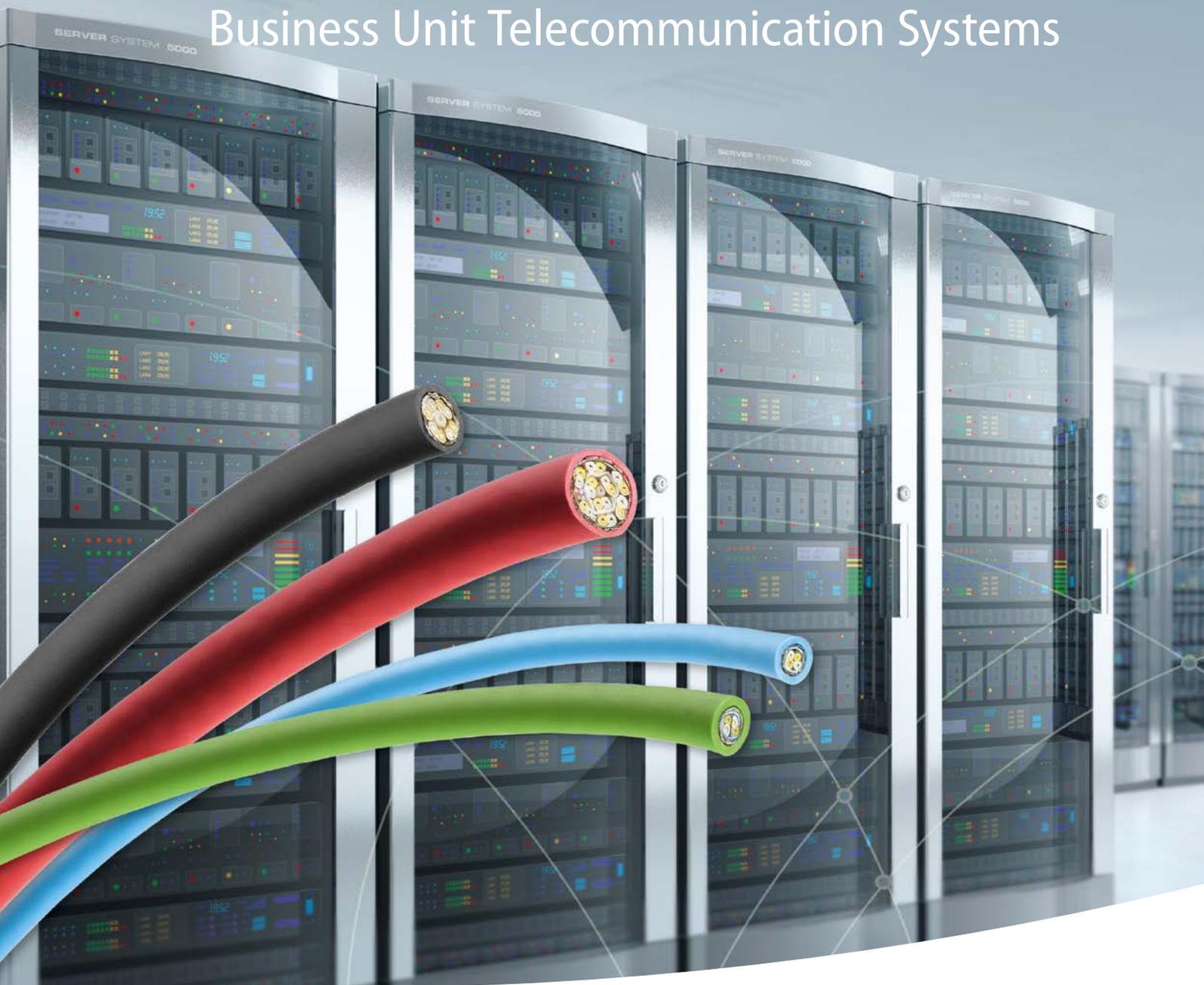


# High Speed Cables for Enterprise Data Solutions Business Unit Telecommunication Systems



**The Quality Connection**

**LEONI**

# The LEONI Group

## Cable competence for different industrial markets



**LEONI is a leading supplier of cable systems and related services for the automotive industry and various other industrial sectors.**

