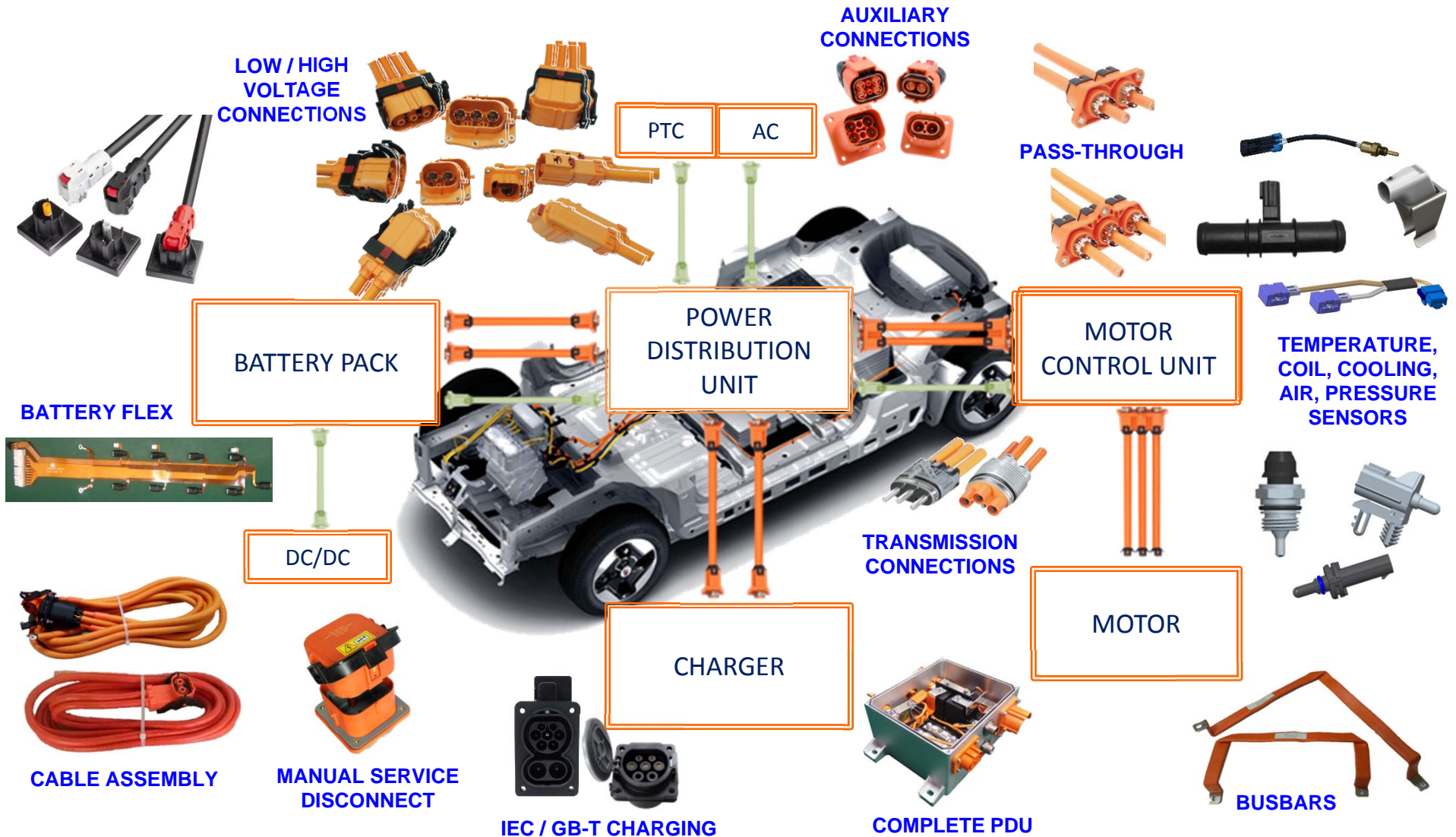




## E-MOBILITY - PRODUCTS TECHNOLOGY & CAPABILITIES

AMPHENOL AUTOMOTIVE, INDUSTRIAL AND SENSORS

## AMPHENOL OFFER A "FULL OPTIONAL SOLUTION"



## BATTERY CONNECTIONS FOCUS



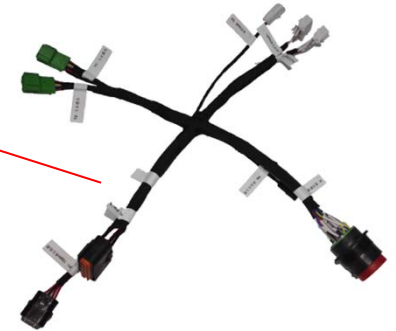
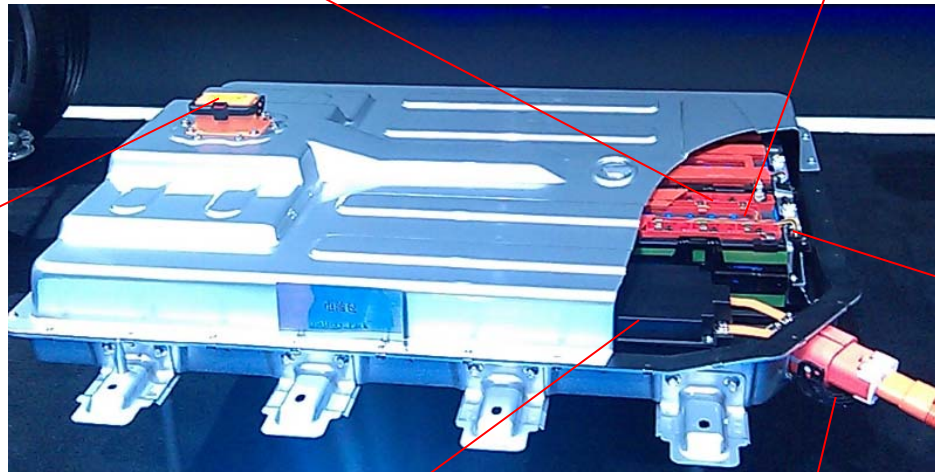
FLEX CIRCUITS



BUSBARS



MSD



CABLE ASSEMBLIES



INNER QUICK CONNECTIONS



HIGH VOLTAGE CONNECTIONS



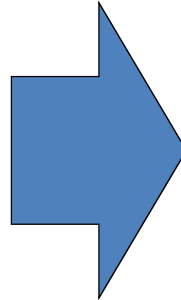
## E-MOBILITY – AMPHENOL SENSORS TECHNOLOGY



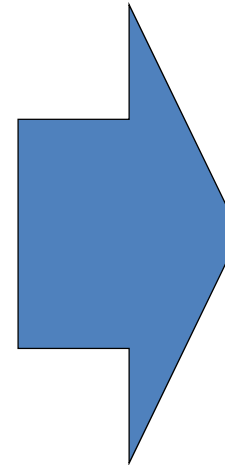
## SENSORS...FROM RAW MATERIALS TO FINISHED PRODUCTS



**Tier 3**  
Elements



**Tier 2**  
Calibrated  
Assemblies  
and Custom  
Components



**Tier 1**  
Complete  
Sensor  
Assemblies

## NOISE IMMUNE THERMISTOR & COATINGS

### EPOXY COATED RADIAL NTC THERMISTOR WITH INTEGRATED EMI PROTECTION



- Component Level EMI Protection
- Drop-In Sensor Upgrade for Existing Design
- No Re-Tooling/ Eliminate Weight&Cost Shielded cables
- Fast Time Response



#### Epoxy

155°C continuous operation  
Coating length to 15mm  
>5000 cycles thermal shock  
Hardness Shore D 60



#### HTF1 silicone

170°C continuous operation  
Coating length to 32mm  
1000 cycles thermal shock  
Flexible  
20kV/mm insulation  
Fast time response



