EcoCharge BMM Support Application
Technical Manual

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Introduction to the Manual

The BMM Support Application Technical Manual describes a software application program that can be run on either Windows or Android devices, intended primarily for tablet usage. When installed on a device with the required Bluetooth connection capability, the app allows configuration and monitoring of both the V3 and legacy V2 EcoCharge Battery Monitoring Modules (BMMs) without requiring the BMM to be connected to a charger.

The app mirrors the functionality of the respective EcoCharge chargers with regards to configuring a BMM. Users familiar with the G3 charger Web UI and the V2 Charger Interface app should be able to use the BMM Support Application without requiring further training.

Distribution of this manual is to be restricted to personnel who already have knowledge of motive power battery charging and chargers. A *User Manual* is available, this document should be supplied to end users.

This document covers the following topics:

- Configuring an EcoCharge series V3 or V2 BMM battery module
- Monitoring the behaviour of a V3 or V2 BMM
- Viewing and recovering logs from a V3 or V2 BMM

This manual does not cover the following topics:

- Day to day operation of the BMM − see the *User Manual*
- Installation of the BMM − see the *User Manual*
- Repair of the BMM − see the *User Manual*
- G3 Charger Web UI functionality − see the *Web UI Interface Manual*

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- BMM V2 functionality — see the *Charger Interface Manual*

> ⓘ This version of the BMM Support Application Technical Manual includes the features of the BMM Support Application software R01.

System Requirements

The BMM Support Application is supported on the following device operating systems:

- Microsoft Windows (version 10, supports both 32- and 64-bit versions)
- Google Android (Android 11 Red Velvet Cake and above as being the versions still being supported at publication of this manual)

Bluetooth®:

- For connection to V3 BMMs the device is required to have a Bluetooth Low Energy (BLE) capable radio.
- For connection to V2 BMMs the device is required to have classic Bluetooth capable radio.

Downloading the BMM Support Application

The BMM Support Application can be downloaded from:

- **Microsoft Store**: https://apps.microsoft.com/detail/9p7xg04g4x0x?hl=en-gb&gl=NZ
- **Google Play:** https://play.google.com/store/apps/details?id=com.enatel.bmm.eco&hl=en

Logging In

When the app is opened the login page displays.

To log into the app, you must enter a username and password. Two types of usernames and passwords are in use: Fixed Passwords and Personal Authentication Codes (PACs).

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Fixed Passwords

For the lower two user access levels fixed usernames and passwords are used. These are:

- Guest access level
  Username: *guest*   Password: *ecocharge*
- Configuration access level
  Username: *configuration*   Password: *97percent*

Personal Authentication Codes

For the higher two user access levels, *advanced* and *profileeditor*, personal authentication codes (PACs) are distributed with a unique username to each technician. The unique username is an email address, employee number or similar unique to the technician. A PAC is six characters long, made up of upper- and lower-case letters, 0 to 9, plus (+) and slash (/). A non-functional example is shown below:
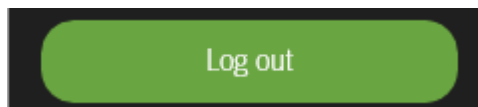
Username: john.smith@distributor.com   Password: 1NwyV+

Contact the distributor support to be allocated a PAC.

When you are logged in to the app, the access level displays at the bottom of the navigation pane.

Log out

0.7.32.0 (Profile Editor)
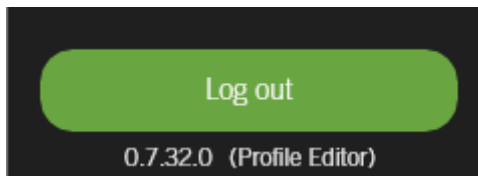
Select *Log out* to log out, which returns you to the login page.

Log out

User Access Levels

Each user is assigned an access level. This access level limits what the user can view and configure using the BMM Support Application. There are four access levels, and each has the following access to features:

Page Access Level	guest	configuration	advanced	profileeditor
Status	👁	✎	✎	✎
Configuration	👁	🖋	✎	✎
Profile Builder		👁	👁	✎
Logs	👁	👁	👁	👁
BMM Settings	👁	👁	✎	✎
Application Settings	👁	✎	✎	✎

👁   The user can view this page but make no changes.

🖋   The user can view this page and make changes using a template.

✎   The user can view the page and make freeform changes.

Application Pages

The application pages consist of two main parts with many pages having a third section:

- Navigation Pane — shown at the left of the page, this allows you to navigate between the app pages.
- Page — the related functions and features for each page as selected from the navigation pane.
- Function Bar — a fixed page section at the bottom of the page window with functional options.
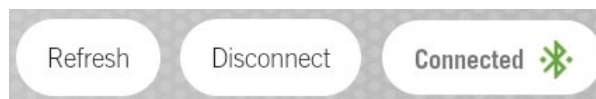
These parts are outlined below:
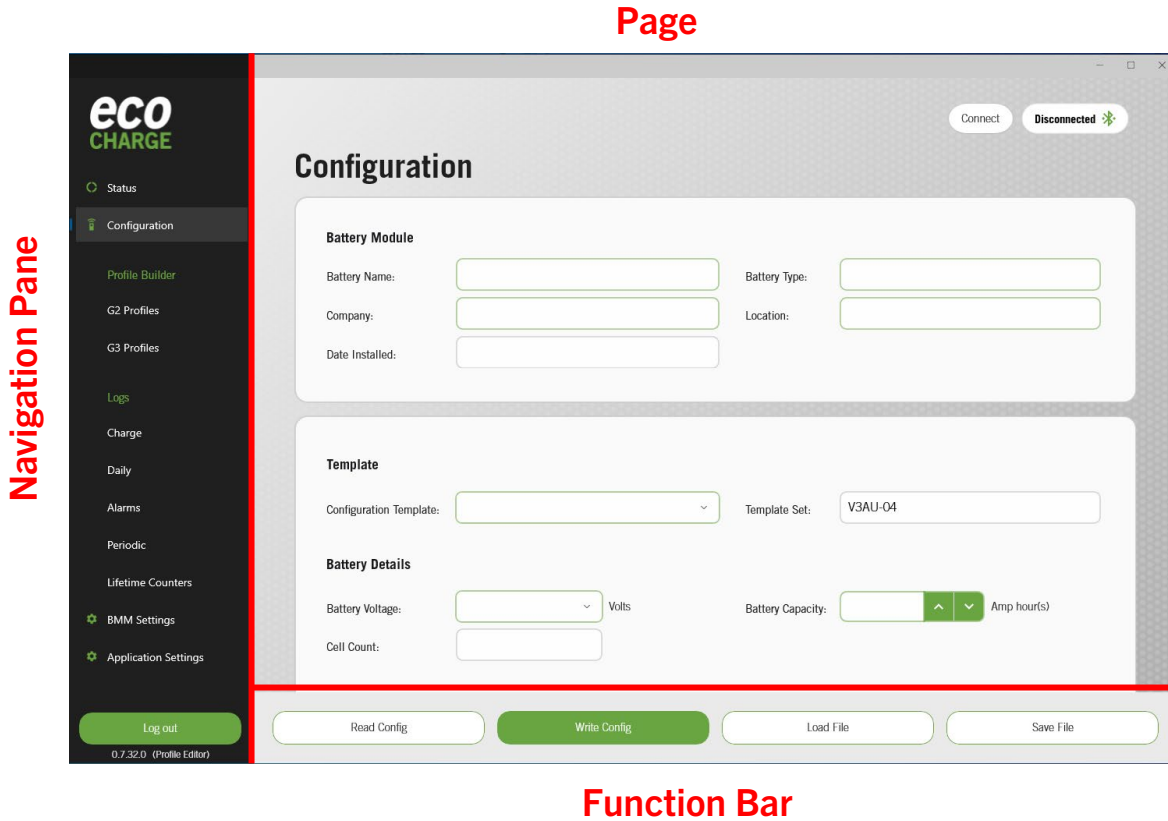
NOTE: all pages display the BMM connection options on the top right corner of the page.
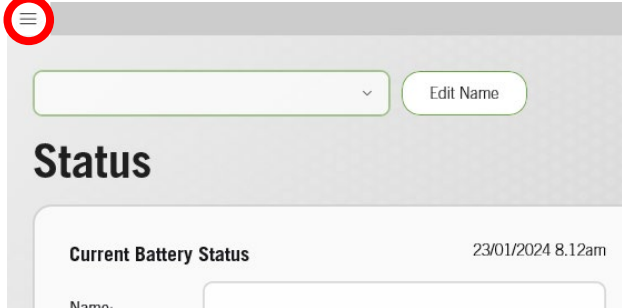
Disconnected:
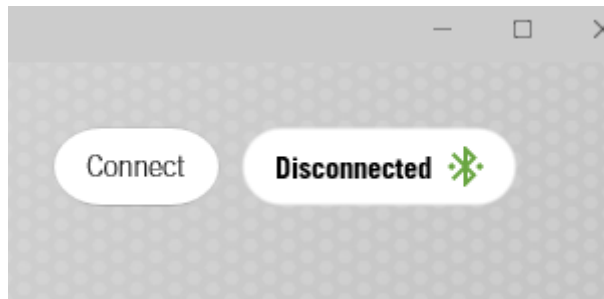
Connected:

When you are using a narrow screen the navigation pane is hidden. Selecting the tribar icon at the top left-hand window corner displays the navigation pane. Note that the application software is specifically designed for tablet use, as opposed to phone.

