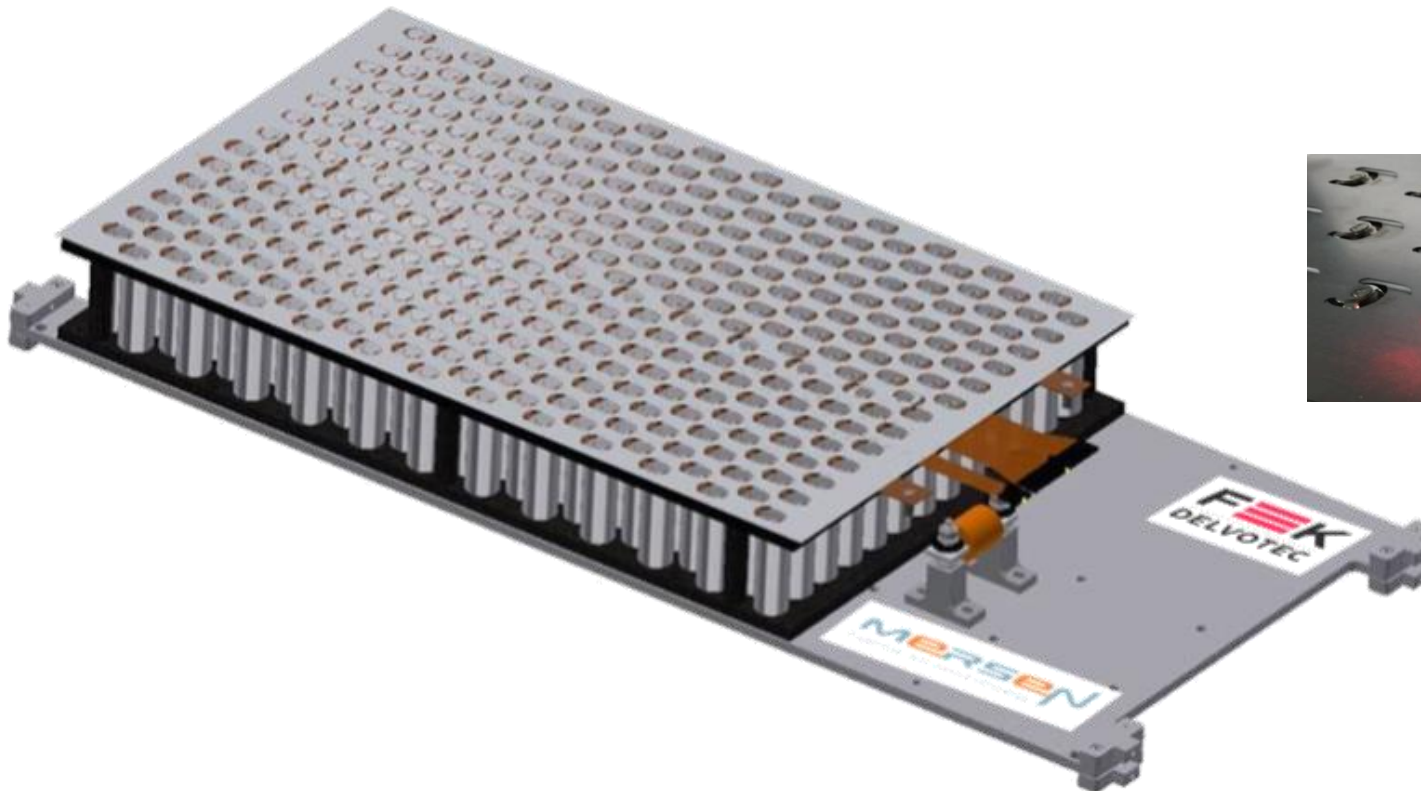




SOLUTIONS FOR STANDARDIZED BATTERY PLATFORM POWER MANAGEMENT

