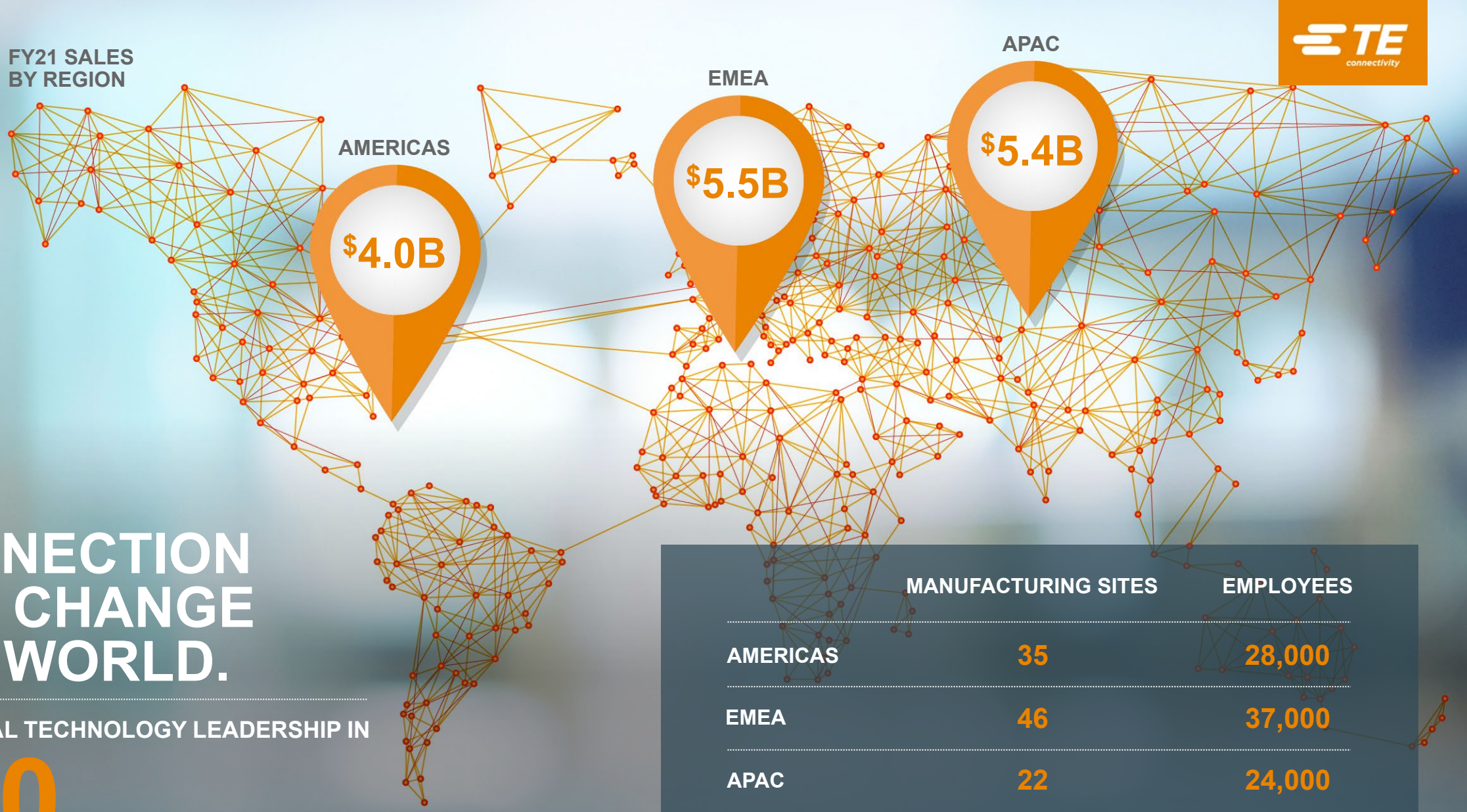
TE Connectivity

Hybrid and E-Mobility Solutions
NAATBatt 2022

Evan J. Dawley
Battery Systems Principal FAE



ANY CONNECTION CAN CHANGE THE WORLD.

