

Amphenol

INTERCONNECT AND VALUE ADDED SOLUTIONS BY DESIGN

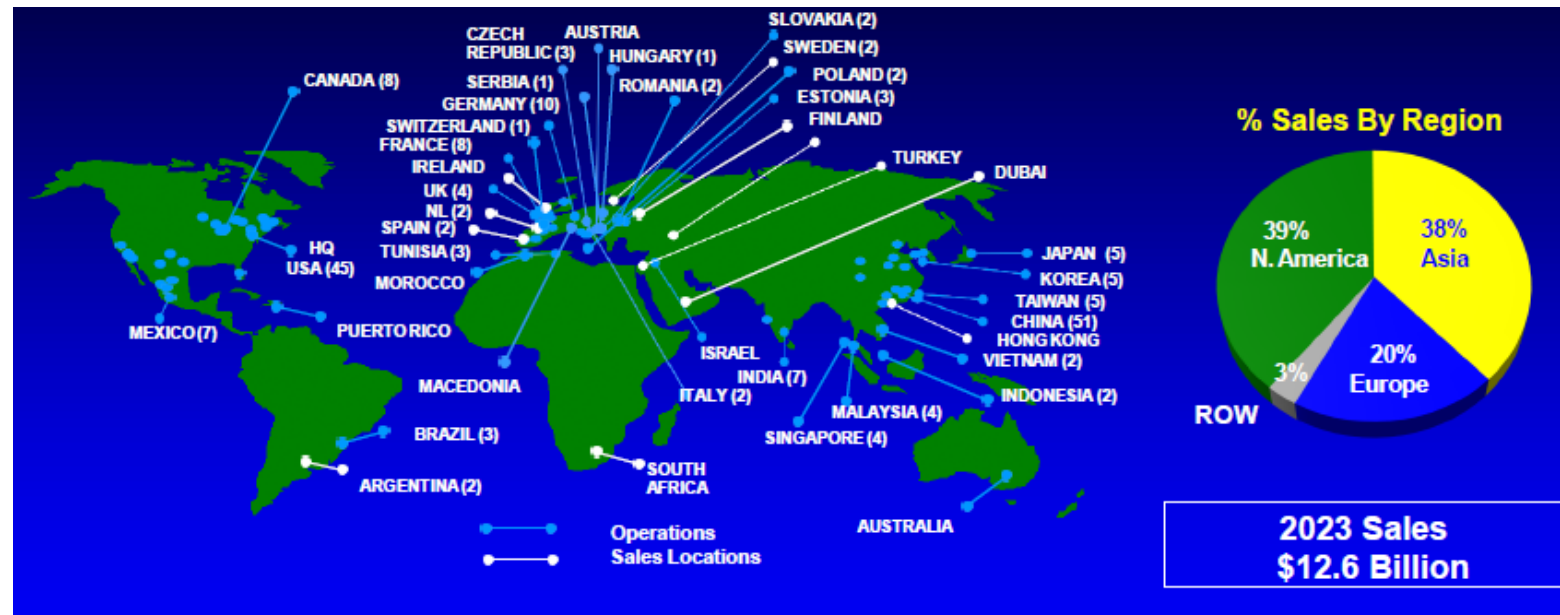
Electrification and Amphenol

Interconnect Products & Sensing Technology

www.amphenol.com

Introducing Amphenol

- Listed on **NYSE** since 1991
- **Second largest** interconnect manufacturer in the world
- Specialize in **high technology interconnect solutions**
- Complimentary acquisitions based on an **entrepreneurial** organization with strong leaders
- Over **95,000 employees** worldwide
- 2023 Sales: **\$12.6+ bn**



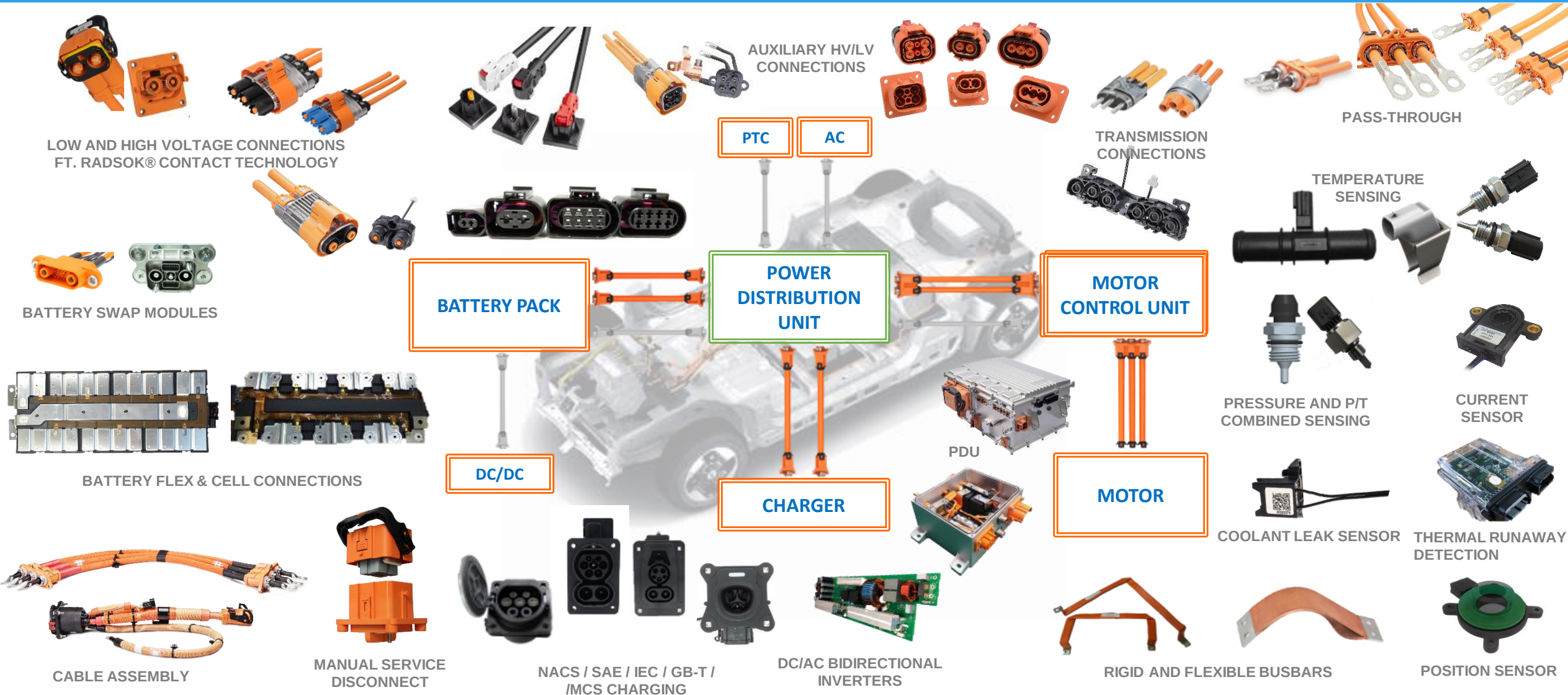
Global Leaders in Interconnect & Sensing Technology in Various Markets