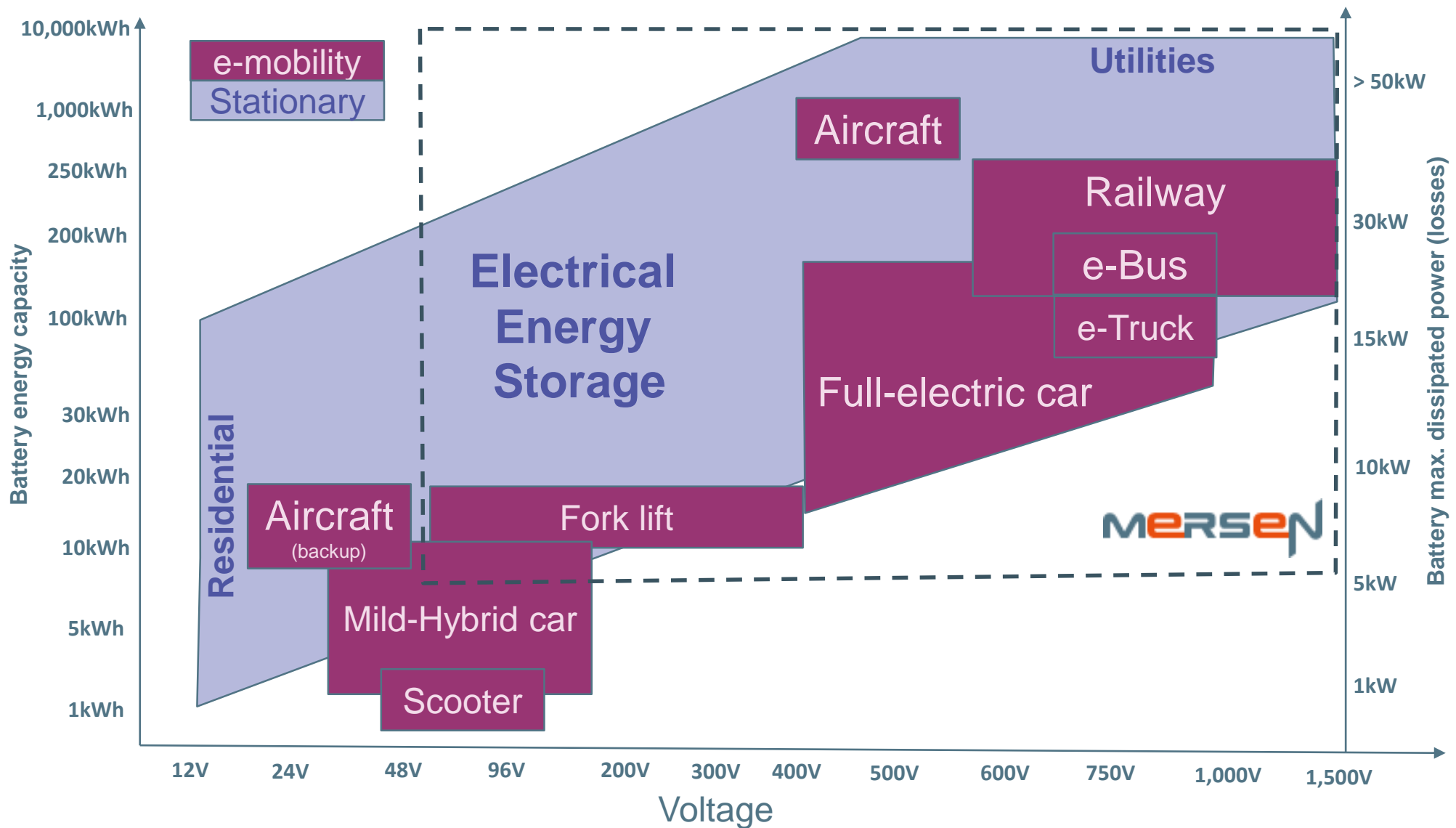
A JOINT-DEVELOPMENT PROGRAM WITH F&K DELVOTEC

