

CRAGG
RAILCHARGER™
Instruction Manual for

20SMC-12V
20SMC-24V
40SMC-12V
40SMC-24V
60SMC-12V
80SMC-12V



Contents

1	Warnings, Cautions, and Notes	1
2	Description	2
3	Features	2
3.1	STANDARD FEATURES.....	2
3.2	OPTIONAL FEATURES.....	3
3.3	CHARGER REGULATION.....	3
3.4	TOP PANEL FEATURES AND COMPONENTS.....	3
3.4.1	AC WAGO Terminal and MOVs.....	3
3.4.2	DC Terminal Block	4
3.4.3	AC Fuses.....	4
3.4.4	DC Output Fuse	4
3.4.5	Voltage Monitor Fuse	4
3.4.6	Remote Voltage Sense	5
3.4.7	Ethernet Port (Requires Optional Add on Board).....	5
3.4.8	Voltage Monitor Relay.....	5
3.4.9	Temperature Input.....	5
3.5	FRONT PANEL FEATURES.....	6
3.5.1	Display.....	6
3.5.2	OK LED	6
3.5.3	FAULT LED	6
3.5.4	Optional Add on Board.....	7
	<i>The optional add on board provides an Ethernet port, RS485 port and a microSD memory card slot.....</i>	<i>7</i>
4	Operation.....	8
4.1	FRONT PANEL DISPLAY AND PUSH BUTTON CONTROLS	8
5	SMC CHARGER Installation.....	9
5.1	MOUNTING	9
5.1.1	Shelf Mount	9
5.1.2	Wall Mount.....	9
5.1.3	Rack Mount	9
5.2	OUTPUT CONNECTIONS	10
5.3	INPUT CONNECTIONS	10
5.4	TEMPERATURE SENSOR INPUT	10
5.5	VOLTAGE MONITOR RELAY.....	10
5.6	REMOTE VOLTAGE SENSE.....	10
6	Basic Setup Procedure	11
7	BATTERY CELL MONITOR SET-UP AND ADJUSTMENTS:	11
8	BATTERY CHARGER SET-UP AND ADJUSTMENTS:.....	11
8.1	STATUS	12
8.1.1	BASIC.....	12
8.1.2	ADVANCED	14
8.2	FAULT HISTORY MENU	15
8.3	SETPOINTS MENU.....	16
8.3.1	ADVANCED SET POINTS	17
8.4	OPTIONAL MCM-SLAVE BATTERY MONITOR	20
8.5	MCM-SLAVE FRONT PANEL FEATURES	20
8.5.1	15 Cell Voltage Sense Input.....	20
8.6	MCM-SLAVE BOTTOM PANEL FEATURES	20
8.7	DUAL RS 485 PORTS	21
	<i>The Dual RS485 Ports are used to supply power to the Monitor Slave Device from the Monitor Master Device. (NOTE: RS458 IS NOT FOR ETHERNET).....</i>	<i>21</i>
8.8	SPLIT CORE DIGITAL CURRENT COIL	21
8.8.1	Thumb Screw	22
8.8.2	RS485 Ports	22

9	MCM-SLAVE Installation	23
9.1	MOUNTING	23
9.1.1	Wall Mount.....	23
9.2	EXTERNAL WIRING CONNECTOR.....	23
9.1	CELL MONITOR STATUS.....	24
9.2	CELL MONITOR MENU	24
9.3	SWITCH MONITOR STATUS	25
9.4	SWITCH MONITOR MENU	26
9.5	BATTERY TESTING STATUS	27
9.6	FACTORY DEFAULTS.....	28
10	Hosted web page (Requires ADDON BOARD)	29
10.1	LOGIN	29
10.2	STATUS TAB.....	30
10.3	SETTINGS TAB.....	31
10.4	EQUALIZATION TAB	32
10.5	BATTERY CAPACITY TAB.....	33
10.6	BATTERY TESTING TAB.....	34
10.7	CELL MONITORING TAB.....	35
10.8	SWITCH MONITORING TAB.....	36
11	Specifications.....	37

List of Tables

Table 1.	Warnings, Cautions, and Notes.....	1
Table 2.	AC Fuse Ratings.....	4
Table 3.	DC Fuse Ratings.....	4
Table 4.	FAULT LED States	7
Table 5.	Temperature Compensation Rates	17
Table 6.	Current Sensor Configurations.....	18
Table 7.	General Specifications	37
Table 8.	Model Specifications	37

List of Figures

Figure 1.	Top of Battery Charger (Model 40SMC-12V)	3
Figure 2.	Front of Battery Charger (Model 40SMC-12V)	6
Figure 3.	Push Button Controls.....	8
Figure 4.	System Status	30
Figure 5.	Overview of the Charger Settings	31
Figure 6.	Equalization Settings	32
Figure 7.	Battery Capacity Settings.....	33
Figure 8.	Battery Testing Settings.....	34
Figure 9.	Cell Monitoring Settings.....	35
Figure 10.	Switch Monitoring Settings.....	36

1 WARNINGS, CAUTIONS, AND NOTES

Please read the entire instruction manual before using the battery charger.

Also, read the warnings, cautions, and notes in Table 1. Failure to observe the warnings and cautions can lead to equipment damage or personal injury.

If you have any questions concerning the manufacture, design, function, installation, operation or maintenance, contact Railway Equipment Company before proceeding.

Table 1. Warnings, Cautions, and Notes

Symbol	Description
	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate personal injury. It may also be used to alert against unsafe practices.
NOTE	NOTE indicates explanatory information that applies to the next step in the procedure. It is used to clarify and expand upon the importance of the procedural step when needed.
	Hook up all DC connections before energizing the AC power, if the red led is on or the DC fuse blows you have hooked up the DC connections incorrectly.



Warning: The appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.



Warning: Do not use this charger to recharge non-rechargeable batteries.



Warning: Before connecting power to the battery charger, make sure AC power is turned off. Connect AC power to the battery charger per label above the WAGO terminal blocks.



Warning: The appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.



Warning: Do not use this charger to recharge non-rechargeable batteries.

2 DESCRIPTION

The SMC charger has an input voltage range of **115-230VAC**, with a DC output voltage of 7 - 18.8VDC or 24 to 42.5VDC, depending on the model. Depending on the model, the DC output current ranges from 20A to 80A. The SMC has an operating temperature range of -40°F to +158°F (-40°C to +70°C) allowing it to work effectively in a wide temperature range.

The SMC also has a Temperature Compensation feature. Using the optional RTD Temperature Sensor, the charger can adjust the DC Output based on the temperature reading of the battery, there by extending the life of the battery and adhering to the manufacturer's specifications. Contact Railway if you need a longer temperature probe.

A remote voltage sense capability is used to compensate for voltage drop across wires between the charger and the battery.

A set of contacts are provided for monitoring the High and Low Battery Voltage, Current, AC power loss and Temperature alarms, which have user defined settings.

3 FEATURES

3.1 Standard Features

- Fully Automatic Charging
- Convection Cooled
- For use with Lead Acid and NiCad Batteries
- Temperature Compensation with Controlled Limits
- Adjustable Current Limit
- Battery Voltage Monitor with Relay Output
- Remote or Local Battery Voltage Sensing
- Equalization Feature to Extend Battery Life
- WAGO Terminals
- AC & DC Circuit Transient Protection
- Meets or Exceeds AREMA Specifications
- Rack Mounting Kit Available
- AC Input 115-230VAC 50, 60 Hz
- Operating Temperature -40° to +70° C (-40° to +158° F)
- ±1% Voltage Regulation
- <100 mv Volt Peak to Peak Output Ripple
- 2-Year Warranty

3.2 Optional Features

- Add on board with RS485 Port for Current Monitoring and Ethernet Port for Monitoring and Configuration.
- RTD Temperature Sensor that can be used with Temperature Compensation enabled.

3.3 Charger Regulation

The charger will regulate output voltage to less than ± 1 percent from full load to no load with a supply voltage of 115-230VAC. The output ripple is less than 100mv at any load.

3.4 Top Panel Features and Components

This section describes the features and components that are on the front panel of the battery charger (see Figure 1).



Figure 1. Top of Battery Charger (Model 40SMC-12V)

3.4.1 AC WAGO Terminal and MOVs

The AC terminal block has the connections for the AC power. The battery charger is capable of 115V - 230V input. The MOVs are used to protect the charger from voltage spikes. There is a set of three MOVs installed for the AC input and one installed for the output.

3.4.2 DC Terminal Block

The DC Output WAGO terminal block is labeled – and +.



CAUTION: Be sure to observe correct polarity on battery and remote sense connections.

3.4.3 AC Fuses

The AC input fuses are labeled **F1** and **F2**. These should be replaced with MDA, 250 Volt, slow blow fuses (use Cooper Bussman® part number BK/MDA-xx or equivalent).

Table 2. AC Fuse Ratings

Model Number	MDA Fuse Rating
20SMC -12V	15 Amp
20SMC -24V	15 Amp
40SMC -12V	15 Amp
40SMC-24V	30 Amp
60SMC -12V	30 Amp
80SMC-12V	30 Amp

3.4.4 DC Output Fuse

The DC output fuses is labeled **F3**. This will protect the customer load and battery charger from malfunctioning. This is a BF1, 58 Volt, slow blow fuse (use Littelfuse® or equivalent).

Table 3. DC Fuse Ratings

Model Number	BF1 Fuse Rating
20SMC -12V	100 Amp
20SMC -24V	100 Amp
40SMC -12V	100 Amp
40SMC-24V	100 Amp
60SMC -12V	150 Amp
80SMC-12V	150 Amp

3.4.5 Voltage Monitor Fuse

The voltage monitor relay is protected with a 2 Amp, 32 VDC, fast acting mini fuse (use Littelfuse® part number 0297002 or equivalent).

3.4.6 Remote Voltage Sense

It is recommended that two separate wires be connected from the battery terminals to the remote voltage sensor input terminals on the charger. If the batteries to be charged are located more than 12 feet from the charger, there will be significant voltage drop through the wires.

3.4.7 Ethernet Port (Requires Optional Add on Board)

This RJ45 Ethernet connection is used for accessing the charger, either via its internal webpage or via the Remote Monitoring Server.

3.4.8 Voltage Monitor Relay

The voltage monitor provides a Form C dry contact relay which can be used to indicate when the battery voltage, current and temperature are either above or below the parameter settings.

The voltage monitor circuit is independent from the battery charger system and the AC power, and operates from the battery voltage.

The “normally open” contact is closed when the battery voltage, current and temperature is between the high and low settings.

The relay is rated for 2 Amps at 60 VDC, or 2 Amps at resistive loads. The mechanical contact life is 5,000,000 operations. Minimum inductive life @ .5 Amps, 12vdc is 50,000 times.

