KOSTAL

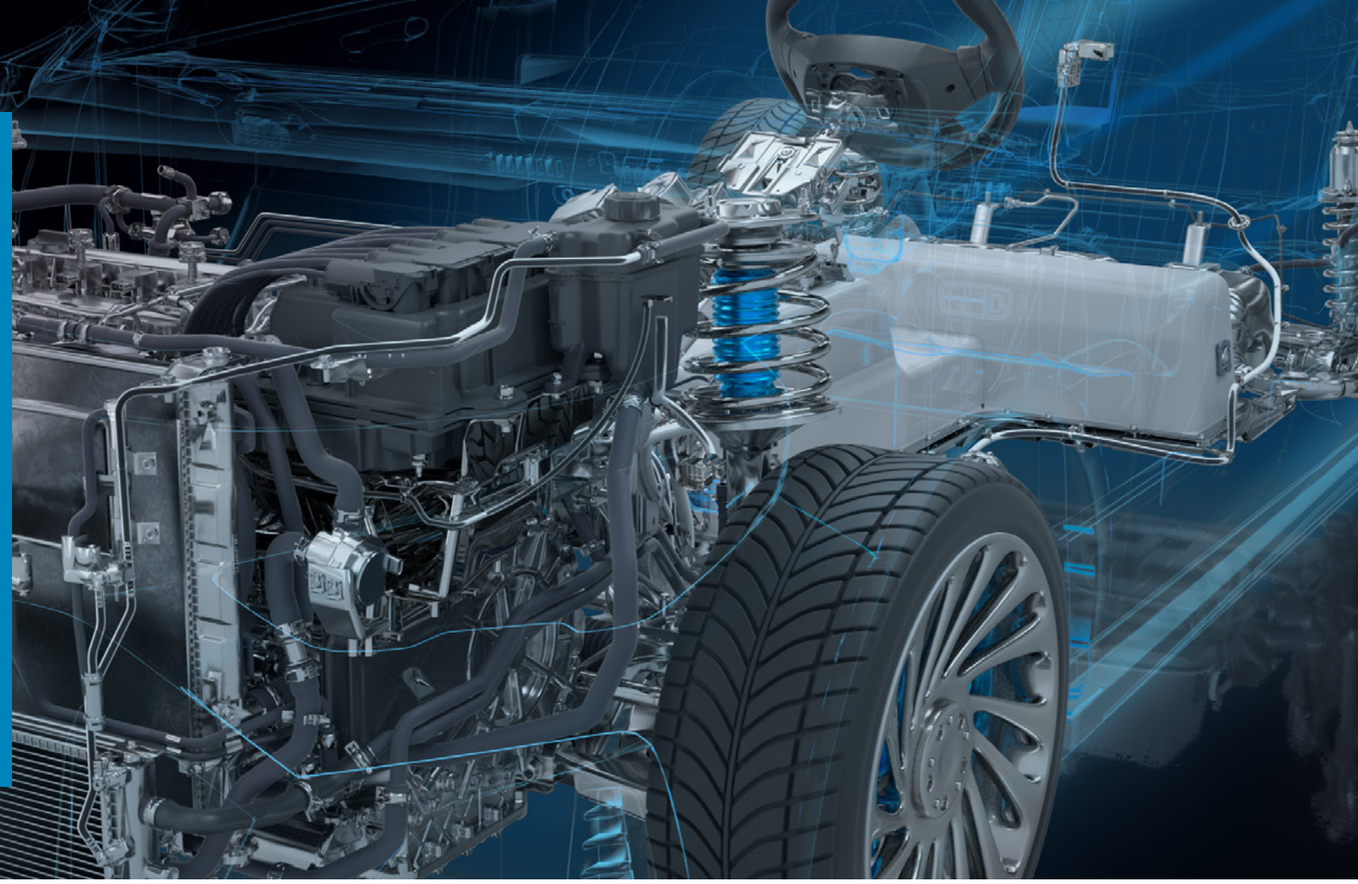
48 V
CONNECTOR SYSTEMS

KOSTAL Connectors

48 V
wiring harness architecture

The automotive industry is facing a radical change with increasing demands: Energy efficiency, emissions reduction and more comfort features.