When collapsed (icon circled):

When expanded:
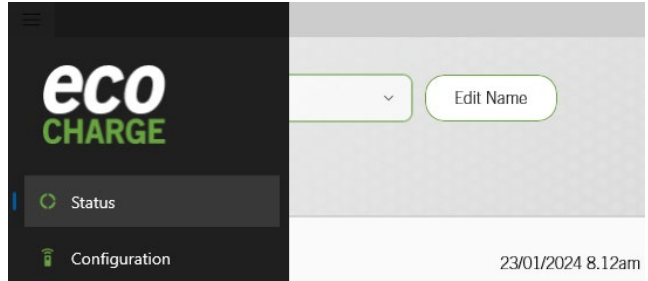
Connecting to a BMM

IMPORTANT: the device hosting the BMM Support Application cannot connect to a BMM when the BMM is connected to a charger via Bluetooth. A BMM can only have one Bluetooth connection.
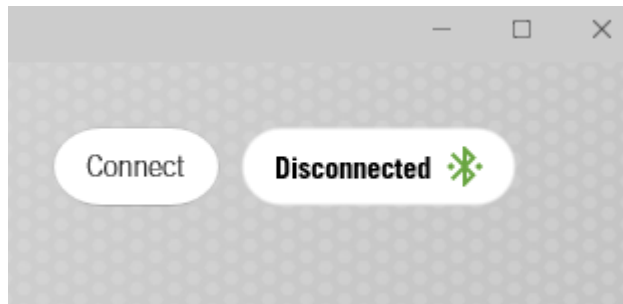
Select *Connect* to connect a BMM using Bluetooth. This can be used to monitor or configure a powered BMM that is within range of the Bluetooth radio.

> ! A Bluetooth connection to a BMM is not available during a BMM Enabled charge. During a BMM Enabled charge the Bluetooth connection is reserved for communication with the charger.

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To connect to a BMM using Bluetooth:

1. Select the Connect button. The device scans for available BMMs.
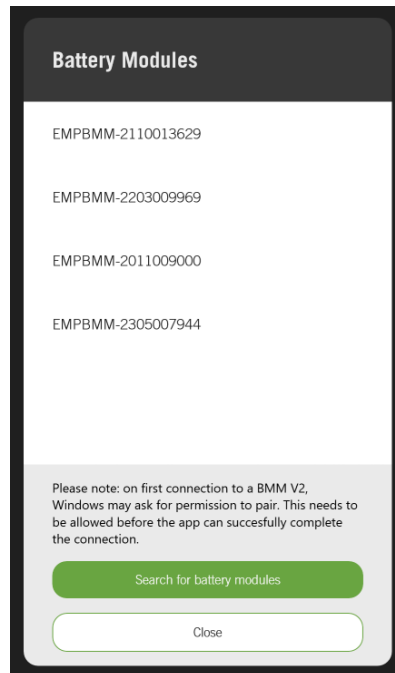
2. Select the required BMM.
3. The *Connected* button displays along with *Refresh* and *Disconnect* options.
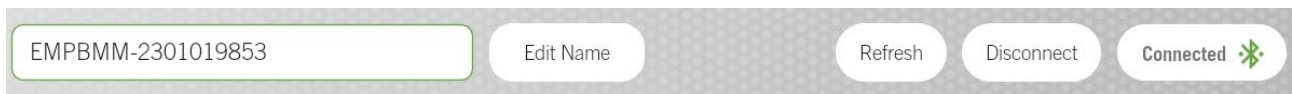
Select the *Refresh* button to attempt to reconnect to the same BMM should the connection be interrupted.

IMPORTANT: when connecting to a V2 charger your device requests to pair the device as a classic Bluetooth connection. Follow the device's Bluetooth prompts to connect to the BMM.
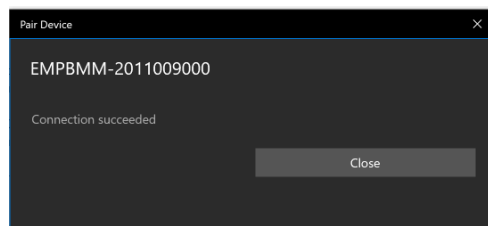
Option to Rename the BMM

When connecting to a BMM for the first time a popup window displays providing the option to rename the BMM.
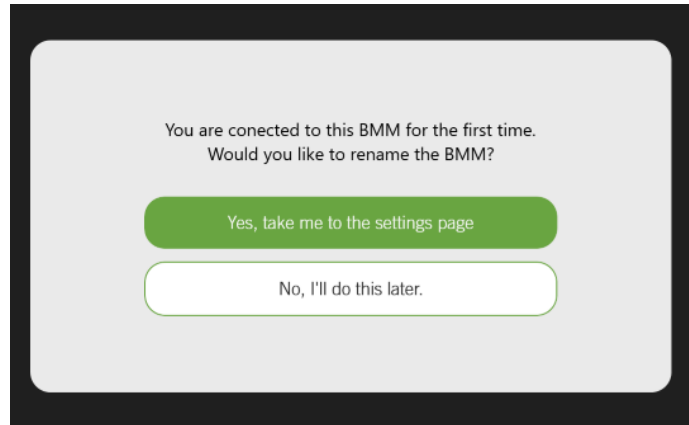
This popup window can be disabled in the Application Settings page.

Overview of Pages

The pages in the web interface are grouped by purpose:

- Status
- Configuration 🔒
- Profile Builder
  G2 Profiles 🔒 🔒
  G3 Profiles 🔒 🔒
- Logs
  Charge
  Daily
  Alarms
  Periodic
  Lifetime Counters
- BMM Settings
- Application Settings

Pages above that are marked with a lock (🔒) can be accessed by users with configuration or greater access only, pages marked with two locks (🔒 🔒) can only be accessed by users with advanced or profile editor access only.

See User Access Levels.

![ECOCHARGE logo]

Status
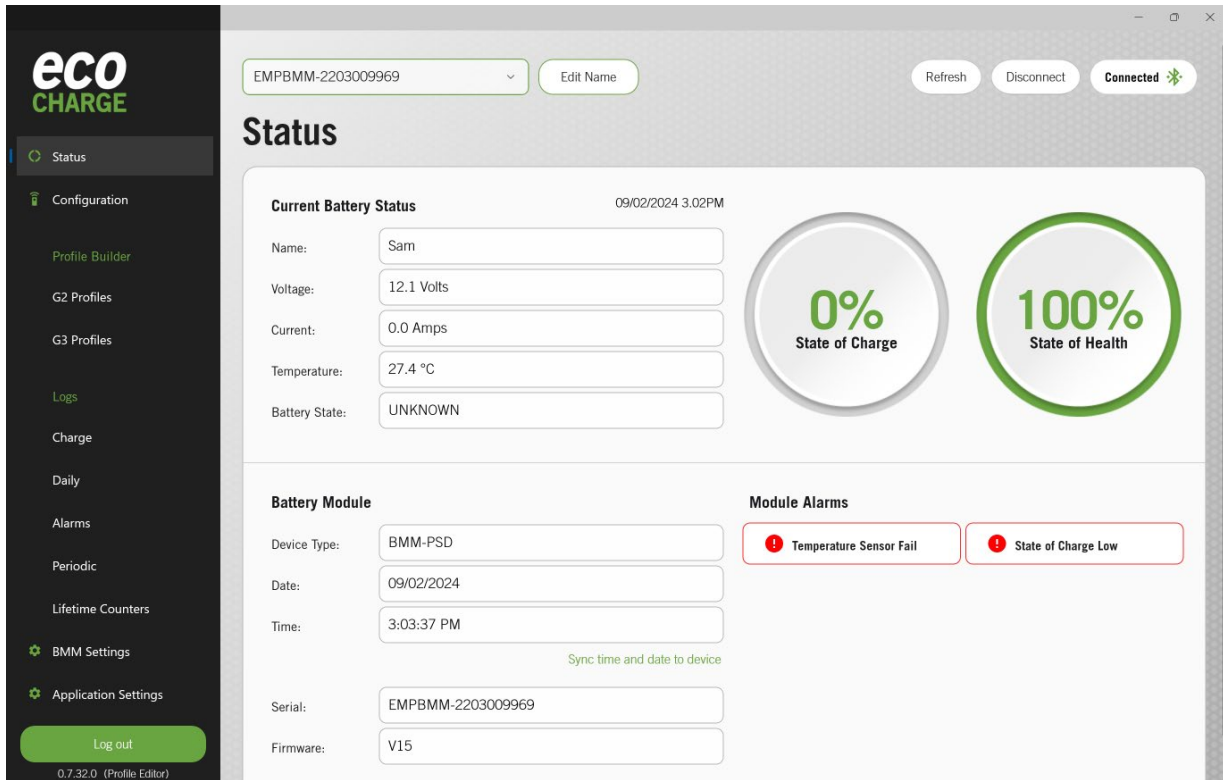
Edit Name: the name which the app displays for a BMM can be modified to become a 'friendly name' in this field. The app friendly name is saved and used in the app, only. It is typically used to display a more intuitive BMM name during the connection process. This is different from the *Name* noted in the Current Battery Status section which is the BMM name. Note that the friendly name is associated with the BMM serial number.

Current Battery Status

Name: is the Battery name configured and stored on the BMM. This field cannot be edited on the Status page. It is edited on the Configuration page.

Voltage: is the battery voltage status.

Current: is the battery current discharging or charging. A discharge is designated as a negative current.

Temperature: the battery temperature as measured by the BMM temperature sensor.

Battery State: displays only for V2 BMMs.

State of Charge: the state of charge is displayed as a percentage.

State of Health: the state of health is displayed as a percentage.

![ecoCHARGE logo]

Battery Module

Device Type: indicates the type of BMM connected to whether BMM or BPT.

Date: date as configured on the BMM.

Time: time as configured on the BMM.

Sync time and date to device: overwrites the existing date and time of the BMM to match the date and time of the connecting device.

Serial: the serial number of the BMM.

Firmware: the firmware version installed on the BMM.

Module Alarms
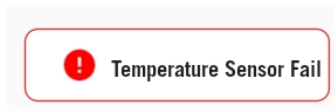
Active BMM alarms display in the Module Alarms page section.

Configuration

A BMM can store both an ECO970 series and XHF charge profile. This page allows you to configure a BMM with both types of charge profile.