Our group of companies employs more than 65.000 people in 33 countries. Corporate vision, highest quality and innovative power have made us one of the leading cable manufacturers in Europe. LEONI develops and produces technically sophisticated products ranging from wire and optical fibers to cables through to complete cable systems and also offers the related services. Moreover, the product portfolio comprises strands, standardised cables, hybrid cables, glass fiber as well as special cables, cable harnesses, wiring systems components and fully assembled systems for applications in various industrial markets and achieved a group turnover of EUR 3.92 bn in 2013.

### Your markets – our strength.

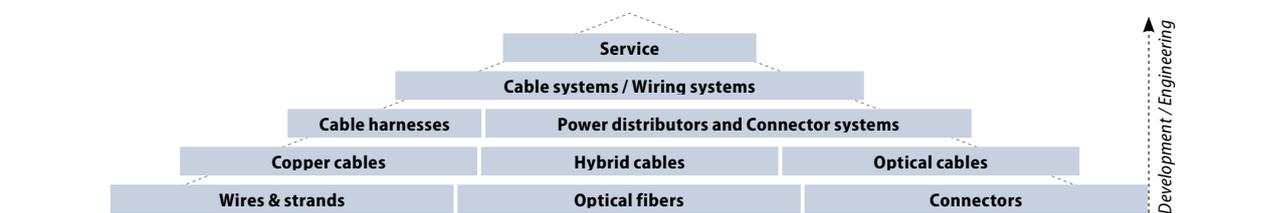
As diverse as our product and service range are the markets and sectors LEONI is supplying. We focus our activities on customers in the fields of Automotive & Commercial Vehicles, Industry & Healthcare, Communication & Infrastructure, Electrical Appliances and Conductors & Copper Solutions.

We are among the leading European suppliers in the Industry & Healthcare market to which at LEONI as a cable manufacturer also belong activities in the fields of telecommunication systems, fiber optics, industrial solutions and healthcare. Our customers benefit worldwide from innovative as well as reliable and long-lasting products of high quality.

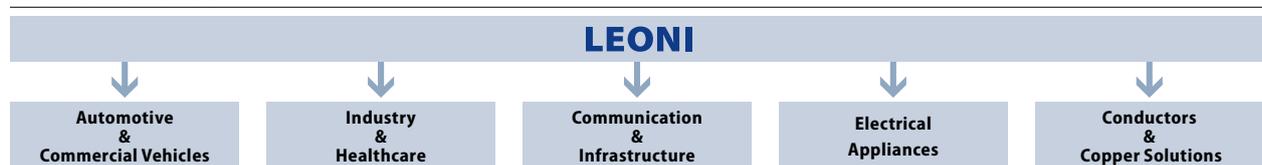
**LEONI – we create the best connection for your future.**

For further information [www.leoni.com](http://www.leoni.com)

## Products and services portfolio at a glance



## LEONI's core markets



# Business Unit Telecommunication Systems

## Securing high speeds



With an extensive product portfolio and excellent technical expertise, LEONI has over 30 years of experience in meeting the constant demand for more bandwidth and faster speeds in telecommunications. Our high-quality cable and connection technologies are the high-performance components for your transmission channels across the globe.

In close cooperation with our partners, we develop and manufacture cables and cable assemblies that are perfectly suited to your purposes in core, microwave and mobile phone technology. Our high speed cables for data centres currently offer transmission speeds of more than 25 Gb/s per pair, using copper. Requests for longer lengths can be realised using optical engines. Our high speed cables and connector systems (proprietary PCBs) are perfectly harmonised with each other and therefore form a secure cable system for reliable data transmission.

