) to come directly from the rectifier and shelves via the RJ45 connection. Sensing directly from the shelf via the Serial Bus Connector requires jumpers to be fitted on the shelf backplane, no other external hardware is required (See the Rectifier Shelf Manual).
Note that in larger systems it may be desirable to sense the System Bus Voltage at the point where the battery is connected to the rectifier/load bus. This will keep the voltage on the battery more constant (during battery float charge) as the load varies. In this case the voltage sense wires will need to be "broken out" of the RJ45 control loom. The specific system schematic for that application will show this.

10.2.7 Current Measurements

The EM4x controller has two current inputs (SHNT 1 and SHNT 2), each configured to take a bipolar input within the range ±55mV which is adjustable in the Web UI. See IO Configuration>IO Boards>Shunt Controls. These input connections are available on the Internal Systems Connectors, J9 and J10.

Figure 10: EM4x Shunt Input Connectors
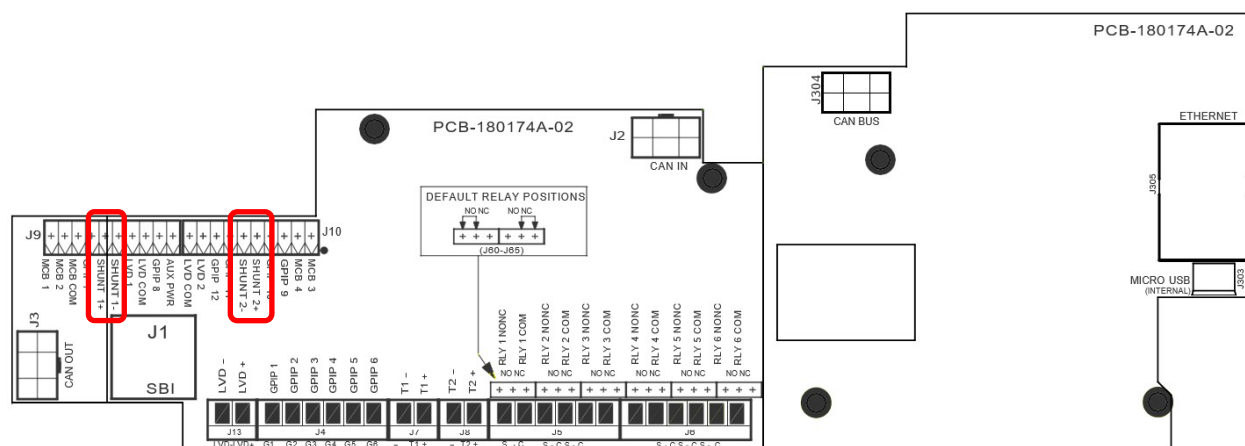
The current sensors must be placed in the negative of the DC system. When the current sensors are wired to a controller, a 4k7 resistor should be placed in series with each sense wire at source. The main reason for this is to protect the sense wire, however, it also provides the required input resistance to a controller to maintain the calibration.

Figure 11: Connection of a shunt to the controller
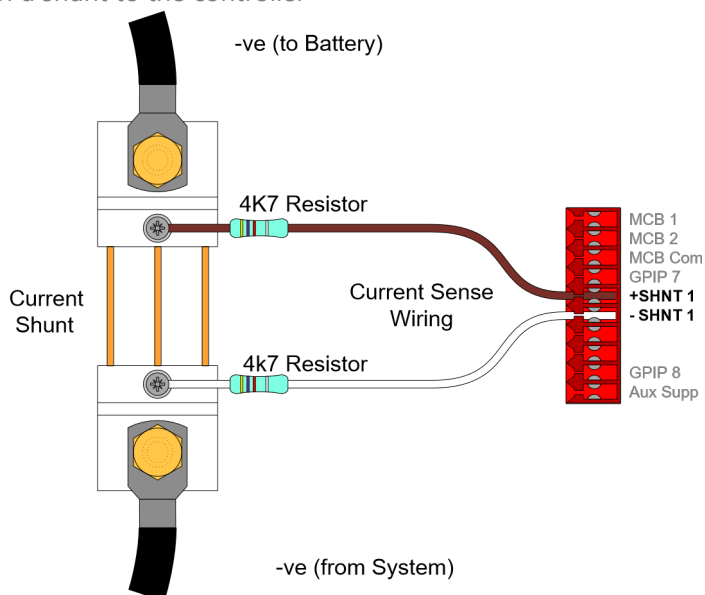
10.2.8 Temperature Sensor (Optional)

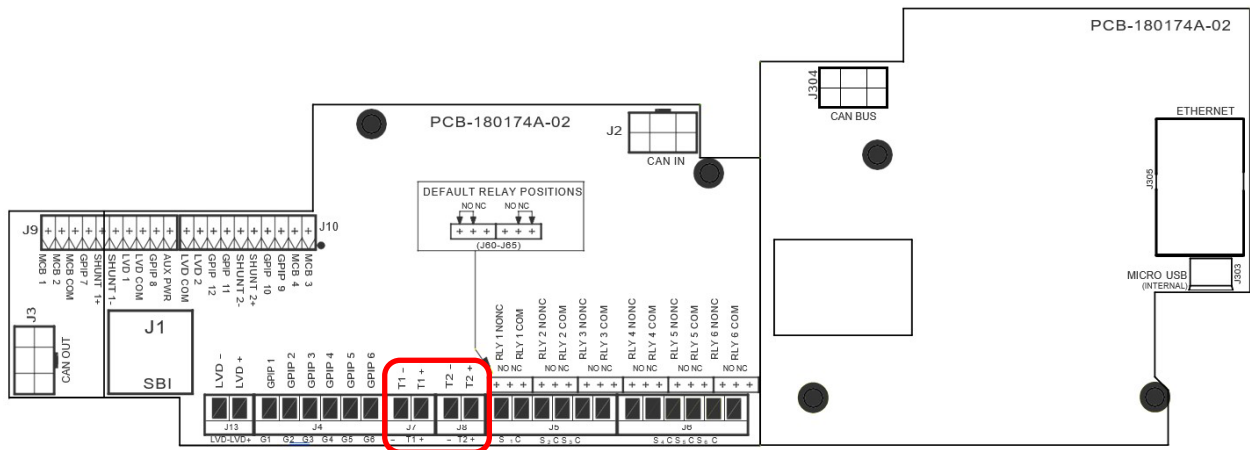WLA-TEMPEM4X-03   Calibrated Temperature sensor cable assembly (length 3 meter)
WLA-TEMPEM4X-07   Calibrated Temperature sensor cable assembly (length 7 meter)
When connecting the temperature sensor to the controller, the trace wire should be connected to the -ve terminal and the non-trace wire to terminal TS1 (or TS2) on connector J100 (or J110).

The temperature sensors can be configured to measure any temperature, however TS1 is normally designated as Battery Temperature. It should be placed in a position that represents the ambient battery temperature and is required for temperature compensation of float voltage. TS2 is normally designated as Ambient (or room) Temperature.

10.2.9 General Purpose Inputs

General Purpose Inputs (GPIPs) may be configured as either digital or analogue inputs. There is a total of 12 GPIPs on the EM4x I/O card (the number available for customer usage depends on specific system configuration). Connections are to be made to the corresponding terminal on connector J4 (1.5mm^2 plug-in Combicon connectors). Configuring the inputs as analogue or digital is done from the Input Logic of the Web UI.

Figure 13: EM4x General Purpose Inputs
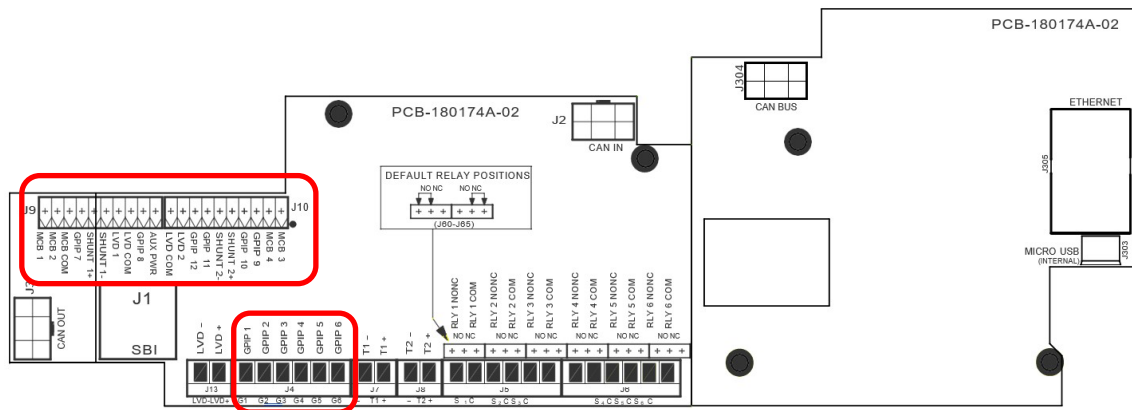
When used as digital inputs, the GPIPs are normally activated by connecting the system positive (usually system common) to the input. With a simple configuration modification in the Web UI Input Logic page the GPIPs can be activated by connecting to negative.

These inputs may be assigned to contribute to alarm states within a controller. This state mapping is defined in the Web UI configuration file.

When used as an analogue input, the range is from 0V to 70V, where 0V is referenced to the system negative.

10.2.10 Relays 1 to 6

Each EM4x I/O card has 6 relay outputs for remote indication of alarms or control (if more relay outputs are required, further IO boards can be fitted). The function of each relay is defined in the configuration file.

Connections to the relays are available on connectors J5 (relay 1-3) and J6 (relay 4-6) of the controller with one pair of voltage free contacts for each relay. Each relay output has a common (C) connection and switched (S) connection.
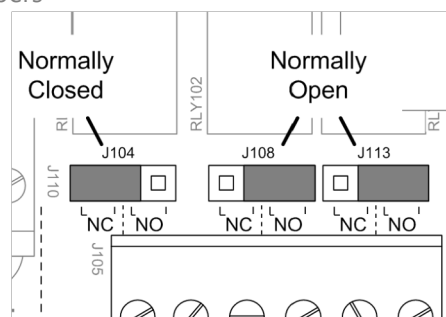
Figure 14: EM4x User Relay Outputs
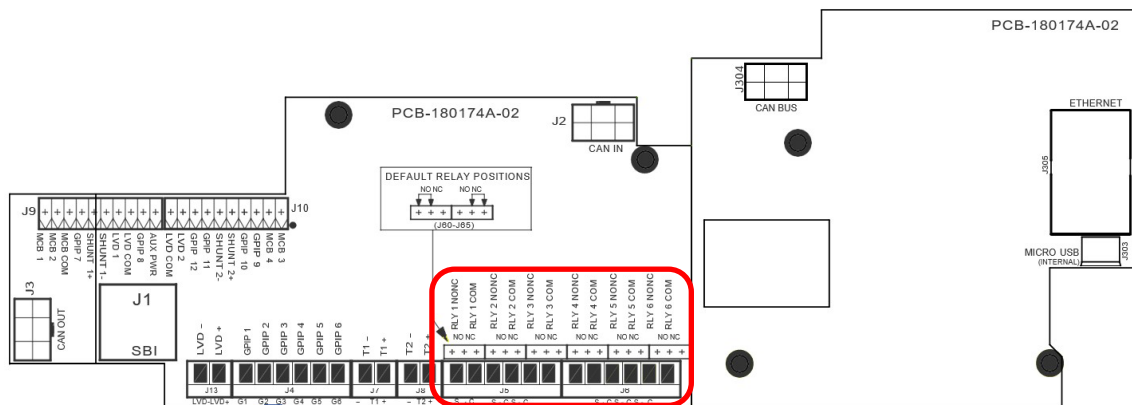
The output state of each relay is dependent on the selection of the jumper corresponding to each relay. For Normally Closed contacts the jumper must be in the NC position, for Normally Open contacts the jumper must be in the NO position.

NOTE: the relays must be either NC or NO.

Figure 15: EM4x Relay State Jumpers

Relay 1 is permanently configured as Monitor OK, and as such is in a Normally Energized state.
Relay 2 has a default setting as an Urgent Alarm, and as such is in a Normally Energized state.
Relay 3 has a default setting as a Non-urgent Alarm, and as such is in a Normally Energized state.
Relays 4-6 are spare and can be set to indicate any number of fault conditions as set in the controller configuration.

The default configuration relays can be modified and programmed as either normally energized or normally deenergized. The energized state requirements are dependent on the alarm/s mapped to the relay. Normally energized relays change state in the event of a system controller failure (i.e. low float alarm will activate if DC is removed), whereas normally de-energized relays do not change state.

NOTE: All labelling refers to the contact state when the relay is not energized.

To check the actual state of the alarm contacts, simply measure the relay output terminals with a multi-meter (check for continuity).
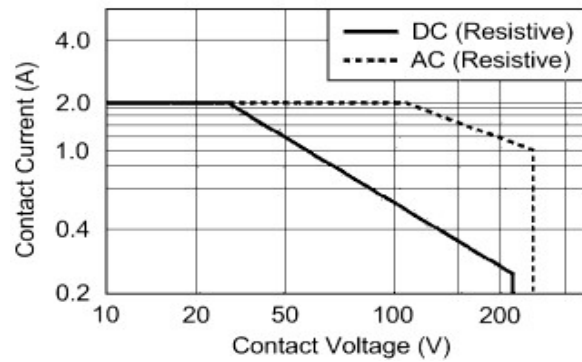
NOTE: The relays fitted are not suitable for use with inductive type loads. A suitably rated interface relay should be used for inductive load applications.

10.2.11 Low Voltage Disconnect (LVD) Connections

The Low Voltage Disconnect (LVD) function in the controller can be used for load disconnect or battery disconnect – the function dictated by the system wiring.

Each EM4x I/O board controls up to 2 ordinary coil type or magnetically latched type contactors. The method of connection is different for each type of contactor. Newmar's recommendation is to only use latching style contactors.

The controllers have a dedicated FET drive circuit for powering contactors. This drive circuit has a rating of 3A per LVD output. This requires a 48V power source typically connected to the bus.

The following figures give examples of how the different types of LVD are to be connected to a controller. (For simplicity only one LVD is shown in each diagram, but the same principles apply to subsequent LVDs connected.)

Figure

17: Magnetically Latched LVD Connections

```
MCB  3
MCB  4
GPIP  9
GPIP  10                              LVD 2 Control
SHUNT  2+
SHUNT  2-
GPIP  11
GPIP  12
LVD  2
LVD  COM
AUX PWR
GPIP  8
LVD COM
LVD 1                                 LVD 1 Control
SHUNT 1-
SHUNT 1+
GPIP  7
MCB COM
MCB  2
MCB  1
```

LVD 1

+   -

System Live   Battery Live
-ve
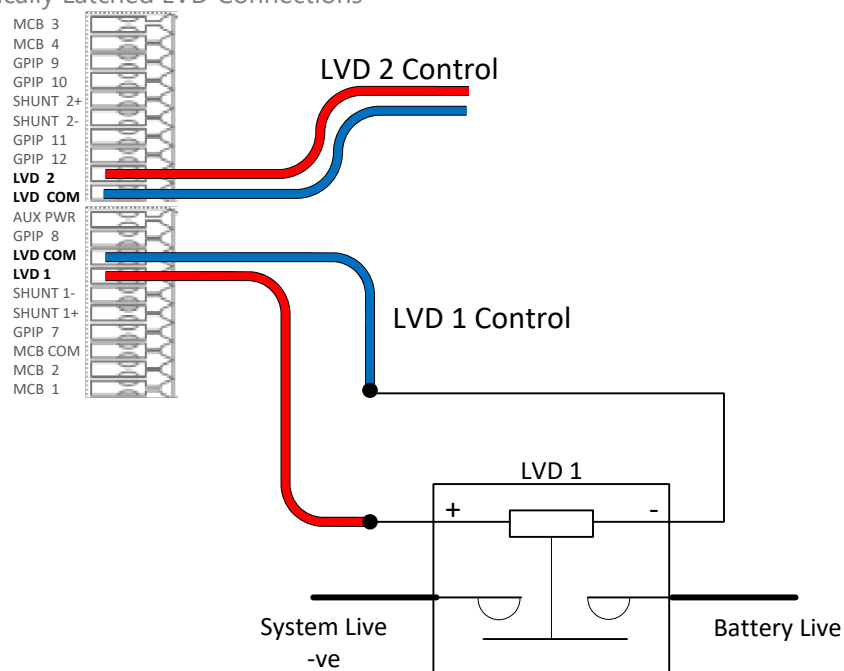
CAUTION   When using magnetically latched contactors (as is usual practice), at IO Configuration>IO Boards>LVD Controls make sure that LVD Latching is ALWAYS ON:

LVD Controls

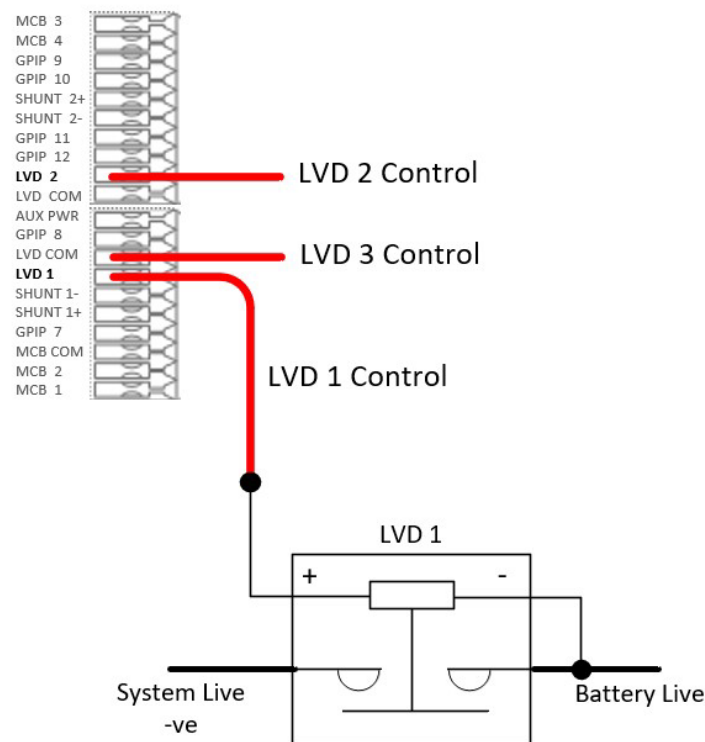LVD Latching   On   Off   ⟳

Failure to do this may lead to the LVD contactor coil overheating and burning out.

18: Normally Open/Normally Closed LVD Connections

Figure

MCB 3
MCB 4
GPIP 9
GPIP 10
SHUNT 2+
SHUNT 2-
GPIP 11
GPIP 12
LVD 2 — LVD 2 Control
LVD COM
AUX PWR
GPIP 8
LVD COM — LVD 3 Control
LVD 1
SHUNT 1-
SHUNT 1+
GPIP 7
MCB COM
MCB 2   LVD 1 Control
MCB 1

LVD 1

+   -

System Live   Battery Live
-ve

CAUTION   When using non-magnetically latched LVDs at IO
Configuration>IO Boards>LVD Controls make sure that LVD Latching is OFF.

LVD Controls

LVD Latching   On   **Off**   ↻
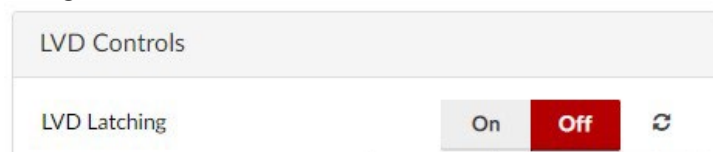
10.3 Cable Management

The EM4x 1U tray model allows cables to exit through either the front or rear of the controller, or a combination of the two. Cable relief slots are provided on the controller metalwork for either method of termination and should be used to secure cables.

10.3.1 Front Termination

Connections are made to the terminals required according to requirements of the system.
The cables should be loomed together to allow easier management of the loom. Route the cable along the front and out the left-hand side of the controller metalwork. The fold allows for full insertion of the controller yet allowing some space for cable exit.

10.3.2 Rear Termination

For the EM4x 1U connections are made to the terminals according to requirements of the system.
The cables should be loomed together to allow easier management of the loom. Route the cable through the rear of the controller and out the rear of the system. Cable lengths should allow for access when the controller is pulled forward for removal and maintenance.

10.4 Manual Reset

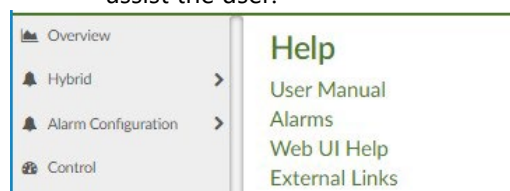To reset the controller manually the power supply through the J1 SBI Port can be disconnected and reconnected.

11 SITE INSTALLATION AND INFORMATION SETUP

NOTE: see 10.1 Energy Manager Connectivity and the Web UI for access to the Web UI.

11.1 Comment on the Web UI and Commissioning

During commissioning specific attention should be given to the following Web UI functions:

- If batteries are installed check the correct battery type is selected for the system. See 13.8.1 Battery Type.
- Complete the general settings. See 11.3 Help
- The Help page provides explanation of the Web UI inbuilt help functions along with resources to assist the user.
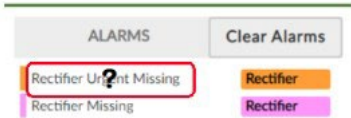
Click on each heading to expand the section.

