B·M·A·R·S

Standby Energy BMARS User Manual

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Overview

In today's world, virtually everything we have is ultimately powered by electricity from the Utility Grid. However, during a time when all equipment needs more "Clean", "Reliable" electric power for proper operation, our utility companies have more trouble providing it because of the complexities of our nation's Electrical Grids. Utility companies have longer utility transmission distances, differing customer loads, power surges, electrical load noise, accidents, weather conditions, and unexpected equipment failures without warning, etc. For site protection against all these potential happenings, the most common way available to keep everything operating successfully is to provide a means of having clean, reliable power at the site. This is usually accomplished by having your own AC and or DC Power sources fed from the utility and of sufficient size and ride-thru duration to successfully provide for the plant needs. The heart of this power source is almost always a Battery.

The potential problem with Batteries, as with all man-made products is, they are not infallible, and they do not last forever. Although we tend to make jokes about "Murphy's Law", the concept remains true. **"Anything** that can go wrong will go wrong, and at the most troubling times."

A lot of suppliers manufacture their own version of Battery Monitors to help with this problem and most of them do a good job of telling you when the battery has failed. However, this can be compared with having the Doctor tell us the patient died of a Heart Attack when it is too late for us to do anything to help prevent it.

It is with this in mind, that we have developed BMARS© (Battery Monitor and Recharge System). BMARS monitors every Cell in the battery 24/7/365 and logs all critical data of each Cell and the entire Battery every 10 seconds to make this information available anytime anyone wants to look at it. This provides time for any maintenance or correction that needs to be made.

In short BMARS records:

*Battery Voltage
*Battery Charging Current
*Battery Discharging Current
*Each Cell Voltage
*Each Cell Temperature
*Total Battery AH Capacity Remaining
*Days since the last Complete Battery Recharge

This information allows the Battery to be Serviced and properly maintained for prolonged life. You can look at the condition of your battery from your desk at your Corporate Office, and if you are configured to "Mod Bus" you can control the system from your desk. Example, if a Hurricane is coming and you wish all of your Batteries were Fully Recharged, you could look at the Battery Capacity via Mod Bus and if the Battery was say 91% Charged, you could trigger the Charger to go to "Equalize" and the Battery would be Fully Recharged in a few hours.

BMARS also allows you to conduct your own Battery Load Test anytime you like.

All conditions which would be of concern can be alarmed (with a C, NO, NC relay to the Station Control Panel) alerting site personnel to check the BMARS Screen for specific instructions. All conditions are also being stored with appropriate Date & Time Stamp to provide easy location and observation of the suspected problem for later study. The last few lines of Data Logged at Midnight at the end of each day, week, and a month is the worst-case Battery and Cell condition for the previous period. This information is stored to the BMARS with approximately 3 years of storage and can be downloaded to your own permanent storage anytime desired.

When installing BMARS on a new or existing Battery the Operator can insert the Battery AH Rating provided by the manufacturer, or they can use BMARS to conduct their own Battery Load Test to determine the actual AH capacity of the existing Battery when fully recharged.

NOTE 1: For conducting a Battery Load Test, IEEE recommends the Battery Charger be switched to the “Equalize” voltage setting recommended for that specific Battery for 24 hours, then switch the Battery Charger back to the recommended “Float” voltage setting for an additional 24 hours to allow the voltage and capacity to stabilize in the battery plates. Then run the Load Test for whatever time base is desired.

NOTE 2: Short, fast dischargers are more difficult for a battery to perform than long slower discharges. Therefore, if a battery passes a Load Test for a shorter discharge period, it will certainly pass the load test for a longer period.

NOTE 3: As all batteries are being Recharged the charging current drops off rapidly as the battery nears Full Charge. At the battery Recommended “Float” voltage, if the battery is more than 80% Charged when the charger is operating it will maintain the present % Charged of the battery, but it will not put much IF ANY appreciable Recharge Current back into the battery at this low voltage. (It must be switched up to the “Equalize” voltage to do this.) The little amount of current flowing into the battery at this time is usually referred to a “Trace Currents” and flows down the Positive Post, traces along the surface of the Positive plates, passes through the electrolyte, traces across the surface of the Negative plates, and out the Negative Post. Very little actual charging occurs at the Battery recommended “Float” voltage setting of the charger after the battery is 80% charged because the power is too low to force current homogeneously through the plates of the cells. BMARS does not accumulate Current into the Battery after the Battery is 80% Charged when the Charger is still in the “Float” mode of operation.