Irrespective of the application:

**We will transfer your data securely and at high speeds!**

Our ParaLink high speed copper cables correspond to up to date data centre cabling requirements and on its latest standards, such as Ethernet Alliance, SFF specifications and Infini-Band. They will be highlighted in this catalogue. Feel free to contact our sales team if you are looking for further information on a product or any other system solution to suit your special application. We are happy to provide you perfect cable or cable system solutions!

### Contents

Applications and products	4
Advantages, benefits and technologies	6
<b>ParaLink® 23</b> up to 26 GHz operations	8
<b>ParaLink® 14</b> up to 14 GHz operations	9
<b>ParaLink® 11+</b> up to 10 GHz operations	10
<b>ParaLink® 5</b> up to 5 GHz operations	11
<b>ParaLink® hybrid and customised solutions</b>	12
Testing capabilities	14
The Quality Connection worldwide	15

Issue 10/2014

# Applications and products

## High speed cables for a rapidly changing world

### Core networks



- High frequency cables
- Switchboard cables
- Data cables
- Power cables
- Fibre optic cables
- Patch cables

### Distributing box



- High frequency cables
- Switchboard cables
- Data cables
- Power cables
- Fiber optic cables

### Audio video conferencing



- High speed cables and cable systems
- Switchboard cables
- Data cables
- Coaxial cables
- Multi coaxial cables
- Power cables
- Hybrid cables
- Fiber optic cables
- Patch cables

### Wireless indoor solutions



- Coaxial cables
- Power cables
- Hybrid cables
- Fiber optic cables
- Jumper cables
- Accessories\*

### Local exchange



- High speed cables and cable systems
- High frequency cables
- Data cables
- Power cables
- Fiber optic cables
- Patch cables

### Supercomputing



- High speed cables and cable systems
- Data cables
- Power cables
- Fiber optic cables
- Patch cables

### Internet exchange server



- High speed cables and cable systems
- Data cables
- Power cables
- Fiber optic cables
- Patch cables

### Server farms



- High speed cables and cable systems
- Data cables
- Power cables
- Fiber optic cables
- Patch cables

### Cloud computing



- High speed cables and cable systems
- Data cables
- Power cables
- Fiber optic cables
- Patch cables

### Microwave applications



- Coaxial cables
- Power cables
- Hybrid cables
- Fiber optic cables
- Jumper cables
- Accessories\*

### MSC (Mobile switching centre)



- High speed cables and cable systems
- Data cables
- Power cables
- Fiber optic cables
- Patch cables

### Aviation



- Cables and system solutions

### Mobile networks



- Coaxial cables
- Multi coaxial cables
- Power cables
- Hybrid cables
- Fiber optic cables
- Jumper cables
- Accessories\*

### Space aviation

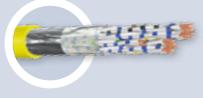


- Cables and system solutions according to ESCC standard

**ParaLink® High speed cables**



**High frequency cables 120/135 Ω**



**SFP+ High speed cable systems**



**QSFP+ High speed cable systems**



**CXP High speed cable systems**



**Switchboard cables**



**Data cables**



**Patch cables**



**Fiber optic cables and systems**



**Hybrid cables**



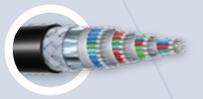
**FlexLine® Coaxial cables**



**Jumper cables**



**Multi coaxial cables**



**Power cables**



**Wires / Strands**



**Aerospace cables**





1 Optimised signal integrity

2 Easy termination

3 Diameter-optimisation

4 Superior safety and mechanical performance

# ParaLink® cables

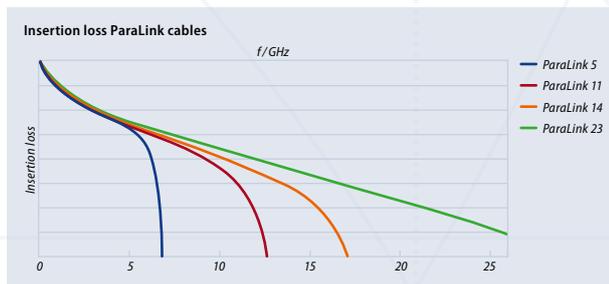
## Advantages, benefits and technologies

Many years of experience in cable manufacturing and technical expertise have driven our cable developments to ever exceeding high speed transmission levels. The manufacturing process control and extensive electrical, thermal and mechanical testing in our engineering and manufacturing plant make the formula for standard and customised high speed cables.

