HESS – Hybrid Energy Storage System

Facts & figures about Rutronik

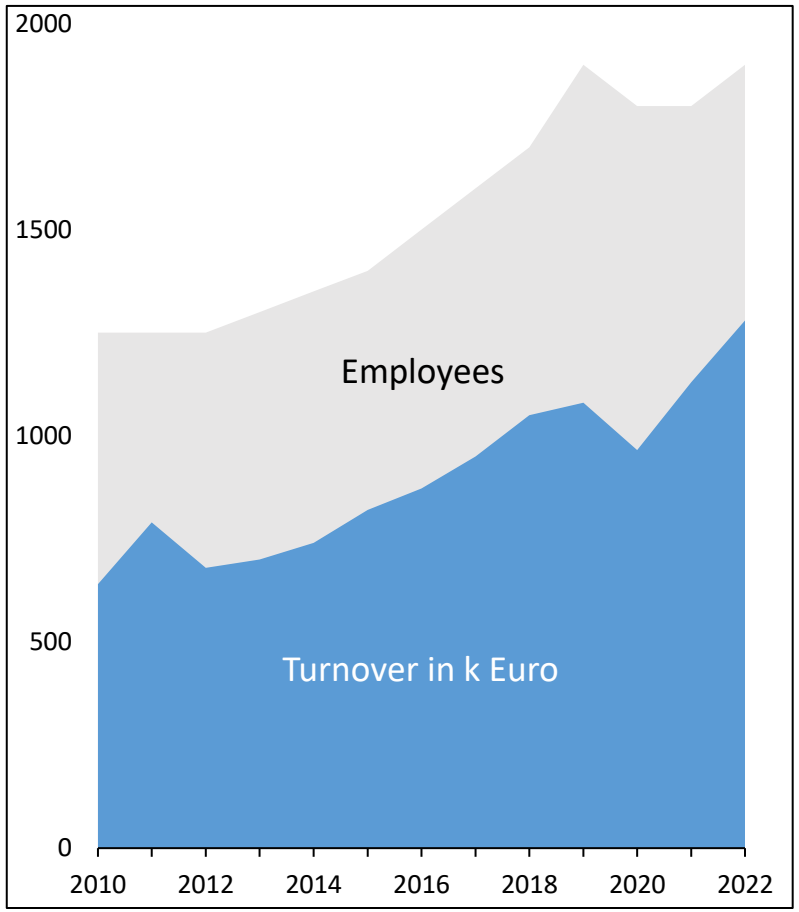
Leading in the **European** and **on global** distribution markets

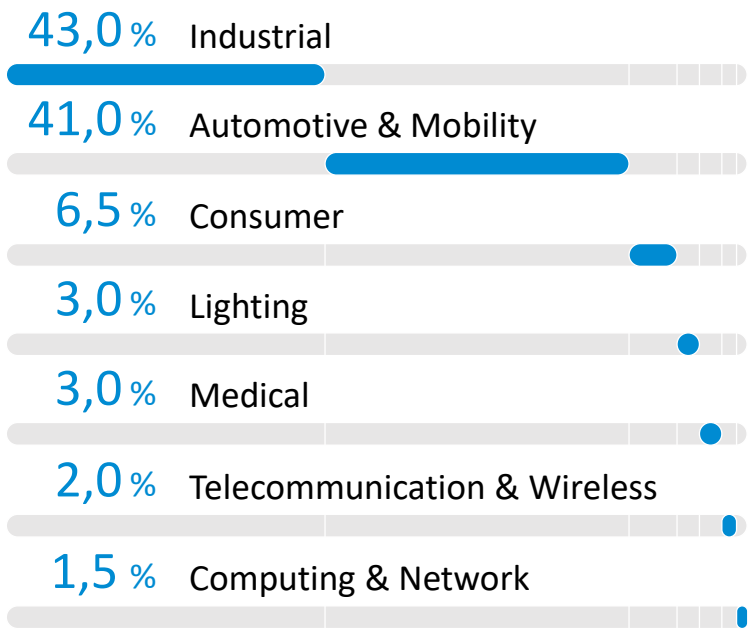
Privately owned and independent **since 1973**

