Single Pair Ethernet

Choosing the right connectivity for your application

Single Pair Ethernet Technology Days 2020

Single Pair Ethernet
System Alliance

Strong partners for the next generation of Ethernet - SPE

Phoenix Contact

A world market leader in industrial connection technology and automation.

Verena Neuhaus

Product Management
Field Device Connectors

Two wires – unlimited opportunities

Single Pair Ethernet (SPE) is one of the megatrends in industrial data transmission. SPE deliberately does not define new transmission speeds and distances, but forms the normative framework for reduced cabling in line with the application. Together with other new technologies such as TSN, OPC-UA or 5G, SPE enables both continuous IP communication between the server and the cloud, as well as the power supply in complex IIoT solutions.

Weidmüller

We are your experts for the best connections in Industrial Connectivity
Let's connect

Simon Seereiner

Head of Product Management IE & SAI

Smart connections from the sensor to the future

In the factory of the future, machines and systems will be connected via a digital infrastructure. The result are cyberphysical systems that communicate in real time as independent actors in the Industrial Internet of Things (IIoT) and control production processes. In order to achieve this, a future-proof combination of two disciplines is required: automation and digitalization. Weidmüller believes that Single Pair Ethernet is the Backbone Infrastructure of these two disciplines.

The SPE product range for the market launch Q4 2020

IEC 63171-2

IP 20 connector

IP 20 socket

IEC 63171-5

IP 67 M8 connector

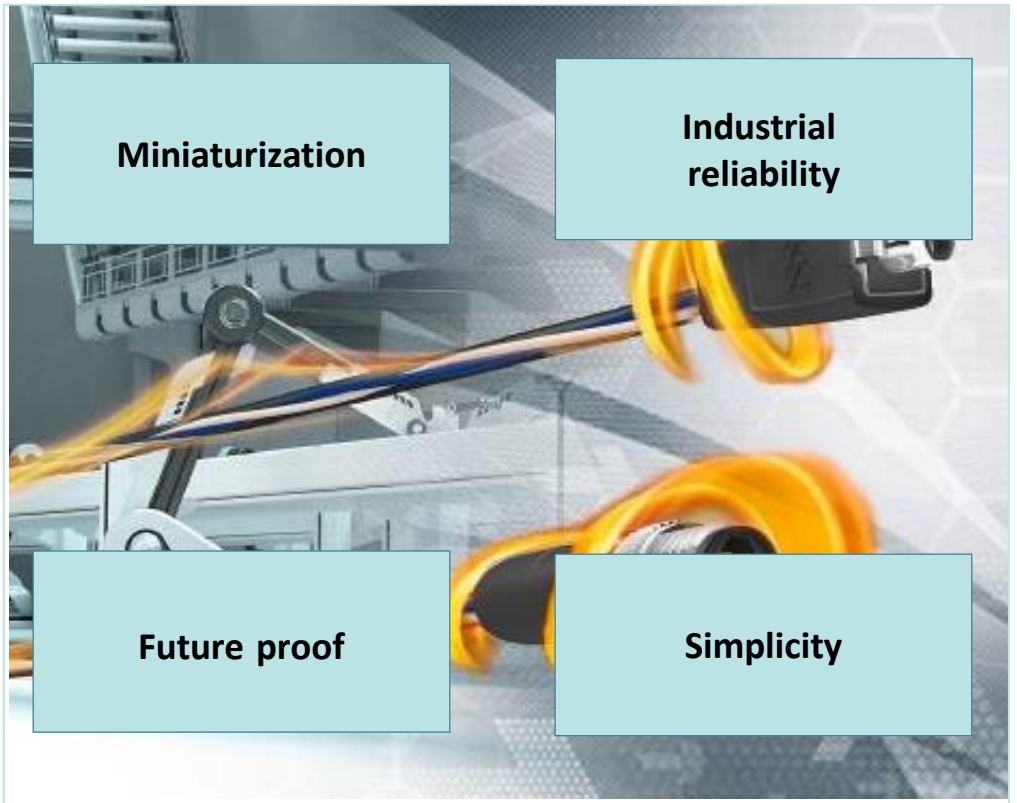
IP 67 M8 socket

Market requirements for SPE connection technology (FA / BA)

Analysis of the market requirements profile

Market research

- Small installation space for the connection technology in the devices
- Industrial contact and locking system
- Consistency of the mating face from IP20 to IP67
- Flexibility and variance of existing cabling systems is the benchmark
- Future-proof transfer rates
- One mating face, no parallel systems



Benefit argumentation SPE connector system

Miniaturization

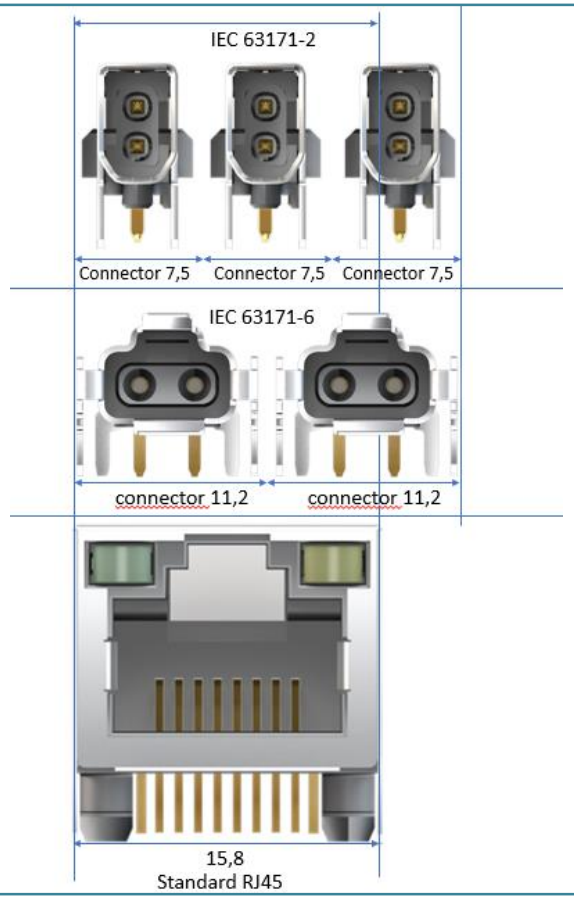
1. Most compact industrial SPE Interface
2. High packing density 50% of the installation space of standard RJ45
3. Integration in standard M8 housing and connector