The voltage monitor can be used for an alarm by connecting the coil of an indication relay to the normally open relay contact terminals on the battery charger, with power for the relay supplied by others.

The voltage monitor relay is protected with a 2 Amp, 32 VDC, fast acting mini fuse (use Littelfuse® part number 0297002 or equivalent).

3.4.9 Temperature Input

When the temperature sensor is connected and Temperature Compensation is enabled, the battery charger will adjust the output voltage up or down depending on the probe temperature and the Temperature Compensation Rate (See **TABLE 5**). The probe end can be placed between battery cells to accurately monitor battery temperature. If the remote temperature sensor is not used, the temperature compensation function will be fixed at 77°F. **NOTE: The RTD Temperature sensor is optional.**

3.5 Front Panel Features



Figure 2. Front of Battery Charger (Model 40SMC-12V)

3.5.1 Display

The display is a long life OLED display. It enters “sleep mode” after inactivity to extend the life of the display. To “wake” the display, touch any control button.

3.5.2 OK LED

The OK LED is on when the DC Output Voltage is between the **HIGH VOLTAGE FAULT** and **LOW VOLTAGE FAULT** settings (see section 7.3.1 for configuration).

3.5.3 FAULT LED

The FAULT LED has three different states, OFF, ON and FLASH. In addition to the FAULT LED, the display will show fault description. The fault conditions are described in the table below. In the case of AC Power Lost, the display will go into sleep mode after 30 seconds to preserve battery power. To wake the display, touch any control button.

Table 4. FAULT LED States

Description	FAULT LED (Red)
No Fault	OFF
Battery Temperature Fault	ON
DC Output Current Fault	ON
DC Output Voltage Fault	ON
Temp Comp On, No Temp Probe Connected	ON
AC Power Lost	FLASH
DC Output Fuse Blown	FLASH
DC Output Reverse Polarity	FLASH

3.5.4 Optional Add on Board

The optional add on board provides an Ethernet port, RS485 port and a microSD memory card slot.

- The Ethernet port provides a network connection in order to access the battery charger's hosted webpage.
- The RS485 port provides a connection to numerous devices such as the Multiple Cell Monitor Slave, Current Coil and Current Shunt.
- The microSD memory card slot is used to store a memory card.

4 OPERATION

4.1 Front Panel Display and Push Button Controls

The front panel has a digital display and four control buttons. The Display will auto dim after several minutes of inactivity. Once a button is pressed the display will return to full brightness.

SET-UP AND ADJUSTMENTS: To change settings do the following:

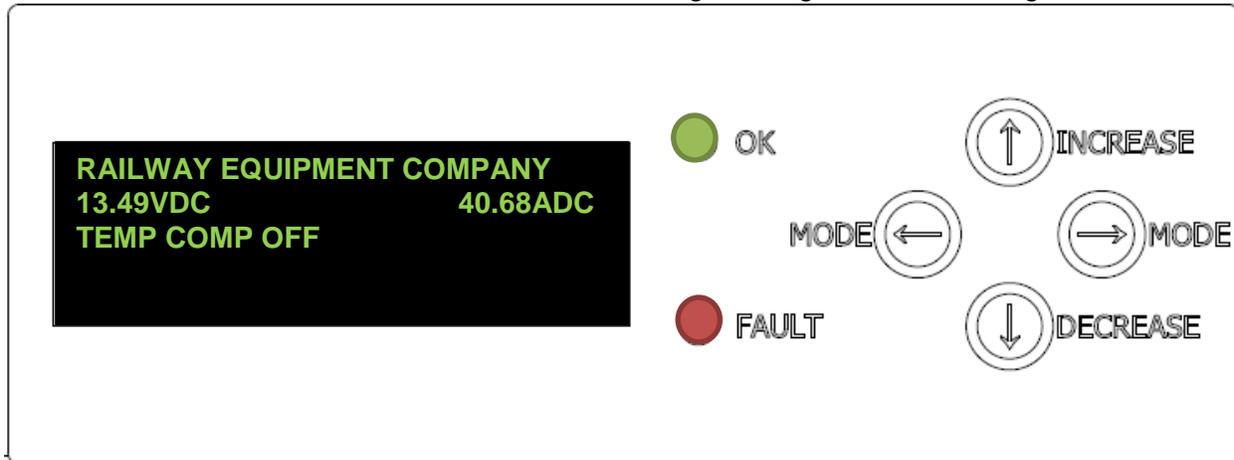


Figure 3. Push Button Controls

MODE LEFT/MODE RIGHT

Pushing the **MODE LEFT** or **MODE RIGHT** push button will cycle left or right through the menus. Each time you press one of the **MODE** buttons, you will advance one menu selection.

VALUES INCREASE/VALUE DECREASE

The **VALUES INCREASE** and **DECREASE** push button allows you to change the displayed values. NOTE: Values that are changed will be saved after 15 minutes, or when you return to the status screen.

5 SMC CHARGER INSTALLATION



Warning: Before connecting power to the battery charger, make sure AC power is turned off. Connect AC power to the battery charger per label above the WAGO terminal blocks.



Warning: The appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.



Warning: Do not use this charger to recharge non-rechargeable batteries.

5.1 Mounting

5.1.1 Shelf Mount

The charger is designed to allow enough air flow through the bottom of the charger when it is set on a shelf.

5.1.2 Wall Mount

Use the two-four keyed slots on the back of the charger for mounting to a wall.

5.1.3 Rack Mount

Optional Rack Mount brackets are available for purchase. These attached to the sides of the charger and allow for mounting at various different depths.

20/20-24V/40SMC -P/N 31084708

40-24V/60/80SMC - P/N31084709

5.2 Output Connections



Warning: Batteries being used with this charger should be placed in a well ventilated area during charging.



CAUTION: WHEN CONNECTING WIRES FROM THE BATTERY TERMINALS TO THE CHARGER, VERIFY THE VOLTAGE POLARITY.

1. Connect the wires that will go between the battery and the DC Output WAGO terminal block labeled – and +.
2. Connect those wires to the battery posts. The charger should now power up from the battery.

5.3 Input Connections

1. Connect the AC wires to the AC Input WAGO terminal block. This terminal block are labeled **LINE 1**, **LINE 2/NUETRAL** and **GND**.
2. Apply AC power to the charger.

5.4 Temperature Sensor Input

The Temperature Sensor is an RTD temperature probe. Plug the connector end into the temperature input on the Charger, and the other end can be placed between the individual cells of the battery bank. **NOTE: The RTD Temperature sensor is optional.**

5.5 Voltage Monitor Relay

Wire size should be minimum 18GA, maximum 16GA. This is a Form C dry contact relay with a Normally Open and Normally Closed set of contacts.

5.6 Remote Voltage Sense

This is done by removing the two pre-installed jumper wires from the remote voltage sense terminals and the DC output terminals and replacing them with wires from the battery terminals to the remote voltage sense terminals. If the remote voltage sensing function is not used, leave the two jumpers from remote voltage sense terminals to the DC output terminals connected.



CAUTION: WHEN CONNECTING WIRES FROM THE BATTERY TERMINALS TO THE CHARGER, VERIFY THE VOLTAGE POLARITY.

1. Disconnect the two jumper wires from the remote voltage sense terminals inside the wire terminal area and the DC battery output terminals.

NOTE: Before connecting the two wires to the battery terminals, make sure that the polarity is correct to avoid other equipment damage and prevent personnel injury.

2. Using minimum 18GA, maximum 16GA wire, connect two wires to the remote voltage sensing input terminals using a WAGO 210-719 terminal block operating tool on the terminal insertion tabs.
3. Ensuring proper polarity, connect the two wires to the battery terminals.

6 BASIC SETUP PROCEDURE

Go to the **SET POINTS** menu.
Set the **PASSWORD** to **5**.
Leave **USER LEVEL** at **BASIC**.
Select **BATTERY TYPE (LEAD ACID or NI-CAD)**
Set **NUMBER OF CELLS** per your battery bank.
Set **VOLTS PER CELL** to battery manufacturers specs.

The charger should be ready to operate.

7 BATTERY CELL MONITOR SET-UP AND ADJUSTMENTS:

Setup of the Battery Cell Monitor is performed using the settings in the Cell Monitor menu or by accessing the internal web page of the battery charger. Connect to the charger using an Ethernet cable as described in Section 9 of this manual.

8 BATTERY CHARGER SET-UP AND ADJUSTMENTS:

Controller Menu

The controller has 4 Menu Screens:

1. **STATUS**
2. **FAULT HISTORY**
3. **SET POINTS**
4. **FACTORY DEFAULTS**

Menu Screen Selection:

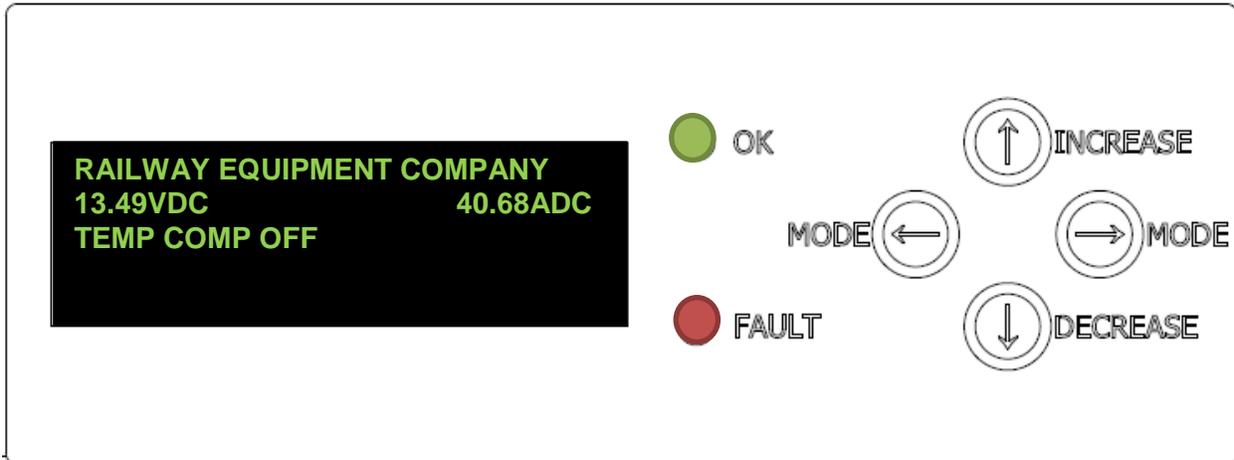
To select the desired Menu Screen, press the **MODE LEFT** or **RIGHT** button until ****** MENU SELECT ****** is displayed, on line 1, and then use the **INCREASE** or **DECREASE Value** button to select the appropriate menu. Once the appropriate menu is selected, use the **MODE LEFT** or **RIGHT** buttons to view the contents of the menu.