- General Settings.
- Complete the network settings. Refer to the Settings>Network Settings page of the Web UI.
- Download and store a back-up configuration file that includes the site and network settings. See 14.3 Configuration File.
- Complete the site information.
- Download and store a copy of the site information.
- Complete the Web UI security settings: to establish a new set of usernames and passwords as required plus modifying the user level functionality at need.
- Enter a new PIN code for the EM4x-01 touchscreen if required.

11.2   Web UI Primer

The Web UI content and features are dependent on the type of system, software feature unlocks, battery types and configuration. Please note images, menus and materials in this manual are not necessarily what each user may see when opening the Web UI.

The EM4x Web UI opens on the Overview page. The Overview page shows critical system information in real time, custom configurations and has an expandable section for further information on the power modules and associated peripherals.
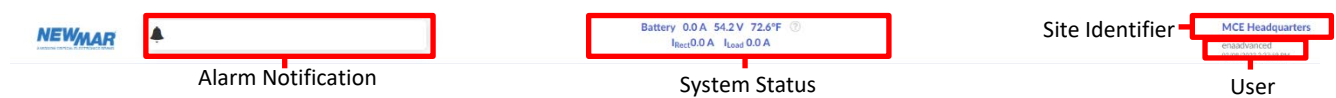
11.2.1 Navigation Pane

On the left side of the screen is a navigation pane page hierarchy that provides access to the features listed. NOTE: the available features can vary depending on the specific system type and the license locked features enabled.

11.2.2 Header

Alarm Notification   System Status   Site Identifier → MCE Headquarters
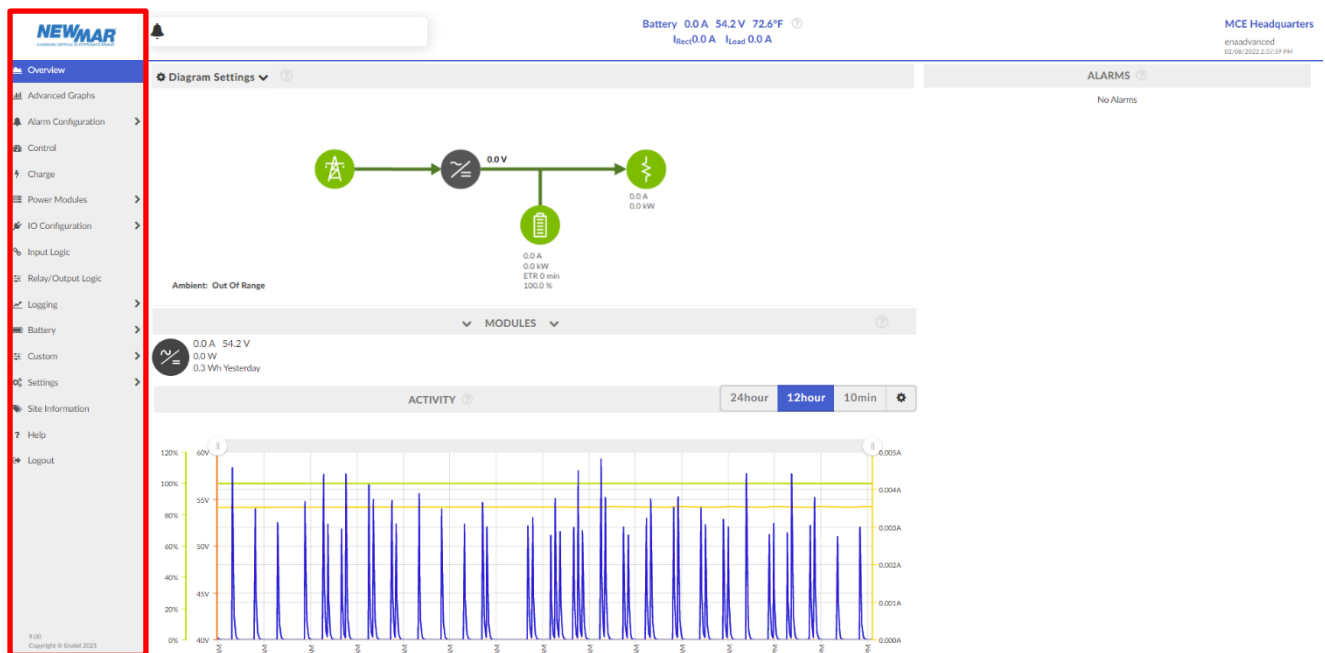
                                                                        User

The universal header section displays:

1.   An alarm notification list.

NOTE: this header alarm list is different from the Alarms section of the Overview page. Alarms in the Alarms section provide a help file when selected.

2.   A system status summary.
3.   The site identifier.
4.   The user logged in.

NOTE: when no unique username has been created this displays as the access level logged in as.

11.2.3 Alarms

Note the Alarms section of the Overview page that displays the current active alarms. Custom alarms also display here. Further information on the alarms can be obtained by placing the cursor over them. Clicking on the alarm brings up a pop-up menu with the alarm description and recommended action as appropriate.
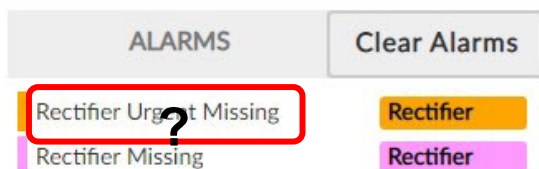
Alarms also display on the header which is seen on every page.

NOTE: see16.3 Alarm Configuration to understand the color coding of the alarms. A pale green alarm could be termed a flag rather than an alarm for instance, indicating normal operation and informative only.

See 16.4 Energy Manager Alarm List, Description and Action for a complete list of alarms (except custom alarms), their definition and any recommended actions.
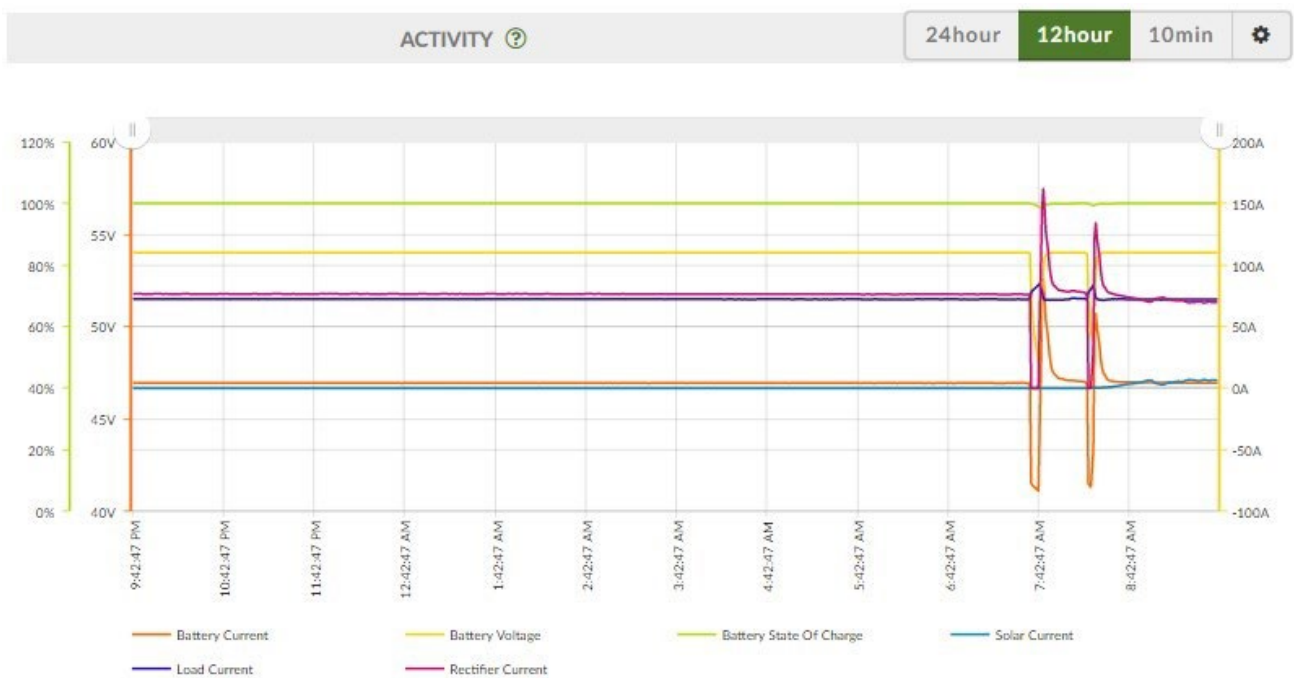
11.2.4   Modules Expanding Section

Click on the MODULES grey bar to expand the section which provides information on the power modules in the system and status.
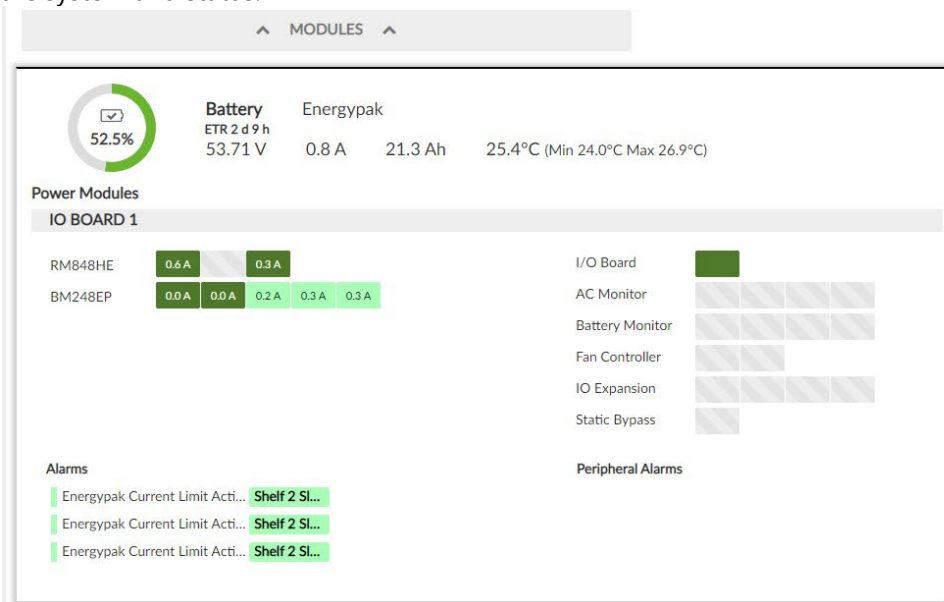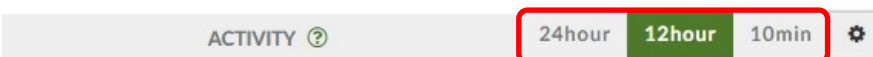

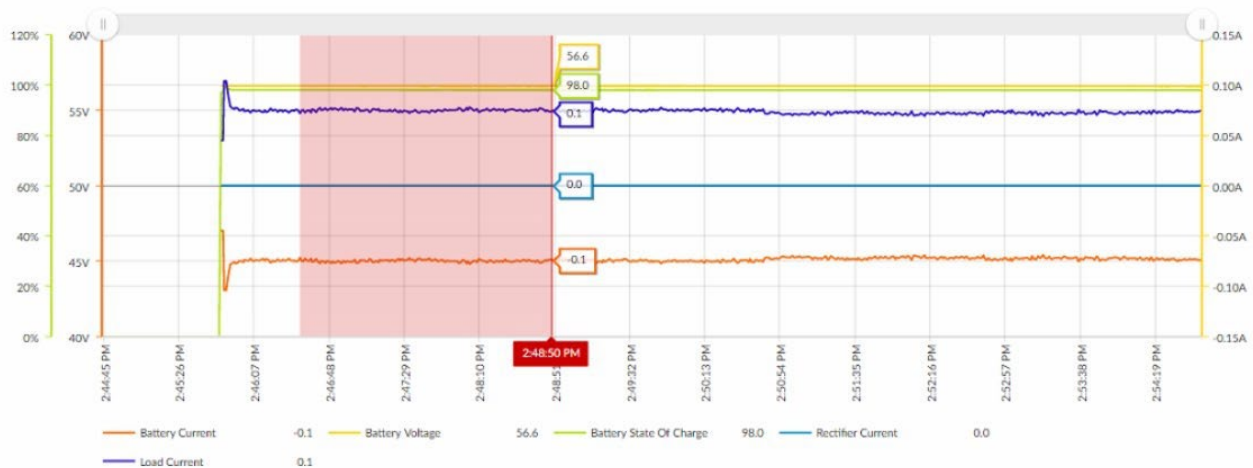Click on the individual modules for further information. See 13.6 Power Modules.

11.2.5 Activity Graph

NOTE: if the activity graph displays no information (particularly when first commissioning a system) change the time scale on the Activity bar.

A section of the graph can be zoomed in on by click, hold and dragging the cursor over the required graph section.

The time scale can be manually adjusted by dragging the ⏸ icons at the end of the graph inwards.
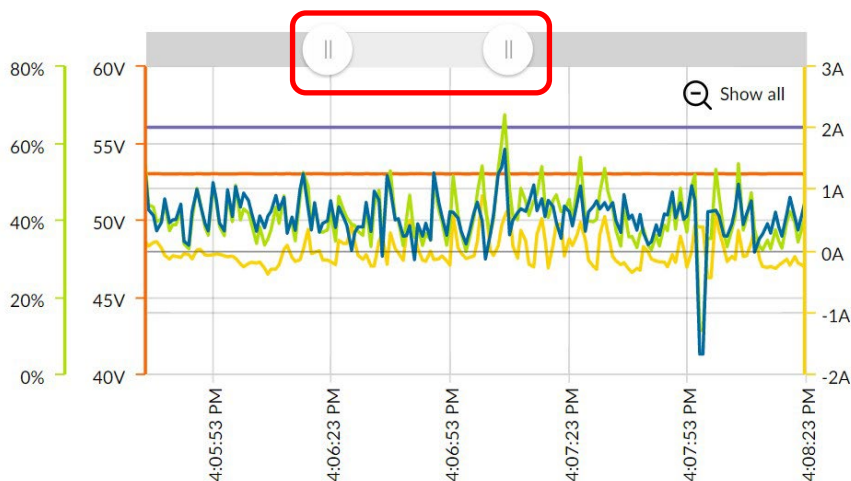
The information displayed in the activity graph can be managed by clicking on the parameter options, to toggle each display line on and off.

For example, the Renewable Current is toggled off and greyed out in the following screenshot.
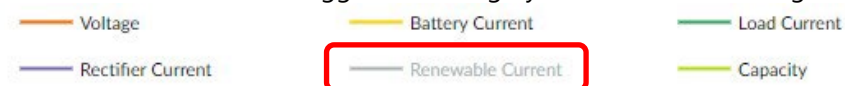
Click the gear icon ⚙ to add a variable to the graph.

Click the Add Variable button.

Select the required variable from the dropdown menu.

11.2.6 Advanced Graphs

The Advanced Graphs page provides four activity graphs which can be customized to allow concurrent observation of multiple variables as required.

11.3   Help

The Help page provides explanation of the Web UI inbuilt help functions along with resources to assist the user.

Click on each heading to expand the section.

11.4 General Settings

Fundamental parameters for the power system are defined on the Settings>General Settings page of the Web UI.

NOTE: see 14.3 Configuration File and 14.6 Firmware for information on the Upgrade Firmware and Backup/Restore Configuration functions of the Setting page.

11.4.1 Locale Settings

Select the Time zone Region and Time zone Locale from the dropdown menu then click on the Set Timezone button to set the applicable time zone. Access level required: *enabasic*.
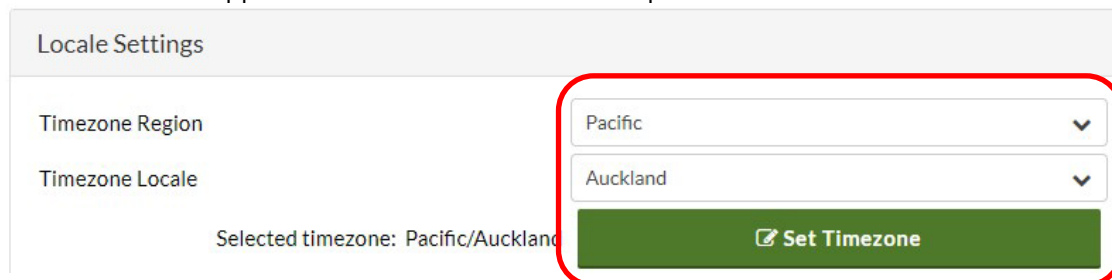
Important: temperature scale, whether degrees Celsius or Fahrenheit, is set by the Timezone Locale drop-down menu selection (which can be also managed on the EM4x screen interface at Settings/Time/Network Time setting.

Set Locale (Date and Time format) to select between dd/mm/yy and mm/dd/yy calendar displays.

Locale (Date and Time format)   NZ (dd/mm/yy)   ∨ ⟳ ✓

11.4.2 Date and Time Settings

Access level required: *enabasic*

The energy manager date and time can be synchronized to a connected computer by clicking on the Set to Computer Time button.

NOTE: this over-writes the Locale Settings for timezone region. Do not use this function unless in the correct timezone for deployment.

Date & Time Settings

Monitor Date & Time   19/03/2020, 1:36:06 pm

⊘ **Set to Computer Time**
19/03/2020, 1:36:05 pm

To allow the energy manager to access an external server clock toggle NTP Enable On.

NTP Enable   **On**   Off   ⟳

To set the required NTP server, enter the location in the NTP Server field.

NTP Server   time.google.com   ⟳ ✓

11.4.3 Unlockable Features

The energy manager has a variety of features that are license locked. These features are, either included in the Web UI at the factory when supplied to a customer or able to be enabled via a dedicated unlock file.

NOTE: if a license locked feature has not been enabled it does not display in the Web UI.

Those features already enabled are displayed in the Unlockable Features section.

Unlockable Features

Unlocked Features   Grid Tariff Optimisation
LUA Script Editor
Modbus Master
Phase Balancing

⊳ **Upload Unlock File**

NOTE: to confirm what license locked features may be suitable for your applications please discuss with your Newmar representative.

To access a licensed feature an unlock file must be first obtained from Newmar.

1. Click on the Upload Unlock File. Access level required: *enaadvanced*.

Unlockable Features

Unlocked Features   Grid Tariff Optimisation
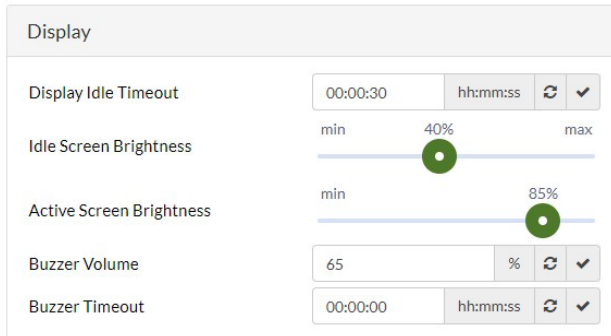LUA Script Editor
Modbus Master
Phase Balancing

⊳ **Upload Unlock File**

2. Drag and drop or navigate to the unlock file to upload into the EM4x and complete the process.

11.4.4 Display

This section modifies the energy manager LCD screen and alarm buzzer. Access level required: *enaadvanced*. Options are self-explanatory. Changes can be viewed in real time.

NOTE: if a buzzer alarm is raised pressing any keypad button on the energy manager front panel interface turns the buzzer off.
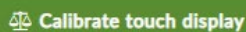
Note that setting the Buzzer Timeout to 00:00:00 means the buzzer will run constantly until a front panel button is pressed.

Calibrate Display

The touch display of the EM4x-01 controller can be recalibrated at need.

Click on the Calibrate touch display button then follow the on-screen instructions on the EM4x LCD.
NOTE: this button only displays on the EM4x-01 Web UI

11.4.5 PIN Locking the EM4x-01

The EM4x-01 has the option to PIN lock setting change through the touchscreen interface.
Access level required: *enaadvanced*.

1. Toggle the PIN code enabled On to engage this feature.

2. Click the eye icon to display the PIN code.

3. To change the PIN code, enter the new password then click the tick icon to save the change.

The PIN code can be from 4 to 8 numbers long. It cannot start with a 0. That is, the PIN code must be at least 1000.
NOTE: the default PIN code = 1234
NOTE: a factory reset reverts the PIN code to the default 1234.
The PIN code time out duration begins from the last action on the touch screen.

4. To change the time out period, enter the new time then click the tick icon.

11.4.6 Restart Monitor

To force an energy manager reboot click on the Restart Monitor button. Access level required: *enaadvanced*.
NOTE: a restart over-rides any active process.

NOTE: the system continues to supply the load during this process.
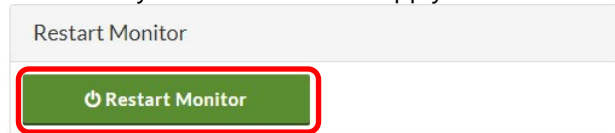
11.4.7 Restart Control Systems
To restart the control loop (effectively a soft restart) click on the Restart Control Systems button.
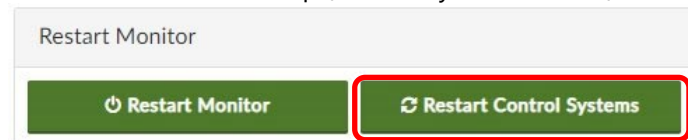
This function is primarily used during troubleshooting to assist with problem identification.

11.4.8 Factory Reset

CAUTION **A factory reset over-writes all site-specific settings and customized input logic.**

IMPORTANT: make sure the Preserve networking settings across factory reset check box is enabled if doing a factory set remotely. If this is not enabled the network settings are lost and the energy manager could go off line.
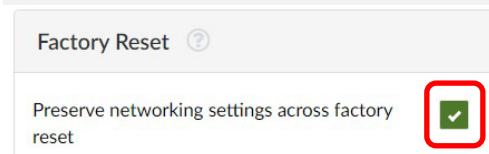
Click on the Factory Reset button for a complete factory default settings reset of the system. Access level required: *enaadvanced*.