Headquartered in Ispringen (Germany) with established re-presentations and logistic centers in Asia and North America

82 offices and **37** subsidiaries

Over **130 billion components** shipped per year to more than **40,000 customers worldwide**





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Rutronik System Solutions


RDK2

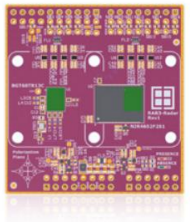

RDK3


RDK4


RAB - TTS


RAB1 – Sensorfusion


RAB2 – CO2


RAB3 - Radar


RAB4 - RTK

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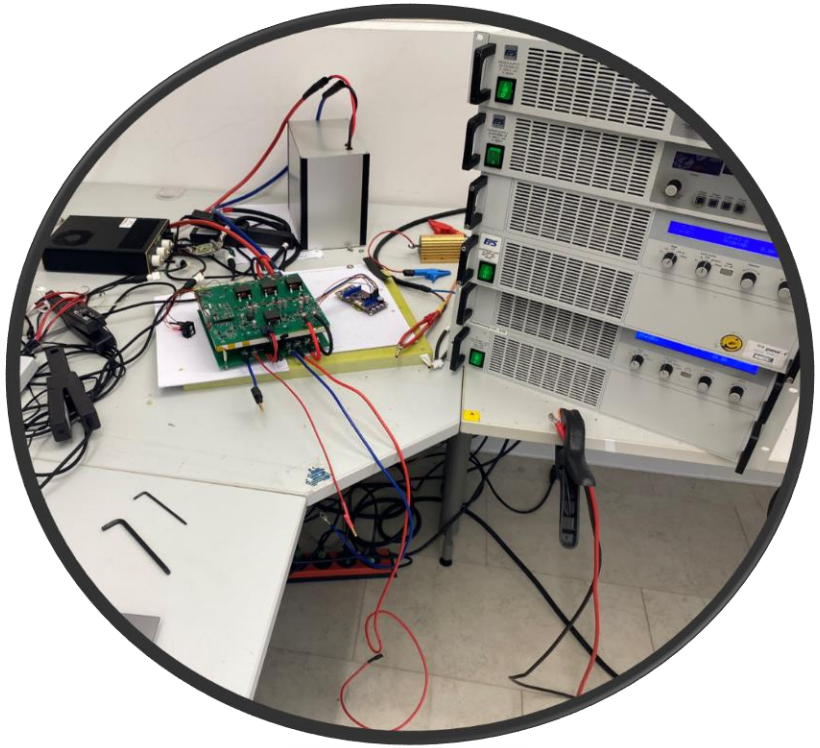
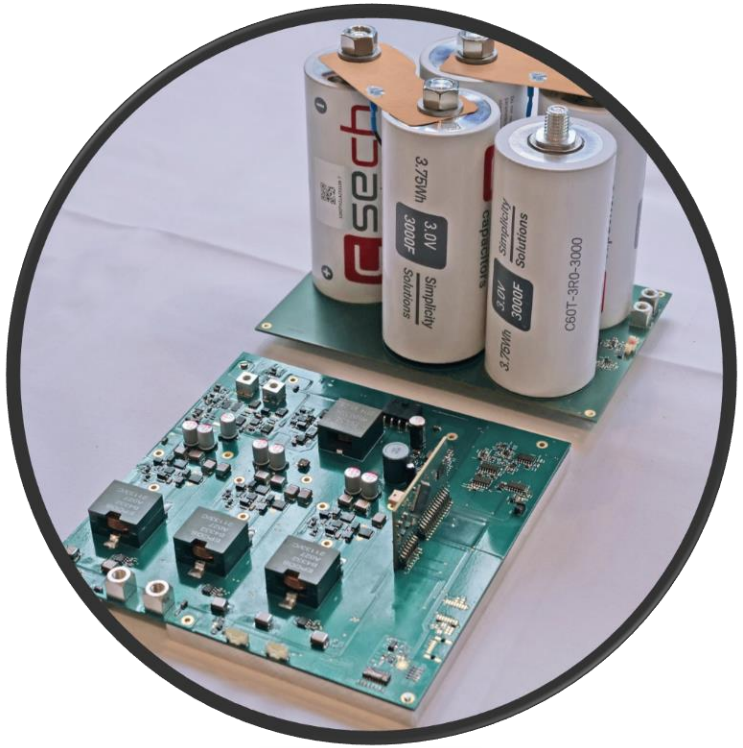
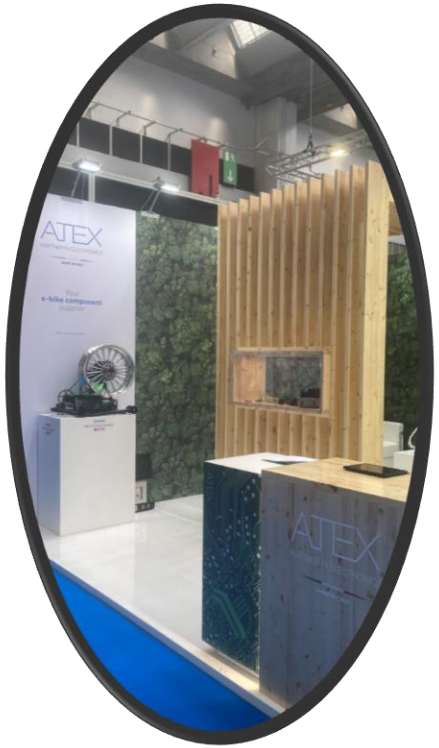
LET‘S TALK ABOUT HESS (Hybrid energy storage system)