NOTE 4: This document speaks of switching the Station Charger between the “Float” and “Equalize” mode of operation. BMARS has a Form C Relay Contact and a RS 485 Communications Port for performing this function if your Station Charger has this remote-control capability. In the event your Charger does not have the capability for Remote switching between “Float and “Equalize”, BMARS also sends an Alarm Relay Contact to the Station Control Panel to notify Plant Personnel to “Look at the BMARS Control Panel”. The Panel will give them whatever directions they need to see. In this case, it will direct them to switch the Charger to Float or Equalize by printing out in Bold RED letters on the top of the BMARS Screen the message “Switch Charger to Float” or “Switch Charger to Equalize”. Because BMARS is constantly looking at the Battery Voltage it will know when this has happened and will automatically begin measuring the current back into the Battery.

Mode of operation of BMARS

Once the site is satisfied with the AH Capacity of the Battery being used at the site everyone needs to remember no one knows how many AH's are in the battery at this moment in time. The Battery Charger needs to be placed in the "Float" Charging mode of operation for 24 hours. This will bring the Battery AH Capacity up to about 80% Charged. Plug this information into the BMARS "Commissioning Controls" and switch the Station Charger to the "Equalize" mode of operation until BMARS says it is Fully Charged. BMARS will control, or help your people control, the Charging of the station battery from here on.

The Station Battery is always connected directly across the Station Charger. Starting with a Full Charge on the Battery, BMARS will monitor all cells in the Battery and record all critical parameters of the battery. The normal DC Loads are being supplied from the Station Charger. Any short duration Surge Currents (Load surges too short in duration for the charger to respond to) will be supplied from the battery. In the event of Charger Malfunction, or much more probable, in the event of a Utility Outage the Load will be supplied directly from the Battery without any switching at all. BMARS will measure this current and Integrate it with time and deduct this amount of AH's from the Batteries "AH Capacity Remaining". Whenever current is drawn from the Battery, BMARS continues this monitoring and recording function.

When the Station Battery falls below 80% Charged, and after AC Power returns to the Station Charger the Charger will turn back on in the "Float" mode of operation until BMARS says the Battery is 80% Charged. When BMARS determines the Battery is 80% Charged it will switch (or direct plant personnel to switch) the Charger to the "Equalize" mode of operation until BMARS says the Charger is 100% Charged, at which time BMARS will determine the Battery is Fully Charged and switch the Station Charger back to "Float".

In the event the Battery has not fallen to 20% Discharged (80% Charged) in the last 12 months, BMARS will switch (or tell the Station staff to switch) the charger to "Equalize" until the AH's in the Battery, minus the Recharge Losses of the Battery, equals 100% Charged. Then BMARS will direct the charger back to the "Float" Mode of Operation, and continue Monitoring and Logging.

BMARS will keep the Station Charger between 80% and 100% Charged whenever Utility Power is there to do this and will not allow the battery to be Overcharged or Undercharged for an extended period. This will result in longer Battery life, less water loss, and reduced maintenance on the Battery.

