Sales Training Meeting | Battery Systems

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ERNI Americas | 12th Jul, 2021

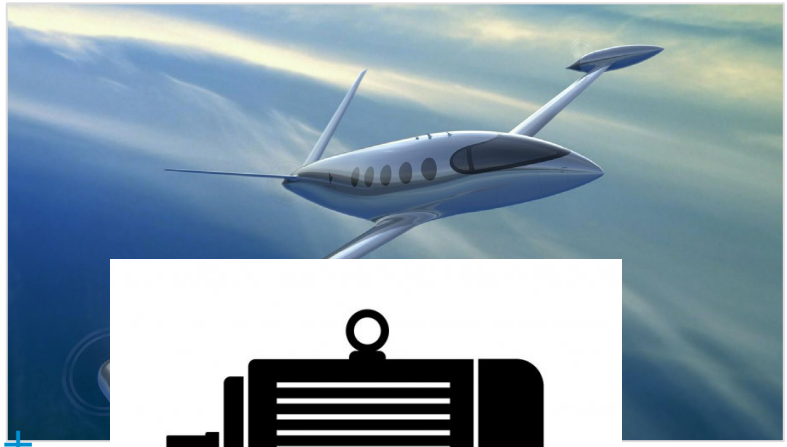
Agenda

1. Electrification and Applications
2. ERNI Products
3. Basic with Li-ion Batteries
4. ERNI Success in BMS

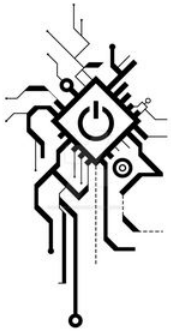
Emergence of Electrification & Applications

Battery Systems

Electrification is everywhere



Electrification =



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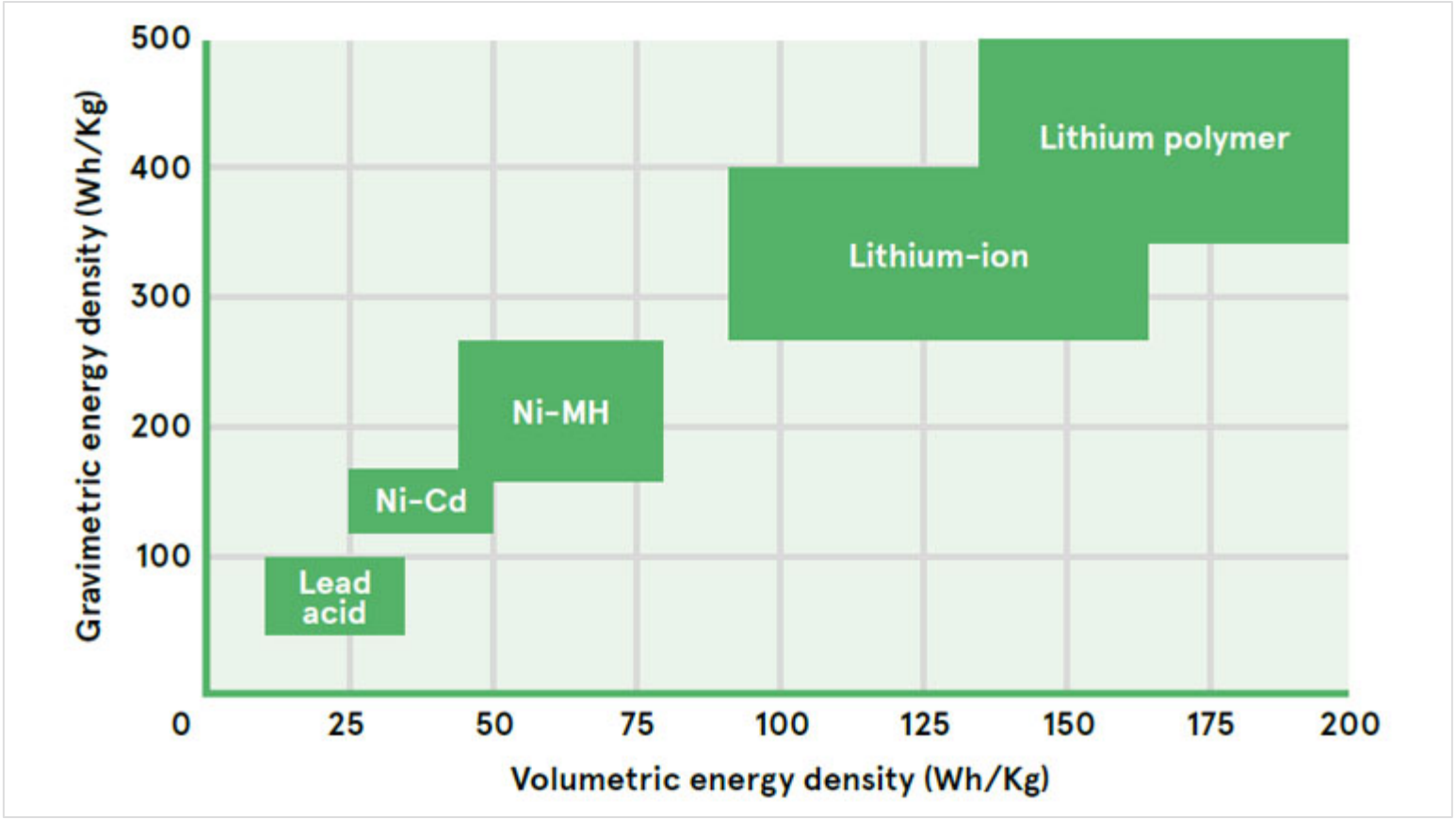
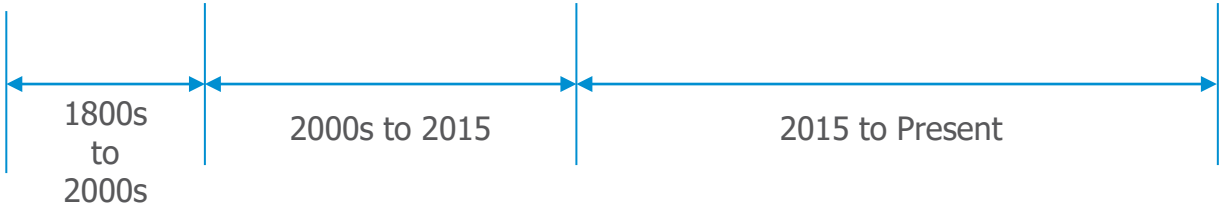
Battery Systems