NOTE: the system continues to supply the load during this process.

11.5   Site Information
The Site Information Web UI page Site Information section provides for the recording of individual site details. The non-greyed-out fields should be completed during site commissioning as appropriate.

The site details can be downloaded as an xml file for record keeping.

Or copied onto a clipboard for pasting into any text reading program such as Word or Note.

NOTE: It is recommended a backup file record of each site is kept as there may be critical site information required when the site is down and the Web UI unavailable remotely.

Access level required to save the *.xml site information file is *enaguest*.

NOTE: for license unlocking the CPU Board Serial Number is found here in the EM4x Monitor Information section.

CPU Board Serial Number	1908497487

11.5.1 Create Diagnostic File

This is a factory use only feature that creates a *.tgz file for diagnostic assistance.

11.5.2 Site Reports Print to pdf

There are 2 reports that can be printed to a pdf file for record keeping on the Site Information page.

- **Site Information Report**: which provides a summary of the site name, information, monitor and devices.
- **Site Configuration Report:** which provides all configuration settings of the EM4x.
    1. Click on the required tab.

2. Click on the – and + icons besides the file heading to manage what is displayed and printed in the report.

Site Configuration Report

Name

System Description : SM4x Monitor
System Name : SM4x
IPv4 Address : 192.168.2.188
Bootloader Version : 20200528.0-release
Software Build Identifier : EM4X-5.02-release
Site Identifier : Bunker Bottom - 50% Cycles
System Serial Number :
Date/Time : 16/02/2021, 9:38:21 am
MAC Address : d4:ce:b8:1:a9:a5

Alarm Configuration

3. Click on the Download PDF report button to download the required pdf file.

Download PDF report

11.6 Users

On the Settings>Users page new users and the user permissions can be set along with changing or adding new passwords.
NOTE: those fields the current access level does not have permission to modify are greyed-out.

Click on the Add New User button to open the New User menu.

In the Configure User section modify the new, or existing user. Enable each feature to provide permission access to the new user as required.

Enter a new password.

NOTE: the default password for all customer available levels is: ena123

To delete a user, click on the icon.

Click on the Reload button to remove a user before entering a new password.

11.7   IO Configuration

DC system IO boards, ancillary cards, and breakers are typically preconfigured and provided with a system. To expand system functionality ancillary cards and new breakers can be incorporated. This is managed through the IO Configuration menu of the Web UI.

NOTE: the options available in the IO Configuration drop down menu in the Web UI navigation side pane are system type dependent. Not all options shown in this manual section may be available to a system.

11.7.1 IO Boards

Note: unlike AC Monitors, Fan Controllers, IO Expansion cards and Battery Monitors, IO Boards are not autodetected and auto-populated in the Web UI. IO Boards must be configured and enabled manually.

To expand functionality if additional IO boards are required the Number of IO Boards must be set first at IO Configuration>IO Boards>IO Board Configuration.

Shunt Controls

In this section shunts in the system have their parameters entered. In the example below there are two 300A/50mV shunts.

The Deadband is the threshold below which the EM4x assumes the current to be zero.

Shunt Controls				
Shunt 1 Voltage Rating	50	mV	⟳	✔
Shunt 1 Current Rating	300	A	⟳	✔
Shunt 2 Voltage Rating	50	mV	⟳	✔
Shunt 2 Current Rating	300	A	⟳	✔
Deadband	2	A	⟳	✔

See <u>10.2.7 Current Measurements</u> for the shunt 1 and 2 connector locations on the IO board. 2 shunts can be connected to each IO board.

Shelf Configuration

Enter the number of modules for each system shelf from the drop down menu. An incorrect number entered here raises a module missing alarm.

11.7.6 Battery MCBs

A maximum of 4 battery MCBs can be configured with each IO board.

Number of Battery MCB	1	⟳	✔

Automatic MCB Inputs when toggled Off uses Input Logic dedicated configuration for the battery MCB settings rather than the default EM4x firmware battery MCB input settings. This is an advanced setting typically only used in factory configuration.

Automatic MCB Inputs	On	**Off**	⟳

Digital MCB Inputs when toggled On allow for the use of GPIPs to be connected across the auxiliary contact of a breaker

Digital MCB Inputs	**On**	Off	⟳

Current Rating of each MCB is obtained from the breaker data sheet.

Current Rating of each MCB	30	A	⟳	✔

Power Rating of each MCB is obtained from the breaker data sheet detailed as Power Loss.

Power Rating of each MCB	5	W	⟳	✔

Voltage Threshold is typically 0.15V.

12   USING THE EM4X CONTROLLER FRONT PANEL INTERFACE

12.1   Introduction

The EM4x monitors have an LCD display on their front panel that allows system parameters to be observed or modified. The display menu is navigated touch control. The display shows the default screen when operating normally and no key has been pressed for about 60 seconds.

12.1.1 Default Screen

When the controller front panel interface is in an idle state, it shows the default screen and the backlight is at minimum. When the screen touched, the backlight increases to maximum. The user interface is now active.

12.3 3U Touchscreen Menu Navigation

The touchscreen menu is navigated by tapping the active elements.

Figure 20: 3U Touchscreen Main Menu Active Elements
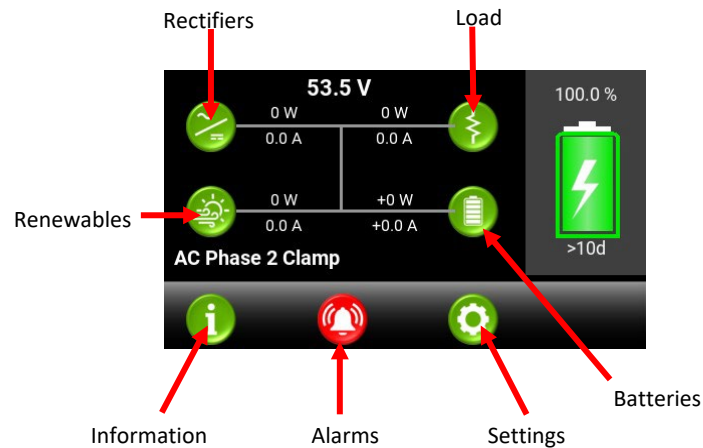
Tap the required icon as shown in Figure 20 to access the submenus.

Slide to scroll through the menu options.

Tap an item line displaying the [»] icon to access further sub-menus.
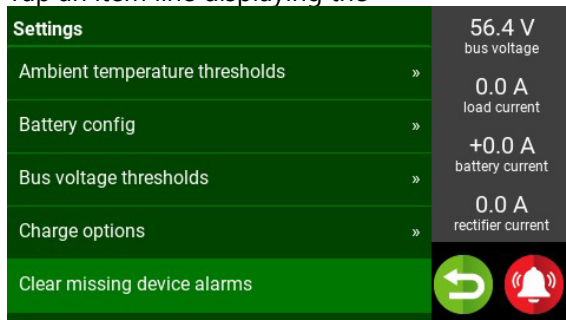
When entering a sub-menu, note the title of the sub-menu is displayed on the top line.

Tap the line item to toggle state changes as required.
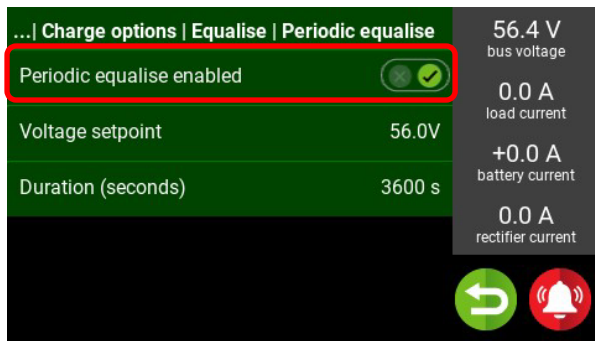
Tap a line item with a numeric value. A number pad appears.
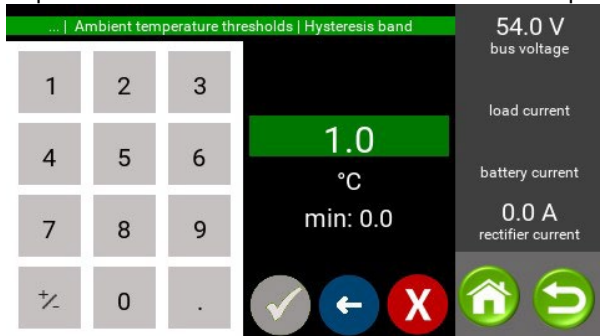
Tap the required field to be modified.

Tap the icon to delete individual items in the field.

Tap the icon to clear the field.

Tap the required numerals on the number pad.

Tap the icon to confirm the entered information.

Tap the icon to return to the previous screen.

Tap the icon to return to the front screen.

NOTE: the EM4x-01 has the option to PIN lock function change through the front screen interface. See 11.4.5 PIN Locking the EM4x-01 for details.

When attempting to change a setting through the touchscreen with PIN code enabled, a request to enter the PIN code appears.

Enter the PIN code to proceed with a required change.

NOTE: the default PIN code is 1234.

12.4 1U and 3U Front Screen Interface

12.4.1 Rectifier Modules

Selecting the Rectifier icon displays a list of rectifiers in the system with the shelf locations where:

B = bus number = a bus number assigned to each I/O board which matches the IO board number.

R = row number = which is the same as the shelf number which in Newmar systems starts at the top 1U of the system (not the first row of battery modules for example).

C = column number = columns relative to the row arrangement. That is, where a row might have an energy manager installed C1 would be the first rectifier in the row after the energy manager reading left to right.

Selecting an individual rectifier displays the serial number, the firmware number, the active current and any alarms raised.

Figure 21: System Row and Column Numbering Example

12.4.2 Load

Selecting the Load icon displays the active current, power and power consumed the previous 24 hours.

12.4.3 Battery Status

Selecting the Battery Status icon varies according to the battery type configured. It displays:
- the total estimated back up battery time remaining for the system (the ETR)
- the average charge percentage of the battery strings,
- and either Battery Modules by location with their model's name (Product), state of charge (Charge) and active current where -
  B = bus number = where in systems with multiple I/O boards the bus number is assigned to each I/O board in the daisy chain.
  R = row number = which is the same as the shelf number which in Newmar systems starts at the top 1U of the system.
  C = column number = columns relative to the row arrangement

12.4.4 Settings

The various Settings are described with reference to their related functionality in the appropriate sections of this manual.

12.4.5 Alarms

The Alarms menu contains alarm states that are currently active. It is a dynamic list and updates whenever an alarm state activates or deactivates.

NOTE: If no active alarms are raised, the list is empty.
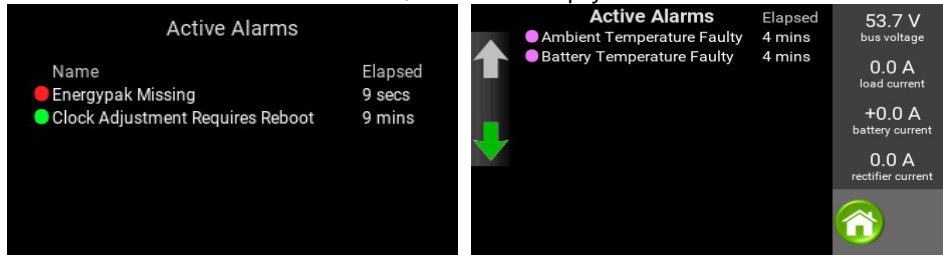
12.4.6 Information

Selecting the Information icon displays the EM4x key product details.
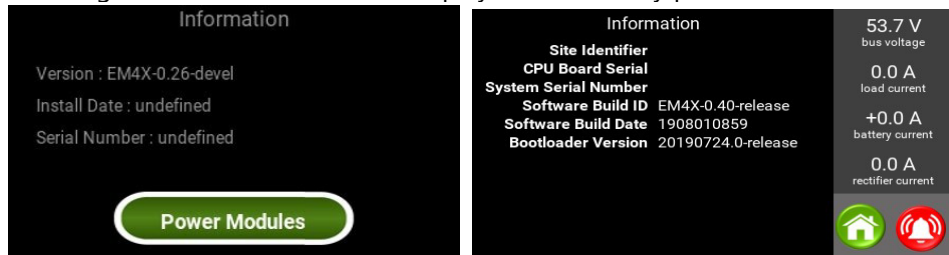
Press the key to select Power Modules which displays all rectifiers and batteries in the system.

B = bus number = where in systems with multiple I/O boards the bus number is assigned to each I/O board in the daisy chain.

R = row number = which is the same as the shelf number. In Newmar systems this starts at the top 1U of the system. Where a row might have an energy manager installed C1 would be the first rectifier in the row after the energy manager reading left to right.

C = column number = columns relative to the row arrangement.

Power Modules		
Position	Product	Current
B1:R1:C1	RM848HE	0.6A
B1:R1:C2	RM848HE	0.4A
B1:R1:C3	RM848HE	0.3A
B1:R2:C2	BM2650	0.9A
B1:R2:C3	BM2650	0.3A
B1:R2:C4	BM2650	0.2A

Selecting a module displays details of the individual module.
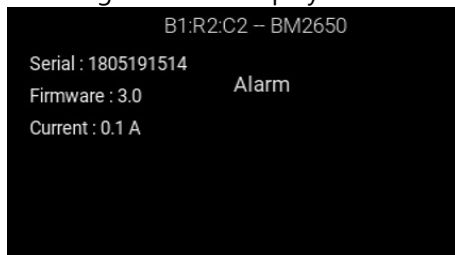
13 ENERGY MANAGER PROCESSES, FUNCTIONS AND REPORTING

NOTE: see for access to the Web UI.

13.1 Introduction

The energy manager gathers information from the DC system and runs processes that control the function of the system. These processes are described in this section.

Sections of the Web UI report information gathered by the energy manager and explanation of these page sections is also provided in this part of the manual.

NOTE: not all features are present in each system type. Also, several features are license locked which are noted as appropriate.

NOTE: when a function is active the Web UI section header changes color to pale green.

13.2 Low Voltage Disconnect (LVD)

The DC system is designed to have batteries connected to maintain DC supply when the AC supply has failed. The batteries have a finite capacity and are designed to support the DC system for only a predetermined period of time. When the battery discharges below certain levels, permanent damage can occur to the battery. The LVD function is designed to detect the end of battery discharge and disconnect the battery from the system to prevent damage. The battery reconnects again when the system recovers (e.g., AC power restored).

The LVD process detects the battery voltage and when it drops below the set threshold, the LVD contactor is opened, disconnecting the battery from the system. DC power will be lost to the load equipment at this moment, but the battery is preserved to recharge when the AC supply is restored.

This voltage mode is the default mode of LVD operation.

Low voltage disconnect settings are accessed:
- Using the Web UI at IO Configuration>IO Boards>LVD Controls
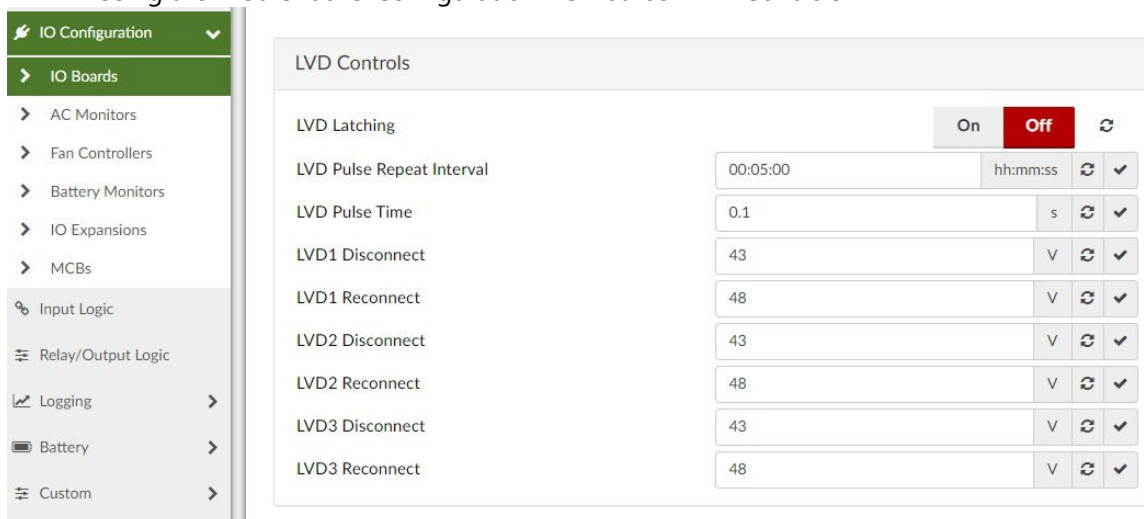
- Using the front panel at Settings>LVDs>IO Board 1 LVDs
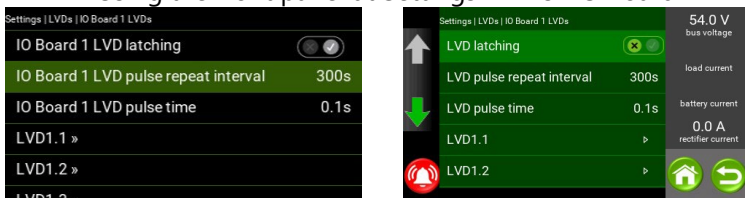
The EM4x can control up to 2 magnetically latched contactors. It can control up to 3 Normally Open or Normally Closed LVD contactors. Magnetically latched contactors require no energy to keep them closed or open, only a pulse to make them change state, whereas N.O. or N.C. contactors require permanent energy to keep them in one state or the other.

Due to the stability and security of operation of magnetically latched contactors, Newmar uses them in preference to Normally Open or Normally Closed contactors.

Note that, in most Newmar systems, the EM4x is kept powered even after the battery LVD may have opened.

See <u>10.2.11 Low Voltage Disconnect (LVD)</u> for the LVD connections to the EM4x.

LVD Pulse Repeat Interval and LVD Pulse Time are settings which in usual operation require no modification from the default 5 minutes and 0.1 seconds respectively.

LVD1 Disconnect: the default setting for lead-acid battery systems is 43V.

LVD1 Reconnect: the default setting for lead-acid battery systems is 48V. Note it is the DC bus that must reach this voltage level for reconnection, not the battery voltage.

For LVD 2 and 3 these settings are made to either align with LVD1 or be significantly different to clarify what are the active parameters.

13.4 Control

13.4.1 Rectifiers

Access level required: *enaadvanced*.

In typical usage the parameters in the Control>Rectifier section are not recommended to be changed.

Rectifier Phases

Set the phase number as 1 or 3.

Rectifier Phases	1	**3**	↻

Rectifier Voltage Regulation Enabled

The purpose of this feature is to improve the accuracy of the float voltage to the batteries. The default setting is enabled.

Rectifier Voltage Regulation Enabled	**On**	Off	↻

The long-term float voltage, when the battery is fully charged and drawing almost no current, is one of the most important parameters affecting the battery life. Voltage is sensed at the DC system bus. With this enabled, as the system load increases (& the rectifier output voltage droops due to circuit resistance), the EM4x ensures that the voltage at this point is maintained. In systems without this active voltage control, typical regulation will be up to 0.5V from zero to full load. With this enabled, regulation can be reduced to better than 0.1V and is often better than 20 or 30mV.

Rectifier Current Share Enabled

This feature provides for the EM4x to more accurately current share than to rely on the default current share inbuilt in the rectifiers as this is critical to the long-term health of a DC system. The default is On.

Rectifier Current Share Enabled	**On**	Off	↻

Float Voltage

Float voltage is a system critical parameter that defines the voltage that the load is supplied at, and the voltage the batteries are charged to. This setting is battery type specific.

Float Voltage	56.7	V	↻	✔

Minimum and Maximum Rectifier Voltage

These values are either default or set by the site limitations of load equipment and the allowed voltage range.

Minimum and Maximum Rectifier Module Power and Current

These settings are default and available to be modified typically only for factory purposes.

Rectifier Urgent Fail Threshold

This figure sets the limit for change in alarm from Rectifier Fail or Rectifier Missing to Rectifier Urgent Fail and Missing. The option is provided for systems with a large number of modules and available redundancy such that a customer may wish to differentiate the alarms and not require call out for a specific number of failures.

Broadcasted Phase 1,2,3 Power Limit & Rectifier Voltage Setpoint

These are parameters that are displayed when phase balancing is enabled. They are primarily included for troubleshooting purposes.

Broadcasted Phase 1 Power Limit	130.69	W
Broadcasted Phase 2 Power Limit	377.32	W
Broadcasted Phase 3 Power Limit	527.15	W
Rectifier Voltage Setpoint	53.18	V

13.4.2 Rectifier Power Save

The controller can control a DC system in a mode that reduces power consumption as rectifiers are more efficient at higher output currents. It does this by shutting down (into a "cold standby" state) enough rectifiers to make the remaining rectifiers operate at the higher efficiency load.

The Power Saving Mode is accessed:

- Using the Web UI at Control>Rectifier Power Save

- Using the front panel at Settings>Power save options

The Power Saving Mode works by progressively shutting down rectifiers that are not required to meet the load demands of the system. The mode becomes active when enabled and none of the cancellation conditions (see below) are active. When active it waits 60 seconds then will turn one rectifier module off if the load current is below the "Turn Off" percentage (e.g. 50%). If the load is still lower than the "Turn Off" percentage for the remaining rectifiers, it will wait 60 seconds then shut down a further rectifier. This process will continue until the load current is greater than the "Turn Off" percentage for remaining rectifiers. To maintain n+1 redundancy, there will always be a minimum of two rectifiers that remain active regardless of how small the load is. This is because those rectifiers that are shut down in their "cold standby" state, take some seconds to ramp back up to full power.