Feb. 2020



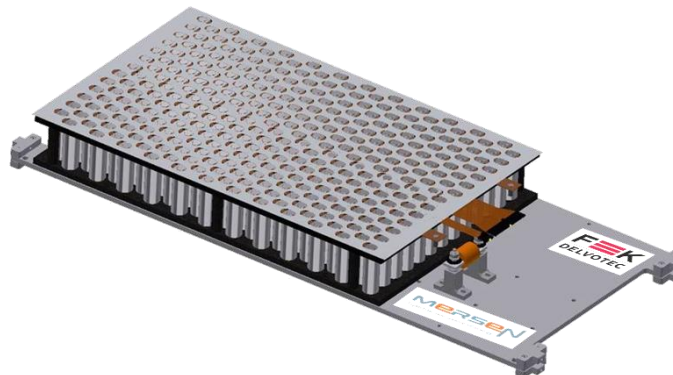
- Public
- Internal
- Confidential

MERSEN ADDRESSABLE SEGMENTS IN BATTERY-RELATED MARKET



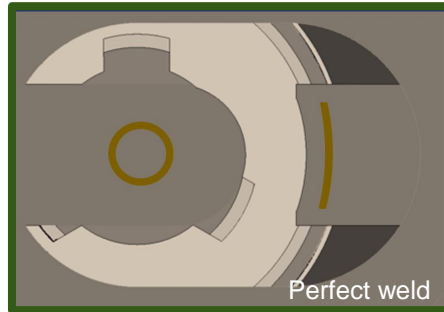
CONTEXT AND OBJECTIVES

- **merseN**, expert in **thermal management, overcurrent protection and laminated monitoring bus bar, and**
- **F~~V~~K DELVOTEC**, expert in **laser welding equipment and process**, have joined their forces to develop a standardized battery platform enabling so many completely new benefits.
- Our goal is to enable leading **\$/kWh** and **kWh/Kg** efficiency at a modular level with our 21700 module solution.

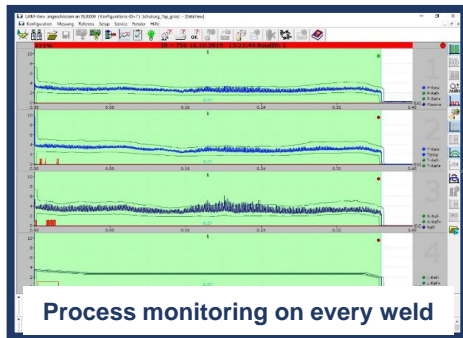


MAIN COMPONENTS OF OUR BATTERY PLATFORM

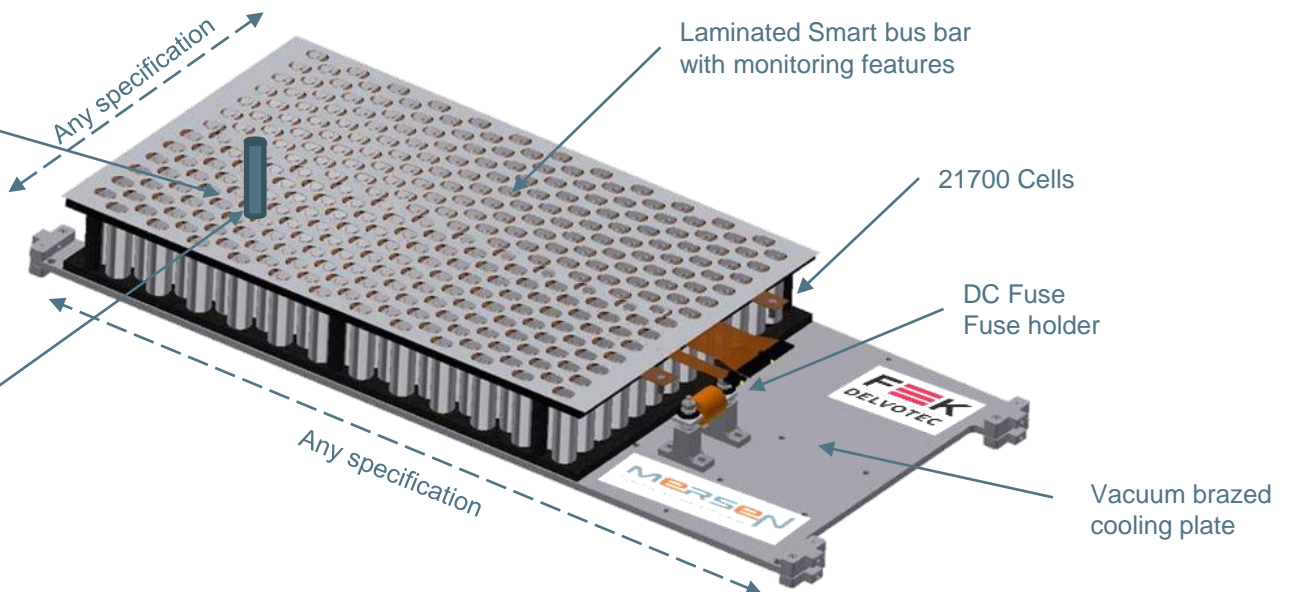
WE DON'T MAKE MODULES, JUST TO BE CLEAR!



