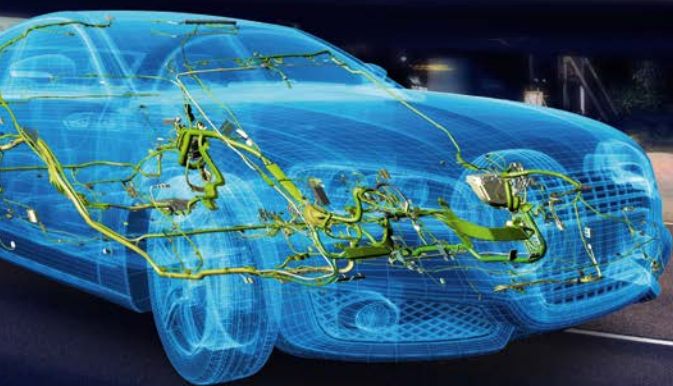


LEONI Wiring Systems Division
Products, services &
complete solutions



The Quality Connection

LEONI

LEONI Wiring Systems a serious global player

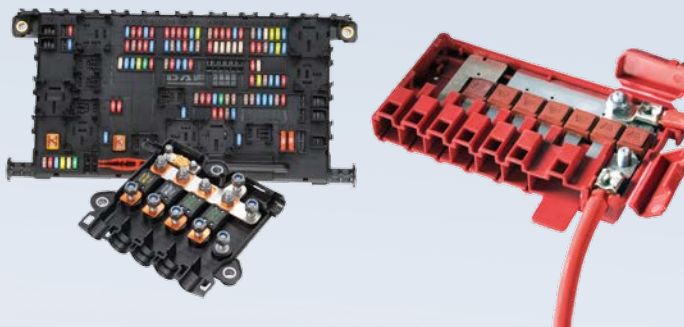


We have global facilities. We supply global customers. We support global platforms. We deliver best-in-class products and services worldwide.

Our network of R&D / customer service centres works to ensure our combination of product and service elements is always right in line with the customer's needs. Our state-of-the-art manufacturing facilities are located in cost-competitive regions world-wide. These are supported by robust yet flexible supply chains and customer specific logistics processes which ensure the right product arrives in the right place at the right time. Every time.



LEONI, beyond harness



LEONI is a long established and leading provider of wiring systems and related components to the automotive industry. The global market is evolving and our proven ability to develop and supply high quality products has now expanded into new areas.

LEONI... we always look for a better way.
Innovation. It is what we do.
It is what our customers expect.
Every day.

Using an industry proven tool-set and a wide range of materials LEONI continues to develop new products – delivering innovative technical solutions to its global customers.

Our products, our processes, our market

OUR PRODUCTS

- Electrical distribution systems
- Junction boxes and electro-mechanical components
- EDS connectivity products
- High voltage EDS systems
- Lightweight EDS solutions

OUR MARKET

- Passenger cars
- Commercial vehicles
- Off-highway vehicles
- Power-sports & recreational vehicles
- Tier 1 suppliers

OUR PROCESSES



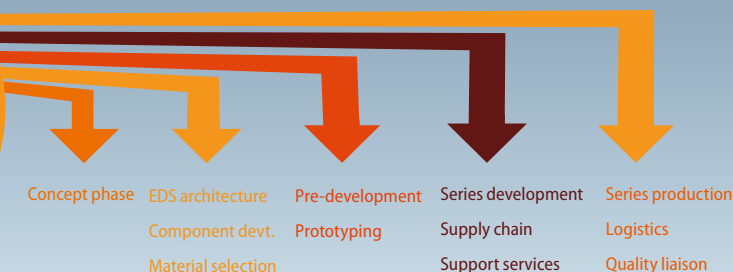
OUR ROLE... System supplier for the distribution of electrical power and information inside the vehicle.

Our extensive product portfolio includes electrical distribution systems, junction boxes and electro-mechanical components, high voltage wiring systems for hybrid and electric vehicles and special connectivity products.

As a systems partner and full service provider, we continually work to develop new products and original solutions focused on adding value for our customers. Experience, expertise and creativity. Ideas and concepts turned into products. Products and related services that result in innovative customer solutions. Customer solutions that deliver customer benefits.

Over 59,000 employees worldwide work on these processes in the Wiring Systems Division every week of the year.