INDUSTRIAL TECHNOLOGY LEADERSHIP IN

140

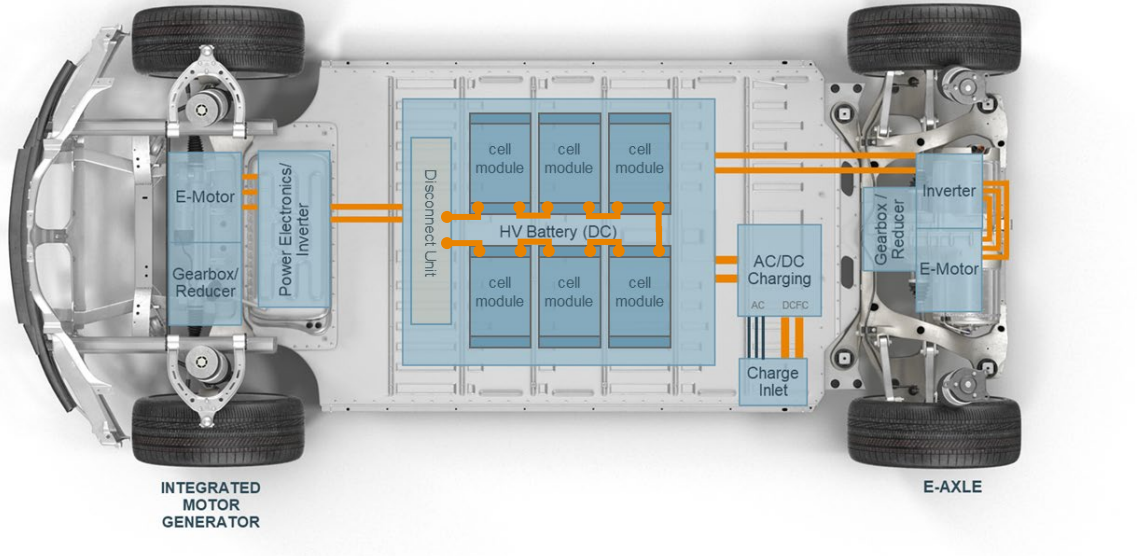
COUNTRIES

	MANUFACTURING SITES	EMPLOYEES
AMERICAS	35	28,000
EMEA	46	37,000
APAC	22	24,000

Sales figures have been rounded for presentation purposes

HIGH VOLTAGE CONNECTIVITY AND CHARGING INLETS

TE partners with customers to meet the industry's most demanding high voltage connectivity requirements in all areas of the EV powertrain.



