

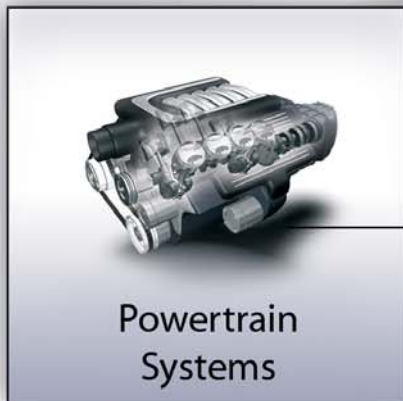


RoHS  
Ready 

# Alternative Power Systems (APS) for the Automotive Industry

Components for Hybrid,  
Electric and Fuel Cell Technology





## THE 5 APPLICATION AREAS

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Convenience



Safety & Security  
Systems



Body & Chassis  
Systems

## INNOVATIVE TECHNOLOGIES

*Tyco Electronics Ltd. is a leading global provider of engineered electronic components, network solutions and undersea telecommunication systems. We design, manufacture and market products for customers in industries from automotive, appliance and aerospace and defense to telecommunications, computers and consumer electronics. The automotive division follows the globalization goals of our customers, speeds up the integration of new technologies and enables our customers access to our vast product portfolio and services.*

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### TERMINALS & CONNECTORS



Tyco Electronics offers a broad range of high quality terminals and connectors. Our electrical/electronic interconnection products and solutions are used to electrically and mechanically join wires and cables, printed circuit boards, integrated circuit packages and batteries. Tyco Electronics expanding capabilities include new copper and fiber-optic connectors, wires, cables/cable management systems that are designed to meet automotive industry demands. Our brands encompass the broadest range of connectors in the world, including high-density, high-speed designs for leading-edge communications equipment.



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### SENSORS



Contact-less measuring eliminates interference effects, wear and tear, and provides increased reliability. Tyco Electronics, one of the largest technology providers for the automobile industry, offers contact-less sensors for a variety of applications.

As sensor manufacturer and processing partner, Tyco Electronics also provides project planning support for new sensor applications, assistance in the selection of the appropriate sensor technology for the respective application, and assistance with defining the corresponding mechanical, electrical and magnetic interface.

Tyco Electronics has a broad electro-mechanical portfolio that includes robust housing technologies, connector systems, and temperature stable designs based on foil and cable networks. This combination of technologies and experience ensures that reliable and cost effective sensor solutions are available for all application types.



## CABLE ASSEMBLY SYSTEMS



Tyco Electronics is your partner for special cable assemblies. We offer research and development capabilities, prototyping, samples as well as manufacturing facilities for special cable assemblies. This includes overmold technology, semi/fully automatic manufacturing, testing equipment and appliances for handling of high volume production.



## INDUCTIVE SYSTEMS



The Automotive Division is your source for interconnection technologies for automotive, truck and off-highway OEMs and Tier 1 suppliers. With the design competency center in Oostkamp (Belgium), and strategic production centers in Evora (Portugal), Bangalore (India), Shuzhou (China), Oostkamp (Belgium), and others, Tyco Electronics' Inductive Systems group is ready to offer you any coil module required in the automotive industry.

The Inductive System group focus lies on the customer requirement, in order to design to the exact demand. This is achieved by highly technical, intelligent and cost-efficient engineering.

In order to be a leader in design, Tyco Electronics' Inductive Systems group has a vast product portfolio, which consists out of antennas, actuators, resolvers, and integrated coil modules. Next to that, several specific applications are designed.



## MECHATRONICS



A variety of technical products are designed today by integrating mechanical components and electronic hardware into one packaging unit thus creating true mechatronic solutions. Mechatronic applications offer amazing and versatile potentials related to functionality, cost, space requirements and quality. Tyco Electronics contributes to those applications with its wide range of innovative and cost-effective product and process technologies.

Advanced stamping, injection molding and assembly techniques are applied along with highly selective surface plating methods.



## HIGH SPEED DATA NETWORKING



High speed data networking within the automobile is becoming more predominant. What was till now restricted to the high end of the market utilizing system such as the MOST network, high speed data transmission based on optical fibers, now with the introduction of MP3 player, display screens and cameras results in the need for high speed networking throughout all platforms.

**MOST IS A TRADEMARK**



## ALTERNATIVE POWER SYSTEMS COMPONENTS FOR HYBRID, ELECTRIC AND FUEL CELL TECHNOLOGY

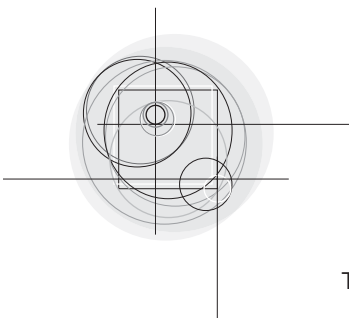


Tyco Electronics is a leader in next-generation transportation technologies and products for hybrid and electric vehicles. The Automotive Division is your source for high voltage power distribution, high current contacts, high voltage connectors and cables, high voltage relays, sensors and temperature protection devices for hybrid and other alternative powered vehicles.



**TYCO ELECTRONICS**

**OUR COMMITMENT. YOUR ADVANTAGE.**



Tyco Electronics' businesses operate in thousands of different areas of industry. The products and services we deliver all have one thing in common. They are vital to everyday living. Individuals and companies worldwide have critical needs. And every minute of every day, we satisfy them.

## RESTRICTION ON THE USE OF HAZARDOUS SUBSTANCES (ROHS)

At Tyco Electronics, we're ready to support your RoHS requirements. We've assessed more than 15 million end items/components for RoHS compliance, and issued new part numbers where any change was required to eliminate the restricted materials. Part numbers in this catalog are identified as:

### RoHS Compliant

Part numbers in this catalog are RoHS Compliant, unless marked otherwise.

These products comply with European Union Directive 2002/95/EC as amended 1 January 2006 that restricts the use of lead, mercury, cadmium, hexavalent chromium, PBB, and PBDE in certain electrical and electronic products sold into the EU as of 1 July 2006.