If the load current increases so that it is above the Power Save Off Threshold percentage, one rectifier will turn on again. If the load is still greater than the Power Save On Threshold percentage of the rectifiers on, a further rectifier will turn on after 60 seconds. This process will continue until the load current is less that the "Turn On" percentage.

Power Saving Mode will immediately cancel if any one of the following occurs:

- a rectifier fails
- a mains fail occurs
- any rectifier goes into current limit
- a Battery Test occurs

Power mode will become active again when all these events have been cleared.

After the defined Auto Rotate Period the rectifier module that has been shut down the longest will turn on and the next rectifier module in sequence will be shut down in its place. This rotation can ensure that all rectifiers get even usage.

This mode can only be used in concert with rectifiers having serial numbers beginning 0819xxxxxx (i.e., manufactured after 2008) or greater. If used with earlier rectifiers, these rectifiers will not respond to power saving commands.

13.4.3 Rectifier System Current and Power Limit

CAUTION **Use this function with care. If these values are set too low, it may be possible, after a battery discharge, to end up in a state where there is insufficient current to power the load AND charge the battery. If this occurs, the battery will continue to discharge, eventually causing the site to go off air. Newmar cannot be held responsible for miss-application of this function and these parameters.**

Access from the Web UI, Control>Rectifier System Limits:

Rectifier System Limits				
Rectifier System Current Limit	✓	Disabled	A	⟳ ✓
Rectifier System Power Limit	✓	Disabled	W	⟳ ✓

In specific system scenarios it is desirable to limit the rectifier output to a setting lower than their maximum. This may be used when the AC grid feed is limited and is a way of limiting input current. The current and the power is the total system output current or power (not the current or power per module).

This function is not the same as the Rectifier Current & Power Limits that are set in the rectifier module EPROM in the Control>Rectifier section.

13.4.4 Current/Power Limit Options

This section is used for legacy non-HE Newmar rectifiers.

Current/Power Limit Options			
Power/Current Limit Minimum Voltage	43	V	⟳ ✓
Power/Current Limit Hysteresis	0.3	A	⟳ ✓
Power/Current Limit Backoff Voltage	0.5	V	⟳ ✓

This is not the same as setting the Rectifier Current Limit. See Minimum and Maximum Rectifier Voltage.

Power/Current Limit Minimum Voltage

Current & power limiting operate by lowering bus voltage. Set this value to a level that is higher than the LVD trip threshold to guarantee that abnormal operation of the current limit does not cause complete system failure.

Power/Current Limit Hysteresis

As the bus voltage decreases to achieve the target Current Limit this hysteresis is applied to prevent "hunting" around this set point.

For example, if a battery size is 100Ahrs, and the Battery Current Limit is set to 25%, then the target current is 25A – 1A hysteresis, making it 24A.

This setting is usually only relevant in larger systems with larger batteries where a small increase in voltage results in a large increase in battery current.

The default setting is 1A, however, in larger systems (with batteries of say, >1000Ahrs) this can increase to 5 or 10A, or about 1% of the total battery Ahrs.

Power/Current Limit Backoff Voltage

This is the voltage step that the EM4x will reduce the bus voltage by as soon as one of the Current/Power Limits is exceeded. This should immediately cause the over-current situation to cease.

The EM4x will then increment the voltage in smaller steps so that the current/power threshold can be carefully controlled.

This setting is useful during Hybrid control set-up where it may be desired to reduce generator load by smaller amounts rather than a large step change. This can help prevent generator over-run/over-speed.

13.4.5 DC Converters

Converter Voltage Regulation Enabled

The purpose of this feature is to improve the accuracy of the float voltage to the batteries. The default setting is enabled.

Converter Voltage Regulation Enabled   On   Off   ⟳
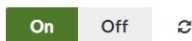
The long-term float voltage, when the battery is fully charged and drawing almost no current, is one of the most important parameters affecting the battery life. Voltage is sensed at the DC system bus. With this enabled, as the system load increases, the EM4x ensures that the voltage at this point is maintained. In systems without this active voltage control, typical regulation will be up to -0.5V from zero to full load. With this enabled, regulation can be reduced to better than 0.1V and is often better than 20 or 30mV.

Converter Current Share Enabled

This feature provides for the EM4x to more accurately current share than to rely on the default current share inbuilt in the converters as this is critical to the long-term health of a DC system. The default is On.

Converter Current Share Enabled   On   Off   ⟳
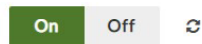
Converter Voltage Setpoint

Enter the required voltage to set the voltage output of the converters.

Converter Current Limit

1.   Click the left side   icon to enable
   ✓ | Disabled | A ⟳ ✓   converter current limit.

2. Enter the required figure.
   ✓ | 55 | A ⟳ ✓

3. Click the right side ✓ icon to save the changes.
   ✓ | 55 | A ⟳ ✓

DC Converter Urgent Fail Threshold

This figure sets the limit for change in alarm from Converter Fail or Converter Missing to Converter Urgent Fail and Missing. The option is provided for systems with a large number of modules and available redundancy such that a customer may wish to differentiate the alarms and not require call out for a specific number of failures. 13.4.6 Renewable Energy

When solar and/or wind modules are present in the system the Renewable Energy section displays.

The Converter Bias is set to force the load to be supplied from the renewable modules as a priority over the rectifiers.

NOTE: the default value for the bias is .2V.

The Urgent Fail Threshold is the number of modules that must fail before the Urgent Fail alarm is raised. This is done to allow a priority of warning or critical alarms settings if there is n+1 redundancy on the modules.

13.5 Charge

In the Charge>Charge Settings page details of the charge options are provided. The information displayed on this page is battery type specific.

13.5.1 Lead-Acid Fast Charge

The controller has an optional Fast Charge feature for lead-acid batteries. This feature aims to reinstate the batteries to the fully charged state as quickly as possible after a discharge, without damaging the batteries. When Fast Charge is enabled, the controller measures any battery discharge, recording the amp-hours of that discharge. When the recharge begins it raises the charge voltage to a higher level until the total discharged amp hours has been returned to the batteries plus a percentage.

Fast Charge, once activated, will remain active until the Recharge capacity has been returned to the battery or the Fast Charge time limit expires.

Access Fast Charge:

*   Using the Web UI at Charge the Fast Charge section

Using the front panel at Settings>Charge options>Fast Charge

Fast Charge Voltage Setpoint is the target bus voltage that the EM4x tells the rectifiers to aim for during the Charge session. Set this value to that recommended by the battery manufacturer (usually between 2.3V/cell to 2.4V/cell (55.2 and 57.6 for 48V systems) at 25°C). Note that this voltage is temperature compensated.

Fast Charge Lockout Period is, when enabled, the period of time after completing fast charge set up before a fast charge may occur, as might be required during commissioning for example.

Minimum Discharge to enter Fast Charge is a value set to protect against effective false triggers.

Start when Voltage Below is where if during a discharge the bus voltage drops below this level then Fast Charge will be enabled during recharge. This is subject to some other general conditions for fast charge being allowed to start. The bus voltage must remain below the voltage setpoint for a full 30 seconds before this initiates a fast charge start.

Time Below Voltage Threshold to trigger start is a time limit to ensure correct triggering of the Start when Voltage Below parameter.

Start when Capacity Below is the battery capacity that if the battery gets below during a discharge, the EM4x will initiate the Fast Charge when AC power is restored. For example, when set at 90%, if you have a 400Ahr battery, and you have a discharge event that takes out 36Ahrs (i.e., say 9A for 4 hours), then when AC is restored the Fast Charge will not be activated. However, if the discharge is a 40.4Ahrs (i.e., say 10.1A for 4 hours), then when AC is restored the Fast Charge routine will be activated. This is subject to other general conditions for fast charge being allowed to start.

Start after Discharge Time is where if a discharge lasts longer than the stated time, then Fast Charge will be enabled during recharge. This is subject to other general conditions for fast charge being allowed to start.

Low Current Threshold and Terminate on Time below Low Current Threshold is when during recharge, the battery voltage is within 0.5V of the target Fast Charge voltage (taking into account temperature compensation), and the Battery Current drops below this value for more than 10 minutes, the Fast Charge will cease, and the system will revert to Float Voltage. Note the figures stated are Newmar default and are customizable.

Terminate on Recharge (% of the discharge) is where if the Recharge amount is reached before the Fast Charge Time Limit elapses, then the Fast Charge routine will cease.

NOTE: the Recharge amount is the percentage of the Ahrs taken out of the system during the last discharge. The percentage entered here is not percentage of the battery capacity. For example, if this setting is 110%, and if 50Ahrs is taken out of the battery, Fast Charge will continue until 55Ahrs is put back in (unless the Time Limit is reached first).

Terminate on Time Above Float Voltage provides a maximum duration for fast charge to be provided once recharge to float voltage is achieved.

13.5.3 Battery Test

The Battery Test process is intended to test if the batteries can supply the load.
Lead acid, lithium, and other battery types can be tested using the battery test. A battery test may compromise backup capability.

CAUTION   Setting up Battery Test requires the user to be familiar with the type of battery they are using, its discharge characteristics, and the system load. The battery test

time must be considered carefully. The voltage range of the test must be considered carefully. If the AC power should fail during the test or the subsequent recharge cycle, there should be enough capacity remaining in the battery to ensure security of the DC supply. If the voltage range is outside the battery normal operation the batteries could be damaged.

Newmar cannot be held responsible for a user's lack of knowledge or misapplication of this feature.

When a battery test begins, the rectifier modules are turned down to a voltage just below the specified termination voltage. (This ensures that if the battery does not perform, the rectifiers automatically re-assume the load.) The battery test continues for either the Battery Test Duration specified, or the Battery Test Minimum Voltage is reached, whichever comes first. If the test ends due to the time expiring, then the test is a pass. If the test ends due to the termination voltage being reached, this is a failure and a Battery Test Fail alarm is generated.

The battery test time must be considered carefully. If the AC power should fail during the test or the subsequent recharge cycle, there should be enough capacity remaining in the battery to ensure security of the DC supply.

Battery tests may be activated manually or set to run periodically. The manual test is performed using all the periodic test criteria.

Battery Test Lockout Period may be set to ensure that battery tests are not attempted too soon after a previous discharge event, whether that event was a simulated or a real discharge. This ensures the battery is fully recovered before further tests are allowed.

Some active system processes can prevent a test occurring. A battery test may be over-ridden by a prioritized event.

The failure of a battery test produces a Battery Test Fail alarm. This alarm will remain active until the next test or until reset via the Clear Battery Test Alarms button.

Battery Test					
					↻ Reset
Battery Test Duration	00:15:00		hh:mm:ss	↻	✔
Battery Test Minimum Voltage	46		V	↻	✔
Battery Test Lockout Period	00:00:10		hh:mm:ss	↻	✔
Fail on Symmetry Alarm		On	Off	↻	
	Clear Battery Test Alarms				

Fail on Symmetry Alarm: if this is enabled and the String Asymmetry Setpoint is exceeded the battery test will cease, and the Battery Test Fail alarm is raised. See the Battery Settings>Battery String Configuration section for the String Asymmetry Setpoint.

Periodic Battery Test

Periodic Battery Test Enabled toggled On performs a battery test every Periodic Battery Test Interval.

The Required Battery SoC Before Test is set to prevent the battery test starting after a discharge event when the batteries may be at a charge too low to provide required back up

Next Periodic Battery Test states the duration till the next test is scheduled to run.

Latest Reason for Failure displays a record of why the previous test was cancelled.

Periodic Battery Test				
Periodic Battery Test Enabled		On	Off	↻
Required Battery SoC Before Test	95	%	↻	✔
Periodic Battery Test Interval	7	days	↻	✔
Next Periodic Battery Test	7/09/2020, 12:37:34 pm		↻	
Latest Reason For Failure			↻	

Manual Battery Test Control

Click on the Start Battery Test button to manually start a battery test.

Manual Battery Test Control

Battery Test Lockout Time Remaining	00:00:00	hh:mm:ss
Battery Test Time Remaining	00:00:00	hh:mm:ss

Start Battery Test

Battery Test Lockout Time Remaining indicates if a Battery Test Lockout Period is active and the duration before a battery test many be performed.

Battery Test Time Remaining is the duration a currently running battery test requires to complete the test.

13.5.4 Lead-Acid Equalize

Lead-Acid Periodic Equalize

The Periodic Equalize function allows lead-acid batteries to be charged on-line at an elevated voltage for a set period of time. This charge function will repeat automatically at the specified interval. The initial interval begins from when the Periodic equalize function is enabled or the interval changed.

A periodic equalize will not occur if a battery test or manual equalize is active. It will cancel that instance and try again after the next interval.

Access Periodic equalize:

- Using the Web UI at Charge>equalize.

- Using the front panel at Setting>Charge options>Equalise>Periodic equalise

Lead-Acid Manual equalize

The Manual equalize function allows lead-acid batteries to be charged on-line at an elevated voltage for a set period of time. This function must be manually enabled each time this charging is to occur. It will be disabled when the charge cycle is complete.

A manual equalize cannot be instigated if a battery test or periodic equalize is currently active.

Access Manual equalize:

- Using the Web UI at Charge the equalize section

Manual Equalise

Manual Equalise Duration		⟳
Manual Equalise Voltage Setpoint		⟳
Manual Equalise Time Remaining		

Start Manual Equalise

- Using the front panel at Settings>Charge options>equalize>Manual equalize
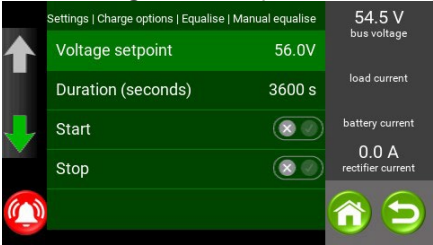
13.6 Power Modules

The Power Modules>Power Modules page displays the power modules present in the system along with ancillary boards and cards.

Click on a module to bring up details on each module and associated alarms.
NOTE: the module is displayed in its respective shelf location.

Toggle the Alarm Flasher to have the orange LED blink on the selected module. This feature is to assist positive identification of a module at site.

Toggle Shutdown to turn off the module where clicking the On button shuts the module down. The module remains shutdown until toggled Off.

Click on the Clear Alarms button to clear module alarms raised. This is usually used during maintenance and commissioning where moving or replacing modules raises a Rectifier Missing or Rectifier Missing Urgent alarm or similar.

Click on the Clear Shutdown Latch to manually clear a shutdown latch of a module.
Comment: while latching for over temperature or over voltage where the module is shut down (i.e. locked out from attempting to restart) can be enabled for each module, in modern DC systems this is seldom used.

For use of the Show Upgrades check box see 14.6.3 Upgrading Non-Controller Firmware

Click on the Enable Polling check box in the Select Module Information section bar to have the information of the selected module automatically refresh on the page.

13.6.2 Profiles

All Newmar power modules are shipped configured with a parameter profile, either default factory settings, or configured for a specific DC system. These setting provide hard limits that the controller cannot override and are the limits the system works to if the controller fails, or comms are lost.

These settings may need to be changed after installation, perhaps new equipment has been added to the site load with different voltage limitations, perhaps new breakers are installed, and the modules' output limits need to be adjusted to suit.

Some or all of the power modules profiles can be modified at Power Modules>Profiles.

1. Click on the New Profile button.

2. Select the Profile Type from the drop-down menu.
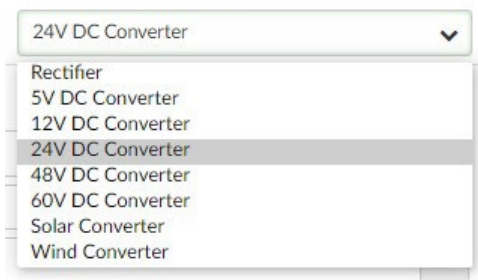
3. Click on the check boxes to enable features or adjust settings.

4. Click on the All Modules of this Type radio button to modify all of the power modules of this type in the system to match the new settings.

5. Click on the Selected Positions Only radio button to choose which modules in the system array to have the new profile loaded into.

6. Click on the required IO Board.

7. Click on the module required and modify the Profile Settings.
8. Click on the Save button to write the new settings to memory.

13.7 Logging

The EM4x controller records and displays detailed system parameters. These are accessed via the Web UI under Logging.

1. Periodic Logging: records a wide suite of system functionality parameters. Both default system and custom variables can be logged. Note that file size can be large and varies in proportion to the polling rate set at Logging>Periodic Logging>Show Settings>Logging Interval in the Web UI. Also note that events are overlaid into this log, so that if you have, say a 5-minute periodic log, you may see a number of logs between the 5 minute markers which would have been triggered by events "rising" or "falling". NOTE: mouse-over column headings for full descriptions of each item.
3. Battery Logging: records battery specific related information such as logs of individual performance.
4. Energy Logging: records information regards the time stamped status of battery charge and discharge, the load and rectifier usage all in use to assist clarity of overview. Records of custom metering configured in the Web UI under Custom>Custom Metering also appear here.
5. Power Module Log: records information regards individual power modules such as rectifiers and DC converters from the bus. Note it is not recommended to have this poll continually, it is intended to be a time limited analysis tool, only. The default state of this log is Off. To activate this log, click on the Show Settings button and toggle Power Module Logging On.
6. Real Time Metering: records and displays a list of system performance indicators shown in a time scale format.

For all pages except Real Time Metering there are two options to download logs in an .xml file.

Download XML: downloads only those log items that have been filtered by the check boxes, radio buttons and other options on each page. It is strongly recommended to use this option.
Download XML (All): downloads all logs of the page currently in memory. Note this file can be very large.
Note: system temperature units are set at Settings>General Settings>Temperature scale. Logs can be shown in degrees Celsius, Fahrenheit or Kelvin.
NOTE: *.xml files can be opened in excel spreadsheets.

13.8 Battery Settings

13.8.1 Battery Type

Many of the energy manager functions depend on the type of batteries associated with the DC system to be monitored.

> **The energy manager must be configured for use with the correct battery type when batteries are included in the system.**

For typical applications the configuration file provided with the energy manager is set to the use case default batteries.
NOTE: the energy manager is not able to manage multiple battery types in the default factory configuration. Should a mix of battery technologies be required for a DC system please consult your Newmar sales representative.
See Battery>Battery Settings in the Web UI:

Lead Acid are the traditional lead acid batteries used in the telecom industry.
Basic Li are Lithium chemistry-based batteries whose BMS cannot be communicated with via Modbus RTU.

Modular Li is a limited group of batteries whose BMS can be communicated with via Modbus RTU. Contact your Newmar representative for the full list of batteries with this functionality.

13.8.2 MCB Current Limit Scaling

The main circuit breaker current limit scaling feature is enabled in systems that rely on voltage drop across a battery circuit breaker to detect if the battery circuit breaker is open or closed. This feature is disabled in systems where the breaker status is detected by auxiliary contacts on the circuit breaker for example.

13.8.3 Lead-Acid Battery Capacity Settings

To calculate the battery capacity and discharge time remaining lead acid batteries require information entered under Battery>Battery Settings. The 10h Rate Battery Capacity, the Secondary Capacity Rate Time and the Secondary Capacity. Refer to the battery specification sheet for this data. Note that the Ah values entered in this section are for the total battery capacity of the system (i.e., all strings added together).

Access capacity settings:

- Using the Web UI at Battery>Battery Settings

- Using the front panel at Settings>Battery Config>Capacity

Battery State of Charge can be used at the time of installation (or for testing purposes) in case the installed battery is not initially fully charged. Enter the value that the battery SoC is estimated. The value corrects itself once the battery has been on charge for some time or gone through charge/discharge cycles.

Battery Recharge Efficiency is a setting to assist capacity exit conditions during battery cycling. It is how good the battery is at storing energy e.g., 97% is being converted into stored charge - 3% of inefficiency of charging so the battery is over charged by 3% to account for the losses.

Battery Discharge Threshold is a buffer to prevent false triggering of discharge notification.

13.8.4 Battery Current Limit

It is important to prevent batteries being charged faster than the recommendations of the manufacturer. Lead acid batteries charging too fast can cause excessive gassing in the battery and can also damage the battery.

The controller allows for the maximum battery charge current to be limited to a percentage of the battery capacity. The rectifiers, if this function is enabled, reduce their output voltage so that the load current is supplied as normal, but the battery current is limited.

Access the Battery Current Limit settings:

- Using the Web UI at Battery>Battery Settings in the Lead Acid Settings section

- Using the front panel at Settings>Battery Config>Charge

13.8.5 Temperature Compensation

Lead-acid battery manufacturers recommend that the float voltage of the battery is decreased at the temperature increases. The controller will automatically adjust the float voltage of the rectifiers with temperature when the temperature compensation function is enabled.

With Lead-Acid batteries enabled in the Web UI, temperature compensation can be toggled on and off on the Battery>Battery Settings page in the Temperature Compensation section Rectifier Compensation.

From the front panel interface navigate to Settings>Temperature compensation>Enabled (rectifiers)

To set the Maximum Temperature, Minimum Temperature and Temperature Slope consult the relevant battery specifications.

Temperature compensation works only on the float voltage of the rectifiers connected to the controller. Any converters within the system are not affected by temperature compensation (Note the separate toggle option for Converter Compensation). Nor are equalize, fast charge or other process settings.

When temperature compensation is enabled, the two alarm states, High Float Alarm Bus 1 and Low Float Alarm Bus 1, are automatically varied with temperature along with the float voltage. This prevents false activation of these alarms under high and low temperature conditions.

