INTISARI

ANALISIS PENGARUH KONFIGURASI SERI (4S, 5S, 6S, DAN 7S) PADA KINERJA DALY 100 *BATTERY MANAGEMENT SYSTEM* UNTUK BATERAI LITHIUM ION 18650

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Tantangan utama dalam pengoperasian baterai Li-ion adalah cell imbalance, yaitu ketidakseimbangan tegangan antar sel dalam satu rangkaian. Pada konfigurasi seri baterai, seperti 4S, 5S, 6S, dan 7S, peran Battery Management System (BMS) menjadi semakin penting untuk memastikan kestabilan dan efisiensi sistem. Meningkatnya kompleksitas sistem dengan bertambahnya jumlah sel berpotensi memengaruhi efisiensi operasional dan kestabilan sistem baterai. Penelitian ini bertujuan untuk menganalisis karakteristik dan kinerja BMS Daly 100 yang dipengaruhi oleh konfigurasi seri baterai lithium-ion tipe 18650, terutama dalam hal akurasi pembacaan tegangan, kemampuan balancing, dan efektivitas proteksi, seperti overcurrent, overcharge, overdischarge, dan suhu tinggi.

Eksperimen dilakukan pada konfigurasi seri 4S hingga 7S dengan pengujian parameter akurasi tegangan antar sel, waktu dan suhu kerja selama balancing, serta proteksi terhadap overcharge (>4.2V), overdischarge (<2.8V), overcurrent (>5A), dan high temperature (>50°C). Dalam upaya menganalisis kinerja BMS, untuk setiap konfigurasi dalam sebuah pengujian, dilakukan 10 kali percobaan. Data diambil secara real-time melalui aplikasi BMS, divalidasi dengan multimeter dan battery tester, lalu dianalisis menggunakan perangkat lunak Microsoft Excel untuk mengidentifikasi pola performa BMS berdasarkan konfigurasi.

Studi ini menunjukkan keandalan BMS Daly 100 dalam mengelola baterai terutama dalam kemampuan balancing dan efektivitas proteksi terutama pada konfigurasi seri kompleks. Hasil menunjukkan bahwa konfigurasi seri memengaruhi kinerja BMS secara signifikan, tetapi BMS menjalankan fungsinya dengan baik. Pada 4S, akurasi pembacaan tegangan memiliki rerata standar deviasi terendah (0,00055 V) serta waktu balancing lebih singkat (rata-rata 43,721 detik) dengan suhu kerja lebih rendah (<40°C). Sebaliknya, 7S, memiliki akurasi pembacaan tegangan memiliki rerata standar deviasi tertinggi (0,0018 V) memerlukan waktu balancing lebih lama (rata-rata 224,271 detik) dengan suhu kerja lebih tinggi (hingga 59,95°C). Sedangkan, proteksi bekerja optimal dalam semua kondisi.

Kata kunci: *BMS, Baterai Lithium Ion 18650, Analisis Kinerja Konfigurasi Seri*

ABSTRACT

ANALYSIS OF THE IMPACT OF SERIES CONFIGURATIONS (4S, 5S, 6S, AND 7S) ON THE PERFORMANCE OF DALY 100 BATTERY MANAGEMENT SYSTEM FOR 18650 LITHIUM-ION BATTERIES

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The primary challenge in operating Li-ion batteries is cell imbalance, which refers to voltage discrepancies between cells in a single circuit. In series configurations, such as 4S, 5S, 6S, and 7S, the role of the Battery Management System (BMS) becomes important, ensuring system stability and efficiency. As the number of cells increases, the system's complexity grows, potentially affecting battery performance and stability. This study aims to analyze the characteristics and performance of the Daly 100 BMS as influenced by the series configuration of 18650 lithium-ion batteries, particularly in terms of voltage measurement accuracy, balancing capability, and protection effectiveness, including overcurrent, overcharge, overdischarge, and high temperature.

Experiments were conducted using series configurations ranging from 4S to 7S, testing parameters such as voltage accuracy, balancing time and working temperature, and protection against overcharge (>4.2V), overdischarge (<2.8V), overcurrent (>5A), and high temperature (>50°C). To evaluate BMS performance, each configuration was tested 10 times per experiment. Data were collected in real-time via the BMS application, validated using a multimeter and battery tester, and analyzed with Microsoft Excel to identify BMS performance patterns.

The study demonstrated the reliability of the Daly 100 BMS in managing batteries, particularly its balancing capability and protection effectiveness, even in complex series configurations. Results showed that series configurations significantly influenced BMS performance, but the BMS performed its functions effectively. In the 4S configuration, voltage measurement accuracy had the lowest average standard deviation (0.00055 V), with shorter balancing times (an average of 43.721 seconds) and lower working temperatures (<40°C). Conversely, the 7S configuration exhibited the highest average standard deviation in voltage measurement accuracy (0.0018 V), required longer balancing times (an average of 224.271 seconds), and reached higher working temperatures (up to 59.95°C). Meanwhile, protection mechanisms operated optimally under all conditions.

Keywords**:** *BMS, Lithium-Ion Battery 18650, Series Configuration Performance Analysis*