CLASS 4-5 HIGH POWER POWERTRAIN APPLICATIONS

HC STAK 25

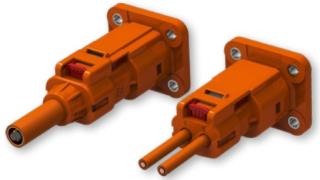
HC STAK 35

HVP800

HVU2100

CLASS 1-3 LOW-MID POWER AUXILIARY APPLICATIONS

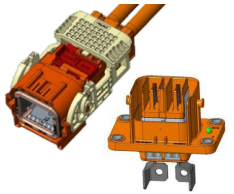
HVA280



HVA280 MULTI-BAY

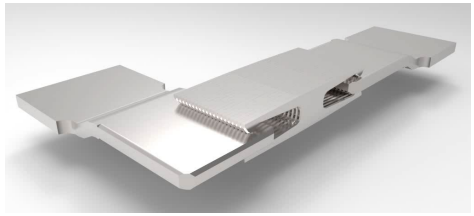
HVA630

HVA1200



SPECIAL APPLICATIONS

MOTOR TO INVERTER DIRECT MATE



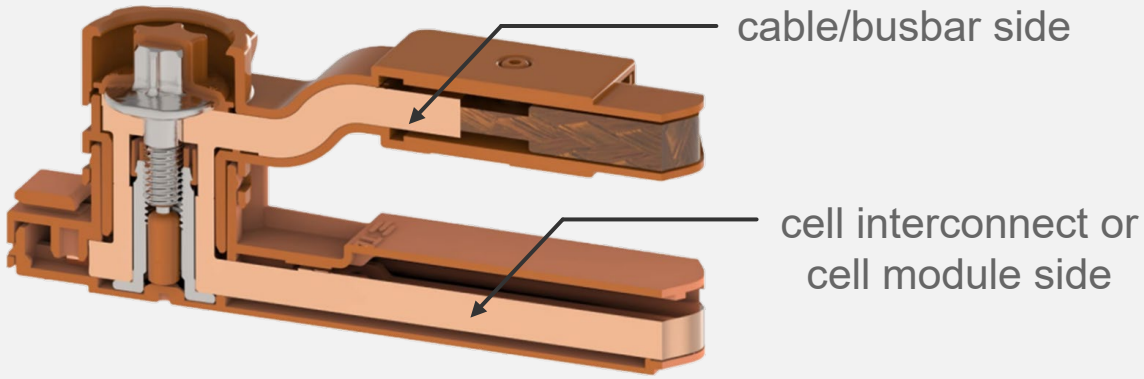
CELL MODULE

BCON+

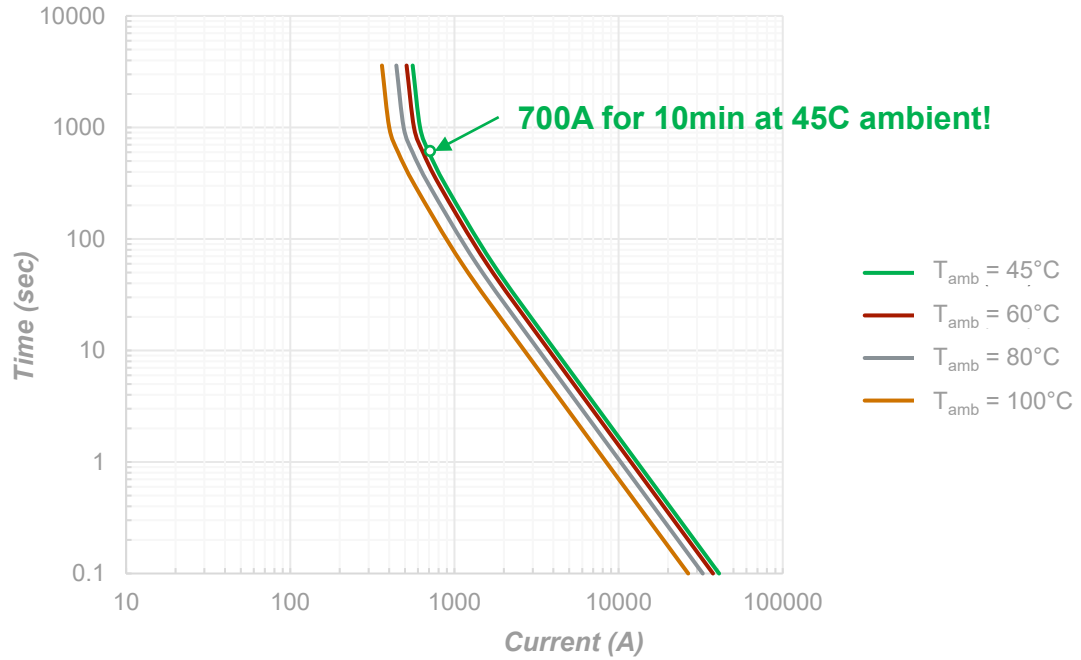
CHARGING INLETS

BCON+ *Fingerproof Bolted Connections* For Battery Cell Modules and BDUs

- **Fully fingerproof protection** to IPXXB standards in mated and un-mated state
- **High power connection with <10µΩ,** enabling 400A+ continuous operation
- **Integration possible with all types of cables/busbar** and a wide range of cross-sectional areas
- **Stability over life** – electromechanical performance up to -40°C – 140°C and vibration level 3
- **Building blocks for busbar and device side connections** supplied as kits or up-integrated into battery cell interconnect boards.



Transient Current Carrying Capacity 2x50mm² cable



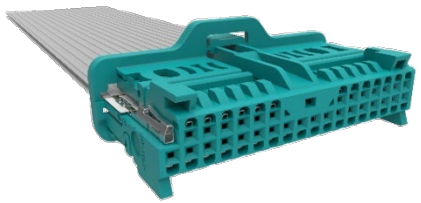
LOW VOLTAGE TERMINALS AND CONNECTORS

THE MINIATURIZATION TREND

TE's portfolio of terminals and connectors are **pushing the limits of miniaturization**, allowing customers to **reliably maximize volumetric efficiency** across a variety of signal applications.

FFC/FPC Applications

NanoMQS for Flexible Flat/Printed Circuit



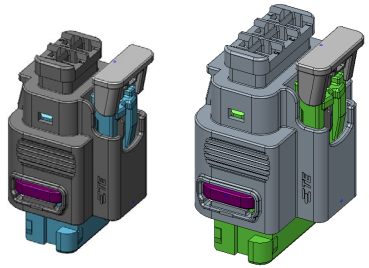
THT and SMD Headers

Pressfit Pins for PCBs

New AMPfit50

Sealed Connectors

MCON 0.5



MQS, V = 6.3cm³

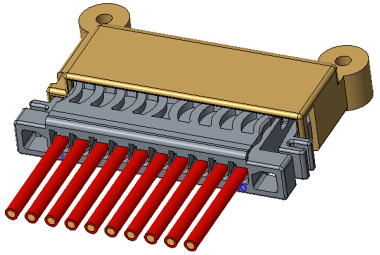
Robust 0.63x0.63mm pin. Validated to USCAR/GMW3191. Offers highest PCB retention forces.