#### CR1

190°C continuous operation  
Coating length to 32mm  
>5000 cycles thermal shock  
Flexible  
50kV/mm insulation  
2000h water immersion  
Acid/ fuel/ moisture resistant



## HEV/EV SENSOR APPLICATIONS

### TEMPERATURE SENSORS Inverter, Battery Cell



### MOTOR COIL TEMPERATURE SENSORS



### COOLING SYSTEM SENSORS Temperature, Temp/Press Combined

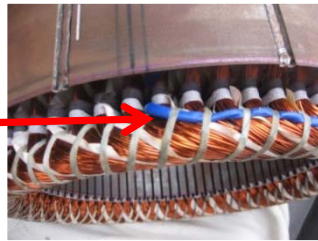


### CELL CONNECTION SYSTEM Temperature, Voltage



## HEV/EV SENSOR APPLICATIONS

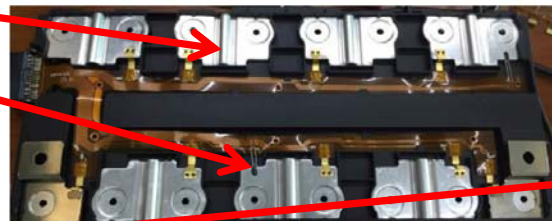
**ELECTRIC  
MOTOR WINDING  
TEMP**



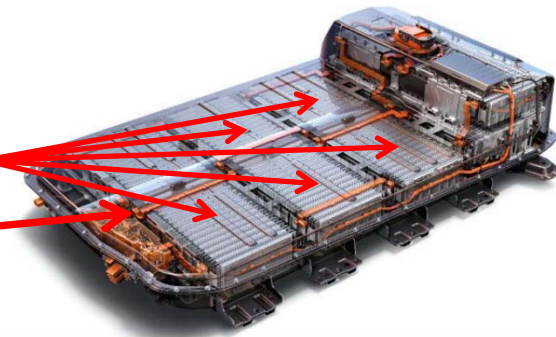
**POWER  
ELECTRONICS  
TEMP**



**BATTERY  
CELL/PACK  
TEMP AND VOLTAGE**



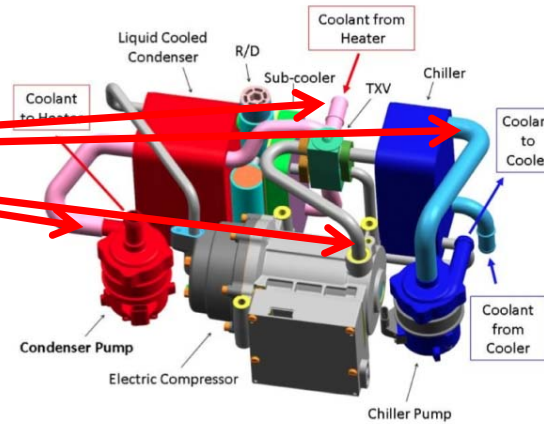
**BATTERY COOLANT  
TEMPERATURE**



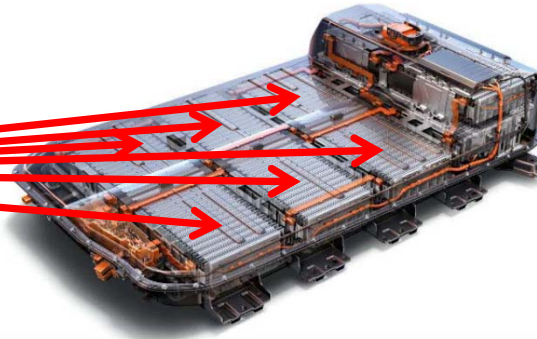


## HEV/EV SENSOR APPLICATIONS (NEXT GEN)

**HVAC/UNIFIED  
COOLANT SYSTEM  
TEMP+PRESS**



**BATTERY FAILURE  
DETECTION  
GAS+TEMP+PRESS  
SUITE**



**E-AXLE AND MOTOR  
RESOLVER ALTERNATIVE  
HIGH SPEED INDUCTION  
POSITION SENSING**



## Battery Temperature Sensors

### Battery Cell Temperature

|                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Description/Usage</b><br> <p>Temperature probe and shielded wire probe, connected to a connector. High accuracy, fast response, high reliability.</p>                                                                                 | <b>Specifications</b><br># 0001 11000 ohms @ 25°C<br># 0200 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds<br>Connector: M8H-301403000<br># 0200 11000 ohms @ 25°C<br># 0200 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds<br>Connector: M8H-301403000 |
| <b>Benefits</b> <ul style="list-style-type: none"> <li>High accuracy, fast response</li> <li>High reliability, long life span</li> <li>Connector: M8H-301403000</li> <li>High precision and accuracy up to 0.05°C</li> <li>High reliability and stability over battery lifetime</li> <li>Shield wire for high accuracy</li> </ul> | <b>Applications</b><br># 0200 11000 ohms @ 25°C<br># 0200 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds<br>Connector: M8H-301403000<br># 0200 11000 ohms @ 25°C<br># 0200 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds<br>Connector: M8H-301403000   |

### Steel Battery Coolant Temp Sensor

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Description/Usage</b><br>Description: Battery/In-line coolant Coolant Temperature<br>Model: Steel Protected<br>Manufacturer: Fako Rio<br>Min. customer: 100 Ea<br><b>Other features:</b><br>#412 thread<br>#2mm hole and 25405 or cut 0.630 - 0.640 diameter<br>Min. order: 100 ea (multiple lots allowed)<br><b>Main parameters:</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |                                                                                                                                                  |
| <b>Benefits</b> <ul style="list-style-type: none"> <li>High accuracy, fast response</li> <li>High reliability, long life span</li> <li>Connector: Posidant 1206 2112</li> <li>High precision and accuracy up to 0.05°C</li> <li>High reliability and stability over battery lifetime</li> <li>Shield wire for high accuracy</li> </ul>                                                                                                                                                                                                                           | <b>Applications</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |

### Battery Coolant Temperature

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Description/Usage</b><br>Description: Battery Coolant Temperature<br>Model: Steel Protected<br>Manufacturer: Fako Rio<br>Min. customer: 100 Ea<br><b>Other features:</b><br>#412 thread<br>#2mm hole and 25405 or cut 0.630 - 0.640 diameter<br>Min. order: 100 ea (multiple lots allowed)<br><b>Main parameters:</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |                                                                                                                                                  |
| <b>Benefits</b> <ul style="list-style-type: none"> <li>High accuracy, fast response</li> <li>High reliability, long life span</li> <li>Connector: Posidant 1206 2112</li> <li>High precision and accuracy up to 0.05°C</li> <li>High reliability and stability over battery lifetime</li> <li>Shield wire for high accuracy</li> </ul>                                                                                                                                                                                                           | <b>Applications</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |

### In-line Temperature Sensor

|                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Description/Usage</b><br> <p>Highly accurate, fast response, high reliability, long life span.</p>                                                                                                                                    | <b>Specifications</b><br># 0257 11000 ohms @ 25°C<br># 0257 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds |
| <b>Benefits</b> <ul style="list-style-type: none"> <li>High accuracy, fast response</li> <li>High reliability, long life span</li> <li>Connector: M8H-301403000</li> <li>High precision and accuracy up to 0.05°C</li> <li>High reliability and stability over battery lifetime</li> <li>Shield wire for high accuracy</li> </ul> | <b>Applications</b><br># 0257 11000 ohms @ 25°C<br># 0257 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds   |

### Battery Cell Temperature

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Description/Usage</b><br>Description: Battery Cell Temperature<br>Model: Steel Protected<br>Manufacturer: Fako Rio<br>Min. customer: 100 Ea<br><b>Other features:</b><br>#412 thread<br>#2mm hole and 25405 or cut 0.630 - 0.640 diameter<br>Min. order: 100 ea (multiple lots allowed)<br><b>Main parameters:</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |                                                                                                                                                   |
| <b>Benefits</b> <ul style="list-style-type: none"> <li>High accuracy, fast response</li> <li>High reliability, long life span</li> <li>Connector: Posidant 1206 2112</li> <li>High precision and accuracy up to 0.05°C</li> <li>High reliability and stability over battery lifetime</li> <li>Shield wire for high accuracy</li> </ul>                                                                                                                                                                                                        | <b>Applications</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |

### Motor Coil Temperature

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Description/Usage</b><br>Description: Motor Coil Temperature<br>Model: Steel Protected<br>Manufacturer: Fako Rio<br>Min. customer: 100 Ea<br><b>Other features:</b><br>#412 thread<br>#2mm hole and 25405 or cut 0.630 - 0.640 diameter<br>Min. order: 100 ea (multiple lots allowed)<br><b>Main parameters:</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |                                                                                                                                                  |
| <b>Benefits</b> <ul style="list-style-type: none"> <li>High accuracy, fast response</li> <li>High reliability, long life span</li> <li>Connector: Posidant 1206 2112</li> <li>High precision and accuracy up to 0.05°C</li> <li>High reliability and stability over battery lifetime</li> <li>Shield wire for high accuracy</li> </ul>                                                                                                                                                                                                      | <b>Applications</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |

### Transmission Fluid Temperature

|                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Description/Usage</b><br> <p>Highly accurate, fast response, high reliability, long life span.</p>                                                                                                                                  | <b>Specifications</b><br># 0219 11000 ohms @ 25°C<br># 0219 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: M8H-301403000 |
| <b>Benefits</b> <ul style="list-style-type: none"> <li>High accuracy, fast response</li> <li>High reliability, long life span</li> <li>Connector: M8H-301403000</li> <li>High precision and accuracy up to 0.05°C</li> <li>High reliability and stability over battery lifetime</li> <li>Shield wire for high accuracy</li> </ul> | <b>Applications</b><br># 0219 11000 ohms @ 25°C<br># 0219 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: M8H-301403000   |

### Battery Case Temperature

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Description/Usage</b><br>Description: Battery Case Temperature<br>Model: Steel Protected<br>Manufacturer: Fako Rio<br>Min. customer: 100 Ea<br><b>Other features:</b><br>#412 thread<br>#2mm hole and 25405 or cut 0.630 - 0.640 diameter<br>Min. order: 100 ea (multiple lots allowed)<br><b>Main parameters:</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |                                                                                                                                                 |
| <b>Benefits</b> <ul style="list-style-type: none"> <li>High accuracy, fast response</li> <li>High reliability, long life span</li> <li>Connector: Posidant 1206 2112</li> <li>High precision and accuracy up to 0.05°C</li> <li>High reliability and stability over battery lifetime</li> <li>Shield wire for high accuracy</li> </ul>                                                                                                                                                                                                        | <b>Applications</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |

### Battery Pack Temperature

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Description/Usage</b><br>Description: Battery Pack Temperature<br>Model: Steel Protected<br>Manufacturer: Fako Rio<br>Min. customer: 100 Ea<br><b>Other features:</b><br>#412 thread<br>#2mm hole and 25405 or cut 0.630 - 0.640 diameter<br>Min. order: 100 ea (multiple lots allowed)<br><b>Main parameters:</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |                                                                                                                                                |
| <b>Benefits</b> <ul style="list-style-type: none"> <li>High accuracy, fast response</li> <li>High reliability, long life span</li> <li>Connector: Posidant 1206 2112</li> <li>High precision and accuracy up to 0.05°C</li> <li>High reliability and stability over battery lifetime</li> <li>Shield wire for high accuracy</li> </ul>                                                                                                                                                                                                        | <b>Applications</b><br># 0211 11000 ohms @ 25°C<br># 0211 10000 ohms @ 25°C<br>Temp. range: -40°C to 150°C<br>Response time: 1-50 seconds liquid to liquid<br>Connector: Posidant 1206 2112<br>Noting Connector: Posidant 1206 2112 |

