Instruction Manual

For

Integrated Battery Monitoring + Testing

Manufactured
By

RECO

Railway Equipment Company

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Table of Contents

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# 1   Introduction

1.1   System Description

The Integrated Battery Monitoring + Testing is a multi-functional device used with an SMC Battery Charger. This device is a cell monitor, current coil, and a load bank all in one small package. When this device is installed to the charger, it has the capabilities to monitor and test a battery bank. The user has the ability to set up monthly testing for the batteries.

1.2   Standard Features

Here is a list of standard features that come with the Integrated Battery Monitoring + Testing:

- 1-12 battery cells can be connected to the device
- Constantly checking/monitoring the status of the battery cells and will report when there is a bad cell
- The current coil is rated to ±80 Amps when monitoring the battery bank current
- The device has an internal 5Ω resistive load that can be switched on during testing
- Easily installed to the SMC Battery Charger using the RS485 ports
- Monthly testing can be set up to test the health of the batteries and will let the user know if there are any bad cells

1.3   Device Connections
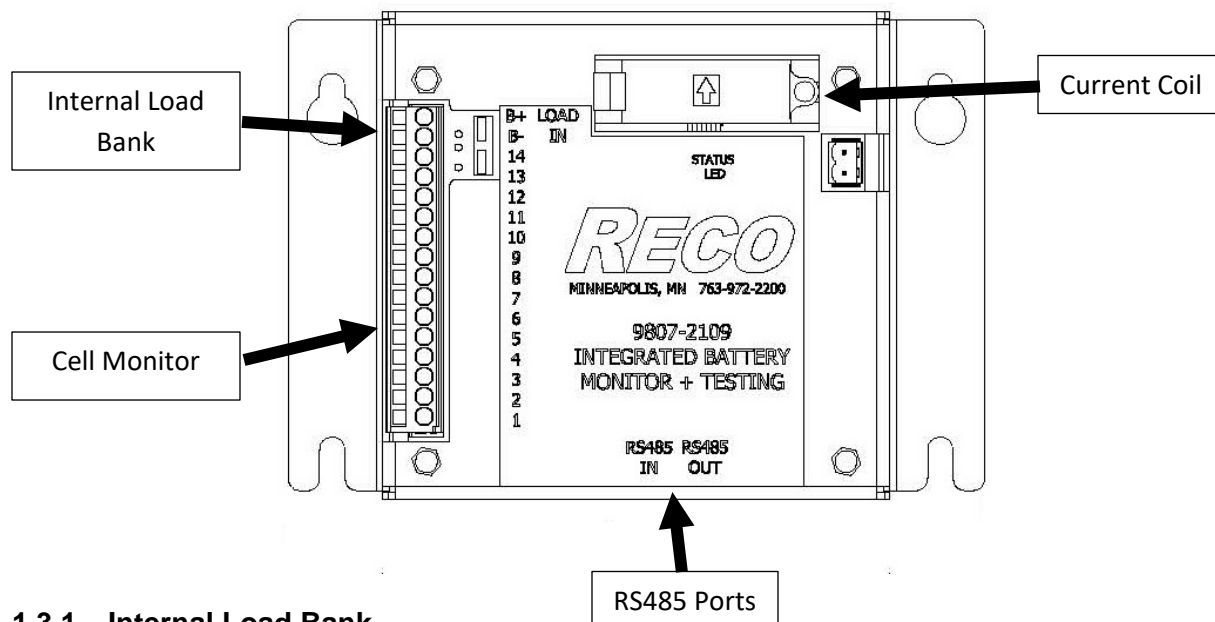
1.3.1   Internal Load Bank

The internal load bank is a 5Ω resistive load that can be switched on to be used during testing.

1.3.2 Cell Monitor

The Cell Monitor allows the user to have 1-12 cells be connected to the device. When connected, this will constantly check and monitor the status of the batteries. It will report when there is a bad battery cell.

1.3.3 Current Coil

The Current Coil is rated to ±80 Amps when monitoring the battery bank current.