Advances in Rechargeable Cell/Battery Chemistry

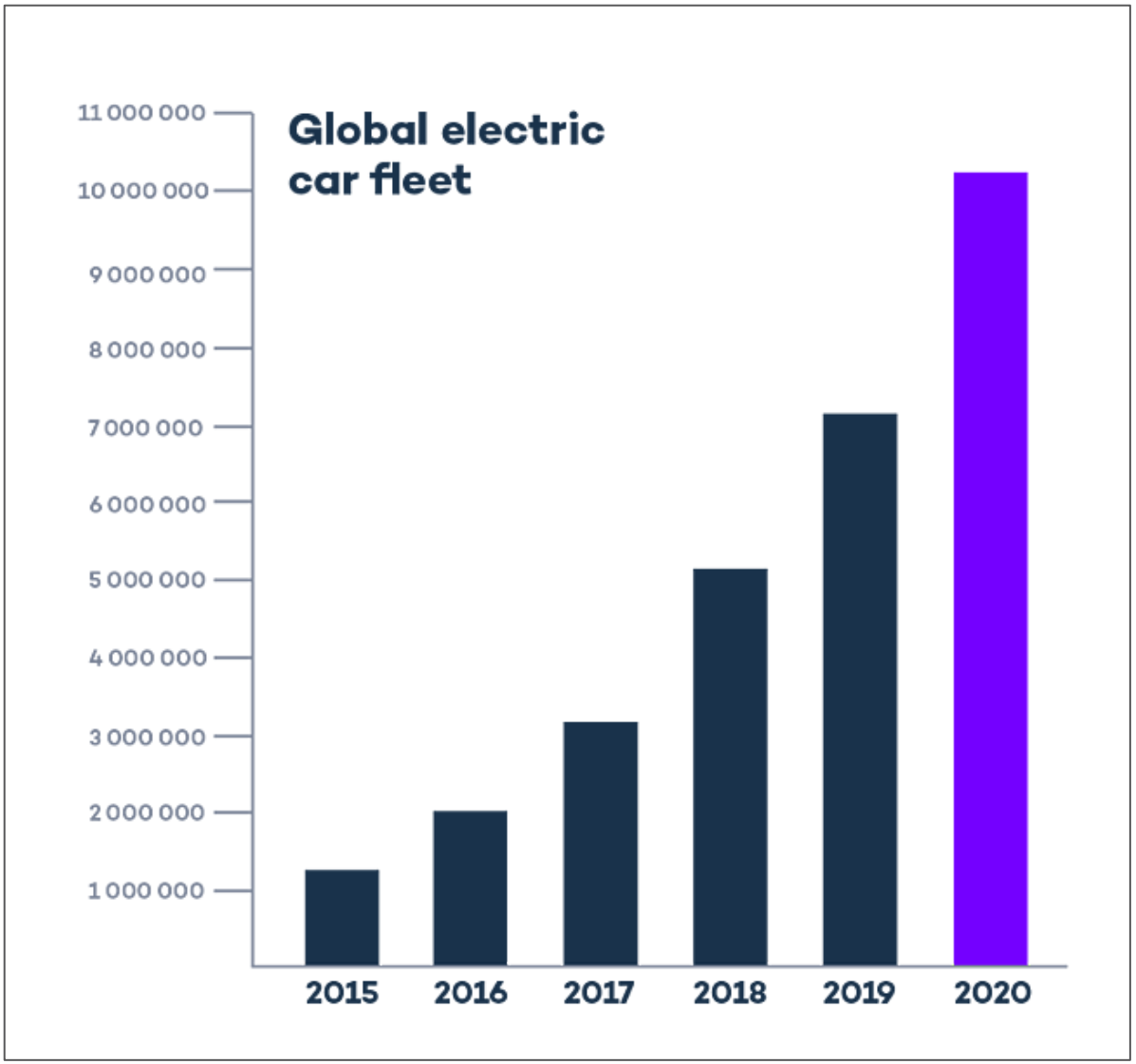




courtesy of Avnet, Inc

Battery Systems

Global electrification Forecast



Number of EV Companies	
• China	**31 ~ 22**
	NIO, Byton, BYD, Tesla
• EU	**8 ~ 10**
	Renault, VW, Audi, Nissan
• USA	**6 ~ 8**
	Tesla, Lucid, Ford, GM, Rivian