The table below shows how a BMM interacts with an ECO970 or XHF series charger:

BMM Configuration	XHF Charger Behaviour	ECO970 Charger Behaviour
Configured with an XHF charge profile only	Will charge according to XHF profile	Will charge according to XHF profile
Configured with an ECO970 charge profile only	Will not charge	Will charge according to ECO970 profile
Configured with both XHF and ECO970 charge profiles	Will charge according to XHF profile	Will charge according to ECO970 profile

There are two features this allows:

- Sites with existing BMMs that were used with XHF chargers do not have to be reconfigured before being used with ECO970 series chargers.
- BMM's can be configured so that they can be charged using a mix of XHF and ECO970 series chargers.

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> Before being used with an ECO970 series charger a BMM battery module must be updated to firmware version 28 or later, even if only XHF profiles are used.

Battery Module

Battery Module

Battery Name:		Battery Type:	
Company:		Location:	
Date Installed:			

Battery Name: enter a name for the battery. This is important as it identifies the battery in all BMM and charger logs.

Battery Type: enter the type of battery.

Company: enter the battery supplier company name.

Location: enter a description of the location of the battery.

Date Installed: the date installed auto-populates here when the BMM is fitted to the battery.

Template

> It is best practice to start all fixed configurations using a template. Chose the template in the list that is closest to the battery to be charged, then make any adjustments necessary.

Template

| Configuration Template: | | Template Set: | V3AU-04 |

Configuration Template: select the battery template from the dropdown menu.

Template Set: displays what set of templates is in use.

These values should be set to match the battery the BMM is fitted to and are used for both the ECO970 series and XHF charge profiles.

Battery Details

The fields in the Battery Details section are populated by the template chosen. A user with the appropriate access level can modify these fields.

Battery Details

| Battery Voltage: | | Volts | Battery Capacity: | | Amp hour(s) |
| Cell Count: | | | | | |

Battery Voltage: sets the battery voltage.

Battery Capacity: sets the battery capacity.

Cell Count: sets the cell count (note this field does not display if a BPT-BT3 is connected).

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ECO970 Profile

The fields in the ECO970 Profile section are populated by the template chosen in the Template section. A user with the appropriate access level can modify these fields as required.

ECO970 Profile

Charge Profile: [⌄]

Starting Rate: [^ ⌄] A/100Ah   Finishing Rate: [^ ⌄] A/100Ah

Charge Profile: select the required profile from the dropdown menu.

| Flooded Conventional
Flooded Opportunity
Flooded Fast
AGM Conventional
Gel Conventional

Starting Rate: sets the charge rate in the first stage of the charge.

Finishing Rate: sets the charge rate in the third stage of the charge.

XHF Profile

The XHF Profile is used with the V2 BMM.

XHF Profile

Dual Profile [On | Off]

| Primary profile | Secondary profile |

Profile Name: [⌄]   Starting Current: [^ ⌄] A

Delay to secondary profile: [^ ⌄] Hours [^ ⌄] Minutes [^ ⌄] Seconds

Dual Profile: select *On* if two different charge profiles wish to be used with the battery. For instance a high rate charger could be configured to charge a battery with an opportunity profile when connected during the day, then perform a standard rate full charge when the battery is left connected overnight.

Primary and Secondary Profile: the *Secondary Profile* tab only displays if *Dual Profile* is *On*.

Profile Name: select the profile type from the dropdown menu. This is the equivalent of the *Charge Profile* in the *V2 Charger Interface Software*.

Starting Current: enter the appropriate starting current for the profile.

Delay to secondary profile: a period of time can be set for the secondary profile to initiate from the end of a primary profile.

> The XHF profile uses a *starting current,* rather than a *starting rate.* Care should be taken not to confuse these two different parameters.
> *Starting Rate x Battery Capacity = Starting Current*

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Secondary Profile

Primary profile	Secondary profile

Profile Name: [_____ ⌄]   Starting Current: [_____ ^ ⌄] A

Profile Name: select the profile type from the dropdown menu.

Starting Current: enter the appropriate stating current for the profile.

Installation Options

Installation Options

☐ Electrolyte Sensor Fitted   ☐ Midpoint V Sensor Fitted

☐ State of Charge Monitoring   ☐ State of Health Monitoring

☐ Allow Timezone Update   ☐ Allow Dual Connector

☐ Swap Current Sensor Direction

Electrolyte Sensor Fitted: enable this box if the optional electrolyte level sensor is fitted to the battery. (Note in V3 BMMs the temperature sensor is part of the electrolyte sensor).

State of Charge Monitoring: this is normally enabled but should be disabled where the state of charge measurement by the BMM is not reliable.

> **(!)** The BMM needs to measure all the current going into and out of the battery to accurately track the battery state of charge. Typical situations where inaccuracy occurs are when the BMM is fitted over only one cable of a dual cable battery (and sees only part of the charge current), or when a BMM is fitted to a truck (and only sees discharge current).

Allow Timezone Update: when enabled the timezone of a connected charger overrides the BMM timezone regional setting.

Swap Current Sensor Direction: this should be enabled if the current sensor is fitted in the wrong direction. Note, it is recommended that the use of this setting is to be avoided, that the current sensor is attempted to be installed in the correct orientation.

Midpoint V Sensor Fitted: enable this if the optional midpoint voltage sensor is installed onto the intercell connection between two central cells of a battery.

State of Health Monitoring: this is normally enabled.

Allow Dual Connector: is enabled when a dual connector charger is connected to the battery.

Read, Write, Save or Load a Configuration

Read Config	Write Config	Load File	Save File

Read Config: reads and then populates the app fields with the configuration currently stored in the BMM. Use this button if you have made changes you want to discard.

Write Config: saves the changes you have made on this page to the BMM.

Load File: configures the BMM based on a charger *.json configuration file which is uploaded from the device.

Save File: creates a BMM *.json configuration file based on the current configuration of the BMM. Between the save and load configuration functions, you can configure one BMM, then use a saved configuration file to conveniently configure many other BMMs with the same configuration.

Profile Builder - G2 Profiles

This page can be used to view, edit or create V2 BMM charge profiles. Users with configuration or advanced access levels can view this page, users with *profileeditor* access level can edit existing profiles or build new ones.

The profile being viewed or edited is selected using the dropdown menu at the top of the page:
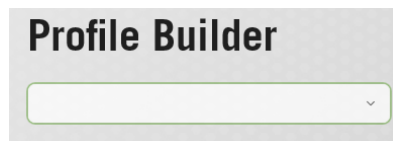
Select the required profile.
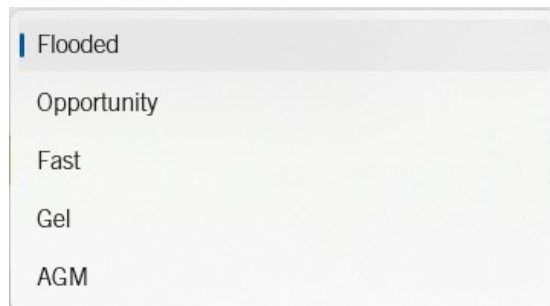
Note that some page fields and the Auto EQ Refresh Options default states change depending on the profile selected.

Profile Name: edit this field to enter a unique name if required.

Profile Type: the *Profile Type* drop-down list allows the basic structure of the profile to be selected. Descriptions of the available profile types are listed below:

| Profile Type | Bulk | Finishing | | Description |
	Stage 1	Stage 2	Stage 3	
IUIa	constant current	constant voltage	constant current	standard three stage charge profile for flooded cells
Ia	constant current			useful for commissioning or de-sulphating batteries, normal charger min/max voltage operation parameters apply
IUUa	constant current	constant voltage	constant voltage	useful for infrequent charging of AGM traction batteries
IUa	constant current	constant voltage		charging reserve batteries or using as a power supply

Stage 1 Current – the percentage of the *Start Current* (set in the configuration) that is used for the bulk charge stage, normally set to 100%.

Stage 1 Timeout – maximum time the charger will stay in bulk charge. If this time is exceeded the charger stops with a major alarm as it could indicate a faulty battery with short circuit cells. While the setting is in minutes the

timeout is actually calculated based on capacity returned to the battery rather than just time, allowing a faulty charger module to reduce the charge current available and lengthen the bulk charge time accordingly.
Note: this field name changes when using an Opportunity charge to **State 1+2 Timeout**.

| Stage 1 Timeout: | 360 | ∧ ∨ | Minutes |

Stage 2 Voltage – the setting for the constant voltage stage, set in accordance with the battery technology depending on when a particular battery type starts to gas.

| Stage 2 Voltage: | 2.37 | ∧ ∨ | Volts |

Stage 3 Current – the percentage of the start current to which the charge current needs to reduce to in order to transition to second constant current stage. The setting varies with the capability of the battery technology to accept current during gassing. This setting is very important for sealed cells where it needs to be quite low to prevent the battery losing electrolyte and drying out.

| Stage 3 Current: | 31 | ∧ ∨ | % |

Stage 3 Min dV/dt – rate of change of battery voltage in mV/15min/cell used to determine the automatic end point of the charge cycle.

| Stage 3 Min dV/dt: | 3 | ∧ ∨ | mV/15min/cell |

Stage 2 Timeout – maximum time the charger will stay in the constant voltage stage of the cycle.

| Stage 2 Timeout: | 0 | ∧ ∨ | Minutes |

Stage 3 Max Cell Voltage – maximum voltage the charger will reach in stage 3. This provides protection against applying too great a voltage to the battery. The occasional maximum voltage terminations are not a major problem and the charge completes with a minor alarm. Regular maximum voltage terminations occurring indicates that the battery needs attention.

| Stage 3 Max Cell Voltage: | 2.75 | ∧ ∨ | Volts |

EQ/Refresh Current – the percentage of the start current (set in the configuration) that is used for the equalisation, normally set to quite a low value, typically 25% for a flooded battery, less for GEL or AGM.

| EQ/Refresh Current: | 31 | ∧ ∨ | % |

EQ/Refresh Min dV/dt - rate of change of battery voltage in mV/15min/cell used to determine the automatic end point of the equalisation cycle.