1.3.4 RS485 Ports

The RS485 Ports allow communication between the Integrated Battery Monitoring + Testing device and the SMC Battery Charger.

2 Operation

This section will go over how to connect the Integrated Battery Monitoring + Testing device, how to set up the device through the SMC Battery Charger, settings, and other additional features.

2.1 Connecting the Integrated Battery Monitoring + Testing Up

2.1.1 Load Bank

To be able to use the load bank for testing the battery bank, the user will need to have a wire on the lowest negative potential battery terminal and going to B-. There will also need to be a wire coming from the highest positive potential battery terminal and going to B+.

2.1.2 Cell Monitor

To be able to monitor the battery bank, the user will need to use included wires and follow below:

Connector Position #1: Connect the red wire to the positive terminal of the highest battery cell
Connector Position #2: Connect the red wire to the positive terminal of the second battery cell
Connector Position #3: Connect the red wire to the positive terminal of the third battery cell
Connector Position #4: Connect the red wire to the positive terminal of the fourth battery cell
Connector Position #5: Connect the red wire to the positive terminal of the fifth battery cell
Connector Position #6: Connect the red wire to the positive terminal of the sixth battery cell
Connector Position #7: Connect the red wire to the positive terminal of the seventh battery cell
Connector Position #8: Connect the red wire to the positive terminal of the eighth battery cell
Connector Position #9: Connect the red wire to the positive terminal of the ninth battery cell
Connector Position #10: Connect the red wire to the positive terminal of the tenth battery cell
Connector Position #11: Connect the red wire to the positive terminal of the eleventh battery cell
Connector Position #12: Connect the red wire to the positive terminal of the twelfth battery cell
Connector Position #13: Connect the red wire to the negative terminal of the lowest battery cell

NOTE: If you do not have 12 cells, connect all cells like stated and then on the last cell connect the negative terminal to the next available position on the connector.

2.1.3 Current Coil

To hook up the current coil to the battery bank, the user will need to clamp the coil over one of the DC output wires from the battery. The current coil is directional and has an arrow showing the direction of current.

2.1.4 RS485 Ports

To make so the Integrate Battery Monitoring + Testing communicates to the SMC Battery Charger, the user will need to use an ethernet cable and have one end be plug into one of the RS485 ports on the device and the other be plugged into the SMC RS485 port.

2.2 Connecting the Device to a SMC Battery Charger

1. In order to get the device to work properly with the charger, first check the program revision that is installed to the battery charger. If the revision is before 221118, then you will need to contact RECO to obtain a new program revision.

2. Connect the Integrated Battery Monitoring + Testing to the SMC Battery Charger using an ethernet cable. Have one end go into one of the RS485 ports on the device and the end go to the SMC RS485 port.

3. At first the LED will be flashing orange, ignore for now.

4. Go to the Battery Charger and go to the Setpoints Menu.

5. Once there, enter in a password of 85 and set the user level to be advanced.

6. Continue through that menu category and change the following setpoints:
   a. Cell Monitor Is Not Installed → Cell Monitor Is Installed
   b. Battery Meter Is Not Installed → Battery Meter Is Installed
   c. Battery Testing Disabled → Battery Testing Enabled

7. After that, you will need to go to Menu Select Cell Monitor and enter in the serial of the device into Cell Puck 1 SN.

8. You will then need to go to Menu Select Battery Meter and select for the current setup up to be Sensor 1: CBTS, Sensor 2: None.

9. Once that is done, then enter in the serial number again under Sensor 1 SN.

10. After the serial number is entered in, the LED on the device should start flashing green indicating communicating has been established.

11. Refer to the next section on the different setpoints to change for the device.

2.3 Settings

2.3.1 Cell Monitor

- **Cell Puck Select:** This is used to select the active Cell Puck.

- **Cell Puck 1 SN:** This is where the serial number of the active Cell Puck is entered.
  NOTE: This number is found on the device.

- **Cell Puck 1 Number Of Cells:** There is where the number of battery cells are entered. You can have 1-12 cells installed.

- **Puck 1 Comms:** Here will display how many times there has been a communication error, communication has been okay and the firmware revision the puck has.

