

Single Pair Ethernet

The Network Infrastructure for the Industrial IoT



Weidmüller 



**One Global
Standard**

Single Pair Ethernet

New SPE Connectivity for Industry

In the factory of the future, machines and systems will be seamlessly connected through a data infrastructure. These cyber-physical systems can operate autonomously within the Industrial Internet of Things (IIoT), communicate in real time, and control production processes. To enable this, an end-to-end network with high-performance data connections from the sensor to the cloud is required. This pushes conventional communication systems to their limits.

Single Pair Ethernet (SPE) extends Ethernet technology all the way to the sensor level. SPE is compact, flexible, and enables long transmission distances. It allows the expansion of existing installations and supports seamless communication based on the Ethernet protocol. For Weidmüller, SPE is therefore the missing building block for closing today's gap between the standard Ethernet network and the field level.

SPE does not define new transmission speeds through its two-wire technology. Instead, it provides the standardized framework for application-specific, simplified Ethernet cabling using data cables up to 1,000 m in length. Together with technologies such as TSN, OPC UA, PROFINET over SPE, and EtherNet/IP, SPE enables both continuous IP communication between servers and the cloud as well as power transmission in complex IIoT solutions.



New Unified Mating Face

One Standard for All Applications

The user organization PROFIBUS & PROFINET International (PI), in which electrical connectivity expert Weidmüller is actively involved as one of more than 1,800 members, has established a unified mating face for Single Pair Ethernet (SPE) based on key application requirements. Through its core technologies such as IO-Link and PROFINET, PI is responsible for the development of market-leading, open standards for all areas of industrial production. By agreeing on a unified mating face for PROFINET over SPE, the industry is now taking a decisive step toward the future.

The new SPE connector system is defined in IEC 63171-7 ED2 and provides a unified mating face for applications in control cabinets, in the field, and for hybrid installations. As a result, this standard is increasingly becoming the key connector standard for Single Pair Ethernet in industrial automation and beyond. It defines a unified mating face for IP20, M8, M12, and M12 hybrid applications and has already been adopted as a reference in IEC 61158-2-100 for Ethernet SPE and Ethernet-APL. In addition, it is referenced in other important industrial communication standards, including IEC 61784-1, IEC 61784-2, IEC 61784-5, as well as the PROFINET installation guideline.

IEC 63171-7 ED2 therefore provides the foundation for vendor-independent interoperability and a globally standardized SPE infrastructure. As a key driver of this technology, Weidmüller will expand its product portfolio with solutions featuring the new mating face.



New SPE Connectivity for Industry

A Standardized Connector System for PROFINET over SPE

Unified SPE mating face according to IEC 63171-7

The harmonized mating face for IP20, M8, M12, and M12 hybrid applications unlocks all the benefits of Single Pair Ethernet: interoperability, vendor independence, and future readiness. It reduces planning risks, simplifies integration, and accelerates deployment. Start planning today with Weidmüller as your trusted partner.

The standard for PROFINET over SPE – supported across the industry

For PROFINET over SPE, the mating face specified in IEC 63171-7 Ed.2 has already been defined as the standard in the applicable guidelines. This provides clear guidance for device and machine manufacturers. At the same time, PI, ODVA, the OPC Foundation, and FieldComm Group are driving consistent SPE standardization in a joint working group, including PoDL power classes and suitable connector systems, to ensure interoperable, vendor-independent solutions from the field level to IT systems.

Universal connectivity – integration into the IEC 61158 series

The integration of SPE into the IEC 61158 series is underway. As a result, the mating face is being universally adopted in future fieldbus specifications and is becoming increasingly important for all user organizations, including PROFINET International, ODVA, the OPC Foundation, and FieldComm Group.



More information:
www.weidmueller.com/spe



To our product portfolio

Versatile Applications Across a Wide Range of Use Cases

SPE Applications in Practice

SPE solutions are particularly well suited for infrastructures in machinery and plant engineering, process industries, and building infrastructure. In other words, wherever data must be transmitted seamlessly over longer distances. Field devices, sensors, and actuators can be integrated directly into an existing Ethernet environment using SPE, without the need for additional gateways or interfaces.



Factory automation



Building infrastructure



Process automation



Intrinsically safe process industries with Ethernet-APL

Examples of SPE applications in buildings:

- Building automation systems
- Lighting systems
- Elevator and escalator control systems
- Monitoring systems
- Access control systems
- Safety and fire alarm systems

Examples of industrial applications:

- Industrial automation
- Process automation
- Robotics
- Machinery and plant engineering
- Material handling
- Quality control
- Agricultural machinery technology



The New Standard for Demanding Applications

Single Pair Ethernet Connectors for Industrial Applications

Single Pair Ethernet (SPE) connections can transmit both data and power over a single twisted pair. This enables seamless IP communication from the server to the cloud, while also providing power delivery for complex IIoT solutions. As a result, SPE connectors offer an efficient and future-oriented connectivity solution.

