



NUVATION BMS™

Operator Interface Guide (Multi-Stack)

Nuvation BMS™ Grid Battery Controller

2018-10-08, Rev. 2.0, Babbage 18.08

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1. Introduction

Thank you for choosing Nuvation BMS™

Nuvation BMS™ manages rechargeable battery cells by limiting operation to within the cell's safe operating range, monitoring the state of the cells, estimating State-of-Charge and State-of-Health, reporting measured data, and interacting with the energy storage system controller.

Nuvation BMS™ Operator Interface is a platform-agnostic (i.e. Windows, Linux, Mac, mobile OS) plug-and-play user interface. It allows energy storage system operators to manage the operation of Nuvation BMS modules as well as internal and external communications.

With battery management system, operators achieve peace of mind that their cells are protected.

1.1. About this Guide

This *Operator Interface Guide (Multi-Stack): Nuvation BMS™ Grid Battery Controller* covers the graphical dashboard and control of your Nuvation BMS™ via the Operator Interface.

This guide covers multi-stack installations using a Nuvation BMS™ Grid Battery Controller. If you are using a Nuvation BMS™ High-Voltage Stack Controller or a Nuvation BMS™ Low-Voltage Battery Controller please refer to the *Operator Interface Guide Single Stack*.



For purposes of this document, a multi-stack is defined as an installation that uses a Nuvation BMS™ Grid Battery Controller to aggregate information from multiple stacks.



This document applies to Nuvation BMS Babbage 18.08 software release (Operator Interface version 0.38.0). Content may be inaccurate or incomplete for other versions.

We thrive on your feedback and what we build is driven by your input. Please submit support tickets to support@nuvationenergy.com.

2. Setting up your Grid Battery Controller

2.1. Overview

Your Grid Battery Controller allows you to control multiple stacks. You will need to setup and provision each stack before you start setup and provisioning of your Grid Battery Controller



For instructions on how to wire your Nuvation BMS to your energy storage system please refer to the *Nuvation BMS Installation Guide*

To get started with the configuration and setup your Grid Battery Controller you need to:

1. [Network Configuration](#)
2. [Provision your Stacks](#)
3. [Access the Operator Interface](#)
4. [Import the Configuration File](#)
5. [Enable and Connect your Stacks](#)

Let's get started...

2.2. Network Configuration

Network Ports

The GBC has two ethernet ports that manage two separate networks. The following table describes these ports their function and the label name of the port on the physical GBC.

Port Name	Function	Port Label
External	<ul style="list-style-type: none"> • Manage network traffic external to the GBC • Operator Interface is accessed from this port 	ETH2
Internal	<ul style="list-style-type: none"> • Manage traffic from battery management system stacks 	ETH1

The default network settings of these ports are as follows:

Port Name	IP Setting	IP	Gateway
External	DHCP	N/A	N/A
Internal	Static	192.168.4.10	255.255.255.0



The MAC address for the external port is labeled on the front of the GBC. Look for this address in the DHCP server to determine which IP address was assigned to the GBC.

You can change the external and internal port IP configuration through the register interface provided in the Multi-Stack Operator Interface. The process is similar to updating the IP configuration on the BMS single stack except that you use the `gbc_ext_ethernet` and the `gbc_int_ethernet` components. Refer to [modifying network IPs](#) section for details of the process.



Improperly modifying the network settings can result in a Grid Battery Controller that cannot communicate over Ethernet. Refer to the *Troubleshooting* section in the Grid Battery Controller Software Reference Manual if the IP address is unknown



Be sure to record the updated IP address, netmask, and gateway settings if you decide to make changes to these settings.



Do not set the Internal network to use DHCP. Currently the Grid Battery Controller does not provide a DHCP server to assign IPs to the stacks.



The Grid Battery Controller does not require an internet connection to function. However it does use the Network Timing Protocol (NTP) to maintain its clock settings to Coordinated Universal Time (UTC). If the clocks are not able to be updated by NTP, then the GBC software upgrade and remote service connections could fail. The Grid Battery Controller Upgrade AppNote provides details on how to work around this issue.

Modify Grid Battery Controller Network Settings

1. Launch the Multi-Stack Operator Interface for the Grid Battery Controller
2. Unlock the Multi-Stack Operator Interface by clicking the menu and Unlock
3. From the menu, select Registers to bring up the register browser page
4. Under the Manual Register Configuration panel, expand the row for Component Name `gbc_int_ethernet` or `gbc_ext_ethernet` for the external and internal network interfaces respectively.



Use the find feature (Ctrl + F) in your browser to locate components in the page

Register Offset	Register Name	Description	Type	Units	Storage	
0x0	use_dhcp	Flag indicating if DHCP is used	Boolean	Flag	Configuration	Edit
0x1	ip_address	IP address to be used in static configuration	IpAddress	IP	Configuration	Edit
0x2	net_mask	Network mask to be used in static configuration	IpAddress	IP	Configuration	Edit
0x3	gateway	Gateway address to be used in static configuration	IpAddress	IP	Configuration	Edit
0x4	mac	MAC address of this board	UInt64	Value	Manufacturing	Edit
0x5	nameserver	Nameserver to be used in static configuration	IpAddress	IP	Configuration	Edit



The index field may be left blank for all operations.



Changing the `gbc_int_ethernet` configuration to a different network will require all BMS stack IPs to be updated as well.



The internal and external networks cannot be configured to be the same network. The Grid Battery Controller will not function properly with this configuration. If you are using DHCP on the external network, make sure that it's network settings do not match the internal network configuration.