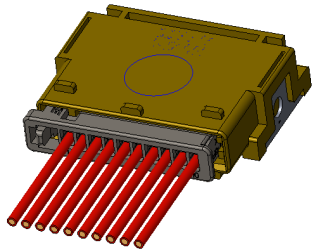
NanoMQS, V = 3.7cm³

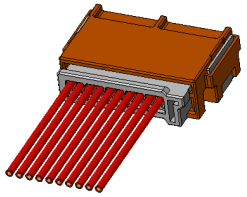
Miniaturized product portfolio for the main harness. Validated to LV214, with USCAR2 underway. Enables 50% reduction in PCB footprint.

PicoMQS, V = 1.4cm³

Lowest pin pitch of 1.27mm, validated to LV214. Translation of Automotive requirements into an ultra small connector for black box applications.







Mated Volume

100%

59%

22%

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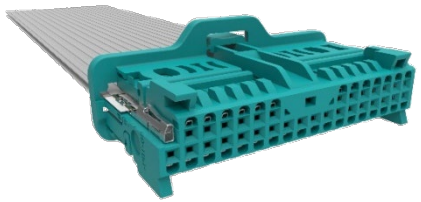


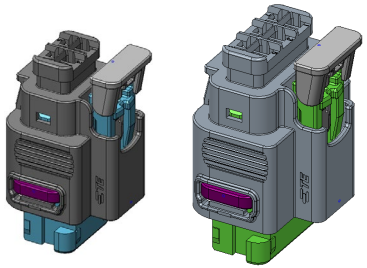
FFCs and FPCs have an important role in the modern electrical vehicle, enabling **critical signal transfer** within the battery module and pack for cell monitoring applications. **TE has been enabling flat flexible circuitry for 25+ years.**

Pressfit Pins for PCBs

New AMPfit50

Sealed Connectors

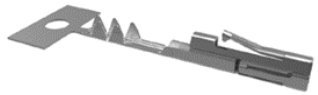
MCON 0.5



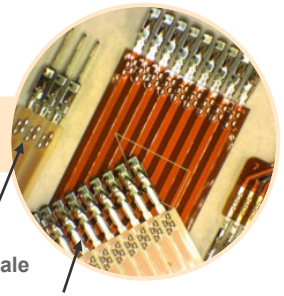
Today's State Of The Art

piercing-style crimp + NanoMQS housing

FFC/FPC Piercing Crimp Terminal



Crimping Machine



MQS Male

MQS Female

TE Multiple Crimp

FPC loaded into housing

TE Connectivity continues to innovate to enable the next generation of FFC/FPC battery applications.

ERNI IS NOW PART OF TE CONNECTIVITY

ERNI's portfolio of connectors serve key segments and sub-component implementations within the electrification value chain

Battery Management Systems

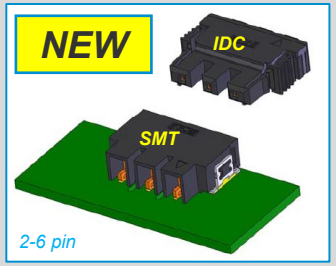
- Master and remote BMS boards
- Battery pack pre-charge
- HVAC units
- others

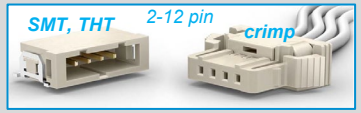
Power Electronics

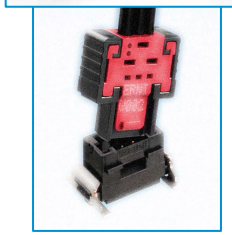
- On-board chargers
- AC/DC, DC/DC converters and inverters
- Power distribution units
- HV interlock loop

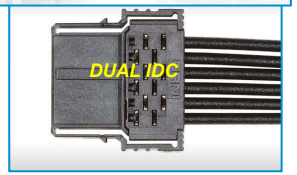
Wire-to-Board | Board-to-Board | Wire-to-Wire | FPC-to-Board

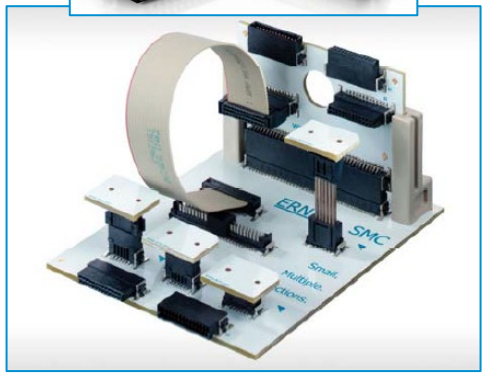
PITCH → 6.2mm+	2.54mm	2.00mm	1.27mm
Voltron (1000V Capable)	**MaxiBridge**	**iBridge Ultra**	**MiniBridge**
MicroBridge	**SMC** Small Multipurpose Connector		