Note the temperature compensation functions are also adjustable on the EM4x front screen under Settings>Temperature compensation.

Figure 22: Temperature Compensation
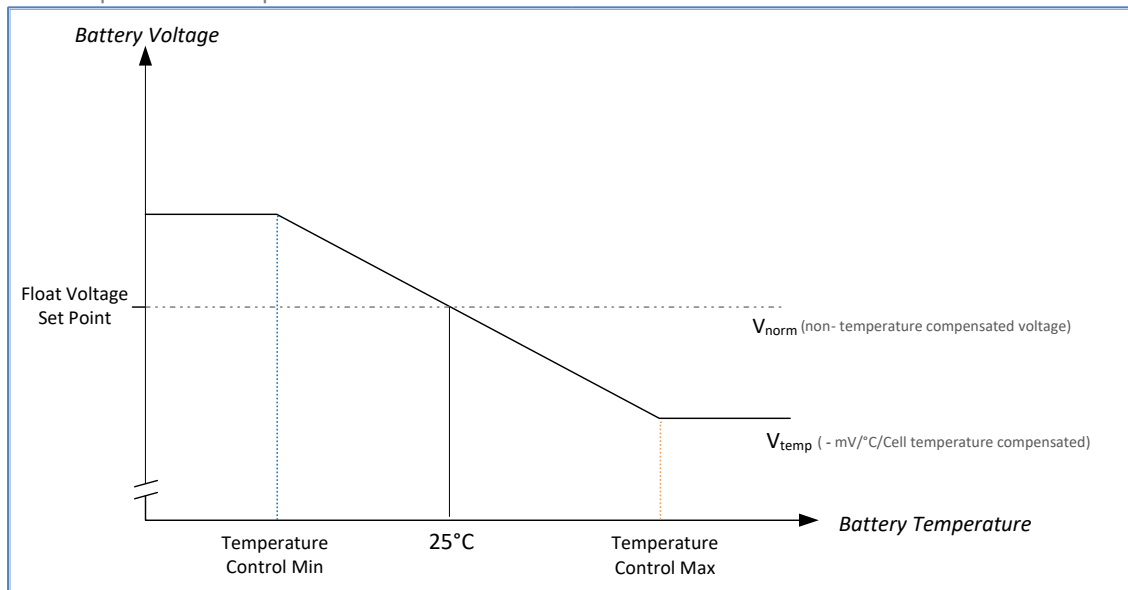
Figure 22 shows the temperature compensation function varies the float voltage of the system based on the float voltage set point, the slope and the measured battery temperature.

The float voltage should be set to the recommended float voltage for the batteries used at 25ºC. The temperature sensor should be placed by the batteries in a position that reflects the average temperature of the batteries.

At battery temperatures greater than the maximum Control Temperature (typically set to 50ºC) and less than the minimum Control Temperature (typically set to 0ºC) the system voltage will no longer change. Between the two control temperatures the voltage relates linearly to the temperature, see Figure 22.

13.8.6 Estimated Time Remaining (ETR)

This is an estimate of the time remaining until end of discharge, based on the system load current or the discharge current. As system load current varies, the estimate is continuously revised.

For lead-acid batteries, as the rate of discharge increases (e.g., going from a 10-hour discharge to 2-hour discharge), the amount of energy (Ahrs or WHrs) the battery can supply reduces (Lithium batteries are almost linear in their energy capacity with respect to discharge rate). Hence the ETR is calculated using Peukert's equation. This requires the 10hr battery capacity and another capacity at a lower time (e.g., 5hour capacity) to function correctly. The Peukert's equation is as follows:

$$T = \frac{R(Ip)^n}{I^n}$$

Where:

  T = time in hours
  Ip = current at the specified capacity of the battery (for example If the Battery is rated at 10 discharge rate, then "Ip" is the current at C10 rate of discharge) I = the discharge current n = Peukert's exponent
  R = the hour rating (i.e., 20 hours, or 10 hours etc.)

NOTE: For lead-acid batteries the results are more accurate with new batteries as the Peukert's exponent, n, changes as the battery ages. This exponent is unique to each battery type and calculated in the controller from the two discharge rates supplied.

This is an estimate of the time remaining until end of discharge, based on the system load current. As system load varies, the estimate is continuously revised. This time estimate is formed using Peukert's equation and requires the 10hr battery capacity and the secondary capacity rate time to function correctly.

If multiple battery strings are connected to the system, all settings should be based on the total capacity of all the connected battery strings.

13.8.7 Battery String Configuration

The Battery String Configuration section allows for automated setup of the Battery Conditioning Monitoring (BCM) system. Should a setup of the BCM system not be covered by the automated setup, then the BCM mapping statements need to be written in the Input Configuration.

The Battery String Configuration settings can apply to any battery type depending on the battery cell/monobloc and string implementation.

Enter the Number of Battery Strings and Number of Blocs Per String.

| Number of Battery String | 2 | ⟳ ✔ |
| Number of Blocs Per String | 24 | ⟳ ✔ |

String Imbalance Setpoint is the threshold for an alarm to indicate the current from one string has deviated too far from the other(s). This may indicate a faulty connection or cell is present.

String Asymmetry Setpoint is the threshold to indicate a voltage disparity in a cell in a string of batteries.

String Overcurrent Setpoint is the threshold for an alarm to indicate one string is providing more current than expected – this can indicate a failure in another string, or an unexpected load demand.

String Imbalance Setpoint	5	A	⟳ ✔
String Asymmetry Setpoint	1	V	⟳ ✔
String Overcurrent Setpoint	400	A	⟳ ✔

Common Rail selection is a feature that changes the way information is displayed in the Web UI, whether positive or negative voltage. It has no system impact.

Common Rail	Negative	⟳ ✔
	Negative	
	Positive	

Commonnodes allows the user to auto-configure the battery monitoring system depending on whether the most positive and most negative connections to the battery are measured. In typical Telco +ve earthed systems, the most positive will be very close to the DC Earth, and the most negative will be very close to the Live bus voltage. With Commonnodes ON the controller assumes that it should use the common (same) voltages for the most positive and most negative voltages. So, for example:

Number of wires connected to each string for voltage measurement:

	Commonnodes ON	Commonnodes OFF
Mid-Point (effectively 2 "blocs" per 48V string)	1	3
12V Monoblocs (4 monoblocs per 48V string)	3	5
2V Monoblocs (24 blocs per 48V string)	23	25

With Commonnodes OFF although there are two more sense wires that must be connected to the batteries, this enables more accurate battery voltage as any voltage drop over any cables, shunts or breakers is not included in the measurements.

| Commonnodes | ON **OFF** ⟳ |

The Automatically Assign Voltage, the Automatically Assign Current and Automatically Assign Temperature functions when toggled On automatically assign the parameter reading from the battery monitor in the input logic.

Automatically Assign Voltage	On	Off	⟳
Automatically Assign Current	On	Off	⟳
Automatically Assign Temperature	On	**Off**	⟳

Which displays in an expression table on the page.

String 1 Bloc 1 Voltage	=	IO Board 1 Battery Monitor 1 Voltage 1	—	IO Board 1 Battery Monitor 1 Voltage 2
String 1 Bloc 2 Voltage	=	IO Board 1 Battery Monitor 1 Voltage 2	—	IO Board 1 Battery Monitor 1 Voltage 3
String 1 Bloc 3 Voltage	=	IO Board 1 Battery Monitor 1 Voltage 3	—	IO Board 1 Battery Monitor 1 Voltage 4
String 1 Bloc 4 Voltage	=	IO Board 1 Battery Monitor 1 Voltage 4	—	IO Board 1 Battery Monitor 1 Voltage 5
String 1 Bloc 5 Voltage	=	IO Board 1 Battery Monitor 1 Voltage 5	—	IO Board 1 Battery Monitor 1 Voltage 6
String 1 Bloc 6 Voltage	=	IO Board 1 Battery Monitor 1 Voltage 6	—	IO Board 1 Battery Monitor 1 Voltage 7

Strings on Battery Monitor

Each battery monitor card can connect up to 5 strings of batteries. There may be circumstances with multiple battery monitor cards with differing numbers of strings per card. The settings here allow the energy manager to represent the strings in sequential order.

Enable the required Battery Monitors by clicking on the left side tick icon.

Strings on Battery Monitor 1	✔	1		⟳	✔
Strings on Battery Monitor 2	✔	1		⟳	✔
Strings on Battery Monitor 3	✔		Disabled	⟳	✔

Enter the number of strings of batteries connected to the battery monitor.

Strings on Battery Monitor 1	✔	1		⟳	✔
Strings on Battery Monitor 2	✔	1		⟳	✔
Strings on Battery Monitor 3	✔		Disabled	⟳	✔

Click the tick icon on the right side to save the setting.

Strings on Battery Monitor 1	✔	1		⟳	✔
Strings on Battery Monitor 2	✔	1		⟳	✔
Strings on Battery Monitor 3	✔		Disabled	⟳	✔

13.9 Battery Status

The battery status page provides an overview of the information received from the battery strings.

Battery String Status		
	String 1	String 2
Bloc 1	-2.23 V	-2.23 V
Bloc 2	-2.24 V	-2.22 V
Bloc 3	-2.23 V	-2.21 V
Bloc 4	-2.22 V	-2.24 V
Bloc 5	-2.23 V	-2.23 V
Bloc 6	-2.22 V	-2.23 V
Bloc 7	-2.22 V	-2.39 V
Bloc 8	-2.23 V	-2.08 V
Bloc 9	-2.24 V	-2.22 V
Bloc 10	-2.21 V	-2.23 V
Bloc 11	-2.23 V	-2.22 V
Bloc 12	-2.22 V	-2.22 V
Bloc 13	-2.22 V	-2.23 V
Bloc 14	-2.24 V	-2.22 V
Bloc 15	-2.20 V	-2.17 V
Bloc 16	-2.25 V	-2.23 V
Bloc 17	-2.21 V	-2.23 V
Bloc 18	-2.24 V	-2.22 V
Bloc 19	-2.22 V	-2.23 V
Bloc 20	-2.24 V	-2.23 V
Bloc 21	-2.23 V	-2.22 V
Bloc 22	-2.28 V	-2.23 V
Bloc 23	-2.16 V	-2.23 V
Bloc 24	-2.22 V	-2.28 V
Current	6.00 A	6.60 A
Temperature	27.0°C	27.0°C

Along with the Battery Status summary.

Battery Status

53.75 V   11.4 A   26.9°C
100%
650.0 Ah / 650.0 Ah   Adjust
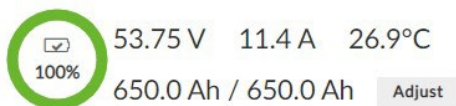
Click on the Adjust button to manually set an override state of charge for the system.

Battery Status

53.76 V   12.6 A   26.9°C
100%
650.0 Ah / 650.0 Ah   Adjust

Battery State Of Charge   100   % ⟳ ✓
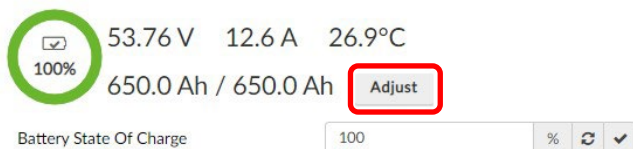
Forcing a state of charge status is primarily used in system testing.

13.10 Lithium Battery Installation

This section describes how to install Lithium batteries that have no communication method with the EM4x, where the battery BMS cannot send or receive information.
To install Lithium batteries with BMS communication via Modbus RTU see 13.11 Modbus RTU Enabled Battery Installation.

1. Click the Basic Li button at Battery>Battery Settings>Battery Type.

Battery Type

Lead Acid   Basic Li   Energypak   Modular Li   ⟳
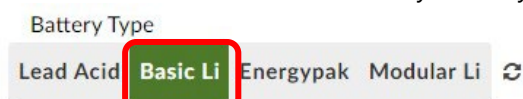
Enter the total capacity of all Lithium connected to the system in the 10h Rate Battery Capacity field in the Battery>Battery Settings>Lithium Settings section.

Lithium Settings

Capacity Rate Time	10			h	Battery Charge Current Limit	✔ 10	% ⟳ ✔	
10h Rate Battery Capacity	28	Ah ⟳ ✔			Calculated Charge Current Limit	2.8	A	
Battery State Of Charge	100	% ⟳ ✔			Battery Charge Overcurrent Setpoint	400	A ⟳ ✔	
Battery Discharge Threshold	-1	A ⟳ ✔			Battery Charge Overcurrent Hysteresis	10	A ⟳ ✔	

2. Enter the information in the Battery Charge Current Limit, Battery Charge Overcurrent Setpoint and Battery Charge Overcurrent Hysteresis fields as matches the batteries installed.

Lithium Settings

Capacity Rate Time	10		h	Battery Charge Current Limit	✔ 10	% ⟳ ✔	
10h Rate Battery Capacity	28	Ah ⟳ ✔		Calculated Charge Current Limit	2.8	A	
Battery State Of Charge	100	% ⟳ ✔		Battery Charge Overcurrent Setpoint	400	A ⟳ ✔	
Battery Discharge Threshold	-1	A ⟳ ✔		Battery Charge Overcurrent Hysteresis	10	A ⟳ ✔	

Battery Charge Current Limit is the figure to prevent over charging. This is noted in the battery data sheet but may wish to be lowered considering battery temperature limits in the operating environment and battery lifespan.

Battery Charge Overcurrent Setpoint is the current to trigger the Overcurrent alarm.

Battery Charge Overcurrent Hysteresis is the current limit allowed above the Battery Charge Overcurrent Setpoint before the Overcurrent alarm is raised. This is to prevent false triggers.

3. Enter the Float Voltage in the Control>Rectifier section.

Control Settings   ⟳ Reload   💾 Save

Rectifier

Rectifier Phases	**1**	3	⟳
Rectifier Voltage Regulation Enabled	**On**	Off	⟳
Rectifier Current Share Enabled	**On**	Off	⟳
Enable Voltage Sense Fail Alarm	On	**Off**	⟳
Virtual AC Monitor	On	**Off**	⟳
Float Voltage	56.7	V ⟳ ✔	

🛈 **CAUTION   The correct float voltage is critical for lithium battery settings. Battery specifications must be referenced and correctly interpreted with understanding of the battery chemistry. Newmar accepts no responsibility for incorrect values being entered here.**

4. Set the battery low voltage disconnect voltage at IO Configuration>IO Boards in the appropriate LVD Disconnect field as required.
   NOTE: this setting depends on if the lithium battery BMS internal LVD is to be used or EM4x controlled low voltage disconnect functionality is incorporated into the system. If the battery BMS LVD is used this setting is redundant.

Note: if an EM4x controlled LVD is incorporated in the system LVD Latching must be On.

5. Set the bus alarms as required at Alarm Configuration>Bus Alarms>Rectifier

NOTE: High voltage setpoint should be higher than High Float Setpoint. Low Voltage Setpoint should be lower than Low Float Setpoint. Typically the float alarms are used as warnings and the voltage alarms are major system failure notification but this is user dependent.

13.11 Modbus RTU Enabled Battery Installation

NOTE: Modbus RTU functionality is a license locked feature. See 11.4.3 Unlockable Features.

For lithium and other batteries that are provided with a BMS that can be communicated with via Modbus RTU Newmar supports a limited set of proprietary Modbus registers for specific vendor products. Please contact an Newmar representative for confirmation on the battery models supported and implementation of new battery modules.

To install a Modbus enabled battery:

1. Click the Modular Li button at Battery>Battery Settings>Battery Type.

Battery Type

Lead Acid   Basic Li   Energypak   **Modular Li**   ⟳

Note: The Basic Li battery button is for 'dumb' lithium batteries without Modbus enabled BMS controls.

2. Navigate to IO Configuration>Modbus Master>Modbus – Settings

Modbus Master   ⟳ Reload   ☑ Save

Modbus Bus 1 - Settings

Enable	On	**Off**	⟳	
Bus Name	Modbus Bus 1		⟳	✔
Protocol	rtu	⌄	⟳	✔
RTU Device/Port	/dev/ttyUSB0	⌄	⟳	✔
Baud Rate	115200	⌄	⟳	✔
Flow Control	none	⌄	⟳	✔
Parity	none	⌄	⟳	✔
Stop bits	1	⌄	⟳	✔

Modbus Bus 1 - Device Map

➕

3. Click the Enable button On for the required communication bus.
   Note: the EM4x currently supports a maximum of 2 Modbus communication buses. If more are required, please contact your Newmar representative.

Enable   **On**   Off

4. Name the bus as appropriate.

Bus Name   Modbus Bus 1   ⟳   ✔

5. Click the ➕ icon to add batteries from theDevice Map.

6. Select the battery type from the drop-down list (if the required battery is not on the list please contact your Newmar representative).

Modbus Bus 1 - Device Map

1	Address		⌄	Product	➖
➕		BELT			
		BT-P48168L-01			
		SLB48			

7. Add batteries as required.
8. Match the Address field number to the battery module address as displayed on the battery.

9.

Modbus Bus 1 - Device Map

1	⬍	Address

Check the correct protocol is set. RTU is default for batteries in the Newmar register list.

Protocol	rtu ⌄	↻	✔

10. Select the correct RTU Device/Port. Default is 0 with most systems requiring only one bus.
    Note: when multiple ports are present USB port number is determined by order of discovery i.e. the chronological order each device is plugged into a USB hub, not the physical location of the hub port. The port count starts at 0.

RTU Device/Port	/dev/ttyUSB0 ⌄	↻	✔

11. Set the Baud Rate to match the battery selected.

Baud Rate	115200 ⌄	↻	✔

Check the battery data sheet and custom settings for Flow Control, Parity and Stop Bits details.

Flow Control	none ⌄	↻	✔
Parity	none ⌄	↻	✔
Stop bits	1 ⌄	↻	✔

Click the Save button.

Modbus Master   ↻ Reload   🖉 Save

Note: check the battery module data sheet for the default rate or match any customized settings.

12. Check the Battery Current = Modular Battery Current on the Input Logic page.

☐	Battery Current ⌄	= NOT (	Modular Battery Current ⌄	)

13. Check the configured batteries are displayed correctly at Power Modules>Power Modules>Bus Name.
    a. Click on the Bus tab.

Select Power Module

I/O Board 1	Modbus Bus 1

   b. Click on a battery to display the battery module details and available alarms.

13.23 ICMP Ping and Reset

The EM4x can ping Internet Control Message Protocol (ICMP) echo request packets to the target host (typically a modem). On failure of return of ping the EM4x then raises alarms. An alarm can be configured to attempt to restart a modem from a relay. Which can save a truck roll to turn a crashed modem on and off. This section details how to configure such a modem reset function.

At Settings>Network Settings>ICMP Settings enter the required parameters:

ICMP Enabled: once the required parameters are entered toggle ICMP Enable **ON**.

IPv4 Address is the IP address of the device to be pinged.

ICMP Transmit Interval is the time between transmitting a ping to the modem. Note the system pings the modem continuously without stopping once enabled.

ICMP Response Timeout is the period without a return of ping that the system determines that a ping return failure has occurred. Note this time must be less than the ICMP Interval setting.

Failures for Warning is the number of failed ping returns to raise the Ping Failed Warning alarm. This provides a buffer to determine there is no false triggers.

Failures for Critical is the number of failed ping returns to raise the Ping Failed Critical alarm. Note that this must be more than the Failures for Warning entry. Note that this figure is the total number of pings from zero, not in addition to the number of pings for Failures for Warning.

Failures for Retry is the number of ping failures before the system resets the Detected Failures to zero and all alarms are turned off. When there is still failure of return of ping the alarm cycle is looped through. Note this figure must be equal or more than the Failures for Critical entry.

Allowed Retries is the number of Failure for Retry loops of alarm cycles the system attempts before allowing the Detected Failures to continuously count. In effect this is the number of times the system attempts to restart the modem.

To manually attempt a restart of the modem toggle ICMP Enable Off and On and the Detected Failures begins again at 0. Note setting this to zero does not stop the controller from attempting to retry pings.

Detected Failures counts the total times the system has failed to detect a return of ping since the last count start.

NOTE: the Detected Failures count resets to zero once a ping return occurs so that the system automatically resets itself once the relay and modem are set up and communicating correctly. 13.23.1 Configuring a Modem Restart from the Ping Failed Critical Alarm

To configure a modem restart using the Ping Failed Critical alarm:

1. Navigate to the Relay/Output Logic page.

2. Click the **Add New Relay** button.

3. Enter the **Relay Name** in the Configure Relay section.

4. Select the required relay from the **Relay/Output** drop down menu.

5. Select **Ping Failed Critical** from the **Source** drop down menu: Alarms>ICMP>Ping Failed Critical.

6. Select either **Normally Energised** or **Normally De-Energised** for the relay state as appropriate for the modem restart functionality.

7. Click the **Save** button.

13.24 Modbus TCP Server

Toggle Enable Modbus Server On to allow the energy manager to function as a Modbus TCP server via Ethernet.

Enable Modbus Server · · · · · · On · · Off · ↻

Enter the correct TCP Port as required.

TCP Port · · · · · · 502 · ↻ · ✓

14 THE WEB UI SOFTWARE COMPONENTS

14.1 Connection

See 10.1 Energy Manager Connectivity and the Web UI for information on how to connect to the energy manager Web UI.