Benefit argumentation

Miniaturization: most compact mating face

1. Most compact industrial SPE Interface
2. High packing density 50% of the installation space of standard RJ45
3. Integration in standard M8 housing and connector

- Smallest mating face compared to all other industrial versions standardized in IEC 63171
- Approx. 38% more compact compared to IEC 63171-6 IP 20 design (Harting)



Benefit argumentation

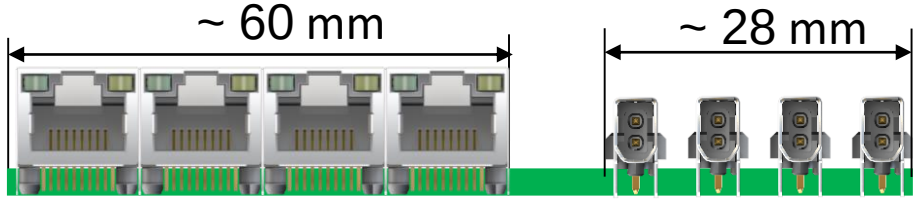
Miniaturization: High packing density

1 Most compact industrial SPE Interface

2 High packing density 50% of the installation space of standard RJ45

3 Integration in standard M8 housing and connector

- Double the packing density compared to RJ45
- Doubling the number of interfaces while maintaining the housing contour
- Requires minimum installation space in the device. Only 20% of the volume of an RJ45 jack



Benefit argumentation

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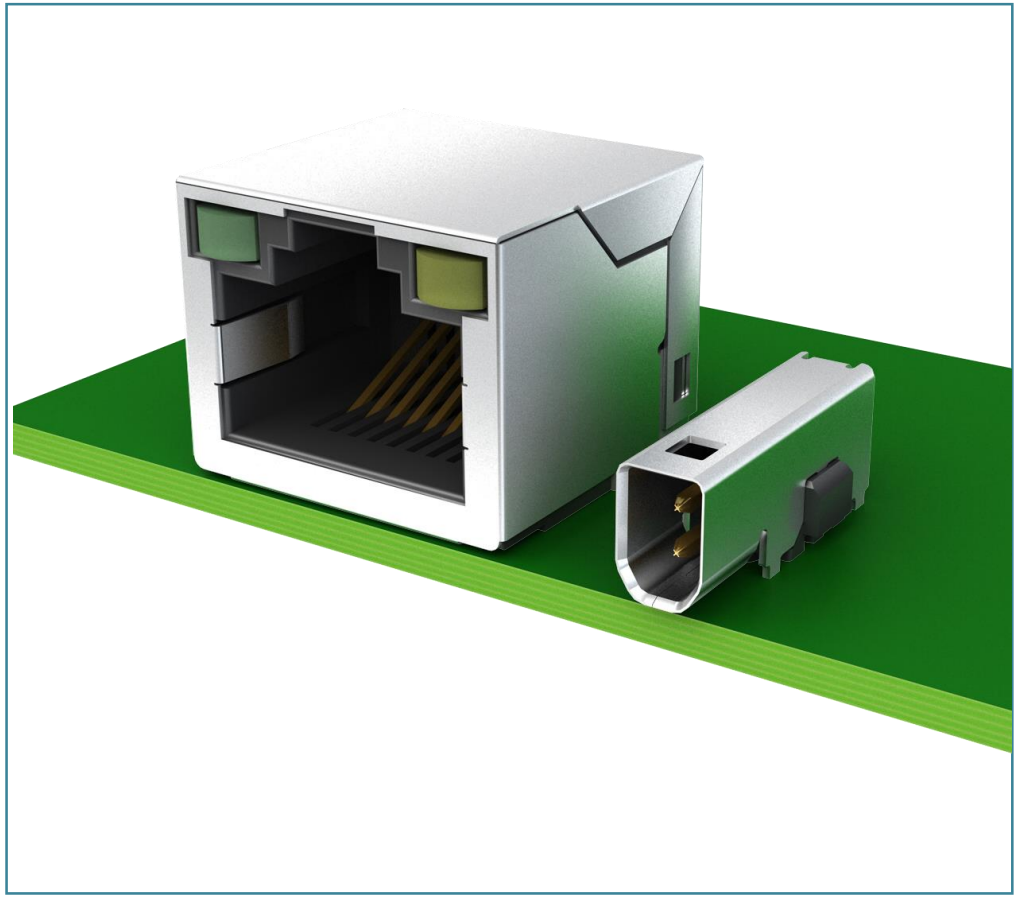

Benefit argumentation

Miniaturization: Integration in standard M8

1. Most compact industrial SPE Interface
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3. **Integration in standard M8 housing and connector**