- **Cell Voltage Deviation Warning Set:** This sets the deviation of the average cell voltage.

- **Cell Error Timer Set:** This is the amount of time below the Cell Deviation Setpoint before it triggers a fault.

- **Cell Fault Reset Timer Set:** This is the resettable amount of time below the Cell Deviation Set point before it triggers a fault.

- **Estimated Inter-Connect Resistance:** The default value is 1000uOhms.

2.3.2 Battery Meter

- **Battery Amp Hours Size:** 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. With this application, you will only have one sensor. Make sure you have the SENSOR 1: CBTS, SENSOR 2: NONE selected.

- **Sensor 1 / 2 SN & FWRev:** This is where the current sensor serial numbers are entered. The serial number will need to be set for each sensor. Once there has been commutation established, it will display the firmware revision of the sensor.
  NOTE: This number is found on the device.

- **Sensor 1 / 2 Direction:** This sets the direction of the current flow being monitored by the sensor. The option is Current In or Current Out.

2.3.3 Battery Test

- **Battery Test Maximum Discharge Time:** This sets the maximum discharge time for the battery test.

- **Battery Test Maximum Discharge WH:** This sets the maximum discharge watts for the battery test.

- **Battery Test Minimum Cell Voltage:** This sets the minimum cell voltage for the battery test.

- **Periodic Batt Test:** By default, this is disabled. You can manually run a battery test at any time by going to the Status page. When enabled, you will have the ability to set how often you wish to have a battery test be done. To set the test frequency, click the increase button and follow the format of DD:HH:MIN. Use the mode left/right to move between digits and increase/decrease to change the values. Hold the right mode to set the time once done.
  NOTE: You can reset the counter back to the original value by holding the decrease button.

- **Battery Test Fault:** By default, this is disabled. When enabled, if the battery test fails, this will trigger a fault and active the fault status LED.

2.4 Additional Features

The additional features are found on the Status Page in the SMC Battery Charger. The following screens will appear once the Integrated Battery Monitoring + Testing device is connected and setup.

Here you will see the current voltages readings of each of the battery cells you have in the system.

If you have more than 6 cells, it will display as many it can on this screen (a total of 9 will be displayed at once per screen) and then you can click either the increase or decrease to cycle through the remaining cells.

Here you will see the date and time of the latest battery test that was run. Along with whether it had PASSED or FAILED.
NOTE: If you have set up for periodic testing, here will also show you how long until the next test.

To start a new test, simply press and hold the increase button. You will see the above screen. Here it will start a timer for the test and display how many watts have been discharged.

If you wish to cancel the running test, press, and hold the decrease button.

After the battery test has finished, click the right mode button and the first test results screen will display the recorded voltage of what the individual cells got to by the end of the test.
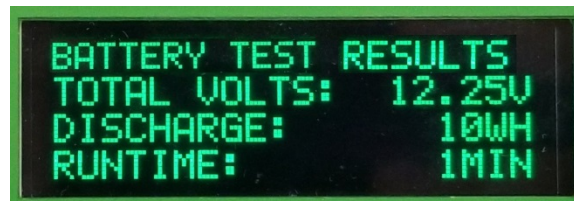
If you click the right mode button once more, there you will see the Battery Test Results from the most recent test.

In the results you will have the total volts the battery string dropped to during the test, how many watts the battery string discharged and, how long the test took too complete.

The first screen you will see for it is the Current Monitor. Here you will see the current readings for the load, battery, and charger.

- **Load**: This is the current of the equipment being used.

- **Battery**: This is the current going in or out of the battery string.

- **Charger**: This is the current charging the batteries and supplying the load.

If you click the right mode button once, you will get to the Battery Meter. Here you will see information regarding the battery string. It will give the percentage of charge the batteries have in them and how much longer the batteries have left till they are fully discharged.

3   Hosted Webpage

The Hosted Webpage will allow the user to be able to change settings, setpoints, and view the status of the system. The hosted webpage is accessed through the SMC Battery Charger.