**Note:** For purposes of this Catalog, included within the definition of RoHS Compliant are products that are clearly "Out of Scope" of the RoHS Directive such as hand tools and other non-electrical accessories.

### Non-RoHS Compliant

These part numbers are identified with a "◆" symbol. These products do not comply with the material restrictions of the European Union Directive 2002/95/EC.

### 5 of 6 Compliant

A "●" symbol identifies these part numbers. These products do not fully comply with the European Union Directive 2002/95/EC because they contain lead in solderable interfaces (they do not contain any of the other five restricted substances above allowable limits). However, these products may be suitable for use in RoHS applications where there is an application-based exception for lead in solders, such as the server, storage, or networking infrastructure exemption.

**Note:** Information regarding RoHS compliance is provided based on reasonable inquiry of our suppliers and represents our current actual knowledge based on the information provided by our suppliers. This information is subject to change. For latest compliance status, refer to our website referenced below.

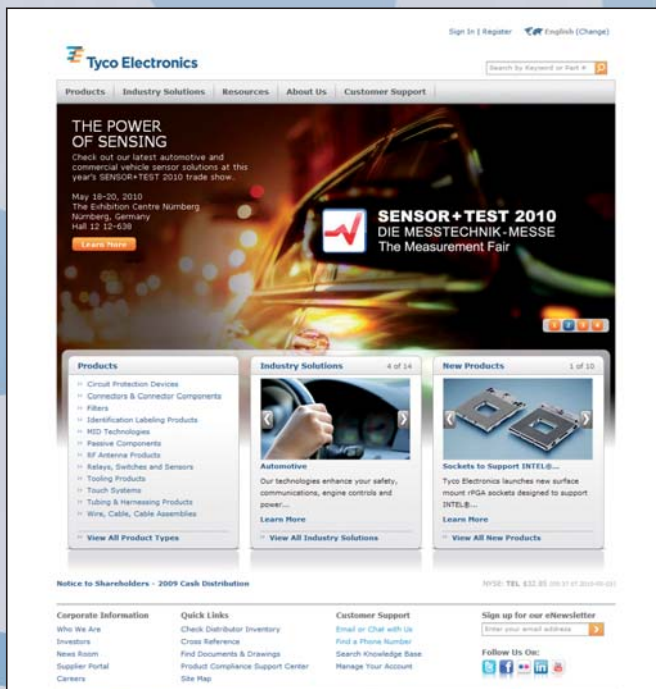
### Getting the Information You Need

Our comprehensive on-line RoHS Customer Support Center provides a forum to answer your questions and support your RoHS needs. A RoHS FAQ (Frequently Asked Questions) is available with links to more detailed information. You can also submit RoHS questions and receive a response within 24 hours during a normal work week. The Support Center also provides:

- Cross-Reference from Non-compliant to Compliant Products
- Ability to browse RoHS Compliant Products in our on-line catalog:  
<http://ecommas.tycoelectronics.com/commerce/alt/RohsAltHome.do>
- Downloadable Technical Data Customer Information Presentation
- More detailed information regarding the definitions used above

RoHS  
Customer  
Support  
Center 

So whatever your questions when it comes to RoHS, we've got the answers at [www.tycoelectronics.com/leadfree](http://www.tycoelectronics.com/leadfree)



## Tyco Electronics Online

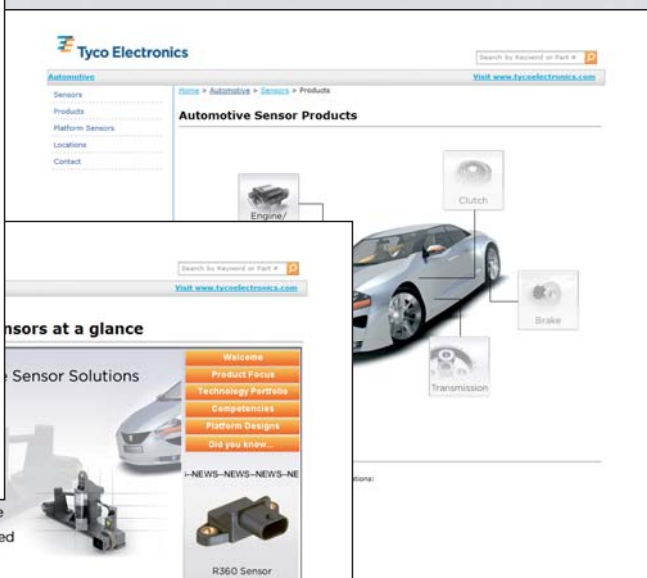
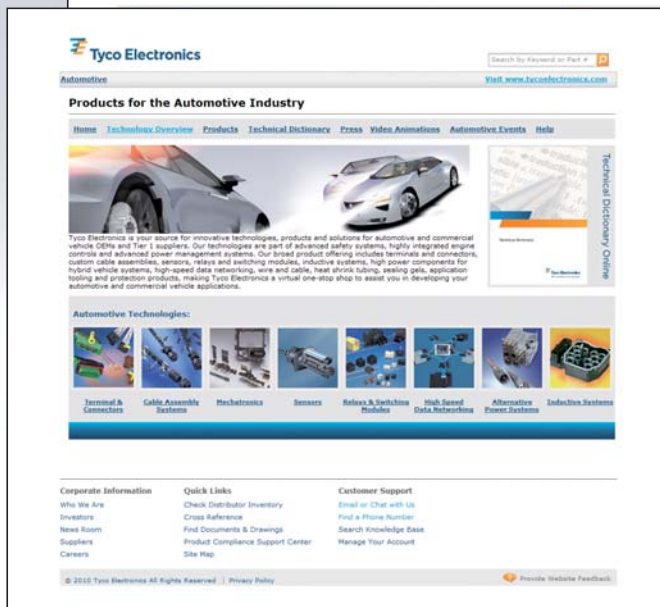
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[www.tycoelectronics.com/automotive](http://www.tycoelectronics.com/automotive)

## Internet

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[www.tycoelectronicsmost.com](http://www.tycoelectronicsmost.com)

## Electronic Internet Catalog

[www.tycoelectronics.com/components](http://www.tycoelectronics.com/components)



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## Product and Machine Literature

Tyco Electronics offers a variety of product specific catalogs, brochures and high impact flyers to help better serve you!