LEONI – beyond harness



LEONI – beyond harness

High voltage technologies

starting on page 6



EDS system developments

starting on page 8



Distributing power and providing circuit protection

starting on page 11



Tools & services

starting on page 14



Product portfolio

High voltage technologies



Full high voltage EDS system competence.

Proven technology.

Proven experience.

LEONI has proven expertise in developing and manufacturing

high voltage wiring systems and power distribution boxes.

Also, LEONI is a leading supplier of high voltage cables. Working in close partnership, we have developed wiring system solutions that are being successfully used in series production hybrid and electric vehicles. These solutions are helping to set the electromobility standards for the future.

Whatever the powertrain concept, LEONI's expertise makes life easier for our customers.

1. HV harness

LEONI provides integrated HV harness solutions for all alternative drivetrains including (P)HEV, EV and fuel cells. These are suitable for all light vehicle applications as well as trucks.

2. HV power distribution box

We can design and supply HV power distribution boxes as part of a vehicle's high voltage EDS system.

3. HV battery harness

We offer interconnection solutions for high voltage batteries (internal battery cabling systems and battery cell connectors).

- (1) HV harness
- (2) HV power distribution box
- (3) HV battery harness
- (4) HV vehicle inlets
- (5) Y-Power distribution



4. HV vehicle inlets


LEONI provides HV vehicle inlets as an interface for the high-voltage charging of electric and hybrid vehicles.

5. Y-Power distribution

With one input and two output lines, the Y-Power distribution unit provides a more direct transfer of power to the auxiliary units in hybrid and electric vehicles. It is small, light-weight and cost effective. It also provides an efficient method of extending the capability of the high-voltage network.

Product portfolio

EDS system developments



We provide the perfect balance between a clear focus on market requirements and innovations that deliver real customer benefits.

Innovation is the application of new solutions to support existing market needs and evolving

customer requirements. That perfectly describes LEONI. We conduct continual research into new materials and explore fresh design approaches. Effective improvements are ensured by a rigorous system and product testing and validation process.

A clear understanding of market trends such as weight reduction and increasing vehicle functionality is the focus for all our product and process development activity.

1. Optimised EDS systems

Optimising EDS system designs is a core competence of LEONI – reducing weight, increasing functionality and cost effectiveness. Our tool set can be applied to all vehicle types – passenger cars, commercial vehicles, off-highway, power sports and recreational vehicles.

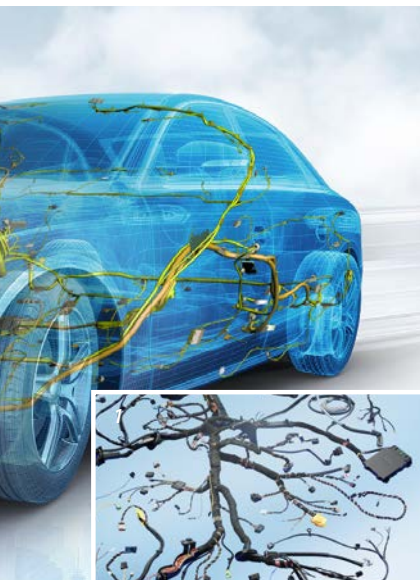
2. Weight reduction / alternative conductors

Delivering weight savings by using alternative conductor materials such as aluminium, CuAg, CuSn and CuMg, as well as smaller cable sizes. Cable sizes range from 0.75mm^2 to $> 100\text{mm}^2$ covering low and mid current as well as power applications. All products are qualified to automotive industry standards as well as OEM specifications.

3. Pre-formed wiring harnesses

LEONI provides harness solutions for very harsh environmental conditions e.g. engines, gearboxes, axles – pre-formed wiring

(1) Optimised EDS systems



- (2) Weight reduction / alternative conductors*
- (3) Pre-formed wiring harnesses*
- (4) Over-moulded harness and embedded sensor solutions*



harnesses. All wires are fully protected against vibration, extreme temperatures, dirt, moisture and mechanical stress. Easier fitting in the tightest of spaces is another benefit of this technique.

4. Over-moulded harness and embedded sensor solutions

By incorporating sensors, actuators, specialist cables, interconnects and other devices in an over-moulded harness assembly, we can ensure high levels of safety and reliability for many applications including engine and transmission control systems.