- Pre-assembled patch cables and field attachable M8 connectors
- Standard M8 cabling as for I/O Link or PROFINET
- Wide variety of sockets with male and female contacts

I/O Link
230KBit/s

PROFINET
100 MBit/s

SPE
1 Gbit/s

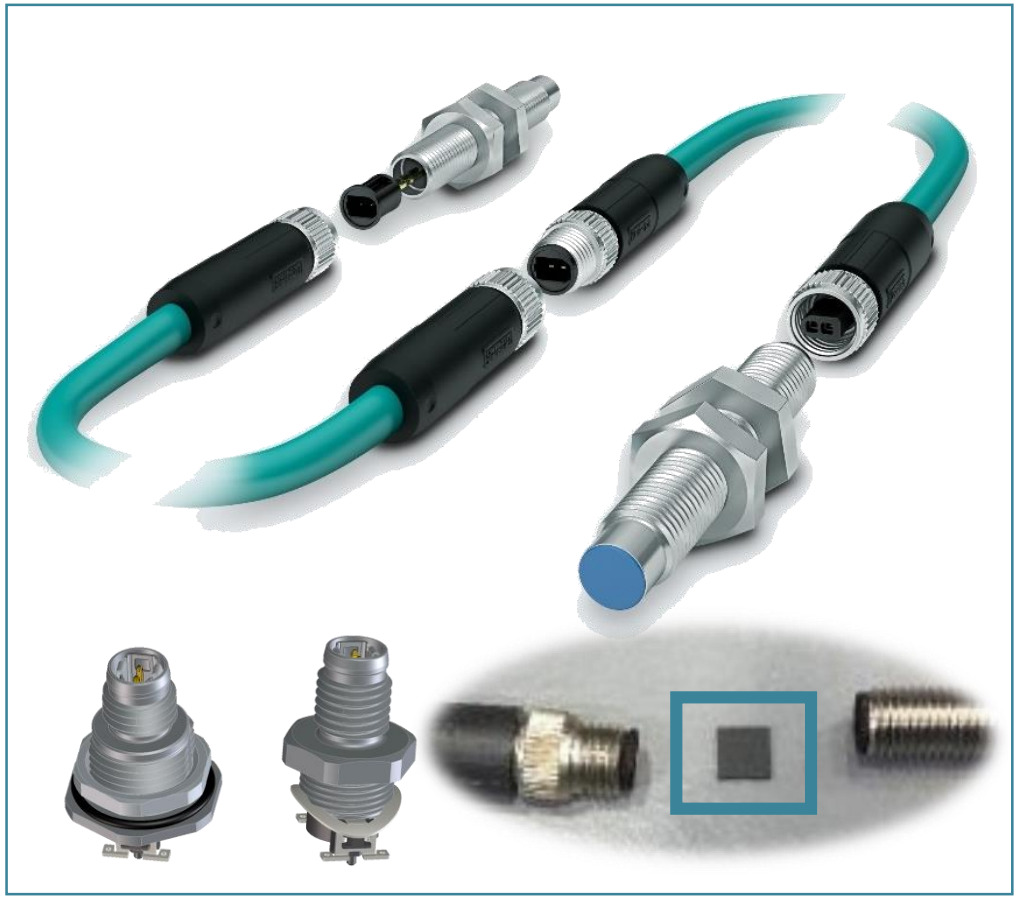
	Plug – Connector (free)		Devce Connector (fixed)	
	Inner - thread	Outer - thread	Inner - thread	Outer - thread
Plug Contact	✓	✓	✓	✓
Socket Contact	✓	✓	✓	✓

Benefit argumentation

Miniaturization: Integration in standard M8

1. Most compact mating face of the IEC 63171
2. High packing density 50% of the installation space of standard RJ45
3. **Integration in standard M8 housing and connector**

- Connectors with male and female contacts
- Front and rear wall mounting possible with male and female contacts
- Easy M8 Sensor integration
- Inverse M8 System possible (PoDL coding)



Benefit argumentation

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Benefit argumentation SPE connector system

Industrial reliability

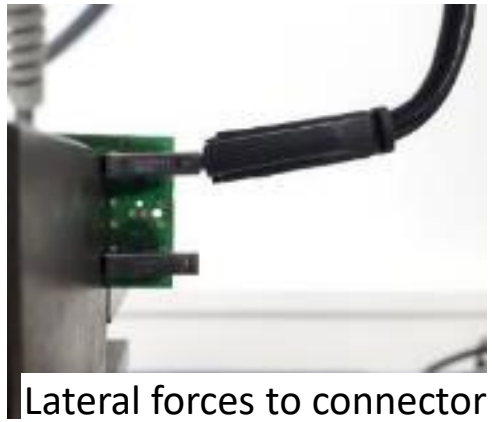
1. Mechanical robustness
2. Vibration safety
3. EMC compatibility
4. Industrial environment