Top Li-Ion Battery Manufacturer in NA

- Panasonic Energy NA
- LG Chem Michigan Inc.
- A123 System LLC
- Samsung SDI
- EnerDel
- EnerSys

Courtesy of Virta Global

Engineering Training

Target Applications – Renewable Energy

Renewable Energy sources

Energy storage and distribution

Engineering Training

The future is now

Trucking/Transportation Industry

Off-the-road Equipment

Engineering Training

The future is now

Hybrid Drones (Li-ion Batteries + Hydrogen FCs)

AMRs (Autonomous Mobile Robots) - Plate

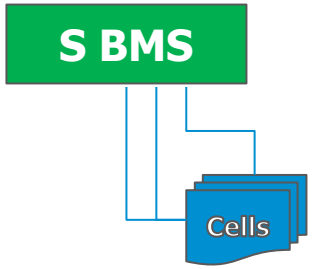
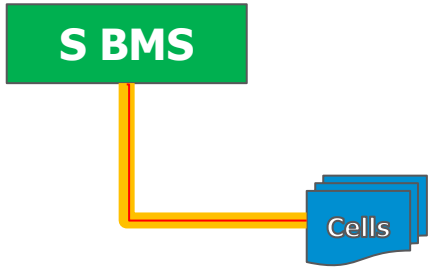
ERNI Products

Battery Systems

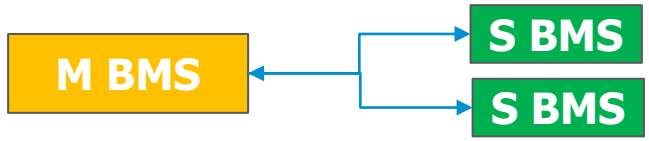
Where does ERNI play well?

Interface Solutions in the Battery Management System:

The two types(or more) interface solutions:

A. Wired solution using cables	**B**. FPC i.e., using Flexible Printed Circuits
	

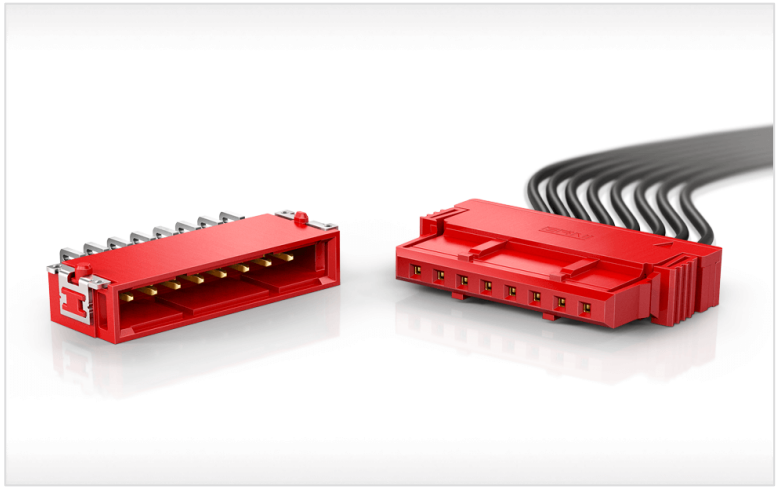
The two main locations needing this :

A. Slave BMS to Slave BMS connection	**B**. Master BMS to Slave BMS connection
	

Daisy Chain:

Battery Systems

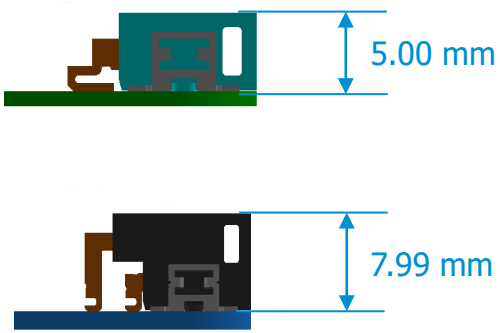
MaxiBridge and MaxiBridge QT | BMS wired solutions



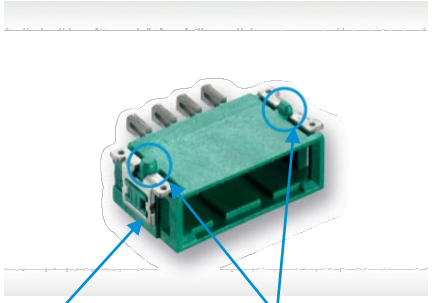
FEATURES

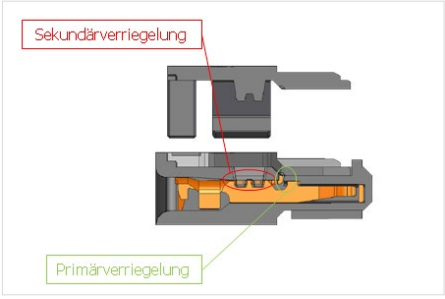
Pitch	2.54 mm
Pin Count	SRC: 2, 3, 4, 5, 6, 8 DRC: 2x5, 2x10
Current per Contact	12 A | 5A (QT)
Operating temperatures	-55°C to 150°C | -55°C to 120°C (Maxi QT Tin ver)
Termination technology	Male: SMT | Female: Crimp
Application	Board-to-Wire
Cable	18, 20, 22, 24, 26 AWG
Configuration	Male Vertical and Horizontal Female Vertical / Straight-out
Color Variants	Black, Blue, Green, Red
Automotive Standards	LV 214; USCAR 2, 21