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

14.2 EM4x Software Overview

The user interactable software elements to the energy manager are:

1. The energy manager configuration *.em4x file which contains input logic and all parameters that defines the fundamental functionality of the energy manager and customized features as required for each application. This can be managed independently of the energy manager firmware and is **not** over-written when installing new firmware. See 14.3 Configuration File.
   NOTE: installing a new configuration file over-writes the existing input logic and alarm configuration of the following items 2 and 3.
2. The input logic dedicated file *.enl which contains only the input logic of the energy manager. This is a component of the *.em4x configuration file which can be managed independently. See 14.4 Input Logic File.
3. The alarm configuration file alarmconfig.em4x which is also a component of the energy manager configuration file used to provide convenient modification of the alarm configuration parameters, only. See 14.5 Alarm Configuration File.
   level. See 14.6 Firmware.
4. The bootloader firmware *.enb file which is included as a separate upload file if upgrades to this feature are required. See 14.7 Bootloader Upgrade File.
5. The SNMP MIB file *.mib which is downloaded for use to obtain the energy manager SNMP traps remotely in a NOC or otherwise.

14.3 Configuration File

The custom variables of the controller such as the dedicated input logic and the specific parameters of each system are stored in a *.em4x configuration file. The variables of this file define each system's functionality and associated peripherals' functionality.

The configuration file can be used to replicate custom settings across multiple DC system sites or used to back up the configuration of individual sites.

This feature is located under the Settings>General Settings page of the Web UI. The login access level required is *enaadvanced*.

Backup/Restore Configuration

Include Site Information in Save/Load

Include Networking Settings in Save/Load

☑ Save To File   ☑ Load From File

The two options Include Site Information in Save/Load and Include Networking Settings in Save/Load are enabled to allow site specific details to be included in the configuration file. Should a generic configuration file be required to replicate a configuration across different sites these check boxes are not enabled.

NOTE: loading a new configuration file over-writes the existing input logic of the system and the alarm configuration.

NOTE: enabling Include Network Settings in Save/Load over-writes the existing network settings when loading a new configuration file. Be careful not to take the system off-line.

14.4 Input Logic File

The input logic *.enl file is managed by the Import and Export buttons on the Input Logic page. The login access level required is *enaadvanced*.

14.4.1 Importing Input Logic

Importing a new input logic file has two options:

1. Add to End of Logic the new file input is appended to the existing input logic.
2. Replace All Logic the existing input logic is completely over-written.

CAUTION   This requires care in use as system critical functions are defined in the input logic.

Import Input Logic

NOTE: it is recommended to export the current *.enl file as back up before attempting an import.

NOTE: if a site has customized input logic it is recommended to save a backup of the input logic either as an *.enl file or more generally as included in a backup configuration file which includes the sites specific energy manager settings.

14.4.2 Exporting Input Logic

Clicking the Export button downloads the complete input logic file.

To select individual components of the Input Logic to export:

1. Enable the required expression check boxes.

2. Click the Export button.

14.4.3 Authoring Input Logic

This section describes the tools (rather than the process) that the Web UI provides to author input logic under the section Input Logic>Logic Expressions. See 15 Creating Custom Features for examples of using input logic.

NOTE: the input logic functions as sequential operations.

To create or remove expressions use the large square + - icons.

To create or remove additional expression conditions use the small round + - icons.

Values can be entered from the drop-down lists provided.

Note the greyed-out options. Click on these to toggle the features. Up to 3 brackets can be nested.

Enable the check box to select an expression.

Use the Copy button to copy a selected expression. Use the Clear button to remove a selected expression.

Note the prompt informing of unsaved changes.
NOTE: navigating away from the Input Logic page without clicking on the Save button **loses all changes made**.

At need the Reset to Default button can be used to return factory default settings however it is recommended that a backup configuration or input logic file be made prior to modifying the input logic and reinstalling this preferred.

Note the Comment option in the expression drop down list.

Selecting Comment allows descriptive text to be entered to provide insight as to the function of sections of the input logic.

For further information on using the input logic see 15 Creating Custom Features.

14.5 Alarm Configuration File

The alarmconfig.em4x file can be imported and exported on the Alarm Configuration>Alarm Configuration page.

The alarm configuration file holds the specific parameters of each alarm setting. It is a subset of the configuration file and does not need to be backed up independently. It is a convenient method to unify custom alarm settings across multiple sites without impacting other aspects of the system settings.

14.6 Firmware

14.6.1 Introduction

From time to time new firmware is made available to upgrade the energy manager. The file format is *.ena. The login access level required is *enaadvanced*.

14.6.2 EM4x Firmware Upgrade Procedure

Before upgrading the firmware it is recommended to back up the configuration file located in the Web UI at Settings>General Settings>Backup/Restore Configuration. A firmware file upgrade does not overwrite the system configuration file, network or other user defined settings, this is a precaution against an interrupted upgrade or similar, only. Note for this back up the Include Site Information in Save/Load and Include Network Settings in Save/Load options should be enabled.

To upgrade the EM4x firmware:

1. Open the Settings>General Settings page.
2. Confirm which ancillary devices are to be upgraded during the process. Toggle the required device ON.

3. Click on the Start Upgrade button.

4. Upload the new *.ena firmware file by either drag and drop or selection with the Upload Firmware Upgrade button.
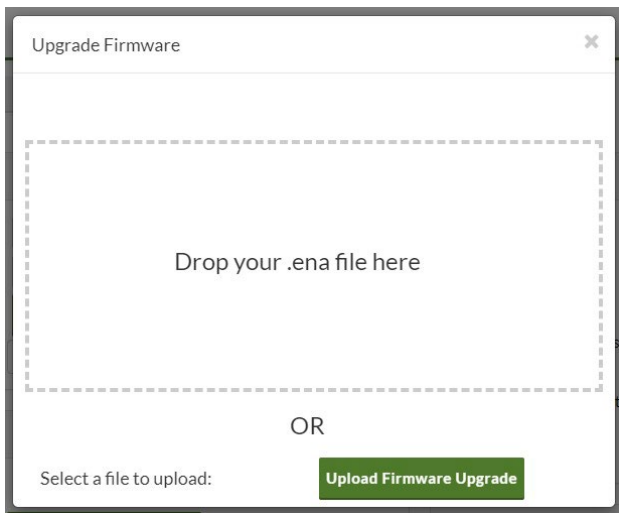
5. The firmware upgrade automatically completes for the EM4x and those ancillary devices enabled. During the process the EM4x reboots and as the final action the Web UI reloads.

NOTE: should the firmware upgrade fail, re-enter the minimized Web UI and repeat the upgrade process.

14.7 Bootloader Upgrade File

To upgrade the bootloader independently of the firmware a *.enb file is provided.

1. Click on the Upgrade Bootloader button in the Settings>General Settings>Upgrade Firmware section.
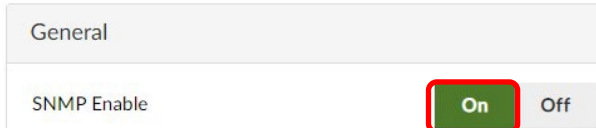
2. Upload the new *.enb firmware file by either drag and drop or selection with the Upload Firmware Upgrade button.
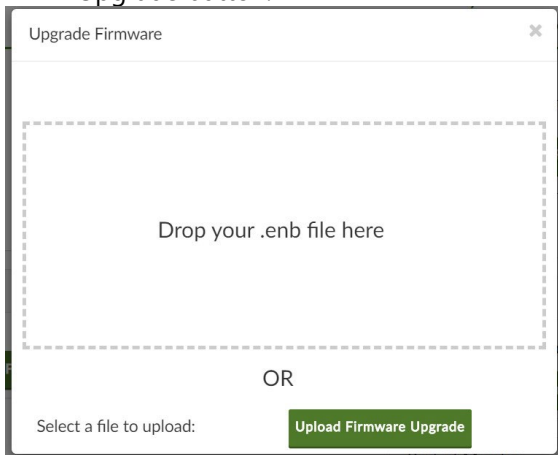
14.8   MIB File

The energy manager MIB file em4x.mib can be downloaded on the Settings>SNMP settings page.
To download the MIB file:

1. Check SNMP Enable is On.

2. Click the Download MIB button.
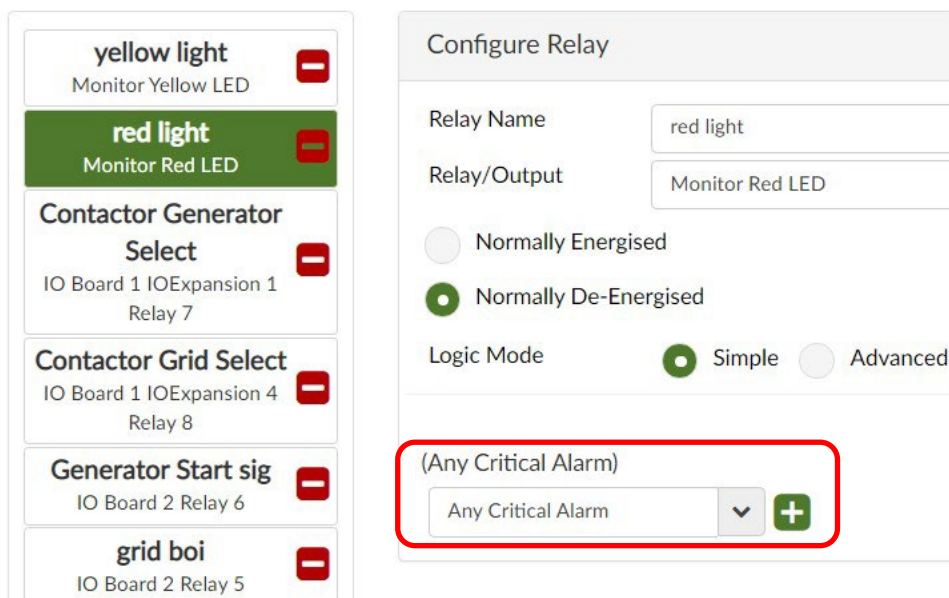
14.9   Relay/Output Logic

Refer to the Relay/Output Logic page Configure Relay section of the Web UI to understand the how the Alarm Configuration is mapped to the EM4x LEDs.

NOTE: the Alarm Configuration > Alarm Configuration page of the Web UI displays the priority setting of each alarm. See 14.5 Alarm Configuration File.

14.9.1 EM4x Red LED Urgent Alarm Mapping

Comment: For reference only. Actual system alarm mapping may vary.

14.9.2 EM4x Yellow LED non-Urgent Alarm Mapping

Comment: For reference only. Actual system alarm mapping may vary.

14.9.3 Adding a New Relay

See 10.2.10 Relays 1 to 6 for hardware connection.

Access level required: *enaadvanced*.

1.   Click on the Add New Relay button on the Relay/Output Logic page.

2.   Enter the new Relay Name in the Configure Relay section.

3. Assign the Relay/Output via the drop down menu to IO Board 1 Relay 1 (where the related feature is connected to for this example).
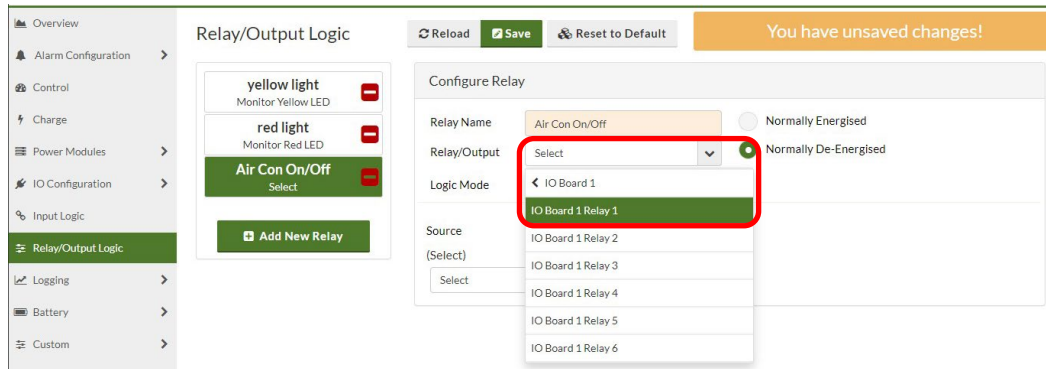
4. Select the Normally De-Energized or Normally Energized radio button as required.

5. Assign the Source to the feature required. In this case an alarm.
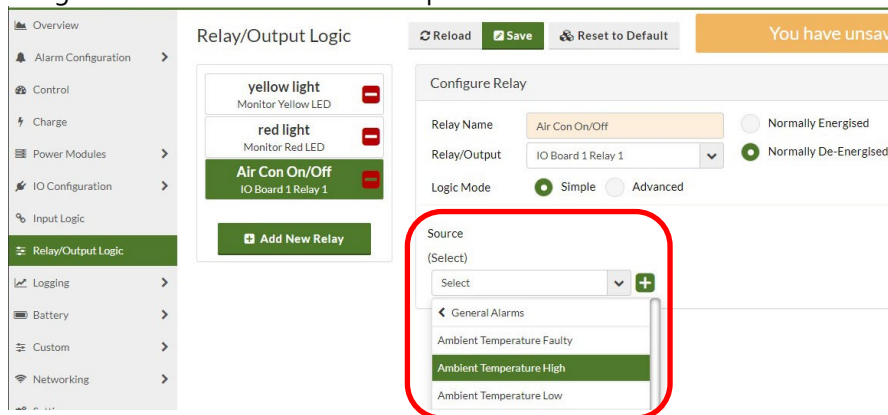
6. Click on the Save button.
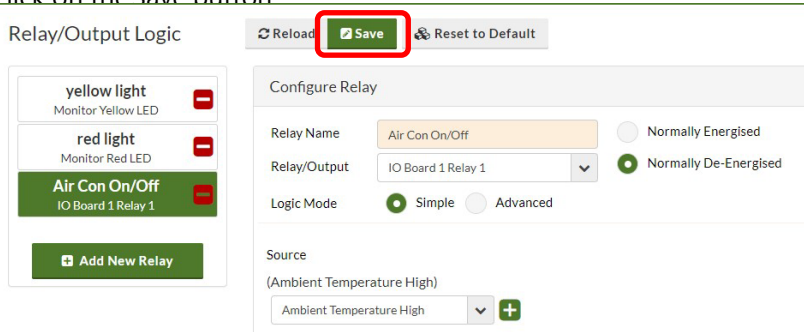
See 15 Creating Custom Features for further details and examples.

14.9.4 Reset to Default

Click the Reset to Default button to remove custom relay and output mapping and return to the factory default.

NOTE: save the configuration file prior to resetting to default to keep a record of the existing settings. See 14.3 Configuration File.

14.9.5 Relay Test

To test a relay is functioning:

1. Select the required relay.
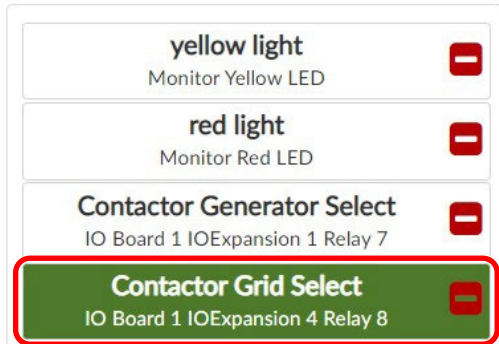
2. Click on the Test button.
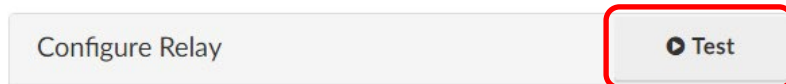
Important: whatever is configured to run from the relay, such as an air conditioner, a generator turn on or similar is activated by this test. Related LEDs/buzzer functions of the energy manager are also activated. NOTE: the test runs for 60 seconds.

15   CREATING CUSTOM FEATURES

This section describes the creation of custom features such as utilizing the relays and output logic for site specific functions. Access level required: *enaadvanced*.

The general process when authoring custom features in the energy manager in sequential order is as follows:

1. Create any custom alarms, variables or metering as required under the Custom menu.
   NOTE: to get a variable to display on the Overview page or in the Logs it must be declared as a Custom Variable. Enable the Show on Screen and Show in Log check boxes at Custom>Custom Variables as required when creating a Custom Variable.
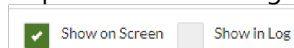
2. Add any new relays required on the Relay/Output Logic page.
3. Author input logic on the Input Logic page.
   NOTE: custom alarms and relays do not show on the Input Logic drop down menus until created and saved into the system.

To assist understanding a variety of example custom features are demonstrated. See 15.4 Custom Features: Example 1.

15.1   Custom Variables

Custom variables can be created at Custom>Custom Variables.
Access level required: *enaadvanced*

1. Click on the +Add Variable button.

2. Enter a name in the Name field.

Name field is empty

3. Select the type of variable from the Type drop down list.

Type

String

String
Number
Boolean

4. Enter the accuracy and units as required.

Decimal Places	Units
0	

5. Enable Show on Screen to have the custom variable display on the Overview page.

Show on Screen

CUSTOM VARIABLES			
AC Input Power	5920.40 Watts	Current Timer	699.83
Time On	988.00	Time Off	948.00
State	Load Off	Cabinet Temp	30.84 C
ACM1 Sum	24.60 A	ACM2 Sum	24.80 A
Parasitic Load	-0.20 A	Testing	

15.1.1 Preserve Custom Variables

When Input Logic is saved, or the Restart Control Systems button at Settings>General Settings>Restart Monitor is clicked, custom variable counters such as a timer are reset to 0.

To keep the present values of custom variables in these situations toggle Preserve Custom Variables On.

Preserve Custom Variables   On   Off

15.2 Custom Alarms

To create a custom alarm navigate to Custom>Custom Alarms.
Access level required: *enaadvanced*

1. Enter an alarm name in the New Alarm field.
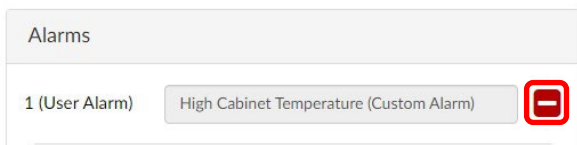
2. Click the ➕ icon.

3. Click the ➖ icon to remove a custom alarm.

15.3   Custom Energy Metering
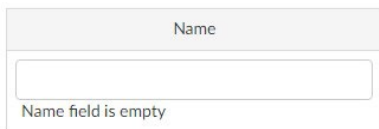
To create a custom energy meter navigate to Custom>Custom Energy Metering.
Access level required: *enaadvanced.*

1. Click on the Add Meter button.
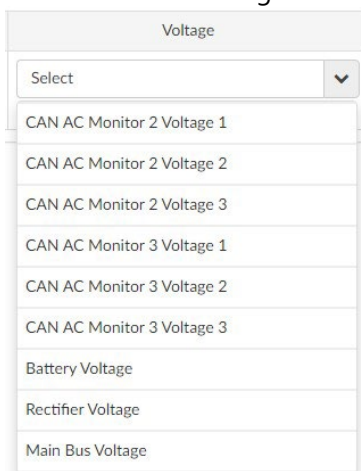
2. Enter a meter name in the Name field.

3. Select a voltage source from the Voltage drop down list.

4. Select a current source from the Current drop down list.

5.   Click the Save button.

15.4   Custom Features: Example 1

A relay is created to turn an air-conditioner on and off depending on the ambient temperature. The Ambient Temperature High alarm is used to turn on the air-conditioner.

Comment: the ambient temperature variable already exists and is assigned in the Input Logic expressions as the sensor usually comes supplied with the Newmar power system.

Comment: for this example the air-conditioner is connected to Relay 1 on the energy manager IO board. See 10.2.10 Relays 1 to 6.

1.   Set the Ambient Temperature High alarm to the required temperature at Alarm Configuration > System Alarms > Ambient Temperature Hight Setpoint

Click on the Save button or the tick icon

3.   Click on the Add New Relay button on the Relay/Output Logic page.

4.   Enter the new Relay Name in the Configure Relay section.

2.   to save the changes.

5. Assign the Relay/Output via the drop down menu to IO Board 1 Relay 1 (where the air-con is connected to for this example).
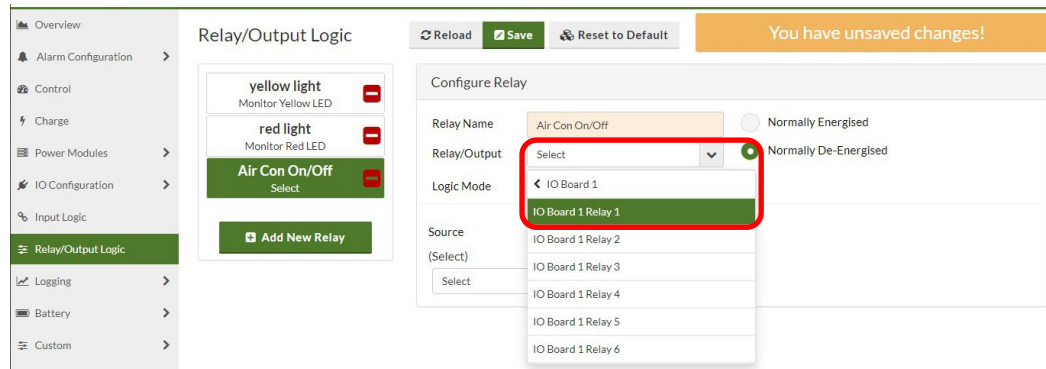
6. Select the Normally De-Energized radio button.
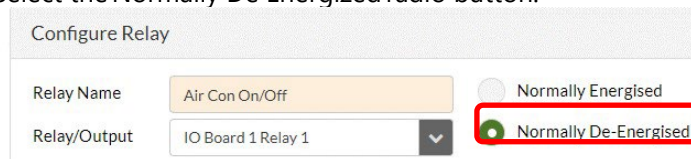
7. Assign the Source to the Ambient Temperature High alarm.
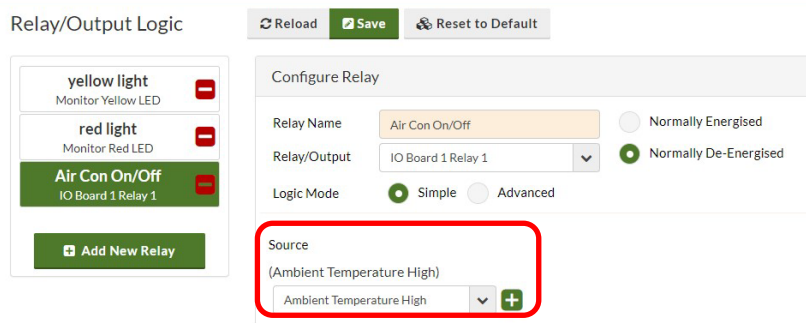
8. Click on the Save button.
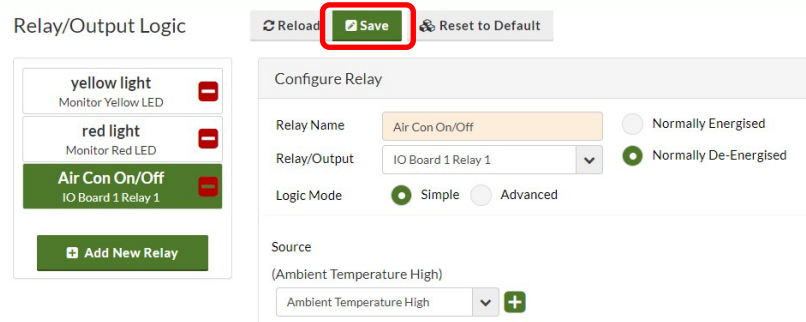
Comment: example 1 is now complete. As the Ambient Temperature High alarm triggers or de-activates the relay energizes or de-energizes to turn the air-conditioner on and off. Note however in actual application further conditions would usually be applied to this function.