Market requirements for data connectors at the field level include:

- Ultra-compact design for the implementation of IIoT devices
- High robustness for use in industrial environments
- Simple connectivity for safe and fast installation
- Future-proof design based on international standards

Miniaturization

Industrial suitability



Simplicity

Future-Proof



Industrial suitability

Made for Demanding Applications Industrial-Grade Robustness of SPE Connectors

The development of SPE technology was driven by the automotive industry. The original driver behind the development of Single Pair Ethernet (SPE) technology was the automotive industry. The goal was to create highly efficient cabling infrastructures. In the future, all industrial sectors can benefit from the SPE standard. Weidmüller SPE connectors are particularly robust and vibration-resistant. They are highly immune to electromagnetic interference and have been specifically designed to meet the demanding requirements of industrial applications.

Mechanical Robustness

- Robust metal housing with metal locking latch
- Reliable industrial dual-contact design compared to the single-contact design of RJ45
- Shock-resistant and vibration-resistant according to IEC 60068
- Secure locking mechanism under lateral forces

EMC Compatibility

- Coupling attenuation at 600 MHz according to IEEE 802.3
- Optimized shield connection to the PCB through four symmetrical contact legs
- Additional burst testing according to IEC 61000-6-2

Suitable for industrial use

- PCB connectors for environments up to Pollution Degree 2
- Impulse voltage withstand capability of 2.25 kV according to IEEE 802.3
- Optimized contact spacing for 100-ohm systems
- The SPE mating face according to IEC 63171-7 ED2 provides compact solutions for Single Pair Ethernet (SPE) applications. It saves up to 33% installation space compared to RJ45 interfaces. This enables device manufacturers to reduce the required PCB space and design more compact devices. As a result, port costs can be reduced and valuable cabinet space can be used more efficiently.

Miniaturization

Especially Compact Especially Compact Miniaturization of Single Pair Ethernet Connectors According to IEC 63171-7 ED2

Compact Mating Face

- Market-leading compact SPE mating face

High Port Density

- More compact PCB integration thanks to the smaller mating face
- More interfaces within the same device footprint
- 33% less PCB area compared to a standard RJ45 jack
- Only 67% of the area required by a standard RJ45 enables more ports per PCB
- Minimal space requirements inside the device
- Simplified PCB layout
- Only two signal conductors instead of four pairs reduce routing complexity
- Compact design enables flexible module and device configurations
- Reduced material consumption





Simplicity

Easy to Use

Ease of Use of Single Pair Ethernet Connectors

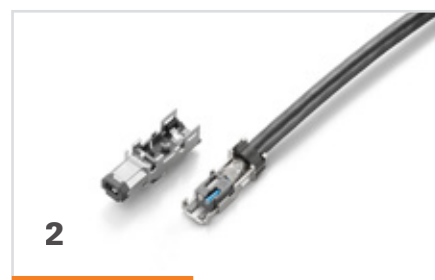
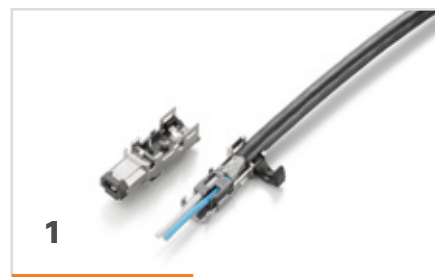
Ethernet technology is too complex for many industrial applications. Thanks to their simplicity, Single Pair Ethernet (SPE) components offer significant advantages. Compared to four-pair Ethernet, installation is easier and enables substantial reductions in both space and weight. In addition, SPE connectors support robust cabling in a short amount of time while providing long transmission distances in an extremely compact form factor.

Proven Locking Mechanism

- Industrial-grade plugs and sockets with metal latch locking mechanism
- Familiar locking and unlocking mechanism based on the RJ45 standard
- High retention force (> 50 N)

Tool-Free Connection

- Proven IDC termination technology
- Easy assembly thanks to the two-piece connector design
- Clear color coding to prevent wiring errors
- Suitable for all commercially available SPE cables





Future-Proof

Ready for the Challenges of Tomorrow

Future-Proof Design of SPE Connectors

SPE Is the Next Milestone in Networking Technology. SPE enables seamless intelligent connectivity across all levels of automation. It is scalable, deterministic, and fully compatible, allowing all components to communicate with one another. As a key enabling technology for Industry 4.0 and IIoT applications, it will form the foundation for a wide range of industrial applications in the future.