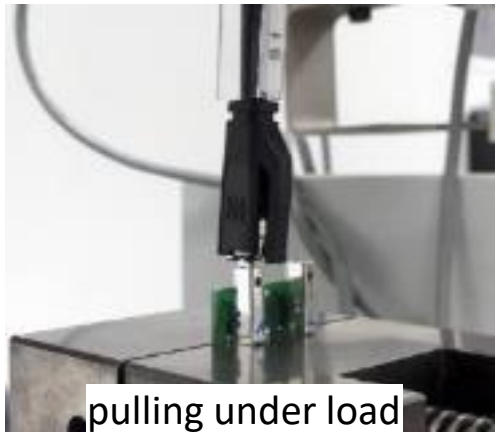
Benefit argumentation

Industrial reliability : Mechanical robustness

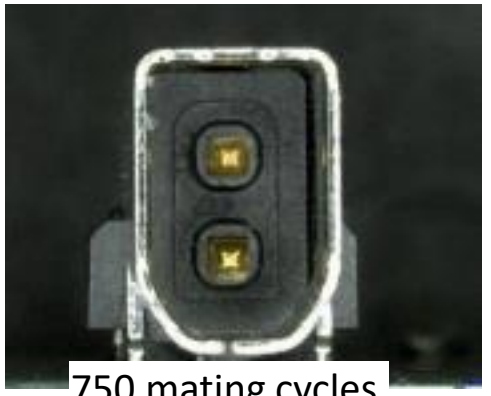
1. Mechanical robustness
2. Vibration safety
3. EMC compatibility
4. Industrial environment

- Flexion test according to IEC 60998-2-2 (20 N 150 rpm no contact break)(4.50 lbf)
- Lateral force protection transverse to the plug-in axis (latching holds)
- Locking > 50N (11.25 lbf)
- 750 mating cycles according to IEC 60512-9-1


Lateral forces to connector


pulling under load


mismating protection


750 mating cycles

Benefit argumentation

Industrial reliability: vibration safety

1 Mechanical robustness

2 Vibration safety

3 EMC compatibility

4 Industrial environment

- Shock IEC 60068-2-27 (40G 11ms 3 axes)
- Vibration IEC 60068-2-6 (5G 10-500 Hz 3 axes)
- Same IEC Vibration standards as for RJ45 and M8 or M12
- Rail and GL tests in preparation

Benefit argumentation

Industrial reliability: EMC compatibility

1 Mechanical robustness

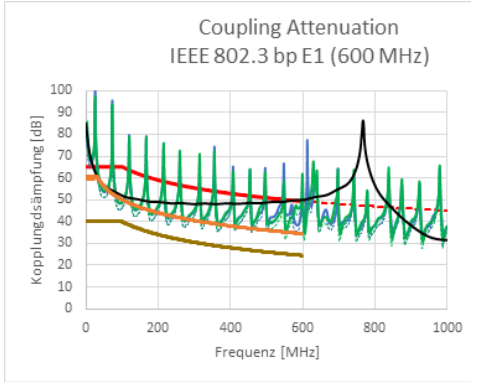
2 Vibration safety

3 EMC compatibility

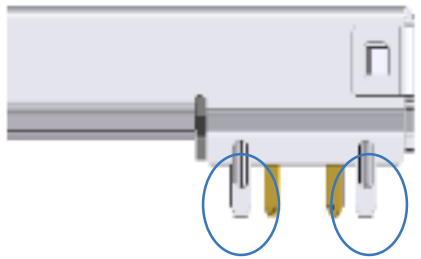
4 Industrial environment

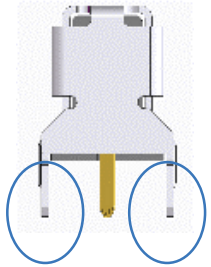
- Compliance of IP 20 connector with coupling attenuation according to MICE E_1 at 600 MHz. (802.3 bp / GigaBit)
- Additional burst test according to IEC 61000-6-2
- Optimal shield connection on the guide plate due to 4 symmetrical legs