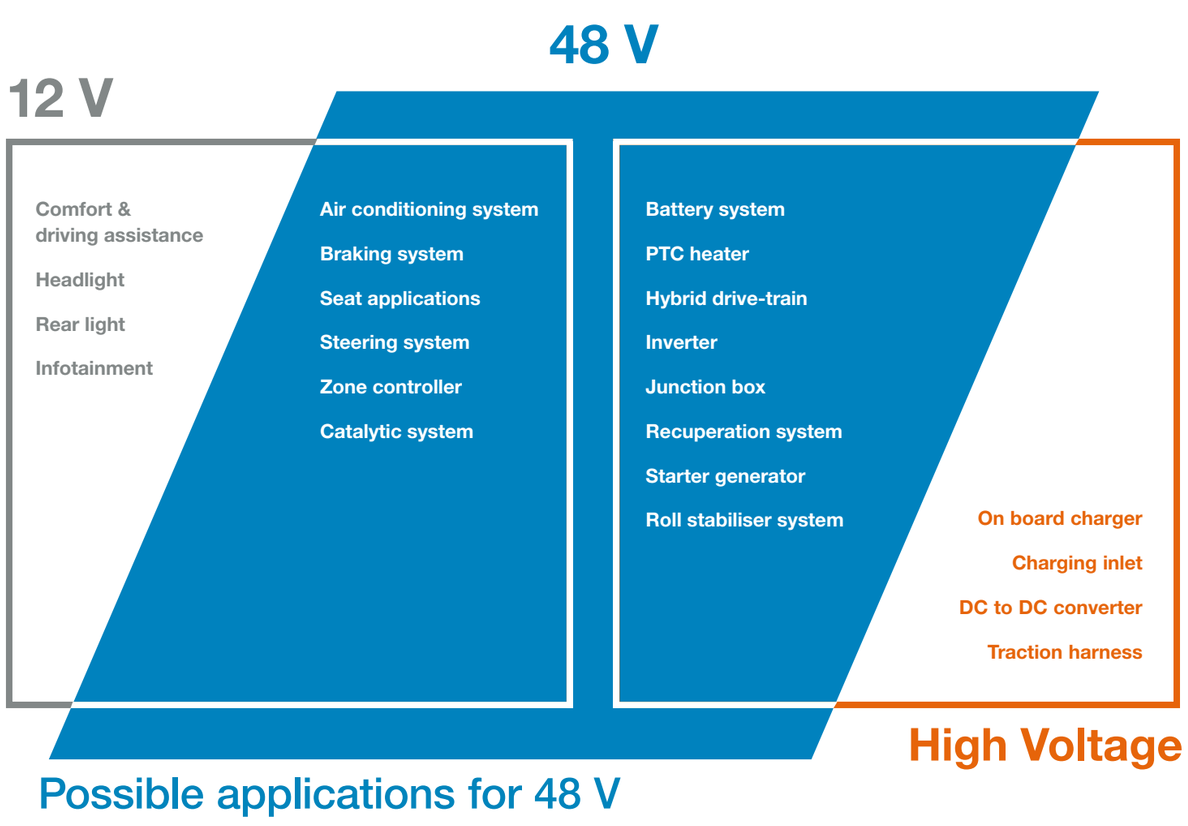
To meet the growing energy demands of today‘s vehicles, the 48 V wiring harness system offers a forward-looking solution while sustaining the environment.



Redefining Power Consumption

The traditional 12 V wiring harness is increasingly reaching its limits as more electrical devices with higher power consumption are integrated into modern vehicles.
48 V systems are increasingly being used since 2018 (mHEV) in mild hybrid and plug-in hybrid vehicles.

48 V is a possible sweet spot between 12 V and High Voltage as shown in the graphic. Existing 12 V applications can shift to 48 V while several HV applications could shift to 48 V as well.



Possible applications for 48 V

Using proven technology

Our 14.5 mm connector systems (PLK 14,5) for 48 V applications have been utilized in MHEV applications for over a decade.

POTENTIAL

Advantages of 48 V wiring harness architecture

The 48 V electrical system offers several advantages in comparison to conventional 12 V wiring harness:

Performance and efficiency

A 48 V electrical system offers enhanced efficiency in power consumption. Electrical devices benefit from the higher voltage, allowing them to utilize the same power with less current or more power with the same current. The enhanced voltage level facilitates the operation of a broader range of electrical applications.

Lightweight design

The 48 V design is more lightweight and efficient, requiring less current than the 12 V design to achieve the same power output. This results in a smaller and lighter wiring harness, contributing to enhanced package efficiency and reduced overall weight.

Cost savings

There is potential to reduce costs by manufacturing motors and other electrical components using for example less copper.

Lower emissions

The increased voltage compared to 12 V allows electrical components to operate with greater efficiency, resulting in improved fuel efficiency and reduced emissions to our environment.