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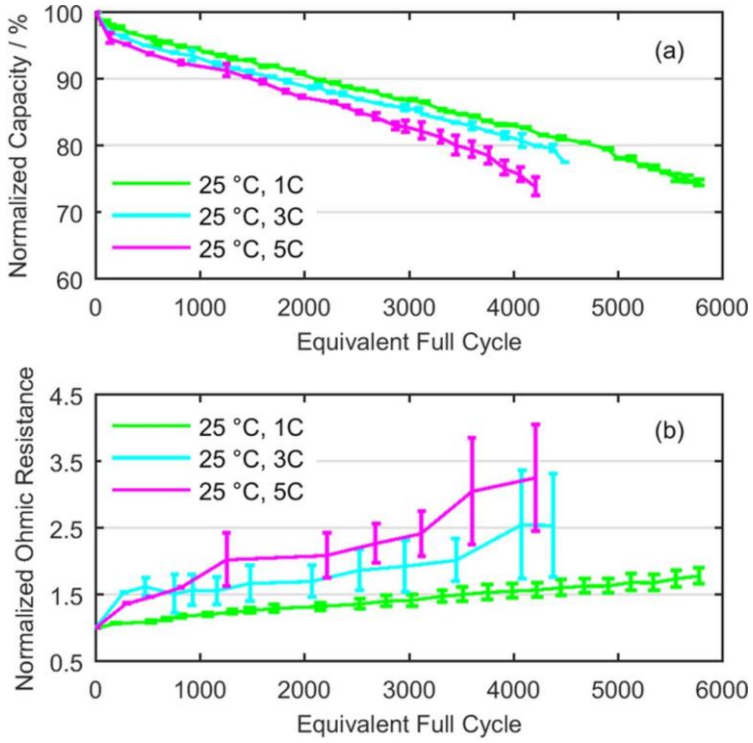
Power Electronics & Energy Storage event
POWER ELECTRONICS
ENERGY STORAGE
28 mei 2024 | 1931 Congrescentrum ‘s-Hertogenbosch