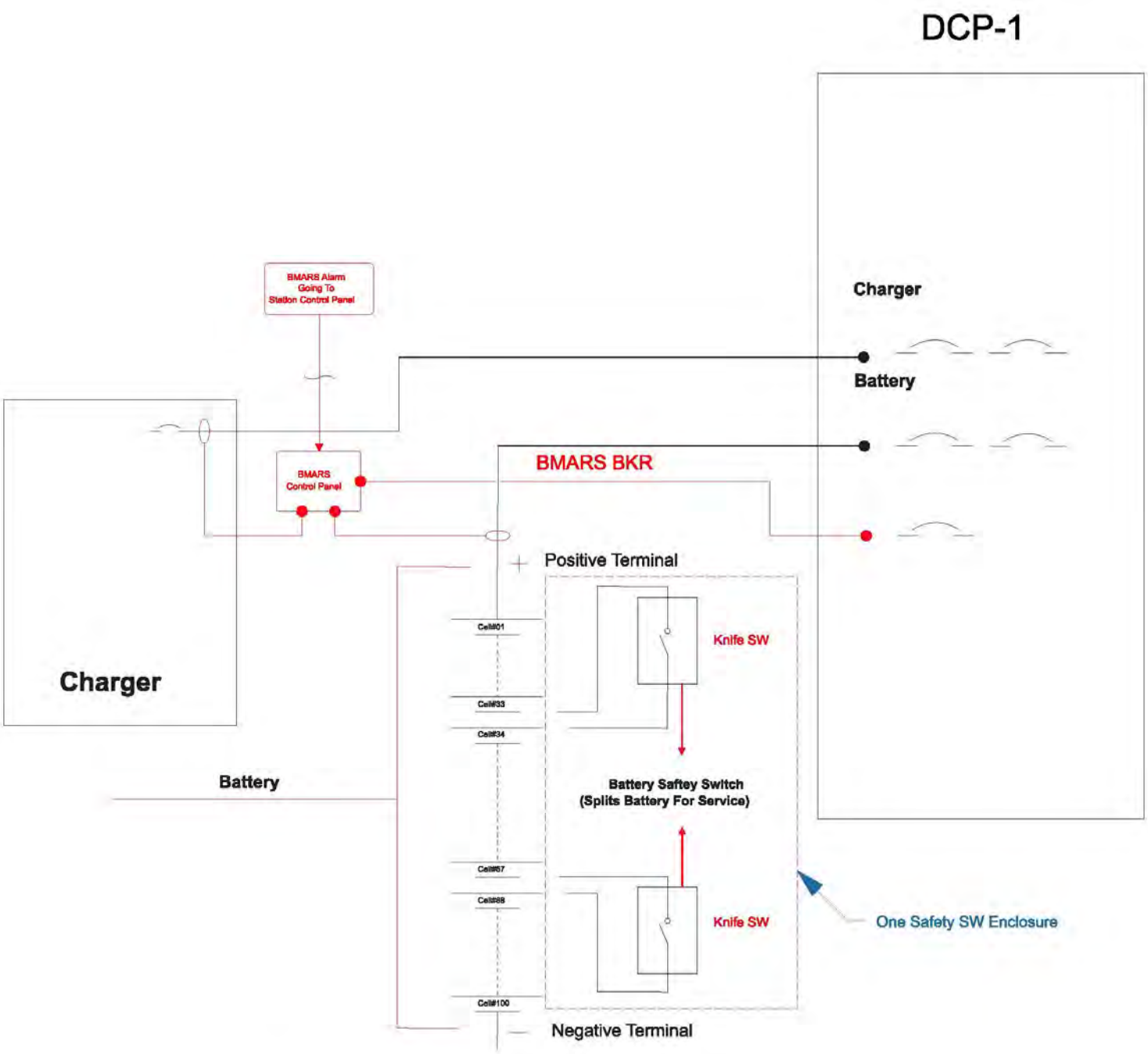
At any time, any operator who wants to can see or print out the Battery condition or shoot it wherever you like for consultation.

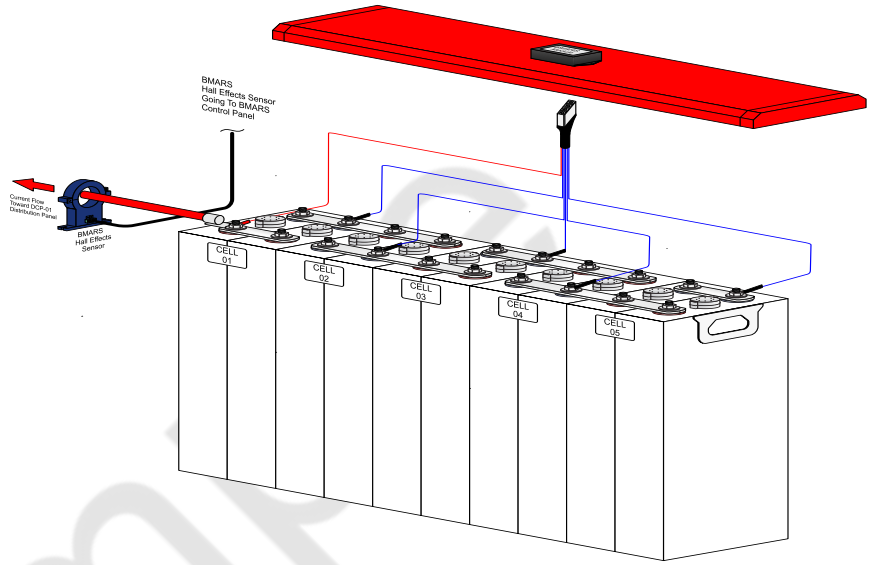
1. Date and Time of Lowest Battery Voltage
2. Date and Time of Highest Battery Voltage
3. Date and Time of Lowest Battery Input Current
4. Date and Time of Highest Battery Input Current
5. Date and Time of Lowest Battery Output Current
6. Date and Time of Highest Battery Output Current
7. Date and Time of Lowest Battery AH Capacity
8. Date and Time of Highest Battery AH Capacity
9. Date and Time of Lowest Cell Voltage
10. Date and Time of Highest Cell Voltage
11. Date and Time of Lowest Cell Temperature
12. Date and Time of Highest Cell Temperature
13. Date and Time of Lowest Average Battery Temperature
14. Date and Time of Highest Average Battery Temperature