12 V
8 mm 2-way

- Smaller installation space
- Less weight
- Less costs

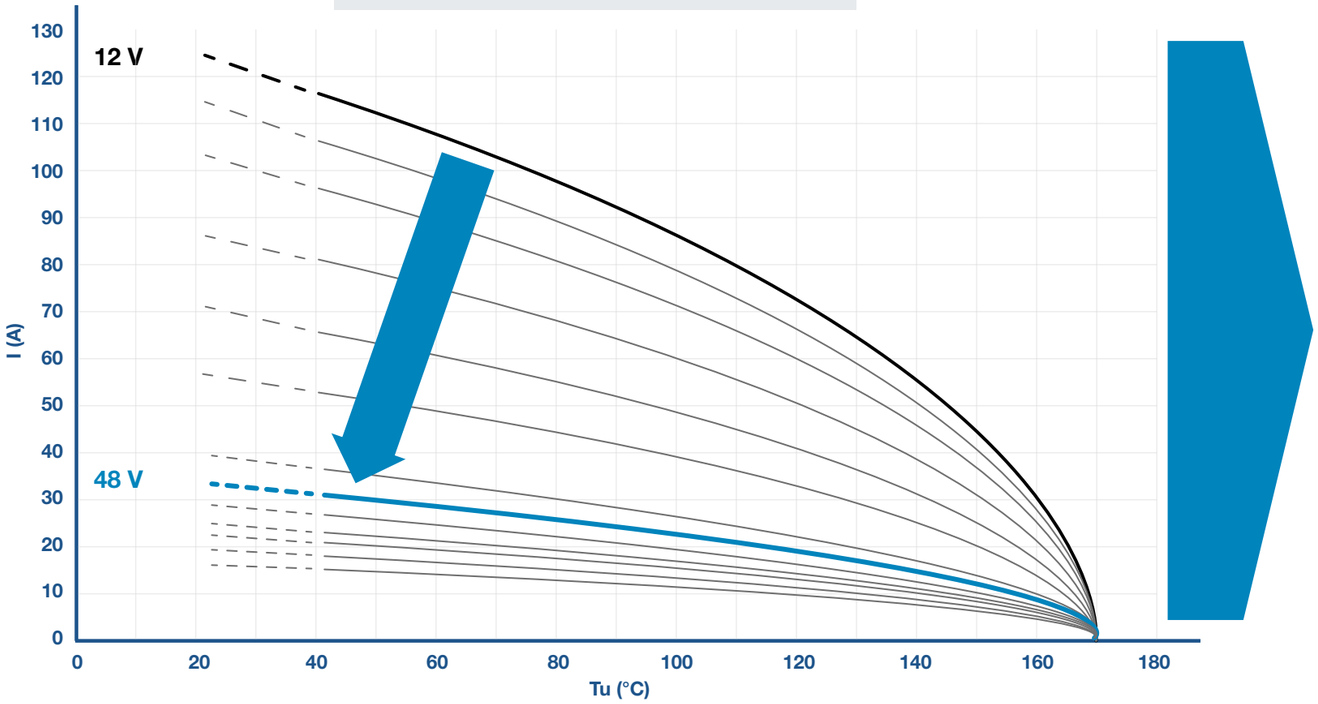
48 V
2.8 mm 2-way

POTENTIAL

Higher performance, lower costs.

Calculation example 12 V compared to 48 V

Receptacle housing 8 mm 2-way
P = 12 V x 96 A = 1152 W → 16 mm²



Wire cross section

- 16.0 mm²
- 12.0 mm²
- 10.0 mm²
- 6.0 mm²
- 4.0 mm²
- 2.5 mm²
- 1.5 mm²
- 1.0 mm²
- 0.75 mm²
- 0.5 mm²
- 0.35 mm²

Receptacle housing 2.8 mm 2-way
P = 1152 W = 48 V x 24 A → 2.5 mm²

12 V I 8 mm 2-way

48 V I 2.8 mm 2-way

The change of the wire cross-section to 2.5 mm² at 48 V instead of 16.0 mm² at 12 V will result in the following significant advantages:

Installation space

- Wire diameter reduction from max. 7 mm to max. 3 mm
- Pitch dimension reduction from 13 mm to 5 mm

Weight

- There is a wire weight reduction of 6 times.
  - Wire FLRY 16 mm²: 171 g per meter
  - Wire FLRY 2.5 mm²: 27 g per meter
  - Wire weight saving with 1 m wire length: 288 g
- There is a connector weight reduction of 4 times.
  - Connector 8 mm 2-way: 26.6 g
  - Connector 2.8 mm 2-way: 6.7 g
  - Connector weight saving: 19.9 g

Costs

- Receptacle housing: The 2.8 mm system is recommended for use in place of the 8 mm system.
- Cost reductions of up to 50 % can be achieved on the entire connector without wire.
- Wire: 2.5 mm² instead of 16.0 mm² technically utilizable