3.1   Logging Onto Webpage

3.1.1   Network Connect

To login, look up the IP address under the SET POINTS and then find MY IP ADDRESS. Take the IP address you have found and follow this format: http://192.168.4.99:50000. **NOTE:** Make sure to add the port number (:50000) after the IP address (the IP address given will be provided by the DHCP server on the network.

3.1.2   Direct Connect

3.1.2.1   Enabling Direct Connect

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. To do this, follow the steps listed below:

1. Navigate to the **SET POINTS** menu under **MENU SELECT**.

2. Any password and user level will work.

3. Use the right arrow button until you come across **ETHERNET MODE**.

4. If you see **DIRECT CONNECT** under **ETHERNET MODE**, then this is done.

5. If you see **NETWORK CONNECT**, then you want to click the increase button once, and you will then see "PRESS INCREASE FOR DIRECT CONNECT".

6. Press and hold the up button for 5 seconds and you will see a timer count down. Once it is finished you will be brought back to the status screen and now you are in direct connect ethernet mode.

3.1.2.2 Changing IP Address of a Windows PC

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.

Follow the steps below to change the IP address on a Windows PC:

1. Click on the Start Menu icon in the lower left of the Desktop.

2. In the search box, type **Network and Sharing Center**.

3. Click on the **Network and Sharing Center** search result.
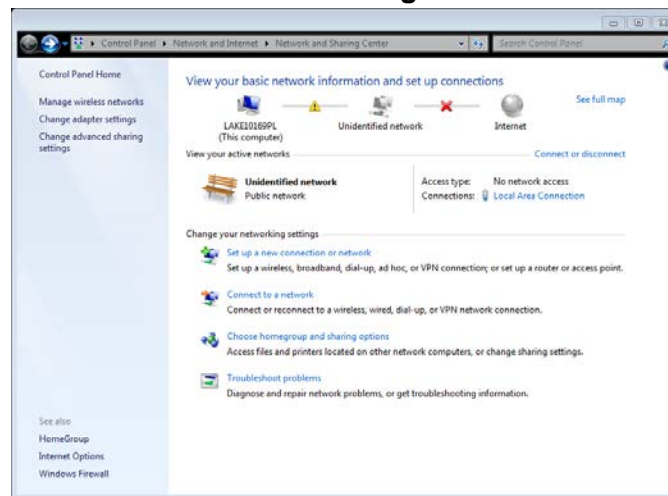
4. Click on **Change adapter settings** on the left side.
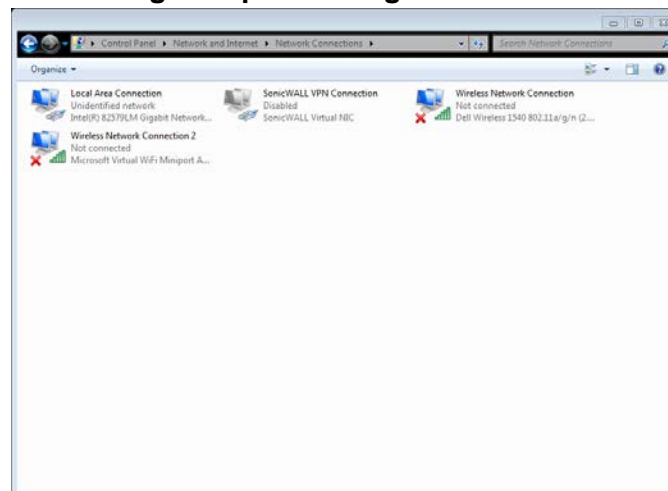
5. Right-click the Local Area Connection and then select **Properties**.