NOTE: Use the Increase or Decrease buttons to change set point values.

8.1 STATUS

The STATUS Screen can display **BASIC** or **ADVANCED** information based on what the **USER LEVEL** is set to.

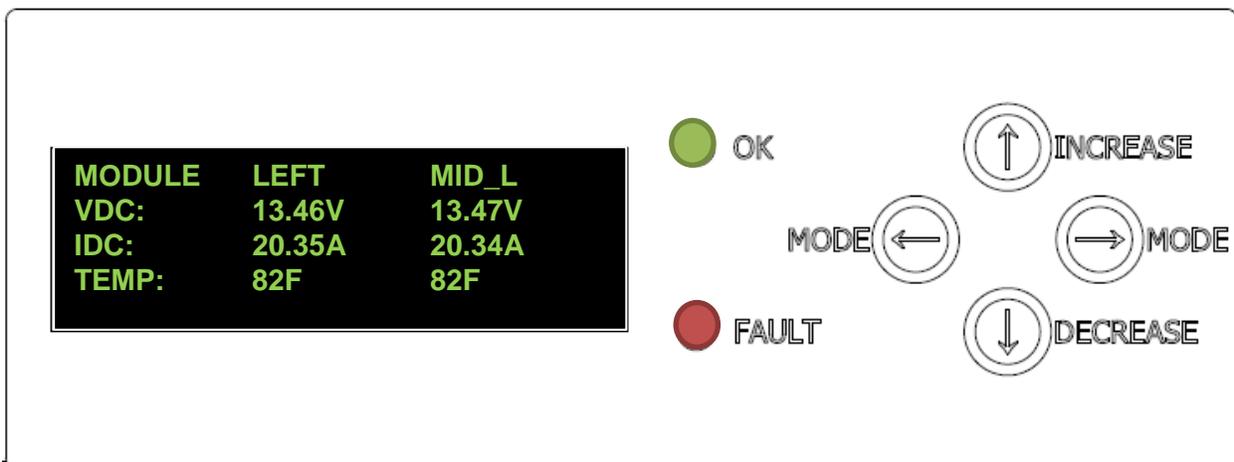
8.1.1 BASIC



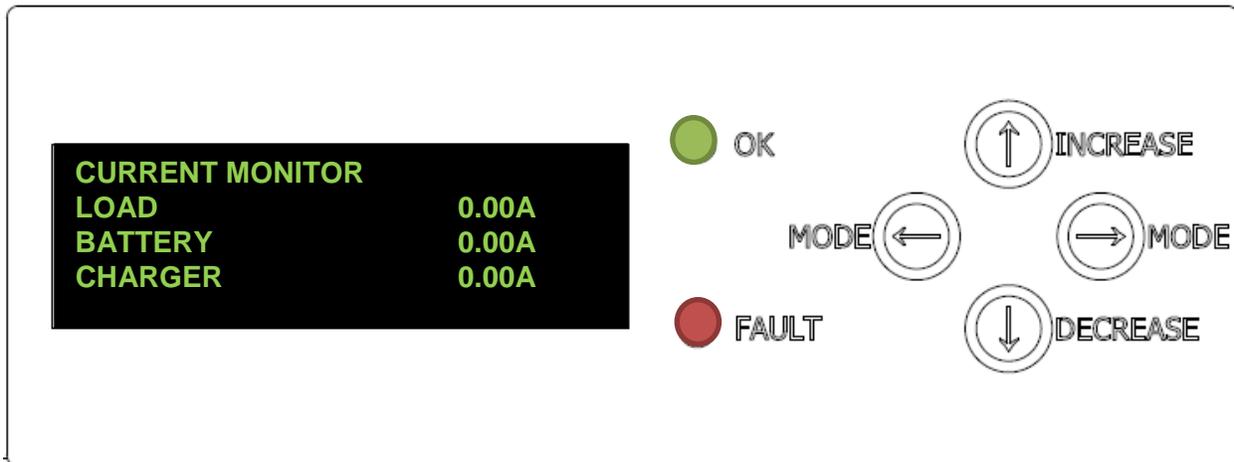
TOTAL VOLTAGE – Displays the total voltage for the entire battery string. This includes battery cells connected to a slave device.

TEMP COMP AND BATTERY TEMP – Displays whether or not **TEMPERATURE COMPENSATION** is enabled or disabled, and displays the temperature of the batteries if a temperature probe is installed. If there isn't a temperature probe installed, this field will be blank.

OUTPUT CURRENT – Displays the load current of the battery string.



MODULE – Displays the voltage, current and temperature of the power supply modules that are installed in the charger. Press UP to display the second pair of modules. (Applies to 80 SMC)

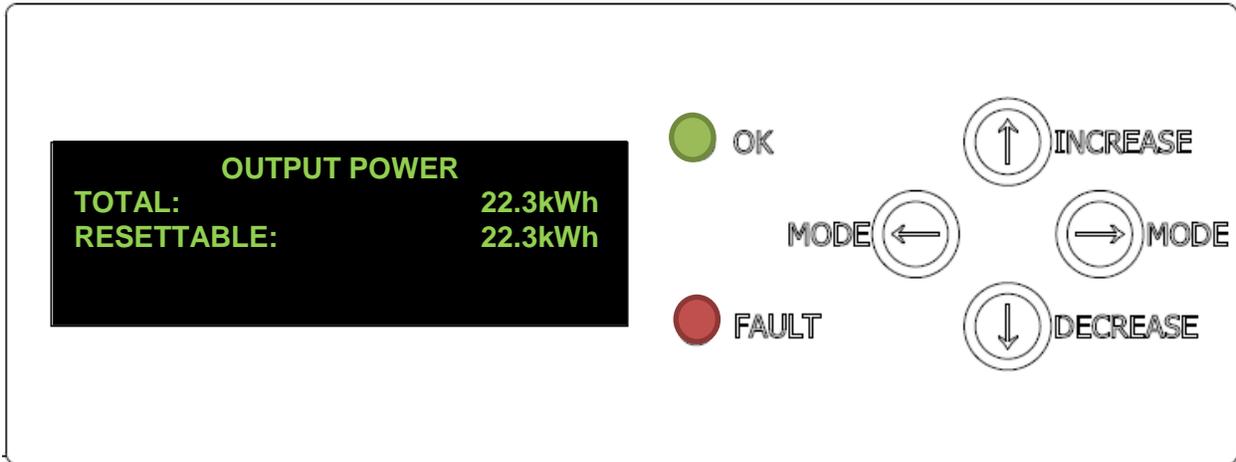


LOAD CURRENT – Displays the load current of the battery string that is being reported by a connected current coil or current shunt.

BATTERY CURRENT – Displays the battery current of the entire string that is being reported by a connected current coil or current shunt.

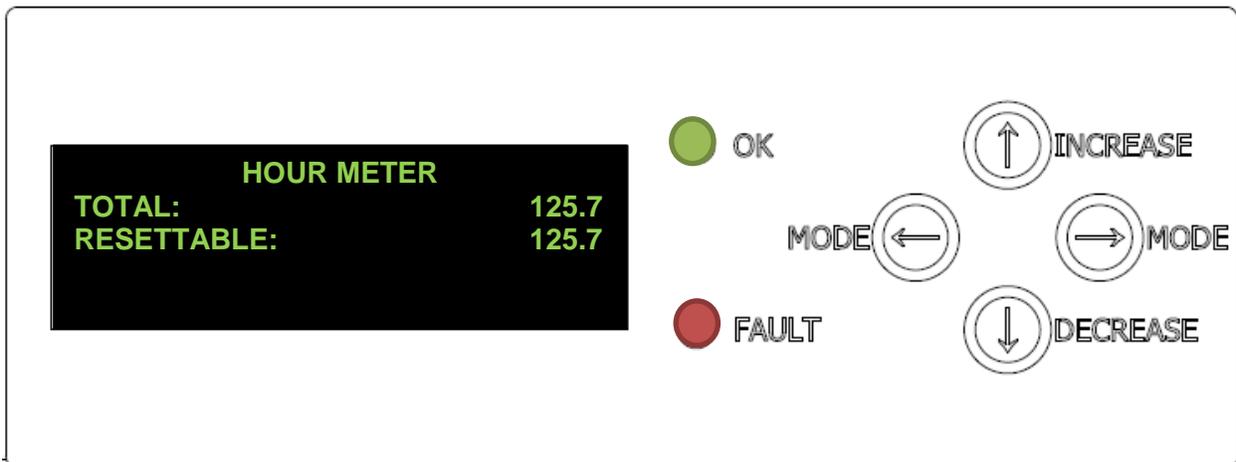
CHARGER CURRENT – Displays the charger current that is being reported by a connected current coil or current shunt.

8.1.2 ADVANCED



TOTAL OUTPUT POWER – Shows the total output power of the battery string.

RESETTABLE TOTAL OUTPUT POWER – This is a resettable display of the total output power.



TOTAL HOUR METER – This displays the total hours this switch monitor has been operating.

RESETTABLE HOUR METER – This displays the total hours this cell monitor has been operating since this counter has been reset. To reset this counter to zero, press the **DECREASE** button.

CIRCUIT BOARD TEMP – This displays the temperature of internal circuit board.

8.2 FAULT HISTORY MENU

NOTE: Some faults may not show in Fault History until there is an actual fault. Press the decrease or increase button to reset the fault count.

OUTPUT RELAY/EQ RELAY – Shows the number of times the battery charger's voltage monitor relay has cycled, and the number of times the battery charger has entered equalization.

POWER UP COUNTER – Shows the number of times the battery charger input power was turned on.

DAYS COUNTER – Shows the total number of days the battery charger has been operating.

TOTAL SECOND COUNTER – Shows the total number of seconds the battery charger has been operating.

HIGH VOLTAGE FAULT COUNTER – Shows the number of times the battery charger voltage's monitor relay has cycled do to a high voltage fault.

LOW VOLTAGE FAULT COUNTER – Shows the number of times the battery charger voltage's monitor relay has cycled do to a low voltage fault.

HIGH CURRENT FAULT COUNTER – Shows the number of times the battery charger voltage's monitor relay has cycled do to a high current fault.

LOW CURRENT FAULT COUNTER – Shows the number of times the battery charger voltage's monitor relay has cycled do to a low current fault.

CHARGER OVER TEMP WARNING COUNTER – Show the number of instances a charger over temperature warning has occurred.