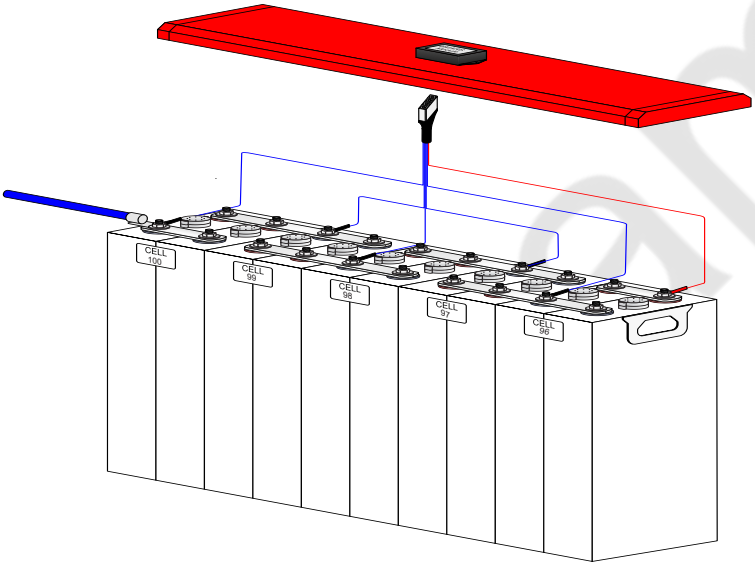
You also have access to all these parameters for every 10 Seconds, ever since BMARS was installed if you ever want to do some serious study of the Battery.

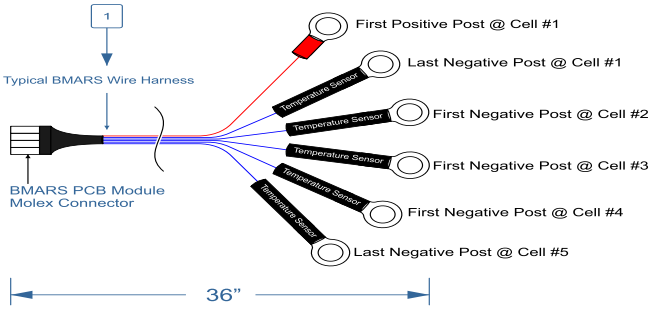
Having BMARS is like having your best technician standing by your battery 24/7/365 with nothing to do except seeing that your battery is properly cared for.

The battery still will not last forever, but it will not fail without letting you know it is in trouble first, while you still have time to prevent it from dropping your plant.