5. Multimedia / Special Cable assemblies

We offer a full design and supply service for special (multi-media) applications e.g. antenna, USB, fibre optics.

6. Engine harnesses

LEONI has a proven capability and extensive experience in this area, incorporating high temperature cables and effective protection.

(5) Multimedia

(6) Engine harnesses

(7) 48-volt technologies

(8) Pass-through

(9) Integration of electronics in connection systems

(10) Pinchguard



7. 48-volt technologies

Higher voltages reduce the current in the wiring system.

LEONI can maximise the weight saving by using smaller and lighter cables.

8. Pass-through

Our extensive ranges of “pass-through” or grommet solutions provide the harness with protection from abrasion and possible damage.

9. Integration of electronics in connection systems

Through the integration of electronics into over-moulded components, we can help to optimise functionality and reliability.

10. PinchGuard

PinchGuard is an anti-pinch sensor for electrically driven closing systems. Typical vehicle applications include windows, tailgates, sliding doors and sun roofs.

Product portfolio

Distributing power and providing circuit protection



Conducting power and providing circuit protection are key functions of an automotive electrical distribution system. LEONI has developed a wide range of fusebox products based on different technologies. These can be tailored to fit the customer's exact needs and help to reduce weight and

Circuit protection.

Power distribution and control.

LEONI technology. LEONI solutions.

complexity through the integration of electronics.

1. Junction boxes – including pre-fuse boxes and power boxes

LEONI develops and manufactures junction boxes based on four primary technologies – hard-wired, PCB, metal fret and hybrid designs. These boxes are designed and developed using the latest 3-D CAD systems and rapid prototyping techniques.

2. Aluminium bus-bar (solid)

On vehicles where the battery is located remotely, this product offers key benefits compared to conventional power cables – less weight, reduced packaging space and greater ease of installation. Assemblies can also include twin bus-bars to support “stop-start” technology where this is fitted to the vehicle.



3. Aluminium flexible battery cables

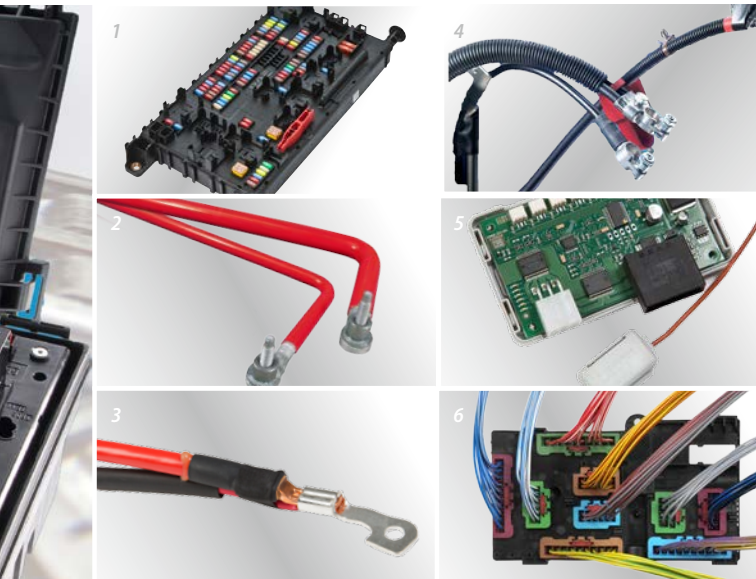
We have developed flexible aluminium alloy battery cables as an alternative to conventional copper cables. These help to reduce weight as well as optimise function and cost.

4. Copper battery cables

Our wide range of copper battery cables offers various current ratings and incorporates different terminal options including customer specific designs.

- (1) Junction boxes
- (2) Aluminium bus-bar (solid)
- (3) Flexible aluminium battery cables

- (4) Copper battery cables
- (5) Ti-box
- (6) Connectors for system solution



5. Ti-box


Ti-box is an intelligent electronic device that manages the lighting function between the towing vehicle and the trailer.

6. Connectors for system solution

LEONI develops and manufactures a wide range of fuse and relay boxes with specially designed connectors for an optimised interface between box and harness.

Product portfolio

Tools & services



Tools to support our services.
Services to support our products.
Everything to support our customers.

Customer care.
Customer support.