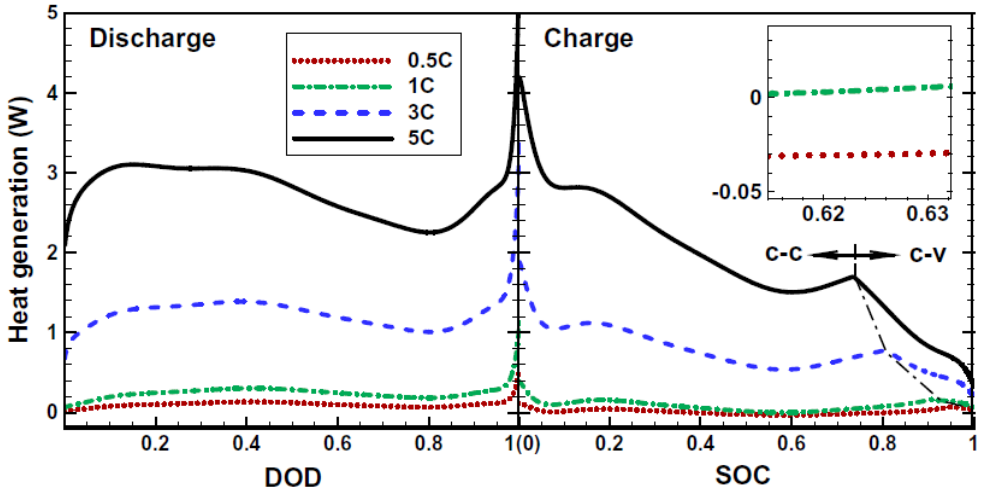
Motivation

Preserve the state of health (SOH) of the batteries → enhance the battery lifetime

- Avoid heat generation
- Avoid excessive discharge



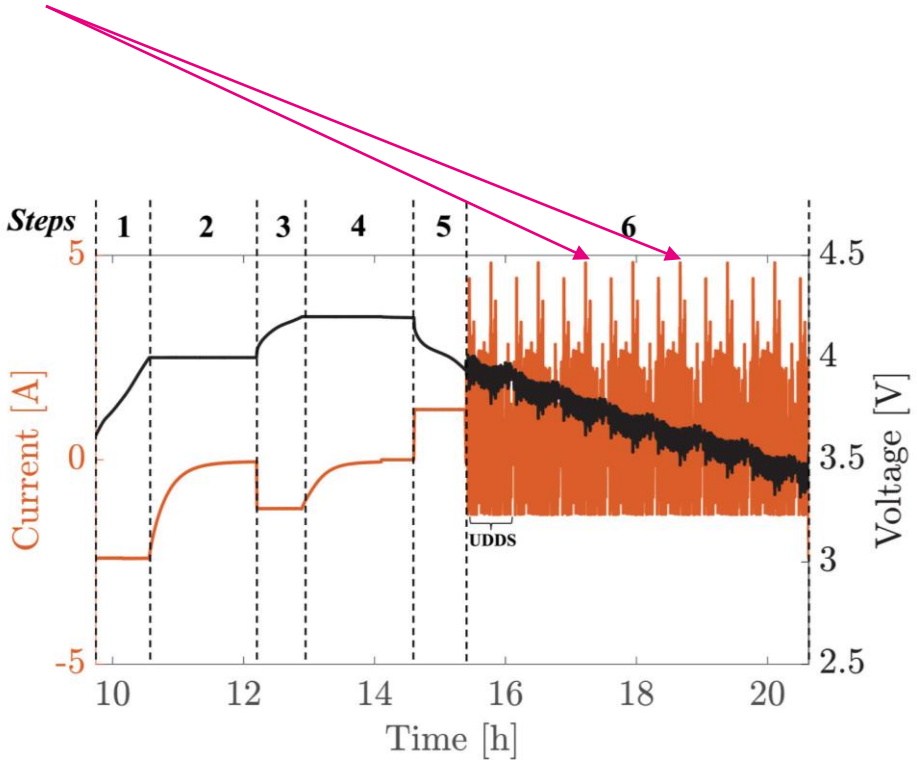
Impact of Temperature and Discharge Rate on the Aging of a LiCoO2/LiNi0.8Co0.15Al0.05O2 Lithium-Ion Pouch Cell
https://www.researchgate.net/publication/317764520_Impact_of_temperature_and_discharge_rate_on_the_aging_of_a_LiCoO2LiNi08Co015Al005O2_lithium-ion_pouch_cell



DOD: depth of discharge / **SOC**: state of charge
Thermal behavior study of discharging/charging cylindrical lithium-ion battery module cooled by channeled liquid flow
https://doi.org/10.1016/j.ijheatmasstransfer.2017.12.083