Optimised 2:1 TAB weld interface



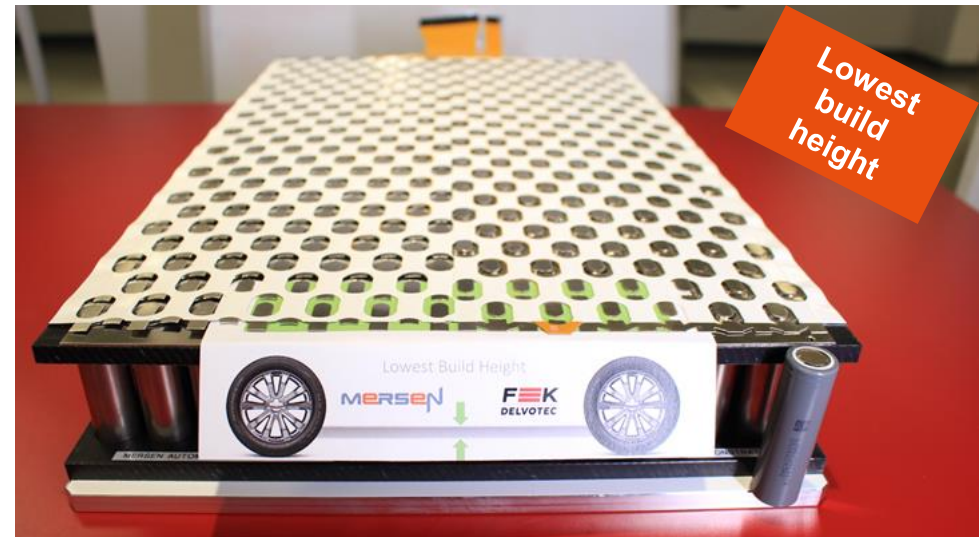
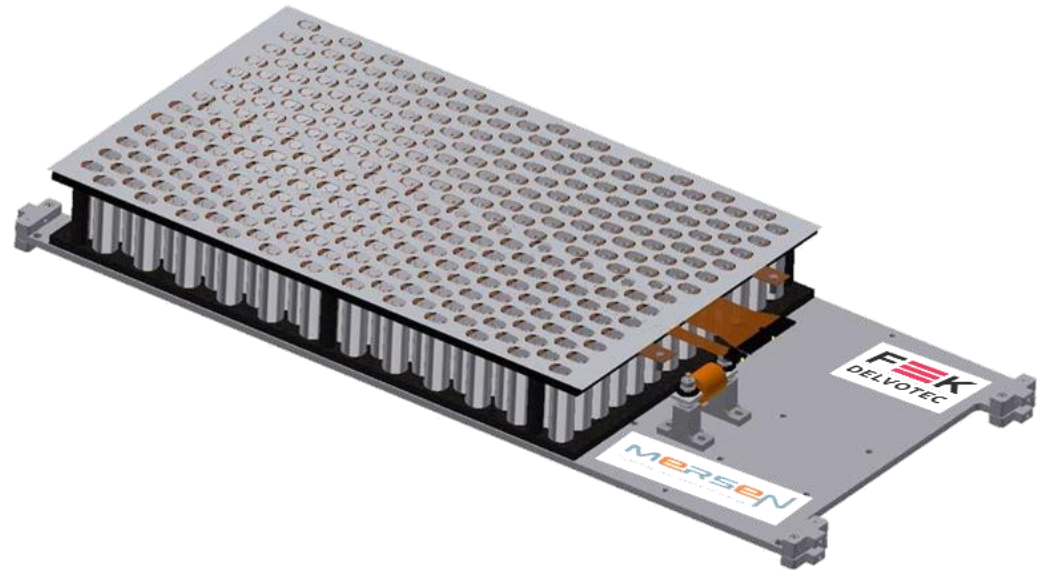
Standardised parameter and weld process monitoring profile library