Depending on the type of port configuration required you will follow one of the two configuration options

Static IP Setting

1. Click the Edit button on the `ip_address` register. This will bring up the Edit Register dialog box
2. Change the IP address to an IP4 standard address (e.g. 192.168.10.1). Then click Write
3. Click the Edit button on the `net_mask` register. This will bring up the Edit Register dialog box
4. Change the network mask to the proper setting for the network. (e.g. default value for the internal network is 255.255.255.0). Then click Write
5. For the external network, update the `gateway` register for the network gateway IP.
6. For the external network, update the `nameserver` register used by the network. This address is defaulted to 8.8.8.8 which is the Google public DNS server.

Dynamic Host Configuration Protocol (DHCP) Setting

1. Click the **Edit** button on the `use_dhcp` register. This will bring up the **Edit Register** dialog box
2. Change the setting to one and then click **Write**
3. Confirm that the value has been updated by clicking **Read**

Apply and Save Ethernet Configuration

1. Under the **Manual Register Configuration** panel, expand the row for component name `gbc_eth_persist`.
2. Click the **Edit** button for the `save` register and write a value of 1. This step will also apply the network configuration on the Grid Battery Controller



Changing the `gbc_ext_ethernet` configuration will cause the Multi-Stack Operator Interface to lose its network connection. The Multi-Stack Operator Interface URL or local DNS/host entry will need to be updated to reflect the updated network settings.



When enabling DHCP on the external port and if there is no DHCP server present, the GBC will revert to its prior static IP setting after 70 seconds.

2.3. Provision your Stacks

Overview

Please refer to the *Installation Guide* and the *Operator Interface Guide* for your Nuvation BMS to setup and provision the individual stacks.

Connecting your Stacks

Once each stack is set up and configured you can change the network configuration for the individual stacks to talk to the Grid Battery Controller.

The Grid Battery Controller manages all stacks through an internal network that is connected to the internal port on the Grid Battery Controller. This port IP address is configurable as described in [modifying GBC network settings](#).

Following the instructions below, change the IP address of each stack to be consistent with the internal network configuration. For example, if the `ip_address` of the internal network was set to 192.168.4.10 and the `netmask` was set to 255.255.255.0, then the stacks must be configured using the IP range 192.168.4.x where x cannot be 0, 10 or 255.



Improperly modifying the network settings can result in a Nuvation BMS that cannot communicate over Ethernet. To restore the Nuvation BMS to its default IP address (192.168.1.21), you must initiate a factory reset action - refer to the Installation Guide for your Nuvation BMS for instructions.

Be sure to record the updated IP address, netmask, and gateway settings if you decide to make changes to these settings.

Modifying the Stack Network Settings

1. Launch the Operator Interface for the stack
2. Unlock the Operator Interface by clicking the menu and `Unlock`
3. From the menu, select `Registers` to bring up the register browser page
4. Under the `Manual Register Configuration` panel, expand the row for Component Name `sc_ethernet`.



Use the find feature (`Ctrl + F`) in your browser to locate components in the page

Register Offset	Register Name	Description	Type	Units	Storage	
0x0	<code>use_dhcp</code>	Flag indicating if DHCP is used	Boolean	Flag	Configuration	<input type="button" value="Edit"/>
0x1	<code>ip_address</code>	IP address to be used in static configuration	IpAddress	IP	Configuration	<input type="button" value="Edit"/>
0x2	<code>net_mask</code>	Network mask to be used in static configuration	IpAddress	IP	Configuration	<input type="button" value="Edit"/>
0x3	<code>gateway</code>	Gateway address to be used in static configuration	IpAddress	IP	Configuration	<input type="button" value="Edit"/>
0x4	<code>mac</code>	MAC address of this board	UInt64	Value	Manufacturing	<input type="button" value="Edit"/>

5. Click the `Edit` button on the `ip_address` register. This will bring up the `Edit Register` dialog box

- Change the IP address according to the constraints discussed [in setting the stack IP](#). Then click Write



The index field may be left blank for all operations.

- Confirm that the value has been updated by clicking Read
- Under the Manual Register Configuration panel, expand the row for component name `sc_locked_cfg_persist`.
- Click the Edit button for the save register and write a value of 1

Edit Register
×

Enter the component index and optional value of the register to read or write:

sc_locked_cfg_persist[

- Verify that the configuration has been saved correctly by reading the error register. The value will be 0 if no errors have occurred.

The network configuration settings have been updated.



The updated network settings are not in use until the Stack Controller is power cycled.

2.4. Access the Operator Interface

2.4.1. Overview

The Operator Interface can be accessed from any computer/tablet with the latest Firefox or Chrome web browser. The OI is used to access the Grid Battery Controller in a multi-stack installation.

2.4.2. Accessing the Operator Interface

To access the Operator Interface, open a web browser and navigate to the external port IP address of the Grid Battery Controller. For example, if the Grid Battery Controller's external port IP address is 192.168.1.20, open a web browser and go to <http://192.168.1.20>. Refer to [updating Grid Battery Controller network settings](#) for further details on the port Ip configuration.



Browser Compatibility

The Operator Interface currently supports the most recent versions of Mozilla Firefox and Google Chrome. Other browsers such as Internet Explorer are not supported. Please install a supported browser before attempting to access the Operator Interface.

2.5. Import the Configuration File

2.5.1. Overview

Your Grid Battery Controller needs a valid configuration file to operate.

For instructions on how to create and modify the configuration file, and to understand the various registers please refer to the Grid Battery Controller Software Reference Manual.