For more information on literature for Tyco Electronics' Automotive Division, please contact your local Tyco Electronics organization or go to [www.tycoelectronics.com/automotive](http://www.tycoelectronics.com/automotive)

## Product Information Center (PIC)

You can rely on Tyco Electronics' PIC Team to provide you support for answers to your general information or technical questions in an efficient and effective manner.

To reach our PIC staff, please contact your local Tyco Electronics organization.

See our Global Contacts page.





Alternative Power Systems (APS)		
Creating "A Green Advantage"	12-1	✓
Introduction	12-2	✓
2 Position HVA 280 Connector System	12-3	✓
3 Position HVA 280 Connector System	12-4	✓
2 Position HVA 400 Connector System	12-5	✓
2 Position Auxiliary Power Terminal (APT)	12-6	✓
2 Position Low Voltage (LV) 800 Connector	12-7	✓
2 Position High Voltage (HV) 800 Connector	12-8	✓
3 Position High Voltage (HV) 800 Connector	12-9	✓
1 Position IPT Shielded Ring Tongue	12-10	✓
EV 200 Contactor	12-12	✓
LEV 100 Contactor	12-13	✓
Power Resistor	12-14	✓
Typical Make/Break Application	12-15	✓
High Current Relay (HCR) 200	12-16	✓
High Current Relay (HCR) 150	12-17	✓
Battery Disconnect Switch (BDS)-A	12-18	✓
High Voltage Cable Assemblies	12-19	✓
Multi-Coil Resolver (MCR)	12-20	✓
Clutch Position Sensor	12-21	✓
Dual Clutch Position Sensor	12-22	✓
Neutral Position Sensor	12-23	✓
Brake Pedal Position Sensor	12-24	✓
Thermal Indicator	12-25	✓
HFT 5000	12-26	✓
Application Tooling	12-27	✓
Numerical Index	12-28	✓

# THE PRODUCTS



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Creating “A Green Advantage”



Tyco Electronics Ltd. is a leading global provider of engineered electronic components, network solutions, specialty products and undersea telecommunication systems, with customers in more than 150 countries.

We design, manufacture and market products for customers in a broad array of industries including automotive; data communication systems and consumer electronics; telecommunications; aerospace, defense and marine; medical; energy; and lighting.

With worldwide engineering, manufacturing, sales and customer service capabilities, Tyco Electronics' commitment is our customers' advantage.

**Global Automotive Division**  
**ALTERNATIVE  
POWER SYSTEMS  
(APS)**

Tyco Electronics is a leader in next-generation transportation technologies and products for hybrid and electric vehicles. The Global Automotive Division is your source for high voltage power distribution, high current contacts, high voltage connectors and cables, high voltage relays, sensors and temperature protection devices for hybrid and other alternative powered vehicles.

Introduction

**High-Power Automotive  
Electrical Systems  
for Hybrid and Electrical  
Vehicles**



Alternative powered vehicles, such as hybrid electric vehicles (HEV's), can reduce harmful pollutants and exhaust emissions. Recent interest in alternative powered vehicles creates a new challenge for vehicle electrical systems because of the need for high power electrical system technology.

The demand for high power electrical components has accelerated due to the constant development of alternative powered vehicles, high power electrical components for "drive by wire" electromechanical systems and high-power systems on vehicles with conventional voltage levels.

Electrical systems on conventional vehicles are typically designed for 12 volts, with the majority of loads less than 30 amps. In contrast, hybrid and electric vehicles have electrical systems with voltage levels between 300–800 volts and currents from 200–1000 amps. High power environments require design and packaging solutions for power switching, circuit protection, electrical power distribution and interconnection systems.

Tyco Electronics offers a wide range of components and subsystems for HEV's, including:

- High power electrical connectors and cables,
- High power contactors for battery switching and control,
- Circuit protection devices, like Raychem PolySwitch™ PPTC's,
- Power Distribution Units.

2 Position HVA 280 Connector System

**2 Position HVA 280 Connector System**



**Application**

- High voltage accessory (HVA) / device interconnect

**Description**

- Sealed
- Touch safe
- 2.8 mm AMP MCP Box/ Blade Contact System
- Wire Range: 2.0–4.0 mm<sup>2</sup>
- Individually Shielded Cable
- Wire-to-device
- Internal safety interlock
- 360° EMC shielding
- Finger actuated two-stage latch
- Multiple indexes available

**Performance**

- **Rated Voltage:**  
600 V DC
- **Current Carrying Capacity:**  
40 A continuous @ +85 °C on 4.0 mm<sup>2</sup> wire in connector  
27 A continuous @ +125 °C on 4.0 mm<sup>2</sup> wire in connector
- **Operating Temperature:**  
–40 °C to +125 °C
- **Degree of Protection:**  
IP6K9K, IPX7 mated,  
IP2XB unmated
- **Vibration Profile:**  
USCAR-2 (Body Profile)



**Ordering Information**

Connector Type	No. of Positions	Product Description	Overview Part Number
HVA 280	2	Plug Housing	1587819-x
		Header Housing	1587831-x

3 Position HVA 280 Connector System

**3 Position HVA 280 Connector System**



**Application**

- High voltage accessory (HVA) / device interconnect

**Description**

- Sealed
- Touch Safe
- 2.8 mm AMP MCP Box/ Blade Contact System
- Multicore shielded cable
- Wire Range: 2 x 2.5–4.0 mm<sup>2</sup>, 3 x 2.5–3.0 mm<sup>2</sup>
- Wire-to-device
- 360° EMC shielding
- Tool actuated latch
- Multiple indexes available



**Performance**

- **Rated Voltage:** 600 V DC
- **Current Carrying Capacity:** 30 A continuous @ +125 °C on 3 x 2.5 mm<sup>2</sup> wire in connector
- **Operating Temperature:** –40 °C to +125 °C
- **Degree of Protection:** IP6K9K, IPX7 mated, IP2XB unmated
- **Vibration Profile:** USCAR-2 (Body Profile)