Industry-Leading Diversification

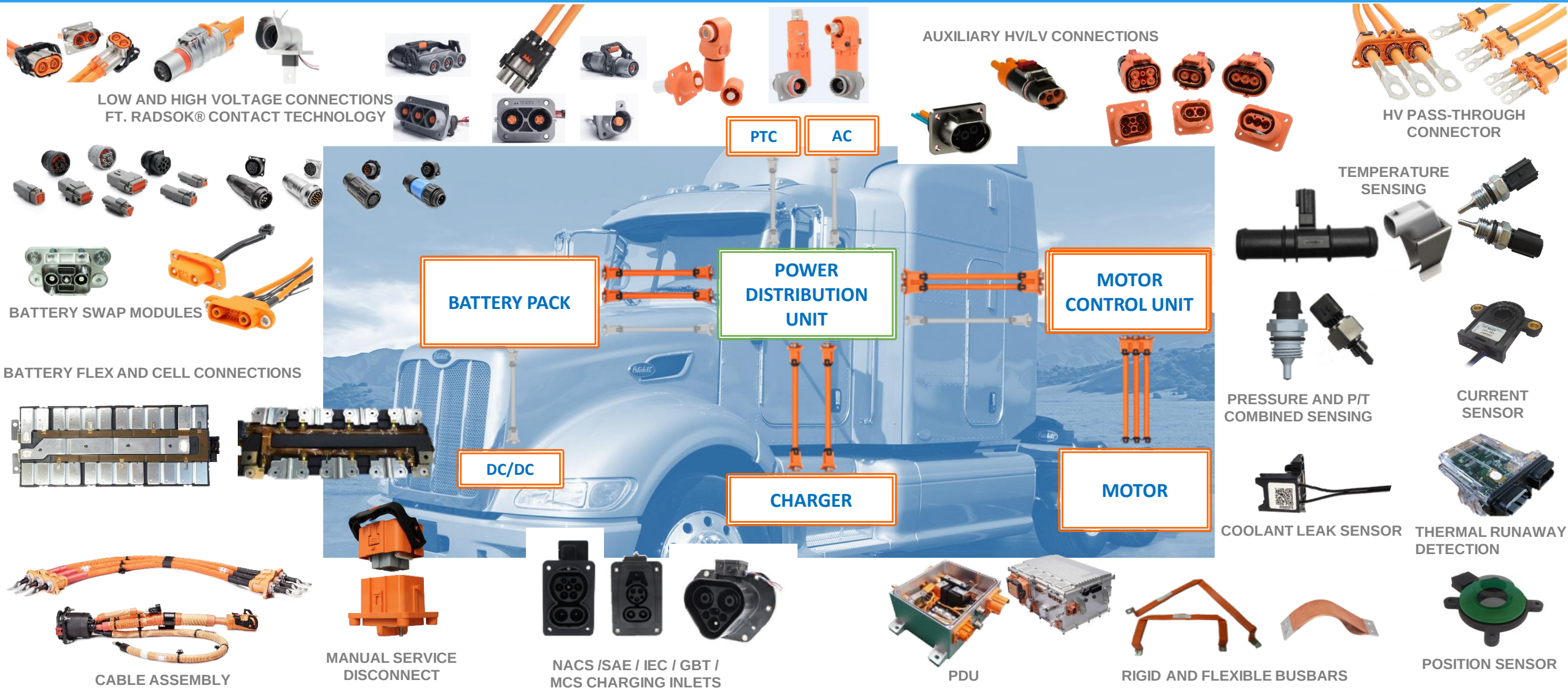


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A Full Solution for Electrification - Automotive