One option to apply a condition to the air-conditioner turning on or off would be to use the Ambient Temperature Hysteresis function of Alarm Configuration>System Alarms. The Ambient Temperature High Setpoint alarm is raised at the number set, the alarm clears at the Ambient Temperature High Setpoint minus the Ambient Temperature Hysteresis. Note however the hysteresis applies to both the Hight Setpoint and the Low Setpoint.

As set below the air conditioner turns on at 30°C and turns off at 23°C

15.5 Custom Features: Example 2

In this example a custom alarm is created to indicate that a door has been opened.
Comment: for the example the door circuit is connected to GPIP2. See 10.2.9 General Purpose Inputs.

1. Enter the alarm name in the New Alarm field at Custom>Custom Alarms.

2. Click on the plus icon ➕ to save the new alarm.

3. Create a new logic expression on the Input Logic page. See 14.4.3 Authoring Input Logic.
4. Assign the expression to the Door Open (Custom Alarm) from the drop down menu.

5. Assign the Door Open alarm to IO Board 1 GPIP2 (digital) from the drop down menu (where the door circuit is connected to).

6. Click on the Save button.
7. Configure the Door Open alarm at Alarm Configuration>Alarm Configuration>Custom Alarms.
   Comment: in this example the Door Open alarm is considered a Warning, it is User Enabled (i.e. it is functional) it is not SNMP Enabled (i.e. not a critical event required to trigger an alarm at a NOC).

8. Click on the Save button.

Comment: this example is now complete. As the GPIP2 changes state so does the Alarm.

15.6 Custom Features – Example 3

In this example a light turns on when the door opens. Note the custom Door Open alarm is already created in Example 2.

Comment: for this example the light is connected to Relay 2 (note in Example 1 the air-conditioner is already connected to Relay 1). See 10.2.10 Relays 1 to 6.

1. Click on the Add New Relay button on the Relay/Output Logic page.
2. Enter Light On/Off in the Relay Name field.
3. Select IO Board 1 Relay 2 in the Relay/Output field. Note IO Board 1 Relay 1 is greyed out if already assigned as in Example 1.
4. Select the Normally De-Energized radio button. In this case we want the circuit to energize to turn on the light.
5. Select the Door Open (Custom Alarm) as the Source.

6. Click on the Save button.

15.7 Custom Features – Example 4

In this example the air-conditioner is turned off while the door is open (rather than attempting to cool the world).

Note the custom relay Air Con On/Off has been created in Example 1, the Door Open alarm created in

Example 2. 1.   Select the Relay/Output Logic>Air Con On/Off relay (as previously created in example 1) 2. Select the Advanced Logic Mode radio button.

Logic Mode   ◯ Simple ⦿ Advanced

3.

Set the logic to AND

[AND ⌄] ➕ Add Variable   ➕ Add Group   ➖ Remove Group

Click on the Add Group button

[AND ⌄] ➕ Add Variable   ➕ Add Group   ➖ Remove Group

Select the NOT logic option
(Ambient Temperature High **AND** (**NOT** Door Open (Custom Alarm)))

[AND ⌄] ➕ Add Variable   ➕ Add Group   ➖ Remove Group

┬ [Ambient Temperature High   ⌄] ➕ ➖

└ [NOT ⌄] ➕ Add Variable   ➕ Add Group   ➖ Remove Group

   └ [Door Open (Custom Alarm)   ⌄] ➕ ➖

6. Select Door Open (Custom Alarm)

4.

5.

┬ [NOT ⌄] ➕ Add Variable   ➕ Add Group   ➖ Remove Group

└ [Door Open (Custom Alarm)   ⌄] ➕ ➖

   ‹ Custom Alarms
   Door Open (Custom Alarm)

7. Click on the Save button.
   Note the completed logic tree and the written expression above it:
   (Ambient Temperature High **AND** (**NOT** Door Open (Custom Alarm)))

[AND ⌄] ➕ Add Variable   ➕ Add Group   ➖ Remove Group

┬ [Ambient Temperature High   ⌄] ➕ ➖

└ [NOT ⌄] ➕ Add Variable   ➕ Add Group   ➖ Remove Group

   └ [Door Open (Custom Alarm)   ⌄] ➕ ➖

Comment: the examples are now complete. The air conditioner turns on at a particular temperature and off at another. There is a door open alarm which turns on a light when the door opens and turns the air-conditioner off when the door is opened.

16 ALARMS AND RELATED OPERATION

16.1 Bus Alarms

At Alarm Configuration>Bus Alarms specific alarms related to each bus voltage are set. These are dependent on system requirements and battery type. For lead-acid batteries customers usually enter these settings during installation after referencing the site battery specifications. For lithium batteries these settings are usually managed at the factory.

High and Low Float Setpoints are typically notifications, only. High and Low Voltage Setpoints may have system operation triggered to these thresholds depending on customer requirements and battery type. Note that these alarms include the bus name in front of the alarm when displayed.

A typical lead-acid setting is as follows.

Note that Temperature Compensation is enabled for lead-acid.

A default lithium battery setting is as follows.

16.1.1 Create Bus

While it is uncommon to include a new voltage bus in the system after shipment the option for new bus alarms is provided here.

1. Enter a bus name.
2. Click on the Create Bus button.
3. Enter the required settings.

24V Battery Bus

High Voltage Setpoint	58	V	⟳	✔
High Float Setpoint	56.2	V	⟳	✔
Low Float Setpoint	48.6	V	⟳	✔
Low Voltage Setpoint	45.6	V	⟳	✔
Temperature Compensation		**On** Off	⟳	

Remove Bus

4. Click on the Save button.

⟳ Reload ✎ Save

16.2 System Alarms

16.2.1 Ambient Temperature

At Alarm Configuration>System Alarms the Ambient Temperature Hight Setpoint and Ambient Temperature Low Setpoint are warning alarms to indicate temperature thresholds as detected by the placement of the ambient temperature sensor. See 10.2.8 Temperature Sensor (Optional).

The Ambient Temperature Hysteresis provides an interval below the High Setpoint and above the Low Setpoint to deactivate each alarm to assist prevention of false readings. See Figure 28.

Figure 28: Temperature Hysteresis
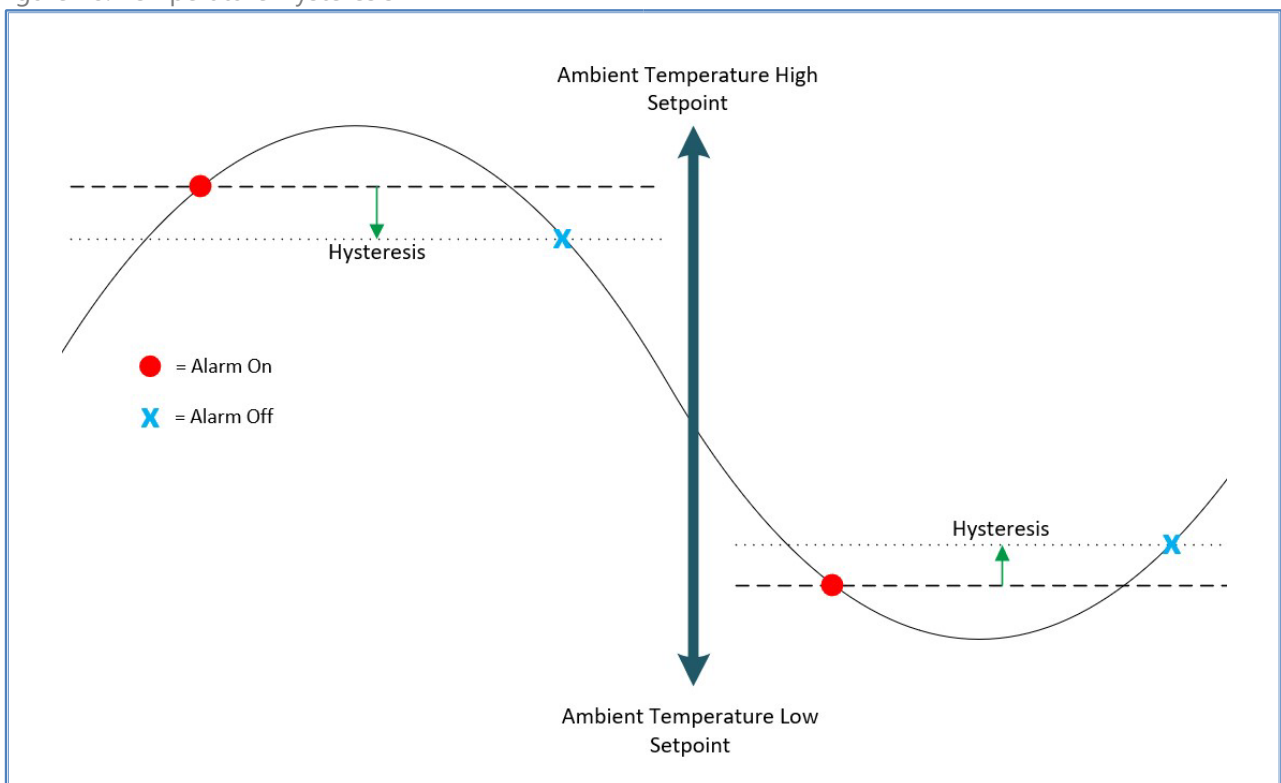
16.2.2 Battery Temperature

At Alarm Configuration>System Alarms the Battery Temperature Hight Setpoint and Battery Temperature Low Setpoint are warning alarms to indicate temperature thresholds as detected by the placement of a battery temperature sensor. See 10.2.8 Temperature Sensor (Optional).

Note this is lead-acid battery specific, lithium batteries report battery temperature by their dedicated comms.

Battery Temperature Hysteresis provides an interval below the High Setpoint and above the Low Setpoint to deactivate each alarm to assist prevention of false readings. See Figure 28. Battery temperature hysteresis works by the same method as the hysteresis for the ambient temperature.

16.2.3 System Load

The Load Current High Setpoint is an alarm setting only. That is, the alarm is raised when the load current is over the parameter set but no other system action is taken.

16.3 Alarm Configuration

The alarm levels of the energy manager are set by default as noted at Alarm Configuration>Alarm Configuration.
The level definitions are:

Table 1: Alarm Level Description

Critical ⌄	a system critical fault that indicates product or function failure
Major ⌄	a significant fault that requires resolution
Minor ⌄	a fault that does not immediately threaten system functionality
Warning ⌄	indicates a situation that precedes a serious event, details of which vary on a case by case basis
Information ⌄	an indication of a normal system operation event

The alarm levels are user configurable in the Web UI under Alarm Configuration>Alarm Configuration.
NOTE: an alarm level setting can be subjective and varies depending on customer requirements. For example, a customer may request that any alarm that requires a site visit be defined as a critical alarm. Please be aware that the Newmar default alarm level list is not universally utilized.

16.3.1 Alarm Options and Test

At Alarm Configuration>Alarm Configuration the user options for each alarm are:

☑ Enabled   ☑ SNMP   ⏵ Test On   ⏺ Test Off

User Enabled: enabled this checkbox allows an alarm to trigger. There may be specific or general situations an alarm may want to be turned off.
SNMP Enabled: enabled this checkbox allows the alarm trap to be transmitted using SNMP. End users may restrict SNMP alarm transmission to a limited priority suite of notifications.
Test On: clicking on the Test On button triggers the alarm so it can be transmitted via SNMP trap to test communication infrastructure is working correctly. The alarm also displays in the logs to confirm event recording is correct. Note that the test button triggers an alarm even if the User Enabled check box is unchecked.
Test Off: clicking on the Test Off button turns the trap test off.

16.4 Energy Manager Alarm List, Description and Action

All energy manager related alarms noted under Alarm>Alarm Configuration are listed below with a description and a remark as to expected action required on the alarm being raised. Alarms are specific to the battery type the system is configured with, refer Table 2: List of Alarms

Alarm	Description	Action
WEB UI Alarm Configuration>AC Monitor (with ACM card fitted to associated IO Board)		
AC Monitor Current High	Any one of the phase currents has exceeded the value in the setting IO Configuration>AC Monitors>AC Monitor X> Current High Setpoint	This alarm is informational, actioning dependent on AC supply e.g. if grid or generator fault.
AC Monitor Frequency High	The frequency of the AC supply has exceeded the value in the setting IO Configuration>AC Monitors>AC Monitor X> Frequency High Setpoint	This alarm is informational, actioning dependent on AC supply e.g. if grid or generator fault.
AC Monitor Frequency Low	The frequency of the AC supply has dropped below the value in the setting IO Configuration>AC Monitors>AC Monitor X> Frequency Low Setpoint	This alarm is informational, actioning dependent on AC supply e.g. if grid or generator fault.
AC Monitor Missing	An AC Monitor that is expected to be present in the system is not detected.	Check power and comms to the AC Monitor card.
AC Monitor Voltage High	Any one of the phase voltages has exceeded the value in the setting IO Configuration>AC Monitors>AC Monitor X> Voltage High Setpoint	This alarm is informational, actioning dependent on AC supply e.g. if grid or generator fault.
AC Monitor Voltage Lost	Any one of the phase voltages has dropped below the value in the setting IO Configuration>AC Monitors>AC Monitor X> Voltage Lost Setpoint	This alarm is informational, actioning dependent on AC supply e.g. if grid or generator fault.
AC Monitor Voltage Low	Any one of the phase voltages has dropped below the value in the setting IO Configuration>AC Monitors>AC Monitor X> Voltage Low Setpoint	This alarm is informational, actioning dependent on AC supply e.g. if grid or generator fault.
AC Monitor Voltage 1 Lost	Phase 1 voltage has dropped below the value in the setting IO Configuration>AC Monitors>AC Monitor X> Voltage Lost Setpoint	This alarm is informational, actioning dependent on AC supply e.g. if grid or generator fault.

AC Monitor Voltage 2 Lost	Phase 2 voltage has dropped below the value in the setting IO Configuration>AC Monitors>AC Monitor X> Voltage Lost Setpoint	This alarm is informational, actioning dependent on AC supply e.g. if grid or generator fault.

Alarm	Description	Action
Virtual ACM Voltage Lost	The virtual ACM (there is no ACM card in this instance) voltage reading from the rectifiers has been lost.	This alarm should be raised in conjunction with an "All Rectifier Input Fail" when the virtual ACM is enabled and is informational in this instance.
WEB UI Alarm Configuration>Battery		
Battery Asymmetric	With a BCM fitted (or BCM functionality programmed), the battery bloc voltages are monitored and the voltage of the blocs compared (Blocs may be 2V, 4V, 6V, 12V or 24V (for mid-point)). This alarm indicates the threshold defined for the allowed voltage difference between the blocs is exceeded. If this feature is not customized, the default setting is 2V. See Battery>Battery Settings>String Asymmetry Setpoint.	Investigate a potential battery fault (e.g., loose terminal) or a battery nearing its end of life.
Battery Charge Overcurrent	The total DC battery recharge current is monitored and causes an alarm to activate when the threshold is exceeded. See Battery>Battery Settings>Battery Charge Overcurrent Setpoint	The cause should be investigated and resolved. Note this alarm is an indicator only and does not adjust the system parameters to prevent this occurrence. This would be set by the Battery Current Limit. There should be consistency between the Battery Charge Overcurrent alarm and the actual Battery Current Limit setting.
Battery Configuration Error	This is typically an issue with the setup of the BCM card. The battery configuration has a fault. The settings are not saved.	Troubleshoot the issue to resolve. See Battery>Battery Settings>Battery String Configuration
Battery Discharge	An indicator that the system batteries are discharging. Threshold for this is set in Battery>Battery Settings>Battery Discharge Threshold	Notification only - Normal operation.

Alarm	Description	Action
Battery Imbalance	With a BCM fitted (or BCM functionality programmed), individual battery string currents can be monitored (provided a battery shunt per string is fitted) and compared which causes an alarm to activate when the difference between the string currents exceeds the threshold. See Battery>Battery Settings>String Imbalance Setpoint.	The cause should be investigated and resolved, this typically indicates a faulty battery or string (e.g., loose terminal). Note this alarm is an indicator only and does not (i.e., cannot) adjust the system parameters to prevent this occurrence.
Battery String Overcurrent	With a BCM fitted (or BCM functionality programmed), individual battery string currents can be monitored (provided a battery shunt per string is fitted). This alarm indicates that one particular battery string is drawing more current than is set in Battery>Battery Settings>String Overcurrent Setpoint.	The cause should be investigated and resolved, this typically indicates a faulty battery or string (and potentially not the string that is causing the alarm). Note this alarm is an indicator only and does not (cannot) adjust the system parameters to prevent this occurrence.
Battery Temperature Faulty	This implies a defective battery temperature sensor.	Investigate wiring and/or replace the sensor as required or fix any configuration error.
Battery Temperature High	With a battery sensor fitted the threshold has been exceeded. The threshold is user configurable (default +40°C). See Alarm Configuration>System Alarms.	Investigate cause and resolve, however the battery temperature is usually not within the control of the Power System.
Battery Temperature Low	With a battery sensor fitted the temperature is below the threshold. The default Newmar setting is 0°C but is user configurable. Alarm Configuration>System Alarms.	Investigate cause and resolve.
WEB UI Alarm Configuration>Battery Monitor		
Battery Monitor Missing	With a battery monitor fitted and enabled the card is not recognized in the system.	Investigate the comms and power wiring.
WEB UI Alarm Configuration>Charge		

Battery Test Failed	An attempted battery test has failed to complete. (Bus voltage has dropped more quickly than anticipated)	Investigate the cause. This may have been over-ridden by an external event that was given priority or could be a significant fault.
Battery Test in Progress	A battery test is underway, this is informative only.	Do NOT attempt this test with no load on the system.

Alarm	Description	Action
Battery Test Lockout Timer Active	A battery test cannot be undertaken during this time due to being deliberately locked out. The duration is set at Charge>Battery Test>Battery Test Lockout Period	Informative only, no action. A lockout occurs if there has been a battery discharge within the time specified. This allows the battery to be fully charged before a test commences.
Equalize	The lead-acid battery equalize function is active.	Normal operation, informational only.
Fast Charge	The lead-acid battery fast charge function is active.	Normal operation, informational only
Manual Equalize	The lead-acid manual equalize function is active.	Normal operation, informational only.
WEB UI Alarm Configuration>DC Busses		
Bus Float High	The bus is higher voltage than normal, but not yet critical. A warning that the system is not operating within expected bounds.	Refer to Alarm Configuration>Bus Alarms. This is typically set by the factory for lithium systems, for lead-acid batteries this will be set by the customer. Note: the name for this alarm is configurable and states the bus name in front of the alarm name.
Bus Float Low	The bus is lower voltage than normal, which in typical usage indicates that the batteries are now in discharge.	Refer to Alarm Configuration>Bus Alarms. This is typically set by the factory for lithium systems, for lead-acid batteries this is set by the customer. Note: the name for this alarm is configurable and may state 'Rectifier' or other designation in front of the alarm name.

Bus Voltage High	The bus is at a voltage level high enough to be deemed critical.	Refer to Alarm Configuration>Bus Alarms for the setting. This is typically set by the factory for lithium systems, for lead-acid batteries this is s et by the customer.

Alarm	Description	Action
Bus Voltage Low	The bus voltage is low indicating discharge to a level deemed to be critical, typically as a warning that the batteries are shortly to reach low voltage disconnect.	Refer to Alarm Configuration>Bus Alarms. This alarm level is usually to be set by the customer to meet their own expectations. Note: the name for this alarm is configurable and may state 'Rectifier' or other designation in front of the alarm name.
WEB UI Alarm Configuration>DC Converter		
12V All Input Fail	DC input supply has failed at a system/bus level.	This is typically an external event to be monitored.
12V Urgent Fail	Multiple converters have failed. Fail is default 1 module while the Urgent Fail alarm indicates multiple modules failing. This threshold value is set at Control>DC Converter Urgent Fail Threshold. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 module in a large system of 10, for example.	Converters are not user serviceable and must be replaced.
12V Urgent Missing	Multiple converters previously recognized in the system are missing from their shelf position. Note moving a converter from one location to another raises this alarm. Missing is default 1 module and Urgent Missing indicates multiple modules missing. This threshold value uses the same field as Control>DC Converter Urgent Fail Threshold. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 module in a large system of 10, for example.	If this has occurred in normal maintenance (as opposed to theft of a module for example) the alarm can be cleared by clicking on the Clear Alarms button on the Overview page.