LEONI provides the tools and services to ensure the customer's every requirement is taken care of – from initial concept studies to the safe installation of the final product.

EDS system analysis. Component design. Product testing.
Logistics support. Full Service Supply – it's the way we work.

1. TOODEDIS the tool

TOODEDIS stands for **TOOL** for **D**imensioning the **E**lectrical **D**istribution system. This is the expert tool that allows our engineers to optimise circuit performance and fusing strategies – as part of a suite of integrated CAD tools it helps to reduce weight and cost.

2. Vehicle measurement

This process utilises a “whole vehicle approach” to measure and analyse the electrical performance of all components. This provides key inputs to optimising all aspects of the electrical distribution system including architecture definition, functionality and fit within the vehicle.

3. Benchmarking

Regular benchmarking activity, often requiring full vehicle strip-downs, is undertaken by LEONI as a means of detailed comparison

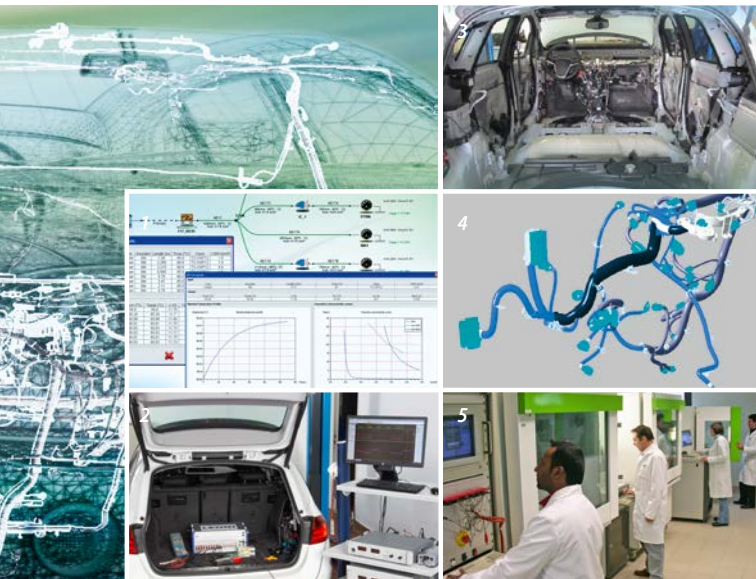
(1) TOODEDIS

(2) Vehicle measurement

(3) Benchmarking

(4) 3-D harness simulation
and CAD tool set

(5) Testing & validation (including
laboratory services)



and system analysis. This leads to new ideas and technical proposals ranging from EDS architectures to individual component designs.

4. 3-D harness simulation and CAD tool set

Integrated CAD systems, incorporating 3-D harness simulation software, provide a flexible design process that ensures the highest levels of accuracy.

5. Testing & validation

Testing and validation is part of Full Service Supply. LEONI Wiring Systems has a global network of laboratories that supports all R&D activities. This includes material analysis, product testing and validation as well as advanced research – helping to support innovation and full product range development.

LEONI Wiring Systems Devision

Global footprint



Americas

Brazil	1
Mexico	2
Paraguay	1

Europe

France	1	Russia	2
Germany	1	Slovakia	2
Italy	1	Serbia	2
Portugal	1	Ukraine	1
Romania	4		

LEONI is a global supplier of wires, optical fibres, cables, cable systems and related services for the automotive sector and other industries.

The LEONI Group, which is listed on the German MDAX, employs nearly 70,000 people in 31 countries and generated consolidated sales of EUR 4.1 billion in 2014.

The wiring systems division is the leading European supplier of wiring systems, and is the number four worldwide.

Our employees have special expertise in EDS systems and products as well as a comprehensive understanding of market trends and customer requirements. LEONI's product value chain, unique in the

**North Africa**

Egypt	3
Morocco	4
Tunisia	4

Asia

China	5
India	1

sector, delivers valuable synergies and benefits; these range from ultra-thin single wires and optical fibres to complex wiring systems with integrated electronics.

The quality principle is resolutely applied at LEONI. It is part of our corporate philosophy and is central to all activities. This approach has resulted in our winning numerous prestigious industry and customer quality awards over many years.

Please note that this brochure can only provide a brief overview of LEONI's EDS system design expertise, innovation and product supply capability.

For further information please contact us directly.

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