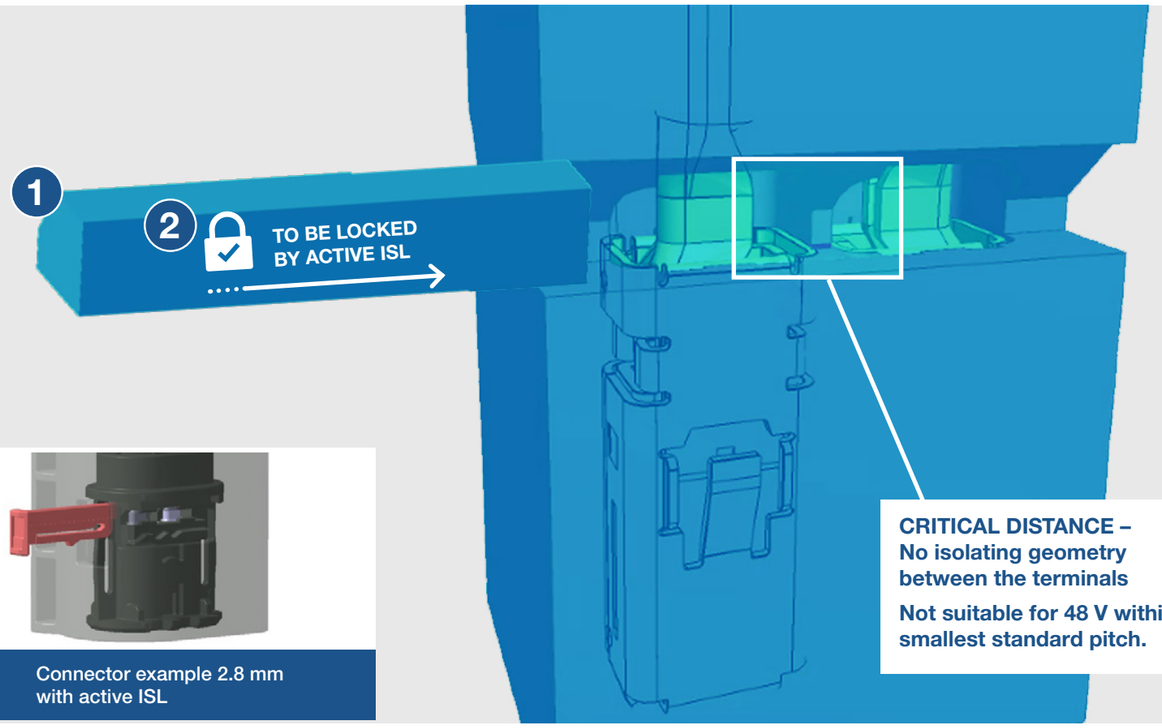
Cost Savings up to 50 %

The smaller design of the components in the shown example saves installation space. The weight of the wire can be reduced by a factor 6. The connector system can also achieve cost savings of up to 50 %.

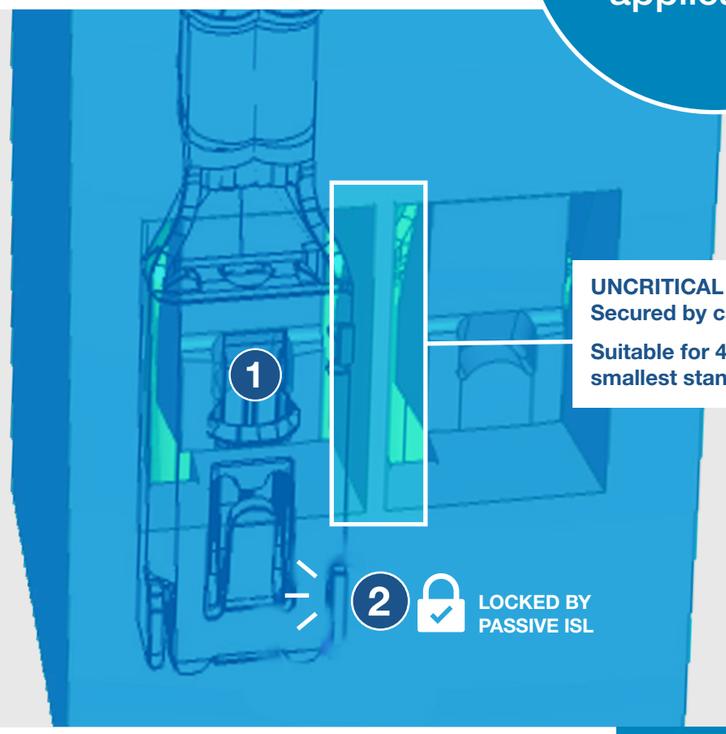
SECURITY ADVANTAGE

Comparison of active and passive Independent Secondary Lock (ISL)

Passive cavity solution for your 48 V application.