2.5.2. Import the Configuration file

1. Ensure Persist Configuration to BMS is checked



Persist Configuration to BMS

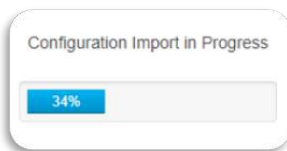
Enabling this option tells the Grid Battery Controller to persist the imported configuration file. If you are using known good configuration files you should check this box.

Disabling this option tells the Grid Battery Controller to not persist the newly imported configuration file. On reboot, the Grid Battery Controller will revert to the previous configuration file. This is useful when tweaking and testing configuration files. It allows you to recover from incorrect configuration settings by rebooting the Grid Battery Controller

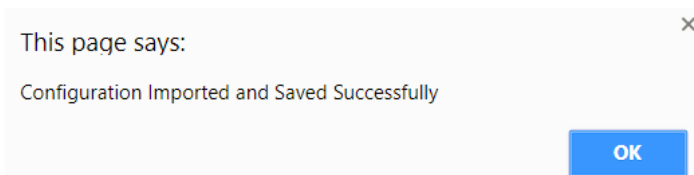


Only registers that are prefixed with pack* and gbc* will be persisted on the GBC.

1. Click Import Configuration
2. Select the configuration file to use and click Open
3. A dialog indicating progress will pop-up



4. Wait until a dialog box appears with the configuration import result. It should indicate that the import was successful.



2.5.3. Troubleshooting

During the configuration file import, if you receive a Register Write failure error, ensure you have valid entries in your configuration file. For details on the various registers and their intended use, please refer to the Grid Battery Controller Software Reference Manual.



If the failures persist, please submit a support ticket with as much detail as possible to support@novationenergy.com.

2.6. Enable and Connect your Stacks

2.6.1. Overview

There are two modes for connecting the stacks of a GBC:

- Automatic connection
- Manual connection

The automatic connection method provides the following advantages:

1. Simple one button connection operation.
2. Connect stacks in preparation for a charge/discharge operation of a battery pack.
3. Connect only stacks that will not violate a maximum connection current.
4. Provide an automatic pack connection when the GBC is brought online from a power cycle.

The following sections detail these two pack connection modes. The configuration of the pack connection is detailed in the *Grid Battery Controller Software Reference Manual*. But prior to either mode of connection, the stacks within the pack need to be *enabled* to allow them to be connected.

2.6.2. Enabling Stacks

1. Navigate to the Stack Status tab. You should see details of the stacks that the Grid Battery Controller can communicate with (i.e. they have been previously configured as *installed*).

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Dashboard Stack Status Details

Overall BMS Status



ALL OK


Clear



Connected
0/0

Connect

Stack 1 Status



ALL OK


Disconnected
Disabled

Connect

Enable

Name	Value
SOC	100%
Stack Voltage	38.3V
Stack Current	3.9A

Stack 2 Status



ALL OK


Disconnected
Disabled

Connect

Enable

Name	Value
SOC	99%
Stack Voltage	38.2V
Stack Current	-0.1A

Stack 3 Status



ALL OK

Disconnected
Disabled

Connect

Enable

Name	Value
SOC	30%
Stack Voltage	38.3V
Stack Current	0.0A

2. For each stack, click the **Enable** button. When all stacks are enabled your screen should look like this:

NUVATION BMS™

Dashboard | **Stack Status** | Details

Overall BMS Status



ALL OK


Clear




Connected
0/3

Connect

Stack 1 Status



ALL OK




Disconnected
Enabled

Connect


Disable

Name	Value
SOC	100%
Stack Voltage	38.3V
Stack Current	-1.1A

Stack 2 Status



ALL OK




Disconnected
Enabled

Connect


Disable

Name	Value
SOC	99%
Stack Voltage	38.2V
Stack Current	-0.1A

Stack 3 Status



ALL OK



Disconnected
Enabled

Connect

Disable

Name	Value
SOC	30%
Stack Voltage	38.3V
Stack Current	0.0A



The *Connect* button for the pack (at the top of this tab) will only be accessible when the [Automatic Stack Connection](#) is configured.