Concept

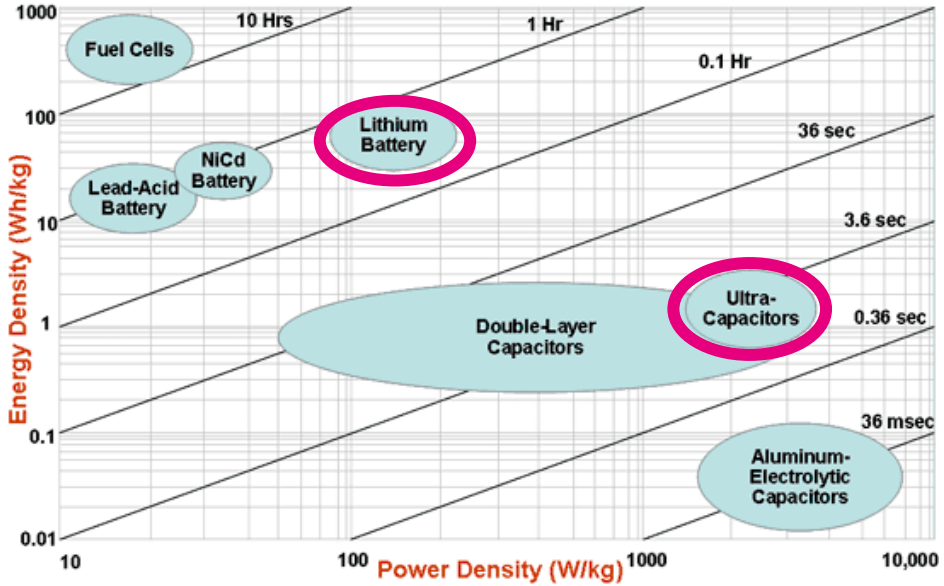
Standard current discharge profile contains a lot of spikes (not good for Lithium batteries)



Lithium-ion battery aging dataset based on electric vehicle real-driving profiles
https://doi.org/10.1016/j.dib.2022.107995
Step 1 to 4: charging, Step 5: discharging at C/4 (from 100% to 80%)

Use advantages of Lithium batteries and advantages of super capacitors

- Super capacitor will be used for its specific power: the speed at which the power can be discharged
- Lithium battery will be used for its specific energy: the total amount of energy it holds



Energy Management for EV Review
https://www.researchgate.net/publication/343167091_Energy_Management_for_EV_Review

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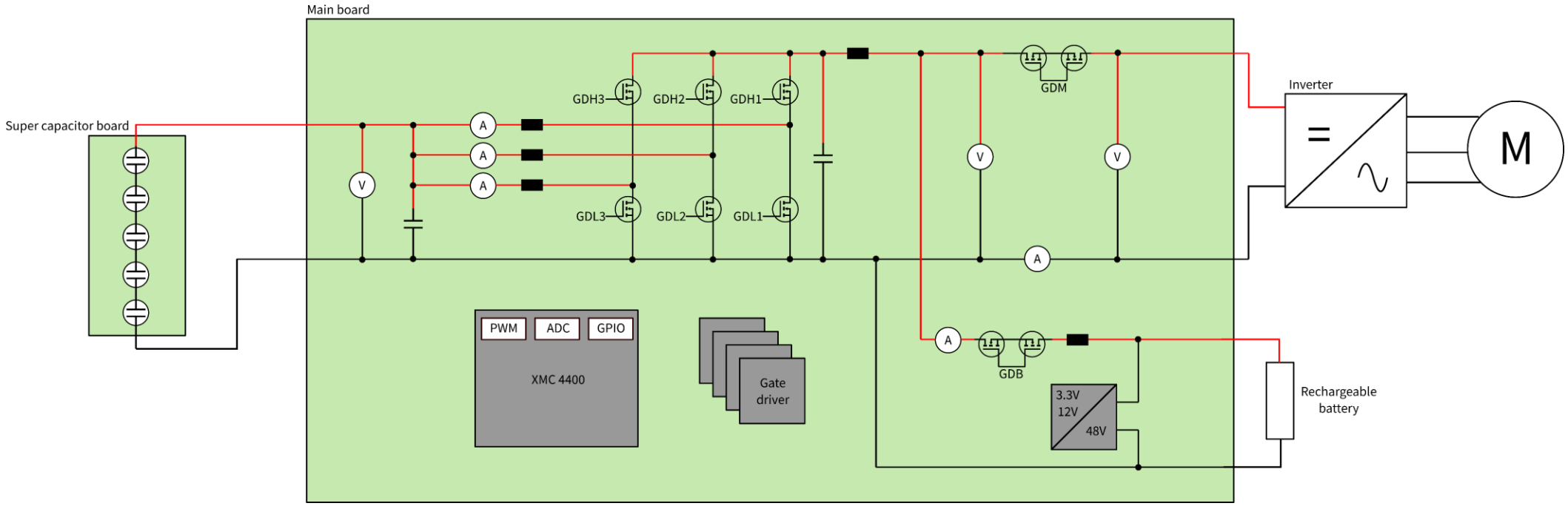
Hardware Implementation