Connector example 2.8 mm with active ISL



Connector example 2.8 mm with passive ISL

Market standard solution with active ISL

The active ISL is an additional 1 plastic part (locking device) which has to be closed with linear movement 2 after the terminal is in the final position with locked primary lock.

Example 2-way: The required pitch size for 48 V capability in pollution degree 3 is 6.75 mm instead of 5.5 mm.

Passive ISL

The passive ISL is a molded flap 1 which will close automatically 2 after the terminal is in the final position with locked primary lock.

Example 2-way: The minimal pitch of 5 mm is 48 V capable. Therefore, the pitch is 1.75 mm smaller compared to active ISL.

ADVANTAGES OF PASSIVE ISL

- COMPONENTS
  → One part less
- ASSEMBLY
  → One assembly step less
- PACKAGE
  → Less space required

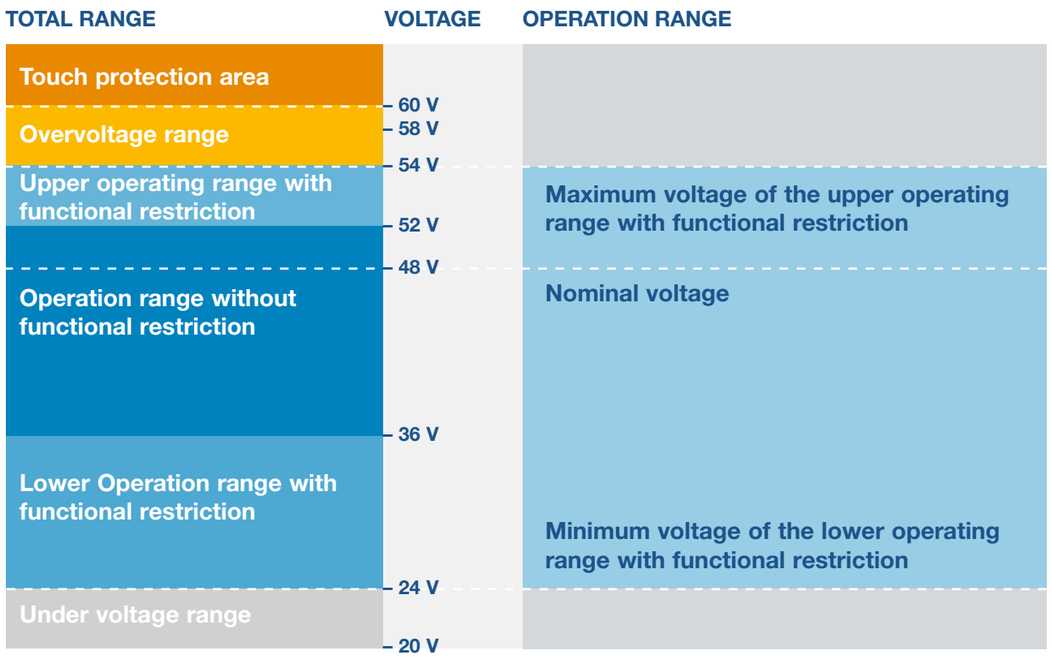
48 V IN APPLICATION

Challenges of 48 V wiring harness architectures

The transition to a 48 V wiring harness presents distinct benefits in terms of performance and efficiency for modern electrification systems. However, this transition also introduces challenges related to complexity and safety requirements for the 48 V architecture.

Safe low-voltage area

The 48 V wiring harness architecture is a low voltage system with a maximum operating voltage below 60 V. The wire harness is safe in terms of electrical shocks and does not require the touch protection as for high voltage connectors.



Challenges

- Arcing
- Interference between 12 V and 48 V systems
- Electrochemical corrosion

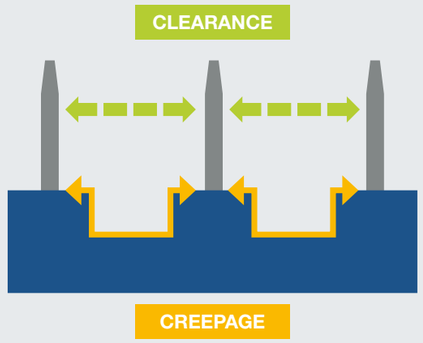
Solutions

- Electronic arc detection, local arc mitigation
- No permanent current during mating and unmating (Proposal: Housing locking features, Terminal locking, CPA)
- Clearance and creepage requirements due to max. 60 V capability acc. to IEC 60664-1 and UL 840

Requirements and evaluation system: IEC 60664-1 and UL 840

Although 48 V is classified as low voltage, there is still a risk of arcing. Therefore, 48 V connectors must comply with the creepage and clearance requirements up to 60 V outlined in IEC 60664-1 or UL 840.