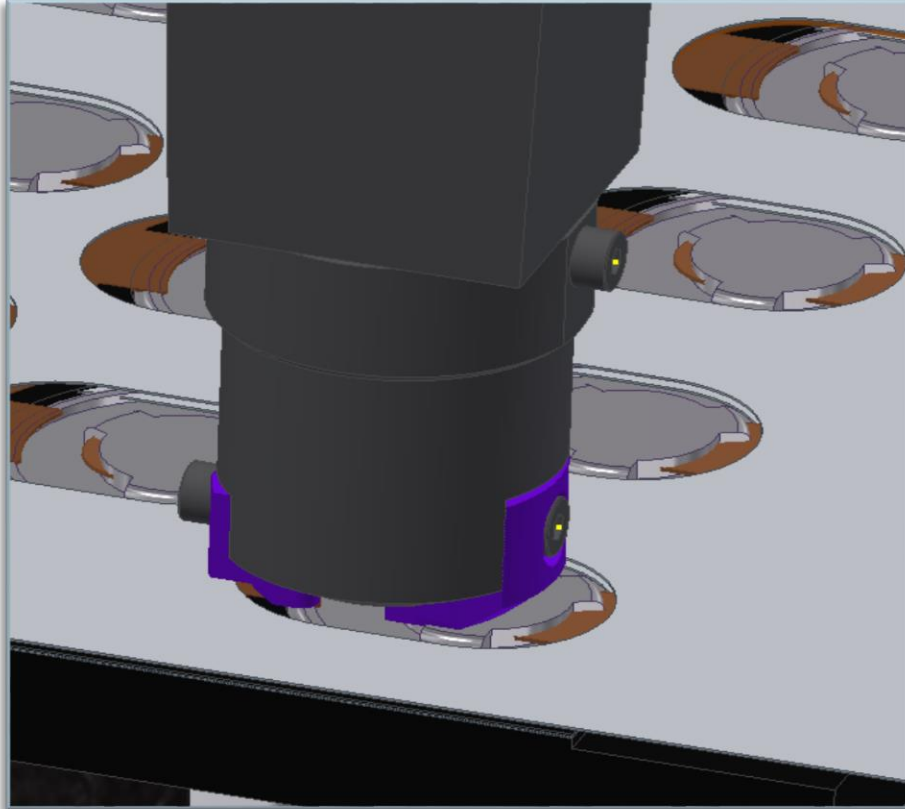
...our platform is the gateway to 21700 - made easy!

KEY BENEFITS AND ADDED-VALUES

- Lowest cost
- Highest Flexibility
- Securest Process
- Safest solution
- Easiest solution



LOWEST COST



....why is it the lowest cost?

- **Standardized modular components**

- Enables the optimize component supply chain for almost any module

- **>4x faster than wire bonding**

- 2 in 1 TAB welding is inherently >4x faster than conventional wire/ribbon insertion & cutting.

HIGHEST FLEXIBILITY



....why is it so flexible?

■ Product Synergy

- Easier product development with standard components & parameters.

■ Modular configuration

- Enabled by standard building blocks, inc. BMS connections, sensors etc.

■ High current made easy

- 8mm TABs and large weld area makes high current easy

■ Monitor what needs to be

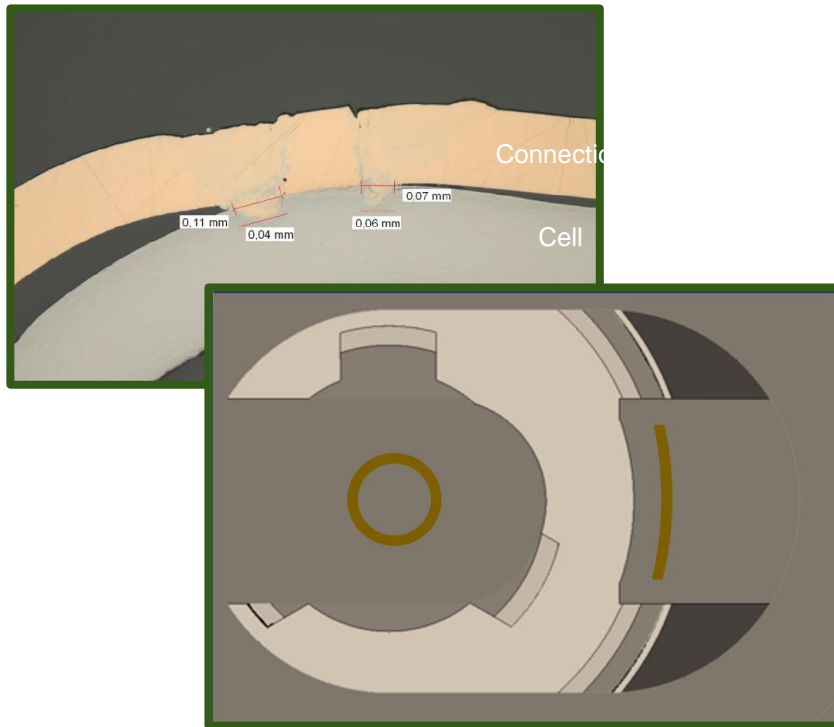
- Smart bus bar can monitor voltage and T° wherever you need