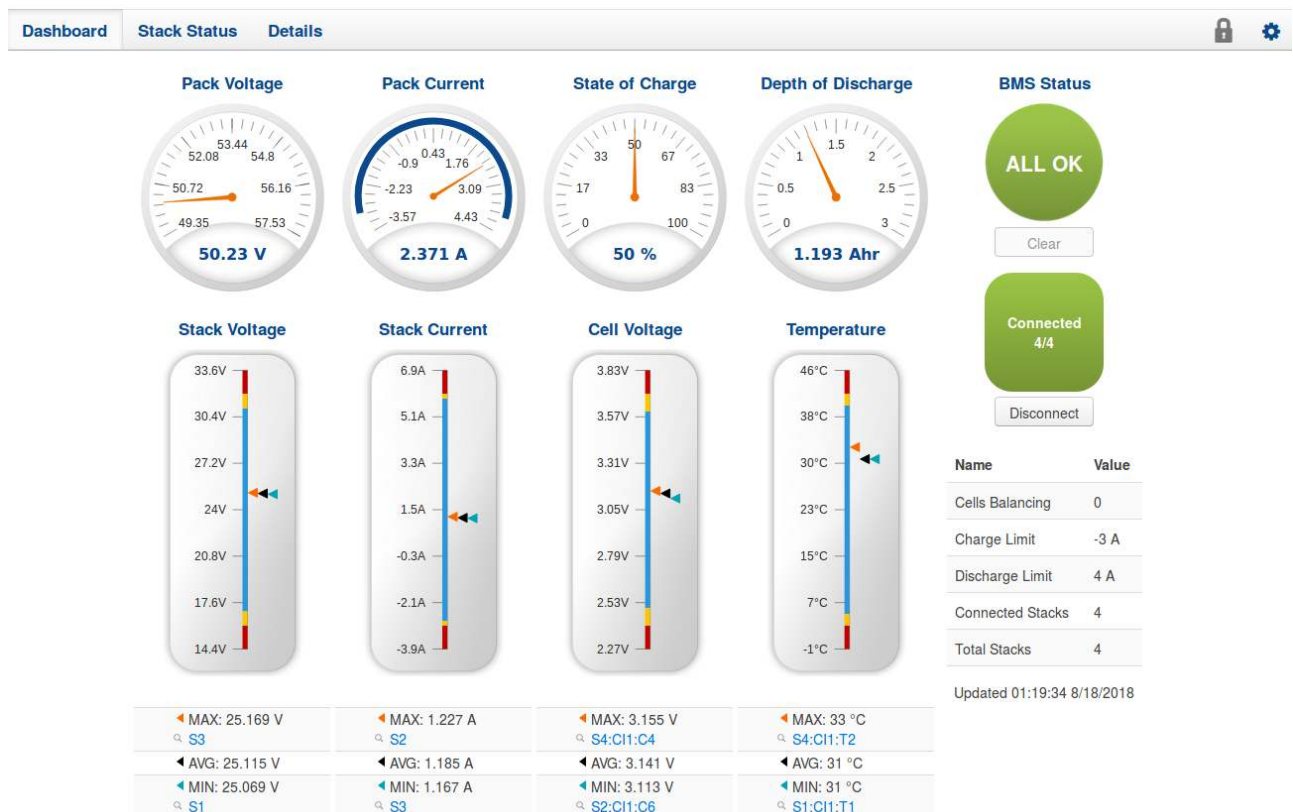
The *Connect* button per stack will only be displayed when the [Manual Stack Connection](#) is configured.



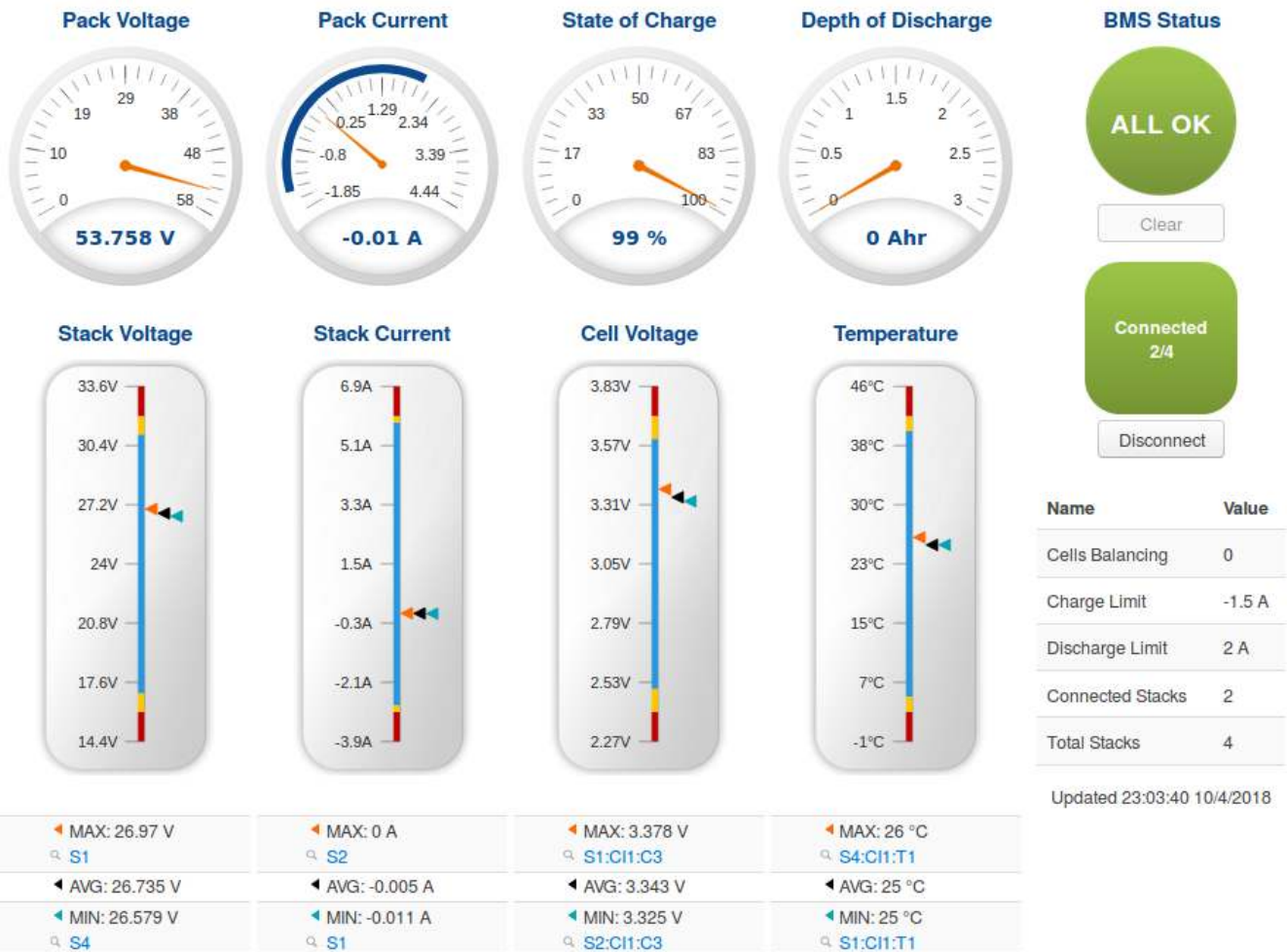
Manually updating the *enabled* state of stacks through the Operator Interface will be lost if the GBC were to power cycle. Once the final enabled state of all stacks is determined, the pack configuration file should be updated and reloaded.

