## **Title**

A Configurable Battery Management System for Optimal

Control and Monitoring of High Voltage Battery Packs

**Thesis Supervision**

|  | **Industry Partner** | **Academic Partner** |
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| **Name of Company / University** | EFT Mobility AG | THD |
| **Department / Faculty / Institute / Chair** | THD | THD |
| **Supervisor in Charge** | [Jonas Fauser](mailto:jonas@eftmobility.com) | Jens Ebekke |

**Thesis Details**

| **Type of Thesis** | Masters Thesis |
| --- | --- |
| **Classification of Thesis** | theoretical / constructive / experimental |
| **Thesis Background** | In the modern world, the need for an effective Battery Management System (BMS) is paramount due to our increasing reliance on battery-powered devices and technologies. These systems play a crucial role in optimizing battery performance, ensuring safety, and maximizing efficiency. With the proliferation of electric vehicles, portable electronics, and renewable energy systems, BMS is essential in preventing issues like overcharging, over-discharging, and overheating, which can pose safety hazards and compromise the longevity of batteries. The efficiency and overall performance of a battery system, however, depend not only on the quality of the individual battery cells but also on how these cells are interconnected and managed within the system. It is important to harness the full potential of managing individual battery cells within a larger battery system. |
| **Thesis Objective** | To enable the individual charging and discharging rates of every cell, high-side voltage and current must be precisely controlled. This control is achieved through the use of specialized controller LTC7872 integrated into the DC-DC converters. These controller LTC7872 allow for voltage and current programming by applying specified values to SETCUR Pin, ensuring that each cell operates within its optimal range. Moreover, the charging and discharging power of each individual cell must be calculated by a microcontroller (STM32). This calculation necessitates the estimation and incorporation of the state of charge (SoC) and state of health (SoH) parameters for each cell. These metrics provide crucial insights into the current health and performance of the cells, allowing for precise management and optimization.  The main aspects covered in this thesis are:   * Functionality * Algorithm Implementation |
| **Thesis Structure** | The Thesis may be structured as follows:   * Cover * (Preface and Acknowledgement) * Table of Contents * Index of Abbreviations * Index of Tables * Index of Figures  1. Intro and Motivation 2. State of the Art 3. Method and Concept 4. Implementation and Result 5. Validation 6. Discussion  * References * Appendix |
| **Thesis Work Packages** | The following Tasks need to be at least covered within the Thesis:   * Literature Review on state of the art …   + Drawbacks of Existing Passive and Active Balancing   + Motivation to Implement an Individual Cell Balancing   + Design Overview of Battery Management Systems (BMS)   + Purpose of BMS With LTC7872 And STM32   + System Description * Documentation and Implementation of The BMS Using Cell Balancing Algorithm   + Reading Current from LTC7872   + Coulomb Counting implementation   + SPI Communication   + SPI Configuration of LTC7872 In STM32   + Iterative Cell Balancing Algorithm Based of Varied Window Sizes   + Code in C/C++ for Cell Balancing Algorithm   + State of Charge (Soc) To Current Conversion |