■ “On the fly” lot changes

- M17LSB programs & modules selectable on the fly

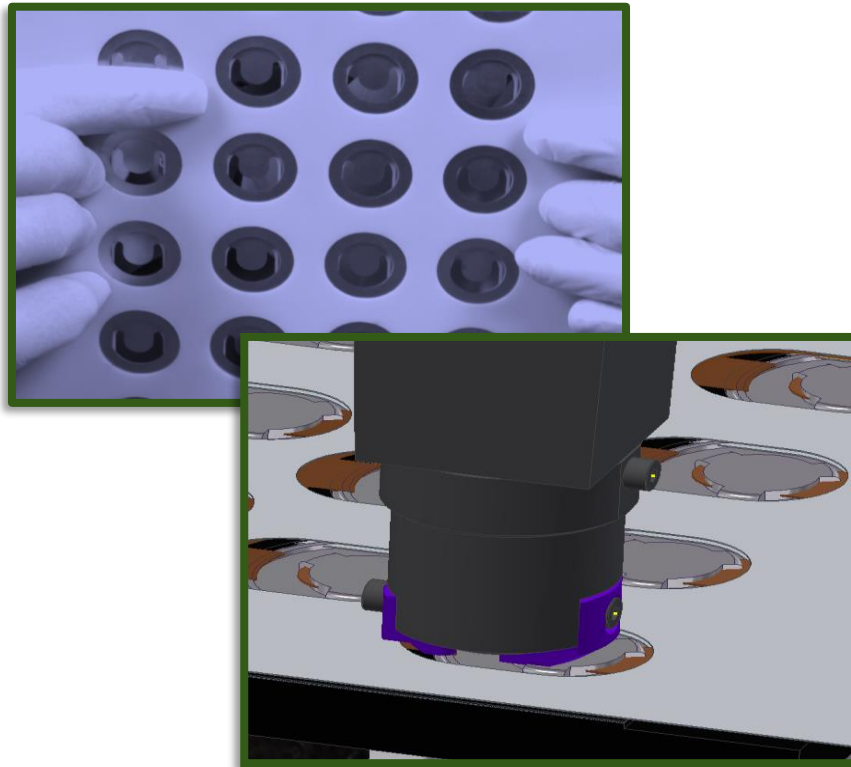
SECUREST PROCESS

....why is the process so secure?



- **Bus bar enables no wiring error**
- **The monitored perfect weld**
 - Optimized weld Parameter data library of common cell types including back reflection data.
- **Zero gap certain**
 - The tool touches every weld in $\pm 1\mu\text{m}$ and feels every weld in $\pm 1\text{cN}$
- **Gasket safe, ultimate accuracy**
 - Negligible heat input with very fast moving weld spot $<40\mu\text{m}$ diameter
- **Contamination robust**
 - Position accuracy with through bus bar scanning combined with 8mm high current TABs

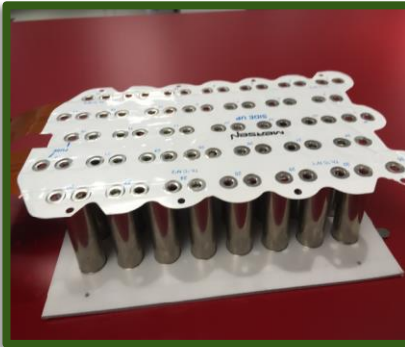
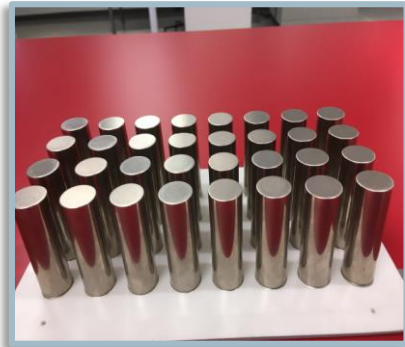
SAFEST SOLUTION



....why is it the safest solution?

- **Assembly - short circuit safe**
 - Cell holder/bus bar geometry is short safe
- **Bonding - short circuit safe**
 - Tab tool is non conducting & short safe
- **Over current protection**
 - Embedded DC fuse enables safe transportation and handling

EASY SOLUTION



....why is it so easy?