Coupling attenuation



Channel-Test





Benefit argumentation

Industrial reliability: Industrial environment

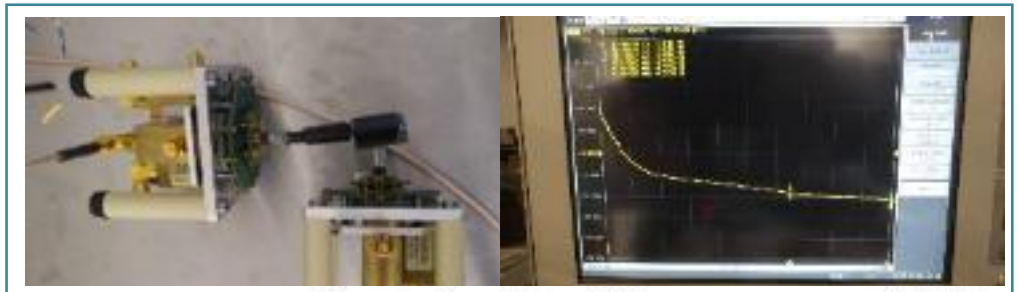
1 Mechanical robustness

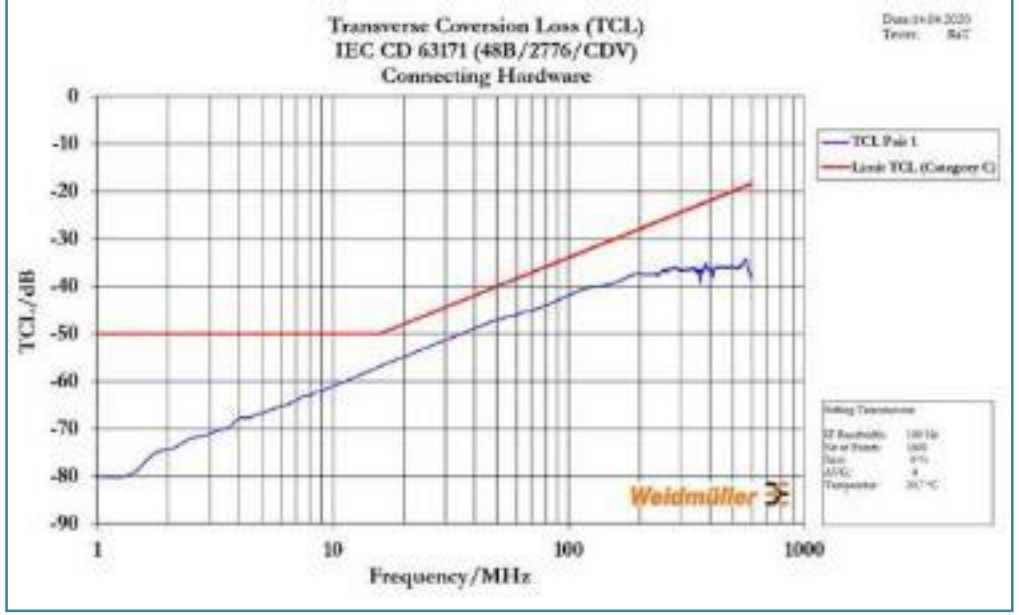
2 Vibration safety

3 EMC compatibility

4 Industrial environment

- PCB connectors suitable for pollution degree 2
- Overvoltage according IEEE 802.3cr = 2.25 kV
- Not susceptible to failure due to optimum TCL properties
- Optimal 100 Ohm System per Design





Benefit argumentation SPE connector system

Simplicity

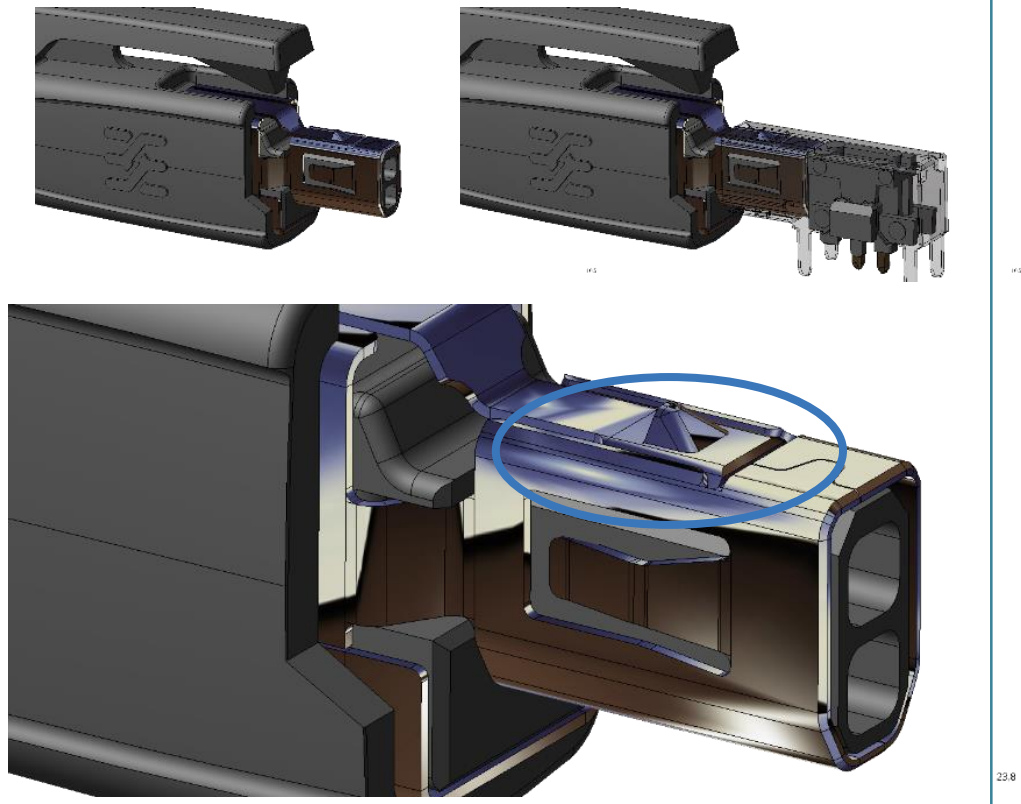
1. Snap-in hook lock
2. Tool-less IDC Connection in the field
3. Same mating face for IP 20 and IP 67 connectors

Benefit argumentation

Simplicity: Locking mechanism

1. Snap-in hook lock
2. Tool-less IDC Connection in the field
3. Same mating face for IP 20 and IP 67 connectors

- Industrial design metal snap-in hook locking mechanism plug and socket
- Same locking and unlocking haptics as standard RJ45
- Min. locking force > 50N
- Unlocks at certain force to protect the socket



Benefit argumentation

Simplicity: Tool-free IDC connection

1 Snap-in hook lock

2 Tool-less IDC Connection in the field

3 Same mating face for IP 20 and IP 67 connectors

- Simple IDC connection technology
- Simple assembly -> Plug consists of 2 parts
- Interchange of cables impossible -> color code
- Robust metal housing with metal snap-in hooks
- Cores from AWG 26-22
- Cable Ø 4.5 - 7.5 mm (0.17-0.29 in)