Our ParaLink cables meet your requirements in:

### 1. Optimised signal integrity

- technical expertise leads to suck-out free frequency ranges up to 26 GHz, as well as excellent XT and shielding performance
- insertion loss 15 – 20% improvement in different frequency ranges with an insertion loss variation (ILV) of +/- 5%
- shielding effectiveness (EMC) up to 90 dB

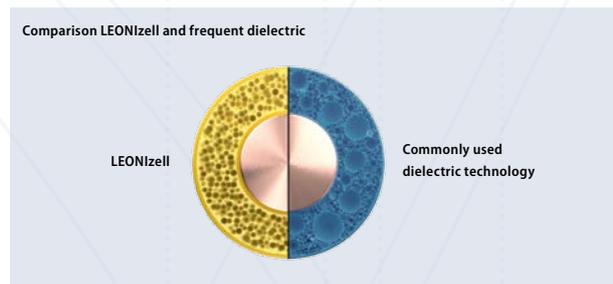


### 2. Easy termination

- colour coding enables orientation of the conductors within the pair
- maximum adhesion of the isolation to the inner conductor minimises shrink back effects of the dielectric

### 3. Diameter-optimisation

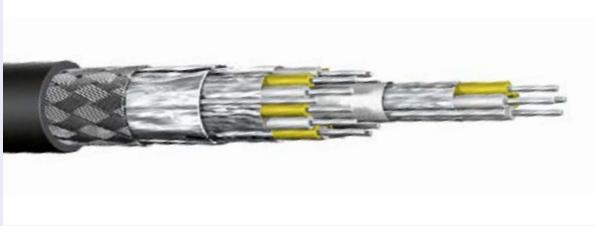
- availability in a range of AWG sizes (24, 26, 28, 30, 32, ...)
- the LEONIZell unique skin-foam-skin dielectric technology offers a very rugged and stable mechanical structure



### 4. Superior safety and mechanical performance

- excellent characteristics of low smoke, low toxicity and low corrosion with halogen free and flame retardant outer jackets (LSZH), also according to RoHS II and CE-guidelines
- availability with UL-certification according to National Electrical Code (NEC) for in-building solutions
- certification according to UL13 type CL2 (UL1685 vertical tray flame test UL version) and CSA class 5731 83 (UL1685 FT4 flame test CSA version)
- availability with UL-recognition according to UL 758 AWM for internal and external use (interconnection of electrical equipment)
- resistance to multiple flexure over a small bending radius due to extreme durability of special materials used and a unique cable geometry

# ParaLink® 23



- swept performance up to 26 GHz
- pair drain position: dual drain pair design
- longitudinally pair shielding
- also available as “no drain”-version with optimised outer diameter
- different jacket colour options