6. Under **This connection uses the following items**, select **Internet Protocol Version 4 (TCP/IPv4)** and select **Properties**.
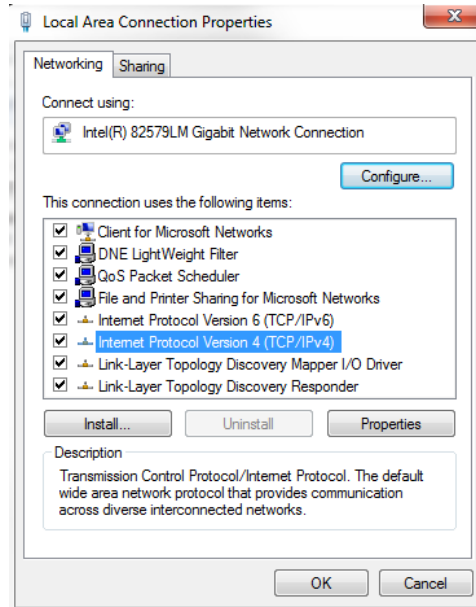
7. To specify an IP address, select **User Configured**, and then, in the **IP address**, **Subnet mask**, and **Default gateway** boxes, type the IP address settings.
    a. IP Address will be on the **192.168.4.X** subnet (i.e. **192.168.4.2**)
    b. Subnet mask will fill in automatically as **255.255.255.0**
    c. Default Gateway is **192.168.4.1**
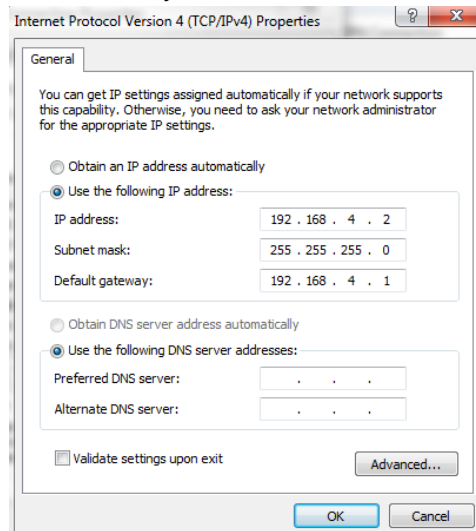
8. Click OK, and then enter the IP address into a web browser as stated in 3.1.1.

3.2 Pages on Webpage

3.2.1 Status Page

The Status Page shows the status of the SMC Battery Charger and system. When you install the Integrated Battery Monitoring + Testing to the charger, you will get three additional items displayed here. You will get information regarding the Battery Test, Battery Meter and it will show all the cells you have.

3.2.2 Settings Page

The Settings page is where the user is able to change any of the settings associated with the system. These settings are what you will see when going through the Setpoints Menu in the SMC Battery Charger. When this device is installed, there will be three additional tabs that the user can access to change settings that have to deal with the Integrated Battery Monitoring + Testing device.

3.2.3 Ethernet Page

This is the Ethernet Tab. Here the user has the ability to change the ethernet settings for the system.

4 Specifications

Description	Specification	
Operating Temperature (0-95% non-condensing humidity)	-40°F to +158°F	-40°C to +70°C
Part Number	9807-2109	
Length x Width x Height	6.875 x 4.80 x 3.980 inches	
Ship Weight	2 lbs.	

5 Drawings

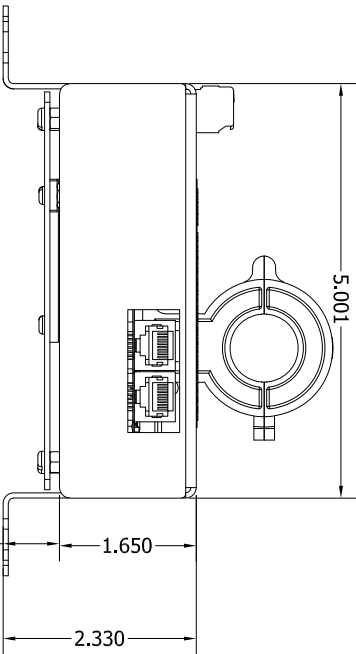INTEGRATED BATTERY MONITORING + TESTING   9807-2109