Benefit argumentation

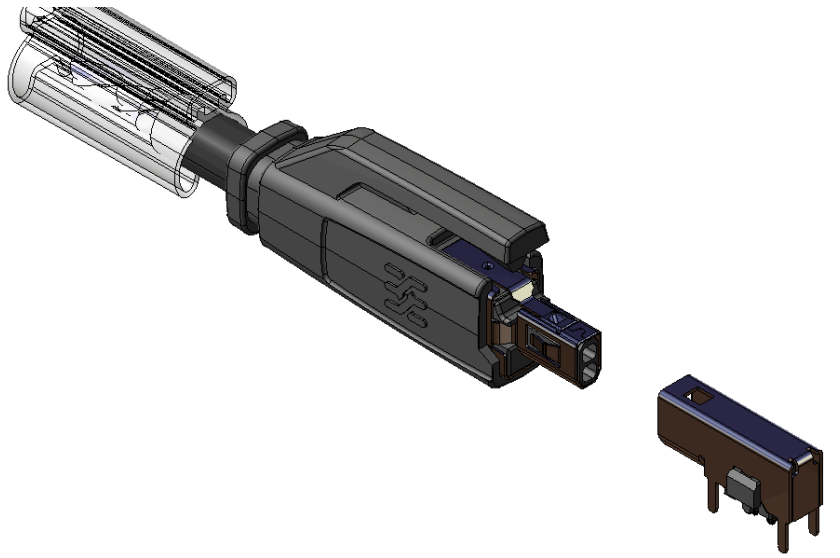
Simplicity: Same mating face

1 Snap-in hook lock

2 Tool-less IDC Connection in the field

3 Same mating face for IP 20 and IP 67 connectors

- Compatibility between IEC 63171-2 (IP 20) and IEC 63171-5 (IP67)
- IP 20 connector can be used as service connector for IP67
- Cost minimization due to use of identical parts for the mating face



Benefit argumentation SPE connector system

Future proof

1. Broad support from numerous connector manufacturers
2. One mating face for low to high transmission rates
3. 4 chamber system for further miniaturization in M12 systems

Benefit argumentation

Future proof: broad support

1. Broad support from numerous connector manufacturers
2. One mating face for low to high transmission rates
3. 4 chamber system for further miniaturization in M12 systems

- Product family is tooled by 4 connector manufacturers
- Broad technology competence through leading technology companies from different markets and applications
- Regular meetings to exchange know-how and create Use cases

Benefit argumentation

Future proof: One mating face for all

1. Broad support from numerous connector manufacturers
2. **One mating face for low to high transmission rates**
3. 4 chamber system for further miniaturization in M12 systems

- One small standardized interface to connect the sensor via the Datacenter to the Cloud.
- Various Ethernet applications can be transmitted with interface (10 Mbit to 1Gbit)
- Simulations indicate Bandwidth up to 2,5 GHz (ready for IEEE 802.3 ch)

IEEE 802.3cg	10BASE-T1 – Single Pair Ethernet with 10Mbit/s up 1.000 m
IEEE 802.3bw	100BASE-T1 – Single Pair Ethernet with 100Mbit/s 15 m unshielded / 40 m shielded
IEEE 802.3bp	1000BASE-T1 – Single Pair Ethernet with 1Gbit/s 15 m unshielded / 40 m shielded
IEEE 802.3ch	MultiGigBASE-T1 – Single Pair Ethernet with 2,5/5/10Gbit/s 15 m shielded
IEEE 802.3bu	Power over Data Line (PoDL) for SPE