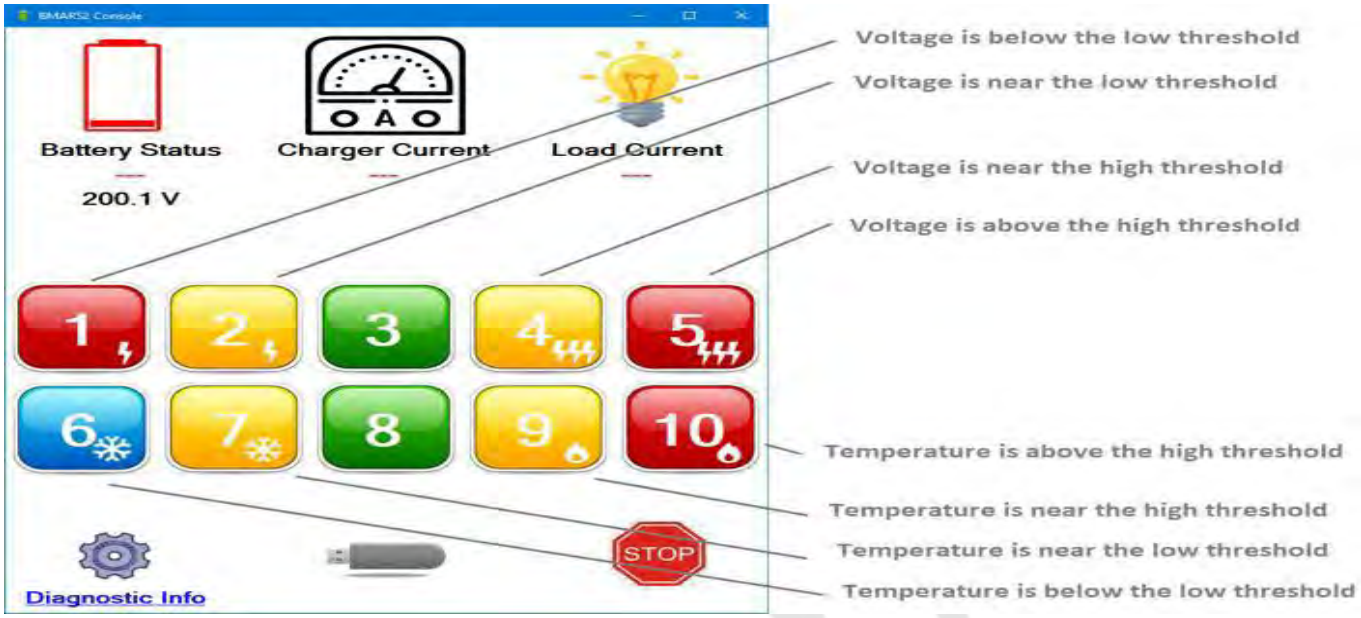

BMARS
Hall Effects Sensor
Going To BMARS
Control Panel
Current Flow
Toward DC/P-01
Distribution Panel
BMARS
Hall Effects
Sensor
CELL 01
CELL 02
CELL 03
CELL 04
CELL 05


CELL 100
CELL 99
CELL 98
CELL 97
CELL 96


1
Typical BMARS Wire Harness
BMARS PCB Module
Molex Connector
First Positive Post @ Cell #1
Last Negative Post @ Cell #1
Temperature Sensor
Temperature Sensor
First Negative Post @ Cell #2
Temperature Sensor
First Negative Post @ Cell #3
Temperature Sensor
Temperature Sensor
First Negative Post @ Cell #4
Last Negative Post @ Cell #5
36”

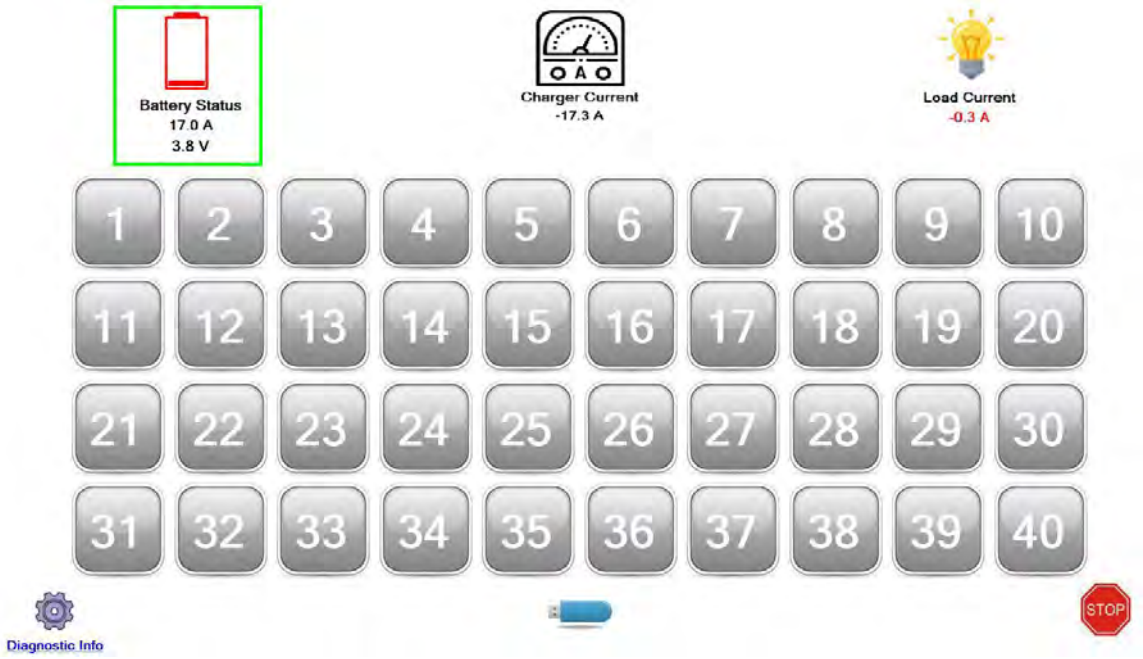
3. Software Features

The general interface of the program is as follows.