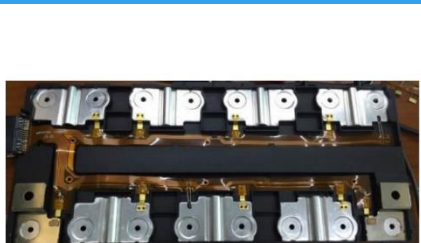


A Full Solution for Electrification – Heavy Transportation



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E-Mobility - Battery Focus



CELL CONNECTION SYSTEMS, POPULATED FLEX CIRCUITS



FPC



Wire-to-Board

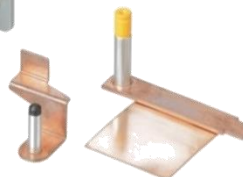


FFC

LOW PROFILE FPC CONNECTOR



BUSBARS



THERMAL MANAGEMENT
COMP. AND ASSEMBLIES



BATTERY MODULE CONNECTION



LOW VOLTAGE
SIGNAL CONNECTOR



BATTERY SWAP MODULE



INNER LV/HV QUICK
CONNECTION



HIGH VOLTAGE DC CONNECTION



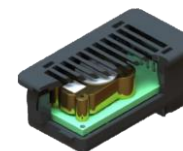
MANUAL SERVICE
DISCONNECT



CABLE ASSEMBLIES



CURRENT SENSING



THERMAL RUNAWAY
DETECTION

A Full Solution for Off-Road Vehicles – Heavy Equipment

USB



ECOMATE



AT SERIES



J1939 ATC/AHD



USCM



HC32



ISOBUS



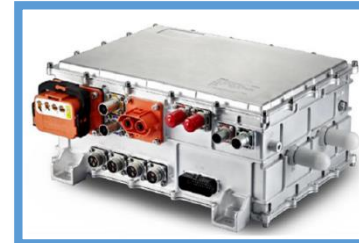
SURLOK+



TRULOC



PDU



ACTIVE PIN LOCK



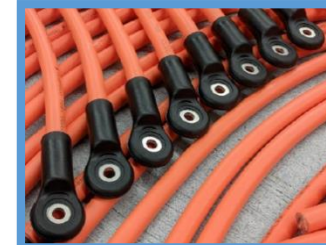
DURAMATE



ACTIVE PINLOK



CABLE ASSY



MIL DERIVATES



RADLOK



USCL



DURALOK



A Full Solution for Off-Road Vehicles – Cockpit Focus



MIL 5015/26482



A-Series



USB



ECOMATE



RF-SMA



X-LOCK

X-LOCK

EV Charging Focus

EV Charging Plug and Inlets



GB/T

- AC up to 80A
- DC +500A
- Combo Inlet Optional

CCS1 SAE DCFC

- AC up to 80A UL
- DC up to 350A UL
- HPC DC up to +500A UL
- Inlet up to 150mm² (500A)

CCS2 IEC DCFC

- AC up to 63A (1 or 3 Phases)
- DC up to 400A IEC
- HPC DC +500A IEC
- Inlet up to 150mm² (500A)



NACS



MCS

- Level 1: +350A
- Level 2: +1000A
- Level 3: 3000A
- 1250V

AC SAE J1772

- AC up to 80A UL
- DC up to 350A UL
- HPC DC up to +500A UL
- Inlet up to 150mm² (500A)

AC IEC

- AC up to 63A (1 or 3 Phases)
- DC up to 400A IEC
- HPC DC +500A IEC
- Inlet up to 150mm² (500A)