2.6.3. Automatic Stack Connection

1. Navigate to the Dashboard tab.
2. Click on the **Connect** button to initiate a pack connection. The stack(s) that meet the *pack connection criteria* will be sequentially connected. Refer to the *Grid Battery Controller Software Reference Manual* for the pack connection configuration and criteria. If all the stacks are connected you will see a dashboard screen like this:



Refer to the *Total Stacks* and the *Connected Stacks* values displayed to the right of the display. If they are not equal in value, not all stacks could be connected due to an unbalanced number of stack(s). Connecting these unbalanced stacks would have violated a stack connection current that has been configured. The pack is now waiting for a charge/discharge operation from an external Power Control System (PCS) to bring the connected stacks closer to the unconnected stack voltage(s). When the pack is in this partially connected state, the dashboard would appear like this:



1. Navigate to the Stack Status tab. This tab will show all the stacks which have connected or remain disconnected. An operator can monitor the stack voltages of the connected stacks while the PCS is charging/discharging the pack. As the pack voltage changes the unconnected stacks will begin to meet the *pack connection criteria* and these stacks would then be automatically connected.
2. One or more stacks may be in faulted state and cannot be connected. The *Stack Status* page allows the monitoring and identification of these faulted stacks. Refer to [Safety](#) section in the Details tab for details on how to address stack faults.

2.6.4. Manual Stack Connection

1. Navigate to the Stack Status tab.
2. For each stack, click the Connect button. When all stacks are connected your screen should look like this:

NUVATION BMS™

Dashboard Stack Status Details

Overall BMS Status



ALL OK


Clear




Connected
3/3

Connect

Stack 1 Status



ALL OK




Connected
Enabled

Disconnect


Disable

Name	Value
SOC	100%
Stack Voltage	38.3V
Stack Current	3.4A

Stack 2 Status



ALL OK




Connected
Enabled

Disconnect


Disable

Name	Value
SOC	99%
Stack Voltage	38.2V
Stack Current	-0.1A

Stack 3 Status



ALL OK



Connected
Enabled

Disconnect

Disable

Name	Value
SOC	30%
Stack Voltage	38.3V
Stack Current	0.0A



Be mindful of your stack voltages when manually connecting. Stacks should be well balanced in relation to each other.



the pack level *Connect* button on the Dashboard and the Stack Status displays will remain disabled while in the Manual Connection mode.

You are ready to use your Grid Battery Controller!

3. Using your Nuvation BMS™ Grid Battery Controller

3.1. The Dashboard Tab

3.1.1. Overview

The default tab of the Operator Interface is the Dashboard. The Dashboard contains a high-level overview on the state of the battery stack.

This is the only page required for daily monitoring of the battery stack.