Benefit argumentation

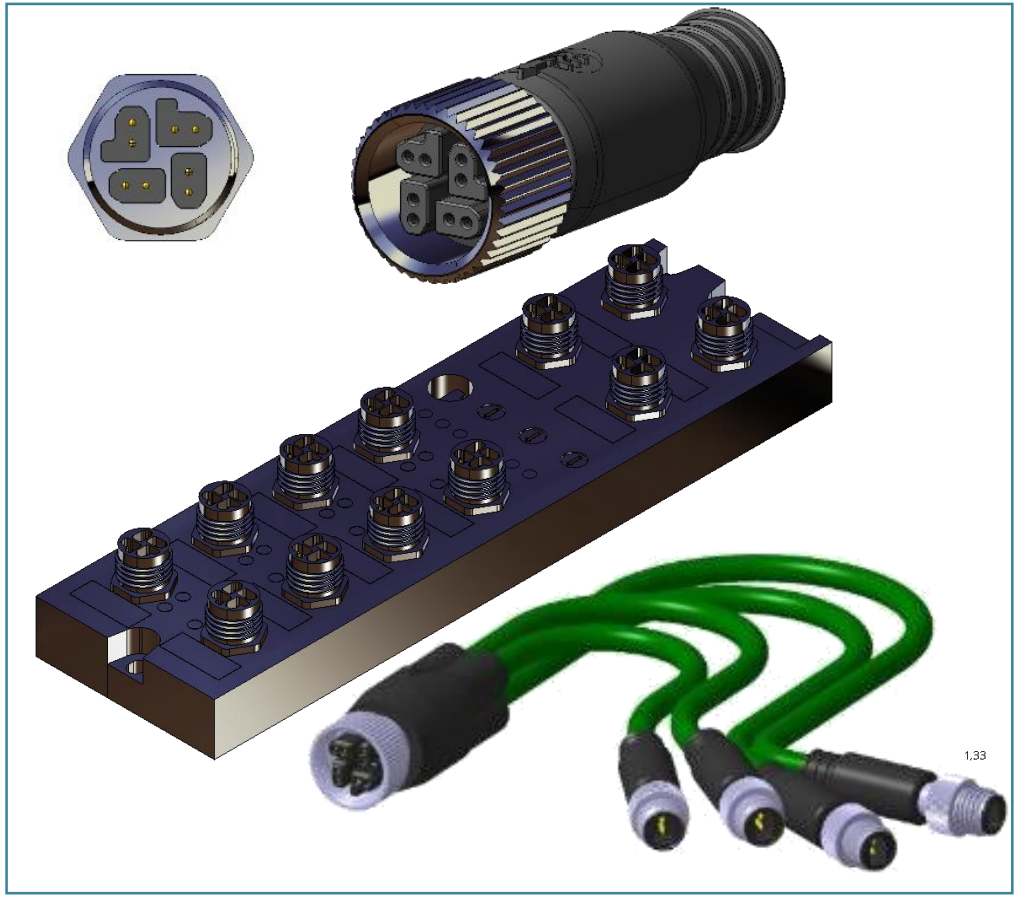
Future proof: 4 chamber system

1 Broad support from numerous connector manufacturers

2 One mating face for low to high transmission rates

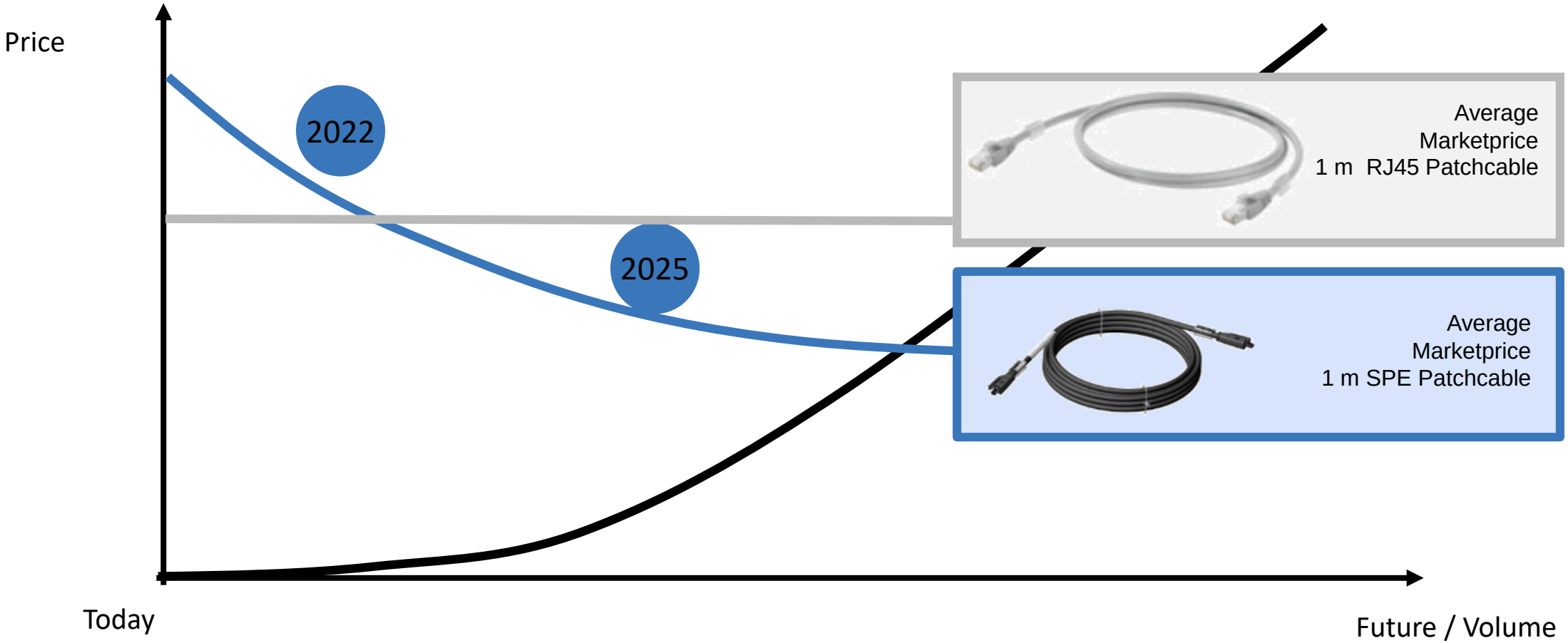
3 4 chamber system for further miniaturization in M12 systems

- 4 chamber system enables to quadruple port density IP20 / IP67
- Can be integrated in standard M12 size
- Allows design of extreme compact IIoT Devices with 32 ports in existing housing structures.



Benefit argumentation SPE connector system

Cost benefits of SPE Connectors



The SPE portfolio outlook IP20

IEC 63171-2

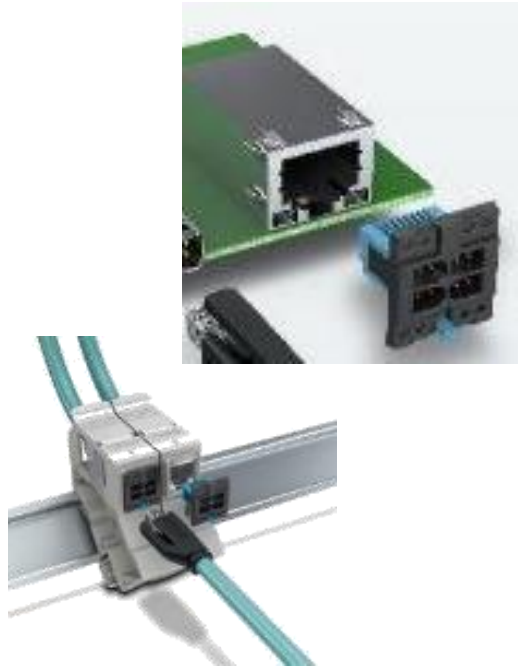
IP20 connector

New length and cable type variants

IP20 socket

IP20 bulkhead

IP 20 4 chamber system



The SPE portfolio outlook M8/M12

IEC 63171-5

M8 Patchcable

M8 connector

M8 socket

M12

M12 hybrid

M12 (4 chamber)