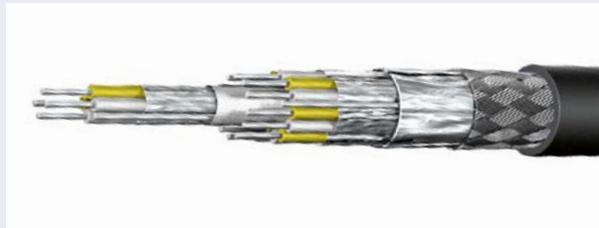
AWG	Single Pair	1x	2x	4x
30	L45468-J112-C60	L45468-J12-C855 (PVC) L45468-J12-C856 (LSZH)	L45468-J212-C855 (PVC) L45468-J212-C856 (LSZH)	L45468-J412-C855 (PVC) L45468-J412-C856 (LSZH)
28	L45468-J113-C60	L45468-J13-C855 (PVC) L45468-J13-C856 (LSZH)	L45468-J213-C855 (PVC) L45468-J213-C856 (LSZH)	L45468-J413-C855 (PVC) L45468-J413-C856 (LSZH)
26	L45468-J114-C60	L45468-J14-C855 (PVC) L45468-J14-C856 (LSZH)	L45468-J214-C855 (PVC) L45468-J214-C856 (LSZH)	L45468-J414-C855 (PVC) L45468-J414-C856 (LSZH)
25			L45468-J214-C955 (PVC) L45468-J214-C956 (LSZH)	L45468-J414-C955 (PVC) L45468-J414-C956 (LSZH)
24	L45468-J115-C60	L45468-J15-C855 (PVC) L45468-J15-C856 (LSZH)	L45468-J215-C855 (PVC) L45468-J215-C856 (LSZH)	L45468-J415-C855 (PVC) L45468-J415-C856 (LSZH)

## Applications



# ParaLink® 14

- swept performance up to 14 GHz
- pair drain position: centre drain design
- spiral wrapped pair shielding
- optimised insertion loss variation (ILV) of +/- 5%
- different jacket colour options

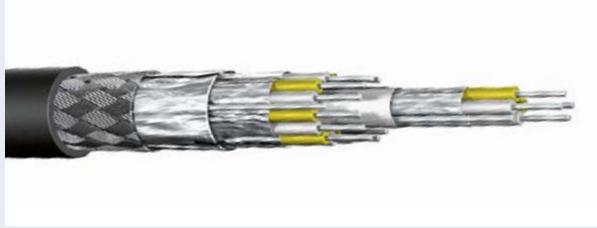


AWG	1x	2x	4x
30	L45468-J12-C395 (PVC) L45468-J12-C396 (LSZH)	L45468-J212-C395 (PVC) L45468-J212-C396 (LSZH)	L45468-J412-C395 (PVC) L45468-J412-C396 (LSZH)
28	L45468-J13-C395 (PVC) L45468-J13-C396 (LSZH)	L45468-J213-C395 (PVC) L45468-J213-C396 (LSZH)	L45468-J413-C395 (PVC) L45468-J413-C396 (LSZH)
26	L45468-J14-C395 (PVC) L45468-J14-C396 (LSZH)	L45468-J214-C395 (PVC) L45468-J214-C396 (LSZH)	L45468-J414-C395 (PVC) L45468-J414-C396 (LSZH)
25	L45468-J14-C695 (PVC) L45468-J14-C696 (LSZH)	L45468-J214-C695 (PVC) L45468-J214-C696 (LSZH)	L45468-J414-C695 (PVC) L45468-J414-C696 (LSZH)

## Applications



# ParaLink® 11+



- swept performance up to 10 GHz
- pair drain position: centre drain design
- spiral wrapped pair shielding
- optimised insertion loss variation (ILV) of +/- 5 %
- available AWG 32 pair design, enabling small outer diameter and bending radius
- different jacket colour options