| EQ/Refresh Min dV/dt: | 0 | ∧ ∨ | mV/15min/cell |

EQ/Refresh Duration – the duration of the equalisation.

| EQ/Refresh Duration: | 180 | ∧ ∨ | Minutes |

EQ/Refresh Max Cell Voltage – the maximum charger output voltage during the equalise charge. Normally set to the same as the Stage 3 max cell volts but can also be a little higher to allow more headroom for a full equalise to occur.

| EQ/Refresh Max Cell Voltage: | 2.75 | ∧ ∨ | Volts |

Stage 3 Timeout – the maximum time the charger will stay in the constant current gassing part of the cycle. This time can vary when the battery is new. While it is necessary to provide a limit to the time, the occasional finishing charge timeout is not a major problem resulting in only a minor alarm indication. Should Finishing Timeout errors be regular then the battery should be investigated. It is not always necessary to have separate stage 2 and stage

3 timeouts. If the stage 3 timeout is set to zero then the stage 2 timeout is used as the combined stage2 and 3 limit.

| Stage 3 Timeout: | 360 | ∧ ∨ | Minutes |

Auto EQ/Refresh After – time that the battery needs to remain connected to the charger for it to initiate an auto equalise cycle. Normally set to 30 hours to allow an equalisation over a weekend period.
Note that this field changes to **Delay to Full Charge** if *Bulk Charge Only, Full Charge after Delay* or *Secondary Profile after Delay* is enabled in the *Auto EQ Refresh Options*.

| Auto EQ/Refresh After: | 30 | ∧ ∨ | Hours |

EQ/Refresh Lockout – the minimum time following the completion of a charge cycle, before an equalise can start. This is sometimes a requirement of battery charger specifications to allow for the battery to cool before applying an equalise charge. When the lockout is set then this is the minimum time between charge complete and equalise even if the equalise is manually initiated.

| EQ/Refresh Lockout: | 0 | ∧ ∨ | Hours |

Temp Comp Factor – temperature compensation factor used to adjust the charger's voltage setting to allow for different battery temperature. Measured in mV/(°C/°F)/cell. Normal setting for lead acid batteries is -3.0.

| Temp Comp Factor: | -3.6 | ∧ ∨ | mV/degC/cell |

EQ/Refresh Constant Voltage – if *On*, the *EQ/Refresh Maximum Cell Voltage* is used as a limit and the refresh current will reduce to maintain the battery voltage at the *EQ/Refresh Maximum Cell Voltage* until the *EQ/Refresh Duration* times out. If *Off* then the refresh charge will terminate when the *EQ/Refresh Maximum Cell Voltage* is reached.

| EQ/ Refresh Constant Voltage | ⬤ On |

Auto EQ Refresh Options

Note the default settings of this section are dynamically modified depending on the profile selected.

Auto EQ Refresh Options

Profile Auto Equalise Enable:	⬤ Off
Bulk Charge Only, Full Charge on Equalise:	⬤ Off
Bulk Charge Only, Full Charge after Delay:	⬤ Off
Prevent Auto Watering:	⬤ Off
Secondary Profile after Delay:	⬤ Off

Profile Auto Equalise Enable: when *On* the profile starts an equalize charge if the battery is still connected after the time set in the *Auto EQ/Refresh After* field.

Bulk Charge Only, Full Charge on Equalise: when *On* the charger only performs the first stage of the profile. If the battery is still connected after the time set in the *Auto EQ/Refresh After* field, or an equalize charge is otherwise triggered, the charger performs a full charge.

Bulk Charge Only, Full Charge after Delay: when *On* the charger only performs the first stage of the profile. If the battery is still connected after the time set in the *Delay to Full Charge* field the charger performs a full charge.

Prevent Auto Watering: a configured auto-watering can be enabled or disabled independently of having to modify the profile.

Secondary Profile after Delay: determines a period of time to wait before the secondary profile initiates. This might be used when a full charge or equalisation is wanted to occur during the weekend.

These fields are typically used when constructing opportunity charge configurations.

Note that if either *Bulk Charge Only, Full Charge after Delay* and *Secondary Profile after Delay* is enabled the *Auto EQ/Refresh After* field changes to *Delay to Full Charge.*

Stage 1 Timeout:	360	∧ ∨	Minutes
Delay to Full Charge	1	∧ ∨	Hours
EQ/Refresh Lockout:	0.1	∧ ∨	Hours

G2 Profile Function Bar

The G2 profile function bar has three options.

Save Profile: writes the G2 profile configured on the page to the BMM.

Load File: writes a *.json G2 profile file stored on the device to the BMM.

Save File: saves the current profile on the BMM to the device as a *.json file.

Save Profile	Load File	Save File
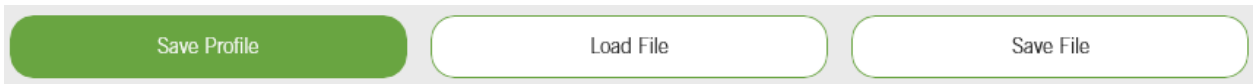
Profile Builder − G3 Profiles

This page can be used to view, edit or create V3 BMM charge profiles. Users with configuration or advanced access levels can view this page, users with *profileeditor* access level can edit existing profiles or build new ones.

Overview of Profile Structure

The charge profile structure consists of five slots. With each of these slots there can be up to three constant current or constant voltage stages. Each slot has a purpose, as shown below:

Pre −this slot is run when a battery is connected with a cell voltage below a threshold. It is intended for use with batteries that require an initial slow charge when they have been over discharged.

Bulk and *Finishing* − the main sections of the charge. There is no difference between the function of the bulk and finishing slots, but the display will indicate which slot is active, and the time in each slot will be logged separately.

Equalise − this slot may be run after the main charge (bulk and finishing slots) has completed. Operator input will trigger it, or one of the conditions set in the Equalise Settings of the Web UI.

Maintenance − this slot will be run when the main charge has completed and one of the optional conditions that trigger a maintenance charge is true as defined in the Global Settings. The maintenance charge may be run a number of times and may occur before or after the equalise charge.

A slot that does not have any contents will not be run, regardless of any conditions.

A charge profile is also independent of cell count and battery capacity. All parameters are defined in terms of current rate (in A/100Ah) and cell voltage.

Selecting or Creating Profile

The profile being viewed or edited is selected using the dropdown menu at the top of the page:

Profile Builder

Flooded Conventional
Flooded Opportunity
Flooded Fast
AGM Conventional
Gel Conventional
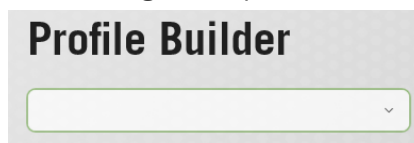
Editing a Profile – Global Settings

The following parameters apply to the entire charge profile:

Name – selects the name of the profile that will be shown on the *Configuration* page and the front panel display. Enter a new name as required.

Name: Gel Conventional

Pre-Charge Threshold – sets the cell voltage threshold for the pre-charge slot. When a battery is connected with a cell voltage threshold below this the pre-charge slot will be run. This can be set to 0 if the pre-charge slot is not used.

Pre Charge Threshold: 0 V/Cell

Maintenance Start Threshold – when enabled sets the cell voltage threshold for the maintenance slot. If the cell voltage of the battery falls to this value when in the complete state, the maintenance slot will be run. Select *Disable* if the maintenance stage is not to be started based on the cell voltage.
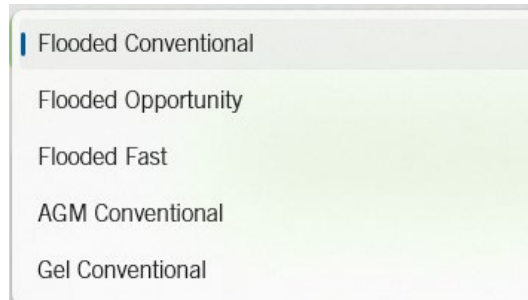

Maintenance Start Threshold: On 0 V/Cell

Maintenance Start Delay – when enabled sets the time delay threshold for the maintenance slot. If the battery is still connected to the charger in the complete state after this time has elapsed since the last charge of any type the maintenance slot will be run. The start threshold should be disabled if start delay is not used.

Maintenance Start Delay: Hours Minutes Seconds

Note that the maintenance slot will be run when either the cell voltage or time conditions are met.

Allow Equalise – sets whether this profile is allowed to run an equalise charge. If this is set to *Off* an equalise charge will never be run, even if there are conditions set in the *Advanced Setup* page and the equalise slot has content.

Allow Equalise On

Allow Auto-Watering – sets whether this profile is allowed to run an automatic watering cycle. If this is set to *Off* a watering cycle will never be run, even if there are conditions set in the *Advanced Setup* page.

Allow Auto Watering Off

Start Threshold Minimum and *Start Threshold Maximum* – together these set the valid range of cell voltage at the start of a charge. When a battery is connected a charge will start only if the cell voltage is between these two thresholds. If it is outside these thresholds the *Incorrect Battery* alarm will be triggered.

Start Threshold Minimum: 1.5 V/Cell
Start Threshold Maximum: 2.3 V/Cell

Nominal Cell Voltage — sets the nominal cell voltage of the charge profile. This should match the ratio of nominal battery voltage for all nominal battery voltages that are to be used with the profile.

| Nominal Cell Voltage: | 2 | ∧ ∨ | V/Cell |

Equalise Lockout Time — sets the minimum time the battery must spend in complete state before a equalise charge can start.

| Equalise Lockout Time: | | ∧ ∨ | Hours | | ∧ ∨ | Minutes | 0 | ∧ ∨ | Seconds |

Over Discharge Cell Voltage and *Over Discharge Retest Time* — the charger can perform an over discharge test on a battery. If a battery is connected with a cell voltage below the *Over Discharge Cell Voltage* the charge raises one of two alarms. If after the *Over Discharge Retest Time* the cell voltage is above the *Over Discharge Cell Voltage* the charger triggers the *Deeply Discharged Battery* alarm, and charging is allowed to continue. If after the *Over Discharge Retest Time* the cell voltage is still below the *Over Discharge Cell Voltage* the charger triggers the *Over Discharged Battery* alarm, and charging stops.

| Over Discharge Cell Voltage: | 1.9 | ∧ ∨ | % |
| Over Discharge Retest Time: | | ∧ ∨ | Hours | | ∧ ∨ | Minutes | 30 | ∧ ∨ | Seconds |

Minimum Starting Rate, Maximum Starting Rate, Maximum Finishing Rate and *Minimum Finishing Rate* — these set the range over which the starting and finishing rates can be adjusted by a user with an access level of at least advanced.