MCS

RADSOK POWER



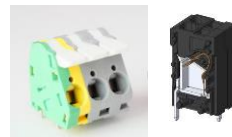
INSTRUMENTATION CONNECTORS



MODULES



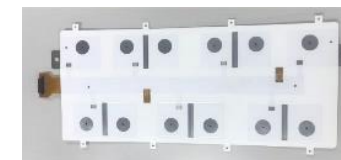
Blind Mate Connectors



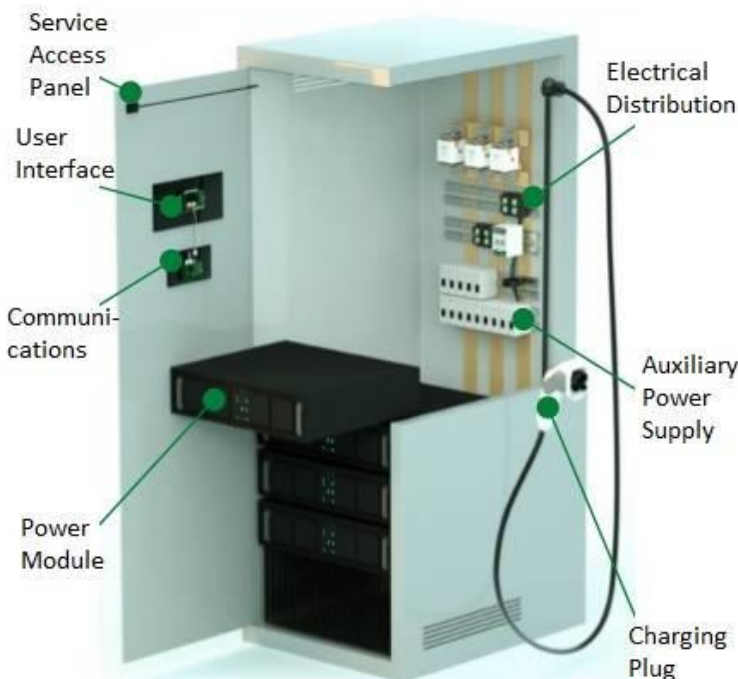
Terminal Blocks



RIGID AND FLEXIBLE BUSBARS



LAMINATED BUSBARS

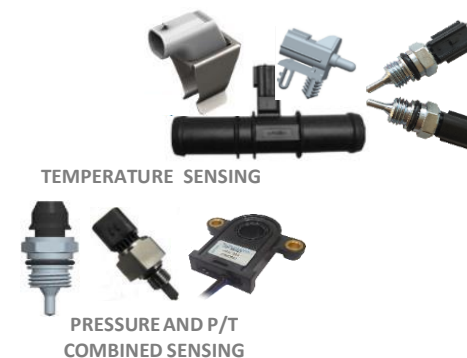


DC Charging Station



CURRENT SENSOR

IR SENSOR



TEMPERATURE SENSING

PRESSURE AND P/T COMBINED SENSING



COOLANT LEAK SENSOR

A Full Solution for Micro-Grid Connectivity

Solar Energy Solutions



Terminal Blocks



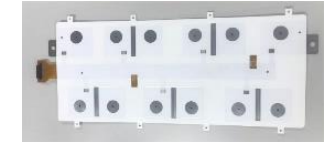
MANUAL SERVICE
DISCONNECT



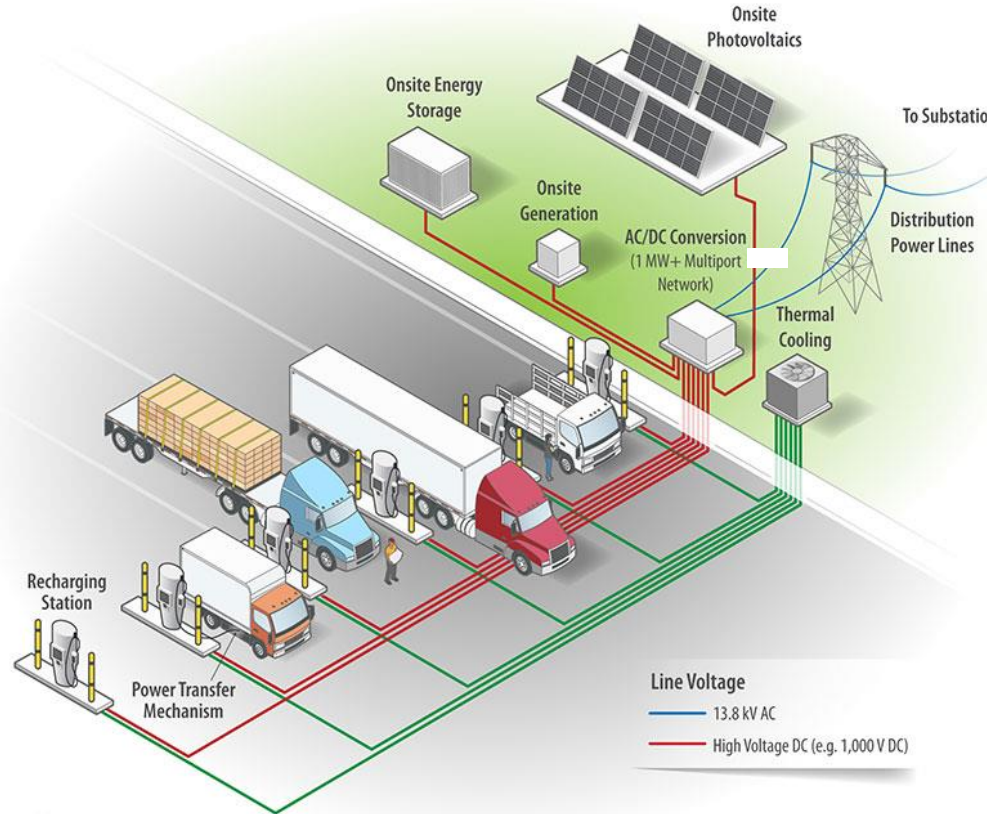
RIGID AND FLEXIBLE BUSBARS



Onsite
Photovoltaics



LAMINATED BUSBARS



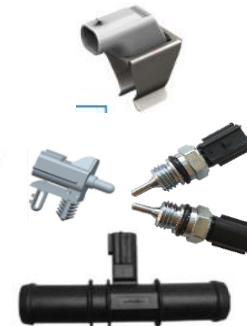
RADSOK POWER



INSTRUMENTATION CONNECTORS



.IoT MODULES



TEMPERATURE SENSING

Energy Storage Solutions



THERMAL RUNAWAY SENSORS



PASS-THROUGH



CURRENT SENSOR



IR SENSOR

Amphenol

INTERCONNECT AND VALUE ADDED SOLUTIONS BY DESIGN



Products: Connectors

HV, LV

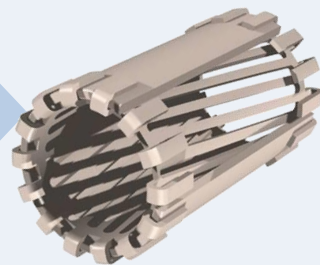
www.amphenol.com

At the Core of Power Connection: Radsok®

Flat Stamped Grid



Twisted Grid



Socket Contacts



Key Benefits:

- Higher Amperage with Smaller Envelopes
- High Durability
- High Current Ratings
- Low Mating Force