Alarm	Description	Action
24V All Input Fail	DC input supply has failed at a system/bus level.	This is typically an external event to be monitored.
24V Urgent Fail	Multiple converters have failed. Fail is default 1 module while the Urgent Fail alarm indicates multiple modules failing. This threshold value is set at Control>DC Converter Urgent Fail Threshold. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 module in a large system of 10, for example.	Converters are not user serviceable and must be replaced.

Alarm	Description	Action
24V urgent Missing	Multiple converters previously recognized in the system are missing from their shelf position. Note moving a converter from one location to another raises this alarm. Missing is default 1 module and Urgent Missing indicates multiple modules missing. This threshold value uses the same field as Control>DC Converter Urgent Fail Threshold. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 module in a large system of 10, for example.	If this has occurred in normal maintenance (as opposed to theft of a module for example) the alarm can be cleared by clicking on the Clear Alarms button on the Overview page.
48V All Input Fail	DC input supply has failed at a system/bus level.	This is typically an external event to be monitored.
48V Urgent Fail	Multiple converters have failed. Fail is default 1 module while the Urgent Fail alarm indicates multiple modules failing. This threshold value is set at Control>DC Converter Urgent Fail Threshold. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 module in a large system of 10, for example.	Converters are not user serviceable and must be replaced.

48V Urgent Missing	Multiple converters previously recognized in the system are missing from their shelf position. Note moving a converter from one location to another raises this alarm. Missing is default 1 module and Urgent Missing indicates multiple modules missing. This threshold value uses the same field as Control>DC Converter Urgent Fail Threshold. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 module in a large system of 10, for example.	If this has occurred in normal maintenance (as opposed to theft of a module for example) the alarm can be cleared by clicking on the Clear Alarms button on the Overview page.

Alarm	Description	Action
Converter Auxiliary Fail	This indicates that the converter secondary power circuit (internal to the converter) has failed	This is not user serviceable, and the unit should be replaced.
Converter Brownout	The converter DC input voltage has dropped low enough that the output has become insufficient for the load. The exact voltage this occurs at can vary depending on the size of the load.	Monitor situation and resolve if consistent, however this is not normally within the control of the Power System.
Converter Current Limit	A module current limit which the converter is being held at is active and functioning.	A system notification, only.
Converter EEPROM Fail	The converter EEPROM has failed.	This is not a user serviceable part and the converter must be replaced.
Converter Fan Fail	The converter fan has failed. The converter can be restarted to see if the issue persists.	If the fan is non-functional this is not a user serviceable part and the converter must be replaced.

Alarm	Description	Action
Converter Input Fail	DC supply to the specific converter has failed. One converter failing amongst multiple converters connected to the same bus may imply an internal fault in the converter.	Understand reason for input fail, if external. Check if other alarms are raised in conjunction.

Alarm	Description	Action
Converter Missing	A converter previously recognized in the system is missing from its shelf position or comm's are lost to it. Missing is default 1 module and Urgent Missing indicates multiple modules missing. This threshold value uses the same field as DC Converter Urgent Fail found at Control>DC Converter Urgent Fail Threshold.	Note moving a converter from one location to another raises this alarm. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 converter in a large system of 10, for example. The alarm can be cleared by clicking on the Clear Alarms button on the Overview page.
Converter Module Fail	A converter fault has caused the converter to stop operating. Converter Module Failed is default 1 module and the Converter Urgent Fail alarm indicates multiple modules failing. This threshold value is set at Control>DC Converter Urgent Fail Threshold. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 converter in a large system of 10, for example.	This is a non-user serviceable part and a faulty converter must be replaced.
Converter Over Temperature	The converter has shut down due to the converter's internal temperature exceeding its operational limits.	By default this is a non-latching state, as such once the fault condition has been resolved the converter will return to normal operation. If latching is enabled, the state needs to be manually cleared by clicking on the Power Modules>Power Modules>Clear Shutdown Latch button.

Converter Over Voltage	The DC output Over Voltage Shutdown voltage threshold has been exceeded and the Converter has shut itself down. See Control>Converter Voltage Setpoint	This is an extremely rare alarm and could be due to the converter module itself losing control and trying to push the output voltage beyond limits, or (more likely) due to an external influence on the DC bus (e.g., surges, someone accidentally shorting another voltage source onto the bus). By default, this is a non-latching state, as such once the fault condition has been resolved the converter will return to normal operation. If latching is enabled, the state needs to be manually cleared by clicking on the Power Modules>Power Modules>Clear Shutdown Latch button.
Converter Postmate	The post-mate pin on the converter connector has failed to engage. (Pre- and post-mate pins are used to ensure the output capacitors in the converters do not cause arcing of the connector pins as the converter is inserted into a live system (hotplug).	This is usually due to a converter not being inserted fully into a system. Ensure the converter is pushed "hard" into the system. If the problem persists, check the pins on the backplane by inserting a different converter into that position. If the Postmate alarm "follows" the converter, it may need to be replaced.
Converter Shutdown	A specific converter has shut itself off due to an external command from Input Logic, or directly by a user from the Power Modules>Power Modules>Shutdown command.	This is a notification only and normal operation.
Converter Soft Starting	The converter is starting. During start-up it goes through a soft start mode to ramp up output current in a controlled manner.	This is a notification only and normal operation.
Converter Temperature Sensor Fail	A temperature sensor internal to the converter module is non-functional.	The converter can be restarted to check if the issue persists. If the temperature sensor has failed this is not a user serviceable part and the converter must be replaced.
Converter Upgrading	The converter firmware is in the process of upgrading. Do NOT disconnect the converter.	Status notification, only.
WEB UI Alarm Configuration>Fan Controller		

IO Board Fan Controller Fan Fail	A fan recognized in the system is not operating.	The fan requires replacement.

Alarm	Description	Action
IO Board Fan Controller Missing	A fan controller expected in the system is missing.	Check comms connections along with IO Board and Fan Controller board configuration in the Web UI.
WEB UI Alarm Configuration>General Alarms		
Ambient Temperature Faulty	The ambient temperature sensor of the EM4x is not functioning correctly.	Check the sensor connection in the EM4x and configuration in the EM4x Web UI. If hardware is damaged contact your Newmar rep for replacements.
Ambient Temperature High	Ambient (room) temperature is higher than the limit set.	With ambient temperature sensor fitted. See the Alarm Configuration>System Alarms page, Ambient Temperature High Setpoint
Ambient Temperature Low	Ambient (room) temperature is lower than the limit set.	With ambient temperature sensor fitted. See the Alarm Configuration>System Alarms page, Ambient Temperature Low Setpoint
Clock Adjustment Requires Reboot	The EM4x internal clock is requesting a reboot to finalize setting adjustments.	A reboot should be undertaken as soon as possible.
Control Loop Startup	This alarm indicates the EM4x has rebooted during start up. It is a notification for internal system logging only. This alarm should only show for a short moment during start up.	If the alarm is continuously on please contact your Newmar sales rep.
Database Upgrade Required	The EM4x internal database is detected as being out of date.	Upgrade the EM4x firmware. This is mandatory.
EM4x Monitor Boot	A notification that the reboot request is successful and the EM4x is about to restart.	Information only.
Invalid System Voltage - Check input Logic	The system is reporting a voltage that it interprets as impossible.	Check the input logic - this should only occur with customer modifications of logic that have created an erroneous reading.
Load Current High	A notification that the load current has exceeded the limit set at Alarm Configuration>System Alarms>Load Current High Setpoint.	This is a notification only; the implications depend on the site load requirements and if this has been custom configured.

Rectifier Current Limit Active	This is a system limit; the total output of the bus will not exceed that number.	A system notification, only, that indicates the feature is active and functioning. Set at Control>Rectifier Current/Power Limit>Rectifier Current Limit.
Rectifier Power Limit Active	A notification that the power limit feature is enabled and active. That is, the combined power of all rectifiers is being limited (rather than limiting individual rectifiers).	See the Control page, Rectifier Current/Power Limit section for details. Note: a typical usage might be where an upstream AC breaker needs protection.

Alarm	Description	Action
Rectifier Voltage Sense Fail	The voltage sense on the bus has failed. Typically, a hardware failure of the voltage sense wires of the EM4x and the DC bus. In this circumstance the EM4x selects a rectifier and continues to monitor voltage from it. Note that this alarm can be enabled or disabled on the Control page.	A system level hardware fault that may be attempted to be repaired by qualified personnel.
User Lua Script Error	There is a Lua Script Error which is the EM4x firmware editor. This requires factory support.	Please contact your Newmar representative. A reboot may be attempted.
WEB UI Alarm Configuration>Hybrid		
Battery Missing	Indicates a battery previously detected in the system is no longer present.	Check comms to the battery, battery MCBs or physical status of the batteries.

Alarm	Description	Action
IOBoard 1 Missing	IO board 1 which has been configured in the system and expected to operate is not detected.	Check control wiring (and connectors) to the I/O board. Investigate, if the cause is a faulty IO board this must be replaced.
WEB UI Alarm Configuration>IO Expansion		
IO Board IO Expansion Missing	An IO Expansion Card configured to be present in the system is not detected.	Check comms and power connection to the IO Expansion Card.
WEB UI Alarm Configuration>Input and Relay/Output Logic		

Input Logic Error	There is an error in the input logic of the EM4x configuration software. This can be reviewed in Input Logic page. This should only occur if custom input logic is entered by an end user.	Do NOT attempt to modify the default factory logic. If this error occurs after programming some Input Logic, carefully examine the logic statements and correct the offending statement. If needed, attempt to reload the default logic by clicking on the Input Logic>Default button. If this fails, please contact your Newmar sales rep.
Relay Logic Error	There is an error in the relay logic of the EM4x configuration software. This can be reviewed in the Relay/Output Logic page for relay settings, or otherwise the Custom menu settings or the Input Logic page. This should only occur if custom relay logic is entered by an end user.	Do NOT attempt to modify the default factory logic. If this error occurs after programming some Relay Logic, carefully examine the logic statements and correct the offending statement. If the factory Relay/Output Logic page has been modified by accident, please contact your Newmar sales representative.
WEB UI Alarm Configuration>LVD		
IOBoard 1 LVD 1, or IOBoard 1 LVD 2, or IOBoard 1 LVD 3	This indicates that the threshold for tripping/activating the contactor for LVD1 has been exceeded and the corresponding LVD contactor has been sent a signal to "open". Note on LVD Alarms: The contactors Newmar uses always have auxiliary contacts on them to indicate the contactor is open or closed. These contacts are fed back to internal GPIPs, and usually have the alarm name "LVD Open". This serves as a confirmation that the LVD contactor has actually obeyed its command to "open".	Normally the threshold for tripping the LVD will be based on low voltage. However, the LVD contactor can also be activated by temperature and/or time.

Alarm	Description	Action
WEB UI Alarm Configuration>MCB Alarms		
Battery MCB Open	Notification that the battery circuit breaker (or fuse) is open.	Ensure the MCB status is correct for intended operation. Also check the correct number of battery MCBs is enabled. See IO Configuration>MCBs>Number of Battery MCBs

WEB UI Alarm Configuration>Phase Balancing		
AC Phase (1, 2 or 3) Backoff	This is pre-set as an informational alarm. While the EM4x is performing a balancing function this alarm/notification is raised.	Informational - no action required.
AC Phase (1, 2 or 3) Clamp	This alarm occurs when the AC breaker current limit is exceeded and a "Rapid Backoff" is required. If the balanced phase current is below the breaker rating, this alarm will turn off. However, if the balance point is beyond the breaker rating setpoint, the EM4x limits the AC input current to this level, and the balance of energy comes from the battery. This alarm stays on until the AC current falls below the breaker rating setpoint.	If this alarm persists, it means there is insufficient power from the grid to both power the load and charge the batteries. Urgent action is required otherwise the battery will discharge and the DC system will crash. Wither site load needs to be reduced, or AC reticulation must be upgraded to a higher power/current level.
AC Phase (1, 2 or 3) Unbalanced	If, for some reason, the phases are unable to be balanced, this alarm is raised. An example of this may be insufficient rectifier load to create a phase balanced system.	This is a warning only and not critical. No action required.
Phase Balancing Inhibited	If, for some reason the EM4x is unable to perform Phase Balancing, this alarm is raised. When this alarm is active, the system will revert to the settings in the Inhibit/Rollback Configuration.	There are a number of reasons why Phase Balancing may be inhibited. Refer to section Inhibit/Rollback Configuration on page 83 for details
WEB UI Alarm Configuration>Rectifier		
All Rectifiers Input Fail	AC input supply has failed at a system/bus level.	This is typically an external event (i.e., AC grid failure) to be monitored.
Rectifier Auxiliary Rail Fail	Rectifier secondary power circuit failure.	This is not user serviceable, and the rectifier module should be replaced.
Rectifier Brownout	The rectifier AC input voltage has dropped low enough that the output has become insufficient for the load. The exact voltage this occurs at can vary depending on the size of the load.	No action required – the AC voltage level is outside the control of the Power System.

Alarm	Description	Action

Rectifier Current Limit	A module current limit which the rectifiers is being held at is active and functioning.	A system notification, only.
Rectifier EEPROM Fail	The rectifier EEPROM has failed.	This is not a user serviceable part, and the rectifier must be replaced.
Rectifier Fan Fail	The rectifier fan has failed/not rotated. The rectifier can be restarted to see if the issue persists.	If the fan is non-functional this is not a user serviceable part, and the rectifier must be replaced.
Rectifier Firmware Upgrading	Notification of upgrade underway.	Information, only.
Rectifier Input Fail	AC supply to the specific rectifier has failed. One rectifier failing amongst multiple rectifiers connected to the same bus may imply an internal fault in the rectifier.	Understand reason for input fail, if external. Check if other alarms are raised in conjunction.
Rectifier Missing	A rectifier previously recognized in the system is missing from its shelf position or comms are lost to it. Rectifier Missing is default 1 module and Rectifier Urgent Missing indicates multiple modules missing. This threshold value uses the same field as Rectifier Urgent Fail found at Control>Rectifier Urgent Fail Threshold.	Note moving a rectifier from one location to another raises this alarm. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 rectifier in a large system of 10, for example. The alarm can be cleared by clicking on the Overview>Clear Alarms button. Note that a Rectifier Missing alarm will also occur if communication is lost between the EM4x and the rectifier – this could be due to interruption/miss-connection of the serial bus wire.
Rectifier Urgent Missing	Multiple rectifiers previously recognized in the system are missing from their shelf position. Note moving a rectifier from one location to another raises this alarm. Rectifier Missing is default 1 module and Rectifier Urgent Missing indicates multiple modules missing. This threshold value uses the same field as Rectifier Urgent Fail found at Control>Rectifier Urgent Fail Threshold. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 rectifier in a large system of 10, for example.	If this has occurred in normal maintenance (as opposed to theft of a module for example) the alarm can be cleared by clicking on the Overview>Clear Alarms button. Note that a Rectifier Missing alarm will also occur if communication is lost between the EM4x and the rectifier – this could be due to interruption/miss-connection of the serial bus wire.

Rectifier Module Fail	A rectifier fault has caused the rectifier to stop operating. Rectifier Module Failed is default 1 module and the Rectifier Urgent Fail alarm indicates multiple modules failing. This threshold value is set at Control>Rectifier Urgent Fail Threshold. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 rectifier in a large system of 10, for example.	This is a non-user serviceable part and a faulty rectifier must be replaced. Note that Rectifier Module Fail also occurs when AC Input fails. This is because the microprocessor in the rectifier module cannot detect the difference between a failure of the module at its input, or the AC input failing.

Alarm	Description	Action
Rectifier Urgent Fail	Multiple rectifiers have failed. Rectifier Module Failed is default 1 module while the Rectifier Urgent Fail alarm indicates multiple modules failing. This threshold value is set at Control>Rectifier Urgent Fail Threshold. The alarms are differentiated because it may be considered unnecessary for a site call out for just 1 rectifier in a large system of 10, for example.	Rectifiers are not user serviceable and must be replaced. Note that this alarm will also occur when AC grid fails This is because the microprocessor in the rectifier module cannot detect the difference between a failure of the module at its input, or the AC input failing.
Rectifier Over Temperature	The rectifier has shut down due to the rectifier's temperature exceeding its operational limits. Internal protection ensures the rectifier is not damaged during this state.	By default, this is a non-latching state, as such once the fault condition has been resolved the rectifier will return to normal operation. If latching is enabled, the state needs to be manually cleared by clicking on the Power Modules>Power Modules>Clear Shutdown Latch button.
Rectifier Over Voltage	A notification that the rectifier has exceeded the voltage set at Alarm Configuration>Bus Alarms> High Voltage Setpoint and has shut itself down.	This is an extremely rare alarm and could be due to the rectifier module itself losing control and trying to push the output voltage beyond limits, or (more likely) due to an external influence on the DC bus (e.g., surges, someone accidentally shorting another voltage source onto the bus). By default, this is a non-latching state, as such once the fault condition has been resolved the rectifier will return to normal operation. If latching is enabled, the state needs to be manually cleared by clicking on the Power Modules>Power Modules>Clear Shutdown Latch button.
Rectifier Postmate	The post-mate pin on the rectifier connector has failed to engage. (Pre- and post-mate pins are used to ensure the output capacitors in the rectifiers do not cause arcing of the connector pins as the rectifier is inserted into a live system (hot plug).	This is usually due to a rectifier not being inserted fully into a system. Ensure the rectifier is pushed "hard" into the system. If the problem persists, check the pins on the backplane by inserting a different rectifier into that position. If the Postmate alarm

		"follows" the rectifier, it may need to be replaced.
Rectifier Power Save Active	A notification that that the rectifiers are in power save mode, with rectifiers alternatively shutting down to optimize efficiency.	See Control>Rectifier Power Save section for details of the power save mode settings.
Rectifier Shutdown	A specific rectifier has shut itself off due to an external command from the Power Save function, Input Logic, or directly by a user from the Power Modules>Power Modules>Shutdown command.	If this is set by Input Logic, then is should be viewed as a notification only. Otherwise, this should be investigated in terms of other alarms raised, the parameters displayed on the Power Module page, or logs.
Rectifier Soft Starting	The rectifier is starting. During start-up it goes through a soft start mode in order to ramp up output current in a controlled manner, thus avoiding large step-load changes on the grid or gen-set.	This is a notification only and normal during a rectifier start-up sequence.
Rectifier Temperature Sensor Fail	A rectifier temperature sensor is nonfunctional.	The rectifier can be restarted to check if the issue persists. If the temperature sensor has failed this is not a user serviceable part and the rectifier must be replaced.

17 SERVICE

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

The energy manager contains static sensitive components that require careful handling and proper precautions to be taken.

If the controller unit should require service, it should be removed from the system by an Approved Service Agent and returned to the manufacturer for servicing.
The controller should not be removed from the system by unauthorized personnel as this may lead to malfunctions of the DC system.

Appendix I NEWMAR ENERGY STANDARD LIMITED WARRANTY POLICY

Newmar warrants that its products shall be free from defects of material or workmanship under use consistent with correct installation and commission, normal operation, product specifications, Newmar's written instructions, and regional standards compliance, for a period of one (1) year from the start date. The start date shall be defined as (a) the date the product is shipped from Newmar's factory; or (b) in the case of resale by an authorized Newmar reseller, whichever is the lesser of i) the date on the sales invoice or ii) ninety (90) days after original shipment by Newmar factory.

The warranty provides for repairing or replacing, at Newmar's sole discretion, those products deemed defective by Newmar after inspection of its products returned by the customer to the factory or other Newmar authorized location within the warranty period. Replaced product provided by Newmar under the terms of this warranty does not extend the original warranty, replacement product assumes the warranty of the original product. Repaired product or component thereof has a warranty period of ninety (90) days or the remainder of the unexpired term of the original product warranty, whichever is greater.

I.A Warranty Exclusions and Restrictions

Products or parts may be excluded from warranty coverage for reasons including, but not limited to: if the hardware or software has been altered or repaired by an unauthorized party; is defective due to misuse, negligence, accident, mechanical damage, improper installation or maintenance; inappropriate on-site conditions such as high humidity, dust, power surges, out-of-range temperatures, animal or insect damage, water or other liquid damage; where serial numbers or identification marks are removed or defaced in any way; Force Majeure event; has cosmetic shortcomings which do not affect normal operation; inappropriate electrical stress; for suspected fraud or abuse of Newmar's warranty policy; the account has breached or is in dispute of Newmar's commercial terms and conditions.

Note Newmar warranty does not cover data loss, regular back-ups to separate storage is required.

I.B Battery Warranty

Battery warranty is NOT covered under this warranty. Where Newmar supplies batteries a separate warranty statement shall govern the battery warranty, or where an Newmar battery warranty is not provided the authorized battery vendor's warranty shall be assigned to the batteries.

Note that batteries' operational limits are typically more constrained than Newmar manufactured equipment, need specific care during storage and maintenance, and requirements typically vary for each battery type and vendor. Newmar product warranty is voided should improper care of associated batteries be the cause of product defect.

Unless stated otherwise in the terms and conditions of sale warranty for peripherals, attachments or apparatus not manufactured by Newmar shall be excluded from this warranty.