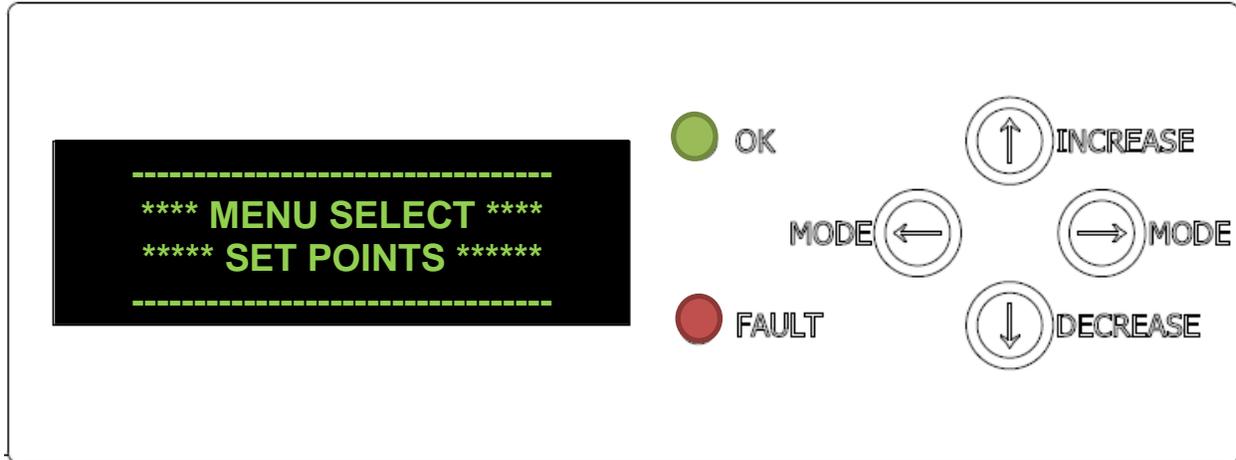
CHARGER OVER TEMP FAULT COUNTER – Shows the number of times that a charger over temperature fault has occurred.

BATTERY OVER TEMP WARNING COUNTER – Show the number of instances a battery over temperature warning has occurred.

BATTERY OVER TEMP FAULT COUNTER – Shows the number of times that a battery over temperature fault has occurred.

AC POWER LOST COUNTER – Shows the number of occasions that the AC line voltage was lost (with the charger connected to a battery).

8.3 SETPOINTS MENU



Under the **SET POINTS** menu, the user defined variables are entered. The parameter screens are:

PASSWORD – To change any user defined parameter, use the increase button to enter the password of **5**. To prevent others from changing parameters, return the password to **0** after making changes. **Note:** If the password is left at **5**, it will automatically reset to **0** after ten minutes.

USER LEVEL (Requires password)

The options are **BASIC** and **ADVANCED**.

BASIC - Access to the basic menu options

ADVANCED – Access to the advanced menu options

BATTERY TYPE – The options are **GENERIC LEAD ACID**, **GENERIC NI-CAD**.

GENERIC LEAD ACID – The type of battery being used is Lead Acid.

GENERIC NI-CAD –The type of battery being used is Ni-Cad.

Note: Also included are presets for several specific brands such as **GNB Absolyte** and **SAFT SPL NI-CAD**.

NUMBER OF CELLS –

NI-CAD - 5-12 cells are useable.

LEAD ACID - 5-8 cells are useable.

VOLTS PER CELL\TOTAL VOLTS –

NI-CAD – The values range from **1.2-1.6VDC**

LEAD ACID – The values range from **2-2.45VDC**.

For **GNB Absolyte** and **SAFT SPL NI-CAD** this value is fixed base on the manufacturers spec. **TOTAL VOLTS** is a calculation of **NUMBER OF CELLS x VOLTS PER CELL**.

TEMPERATURE COMPENSATION – When the temperature sensor is connected, the battery charger will adjust the output voltage up or down depending on the temperature of the batteries. Selecting a brand of battery (GNB, SAFT, etc.) from the “**BATTERY TYPE**” menu may enable this feature if that is the manufacturer’s suggested use. See **TABLE 5** for Temperature Compensation rates. By default this is disabled.

Table 5. Temperature Compensation Rates

Battery Type	Compensation Mode	Compensation Slope	Low Temp Limit	High Temp Limit
Lead Acid	50% V/T	1.47mV/°F/cell	2.35 volts/cell@ +3°F	2.20 volts/cell@ +116°F
Lead Acid	100% V/T	3.0mV/°F/cell	2.35 volts/cell@ +37°F	2.20 volts/cell@ +95°F
Ni-Cad	50% V/T	0.967mV/°F/cell	No Limit	No Limit
Ni-Cad	100% V/T	1.94mV/°F/cell	No Limit	No Limit

CURRENT SET POINT – This setting is used to adjust the maximum output current limit.

HIGH VOLTAGE FAULT – This adjustment is for setting the voltage level when the voltage monitor relay toggles for an over voltage fault.

LOW VOLTAGE FAULT – This is used to set the voltage below which the voltage monitor relay changes state. As an example, it could be set for 10% below the normal battery output voltage, to trigger an alert before the voltage dropped to a point where it would no longer operate the equipment it was attached to.

8.3.1 ADVANCED SET POINTS

HIGH CURRENT FAULT – The parameter is the high amperage setting. The voltage monitor relay will toggle if the current is higher than the selected current.

LOW CURRENT FAULT – The voltage monitor relay will toggle if the current is lower than the selected current. This should be set lower than the expected lowest current output, as when the batteries are fully charged and no equipment is running.

HIGH BATTERY TEMP – This setting allows the user to set the temperature that will trigger a high battery temperature fault. If a high battery temperature fault occurs, the voltage monitor relay will toggle. Factory default value is 160 degrees F.

LOW BATTERY TEMP – This setting allows the user to set the temperature that will trigger a low battery temperature fault. If a low battery temperature fault occurs, the voltage monitor relay will toggle. Factory default value is -40 degrees F.

SELECT F OR C – This is used to choose the temperature units of measure. The choices are F for Fahrenheit and C for Celsius. Factory default is F.

CHARGER OVER TEMP PROTECTION – This cannot be disabled without calling tech support at (763-972-2200). When enabled, if the temperature of the battery charger becomes critical, it automatically decreases the output current limit so to reduce the potential of failure from overheating. Factory default is ENABLED.

BATTERY OVER TEMP PROTECTION – When enabled the charger will go to 50% of the set current output when the battery temp exceeds the **HIGH BATTERY TEMP** set point. If the battery temp exceeds the **HIGH BATTERY TEMP** set point by 10°F, then the charger will go to 0% output. The charger will go back to 100% output once the temperature has dropped 5°F below the **HIGH BATTERY TEMP** set point. Factory default is ENABLED.

EQUALIZATION – This is used to enable or disable the equalization charge function. If enabled, the remaining screens will appear when the **MODE** button is pushed. If equalization is disabled, the following 4 Equalization screens are hidden from view.

EQ FREQUENCY IN DAYS (viewable if **EQUALIZATION** is enabled) – This is used to set the frequency at which equalization charge cycle will occur. It will increment in days.

EQUALIZATION RUN TIME IN xx HOURS (viewable if **EQUALIZATION** is enabled) – This sets the length of time the equalization charge cycle will run in hours. This can be set in 1 hour increments from 1 to 24.

EQUALIZATION VOLTAGE SETPOINT (viewable if **EQUALIZATION** is enabled) – Set the voltage that you want the charger to produce for the equalization charge cycle.

PRESS INCREASE TO RUN EQUALIZATION (viewable if **EQUALIZATION** is enabled) – By pressing the **INCREASE** button, the equalization cycle will begin.

BATTERY CAPACITY – This setting enables the Battery Capacity functionality of the monitor.

BATTERY AMP HOURS – This sets the size, in Amp-hours, of the battery cells being used.

CURRENT SETUP – This sets the configuration of up to (2) current sensors. The options are:

Sensor 1	Sensor 2
Battery	None
Load	None
Charger	Load
Battery	Charger
Battery	Load

Table 6. Current Sensor Configurations

SENSOR SN – This is where the current sensor serial numbers are entered. The serial number will need to be set for each sensor.

SENSOR DIRECTION – This sets the direction of the current flow being monitored by the sensor. The option is Current In or Current Out.

REMOTE COMPENSATION – This enables or disables the battery charger's remote sensing.

MODULE TEMP BALANCE – This setting is used to adjust the output voltage of the power supply modules in order to maintain the same temperature.

CELL MONITOR – This is enabled when an MCM-SLAVE device is connected to the battery charger using the optional add on board's RS485 port. It allows the charger to monitor the voltage of the individual cells in the battery string. When this option is enabled, a fifth menu option is added to see the Cell Monitor settings. Factory Default is Not Installed.

BATTERY TESTING – This is used to test the string of batteries. The user can set a maximum discharge time and maximum discharge wattage for duration. The test will finish when it reaches either the maximum discharge time OR the maximum discharge wattage.

BATTERY TESTING MAXIMUM DISCHARGE TIME – This is used to set the maximum amount of time that the battery test will take to run. The recommended value is:

BATTERY TEST MAXIMUM DISCHARGE WATTS – This is used to set the maximum wattage that the battery test will use. The recommended value is:

BATTERY TEST MINIMUM CELL VOLTAGE – This is the minimum voltage value of each battery cell that the battery test will check for.

AC POWER FAULT RELAY – When AC power is lost the Voltage Monitor Relay will open. Factory default is ENABLED.

DATE AND TIME – This sets the date and time in the battery charger.

SET DISPLAY NAME – This can be used to set a display name in the charger.

ETHERNET MODE – Allows the user to set up the battery charger's IP address for either a network connection or a direct connection via Windows PC.

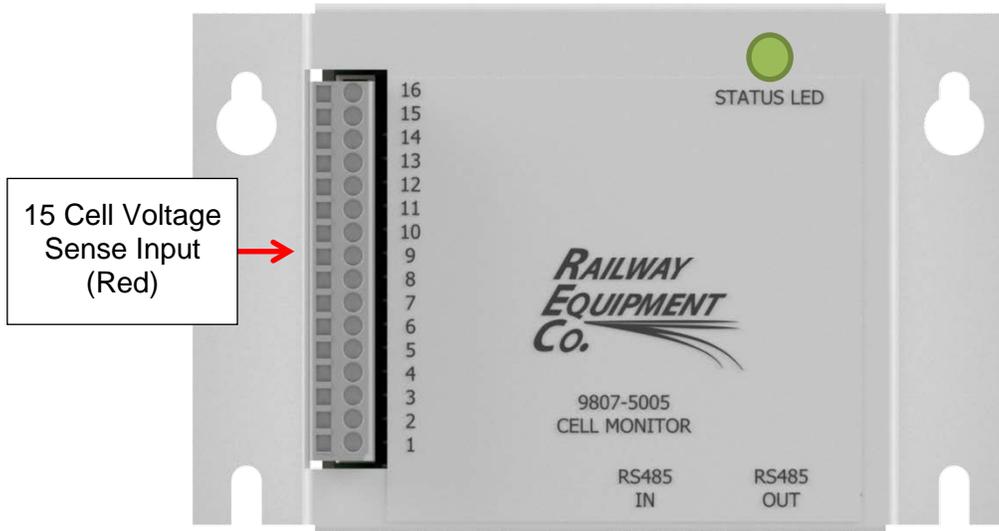
MY IP ADDRESS – Shows the chargers IP address. (DHCP is enabled by default)

PROG REV & DATE – This displays the firmware revision level and the date that revision was released.