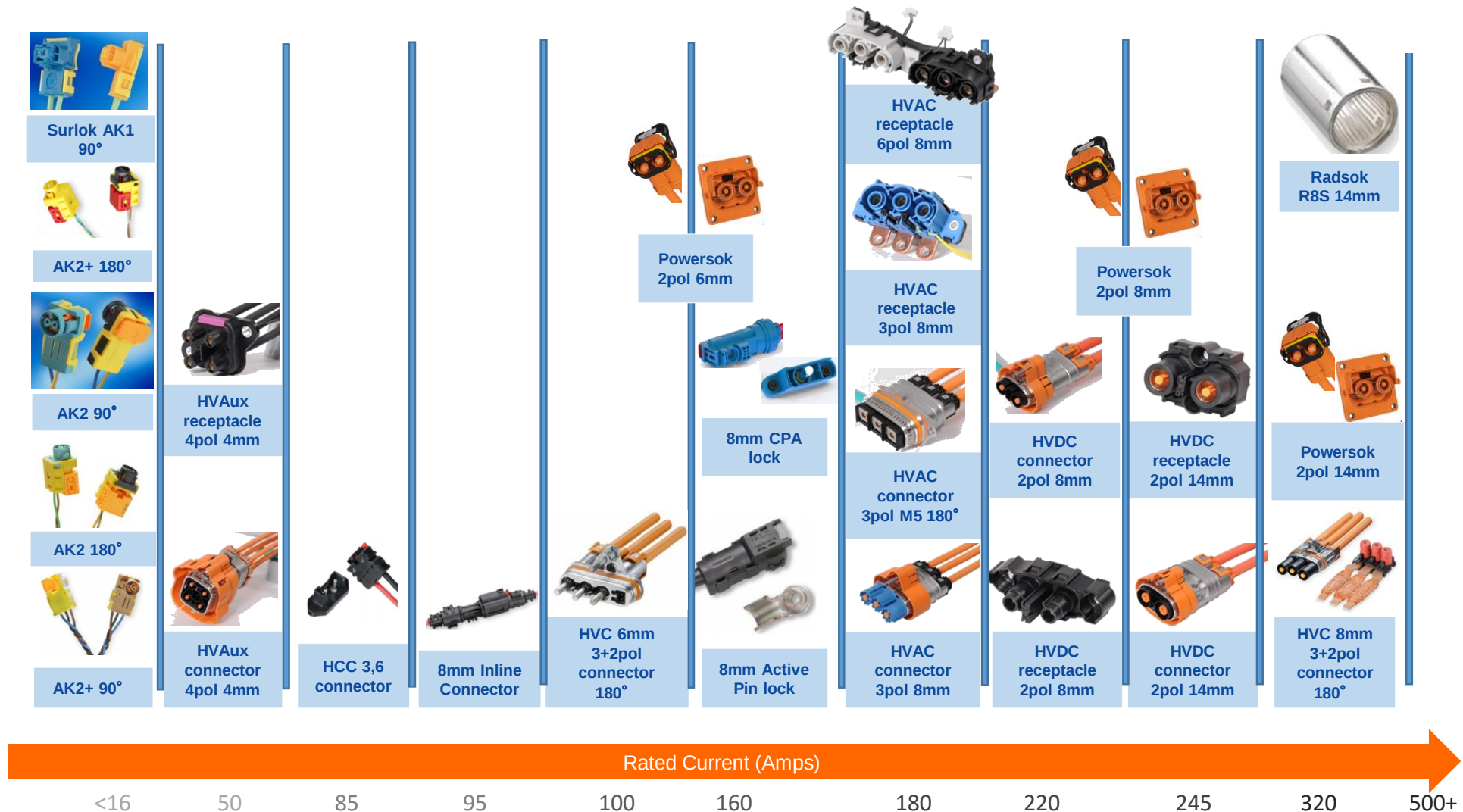
Next Gen (R8S)



- ✓ Smaller and Lighter
- ✓ Higher Current Capacity
- ✓ Reduced Cost
- ✓ Produced from 2 Parts Only
- ✓ Stamped and Formed
- ✓ RoHS Compliant- No CuBe

Pin Diameter	Current Rating at 25C	Current Rating at 85C
2.4 mm	60A	35A
3.0 mm	100A	60A
3.6 mm	120A	80A
5.7 mm	160A	120A
6.0 mm	160A	120A
8.0 mm	300A	200A
9.1 mm	350A	250A
10.0 mm	450A	300A
10.3 mm	500A	350A
11.1 mm	750A	500A
12.0 mm	750A	500A
14.0 mm	900A	600A
18.0 mm	1100A	750A
23.0 mm	1600A	1200A

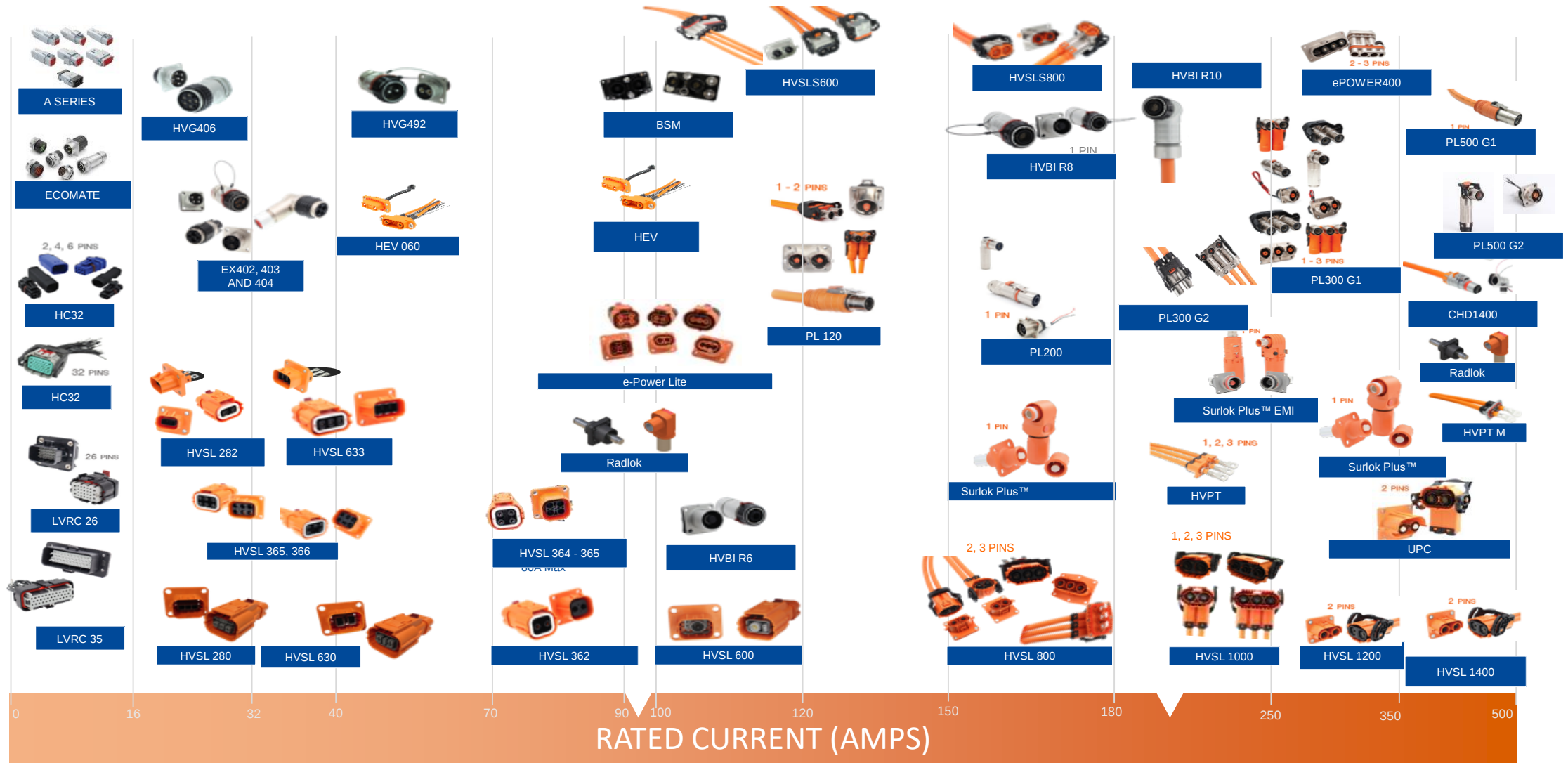
Amphenol Automotive Connectors by Current - ATE