- 5 super capacitors of 3200F (3V)
- Battery voltage: from +27V to +58V
- Maximum battery current: 12A
- Maximum output current to motor: 24A (during 50 seconds)
- Maximum output power: 696W (continuous) / 1392W (during 50 seconds)

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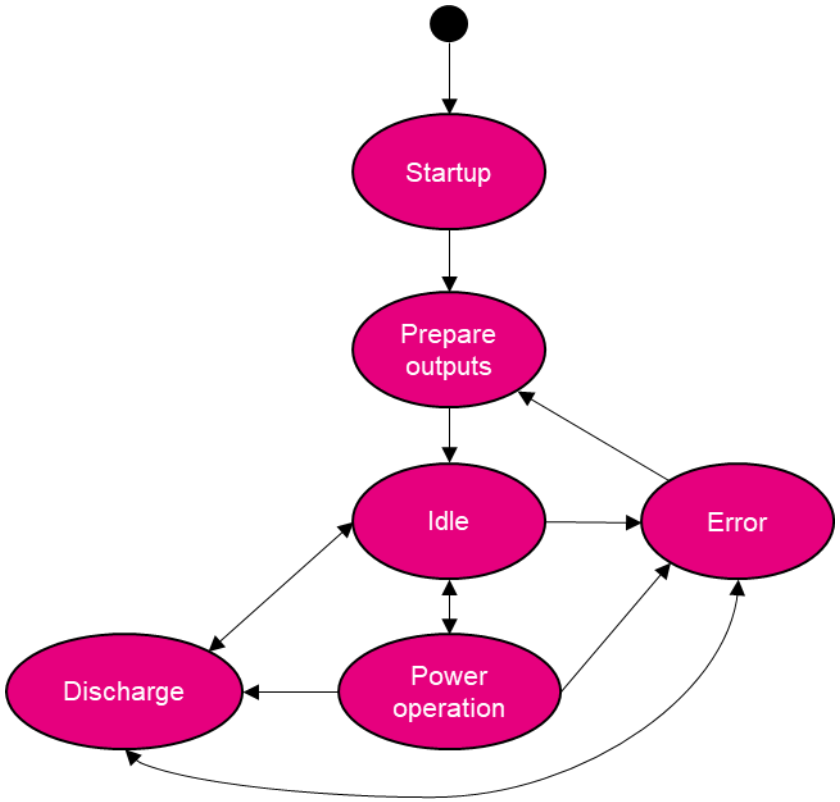
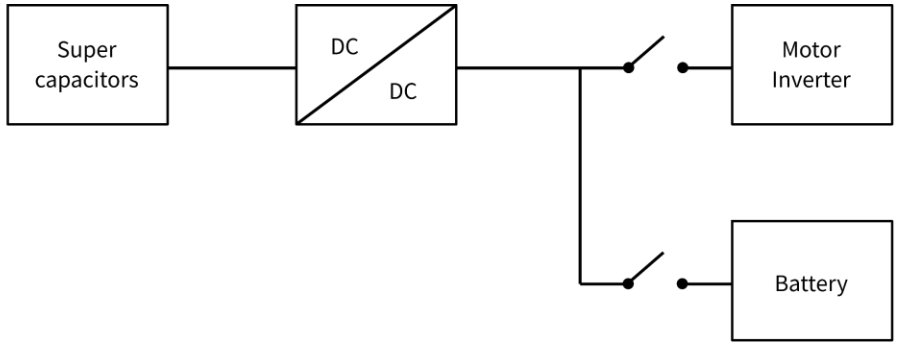
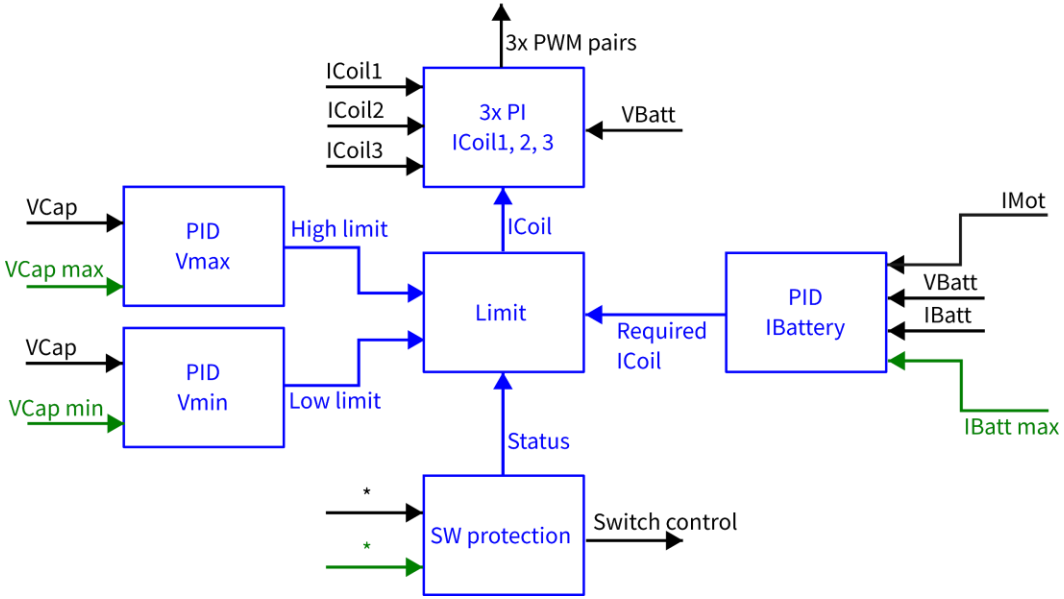
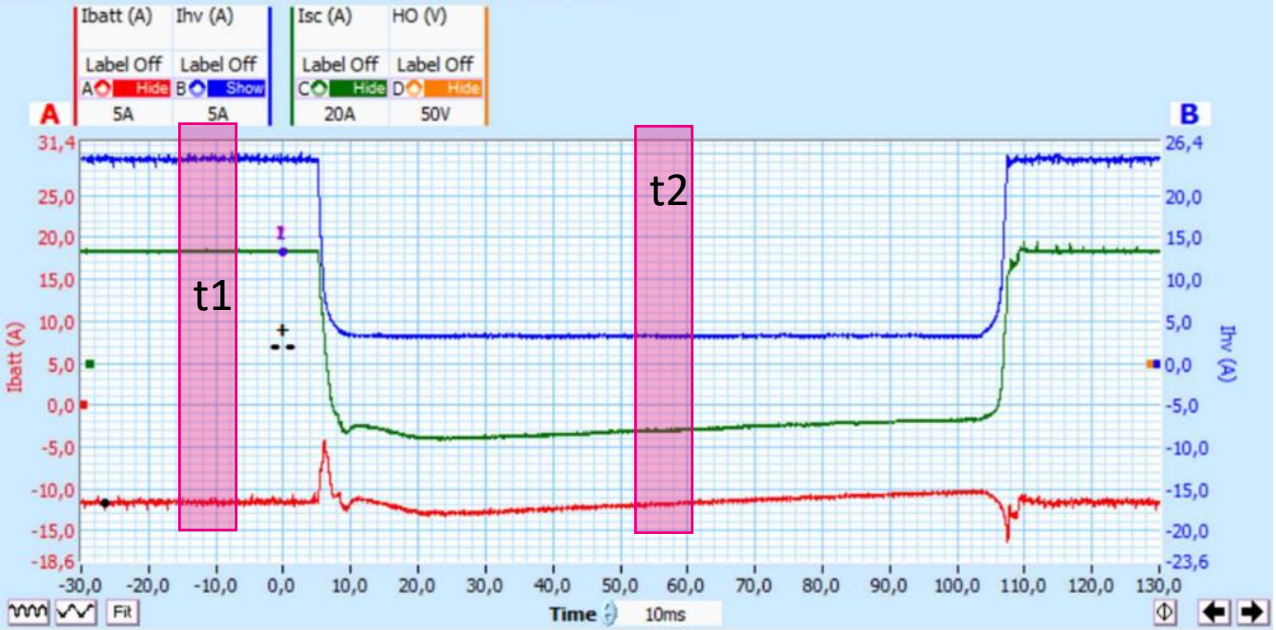
Software Implementation