Critical in the BMS design is Z-Height



KEY FACTORS





Built-in TPA

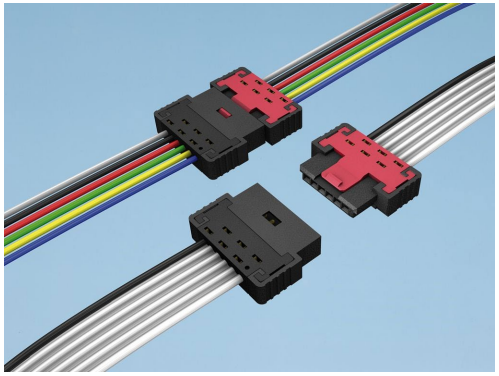
ERNI Product Line-up

MiniBridge and MiniBridge Koshiri

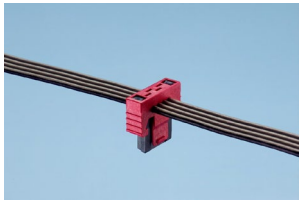
FEATURES

Pitch	1.27 mm
Pin Count	SRC: 2, 3, 4, 6, 8, 10, 12
Current per Contact	4.8 A
Operating temperatures	-40°C to 150°C
Termination technology	Male: SMT | Female: IDC, SMT
Application	Board-to-Wire, Board-to-Board, Wire-to-Wire
Cable	22, 24, 26 AWG | Ribbon and Discrete
Configuration	Male Vertical and Horizontal Female Vertical and Horizontal
Color Variants	Black, Red
Automotive Standards	LV 214

KEY FACTORS

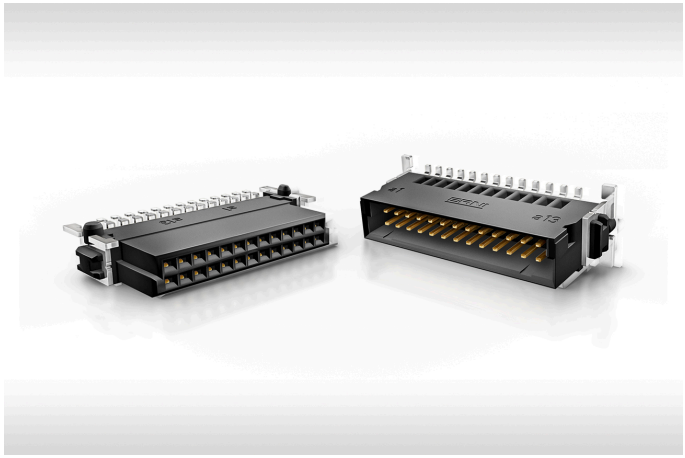


- Koshiri positive lock and guides
- Small form-factor
- Wire-to-Wire, and daisy chain cable assembly abilities.

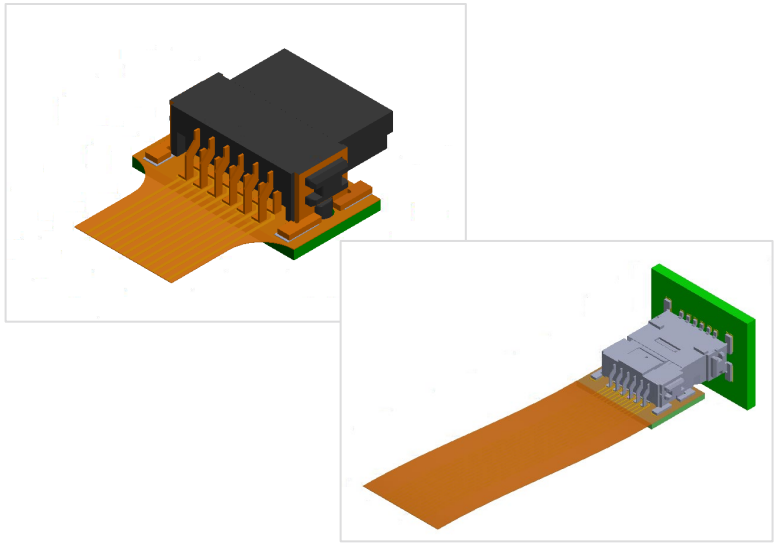


ERNI Product Line-up

SMC (Small Multipurpose Connector) | BMS FPC solutions



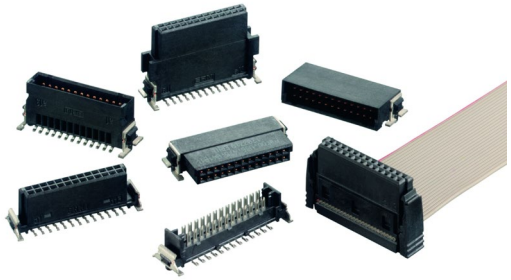
FPCs with SMCs



FEATURES

Pitch	1.27 mm
Pin Count	DRC: 12, 16, 20, 26, 32, 40, 50, 68, 80
Current per Contact	1.7 A
Operating temperatures	-40°C to 150°C
Termination technology	Male: SMT, PF | Female: SMT, IDC
Application	Board-to-Board, Board-to-Wire
Cable	30 AWG / 7 strand Ribbon
Configuration	Male Vertical and Horizontal Female Vertical and Horizontal
Color Variants	Black
Automotive Standards	IEC standards