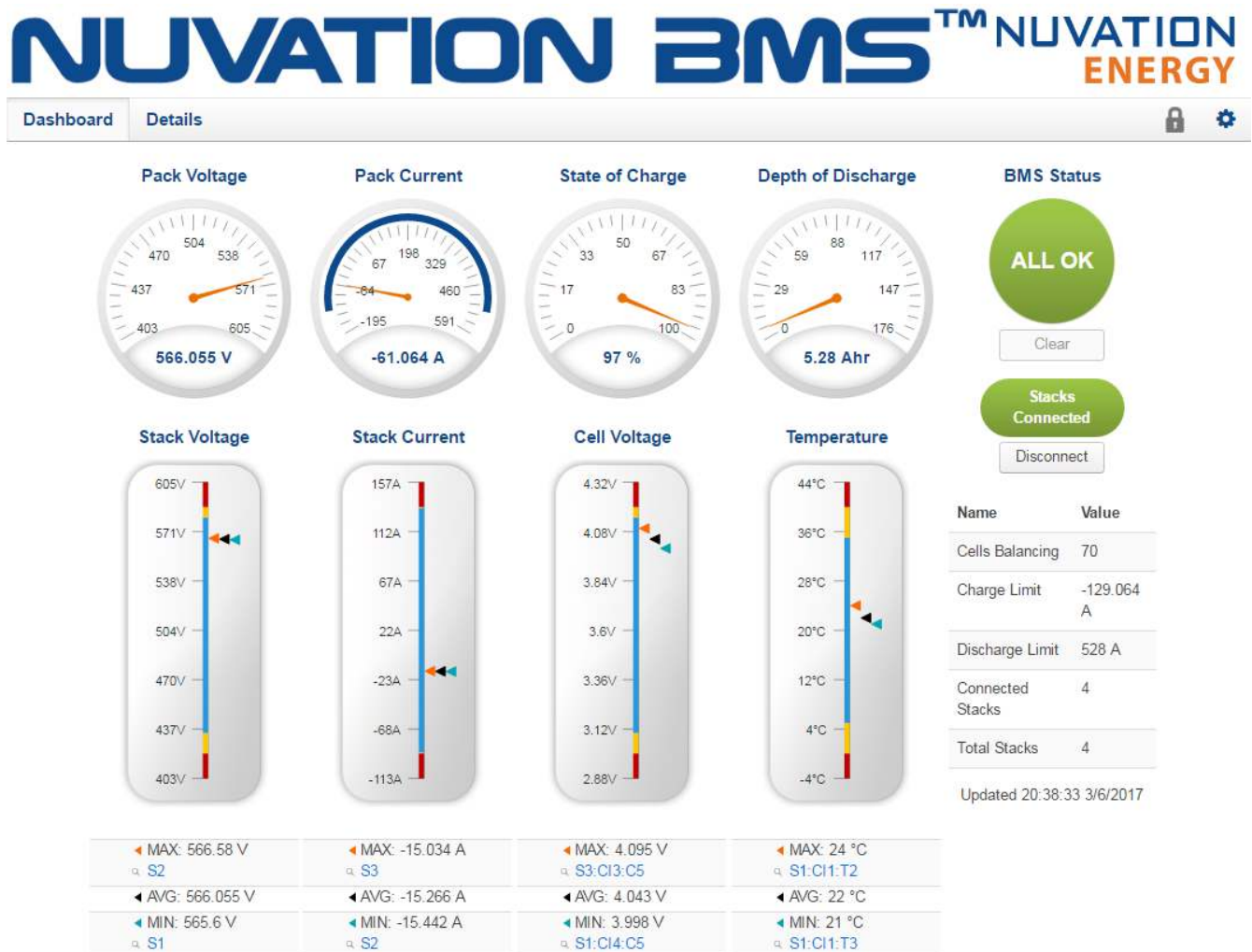





Figure 1. Nuvation BMS™ Operator Interface Multi-Stack Dashboard screenshot

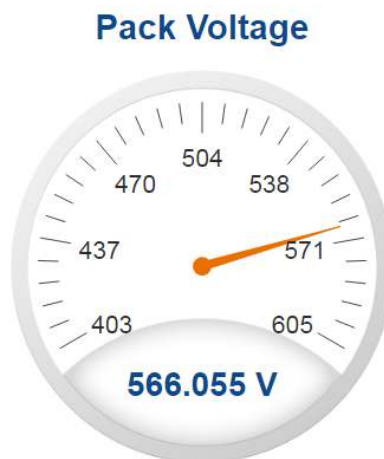
3.1.2. Warnings and Faults

Before going into the details of the gauges and information presented in the dashboard, it is important to understand what a fault and a warning Nuvation BMS status means.

	<p>A Nuvation BMS Warning indicates the state of the battery system has been detected outside of its normal operational range. The cause of the warning should be identified and a corrective action should be performed. For instance, if the warning is a thermistor temperature measurement has become too hot, the battery system should be cooled to bring the measurement back into the normal operational range.</p>
	<p>A Nuvation BMS Fault indicates the state of the battery system has been detected outside of its safe operational range. The cause of the fault must be identified and a corrective action must be performed. For instance, if the fault is a cell voltage measurement has become too low, the cell maintenance manual must be reviewed to identify what remedial actions are required.</p> <p>A Nuvation BMS Fault is more severe than a Nuvation BMS Warning and the source of the fault must be discovered and resolved before attempting to clear the Nuvation BMS Fault to continue operating the battery system.</p>
	<p>An ALL OK indicates that there are no faults or warning. This is the normal state for the Nuvation BMS.</p>

3.1.3. Pack Voltage

The pack voltage radial gauge shows the average stack voltage of the stacks connected to the common DC bus.



3.1.4. Pack Current

The pack current radial gauge shows the battery pack current which is the addition of each stack current that are connected to the common DC bus. The maximum charge current limit and the maximum discharge current limit is also shown. The acceptable current range is visualized on the gauge by the blue arc. An absence of the blue arc indicates the battery pack cannot be charged or discharged in its present condition.

A negative current value indicates the battery pack is charging. A positive current value indicates the battery pack is discharging.

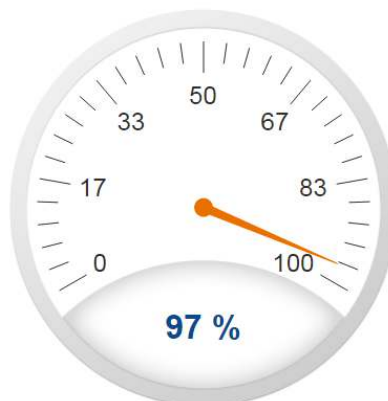
Pack Current



3.1.5. State of Charge

The State-of-Charge radial gauge shows the battery stack's State-of-Charge, which is an average SOC of the stacks connected to the common DC bus. The battery stack is empty when the State-of-Charge value is 0% and full when the State-of-Charge value is 100%.

State of Charge



3.1.6. Depth of Discharge

The Depth-of-Discharge radial gauge shows how much energy has been taken out of the battery stack. It is the sum of all stacks connected to the common DC bus. In an ideal energy storage system, defined as a system with no power losses, the amount of energy shown in this gauge needs to be added back into the battery pack to fill it back up to 100% SOC.

Depth of Discharge



3.1.7. Stack Voltage

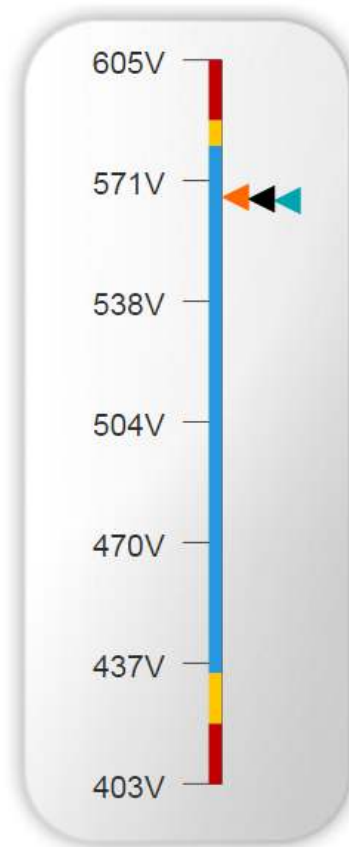
The stack voltage bar gauge shows the maximum, minimum and average stack voltage measurements within the battery pack.