**Ordering Information**

Connector Type	No. of Positions	Product Description	Overview Part Number
HVA 280	3	Plug Housing	1587715-x
		Header Housing	1587727-x

2 Position HVA 400 Connector System

**2 Position HVA 400 Connector System**



**Application**

- High voltage accessory (HVA) / device interconnect

**Description**

- Sealed
- Touch safe
- 4.0 mm pin/socket contact system
- Wire Range: 3.0–6.0 mm<sup>2</sup>
- Individually shielded cable
- Wire-to-wire
- External safety interlock
- 360° EMC shielding
- Tool actuated latch

**Performance**

- **Rated Voltage:**  
600 V DC
- **Current Carrying Capacity:**  
33 A continuous @ +125 °C on 3.0 mm<sup>2</sup> Wire (free in air)
- **Operating Temperature:**  
–40 °C to +125 °C
- **Degree of Protection:**  
IP6K9K, IPX7 mated, IP2XB unmated
- **Vibration Profile:**  
USCAR-2 (Body Profile)



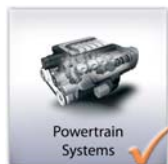
**Ordering Information**

Connector Type	No. of Positions	Product Description	Overview Part Number
HVA 400	2	Plug Housing	1587517-x
		Cap Housing	1587777-x



2 Position Auxiliary Power Terminal (APT)

**2 Position Auxiliary Power Terminal (APT)**



**Application**

- High voltage accessory (HVA) / device interconnect

**Description**

- Auxiliary pigtail system
- Sealed
- Touch safe
- Wire Range: 2.5–6.0 mm<sup>2</sup>
- Individually shielded cable
- Wire-to-device
- Non-serviceable fixed device interface
- 360° EMC shielding

**Performance**

- **Rated Voltage:**  
600 V DC
- **Current Carrying Capacity:**  
30 A continuous @ +125 °C  
on 4.0 mm<sup>2</sup> Wire
- **Operating Temperature:**  
–40 °C to +125 °C
- **Degree of Protection:**  
IP6K9K
- **Vibration Profile:**  
USCAR-2 (on Engine)



**Ordering Information**

Connector Type	No. of Positions	Product Description	Overview Part Number
APT	2	Kit	1587833-x

2 Position LV 800 Connector

**2 Position Low Voltage (LV) 800 Connector**



**Application**

- Accessory/main interconnect

**Description**

- 2 positions
- Sealed
- 8.0 mm socket contact system
- Wire Range: 25.0–50.0 mm<sup>2</sup>
- Wire-to-device

**Performance**

- **Rated Voltage:**  
12 V DC
- **Current Carrying Capacity:**  
210 A continuous @ +85 °C  
on 50.0 mm<sup>2</sup> wire
- **Operating Temperature:**  
–40 °C to +130 °C
- **Degree of Protection:**  
IP6K9K, IPX7 mated



**Ordering Information**

Connector Type	No. of Positions	Product Description	Overview Part Number
LV 800	2	Plug Housing	1670564-x
		Pin Header	1670559-x

2 Position HV 800 Connector

**2 Position High Voltage (HV) 800 Connector**



**Application**

- Accessory/main interconnect

**Description**

- 2 positions
- Sealed
- Touch safe
- 8.0 mm socket contact system
- Wire Range: 25.0–50.0 mm<sup>2</sup>
- Wire-to-device
- Full integrated interlock
- 360° EMC shielding

**Performance**

- **Rated Voltage:**  
800 V DC
- **Current Carrying Capacity:**  
210 A continuous @ +85 °C  
on 50.0 mm<sup>2</sup> wire
- **Operating Temperature:**  
–40 °C to +130 °C
- **Degree of Protection:**  
IP6K9K, IPX7 mated,  
IP2XB unmated



**Ordering Information**

Connector Type	No. of Positions	Product Description	Overview Part Number
HV 800	2	Plug Housing	1719822-x
		Pin Header	1719833-x

3 Position HV 800 Connector

**3 Position High Voltage (HV) 800 Connector**



**Application**

- Accessory/main interconnect

**Description**

- 3 positions
- Sealed
- Touch safe
- 8.0 mm socket contact system
- Wire Range: 25.0–50.0 mm<sup>2</sup>
- Wire-to-device
- Full integrated interlock
- 360° EMC shielding

**Performance**

- **Rated Voltage:**  
800 V DC
- **Current Carrying Capacity:**  
210 A continuous @ +85 °C  
on 50.0 mm<sup>2</sup> wire
- **Operating Temperature:**  
–40 °C to +130 °C
- **Degree of Protection:**  
IP6K9K, IPX7 mated,  
IP2XB unmated

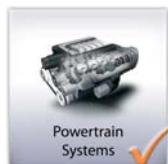


**Ordering Information**

Connector Type	No. of Positions	Product Description	Overview Part Number
HV 800	3	Plug Housing	1563425-x
		Pin Header	1563315-x

1 Position IPT Shielded Ring Tongue

**1 Position IPT Shielded Terminal, Screwed, 25.0–50.0 mm<sup>2</sup>**



**Application**

- Accessory/main interconnect

**Description**

- 1 position
- Sealed
- Ring tongue
- Wire Range: 25.0–50.0 mm<sup>2</sup>
- Wire-to-device
- 360° EMC shielding

**Performance**

- **Rated Voltage:**  
800 V DC
- **Current Carrying Capacity:**  
200 A continuous @ +105 °C  
on 50.0 mm<sup>2</sup> wire
- **Operating Temperature:**  
–40 °C to +130 °C
- **Degree of Protection:**  
IP6K9K, IPX7 mated



**Ordering Information**

Connector Type	Wire Size Range (mm <sup>2</sup> )	Product Description	Overview Part Number
IPT	20.0–50.0	IPT Shielded Terminal	1991227-x

1 Position IPT Shielded Ring Tongue

**1 Position IPT Shielded Terminal, Screwed, 70.0–120.0 mm<sup>2</sup>**



**Application**

- Accessory/main interconnect

**Description**

- 1 position
- Sealed
- Ring tongue
- Wire Range: 70.0–120.0 mm<sup>2</sup>
- Wire-to-device
- 360° EMC shielding