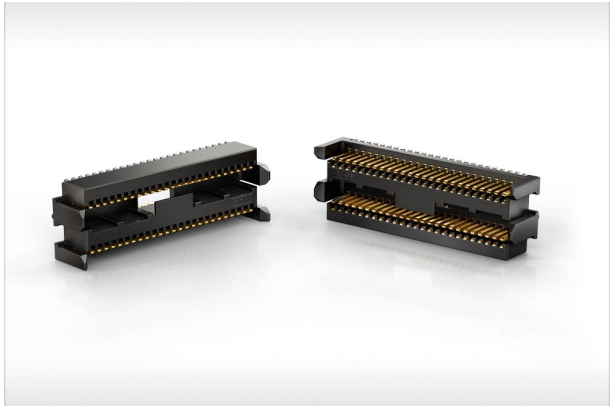
KEY FACTORS



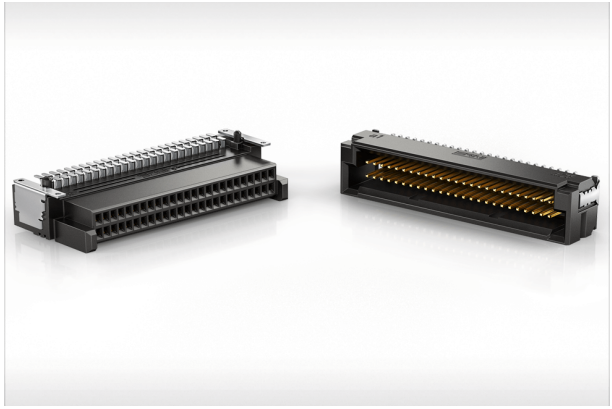
- Board-to-Board Applications
  - Stacked Board (Mezzanine)
  - Stacked with enhanced height
  - Coplanar Board
  - Orthogonal Boards

Battery Systems

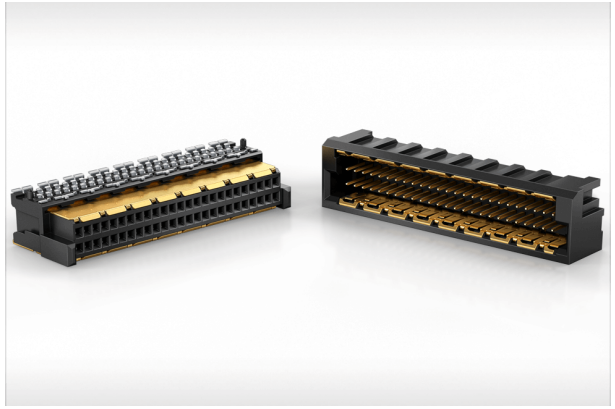
ERNI Products with Flexible PC



MicroStac

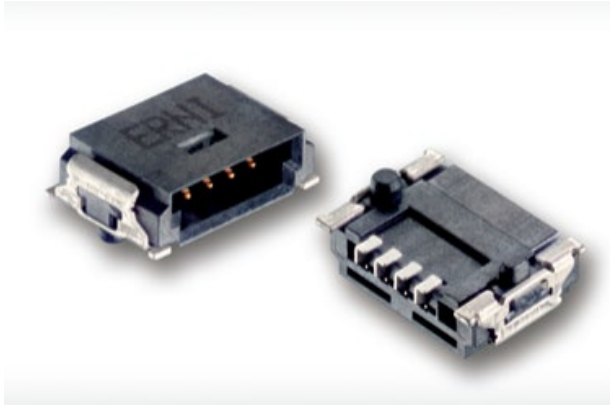


MicroCon



MicroSpeed

SMC



MiniBridge (2p, 3p, 4p, 6p)

Basics with Li-Ion Batteries

Battery Systems

How a Battery Pack is made

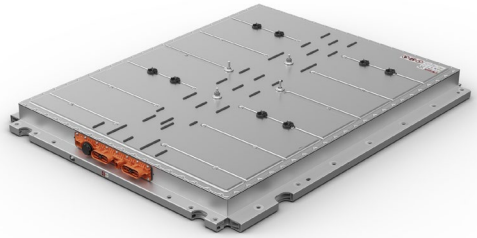
Cell

Brick

Array

Module

Battery Pack



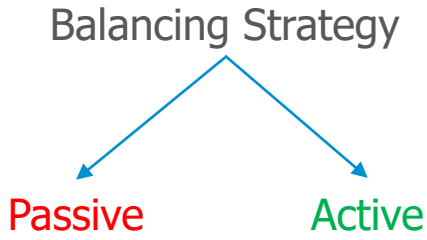
Energy Storage System Grid

Battery Systems

Battery Management System (BMS)