Amphenol Automotive Connectors by Current - AACCS



Amphenol Industrial Connectors by Current



High Voltage Connections | Meets SAE-USCAR-2/37 and LV215 compliant



HV CONNECTION – ENERGY STORAGE



HV METAL RUGGEDIZED CONNECTIVITY



BATTERY MODULE BUSBAR CONNECTION



HV AUX CONNECTION

- Options up to 700A @ 85°C
- Options up to 300mm² cable size
- Options up to 1.500V DC
- IP67 / IP69K
- EMI Shielding
- Low/High Voltage Interlock
- Plastic or Metal Housing
- High Mating Cycles



HV PASS THROUGH CONNECTION

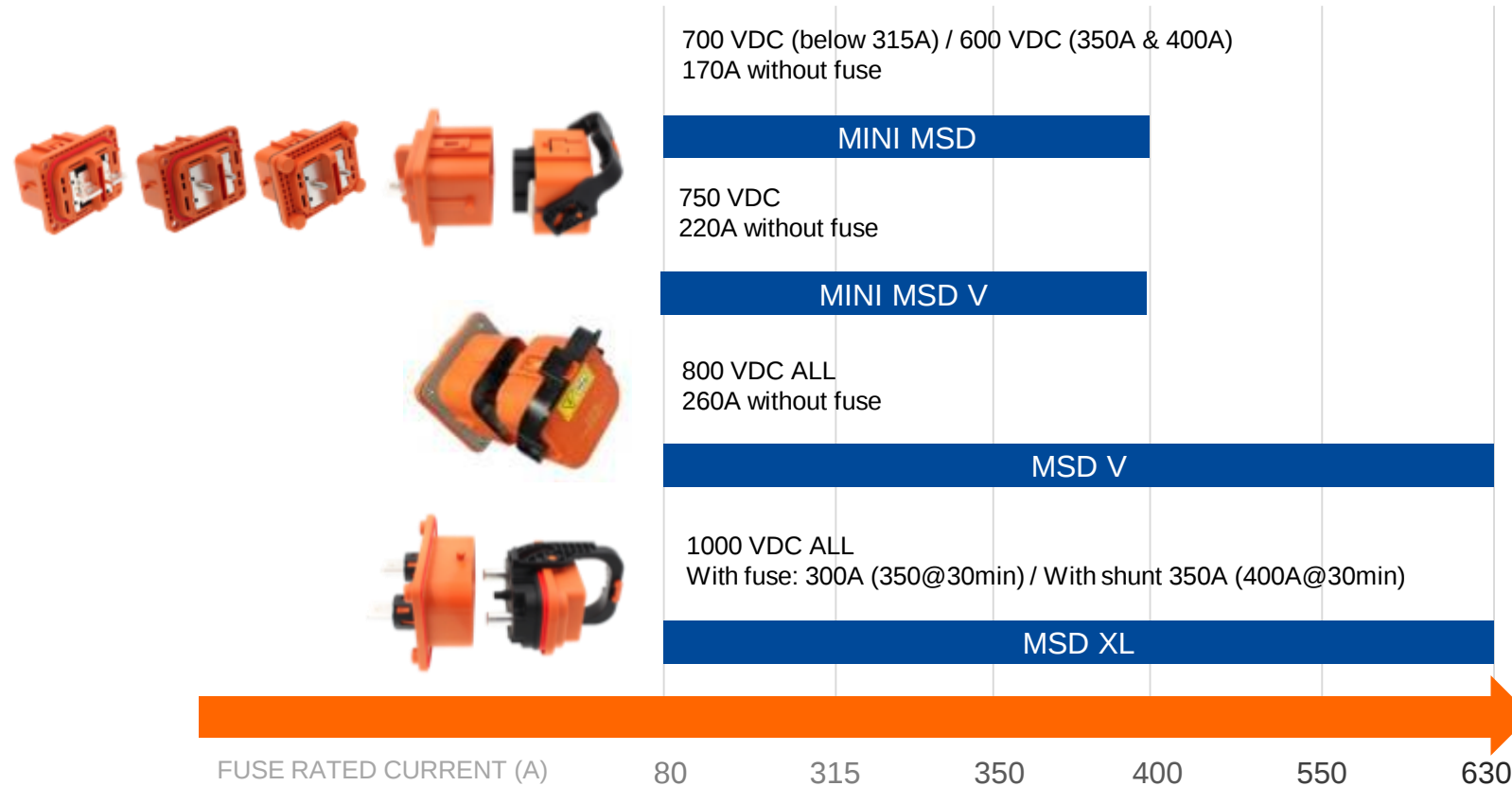


HV AUTOMOTIVE CONNECTION



HV AUTOMOTIVE SCREW CONNECTION

Manual Service Disconnect (MSD)