**Performance**

- **Rated Voltage:**  
800 V DC
- **Current Carrying Capacity:**  
420 A continuous @ +105 °C  
on 120.0 mm<sup>2</sup> wire
- **Operating Temperature:**  
–40 °C to +130 °C
- **Degree of Protection:**  
IP6K9K, IPX7 mated



**Ordering Information**

Connector Type	Wire Size Range (mm <sup>2</sup> )	Product Description	Overview Part Number
IPT	70.0–120.0	IPT Shielded Terminal	1670904-x

Make / Break

## EV 200 Contactor



### Application

- Main relay
- Accessory relay
- High speed pre-charge relay

### Description

- Form X
- Available with and without Economizer (see application note)
- Hermetically sealed

### Performance

- 500 A DC continuous carry
- 2,000 A, 320 V DC emergency interrupt
- 900 V DC contact maximum
- Capacitive make switching
  - 50,000 cycles, 360 amps peak
  - 50 Cycles, 650 amps Peak
- 9 to 95 V DC coil voltage
- 1.6 watts coil power



### Ordering Information

Product Description	Part Number
EV200AAANA-** (with Economizer)	2098190-1
EV200A1ANA-** (without Economizer)	2098372-1

Make / Break

## LEV 100 Contactor



### Application

- Low cost 135 A sealed contactor
- Side or bottom mount – not position sensitive
- Multiple coil options available

### Application

- Main relay
- Accessory relay
- High speed pre-charge relay

### Description

- SPST – no form X
- Hermetically sealed

### Performance

- 135 A DC continuous carry
- 200 A DC (>3 minutes carry)
- 1000 A, 400 V DC emergency Interrupt
- 900 V DC contact maximum
- 12, 24 and 48 V DC coil voltage
- 5.5 watts coil power



### Ordering Information

Product Description	Part Number
LEV100A4BNG01	5-1618389-5



Make / Break

**Power Resistor**



**Application**

- Filter capacitor pre-charge

**Description**

- Thick film isotop (shown)
- Cement encased wirewound
- Aluminum housed
- Ceramic housed

**Performance**

- Typical 700 joules (360 V, 7 mF)
- 3 charges at 5 second intervals
- 500 V DC
- 2000 V AC flash tested