Min Starting Rate	10	∧ ∨	A/100Ah
Max Starting Rate	20	∧ ∨	A/100Ah
Min Finishing Rate	1	∧ ∨	A/100Ah
Max Finishing Rate	4	∧ ∨	A/100Ah

Start Up Battery Over Temperature — sets the maximum battery temperature that a charge is allowed to start at. If the temperature of the battery exceeds this value a charge start is terminated and the *Over Temp — Start of Charge* alarm is triggered.

| Start Up Battery Over Temperature | 55 | ∧ ∨ | ºC |

Charging Battery Over Temperature — sets the maximum battery temperature that a charge will be allowed to continue at. If the temperature of the battery exceeds this value during a charge the *Over Temp — During Charge* alarm is triggered and the charge terminated.

| Charging Battery Over Temperature | 60 | ∧ ∨ | ºC |

Battery Restart Temperature — sets the battery temperature at which an automatic restart is allowed. When a charge is stopped by *Over Temp — During Charge* or *Over Temp — Start of Charge* alarm it automatically restarts if the battery's temperature falls to this value.

| Battery Restart Temperature | 45 | ∧ ∨ | ºC |

Minimum Equalise Start Temperature and *Maximum Equalise Start Temperature* — these set the range over which an equalise charge is allowed to start. If a battery is outside of this temperature range when an equalise charge is scheduled to start the charge pauses until the battery's temperature rises or falls to within this range.

| Min Equalise Start Temperature | 0 | ∧ | ∨ | °C |
| Max Equalise Start Temperature | 50 | ∧ | ∨ | °C |

Editing a Profile — Parameters for Each Slot

The slot being viewed or edited is selected by clicking the tab for that slot at the top of the slot and stage section of the page.

| | | Bulk Charge | Finishing | Equalise | Maintenance |
| Global Settings | | | | | |

Pre Charge
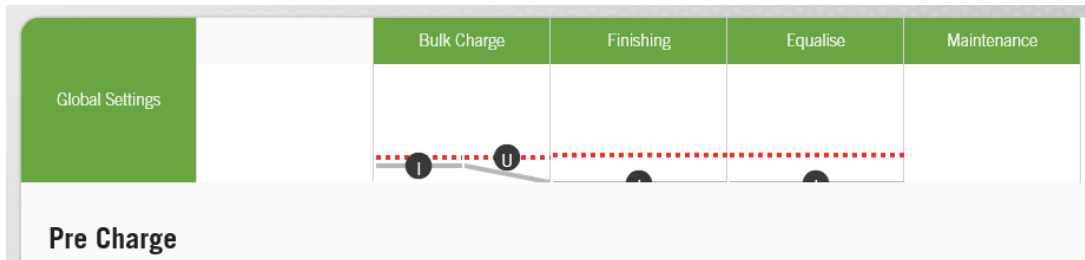
The selected slot blanks out. The stages in each slot are also shown below.

The following parameters can be set for each slot:

Slot Timeout — sets a time limit for the slot. If a charge remains in this slot until this limit is reached during a charge that slot's timeout alarm will be triggered, and the charge will stop. The *disable* checkbox should be checked if you do not wish to place a time limit on the slot.

| Slot Timeout | | ∧ | ∨ | Hours | | ∧ | ∨ | Minutes | 0 | ∧ | ∨ | Seconds |

Slot Capacity Timeout — sets a limit on how much of the battery's capacity may be returned in the slot. If more than this proportion of the battery's capacity is returned within a slot that slot's timeout alarm will be triggered, and the charge will stop. The *Slot Capacity Timeout* slider should be set to *Off* if you do not wish to place a capacity limit on the slot.

| Slot Capacity Timeout | ⬤ On | 9 | ∧ | ∨ | % |

Timeout Behaviour: Note that the timeout alarm will be triggered if either the *Slot Timeout* or *Slot Capacity Timeout* limits are reach. The alarm behaviour can be set in the dropdown menu.

| Timeout Behaviour | | ∨ |

| Default |
| Termination |
| Urgent |

Stage List — shows the stages that are present in this slot. The stages will be run in order from left to right during a charge. The stage shaded green is selected, and its parameters can be set in the stage parameters section. The plus (+1) button at the right end of the list can be used to add another stage to the slot, up to a maximum of three stages.
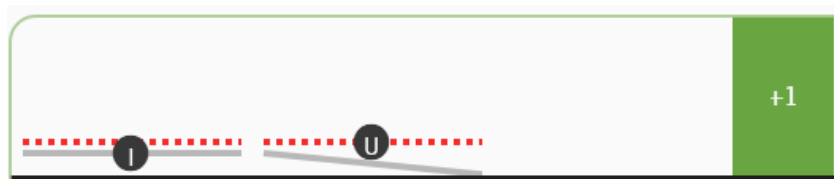
Add, Move and Delete — the arrow buttons can be used to move the selected stage within the slot. The page icon adds a new stage while the bin icon deletes the selected stage.

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Editing a Profile – Parameters for Each Stage

The stage that is to be edited can be selected from the stage list in the slot parameter section. The selected stage will be shaded light grey in that list.

The following parameters can be set for each stage:

Stage Mode – sets whether the stage is constant voltage or constant current.

Const. Current **I**	Const. Voltage **U**

Set Voltage and *Set Current* – these set the maximum current and voltage that the stage will reach at any point. For a constant current stage the *Set Current* would be set to the stage current rate, and the *Set Voltage* would be set to the highest voltage the stage will reach, usually this will match the *Termination* voltage.
For a constant voltage stage the *Set Voltage* would be set to the setpoint for the stage, and the *Set Current* would be set to the maximum current expected in the stage, often the termination current of the previous stage.

Set Voltage:	2.33	^ v	V/Cell
Set Current:	16	^ v	A/100Ah

Termination – sets the termination value for the stage. When the stage is constant current mode this is a maximum voltage, when the stage is constant voltage mode this is a minimum current.

When in constant current mode:

Termination:	1.5	^ v	V/Cell

When in constant voltage mode:

Termination:	1.5	^ v	A/100Ah

Derivative Limit – this parameter has a different behaviour depending on the mode of the stage.
When the stage is constant current this sets the level of a minimum dV/dt (rate of voltage change with respect to time) termination. The *Minimum dV/dt* alarm will be triggered when the rate falls below the *Derivative Limit*.

Derivation Limit:	On	20	^ v	V/15min/cell

When the stage is constant voltage this sets the level of a maximum dI (difference in current) termination. The *Positive dI/dt* alarm will be triggered if the current increases by more than this limit beyond the minimum current it had reached in a stage.

Derivation Limit:	On	20	^ v	A

For example, take a constant voltage stage with a limit of 20A. If this stage was to start at a current of 100A, which reduced down to 30A, then increased to 51A, the *Positive dI/dt* alarm would be triggered and the charge stops.
The *Derivation Limit* should be set to *Off* if you do not wish to place a derivative limit on the slot.

Derivation Limit:	Off

Timeout – when enabled sets a time limit for the stage. If a charge remains in this stage until this limit is reached during a charge that slot's timeout alarm will be triggered, and the charge will stop.

Timeout:	On	^ v	Hours	^ v	Minutes	^ v	Seconds

Capacity Timeout – when enabled sets a limit on how much of the battery's capacity may be returned in the slot. If more than this proportion of the battery's capacity is returned within a slot that slot's timeout alarm will be triggered, and the charge will stop.

Timeout Behaviour — sets the type of alarm that is raised when a timeout occurs.

Temperature Compensation — sets the temperature compensation coefficient for the stage. This coefficient is multiplied by the *Typical Battery Temperature* when a *Fixed* or *Auto-Voltage* configuration is in use, or the temperature measured by the BMM when a *BMM Enabled* configuration is in use. The product is then used to adjust the voltage setpoints of the *Set Voltage* and *Termination* voltage (if the stage is constant current).

Control Set Current with Start Rate, Control Set Current with Finish Rate and *Control Termination with Finish Rate* — these three controls are used to link the *Starting Current* and *Finishing Current* controls on the *Configuration* page to the charge profile.

Control Set Current with Start Rate — would usually be used for a constant current first stage of a profile. It may also be used for the second stage if it is a constant voltage stage of an IUa or IUIa profile.

Control Set Current with Finish Rate — would usually be used for a third stage in an IUIa profile.

Control Termination with Finish Rate — would usually be used for the constant voltage second stage of an IUIa profile.

If *Control Set Current with Start Rate* is not set to *On* for one of the stages in the profile, then the *Starting Rate* will not be editable.

If *Control Set Current with Finish Rate* and *Control Termination with Finish Rate* is not set to *On* for one of the stages in the profile, then the Finishing Rate will not be editable.

G3 Profile Function Bar

Read Profile: reads the existing profile on the BMM (if present) and populates the G3 Profile page fields accordingly.

Write Profile: writes the current G3 Profile page configuration to the BMM.

Load File: loads a G3 profile *.json file from the device.

Save File: saves the G3 Profile page configuration to a *.json file on the device.

Logs — Charge

NOTE: Logs may not automatically download and display if the option to do so is disabled on the Application Settings page. When connected to a BMM select *Refresh* to update logs that have automatic download *Off*.