8.4 Optional MCM-SLAVE Battery Monitor

The optional battery monitor is capable of monitoring the voltages of up to 15 individual cells or it can be used as a switch monitor. It is powered by the RS485 port located on the optional add on board.

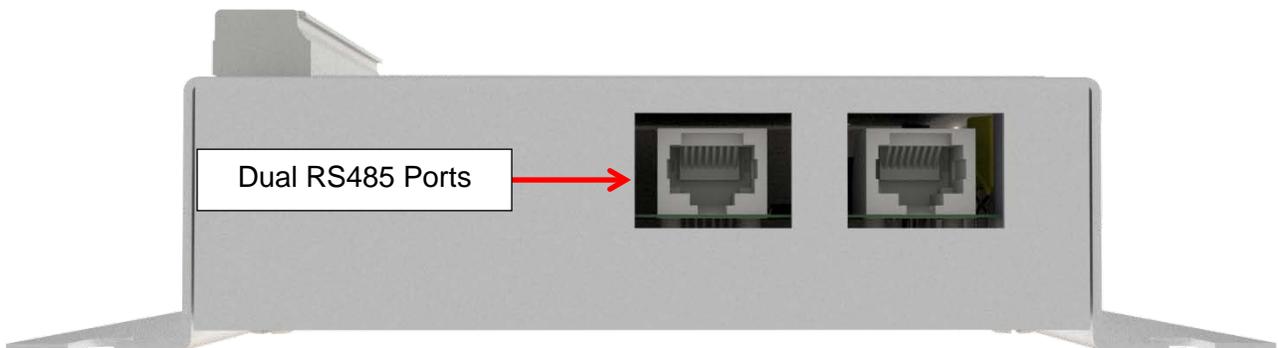
8.5 MCM-SLAVE Front Panel Features



8.5.1 15 Cell Voltage Sense Input

The Cell Guard Cell Monitor's (16) position WAGO terminal connector is used to connect the red voltage sense wires from the monitor to the battery bank.

8.6 MCM-SLAVE Bottom Panel Features



8.7 Dual RS 485 Ports

The Dual RS485 Ports are used to supply power to the Monitor Slave Device from the Monitor Master Device. (NOTE: RS458 IS NOT FOR ETHERNET)

8.8 Split Core Digital Current Coil



8.8.1 Thumb Screw

The Current Coil has a thumb screw that can be removed and re-installed after the coil is installed.



8.8.2 RS485 Ports

The Split Core Current coil has (2) RS485 ports used to connect the coil to the switch monitor and to daisy chain additional current coils.

9 MCM-SLAVE INSTALLATION



WARNING: It is advised to take extreme caution when dealing with high DC voltages. If precautions are not taken, injury or even death can result.

NOTE: The term “Highest” refers to the battery cell with the highest potential. The term “Lowest” refers to the battery cell with the lowest potential.

9.1 Mounting

9.1.1 Wall Mount

Use the two-four keyed slots on the back of the monitor for mounting to a wall.

9.2 External Wiring Connector

NOTE: FOR USE AS A CELL MONITOR

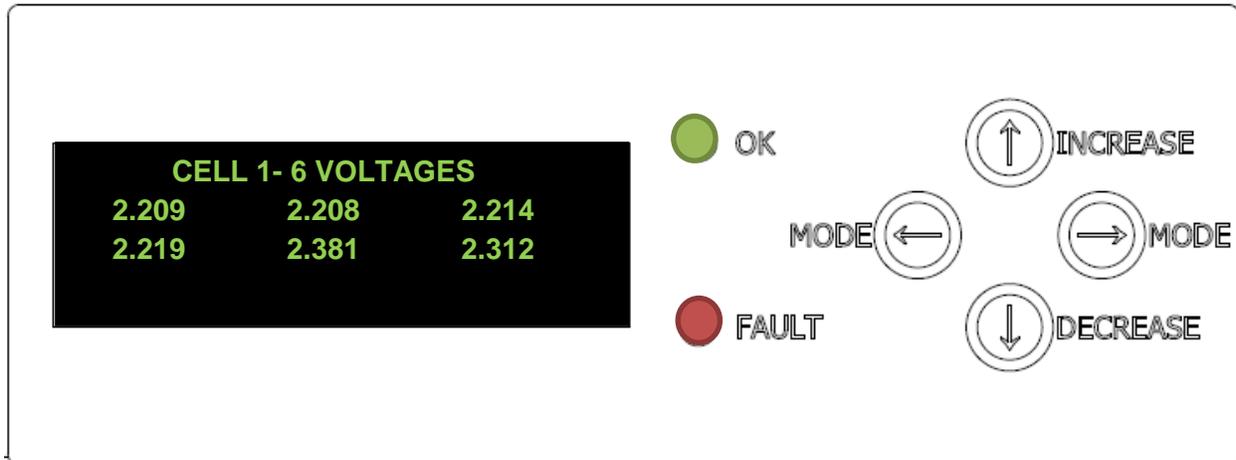
The Cell Guard MCM-SLAVE (16) position WAGO terminal connector is labeled 1-16.

Starting at 1, connect the positive wire of the highest battery cell to the cell monitor, and then connect the next highest positive battery cell to 2, and then connect the next highest positive battery cell to 3 and so on until you have hooked up all the positive battery terminals. You will then need to hook the negative wire from the lowest cell to the position next to the lowest positive cell. EX if you had 10 cells you would need to hook the negative wire to position 11, and if you had 15 cell you would need to hook it to position 16.

NOTE: The term “Highest” refers to the battery cell with the highest potential. The term “Lowest” refers to the battery cell with the lowest potential.

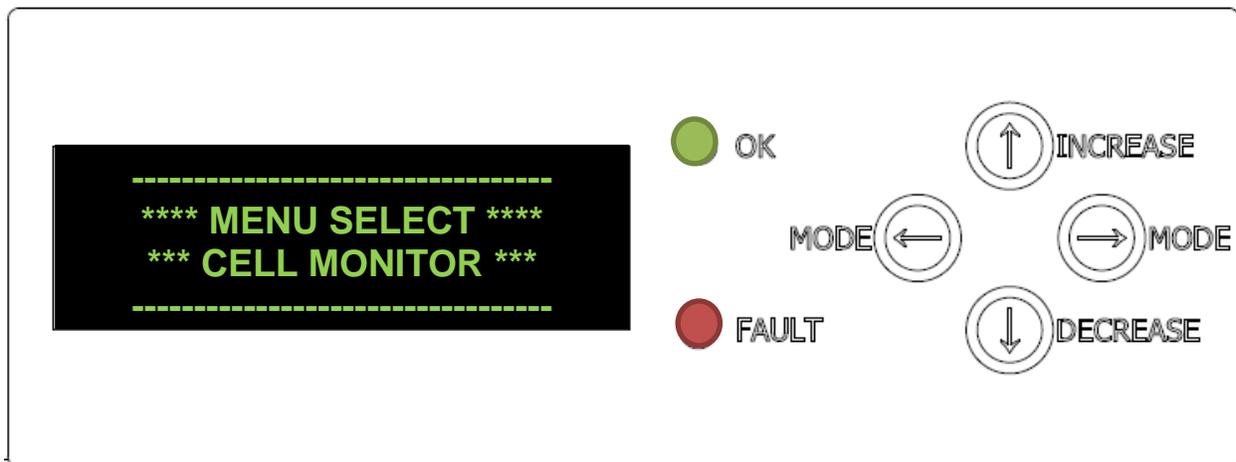
The Split Core Current Coils should be connected to the SMC charger using a standard Ethernet cable. Plug one end of the first cable into the RS485 port on the battery charger’s add-on board and connect the other end to the current coil.

9.1 CELL MONITOR STATUS



CELL VOLTAGE – This displays the voltage reading of the individual cells by the MCM-SLAVE, if one is installed. A total of 6 cells are viewable at a time. If there are more than 6 individual battery cells, press the **INCREASE** button to view the remaining cells.

9.2 CELL MONITOR MENU



CELL PUCK SELECT – This is used to select the active Cell Puck. There is support for up to 4 additional Cell Pucks.

CELL PUCK SN – This is where the serial number of the active Cell Puck is entered. Each Puck requires its serial number to be entered here.

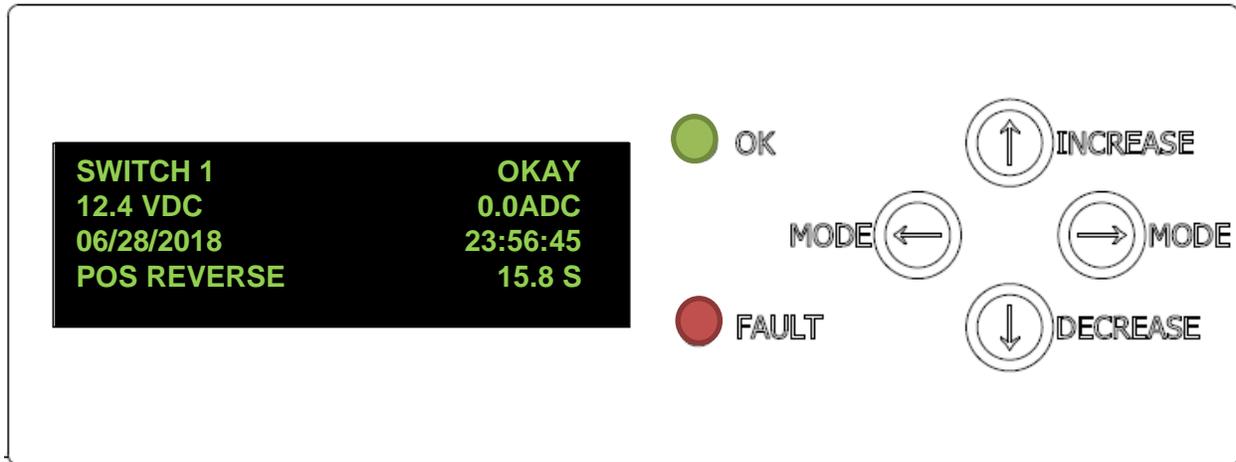
CELL PUCK NUMBER OF CELLS – This is where the number of battery cells is entered for each Cell Puck.