EV Charging : Plugs & Inlets

Amphenol
INDUSTRIAL PRODUCTS GROUP

EV Charging

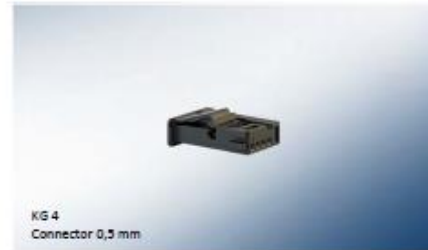


NACS / TESLA		MCS		CCS1 UL		AC SAE J1772		CCS2 IEC		AC IEC		GB/T	
	AC NACS 40A, 50A, 80A		MCS Passive 380A+		CCS1 Plug HPC LCC 500A (*600A)		AC SAE Plug 16A to 80A		CCS2 Plug HPC LCC 500A (*600A)		IEC Plug 20A, 32A		GB/T HPC LCC 600A
	DC NACS 200A, 250A, 375A, 400A		MCS Liquid Cooled 1500A		CCS1 Copper 125A, 150A, 200A, 250A, 300A, 350A 380A, 400A		AC SAE – CAC 32A		CCS2 Copper 150A, 200A, 250A, 400A		IEC Jumper 20A, 32A		GB/T DC 80A to 250A
	DC NACS Liquid Cooled 600A		MCS Inlet Passive Up to 3000A		CCS1 Ultra Thin 40A, 65A, 80A		AC SAE Portable Mode 1 16A to 32A		CCS2 Ultra Thin 40A, 65A, 80A		IEC Shutter		GB/T Combo Inlet
	NACS Inlet 200A to 600A				CCS1 Inlet 65A – 500A		AC SAE Inlet 16A to 80A		CCS2 Inlet 65A – 500A		IEC AC Portable Mode 1 16A/20A, 32A		GB/T Inlet AC or DC

Power & Signal Transmission

Contact Housings:

- 0.5-9.5mm contact systems
- Sealed or unsealed
- Male or female
- Hybrid options



Aggregate Interfaces:

- HV/LV, combined HV/LV solutions
- Sealed or unsealed
- Shielded optional, electrical interlock possible
- Direct connection of interface to PCB via stamped parts or wire-bonded



Safety Restraint Systems: Airbag Connectors

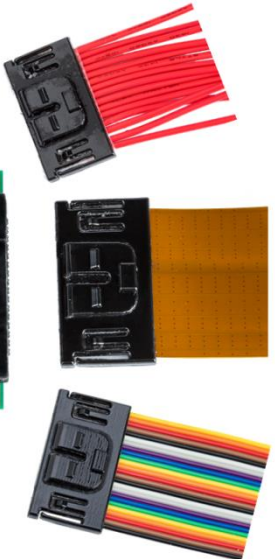
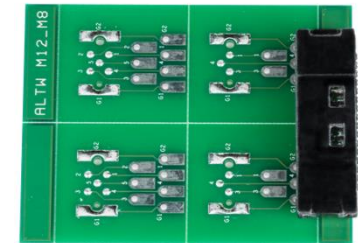


- AK1, AK2 (Europe) and ABX-5 (China) versions for
- 90 and 180 degrees
- Sealed version in development
- Retainers available, wire harnesses completely assembled

Power & Signal Transmission



Multi-Pin and Lay-Out Configurations
Higher Amperage Capacity
Up to IP67 / IP69K rating
EMI Shielding available
Plastic or Metal Housing
Board-to-Board, Wire-to-Flex, Wire-to-Board



Amphenol

INTERCONNECT AND VALUE ADDED SOLUTIONS BY DESIGN

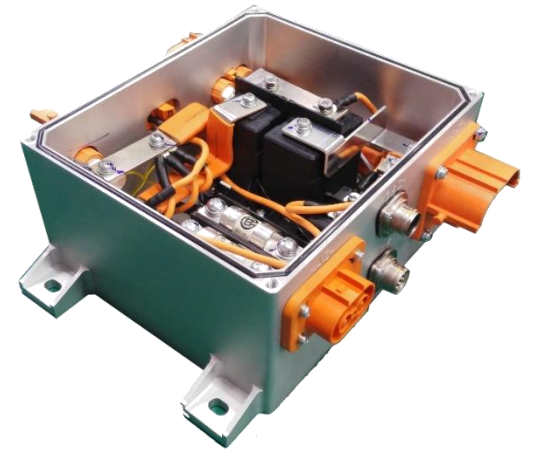


Products: Value Add Assembly

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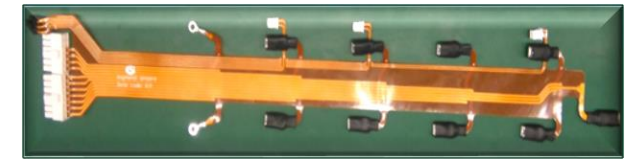
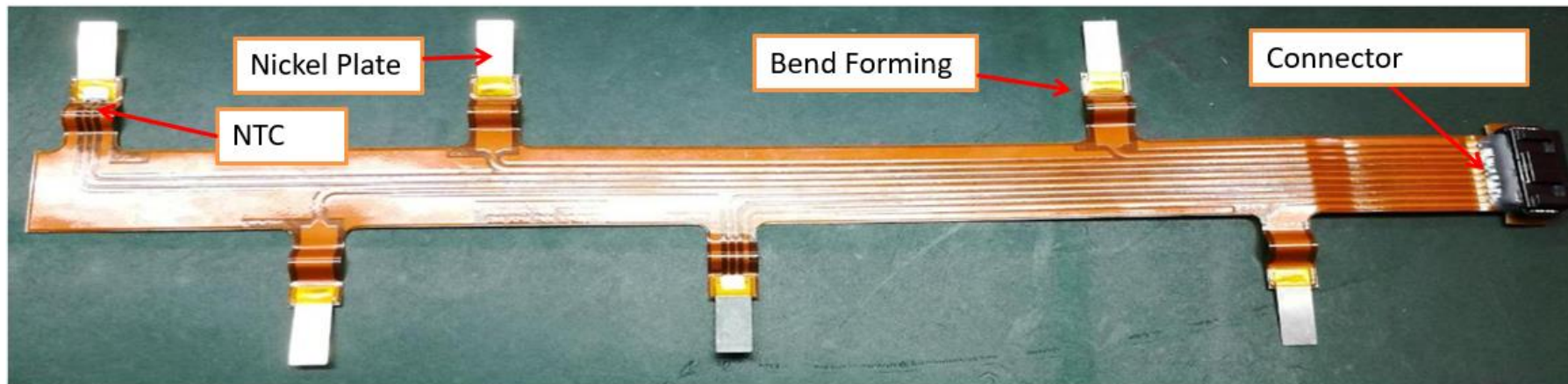
Power Distribution Unit (PDU)