Measurement results



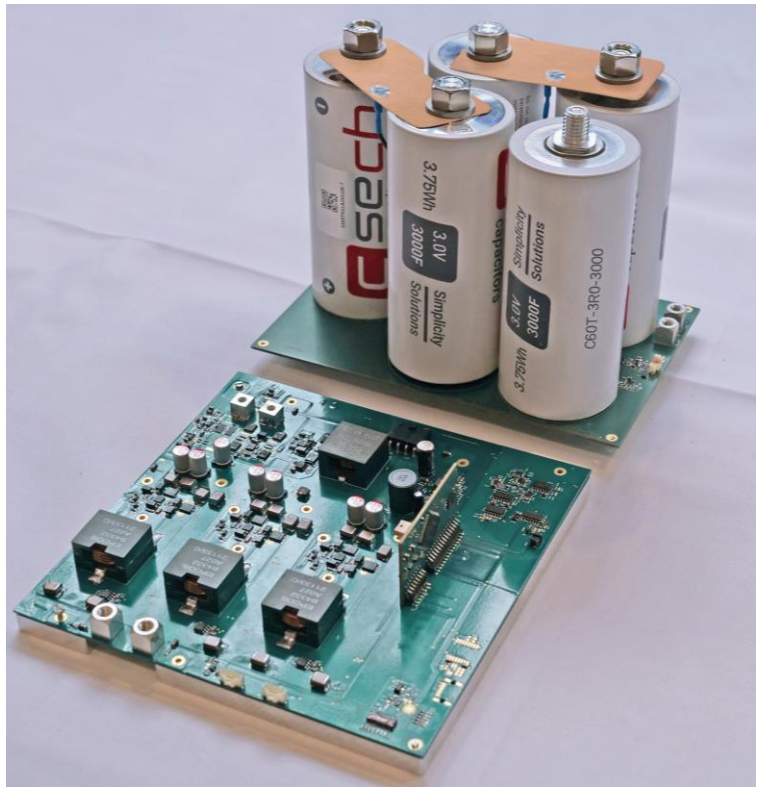
22A load jumps at 48V battery, 12V super cap

Blue: current flowing **to** the motor/load
> 0: consumption mode -> Energy flowing to the motor
Green: current flowing **from** the super capacitor
< 0: super capacitor is being charged (by the battery)
> 0: super capacitor is being discharged
Red: current flowing **to** the battery
> 0: battery is being charged
< 0: battery is being discharged

What happens at t1?
25A (@48V) flowing to the load/motor
~52A (@12V) flowing from the super cap to the HESS → used to drive the load
12A (@48V) flowing from the battery to the HESS → used to drive the load
Remark: 12 + 52/(48/12) ➔ 25A

What happens at t2?
3A (@48V) flowing to the load/motor
~36A (@12V) flowing from HESS to the super cap (used to charge the super cap)
12A (@48V) flowing from the battery to the HESS → used to drive the load and load the super cap
Remark: 12 - 36/(48/12) ➔ 3A

Interested? Get a development Kit



RDK3

Content:

- Main board and super capacitor board
- RDK3 for measurements and BLE
- Android App to see and record the data

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