....It just is!

MERSEN TECHNOLOGY

■ MERSEN Demo module

- Fuse holder
- Fuse
- Bus bar
- Cooling plate

■ MERSEN Concept

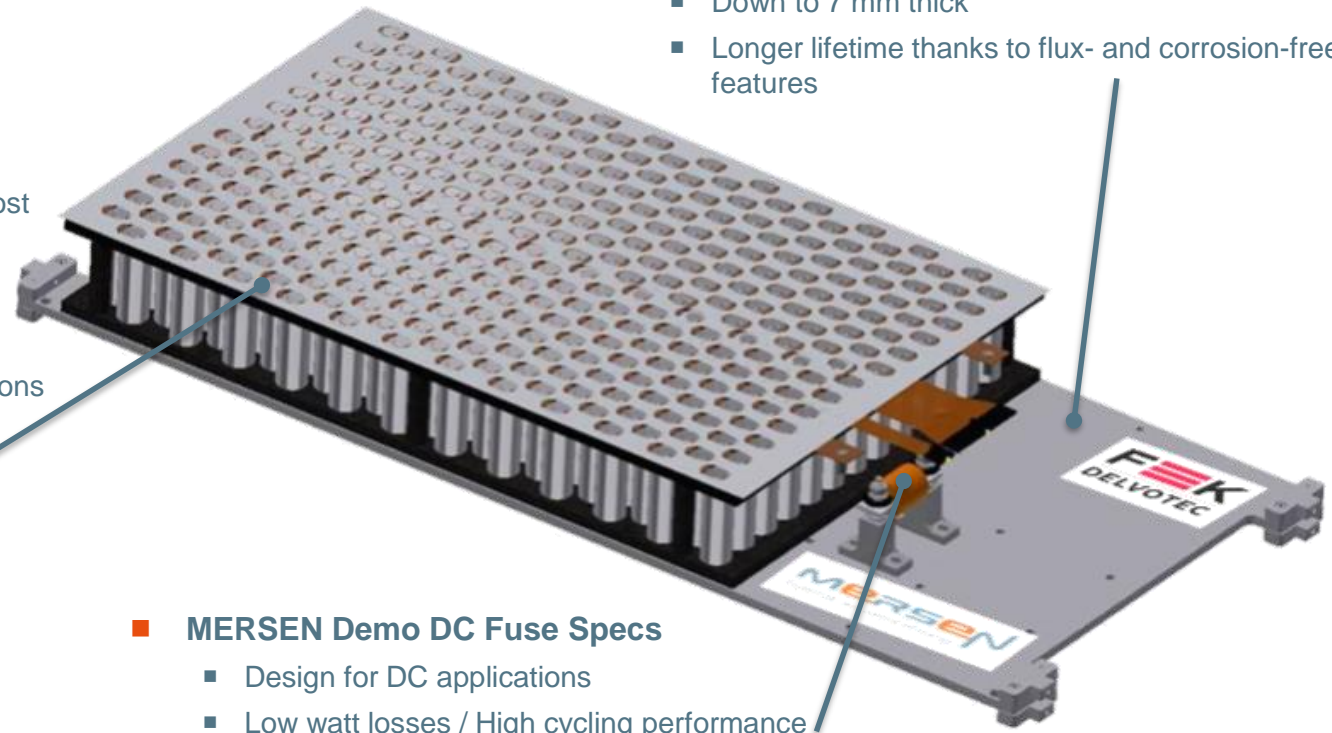
- Flexible in X&Y, P&S configuration
- Modular solution for all sizes = low cost
- No wiring errors
- Simple assembly
- Increased current carrying capability
- High resistance to shocks and vibrations

■ MERSEN Demo Bus Bar Specs

- Module 13P, 24S
- 70A continuous
- 140A overload
- 80V
- Fuse protection
- Cooling plate – vacuum brazed
- Temp < 60°C
- Single layer
- Volt & temp monitoring flex integrated

■ MERSEN Demo liquid cooling plate Specs

- Customized liquid channeling to address battery cell homogeneity requirements
- Large cooling plate capability (up to 650 x 2000 mm)
- Down to 7 mm thick
- Longer lifetime thanks to flux- and corrosion-free features



■ MERSEN Demo DC Fuse Specs

- Design for DC applications
- Low watt losses / High cycling performance
- Ultra-compact size
- Current Ratings (I_n): 50 to 200A
- Interrupting Rating: 20kA @
- 100VDC, L/R < 1.5 ms