- Power Distribution Unit
- Battery Disconnect Unit
- Battery Junction Box
- Built to print & Custom Design



FPC used for Battery Flex Technology

Amphenol
Sincere



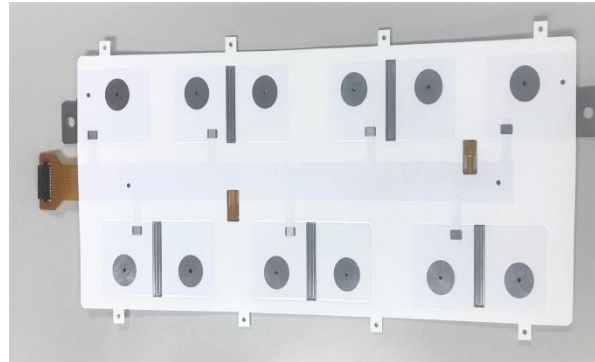
- Single Layer, Multilayer, Rigid Flex, Circuits, upto 3 meters in length possible
- Harsh Enviroment: Reliable in high vibration, great chemical resistance
- Excellent Signal Integrity and insulation: EMI Shielding, Impedance Controlled, Twisted Pair
- Static or Dynamic Flexure: Over 200K Bending Cycles with Standard Materials
- Multiple Surface Treatments
- Provide Design Flexibility, Reduce Weight, Lower Assy Cost & Labor Time, Pack Size Reduction

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Cell Connection Systems: Temperature and Voltage Measuring & Monitoring



Injection Mould Carrier, BusBar and FPC type



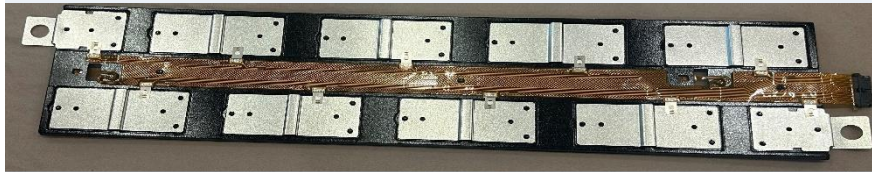
Laminated Busbar Type



Injection Mould Carrier, BusBar and Wire Harness type



Laminated Busbar 1.2m



Vacuum forming / Blister pack, Carrier, Busbar and FPC



*Thick Copper Laminated
Busbar CCS*

- All Battery Cell technology capable: Pouch, Cylinder, Prismatic
- Wired, Flex and Laminated options upto 1.9m in length currently
- Sensors with EMC protection
- Stamping studies to optimize laser welding
- FPC & BusBar Plating when required
- Heat-stake and adhesive-mounted flex circuits
- Full Engineering support
- Modeling & design optimization
- Rapid proto, testing and validation
- Expertise in FPC, SMT, HV
- Printed fusible links, EMC protection, stress/swell analysis, DFMEA / PFMEA

Busbars



Custom busbar design: experts in modeling and simulating current flow, thermal response and induction mitigation

Applications:

- Inner Battery Connections
- Pack To Pack

Experience: copper and aluminum, all sizes

Supported in 3 major regions: NA, Europe, Asia

Wire Harnesses and Cable Assemblies: supported on all continents



Amphenol

INTERCONNECT AND VALUE ADDED SOLUTIONS BY DESIGN



Products: Sensors

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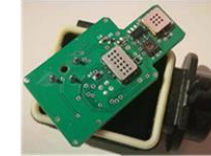
Delivering Value-Add Sensors



NEW xEV Sensor Applications | Safety, Diagnostics, Robustness

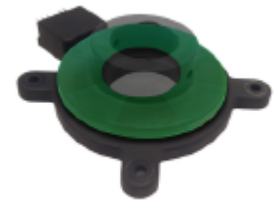
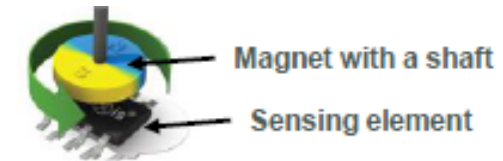
REDTR: Thermal Runaway Detection

- Mounted on Battery Management System
- Combined sensor technology: robust, durable, fast response to thermal runaway precursors\H2 and CO2 sensors
- Definitive Detection of single cell breach
- Layered detection to eliminate type 1 & 2 faults



Position Sensors & Controls

- Contactless Sensors: Hall Effect on Shaft Concentric
- Contactless Sensors: Hall Effect on Shaft Through Hole
- Contactless Sensors: Inductive Through Shaft High Speed



Current Sensors

- Open loop current transducer based on Hall Effect
- Measured current values from 200A to 1.500A
- Applied to battery management, motor control, power-electronics



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Transportation & Electro-Mobility

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