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State	Charging	Idle	Charging	Idle	Charging
Start Time	22/01/2024 7.49pm	22/01/2024 7.48pm	22/01/2024 7.27pm	19/01/2024 1.54am	19/01/2024 1.54am
End Time	22/01/2024 10.49pm	22/01/2024 7.49pm	22/01/2024 7.48pm	22/01/2024 7.27pm	19/01/2024 1.54am
Duration	02:59:59	00:01:00	00:20:37	3.17:32:50	00:00:25
Start SOC %	49.27	49.27	47.62	47.44	47.38
End SOC %	62.81	49.27	49.27	47.62	47.44
Start Voltage	2.27	2.3	2.21	2.22	2.26
End Voltage	2.31	2.27	2.3	2.2	2.23
Min. Voltage	2.27	2.24	2.21	2.05	2.23
Max. Voltage	2.43	2.3	2.44	2.22	2.33

The charge log of the connected BMM populates this page when opened.

Select *Export CSV* to download the connected BMM charge log to the device.

Charge logs of other previously connected BMMs can be selected and viewed from the dropdown menu.

EMPBMM-2301019893.json

EMPBMM-2301019922.json

EMPBMM-2305007944.json

An entry in this log is created each time the BMM changes state. There are three states:

Charge – where the battery is connected to a charger and being recharged.

Discharge – where the battery is connected to a load and being discharged.

Idle – where a battery may or not be connected to a load or charger, but minimal current is flowing through the battery.

Note that log entries for the Charge and Discharge states can include time where the battery is idle. The BMM state transitions from *Discharge* to *Idle* when the discharge current flow has been below the idle current threshold for 120 minutes. Similarly the BMM state transitions from *Charge* to *Idle* when the charge current flow has been below the idle current threshold for 30 minutes.

> The transition times can be changed. The transition time set on a BMM can be viewed and altered using the BMM Settings page *Discharge to Idle Transition Time.*

The meaning of each parameter is detailed below:

- *State* – the state the BMM was in during this log entry: charge, discharge or idle.
- *Start Time* and *End Time* – the time that the charge, discharge or idle period started and ended according to the BMM's real time clock.
- *Duration* – the length of the log entry period.
- *Start State of Charge* and *End State of Charge* – the state of charge at the start and end of the period as a percentage of a full charge.
- *Start Voltage* and *End Voltage* – the total battery voltage at the start and end of the period.
- *Min. Voltage* and *Max. Voltage* – the lowest and highest total battery voltages measured at any point during the period.
- *Start Temperature* and *End Temperature* – the battery temperature at the start and end of the period.

- *Min. Temperature* and *Max. Temperature* — the lowest and highest battery temperature measured at any point during the period.
- *Min. Current* and *Max. Current* — the lowest and highest battery current measured at any point during the period.
- *Capacity* — the capacity returned to the battery by the charger during a charge period or the capacity discharged from the battery during a discharge period. This field is zero for an idle period.
- *Regen Capacity* — the capacity returned to the battery by regenerative charging during a discharge period. This field will be zero during idle and discharge periods.
- *Charge kWh* — the energy returned to the battery by the charger during a charge period. This field will be zero for a discharge or idle period.
- *Alarms* — a list of any BMM alarms that were triggered during this period.
- *Idle Time* — the length of time that the battery was idle within a charge or discharge period. There are a number of reasons idle time can be found outside of idle periods, including:
    - Delays between parts of a charge, such as between a main and equalise charge, that are less than the charge to idle transition time.
    - Idle periods during discharge that are less than the discharge to idle transition time.
    - The idle time field within an idle period will be zero.
- *Over Discharge Time* — the time during a period where the battery voltage was less than 1.8V/cell.
- *Charge Termination* — a list of all the charger alarms that were active where a charge period ended. This is blank for a discharge or idle period.
- *Total Charge Time, Bulk Charge Time, Finishing Charge Time,* and *Equalise Charge Time* — the total time spent charging as well as the times spent in the bulk, finishing, and equalise parts of the charge respectively. These fields are zero for a discharge or idle period.
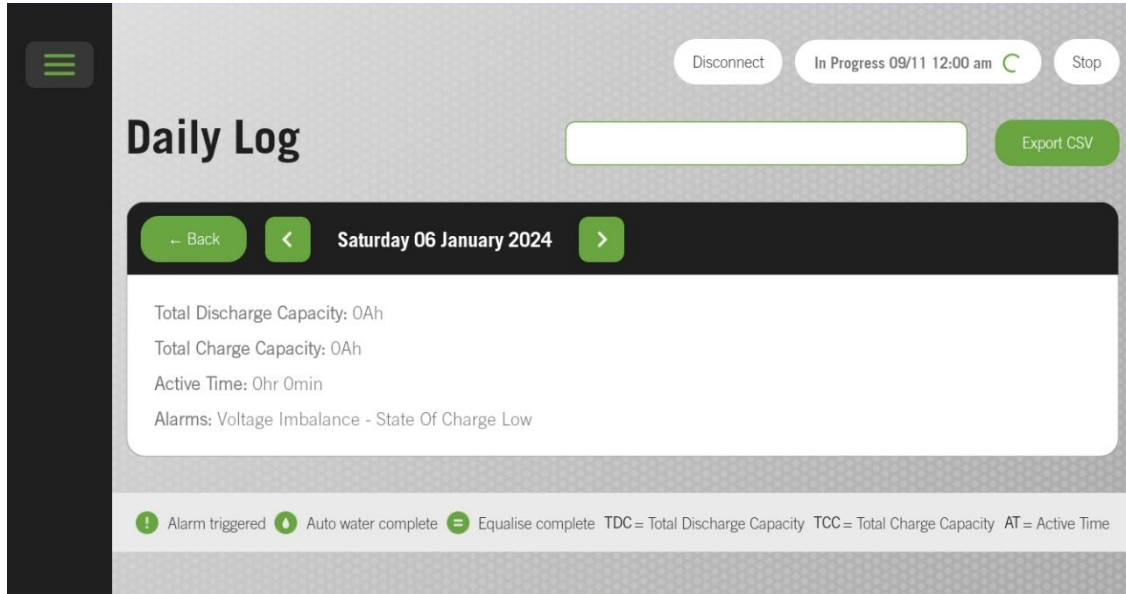
Logs — Daily

NOTE: Logs may not automatically download and display if the option to do so is disabled on the Application Settings page. When connected to a BMM select *Refresh* to update logs that have automatic download *Off*.

The Daily log is an overview of the BMM equipped battery's performance each day. The connected BMM's Daily log populates this page when opened.
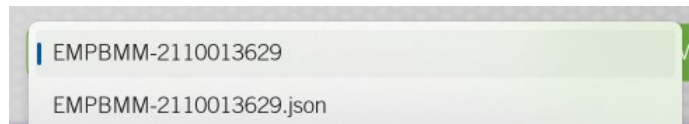
When first downloaded from the BMM the Daily logs display in a monthly format. Select the required month to view from the *Select Month* dropdown menu.
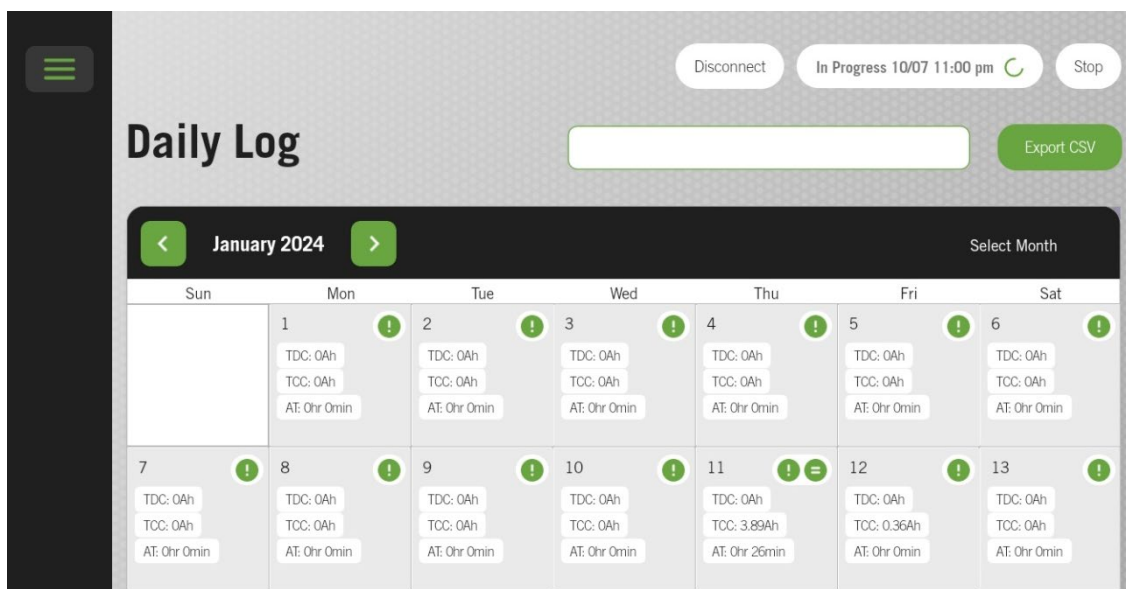
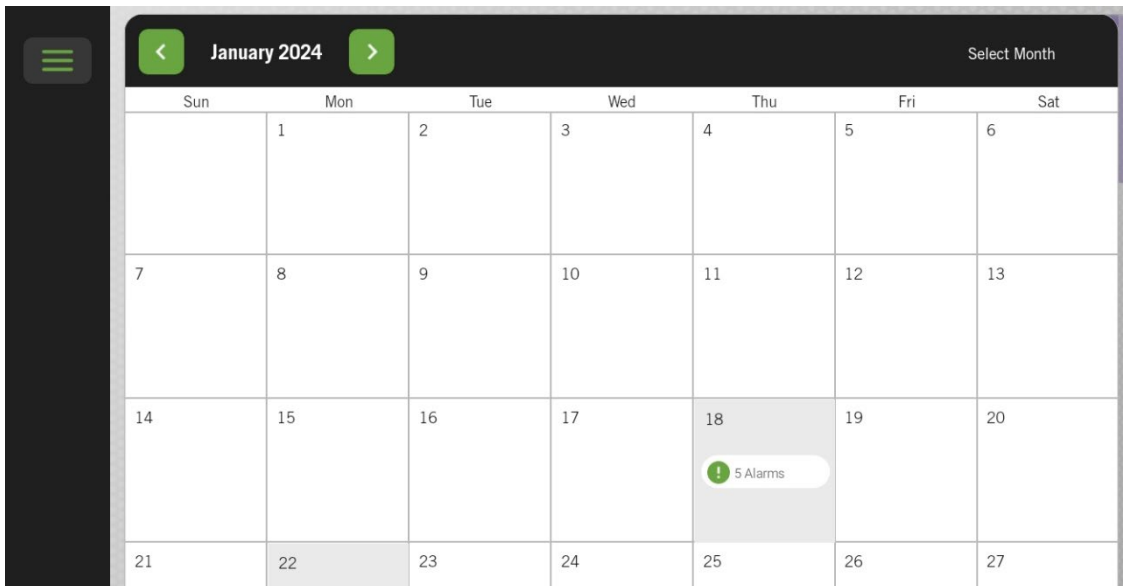To view specific daily logs select the required date.