## CELL CONNECTION SYSTEMS

### Measuring and Monitoring critical temperature



Busbar integration of sensors



- Wired and Flex low voltage harnesses
- Sensors with EMC protection
- Stamping studies to optimize laser welding features
- Plating when required
- Heat-stake and adhesive-mounted flex circuits

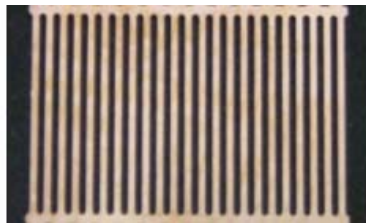


## E-MOBILITY – AMPHENOL ELECTRICAL CONNECTIONS

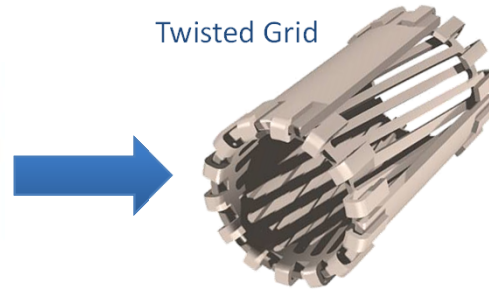


## CONNECTIVITY POWERED BY RADSOK® TECHNOLOGY

Flat Stamped Grid



Twisted Grid



DEVELOPED FROM FLAT STAMPED GRID  
TWISTED INTO A **HYPERBOLIC GEOMETRY**  
TO FORM A SOCKET CONTACT



### KEY BENEFITS OF RADSOK® TECHNOLOGY

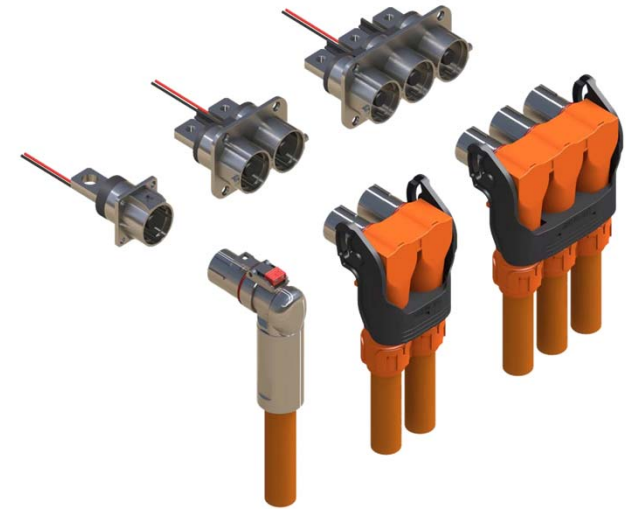
- Higher Amperage with Smaller Envelopes
- High Durability
- High Current Ratings
- Low Mating Force

### RADSOK NEXT GENERATION (R8S)

- Smaller and Lighter
- Higher Current Capacity
- Reduced Cost
- Designed in 2 parts only



## LOW/HIGH VOLTAGE CONNECTIONS



- Up to 500A @ 85°C
- Up to 300mm<sup>2</sup> cable size
- Up to 1.000V DC
- Up to IP67 / IP69K
- EMI Shielding
- High Voltage Interlock
- Plastic or Metal Housing
- SAE-USCAR-2/37 and LV215 Compliant



## SIGNAL CONNECTIONS



- Several Pin and Lay-Out Configurations
- Higher Amperage Capacity
- Up to IP67 / IP69K rating
- EMI Shielding available
- Plastic or Metal Housing
- Different Plating Available Up to 500H Salt Spray

## CHARGING CONNECTIONS



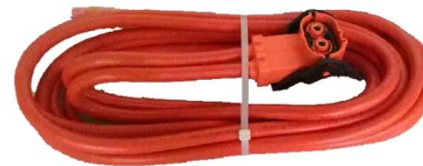
### COMPLIANT TO THE STANDARDS:

- SAE 1772
- GB-T
- IEC 62196-2 / 62196-3

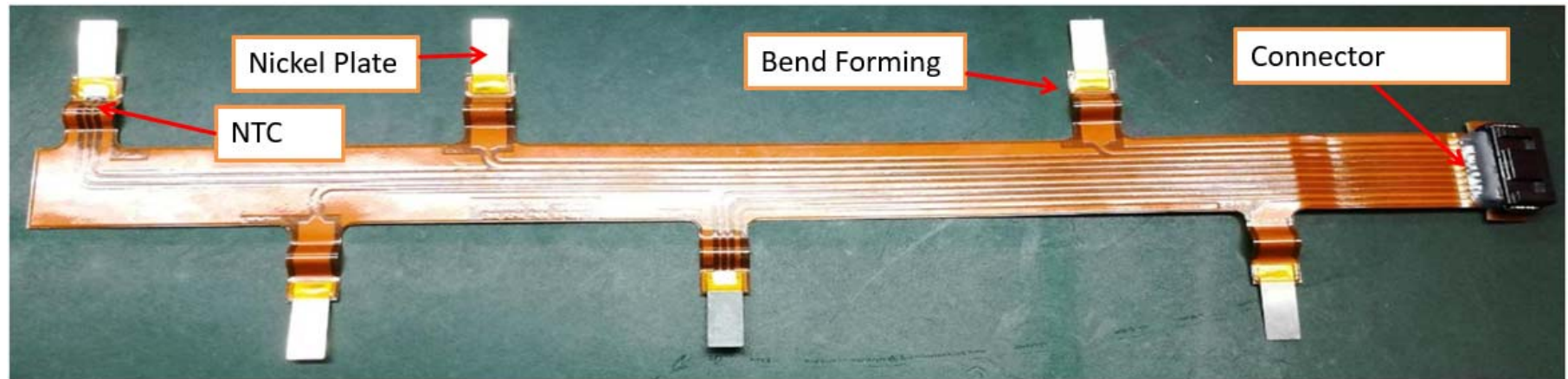




## CABLE ASSEMBLIES

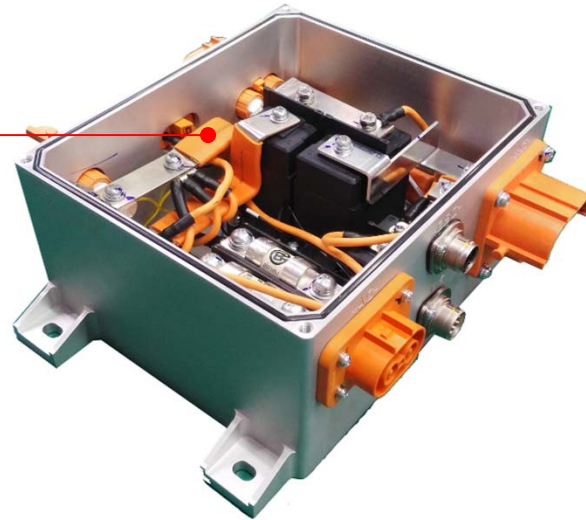


## BATTERY FLEX



- Single, Multilayer, Rigid Flex, Circuits
- Harsh Environment: Reliable in high vibration, great chemical resistance
- Excellent Signal Integrity: EMI Shielding, Impedance Controlled, Twisted Pair
- 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

## BUSBARS



### CUSTOM BUSBAR DESIGN, APPLICATIONS:

- Inner Battery Connections
- Pack To Pack
- Power Distribution Unit





## MANUAL SERVICE DISCONNECT



### MSD FEATURED BY:

- Up To 630A Max Peak, 1.000V DC (With Fuse)
- Up To 300A Max Cont, 1.500V DC (W/O Fuse)
- LV215, USCAR-2/37 Compliant



**Giangiaco De Ambrosi**  
**EV & Battery - EMEA Business Development Manager**

Amphenol Automotive, Industrial and Sensors

T: +39 02 932541 | M: +39 342 1002866

[giangiaco.deambrosi@amphenol.de](mailto:giangiaco.deambrosi@amphenol.de)