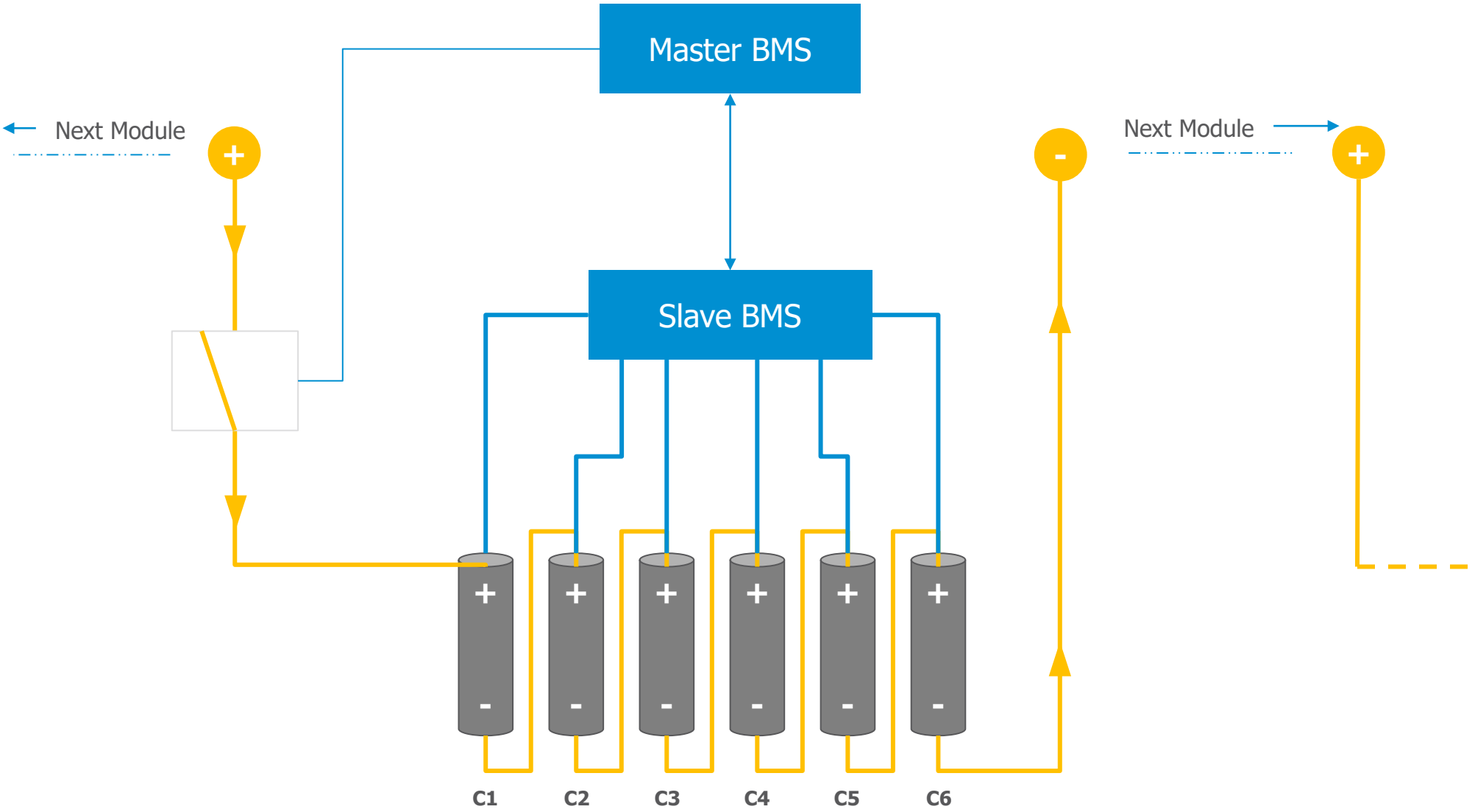
Why is BMS needed and role it plays in Lithium-Ion Battery Chemistries?

- Li-Ion batteries come with good potentials and other higher capacities but have a limiting operating window.
- Over-charging and discharging above or below a required limit is detrimental.
- BMS checks for: voltage, capacity, temperature and the safety parameters of the cell.
- BMS is also used to balance the capacity of the cells during the charging/discharging cycle.