CELL VOLT DEVIATION WARNING - This sets the deviation of the average cell voltage.

CELL ERROR TIMER - This is the amount of time below the Cell Deviation Setpoint before it triggers a fault.

CELL FAULT RESET TIMER – This is the resettable amount of time below the Cell Deviation Set point before it triggers a fault.

9.3 SWITCH MONITOR STATUS



SWITCH NUMBER – Displays the currently active switch machine. The switch monitor supports up to 12 switch machines.

VOLTAGE – Displays the total voltage of the battery string.

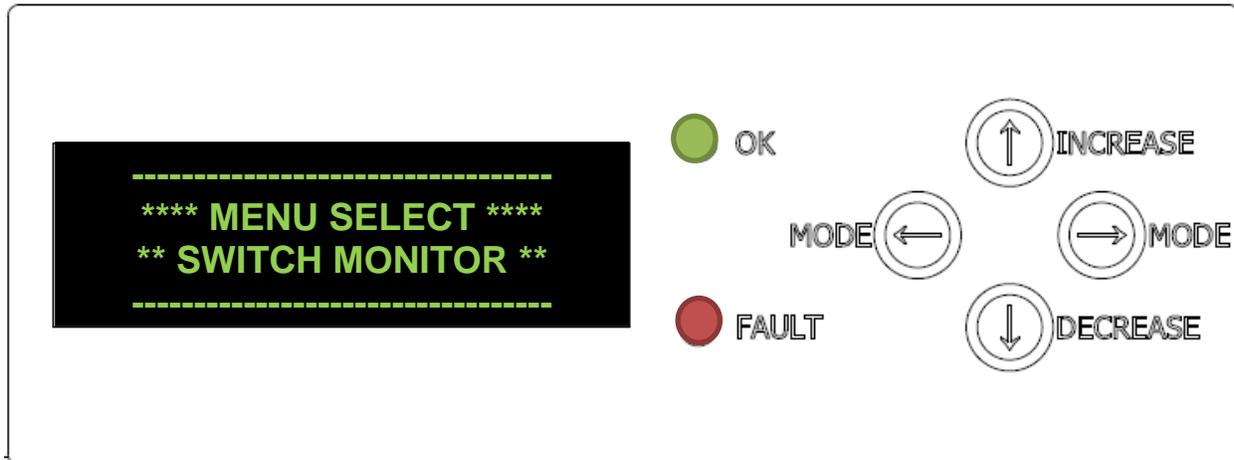
CURRENT – Displays the current being used by the switch machine.

DATE AND TIME – Displays the date and time of the most recent switch movement.

POSITION – Displays the position of the switch machine.

DURATION – Displays the duration of the most recent switch movement.

9.4 SWITCH MONITOR MENU



SWITCH SELECTION – This is used to select the active Switch. There is support for up to 12 switch machines.

SWITCH MAX CURRENT – This displays the switch’s max current of the last movement.

HIGH VOLTAGE FAULT – If the voltage of the battery string goes above this value during an action, it will trigger a voltage fault.

LOW VOLTAGE FAULT – If the voltage of the battery string goes below this value during an action, it will trigger a voltage fault.

HIGH CURRENT FAULT – If the current goes above this value during an action, it will trigger a current fault.

TIMER FAULT – This sets the maximum amount of time an action by the switch machine should take before a timer fault should occur.

CURRENT FOR PROFILE START – This is the amount of current necessary from the switch machine in order to generate a switch profile.

PROFILE WINDOW TIME – This setting is the event window time. (This will be longer than the duration of the action)

TOTAL TIMER COUNTER – Shows the total runtime of the switch monitor in days and in seconds as well as the total number of power up cycles.

FAULT COUNTERS – This displays the total number of faults that have occurred. This includes Voltage, Current and Timer faults.

TOTAL HOURS IN ACTION/ACTION RESET – Shows the total number of hours the switch machine has been in action over time.

RESETTABLE TOTAL HOURS IN ACTION – This is a resettable display of the total number of hours that the switch machine has been in action over time. To reset this meter to zero, press the **DECREASE** button.

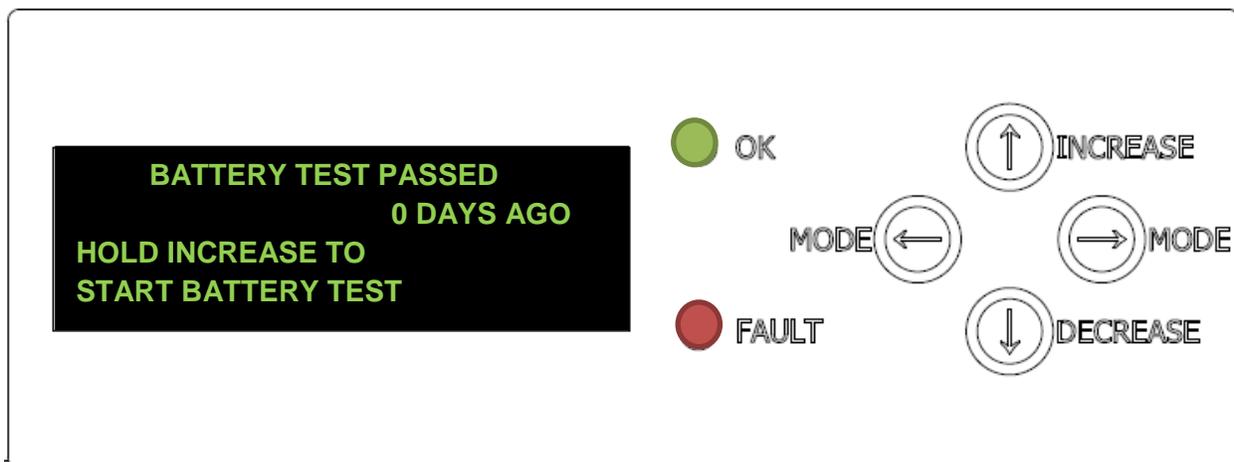
NUMBER OF ACTIONS – Shows the total number of actions the switch machine has performed.

RESETTABLE TOTAL NUMBER OF ACTIONS – This is a resettable display of the total number of actions that the switch machine has completed over time. To reset this meter to zero, press the **DECREASE** button.

CURRENT CAL – Displays the calibration of the connected current shunt.

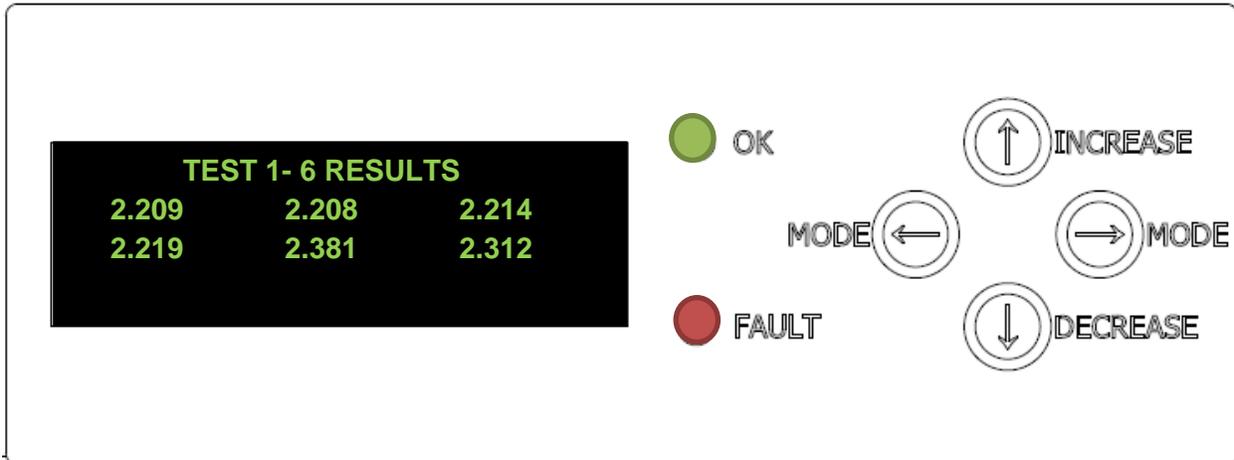
CURRENT SHUNT SN – This is where the current shunt serial numbers are entered. The serial number will need to be set for each of the corresponding switches.

9.5 BATTERY TESTING STATUS

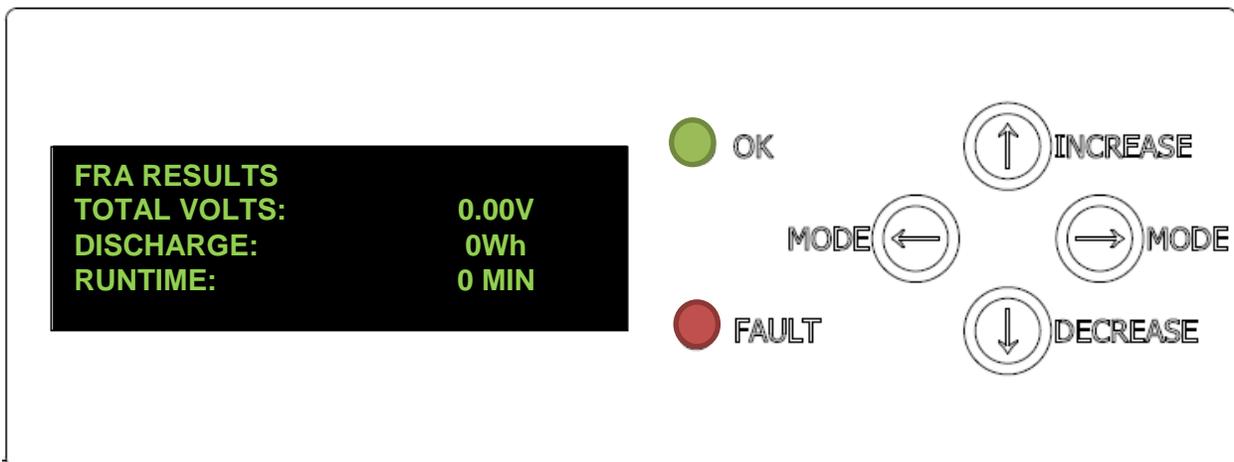


PRESS INCREASE TO START BATTERY TEST – This will begin a battery test that will test the battery string based on the Duration and Power parameters that are set by the user.

BATTERY TEST PASSED/FAILED – This displays the passing or failing of the battery test and when the test was most recently performed.



TEST RESULTS – This displays the results of the most recent battery test performed. A total of 6 cells are viewable at a time. In order to view all of the cells, press the **INCREASE** button.