SYSTEM DIAGRAM   R9224-5414

PARTS LIST

ITEM	PART NUMBER	REV	QTY	UOM	DESCRIPTION
1	260023680O	-	4	EA	STANDOFF, 6-32 X 1" HEX M/F ZINC
2	2831111106	-	4	EA	SCREW, #4-40 X 3/8 PAN SLT
3	2831211104	-	4	EA	SCREW, #6-32 X 1/4 PAN SLT
4	2832110108	-	4	EA	NUT, #4-40 X 1/4 HEX
5	47358	-	2	EA	RES, 10 OHM 50W 5%
6	9801-2102A	A	1	EA	COVER, BACK, COMPLETELY INTEGRATED AUTOMATED BATTERY TESTING SOLUTION
7	9801-2109A	A	1	EA	COVER, TOP, COMPLETE INTEGRATED AUTOMATIC BATTERY TESTING SOLUTION, W/PEMS
8	9803-2025A	A	1	EA	CIRCUIT BOARD, COMPLETELY INTEGRATED AUTOMATED BATTERY TESTING SOLUTION
9	D9807-2109A	A	1	EA	LABEL, INTERGRATED BATTERY MONITOR + TESTING

REVISION HISTORY

REV	ECO #	DESCRIPTION	DATE	BY
A	22-070	NEW PART	09/06/2022	AK

2.780

6.874

5.001

3.980

2.330

2.330

1.650

.680

2.330

RECO
MINNEAPOLIS, MN 763-972-2200
9807-2109
INTEGRATED BATTERY
MONITOR + TESTING

RS485 RS485
IN OUT

STATUS
LED

+8-DIG
-
+7-DIG
-
+6-DIG
-
+5-DIG
-
+4-AN
-
+3-AN
-
+2-AN
-
+1-AN
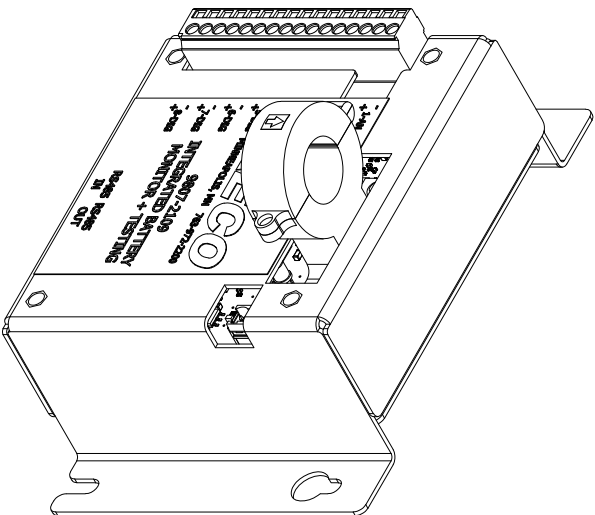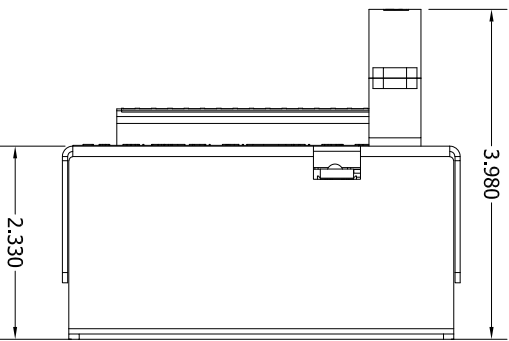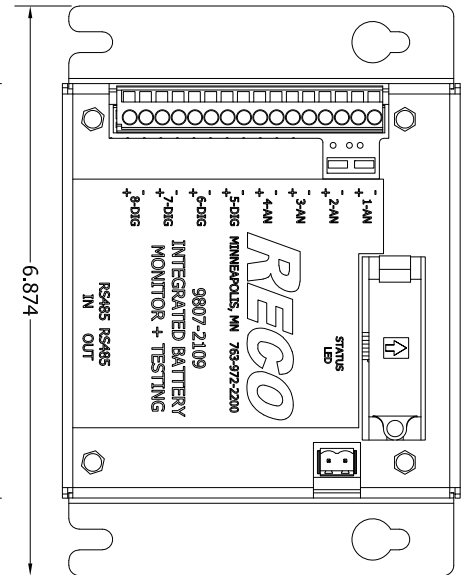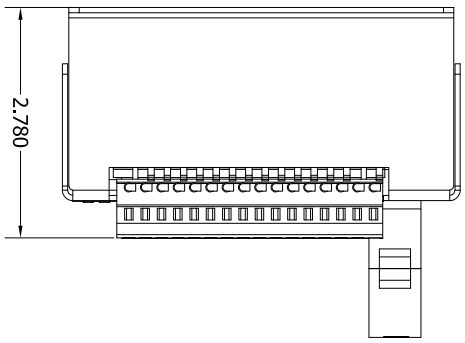
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MINNEAPOLIS, MINNESOTA
(763) 972-2200