Pollution degree	2		3		4	
Specification	IEC 60664-1	UL 840	IEC 60664-1	UL 840	IEC 60664-1	UL 840
Overvoltage category	II (Rated impulse voltage 0.8 kV)					
Clearance distance (5500 m above NN)	0.318 mm	0.2 mm	1.272 mm	0.8 mm	2.544 mm	1.6 mm
Creepage distance depending on material group	0.63 mm for material group I with 600 ≤ CTI 0.9 mm for material group II with 400 ≤ CTI < 600 1.25 mm for material group III a with 175 ≤ CTI < 400		1.6 mm for material group I with 600 ≤ CTI 1.8 mm for material group II with 400 ≤ CTI < 600 2 mm for material group III a with 175 ≤ CTI < 400		Please get in touch with us for further details: kks_portfolio@kostal.com	



Creepance is the shortest distance along the surface of the insulator.

Clearance is the "line of sight" through air between conductors.

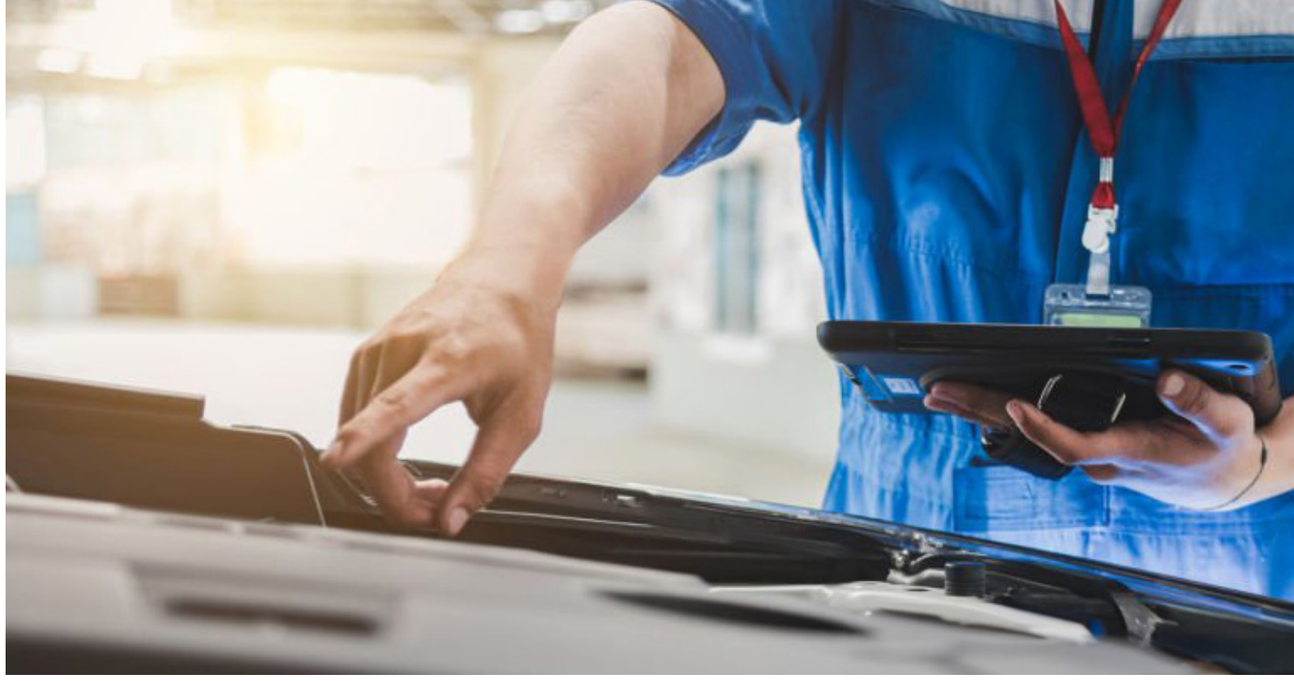
Environment and material properties

- Pollution degree (e.g. according to IEC 60664-1)
- CTI of the housing material (data sheet property)

48 V IN APPLICATION

Safe handling of 48 V in the vehicle

KOSTAL Connectors has extensive experience providing reliable and proven connector solutions to the automotive industry, giving us a thorough understanding of the challenges posed by 48 V systems.



Connector design

Safe terminal position

A secure terminal position should be guaranteed by primary and secondary lock (ISL).

CPA protection

If the correct mating position of the connector on the counterpart cannot be ensured (e.g. camera), it is recommended to use a CPA (Connector Position Assurance). A CPA also prevents the connector system from critical hot unmating if the CPA can be actuated only by a tool (e.g. a screwdriver).

Reliable arc detection

It is possible to use 12 V and 48 V in parallel within a single connectors system. However, it is essential to acknowledge the potential for arcing. Algorithms are employed in the automotive sector to monitor current and voltage signals, thereby averting the occurrence of arcing events.