The high stack voltage and low stack voltage warning and fault threshold is visualized on the gauge with yellow and red segments. The blue segment depicts the acceptable stack voltage range.

If a triangle enters the yellow segment, a warning has occurred. If a triangle enters the red segment, a fault has occurred.

The maximum and minimum stack location in the pack and their voltage value are shown below the gauge, along with the average stack voltage value.

Stack Voltage



◀ MAX: 566.58 V
🔍 S2
◀ AVG: 566.055 V
◀ MIN: 565.6 V
🔍 S1

3.1.8. Stack Current

The stack current bar gauge shows the maximum, minimum and average stack current measurements within the battery pack.

The high stack discharge current and high stack charge current warning and fault thresholds are visualized on the gauge with yellow and red segments. The blue segment depicts the acceptable stack current range.

If a triangle enters the yellow segment, a warning has occurred. If a triangle enters the red segment, a fault has occurred.

The maximum and minimum stack location in the pack and their current value are shown below the gauge, along with the average stack current value.

Stack Current



◀	MAX: -15.034 A
🔍	S3
◀	AVG: -15.266 A
◀	MIN: -15.442 A
🔍	S2

3.1.9. Cell Voltage

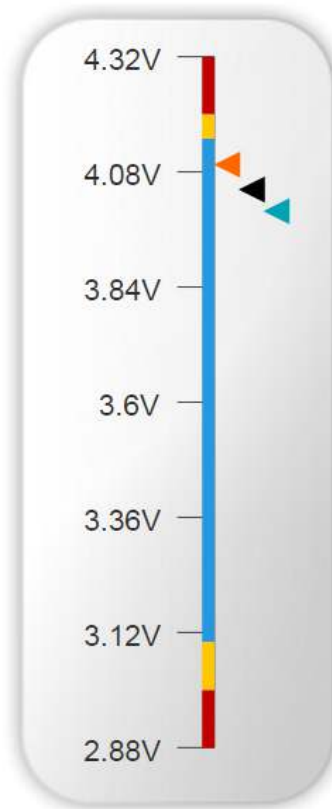
The cell voltage bar gauge shows the maximum, minimum and average cell voltage measurements within the stack.

The high cell voltage and low cell voltage warning and fault threshold is visualized on the gauge with yellow and red segments. The blue segment depicts the acceptable cell voltage range.

If a triangle enters the yellow segment, a warning has occurred. If a triangle enters the red segment, a fault has occurred.

The maximum and minimum cell location in the stack and their voltage value are shown below the gauge, along with the average cell voltage value.

Cell Voltage



◀ MAX: 4.095 V

🔍 S3:CI3:C5

◀ AVG: 4.043 V

◀ MIN: 3.998 V

🔍 S1:CI4:C5

3.1.10. Temperature

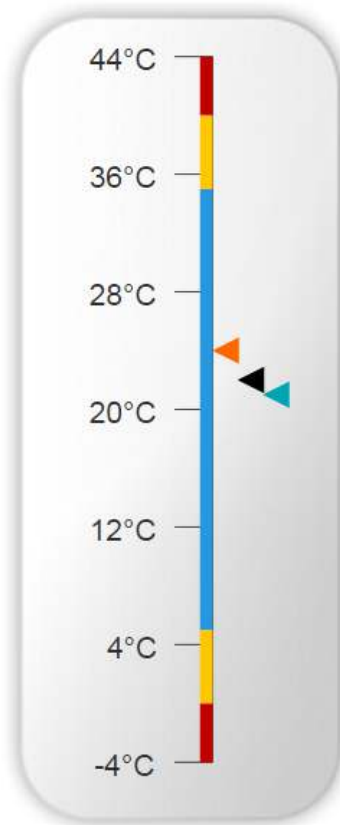
The temperature bar gauge shows the maximum, minimum and average cell temperature measurements within the stack.

The high cell temperature and low cell temperature warning and fault threshold is visualized on the gauge with yellow and red segments. The blue segment depicts the acceptable cell temperature range.

If a triangle enters the yellow segment, a warning has occurred. If a triangle enters the red segment, a fault has occurred.

The maximum and minimum cell location in the stack and their temperature value are shown below the gauge, along with the average cell temperature value.

Temperature



◀ MAX: 24 °C
🔍 S1:CI1:T2
◀ AVG: 22 °C
◀ MIN: 21 °C
🔍 S1:CI1:T3

3.1.11. Nuvation BMS Status

The Nuvation BMS status information contains information on the overall safety status of the battery stack, the battery stack connection state, number of cells balancing, maximum charge current limit, maximum discharge current, number of stacks connected, number of stacks installed in the battery pack, and the time and date of the last update of the Dashboard.

Safety Status

The Nuvation BMS safety state is shown in the big status circular indicator.



Figure 2. Three possible Nuvation BMS safety states

The normal state is All OK and the color of the indicator will be green. The warning state is Warning and the color of the indicator will be orange. The fault state is Fault and the color of the indicator will be red.

Clicking on the indicator will jump to a comprehensive status list of all warnings and faults active in the battery stack.

Clicking on the Clear button below the state will cancel any warnings and faults that are not self-clearing.