FRA RESULTS – This displays the total voltage, total discharge and the runtime of the most recent battery test performed.

9.6 FACTORY DEFAULTS

FOR FACTORY DEFULTS PRESS DECREASE – This is to allow the user to return most settings to the original factory settings by pressing the **DECREASE** button. A password of **5** is required to change this setting.

10 HOSTED WEB PAGE (REQUIRES ADDON BOARD)

Settings can be changed from the hosted web page as well as from the push buttons and display on the front of the charger.

10.1 Login

Logging in on existing Network

To login, look up the IP address under the **SET POINTS - MY IP ADDRESS (SECTION 7.3.1)** of this manual), and enter it in to your browser. The format should look like this <http://192.168.4.99:50000>. Make sure to add the port number of **:50000** after the IP address. (The IP address given to the monitor will be provided by the DHCP server on the network)

Logging in with Direct Connection to the Battery Charger

To login, first enable the Direct Connect Ethernet Mode on the battery charger. This will set the battery charger's IP address as static and allow a user to access the charger's webpage via direct Ethernet connection.

NOTE: If connecting directly to the monitor from a computer, the computer and battery charger need to be on the same subnet. If the computer doesn't support Ethernet crossover detection, a crossover Ethernet cable would be required.

Steps to change IP address of the Windows PC

- Click on the Start Menu icon in the lower left of the Desktop.
- In the search box, type **Network and Sharing Center**.
- Click on the **Network and Sharing Center** search result.
- Click on **Change adapter settings** on the left side.
- Right-click the Local Area Connection and then select **Properties**.
- Under **This connection uses the following items**, select **Internet Protocol Version 4 (TCP/IPv4)**.
- Switch to the **Alternate Configuration** tab.
- To specify an IP address, select **User Configured**, and then, in the **IP address**, **Subnet mask**, and **Default gateway** boxes, type the IP address settings.
 - IP Address will be on the **192.168.4.X** subnet (i.e. **192.168.4.2**)
 - Subnet mask will fill in automatically as **255.255.255.0**
 - Default Gateway is **192.168.4.1**

10.2 Status Tab

Displays status information about the battery charger.

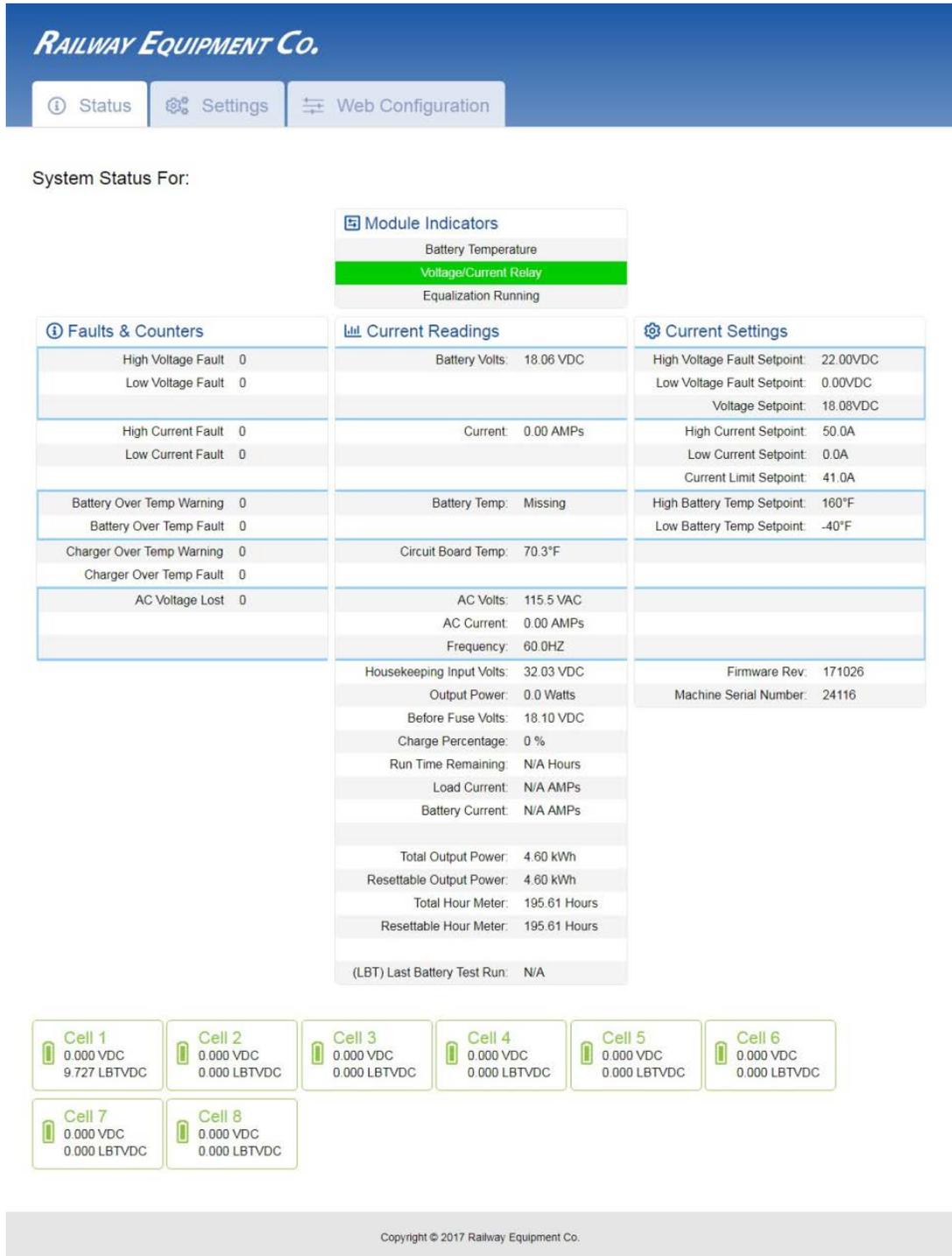


Figure 4. System Status

10.3 Settings Tab

Settings tab allow you to change the settings. The **username** is **admin**, and the **password** is **5**.

RAILWAY EQUIPMENT CO.

Status Settings Web Configuration

Monitor Settings For:

This page allows the configuration of the board's internal settings.
Enter the new settings for the board below:

Overview

Firmware Rev: 171026 Password: 85

Display Line 1: Display Line 2:

Machine Serial Number: 24116 Current Limit: 41.0 Amps

Battery Type: Lead Acid Temperature Compensation: Off

Number of Cells: 8 Volts Per Cell: 2.260 Volts
Total Voltage(18.08)

Update Interval: 5 Min Total Second Counter:

AC Voltage Type: 115v Temperature: °F
115v 230v Fahrenheit Celcius

Date: mm/dd/yyyy Time: hh:mm:ss
12 / 6 / 2017 16 : 4 : 26

Enable Set Date & Time

Tab Settings

Equalization Tab: Enabled Enable Disable

Battery Capacity Tab: Enabled Enable Disable

Cell Monitoring Tab: Enabled Enable Disable

Battery Testing Tab: Enabled Enable Disable

Switch Monitor Tab: Enabled Enable Disable

Relay Fault Trip Parameters

High Battery Temp Setpoint: Enabled 160 °F Low Battery Temp Setpoint: Enabled -40 °F

High Voltage Setpoint: Enabled 22.00 Volts Low Voltage Setpoint: Enabled 0.00 Volts

High Current Setpoint: Enabled 50.0 Amps Low Current Setpoint: Enabled 0.0 Amps

AC Power Fault Relay: Enabled Enable Disable

Save Configuration

Copyright © 2017 Railway Equipment Co.

Figure 5. Overview of the Charger Settings

10.4 Equalization Tab

RAILWAY EQUIPMENT Co.

Status Settings Web Configuration

Monitor Settings For:

This page allows the configuration of the board's internal settings.
Enter the new settings for the board below:

Overview
Equalization
Battery Capacity
Cell Monitoring
Battery Testing
Switch Monitor

Equalization Settings

Equalization: Disabled
 Enable Disable

Equalization Counter: 0 since EqualizationDate

Equalization Frequency: 0.00 Days
Currently(0.00) Days

Equalization Voltage Setpoint: 14.00 Volts

Equalization Run Time: 60 Hours
Currently(0) Min

Copyright © 2017 Railway Equipment Co.