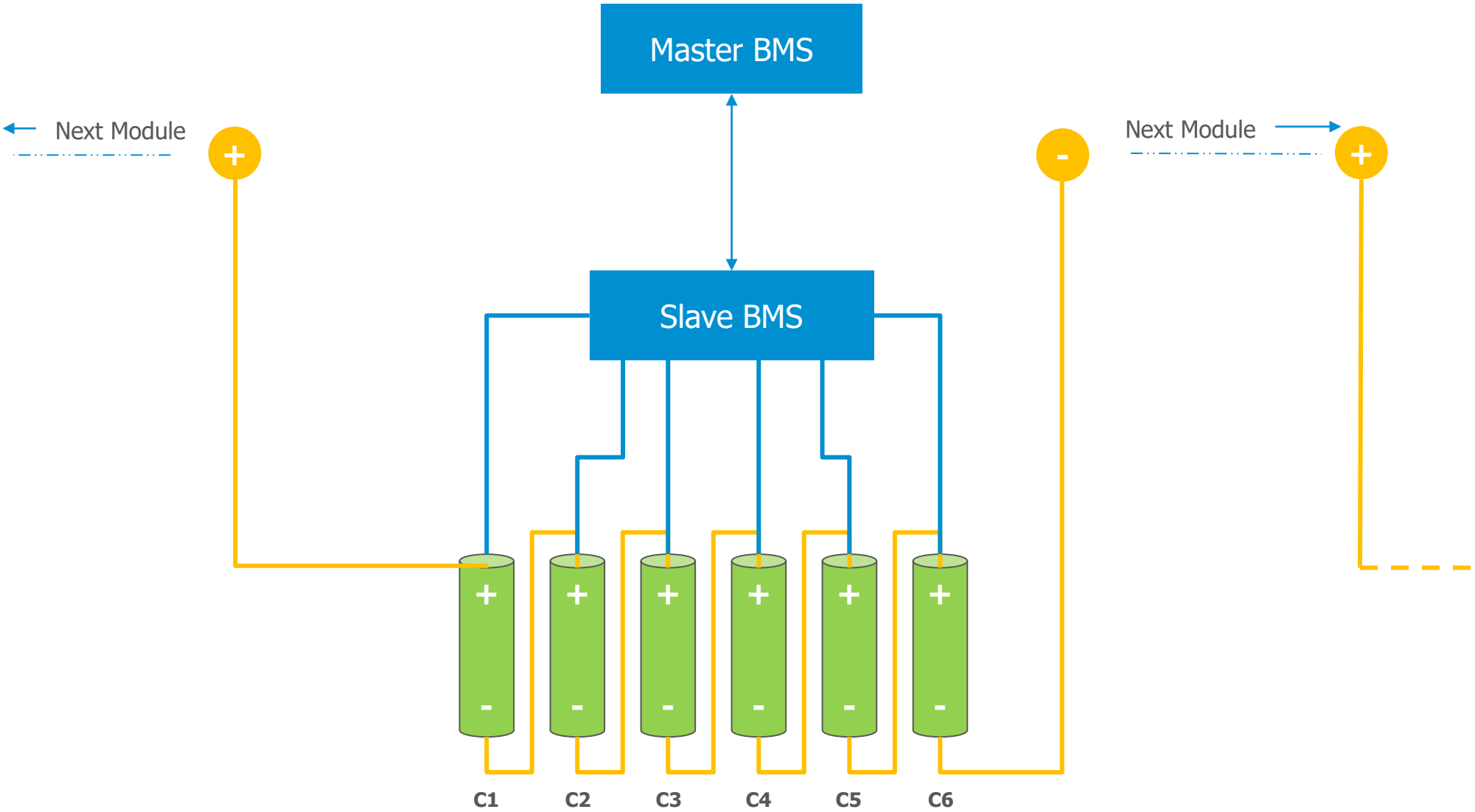
Battery Systems

What does a BMS really do



Battery Systems

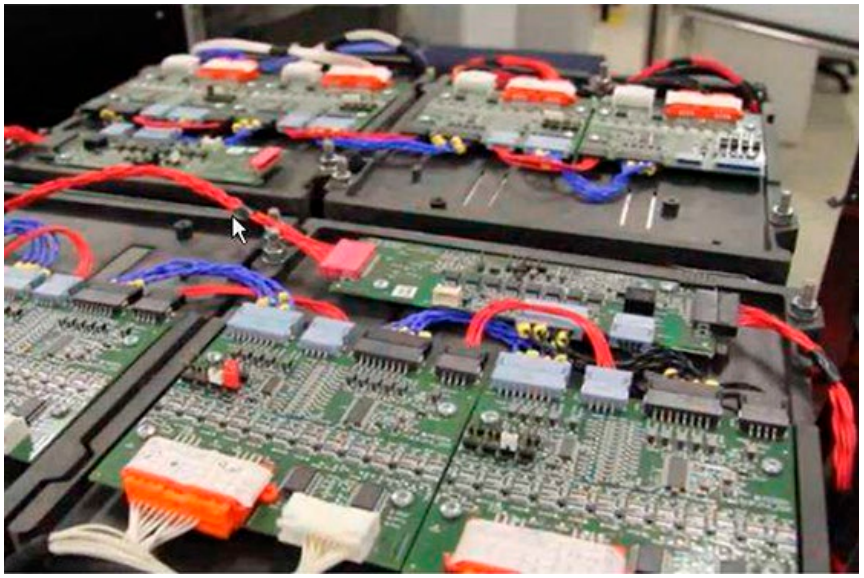
What does a BMS really do



ERNI success in BMS

Applications

Battery Management Systems



Battery Pack of a European OEM PHEV

Case Model Functionalities

- 8 to 12 remote BMS board performing cell monitoring activities – voltage measurement and charge distributions
- Communications between remote boards and with the master board

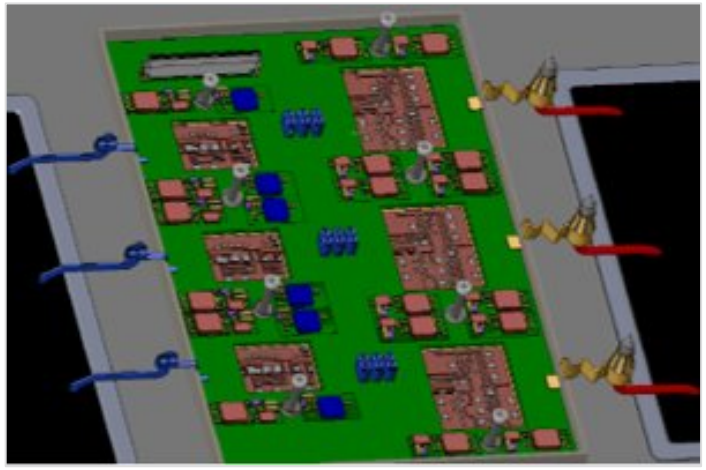
Requirements for the connector

- Nominal creepage and clearance for PHEVs
- Mechanical robustness for high temperature and vibration conditions
- Accept various wire gauges
- Color and key coded