Available up to 5000 joules

**Terminals:**  
Faston, screw

**Mounting:**  
Screw, clip

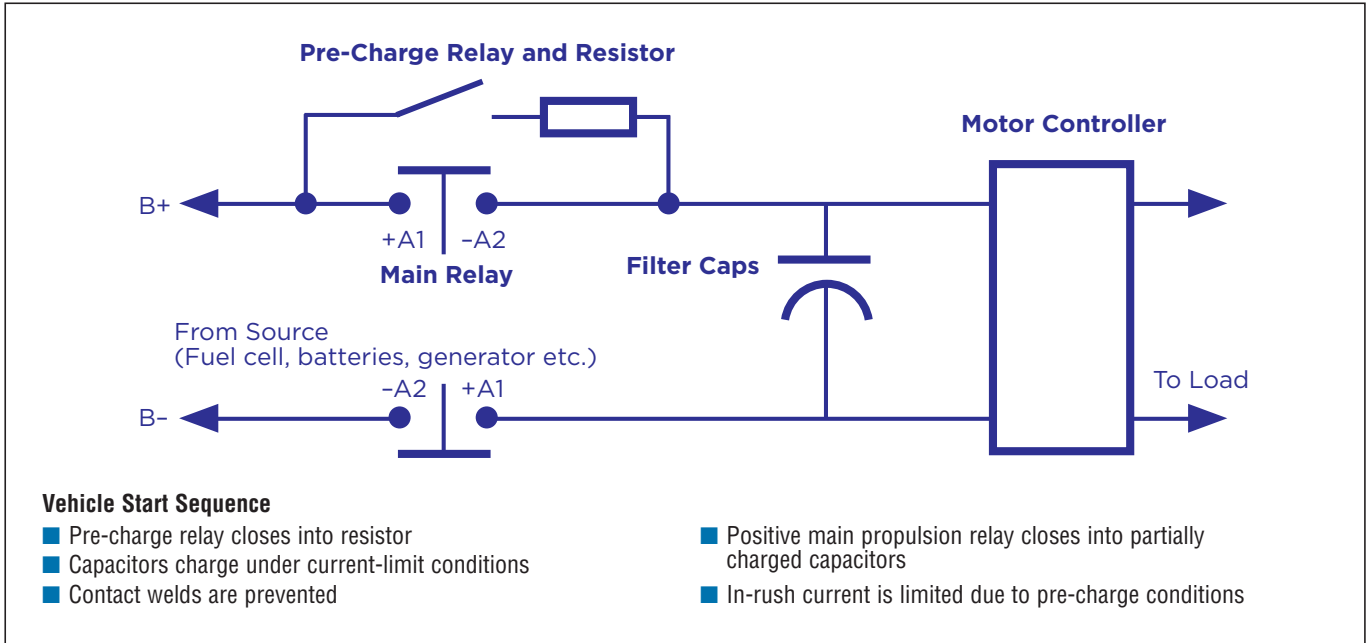


**Ordering Information**

Product	Description	Part Number
Power Resistor	SQBW40	1879068-x

Make / Break

**Typical  
Make / Break  
Application**



**Capacitive Switching Test Protocols**

**Test Protocol 1**

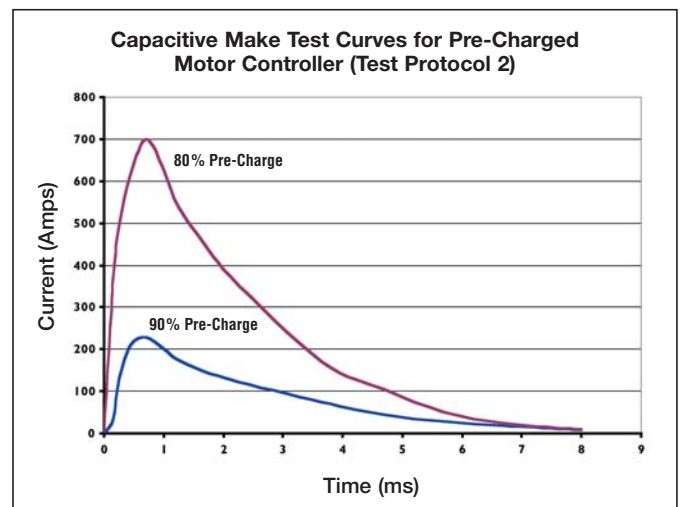
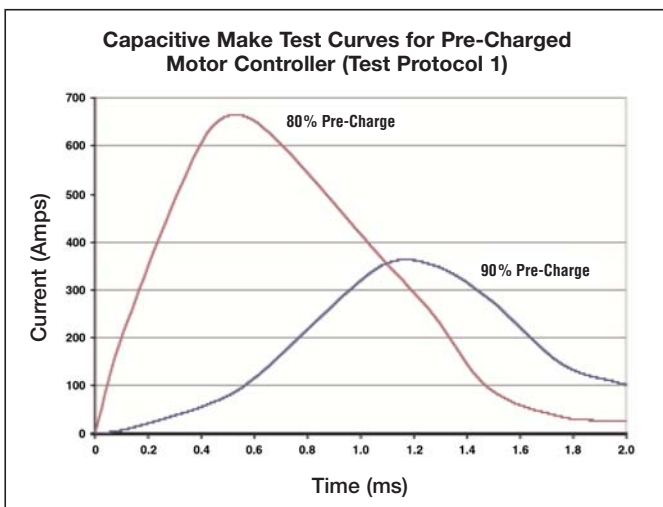
Make/break life capacitive and resistive loads at 320 V DC <sup>1), 2)</sup>

- @ 90% capacitive pre-charge (make only) see charts below
  - @ 80% capacitive pre-charge (make only) see charts below
  - @ 200 A make/break 2 consecutive, reverse polarity <sup>1)</sup>
  - @ 2000 A break only (1700 A for auxiliary contact model <sup>1)</sup>
- |               |        |
|---------------|--------|
| <b>Cycles</b> | 50,000 |
|               | 50     |
|               | 12     |
|               | 1*     |

**Test Protocol 2**

Make/break life capacitive and resistive loads at 320 V DC <sup>1), 2)</sup>

- @ 90% capacitive pre-charge (make only) see charts below
  - @ 70% capacitive pre-charge (make only) see charts below
  - @ 250 A, 320 V make/break 2 consecutive, reverse polarity <sup>1)</sup>
  - @ Interrupt current maximum, 320 V break only (1700 A for auxiliary contact model) <sup>1)</sup>
- |               |        |
|---------------|--------|
| <b>Cycles</b> | 50,000 |
|               | 50     |
|               | 10     |
|               | 4*     |



<sup>1)</sup> Resistive load includes inductance L = 25 µH. Load @ 2500 A tested @ 200 µH.  
\*) Does not meet dielectric and IR after test.

<sup>2)</sup> Life based on projected Weibull Life with 95% Reliability.

Carry / Break

## High Current Relay (HCR) 200



### Features

- Normally closed contact
- Limiting continuous current 120 A @ +110 °C

### Customized Versions on Request

- Integrated components (e.g. resistor, diode)
- Special marking

### Typical Applications

- Energy management
- Battery coupling
- Start-stop

### Design

- ELV/RoHS/WEEE compliant
- Splash-water and dust-tight; protection class IP64 to ISO 20653 (DIN 40050-9)
- Weight: approx. 230 g
- Nominal voltage: 12 V
- Terminals
  - Quick connect terminals (coil)
  - Screw terminals (load)

### Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:  
23 °C ambient temperature,  
20–50 % RH, 29.5 ±1.0" Hg (998.9 ±33.9 hPa).



### Ordering Information

Product	Description	Part Number
HCR 200	V23230-D2001-B200	1-1414995-0

Make / Break

**High Current Relay (HCR) 150**



**Application**

- Main relay
- Accessory relay
- High speed pre-charge relay

**Description**

- Form A, X, C
- Sealed

**Performance**

- 200 A DC continuous carry
- 300 A DC emergency interrupt
- To 200 V DC contact maximum
- 12 V DC, 24 V DC coil voltage
- 3.3 watts coil power



**Ordering Information**

Product	Description	Part Number
HCR 150	V23132-A2001-A100	1416010-1

Make / Break

**Battery Disconnect Switch (BDS)-A**



**Application**

- High current loads (heaters, pumps)
- Dual power network
- Dual battery systems
- Energy management

**Description**

- Compact high current relay for multivalent applications, sealed, mono and bi-stable

**Performance**

- 190 A DC continuous current @ 85 °C
- <40 mOhm voltage drop at 100 A (Initial)
- 1500 A interrupt
- 15 ms operating time (approx. @ 14 V)
- Up to 60 V contact voltage