F&K DELVOTEC TECHNOLOGY

■ M17LSB Laser

- 1kW CW fiber 1070nm laser
- Focus spot <math>< 50\mu\text{m}</math>
- LWM Back Reflection
- Ribbon <math>< 5\text{mm}</math>/TAB interchangeable
- Touch down linear encoder $\pm 1\mu\text{m}$
- Bond force 0-60N

■ M17LSB Platform

- Working area 595mmx340mm
- 100mm Z
- P $\pm 180^\circ$
- Linear encoder resolution 0,1 μm

■ M17LSB Camera recognition

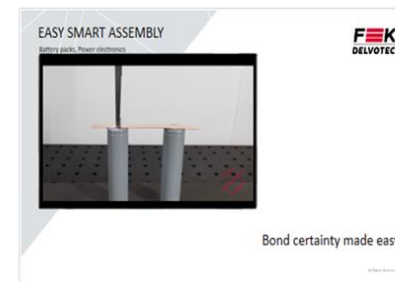
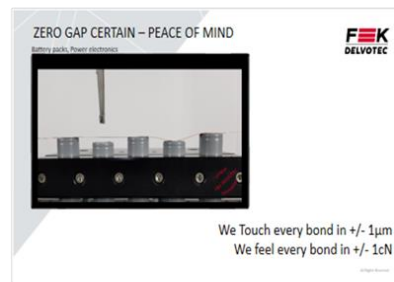
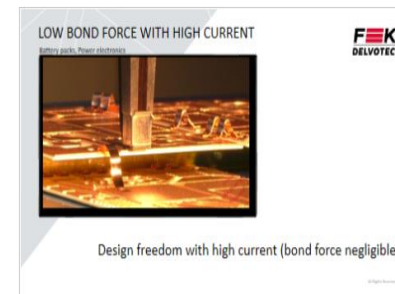
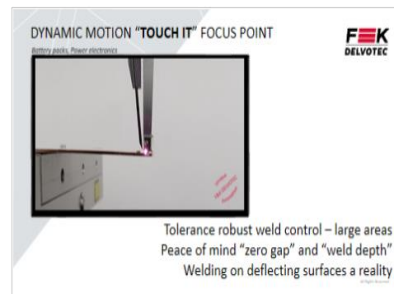
- Cognex PatMax System
- Sub pixel resolution to n0,1 pixel

■ M17LSB Connectivity

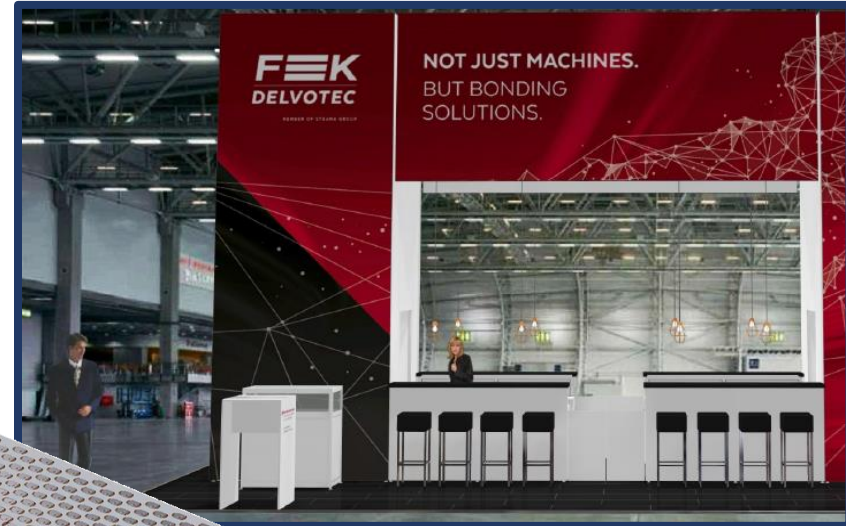
- TCP/IP/FTP data exchange
- SEMI communication - SECS/GEM,
- SMEMA for in-line connections
- MES host connectivity

■ M17LSB Conformity

- CE & Semi S2
- SMEMA Compliant 850mm -1050mm
- Laser Unit Class 1 (EN 60825-1:2014)



DEBUT: APEC 2020



Launch
APEC 2020
March 15-19, 2020 New Orleans, Louisiana