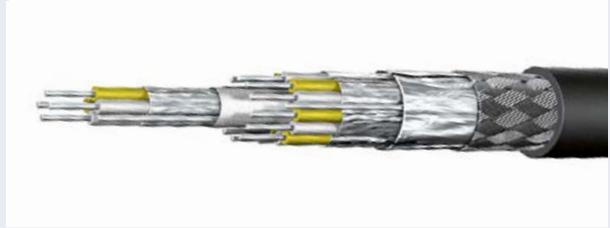
AWG	1x	2x	4x	12x
32	L45468-J11-C445 (PVC) L45468-J11-C446 (LSZH)	L45468-J211-C445 (PVC) L45468-J211-C446 (LSZH)	L45468-J411-C445 (PVC) L45468-J411-C446 (LSZH)	L45468-J1211-C445 (PVC) L45468-J1211-C446 (LSZH)
30	L45468-J12-C445 (PVC) L45468-J12-C446 (LSZH)	L45468-J212-C445 (PVC) L45468-J212-C446 (LSZH)	L45468-J412-C445 (PVC) L45468-J412-C446 (LSZH)	L45468-J1212-C445 (PVC) L45468-J1212-C446 (LSZH)
28	L45468-J13-C445 (PVC) L45468-J13-C446 (LSZH)	L45468-J213-C445 (PVC) L45468-J213-C446 (LSZH)	L45468-J413-C445 (PVC) L45468-J413-C446 (LSZH)	L45468-J1213-C445 (PVC) L45468-J1213-C446 (LSZH)
26	L45468-J14-C445 (PVC) L45468-J14-C446 (LSZH)	L45468-J214-C445 (PVC) L45468-J214-C446 (LSZH)	L45468-J414-C445 (PVC) L45468-J414-C446 (LSZH)	L45468-J1214-C445 (PVC) L45468-J1214-C446 (LSZH)
25	L45468-J14-C425 (PVC) L45468-J14-C426 (LSZH)	L45468-J214-C425 (PVC) L45468-J214-C426 (LSZH)	L45468-J414-C425 (PVC) L45468-J414-C426 (LSZH)	
24	L45468-J15-C445 (PVC) L45468-J15-C446 (LSZH)	L45468-J215-C445 (PVC) L45468-J215-C446 (LSZH)	L45468-J415-C445 (PVC) L45468-J415-C446 (LSZH)	

## Applications



# ParaLink® 5

- swept performance up to 5 GHz
- pair drain position: centre drain design
- spiral wrapped pair shielding
- different jacket colour options



AWG	1x	4x
30	L45468-J12-C25 (PVC) L45468-J12-C26 (LSZH)	L45468-J412-C15 (PVC) L45468-J412-C16 (LSZH)
28	L45468-J13-C25 (PVC) L45468-J13-C26 (LSZH)	L45468-J413-C15 (PVC) L45468-J413-C16 (LSZH)
26	L45468-J14-C75 (PVC) L45468-J14-C76 (LSZH)	L45468-J414-C115 (PVC) L45468-J414-C116 (LSZH)
24	L45468-J15-C45 (PVC) L45468-J15-C46 (LSZH)	L45468-J415-C25 (PVC) L45468-J415-C26 (LSZH)

## Applications



# Hybrid and customised solutions

## Hybrid cable

- combination of high frequency data pairs with different low frequency signal wires
- customised cable layout and pair or wire count possible



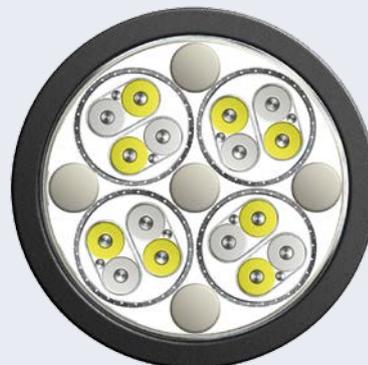
## Single pair cables

- available in different drain wire options:  
Dual side drains or centre drain
- wrapped pair shield design  
and longitudinal design possible
- impedance 85, 90 and 100 ohm
- frequency range up to 22 GHz implemented
- if required single pairs available with jacket



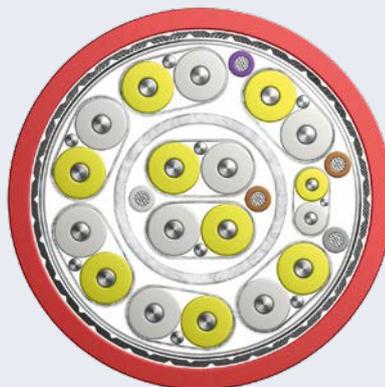
## Breakout cable

- joining 4x SFP+ cables (2 data pairs) in one cable
- available in AWG 30 and 28
- customised jacket printing and jacket colour possible



## PCI-Express cables

- cable can be designed for applicable PCI generation  
PCI GEN2, GEN3
- available in different AWG sizes
- customised jacket printing and jacket colour possible



LEONI is able to offer an unlimited scope of customised and hybrid cable solutions for demanding high speed applications. Any cable construction is possible, e.g. with differing AWG sizes, numbers of pairs, form factors, lengths, colours, including further single wires or in a single pair version in 150, 120, 100, 90 and 85 Ohm.