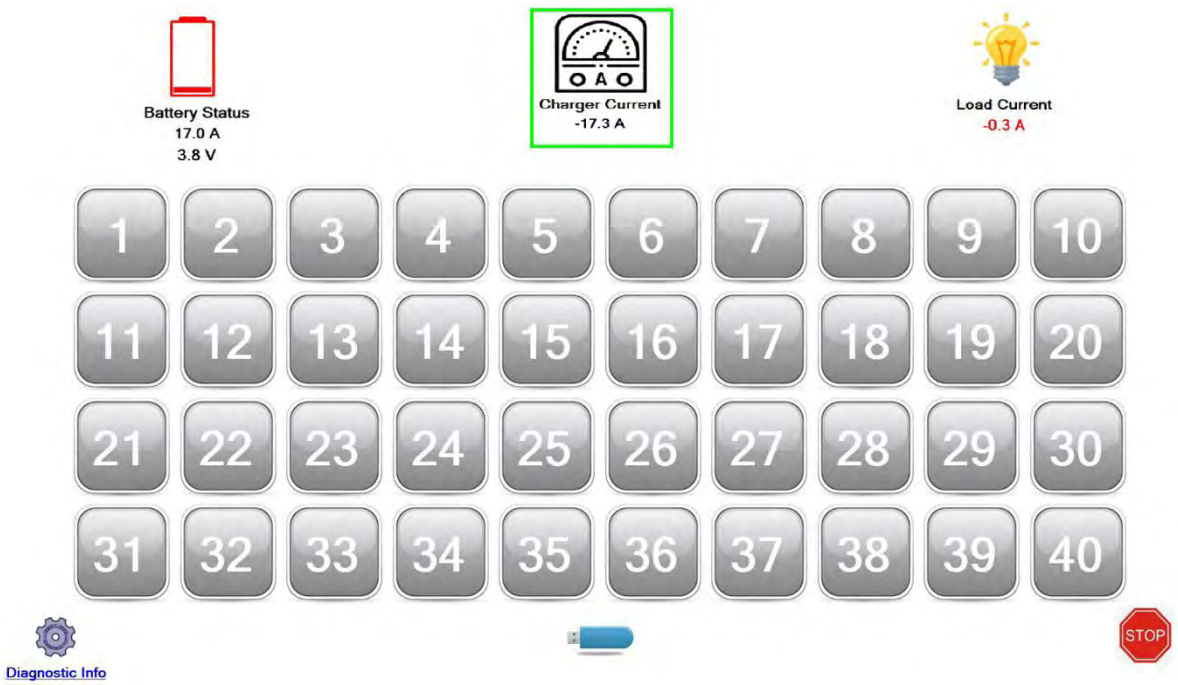
3.1. Battery Status

The battery status sign is placed in the upper left corner of the window. This sign indicates the general capacity and voltage of the total battery pack.



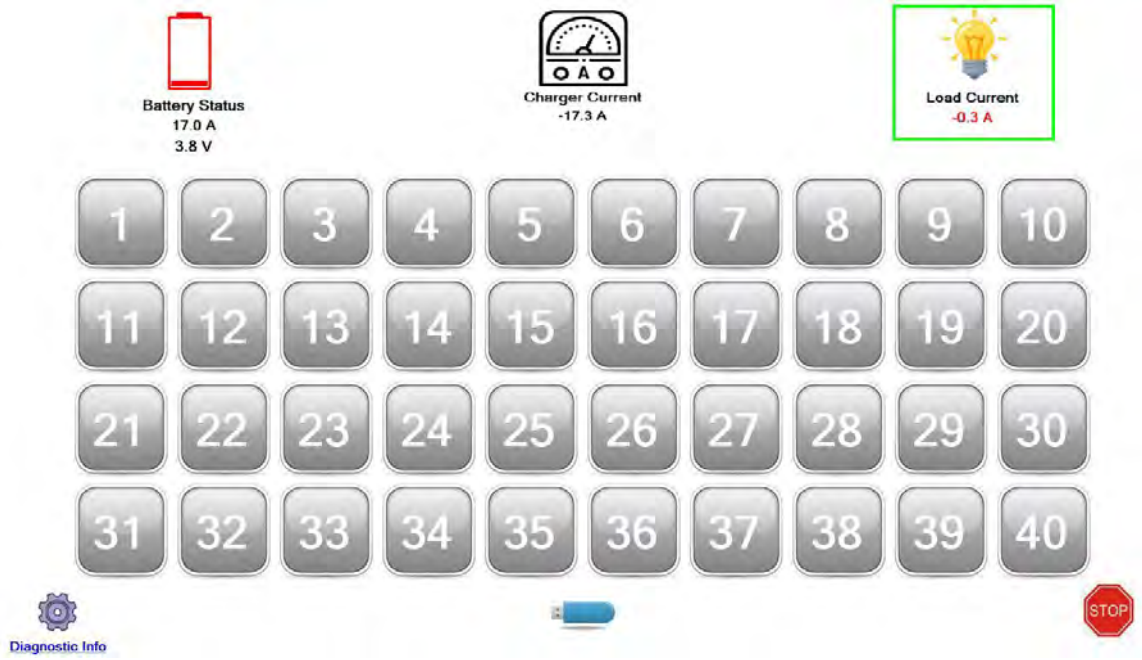
3.2 Charge Current

The charge current sign is placed upper center of the window in the interface screen. This sign indicates the charger current.



