Battery Monitoring for Electric Vehicle Battery Packs

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Contents

[Purpose 1](#_Toc452936749)

[System Requirements 1](#_Toc452936750)

[System Specifications 1](#_Toc452936751)

[References 2](#_Toc452936752)

# Purpose

Battery packs containing multiple batteries in series must be kept balanced, with each individual battery at the same voltage in order to increase the longevity of the battery pack as a whole. If some batteries in the pack are a significantly higher voltage than others, those higher voltage batteries will charge more quickly, and will then be damaged by overcharging while the lower voltage batteries catch up. In lead acid batteries, overcharged batteries will gas, consuming electrolyte in the process, and will therefore need more frequent maintenance (watering) to be kept in working order. [1]

In order to keep battery packs balanced, individual batteries are must periodically be removed and charged individually, so that all batteries in the pack are at or near the same potential. To determine when this is necessary with a simple, “dumb” battery pack, a technician would typically open the battery pack and measure to potential across each individual battery by hand. This process could be greatly simplified if the measurement process happened automatically without the need to open the battery pack.

The purpose of this project is to develop a system capable of taking automated measurements of the voltages of the batteries in the battery pack for the Electric Vehicle Engineering Club’s electric van. The club was recently forced to replace two battery packs because they were destroyed by severely unbalanced batteries. This large cost for the club could have been avoided if a system like this was being used to keep track of individual battery voltages.

# System Requirements

This battery monitoring system will be used to measure the individual voltages of batteries in a battery pack. While it may also be capable of monitoring other designs, it will be specifically intended to monitor lead acid batteries wired in series to create a single, high voltage battery pack. The system will be capable of measuring the individual voltages of eighteen batteries. The maximum measurable voltage will be 250V, which makes the system ideal for measuring the voltages of standard 12V batteries such as the ones used in the automotive and marine industries.

# System Specifications

|  |  |  |  |
| --- | --- | --- | --- |
| Specification | Minimum | Typical | Maximum |
| Input voltage |  | 216 V DC | 250 V DC |
| Number of individual batteries | 1 | 18 | 18 |
| Measurement accuracy | 360 mV | 240 mV | 61 mV |
| Measurement time (per battery) |  | 150 ms |  |
| Measurement frequency (18 batteries) |  | Once per minute | 20 times per minute |
| Auxiliary battery voltage | 6 V | 9 V | 12 V |
| System power consumption (from auxiliary battery) |  |  |  |

# References

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| --- | --- |
| [1] | C&D Technologies, "Charging Valve Regulated Lead Acid Batteries," C&D Technologies, Inc., Blue Bell, PA, 2012. |