Figure 6. Equalization Settings

10.5 Battery Capacity Tab

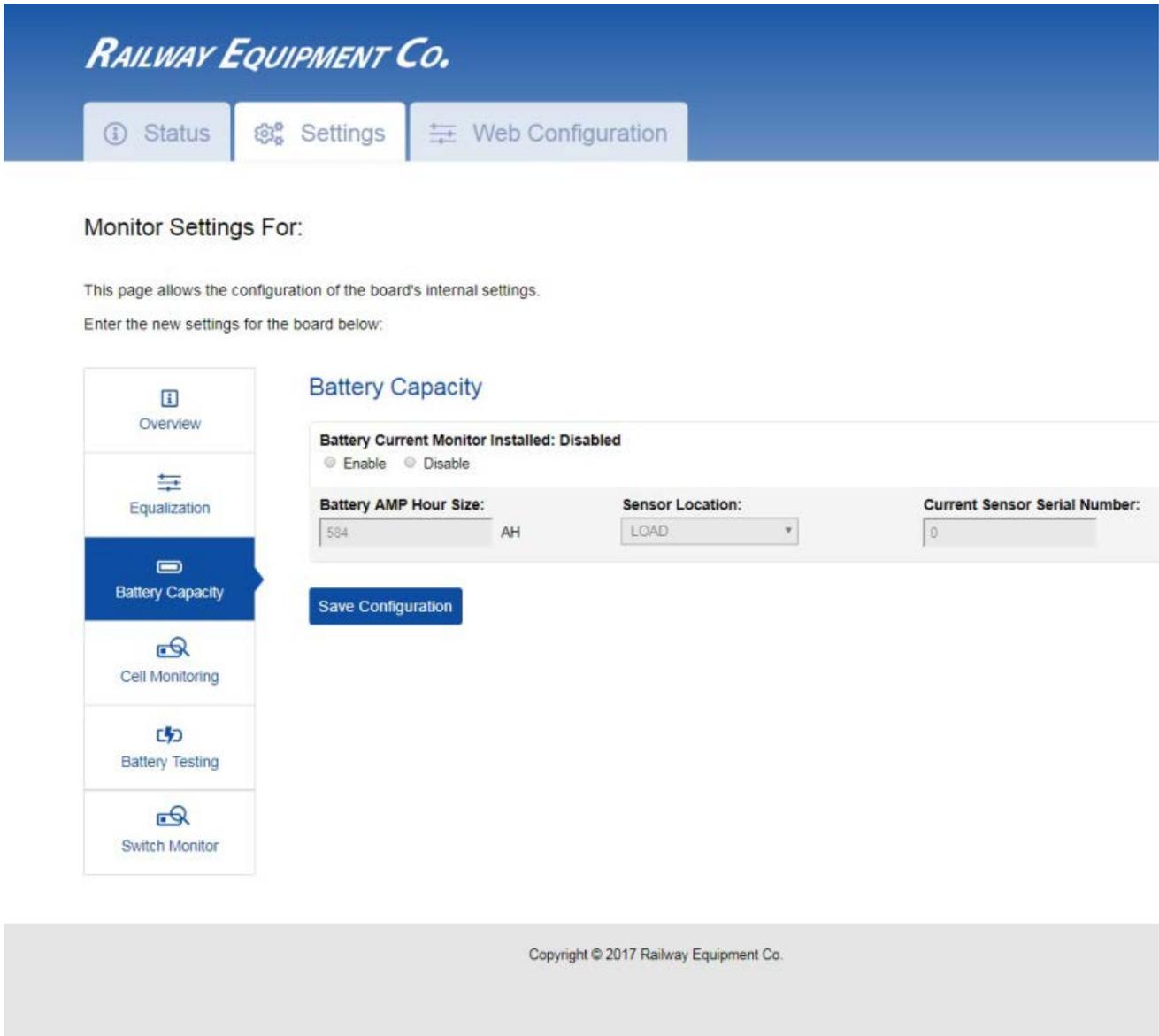
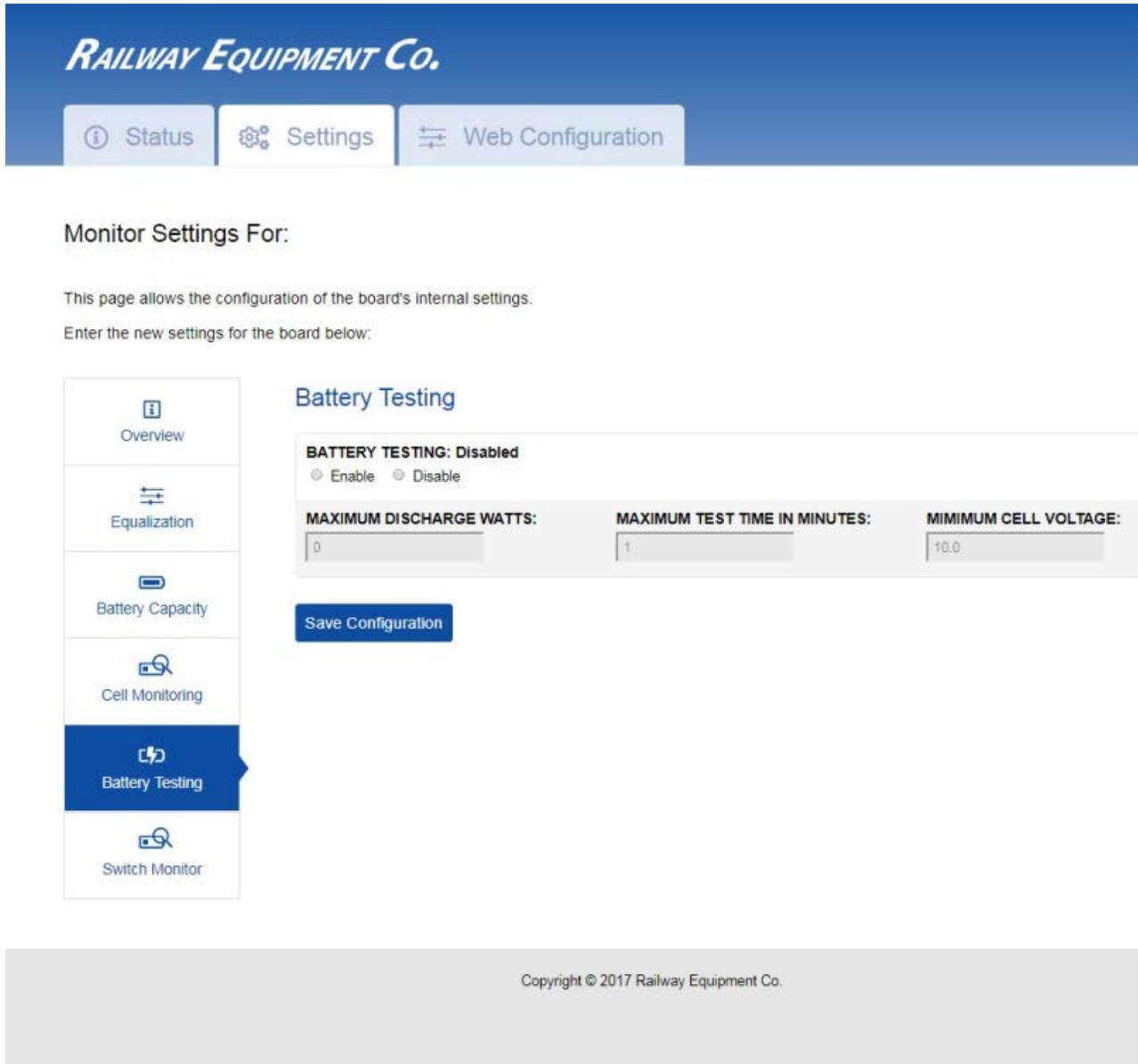


Figure 7. Battery Capacity Settings

10.6 Battery Testing Tab



RAILWAY EQUIPMENT CO.

Status Settings Web Configuration

Monitor Settings For:

This page allows the configuration of the board's internal settings.
Enter the new settings for the board below:

Overview
Equalization
Battery Capacity
Cell Monitoring
Battery Testing
Switch Monitor

Battery Testing

BATTERY TESTING: Disabled
 Enable Disable

MAXIMUM DISCHARGE WATTS:	MAXIMUM TEST TIME IN MINUTES:	MINIMUM CELL VOLTAGE:
<input type="text" value="0"/>	<input type="text" value="1"/>	<input type="text" value="10.0"/>

Save Configuration

Copyright © 2017 Railway Equipment Co.

Figure 8. Battery Testing Settings

10.7 Cell Monitoring Tab

RAILWAY EQUIPMENT CO.

Status Settings Web Configuration

Monitor Settings For:

This page allows the configuration of the board's internal settings.
Enter the new settings for the board below:

Overview
Equalization
Battery Capacity
Cell Monitoring
Battery Testing
Switch Monitor

Cell Monitoring

Cell Monitor Installed: Enabled
 Enable Disable

Cell Volt Deviation: 1.000 Volts
**Average string voltage

Cell Voltage Warning Timer Setpoint: 1 SEC
Currently(0)

Cell Fault Reset Timer Setpoint: 1 SEC
Currently(0)

Cell Puck 1 Serial Number: 26133
 Cell Puck 1 Number of Cells: 6

Cell Puck 2 Serial Number: 0
 Cell Puck 2 Number of Cells: 0

Cell Puck 3 Serial Number: 0
 Cell Puck 3 Number of Cells: 0

Cell Puck 4 Serial Number: 0
 Cell Puck 4 Number of Cells: 0

Save Configuration

Copyright © 2017 Railway Equipment Co.

Figure 9. Cell Monitoring Settings

10.8 Switch Monitoring Tab



Monitor Settings For: SMC P2

This page allows the configuration of the board's internal settings.

Enter the new settings for the board below:

Overview

Battery Capacity

Cell Monitoring

Switch Monitor

Battery Testing

Switch Monitoring

Switch Selection:

Switch 1 ▼

Enable Switch Parameters Change:

Voltage High Fault Setpoint: <input type="text" value="14.5"/> V	Voltage Low Fault Setpoint: <input type="text" value="10.0"/> V
Current High Fault Setpoint: <input type="text" value="30.0"/> A	Current For Profile Start: <input type="text" value="1.5"/> A
Profile Window Time: <input type="text" value="20"/> sec	Total Second Counter: <input type="text" value="0"/> sec
Timer Fault Setpoint: <input type="text" value="15.0"/> sec	Timer Fault Counter: <input type="text" value="0"/>
Voltage Fault Counter: <input type="text" value="0"/>	Current Fault Counter: <input type="text" value="0"/>
Total Seconds in Action: <input type="text" value="0"/>	Total Seconds in Action Reset: <input type="text" value="0"/>
Number of Actions: <input type="text" value="0"/>	Number of Actions Reset: <input type="text" value="0"/>
Current CAL Zero: <input type="text" value="0"/>	Current CAL Gain : <input type="text" value="0"/>
Power Up Counter: <input type="text" value="0"/>	Current Shunt Serial Number: <input type="text" value="0"/>

Save Configuration

Copyright © 2017 Railway Equipment Co.

Figure 10. Switch Monitoring Settings

11 SPECIFICATIONS

Table 7. General Specifications

Description	Specification	
Input Voltage	115-230VAC ± 15%, 50, 60 Hz	
Voltage Regulation	± 1%	
Voltage Ripple	< 100mv volt ripple, peak to peak at maximum output current	
Operating Temperature (0-95% non-condensing humidity)	-40°F to +158°F	-40°C to +70°C

Table 8. Model Specifications

Model No.	Cells	115VAC Amps	230VAC Amps	Output Amps	Output Volts	Width x Height x Depth	Ship Weight
20SMC-12V	5-8 Lead Acid 5-12 NiCad	5.0 Amps	2.5 Amps	20.0 Amps	7.0 to 18.8 Volts	11.375 x 10.875 x 10.50 inches	12 lbs.
20SMC-24V	11-18 Lead Acid 18-26 NiCad	10 Amps	5.0 Amps	20.0 Amps	24.0 to 40.0 Volts	11.375 x 10.875 x 10.50 inches	20 lbs.
40SMC-12V	5-8 Lead Acid 5-12 NiCad	10.0 Amps	5.0 Amps	40.0 Amps	7.0 to 18.8 Volts	11.375 x 10.875 x 10.50 inches	20 lbs.
40SMC-24V	11-18 Lead Acid 18-26 NiCad	20 Amps	10 Amps	40.0 Amps	24.0 to 40.0 Volts	17.50 x 10.875 x 10.50 inches	35 lbs.
60SMC-12V	5-8 Lead Acid 5-12 NiCad	15 Amps	7.5 Amps	60.0 Amps	7.0 to 18.8 Volts	17.50 x 10.875 x 10.50 inches	30 lbs.
80SMC-12V	5-8 Lead Acid 5-12 NiCad	20 Amps	10 Amps	80.0 Amps	7.0 to 18.8 Volts	17.50 x 10.875 x 10.50 inches	35 lbs.