3.3 Load Current

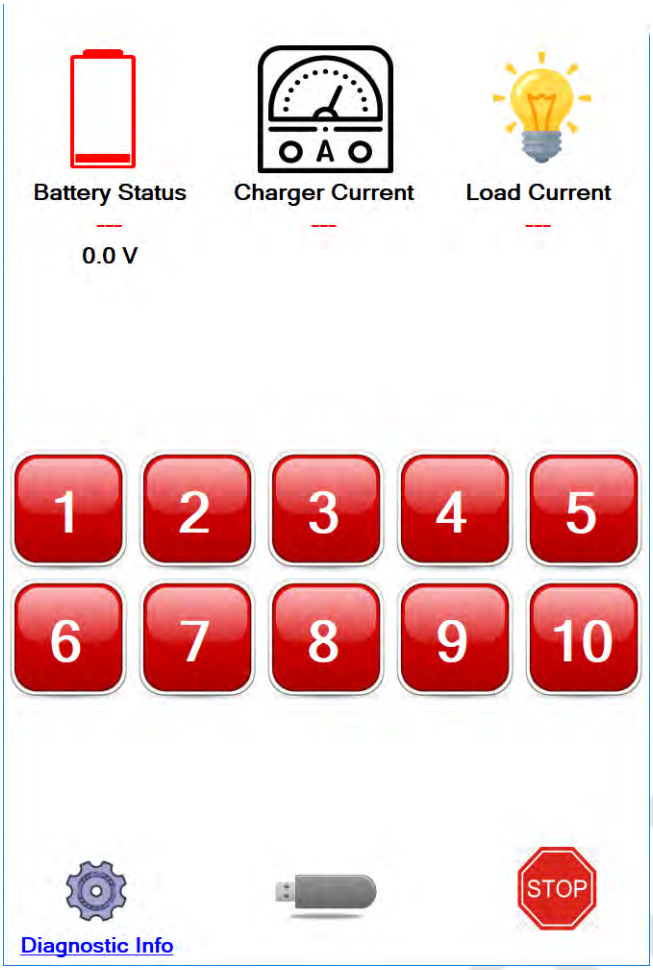
The load current icon is placed in the upper-right section of the window and this sign indicates the output current of the battery pack.



3.4. Cell States

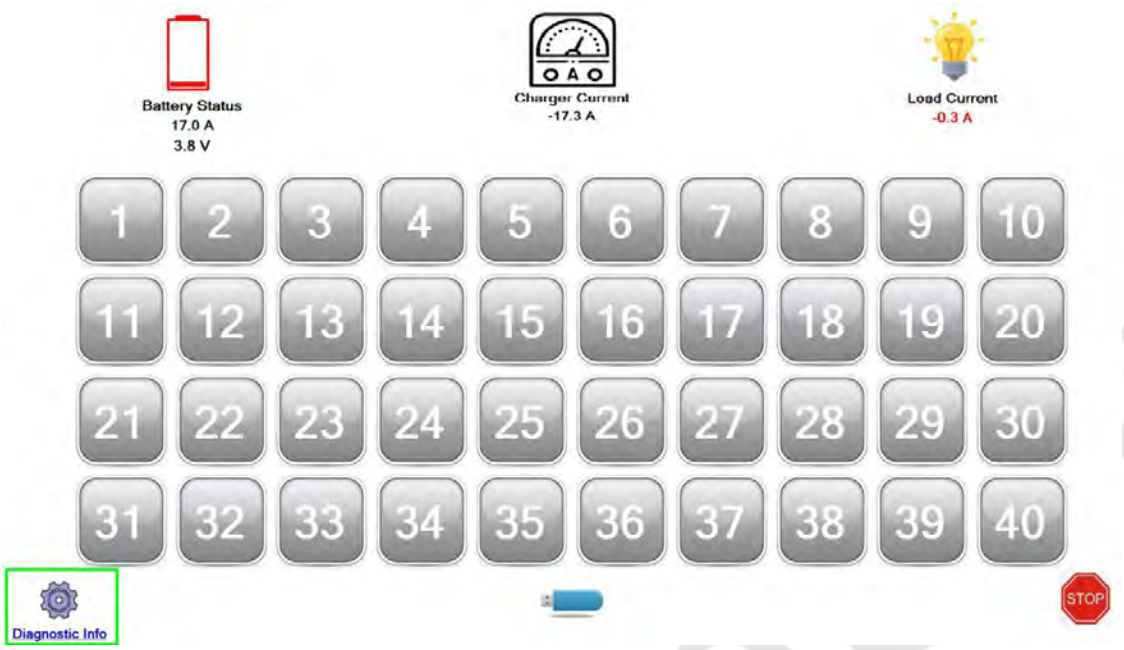
Cell status information is placed in the middle of the interface window. If voltage and temperature values of the cells are good this is indicated in green color, otherwise indicated in red. Click on one of the cell icons to view the cell properties. The following image shows a good battery cell.