TITLE:
INTEGRATED BATTERY
MONITOR + TESTING

DWG NO: 9807-2109A

SCALE: 2/3

DWG SIZE: B

SHEET 1 OF 3

REV: A

BOARD COMPONENTS

BACK

FRONT

6

5

2

5

3

4

1

9

8

TITLE:
INTEGRATED BATTERY
MONITOR + TESTING

REV: A

DWG NO: 9807-2109A

DWG SIZE: B   SHEET 2 OF 3

SCALE: 1 / 1

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS   ANGULAR
.X   ±0.035   ±1
.XX ±0.010   FRACTIONS
.XXX ±0.005   ±1/32
DO NOT SCALE DRAWING

LAST UPDATED: 9/6/2022
BY: akollman
MATL: NA
BEND ALLOWANCE: NA

OUTSIDE AND MOUNTING DIMENSIONS

.250

6.874

6.000

5.000

.500

3.585

RECO

MINNEAPOLIS, MN   763-972-2200

9807-2109
INTEGRATED BATTERY
MONITOR + TESTING

STATUS
LED

RS485   RS485
IN   OUT

- 1-AN +
- 2-AN +
- 3-AN +
- 4-AN +
- 5-DIG +
- 6-DIG +
- 7-DIG +
- 8-DIG +

3.980 CURRENT SENSOR HEIGHT

2.780 PLUG HEIGHT

2.330

4.800

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS   ANGULAR
.X   ± 0.035   ± 1
.XX   ± 0.010   FRACTIONS
.XXX ± 0.005   ± 1/32
DO NOT SCALE DRAWING

LAST UPDATED: 9/6/2022

BY: akollman

MATL: NA

BEND ALLOWANCE: NA

TITLE:
INTEGRATED BATTERY
MONITOR + TESTING

DWG NO: 9807-2109A

DWG SIZE: B

SCALE 1/1

SHEET 3 OF 3

REV: A

REVISION HISTORY

REV	ECO #	DESCRIPTION	DATE	BY
B		UPDATED DIAGRAM	7/6/2022	BN
C		UPDATED SYSTEM	9/8/2022	BN

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MINNEAPOLIS, MINNESOTA   (763) 972-2200

TITLE: SYSTEM DIAGRAM

DWG NO: R9224-5414C   REV: C

DWG SIZE: B

SCALE: 2.75 : 1 | SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS   ANGULAR
.X   ±.0.035   ±1
.XX   ±0.010   FRACTIONS
.XXX ±0.005   ±1/32
DO NOT SCALE DRAWING

DATE CREATED: 7/18/2022
BY: bnelson
MAT'L: NA
BEND ALLOWANCE: NA

Connect to AC Power

SMC CHARGER

AC POWER — L1 L2/N GND

DC POWER — − +

RS485

DISTRIBUTION BLOCK

DC− DC− DC+ DC+ DC+ DC+

GROUND FAULT

RS485 RS485

GND 48V COM

LOAD

Clamp over a Battery Output Wire to monitor the current of the batteries

INTEGRATED BATTERY MONITOR + TESTING

B+ B− 14 13 12 11 10 9 8 7 6 5 4 3 2 1

Load In

RS485   RS485

B1 + −   Highest Potential Cell
B2 + −
B3 + −
B4 + −
B5 + −
B6 + −   Lowest Potential Cell