Just let us know – and we'll design your individual cable!

# Extensive testing capabilities

In order to make good on our company claim and motto „LEONI – The Quality Connection“, we are continuously investing in our testing instrumentation. The performance and reliability of our cables and cable systems are tested in an extensive range of processes. Additional customer-specific testing and measuring systems can be integrated upon request.

## Electrical testing

In order to test and verify the performance parameters of our high speed cables and cable systems, they are subjected to rigorous tests in our own high speed laboratory. Measurements such as insertion and return loss, mode conversion, skew, time delay, etc. of up to 50 GHz are possible.



Tektronix® PPG3202 Pattern Generator appears courtesy of Tektronix. Tektronix® is a registered trademark.

## Mechanical & thermal testing

Besides numerous testing throughout the production process, our cables and cable systems are exposed to precise visual measurement of all their components after manufacturing. Their long-term behaviour under specified conditions is tested in numerous temperature and ageing tests, as well as several mechanical tests assure their tensile strength. As for our cable systems, additional insertion tests to determine their mating cycles and forces are executed.



## Longterm enduring testing

Drag chain, torsion, bending and torsional bending tests are conducted in our own test centre to verify our cables' longevity. Our drag chain test systems have different traverse paths, accelerations and movement speeds. The torsion and torsional bending machines subject our cables to a torsional movement of up to  $\pm 360^\circ$  in lengths of 0.3 to 1.0 m (0.98 to 3.28 ft). Our bending test systems have rolls with diameters of 20 to 250 mm (0.79 to 9.84 in) to proof our cables resistance with different bending radii.



# The Quality Connection – worldwide

## Quality

The outstanding quality and reliability of our products and solutions make our name a brand. With these attributes we are setting standards across the global market. Our quality management system is DIN ISO 9001 certified and parts of it have even been DIN EN 9100 certified. They are being constantly monitored. For the manufacture and sale of products for the North American market we are able to apply over 700 different UL-styles.

## Environment

Business success and environmental responsibility are not a contradiction in terms for us. Environmental protection is consequently a mandatory element of our business activity. Our environmental management system is DIN ISO 14001 certified, which guarantees that our environmental policy is being implemented effectively.

## Energy

Sustainable action will secure the future of our company. In line of economic, environmental and social requirements, we take our social responsibility. We are committed to the continual improvement of energy efficiency and sustainable resource utilisation (DIN ISO 50001).



**USA**  
**LEONI Cables & Systems LLC**  
 San Jose  
 Phone +1 408-914-2270

**Germany**  
**LEONI Special Cables GmbH**  
 Friesoythe  
 Phone +49 4491-291-5060

**Singapore**  
**LEONI (SEA) Pte. Ltd.**  
 Singapore  
 Phone +65 6844-8722

**China**  
**LEONI Cable (China) Co., Ltd.**  
 Shanghai  
 Phone +86 (0)21-623 75 569

Please find your sales contact at [www.leoni-telecom.com](http://www.leoni-telecom.com)

Find out more:

## **Business Unit Telecommunication Systems**

[www.leoni-telecom.com](http://www.leoni-telecom.com)

### **LEONI Special Cables GmbH**

Eschstrasse 1

26169 Friesoythe

Germany

Phone +49 (0)4491-291-5060

Fax +49 (0)4491-291-5061

E-mail [telecom@leoni.com](mailto:telecom@leoni.com)