IEC 63171: Concept comparison

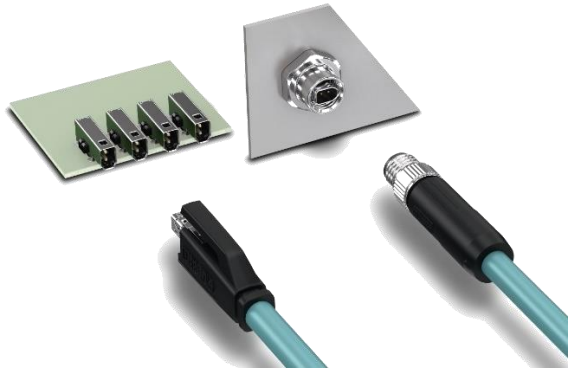
Why do we think we have the better concept?

1. More compact mating face
   Advantages for the device manufacturer to save space on the PCB and to realize smaller devices

2. Continuity in the mating face
   IP20 and M8 connectors can be plugged together
   No adapter required for servicing

3. Portfolio range
   Customers can project existing cabling solutions on SPE (e.g. flying leads, Bulkheads, 4 Chamber System)

4. Cost advantage Design-to-cost



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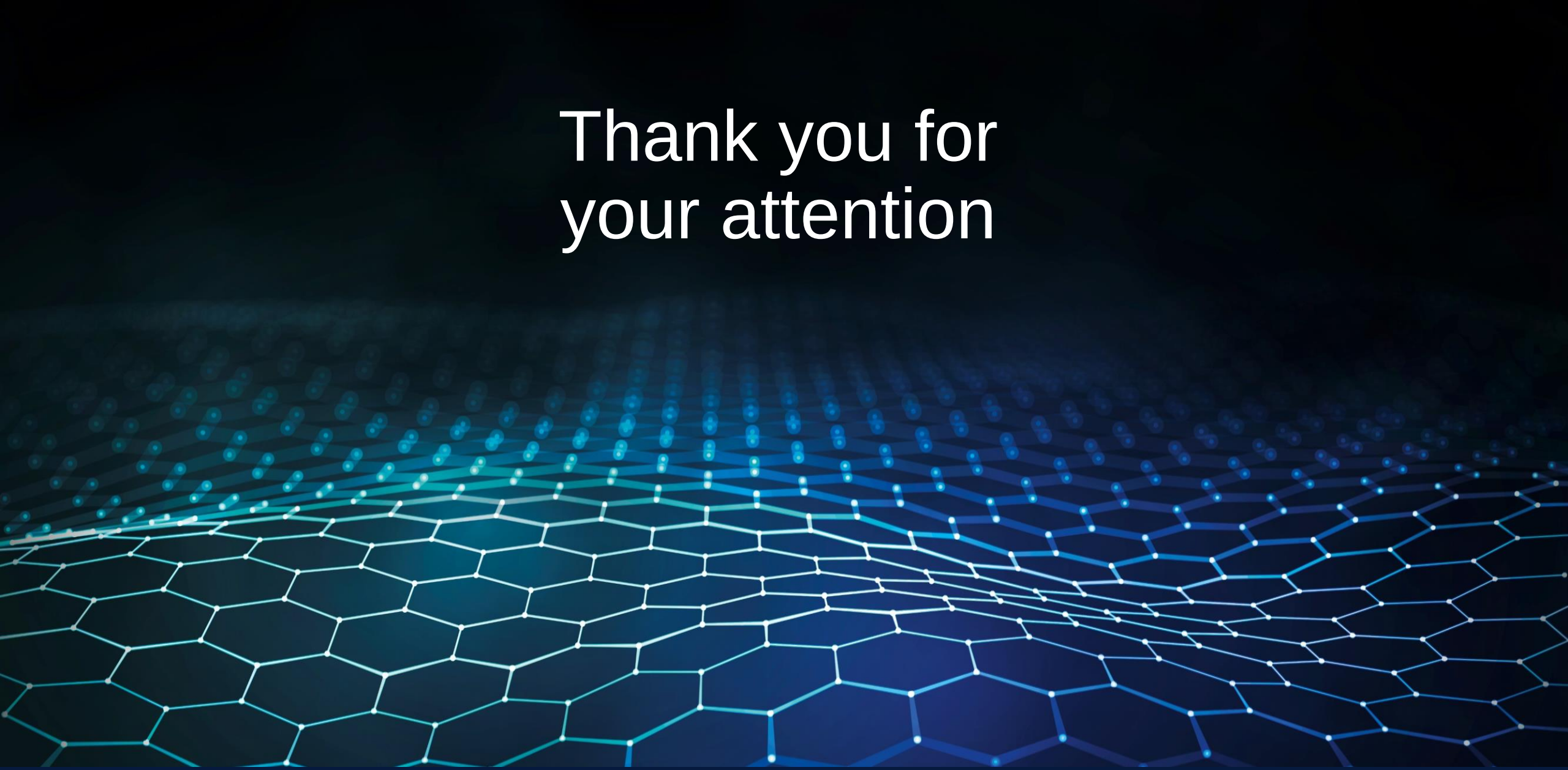

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