To view other BMM's Daily logs previously connected select the required BMM from the dropdown menu.
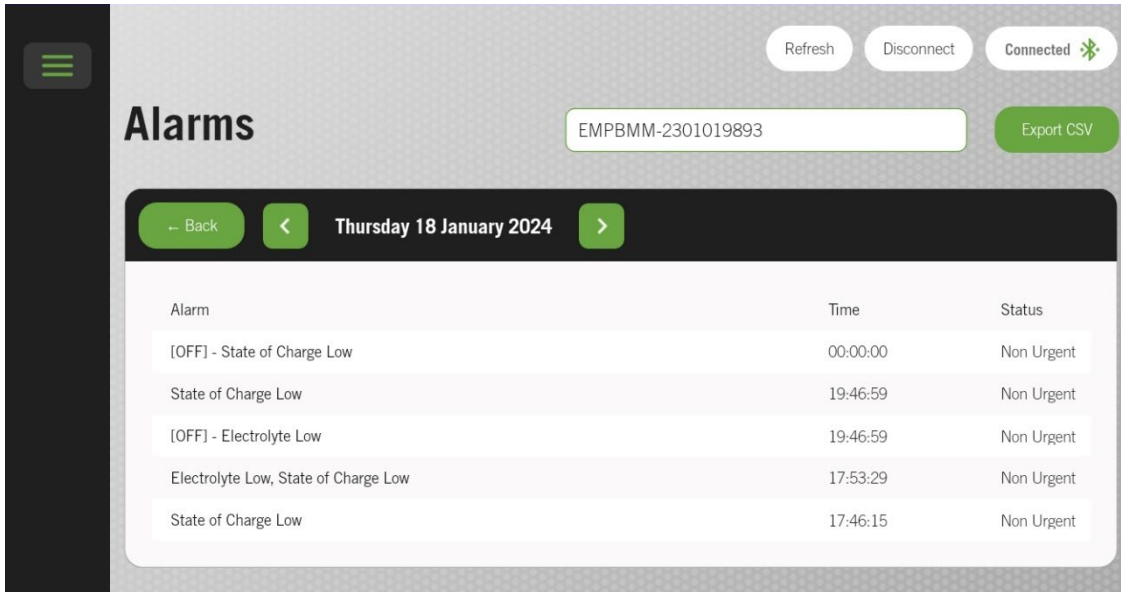

Logs — Alarms

NOTE: Logs may not automatically download and display if the option to do so is disabled on the Application Settings page. When connected to a BMM select *Refresh* to update logs that have automatic download *Off*.

A connected BMM's alarms data populates the page when opened.

When first downloaded from the BMM the Alarm logs display in a monthly format. Select the required month to view from the *Select Month* dropdown menu.

To view specific alarms raised select the required day.

![ECOCHARGE logo]

To view the alarms of previously connected BMMs selected the required BMM from the dropdown menu.
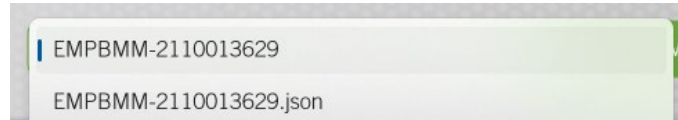
Logs − Periodic

The Periodic logs are a time and date stamped record of the selected battery module voltage, current and temperature.

To view the Periodic logs select *Export CSV* to download the records to the device.
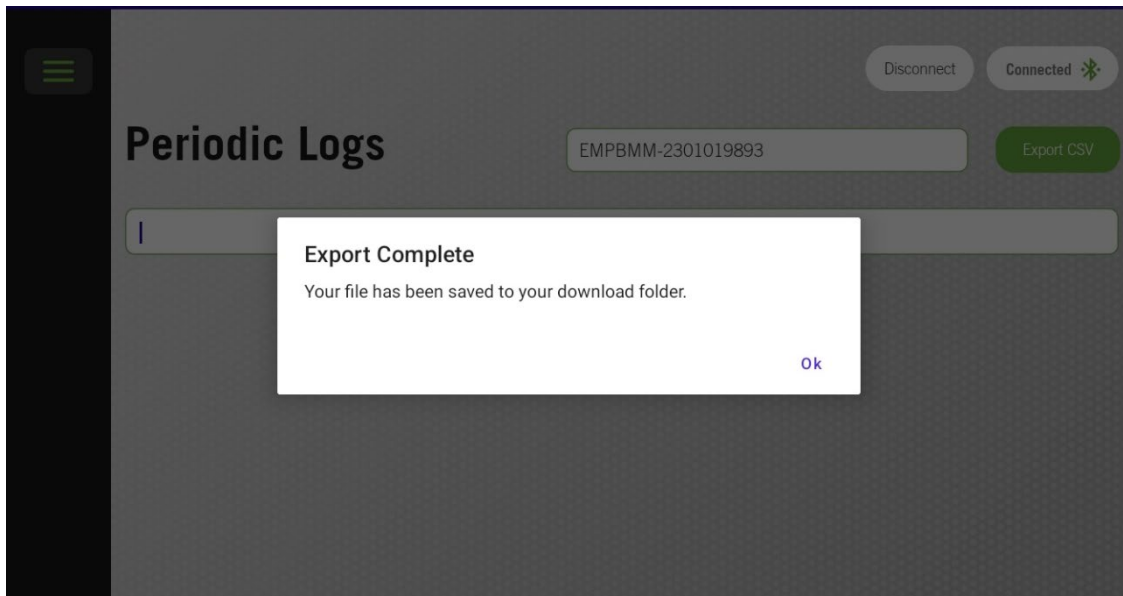
Logs − Lifetime Counters

NOTE: Logs may not automatically download and display if the option to do so is *Off* on the Application Settings page. When connected to a BMM select *Refresh* to update logs that have automatic download disabled.

The Lifetime Counters are statistics recorded since installing the BMM on a battery.

When connected to a BMM the page populates with the connected BMM's data.

Lifetime Counters — EMPBMM-2301019893

Capacity Returned by Charger	2441.57	Capacity Discharged	269.93
Capacity Returned by Regen	1.04	Auto Water Cycles	1
Average Daily Charge	0	Average Daily Discharge	268.84444444444443
Average Daily Regen	0	Average Start Rate	14.651707317073171
Average Temperature °C	16.64	Complete Cycles	26
Cycles Since Auto Watering	67	Cycles Since Imbalance Alarm Activated	0
Cycles Since Last Equalisation	0	Cycles Since Water Level Low Activated	0
Cycles Using Fast Charge Profile	22	Cycles With High DOD	8

The lifetime counters are initiated from the date that the battery module was installed to the battery. The meaning of each counter is detailed below:
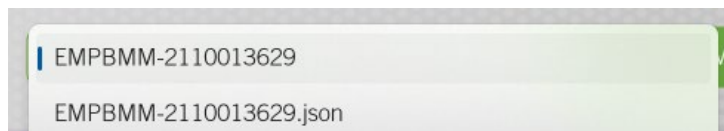
- *Capacity Returned by Charger* — the total capacity returned to the battery during all charge periods.
- *Capacity Discharged* — the total capacity discharged from the battery during all discharge periods.
- *Capacity Returned by Regen* — the total capacity returned to the battery by regenerative charging during all discharge periods.
- *Auto Watering Cycles* — the total number of automatic watering cycles performed on the battery.
- *Average Daily Charge* — the average capacity returned to this battery during charge periods each day.
- *Average Daily Discharge* — the average capacity discharged from this battery during discharge periods each day.
- *Average Daily Regen* — the average capacity returned to the battery from regenerative charging during discharge periods each day.
- *Average Start Rate* — the average starting rate measured over all charge periods.
- *Average Temperature* — the average temperature measured for this battery.
- *Complete Cycles* — the total number of charge periods determined either because the charger communicates to the BMM that the charge completed or the minimum dv/dt threshold is met if not communicating with charger.
- *Cycles Since Auto Watering* — the number of charge periods since an automatic watering cycle last took place.
- *Cycles Since Imbalance Alarm Activated* — the number of charge periods since the *Voltage Imbalance* BMM alarm was triggered.
- *Cycles Since Last Equalise* — the number of charge periods since an equalise charge last took place.
- *Cycles Since Water Level Low Activated* — the number the number of charge periods since the *Water Level Low* BMM alarm was triggered.
- *Cycles Using Fast Charge Profile* — the number of charge periods for this battery where the start rate has met or exceeded 40A/100Ah.
- *Cycles With High DOD* — the number of discharge periods where the depth of discharge has exceeded 80% (where the state of charge has fallen below 20%).
- *Cycles With High Temperature* — the number of charge periods where the *High Temperature* BMM alarm was triggered.
- *Cycles With Imbalance Alarm* — the number of charge periods where the *Voltage Imbalance* BMM alarm was triggered.
- *Cycles With Long Rest Time* — the number of charge periods where the cooldown period after the charge exceeded four days.