Applications

Solar Inverters

Solar Inverter



Case Model Functionalities

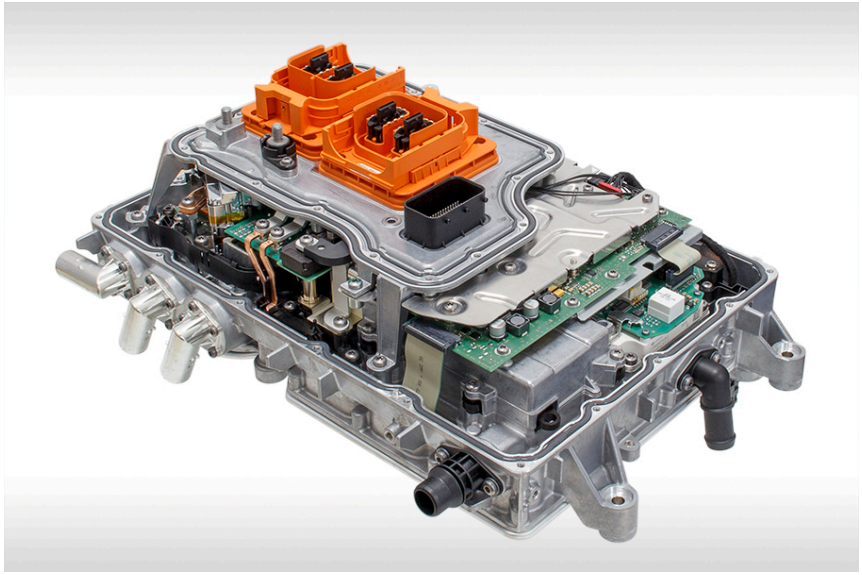
- Communications between the LV control boards and with the HV power board.

Requirements for the connector

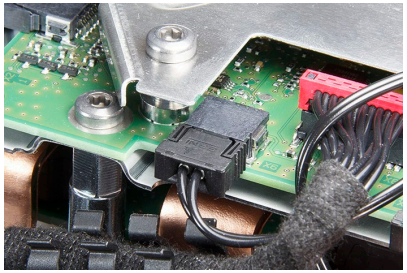
- Compact space and low mezzanine height
- Board-to-Board easy Snap-On connection.
- Mechanical robustness for high temperature and vibration conditions

Applications

Power Electronics Drive Unit

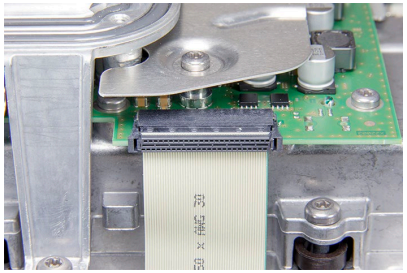


Power Electronics: A German OEM PHEV



MaxiBridge being used for power the on-board processing components

MiniBridge for signal transfer applications



SMC being used for PWM signal transfer between the control board and the power board

Case Model Functionalities

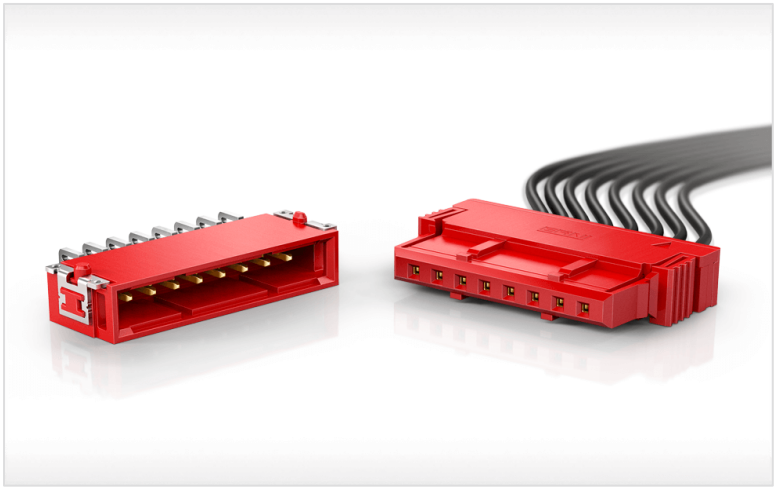
- Power conversion from the energy storage unit to drive the control side and the power side
- Accuracy in the power conversion between AC and DC
- Steady energy and signal transfer between high voltage and low voltage regions of the power electronics

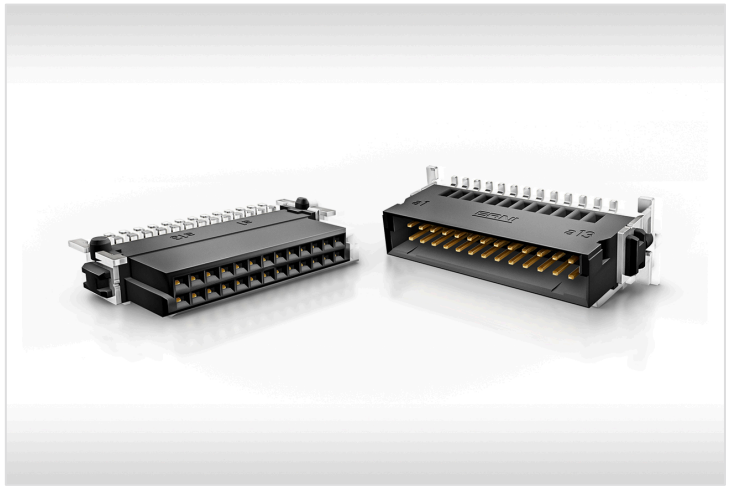
Requirements for the connector

- Compact form-factor for tight and intricate spaces
- Mechanical robustness for high temperature and vibration conditions
- Meet certain pollution degrees
- High current-carrying capabilities

Battery Management Systems

ERNIConnects BMS





ERNIConnects BMS

Wrap up


ERNI