Labeling

To ensure clear distinction between 48 V and 12 V connectors, particularly in service environments, it is recommended to color the housings blue. However, the blue color is not a requirement, as known from the HV sector for the color orange.

Harness design

Avoid short circuits

It is essential to exercise caution to prevent short circuits. One effective method of doing so is to avoid sharp edges at the chassis in the area where wires are located.

Protection of the voltage levels

It is possible to differentiate between the different voltage levels in the wiring harness by using different wire colors. For instance, some suppliers utilize blue or violet wires for 48 V.

Disconnection for servicing

If servicing is required, the 48 V voltage source must be disconnected.This is standard practice in the automotive sector, but it is particularly crucial at 48 V compared to 12 V.

PORTFOLIO

KOSTAL 48 V Connectors

KOSTAL Connectors offers an extensive 48 V connector portfolio that meets the increasing power requirements of today‘s and future vehicle functions, while also providing cost-effective solutions.

Our portfolio of 48 V connectors with terminal sizes from 1.2 to 22 mm covers common wire size ranges.

VIEW OUR 48 V PRODUCT PORTFOLIO

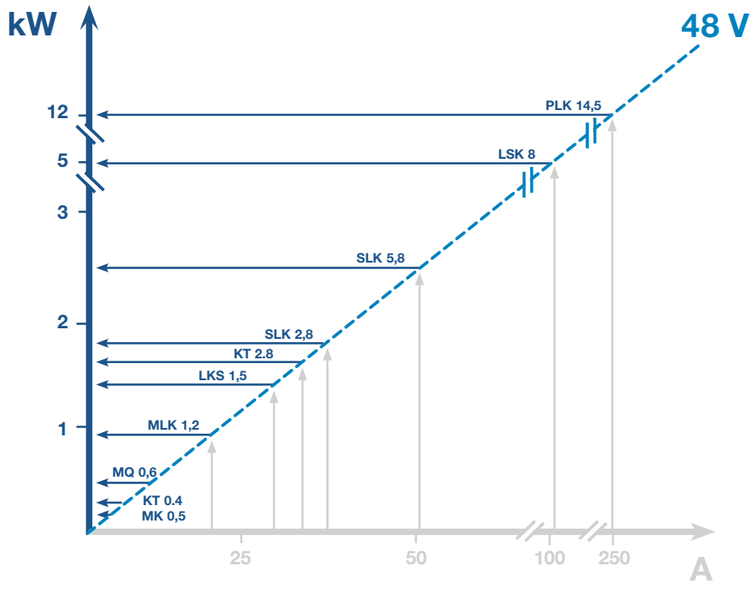
MLK 1,2
2-way

SLK 2,8
2-way

SLK 5,8
2-way

LSK 8
2-way

PLK 14,5
2-way



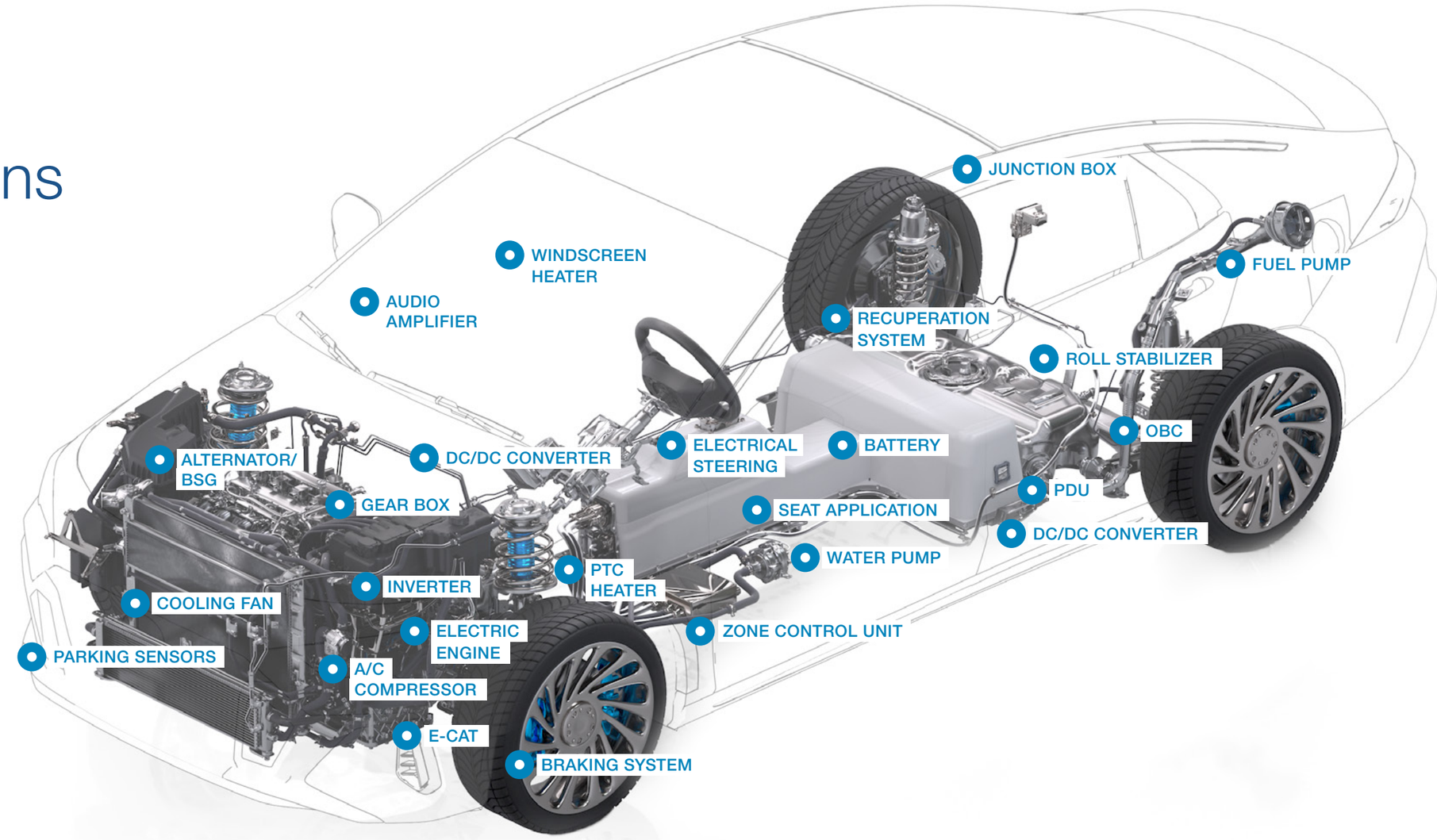
Terminal	Wire size (mm²)	Current (A)*	kW* at 12 V	kW* at 48 V
PLK 14,5	50.0	250	3.0	12.0
LSK 8	16.0	105	1.26	5.04
SLK 5,8	6.0	53	0.636	2.544
SLK 2,8	4.0	37	0.444	1.776
KT 2.8	2.5	34	0.41	1.63
LKS 1,5	2.5	30	0.36	1.44
MLK 1,2	1.5	19	0.228	0.912
MQ 0,6	0.75	8	0.096	0.385
MK 0,5	0.35	3	0.036	0.144
KT 0.4	0.22	4	0.048	0.192