- *Cycles With Low DOD* – the number of discharge periods where the depth of discharge has not exceeded 20% (where the state of charge has not fallen below 80%).
- *Cycles With Low Temperature* – the number of charge periods where the *Low Temperature* BMM alarm was triggered.
- *Cycles With Short Rest Time* – the number of charge periods where the cooldown period after the charge was less than one hour.
- *Cycles With Water Level Low* - the number of charge periods where the *Water Level Low* BMM alarm was triggered.
- *Equalise Cycles* – the total number of charge periods that included an equalise charge.
- *Finish Charge Time* – the total time logged as *Finishing Charge Time* in all charge periods.
- *Low Water Level Time* – the total time where the *Water Level Low* BMM alarm was active.
- *Maximum Start Rate* – the maximum starting rate measured in all charge periods.
- *Maximum Temperature* – the maximum battery temperature measured at any point.
- *Minimum Start Rate* – the minimum starting rate measured in all charge periods.
- *Minimum Temperature* – the minimum battery temperature measured at any point.
- *Over Discharge Time* – the total time logged as *Over Discharge Time* (time during which the battery's cell voltage was less than 1.9V/cell) in all charge periods.
- *Total Cycles* – the total number of charge periods logged.
- *Energy Returned by Charger* – the total energy returned to the battery during all charge periods.
- *Energy Discharged* – the total energy discharged from the battery during all discharge periods.
- *Energy Returned by Regen* – the total energy returned to the battery by regenerative charging during all discharge periods.
- *Weeks With Failed Equalise* – number of weeks where the battery has not received an equalise charge. Note that an interrupted charge is still recorded as having received a charge when considering this functionality.

The counters can be reset when installing an existing battery module to a new battery. The lifetime counters can be exported in *.csv format and downloaded to the device by selecting the *Export as CSV* button.

Select the required BMM lifetime counter log from the dropdown menu for the Lifetime Counter data of previously connected BMMs.

EMPBMM-2110013629

EMPBMM-2110013629.json

BMM Settings

BMM Settings

Update Firmware

Firmware: [   ]   Select File   Update Firmware

The firmware is updated from a *.**bin** file which needs to be obtained and made available on the device. *Select File* then select *Update Firmware* to update the BMM firmware.

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Logging Settings

Logging Settings

Discharge to Idle Transition Time:	120	Minutes
Charge to Idle Transition Time:	30	Minutes
Regen to Charge Transition Time:	1	Minutes
Idle Current threshhold:	5	Amps
Periodic Log Sampling Interval:	1	Minutes

Discharge to Idle Transition Time – sets how long a BMM must have recorded no discharge current before moving from the Discharging to the Idle state.

Charge to Idle Transition Time – sets how long a BMM must have recorded no charge current before moving from the Charging to the Idle state.

Regen to Charge Transition Time – sets the wait period from when a BMM first starts to measure positive current to when the BMM decides it is connected to a charger. If a BMM is tracking a discharge and starts to measure a positive current, the BMM first assumes the positive current comes from regenerative braking in a truck. If the positive current continues for long enough the BMM then assumes it must be connected to a charger instead. The *Regen to Charge Transition Time* dictates how long that wait period is.

Idle Current Threshold – sets the current below which the battery is considered to be idle. This affects how the BMM moves between the Discharge and Idle states. The threshold should be set so that it exceeds the load drawn from the battery when the truck is idle (the combined load of and lights, heaters, and so forth).

Periodic Sampling Interval – sets the time between each entry recorded in the BMM data log for the periodic log. The default is about 2 weeks of logs for an interval of 1 minute. Once the maximum log entries is reached the earliest logs are over-written.

Alarm Settings

Alarm Settings

High Temperature Alarm Threshold:		°C
Low Temperature Alarm Threshold:		°C
Start Up Over Alarm Threshold:		°C
Change Over Temperature Threshold:		°C
State of Charge Alarm Threshold:		%
State of Health Alarm Threshold:		%
Voltage Imbalance Alarm Threshold:		Volts

High Temperature Alarm Threshold – sets the battery temperature which triggers the *Temperature High* BMM alarm when the BMM temperature sensor reads higher.

Low Temperature Alarm Threshold — sets the battery temperature which triggers the *Temperature Low* BMM alarm when the BMM temperature sensor reads lower.

Start Up Over Temperature Threshold — sets the battery temperature which triggers the *Over Temp — Start of Charge* alarm when the BMM temperature sensor reads higher as the operator attempts to start a charge.
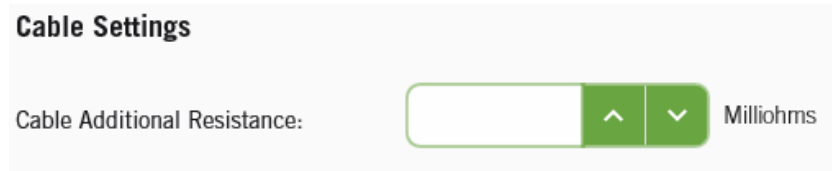
Charging Over Temperature Threshold — sets the battery temperature which triggers the *Over Temp — During Charge* alarm when the BMM temperature sensor reads higher during a charge.

State of Health Alarm Threshold — sets the state of charge which triggers the *State of Health Low* BMM alarm when the BMM has determines the battery's state of health is lower.

State of Charge Alarm Threshold — sets the state of charge which triggers the *State of Charge Low* BMM alarm when the BMM determines the battery's state of charge is lower.

Voltage Imbalance Alarm Threshold — sets how far the midpoint voltage must differ from half of the total battery voltage before the *Voltage Imbalance* BMM and charger alarms are triggered.
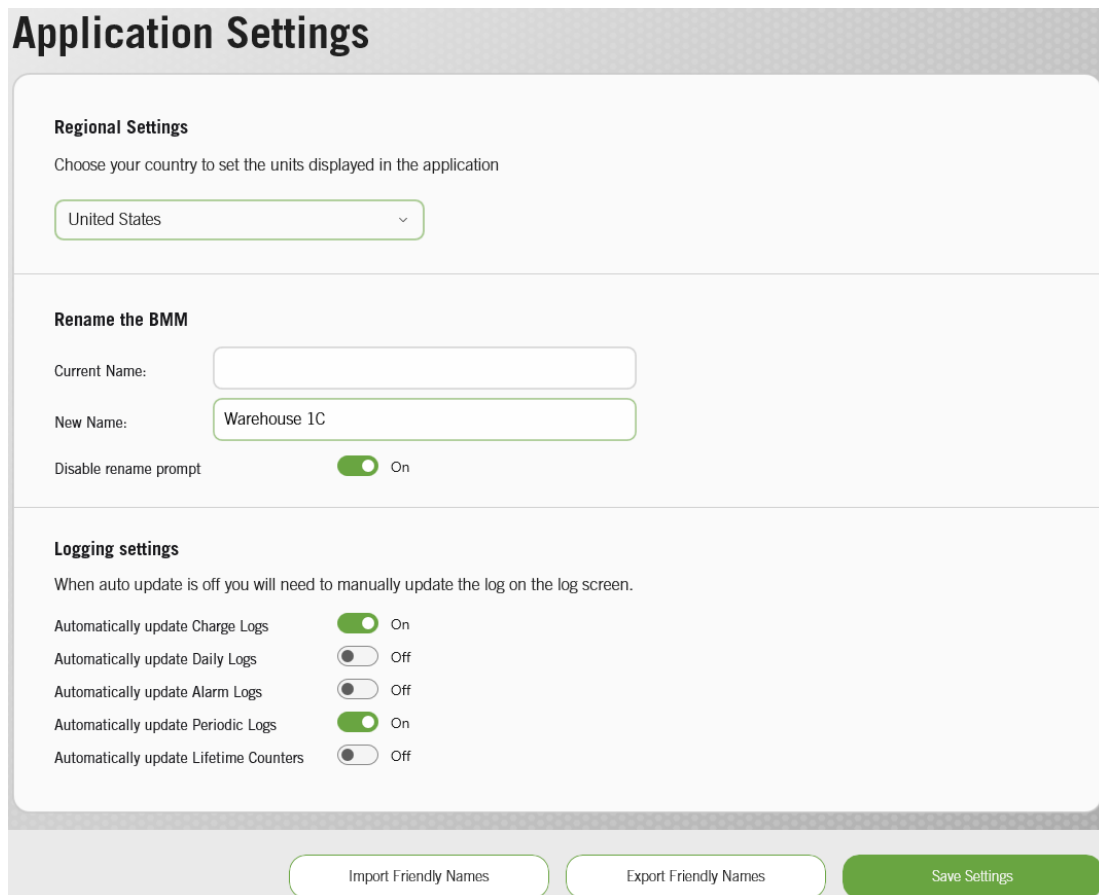
Cable Settings

If a BMM-BT3 is connected an additional field displays:

Enter any additional resistances that may affect the cable resistance calculation in the *Cable Additional Resistance* field.

Application Settings

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Regional Settings

Regional Settings: the app units displayed and time zones are determined by the location selected from the drop down menu.

Rename the BMM

Rename the BMM: the BMM can be given a name, termed a 'friendly name' that displays to identify the BMM in the app and charger. This name is associated with the BMM serial number.

Disable rename prompt: turn *On* to disable the popup window that displays when first connecting to a BMM providing the option to rename the BMM.

Logging Settings

This is a point of user preference. Turn *Off* before downloading a very large file that you may not wish to have the log continually updating with fresh data which can significantly extend the download time. When Off the log requires manually refreshing to update its data.

Import Friendly Names: a *.json file of friendly names can be imported which automatically assigns friendly names to BMMs with the associated serial number.

Export Friendly Names: a *.json file can be exported so that the friendly names assigned to BMMs from this app can be replicated across other devices.

Save Settings: select the *Save Settings* button to save changes to the BMM and app.

This is the end of the BMM Support Application Technical Manual

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