The following image shows bad battery cells:



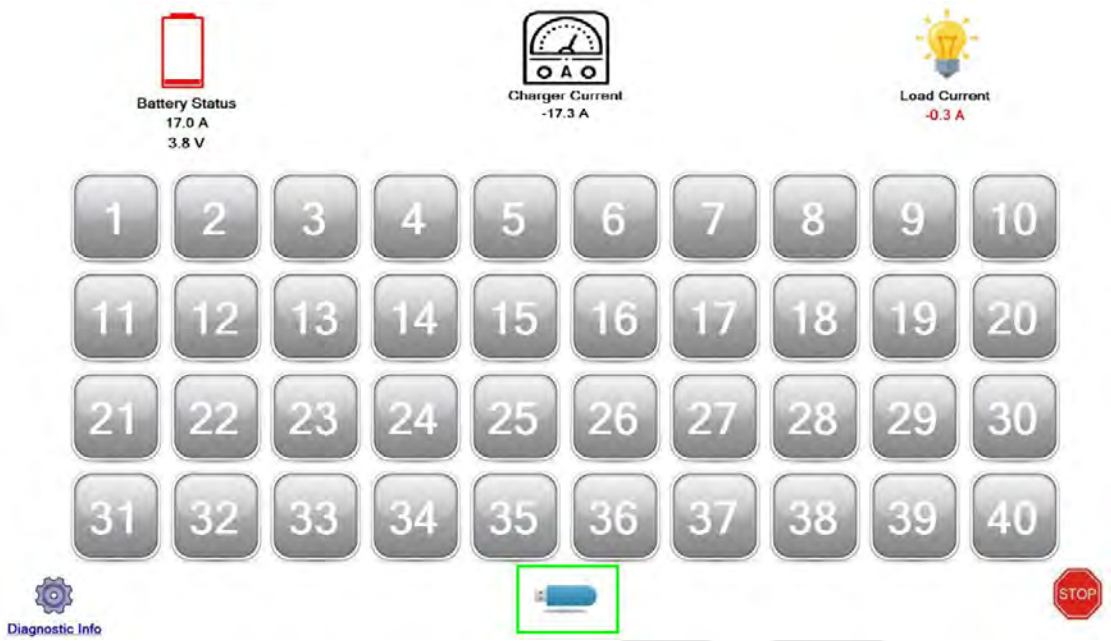
3.5. Software Settings

The software Settings icon is in the lower left of the window. User settings can be changed from this icon.



3.6 Serial Port

Select this icon to download Excel Spreadsheet of battery condition.



4. Logged Data Samples

BMARS 3 board logs data in excel format(.xlsx) and the BMARS board keeps the logged data for 3 years. This data can be downloaded at any time. In the data logs, the user can see the temperature (Fahrenheit) of cells and the voltage of the cells separately with a timestamp.

Here is an example from the log data. In this part of the data, we see that there are 3 different cells as M1, M2 and M3 with time stamp. The highlighted red area reflects the current-voltage level with temperature for M1 cell, the highlighted yellow area reflects the current-voltage level with temperature for M2 cell, and the highlighted green area reflects the current-voltage level with temperature for M3 cell.

	Timestamp	M1:Volt (V)	M1:Temp (F)	M2:Volt (V)	M2:Temp (F)	M3:Volt (V)	M3:Temp (F)
2	2020-08-31 14:07:28	0.01	33.98	0.01	33.98	Not Read	Not Read
3	2020-08-31 14:07:39	0.01	33.98	0.01	33.98	0.01	33.98
4	2020-08-31 14:07:39	0.01	33.98	0.01	33.98	0.01	33.98
5	2020-08-31 14:07:40	0.01	33.98	0.01	33.98	0.01	33.98
6	2020-08-31 14:07:40	0.01	33.98	0.01	33.98	0.01	33.98
7	2020-08-31 14:07:41	0.01	33.98	0.01	33.98	0.01	33.98
8	2020-08-31 14:07:41	0.01	33.98	0.01	33.98	0.01	33.98
9	2020-08-31 14:07:42	0.01	33.98	0.01	33.98	0.01	33.98
10	2020-08-31 14:07:42	0.01	33.98	0.01	33.98	0.01	33.98
11	2020-08-31 14:07:43	0.01	33.98	0.01	33.98	0.01	33.98
12	2020-08-31 14:07:43	0.01	33.98	0.01	33.98	0.01	33.98
13	2020-08-31 14:07:44	0.01	33.98	0.01	33.98	0.01	33.98
14	2020-08-31 14:07:44	0.01	33.98	0.01	33.98	0.01	33.98