*permanent power at 80 °C

Please select terminal size according needed performance (kW).

PORTFOLIO

In applications



VIEW OUR 48 V PRODUCT PORTFOLIO

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MLK 1,2	LKS 1,5	SLK 2,8	SLK 5,8	LSK 8	PLK 14,5	PLK 14,5 inliner
Application examples						

The most reliable connection for over 85 years

Since 1912, we have been at the forefront of automotive innovation, manufacturing high-quality and reliable connectors that are integral to vehicle applications. As a family-owned German manufacturer with a global presence, we understand the unique challenges faced by automotive manufacturers and offer scalable, tailored solutions.

Our in-house capabilities in injection molding and stamping expertise, along with our dedicated testing laboratories and comprehensive engeneering skills, provide us with a competitive edge.

We are not just suppliers; we are collaborative partners deeply embedded in the automotive community. Our active participation in industry standards and our commitment to openly sharing our extensive expertise foster strong, transparent relationships with our customers.

At our core, we embody movement and are dedicated to delivering the reliability that mobility demands.

WE ARE HERE FOR YOU.
On 9 locations, in 8 countries, on 3 continents.

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kks_portfolio@kostal.com
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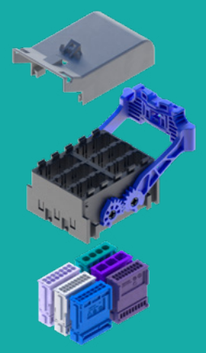
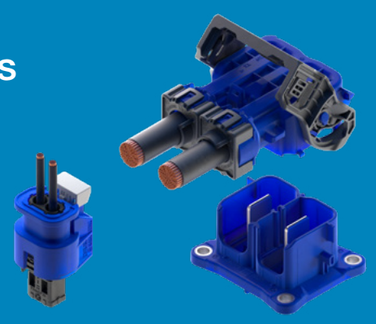
KOSTAL Connectors for your application

Terminals

Low Voltage Connectors



48 V Connectors



Oil Performance Connectors

High Voltage Connectors

KOSTAL

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