Connection State

The battery stack connection state is shown in the oval indicator.



Figure 3. Three possible connection states

Stack Disconnected in a red oval indicates the battery stack is unavailable to be charged or discharged.

Stack Pre-charging in an orange oval indicates the battery stack has connected its pre-charge circuit and is attempting to equalize the battery stack voltage to the system DC bus voltage.

Stack Connected in a green oval indicates the battery stack is available to be charged or discharged.

Clicking the Connect button initiates the stack connection sequence of events. The Nuvation BMS must be in the All OK state for the Connect button to be available.

Clicking the Disconnect button will disconnect the battery stack from the system DC bus.

Information Table

The information table shows the number of cells that are having excess energy bled off to maintain a balanced battery stack.

Name	Value
Cells Balancing	70
Charge Limit	-129.064 A
Discharge Limit	528 A
Connected Stacks	4
Total Stacks	4

The **Charge Limit** shows the maximum charge current limit value. The **Discharge Limit** shows the maximum discharge current limit value.

The **Charge Limit** and **Discharge Limit** values are visualized on the **Stack Current** radial gauge as the limits of the blue arc.

The **Connected Stacks** shows the number of stacks connected to the common DC bus. The **Total Stacks** shows the number of stacks installed in the battery pack.

Last Update

The **Updated** time and date shows the last time the Operator Interface had successfully communicated with the Nuvation BMS and updated all items in the Dashboard with values from the Nuvation BMS. The time and date is based on the local computer/tablet; it does not come from the Nuvation BMS.

Updated 21:42:07 4/6/2017
Error: Register read error

If a communication timeout has occurred, a notification appears beneath the **Updated** time and date. If a timeout has occurred, the information shown on the Dashboard is no longer recent.

3.2. The Details Tab

3.2.1. Overview

The Details tab contains a much more detailed view into the status of the Nuvation BMS. The data values shown in this tab can be easily copied into a spreadsheet as a means of capturing the current state of the Nuvation BMS for manual data recording purposes.

The Details tab has multiple sub-sections called *accordions* that can be expanded to reveal more information. You can have multiple accordions expanded at the same time.



Figure 4. Nuvation BMS™ Operator Interface Details tab screenshot

Information Selector

The drop-down list at the top-center of the Details tab selects what content to display in the tab.

The Pack is the default option and it presents information on the overall battery pack.

The Stack option presents information on that specific battery stack. If a Stack is selected, refer to Operator Interface Guide for more information.



All 36 stacks are listed even when fewer than 36 stacks are installed. Only select stacks that are installed in the battery pack.

3.2.2. Battery

The Battery accordion contains values on the overall battery pack. This information is identical to the values shown in the radial gauges and bar gauges on the Dashboard, except that the stack voltage and stack current bar gauge information is omitted.

Battery		Last update: Thu Apr 06 2017 22:04:47 GMT-0400 (Eastern Daylight Time)
Register Name	Value	
Pack Voltage	566.055 V	
State of Charge	97 %	
Pack Current	-61.064 A	
Depth of Discharge	5.28 Ahr	
Average Cell Voltage	4.043 V	
Maximum Cell Voltage	4.095 V	
Minimum Cell Voltage	3.998 V	
Average Temperature	22 C	
Maximum Temperature	24 C	
Minimum Temperature	21 C	

Figure 5. Battery accordion in Details Tab

3.2.3. Current Limiter

The Current Limiter accordion contains the maximum charge current limit, maximum discharge current limit. This information is identical to the values shown in the Information Table on the Dashboard. The unit of the current limit values is mA.

Current Limiter		Last update: Thu Apr 06 2017 22:11:39 GMT-0400 (Eastern Daylight Time)
Register Name	Value	
Charge Limit	129064	
Discharge Limit	528000	

Figure 6. Current Limiter accordion in Details Tab

3.2.4. Safety

The Safety accordion contains a summary list of the number of Nuvation BMS faults and warnings active in the battery pack well as the overall status of the battery pack. An active fault or warning is shown as Tripped. In normal operation, all warnings and faults should be clear and the battery stack is safe to charge, safe to discharge and overall safe. When faults are Tripped, refer to the Troubleshooting sections of the *Grid Battery Controller Software Reference Manual* and the *Software Reference Manual* documents for pack and stack faults respectively.

▼ Safety
Last update: Sat Aug 18 2018 01:44:25 GMT-0400 (EDT)

Register Name	Value	Initialized
Overall Safe	Safe	Unknown
gbc_fault_eth_conn[0].trig	Clear	Yes
gbc_fault_fw_mismatch[0].trig	Clear	Yes
gbc_fault_controller_wdt[0].trig	Clear	Yes
pack_fault_ready_stacks[0].trig	Clear	Yes
gbc_warn_eth_conn[0].trig	Clear	Yes
gbc_warn_fw_mismatch[0].trig	Clear	Yes
gbc_warn_controller_wdt[0].trig	Clear	Yes
pack_warn_ready_stacks[0].trig	Clear	Yes
pack_warn_stacks[0].trig	Clear	Yes

Figure 7. Safety accordion in Details Tab

Clicking on the Clear Faults and Warnings button at the bottom of this accordion will clear any faults that are not self-clearing. It will not clear any warnings that are not self-clearing; the Clear button on the Dashboard must be used to clear warnings that are not self-clearing.

3.3. The Menu Options

3.3.1. Overview

The menu to the right of the Operator Interface provides access to tools and advanced options. Some of these options may be locked to prevent accidental changes.

Babbage 18.08



Figure 8. Sample About screen

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