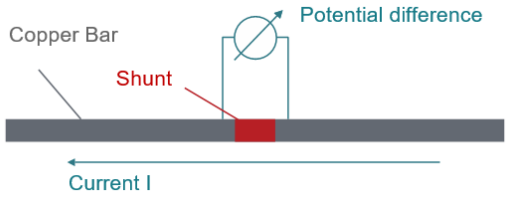
CURRENT SENSORS FOR THE EV POWERTRAIN

Providing **accurate** and **precise** sensing of pack current enables the battery management system to do its job – monitor pack performance and ensure operational safety.

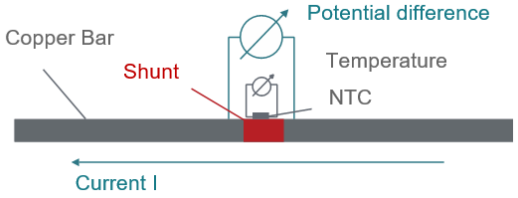
Passive Shunt Current Sensor

- Technology: Shunt Resistor with Optional NTC
- Analog Output
- -40 to 140°C Operating Temperature
- Low-cost PCB-less Design
- Redundant Versions Available
- Best in Class Low Temperature Coefficient Shunt Resistor

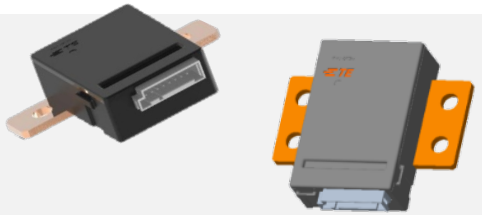
Standard Passive Sensor



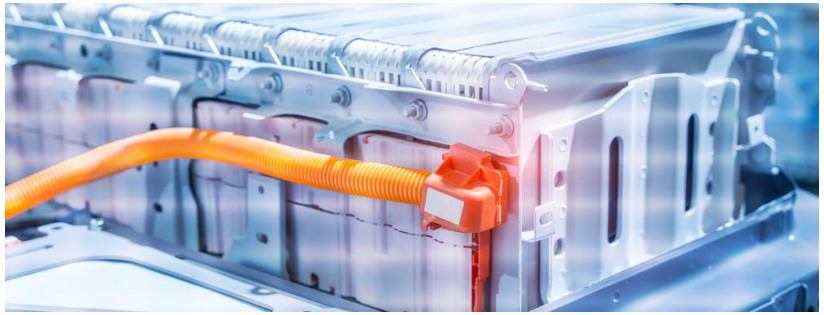
Passive Sensor with NTC



Active Shunt Current Sensor



- Technology: Shunt Resistor With Galvanic Isolation, Signal Conditioning / Calibration, Digital CAN Interface
- -40 to 105°C Operating Temperature
- Integrated Temperature Sensor Range: -45 to 125°C
- Overall Accuracy: 0.5%
- Peak Current Measurement Range Up To ±4000A
- Up to ASIL C Functional Safety



HV CONTACTORS FOR BATTERY MANAGEMENT

Contactors and relays are critical components that **safely** and **reliably** switch high voltage loads in coordination with other parts of the battery protection strategy. TE is developing contactors to meet the battery industry's need for **high performance** and high reliability and will partner with our customers to meet their unique requirements.

What will the next generation of contactors look like?

Contactors with **ultra-low resistance of ≤100µΩ**

Contactors with **integral diagnostics and status monitoring**

Contactors with **high short circuit withstand of 15kA+**

Contactors **rated for 1000V**

Contactors packaged for **streamlined system integration**

Automotive Applications	**PHEV/HEV Main Circuits AC Charging and Auxiliary Devices**		**BEV Main Circuits DC Fast Charing Circuits**			
Typical Application Current	**~80 → 150A**		**~150A → 500A+**			
Product Name	**EVC80** ■	**EVC135** ■	**EVC175** ■	**EVC250** ■	**EVC500** ■	**EVC500HP** ■

■ Pressurized ■ Non-pressurized

Evan J. Dawley
Battery Systems | Principal Field Application Engineer
Automotive & Transportation Solutions

MOBILE +1 (248) 408-6613 EMAIL evan.dawley@te.com

te.com

WHEN TECHNOLOGY CONNECTS, SO DOES HUMANITY.

EVERY CONNECTION COUNTS

TE connectivity