**Ordering Information**

Product	Description	Part Number
BDS-A	V23130-C2021-A412	1-1414939-4

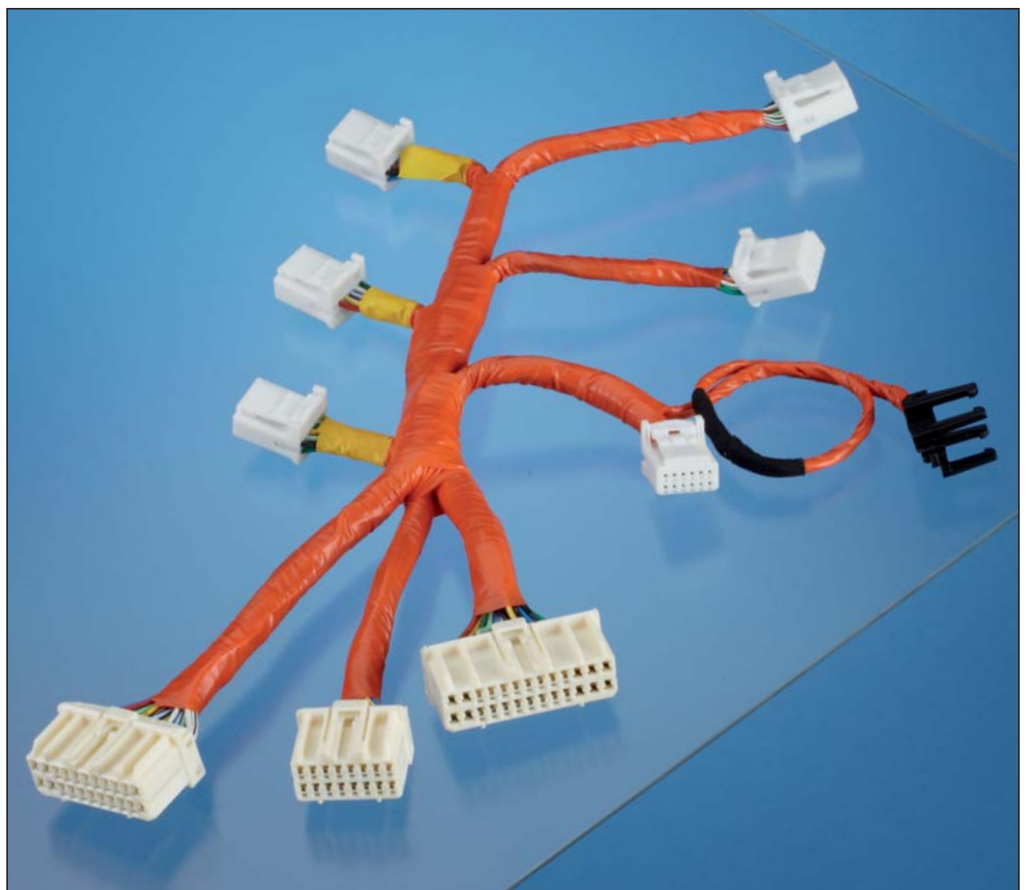
High Voltage Cable Assemblies

**High Voltage  
Cable Assemblies**



High voltage cable assemblies for connections of high voltage systems that provide reliability and robustness to meet the safety requirements of the electric vehicle market.

- System integration of high voltage harnesses from Battery → Power Distribution Systems → Contactor Boxes → Inverters to E-machines
- Multi-core and individually shielded cable capability
- Capability to process cables from 2.5 mm<sup>2</sup> to 120 mm<sup>2</sup> in conductor size
- Design and process competence in contact and shield crimp technology
- Capable of end of line reliability testing



For ordering information please contact your local sales representative.

Position Sensors

**Multi-Coil Resolver (MCR)**



**Application**

- Rotary position sensor for E-Motor

**Description**

- Analog output
- Platform product based on speed numbers

**Performance**

- Wide Temperature Range: -40 °C to +130 °C
- Robust for harsh environments
- High rotational speed
- Connection technology delivered in package
- High reliability, low number of components
- Sensing absolute position and velocity

By connecting the MCR to an AVD converter analog output signals are converted to digital position signals.



For ordering information please contact your local sales representative.

Sensor Solutions for Alternative Powered Vehicles

**Clutch  
Position Sensor**



**Application**

- Alternative powertrain solutions

**Function**

- Measuring piston position at concentric slave cylinder

**Technology**

- Permanent magnetic linear contact-less displacement sensor (PLCD)

**Product Features**

- Small design in
- Measurement Range: 22.0 mm absolute
- Highly temperature stable (up to +180 °C)
- Redundancy possible



For ordering information please contact your local sales representative.



Sensor Solutions for Alternative Powered Vehicles

**Dual Clutch  
Position Sensor**



**Application**

- Dual clutch transmission for hybrid cars

**Function**

- Measuring the position of the clutch actuators

**Technology**

- Permanent magnetic linear contact-less displacement sensor (PLCD)

**Product Features**

- Two PLCD in one housing concept
- PWM interface
- Small, very flat design



For ordering information please contact your local sales representative.

Sensor Solutions for Alternative Powered Vehicles

**Neutral  
Position Sensor**



**Application**

- Start-stop application (mild hybrid)

**Function**

- Measuring neutral position of the transmission

**Technology**

- Active permanent magnetic linear contact-less displacement (PLCD) sensor (moving magnet)

**Product Features**

- Contact-less measurement through transmission wall
- Measurement Range: 28 mm absolute
- Neutral position <2% over travel, temperature, life time, etc.
- Optional redundancy possible



For ordering information please contact your local sales representative.

Sensor Solutions for Alternative Powered Vehicles

**Brake Pedal Position Sensor**



**Application**

- Regenerative brake for hybrid cars

**Function**

- Brake pedal position detection

**Technology**

- Permanent magnetic linear contact-less displacement sensor (PLCD)

**Product Features**

- Optional travel or rotational measurement possible
- PWM or analogue output
- Optional redundancy possible
- High linearity (<2% over travel, temperature, life time, etc.)
- Optional sensor location pedal works or brake master cylinder



For ordering information please contact your local sales representative.

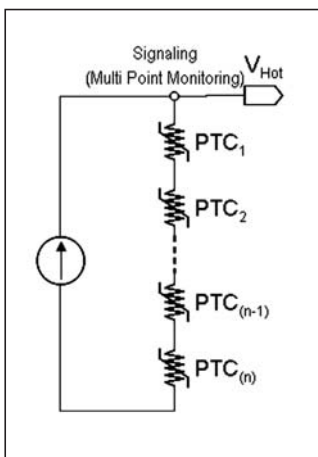
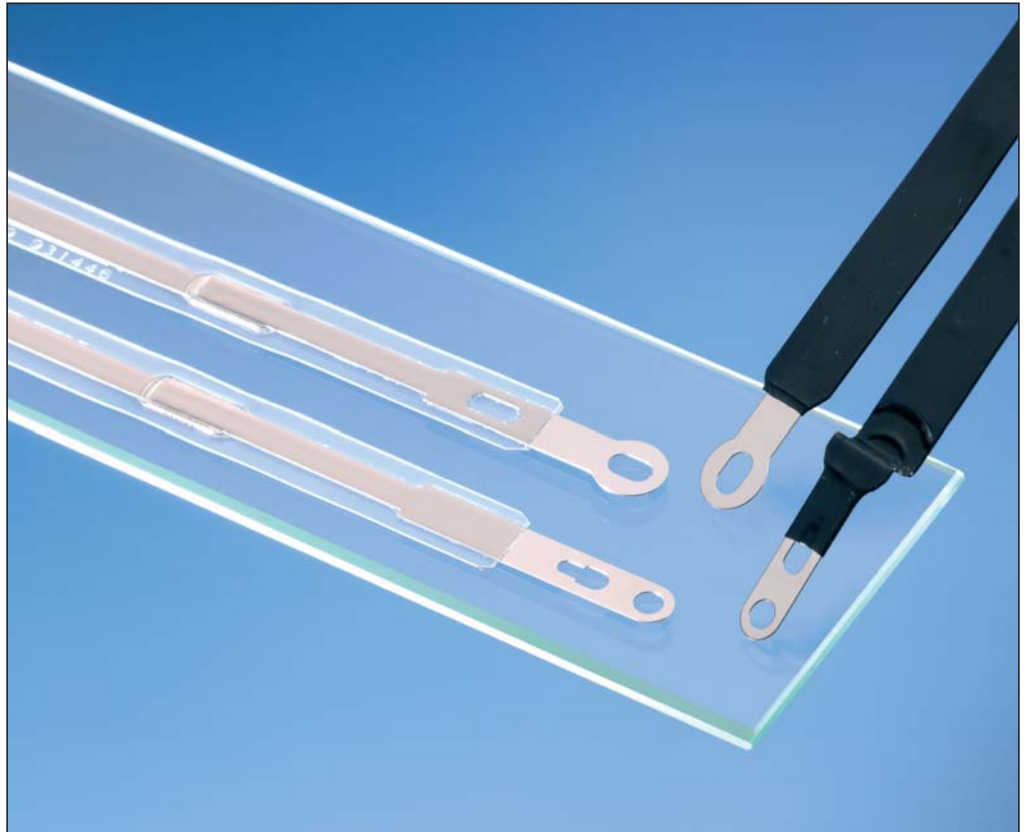
Make / Break

**Thermal Indicator**



**Thermal Indicator for Over-Temperature Detection**

- Thermal indicator with very steep R-T curve
- “Close to digital” resistance response
- Direct input into FET of BJT
- No comparator necessary
- Built-in hysteresis to avoid cycling
- Different temperatures possible from 70 °C up to 165 °C
- Flexible Design: can be located wherever the potential heat might appear
- Can be put in series to protect several cells or places with one controller



Tyco Electronics’s thermal indicators (RTI’s) are used for over-temperature (OT) signaling. They provide “silicon-like” performance (in a passive component), reduce footprint needs and support simple distributed monitoring. In contrast to ceramic PTC devices, RTI devices provide clear, “near digital”, OT signals due to a steep resistance change with temperature (~10 x resistance change per 2 °C).

They also feature a temperature hysteresis response that can minimize signal oscillation traditionally achieved using active components. The steep resistance response and hysteresis also allow for a reduction in support components. RTI devices require only one ballasting resistor to directly control power FET’s and BJT’s. Solutions using ceramic PTC’s might require a resistor network and comparator to offer similar functionality. This reduction in support components translates directly to lower system cost and reduced board area requirements.

Finally, the “near digital” resistance response allows for multiple devices to be placed in series on the same circuit without significant dilution in system measurement accuracy. This allows for a simple, low cost implementation of multi-point distributed monitoring.

For ordering information please contact your local sales representative.

Mechanical Protection for Power Cables

**HFT 5000**



**Description**

- Heat Shrinkable Fabric Tubing (HFT)
- Polyester/polyethylene construction

**Features**

- Temperature rating 125 °C (3000 h), 150 °C (1000 h)
- 2:1 shrink ratio
- High performance polyester fibers
- Highly flexible
- Halogen free
- Available in many sizes
- Low shrink temperature

**Benefits**

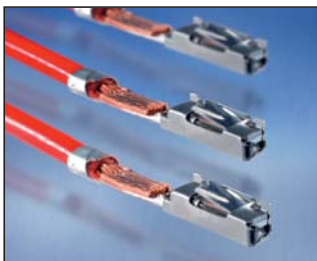
- Excellent mechanical protection for power cables even at high temperatures
- Fits perfectly to all cables therefore minimum space consumption
- Highly flexible thus no constraints regarding routing of power cables



For ordering information please contact your local sales representative.

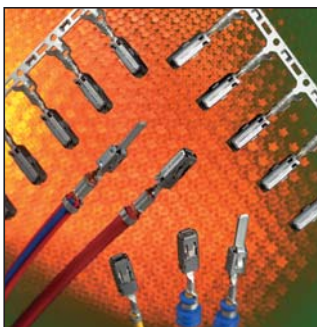


# Tyco Electronics Tooling for the Automotive Industry



Tyco Electronics' Global Application Tooling Division (GATD) is dedicated to providing high quality equipment options to meet all levels of your connector product specifications. We are also able to provide a broad range of equipment for other manufacturer's products.

Our equipment range is vast and unmatched by others operating in the same industry segments, as is our global presence and support network in the form of field service engineers and product managers. You will see from browsing this catalog; we supply everything from simple hand tools to the most complex automated systems – you name it, we supply it!



Equipment is segregated into two categories:

### Generic Equipment

Where we can supply you with sufficient information referenced by Part Number such that you can identify and order what you need yourself.

### Specialized Equipment

Where you will need help from our specialist product managers to identify what's just right for your application.

### Finding Equipment Online

Powerful search functions are available to identify appropriate tooling:

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- Hand Tools — [www.tooling.tycoelectronics.com/europe/handtools.asp](http://www.tooling.tycoelectronics.com/europe/handtools.asp)

Numerical Index

Part Number	Page	Part Number	Page	Part Number	Page
1-1414939-4	12-18				
1-1414995-0	12-16				
1416010-1	12-17				
5-1618389-5	12-13				
2098190-1	12-12				
2098372-1	12-12				

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