Broad Industry Support

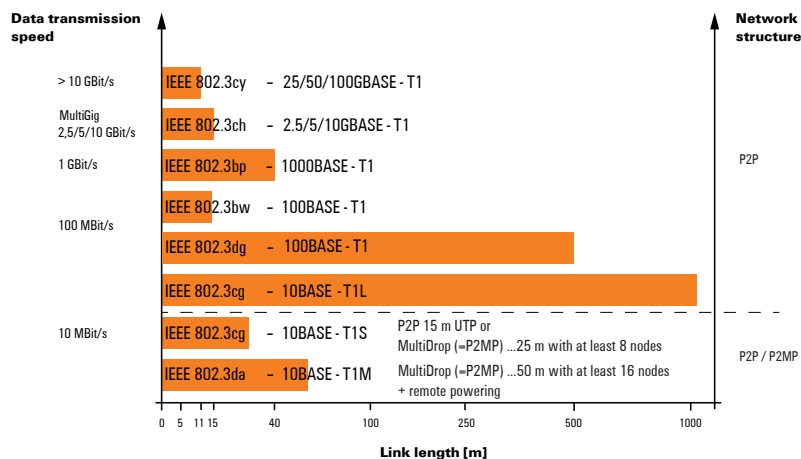
The SPE product family is already supported by several leading connector manufacturers. In addition, partnerships have been established with leading technology companies from various markets and application areas that have joined forces in the Single Pair Ethernet Association. This ensures broad technological expertise that will provide long-term benefits for all users.

Suitable for Low to High Data Rates

The compact SPE interface is suitable for a wide range of Ethernet applications with data rates from 10 Mbit/s to 1 Gbit/s. Simulations have confirmed bandwidths of up to 2.5 GHz, corresponding to the new IEEE 802.3ch Ethernet transmission standard, which is being developed for data rates of up to 10 Gbit/s.

Overview of IEEE 802.3 SPE Protocols

Additional SPE Standards Under Development





Single Pair Ethernet Association

On the Way to a Unified Market Standard The Single Pair Ethernet Association and Its Objectives

The Single Pair Ethernet Association was formed through the merger of the former Single Pair Ethernet System Alliance and the SPE Industrial Partner Network. As an open association, it brings together leading technology companies and research institutions from a wide range of industries and application areas. Manufacturers of sensors, cables, connectors, test and measurement equipment, semiconductors, switches, and end devices work together to establish SPE solutions across a broad spectrum of applications.

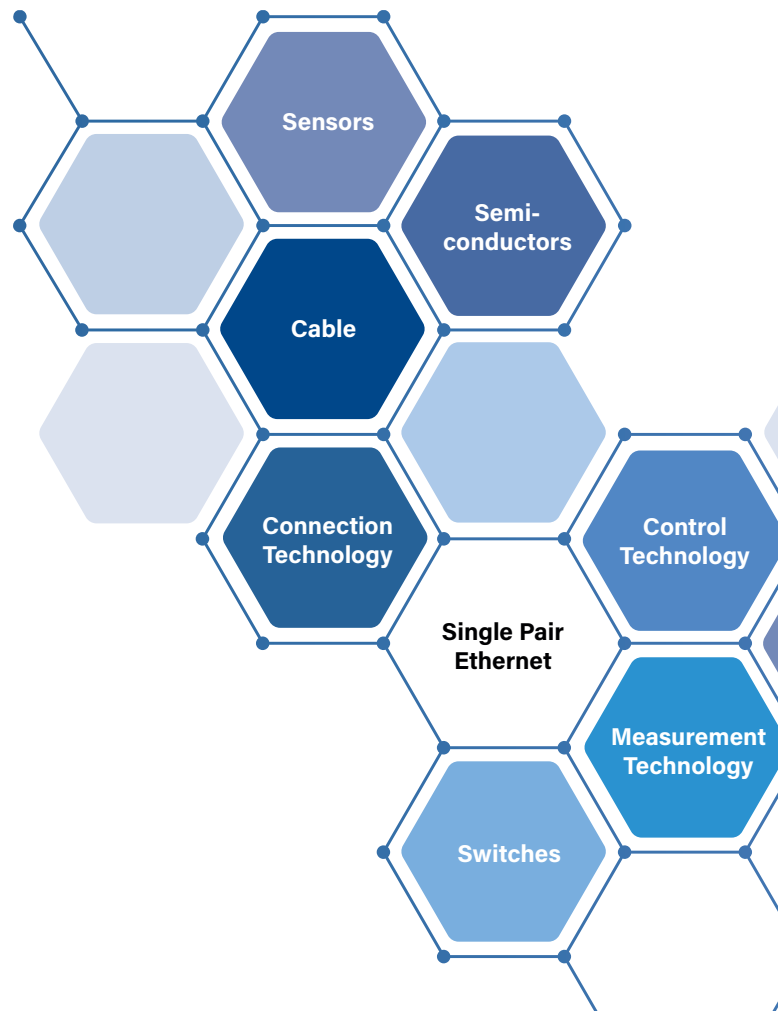
The Mission:

- Promote the exchange of knowledge and expertise among professionals from a wide range of technology fields.
- Build know-how to enable fast and reliable technology implementation.
- Demonstrate the comprehensive benefits of end-to-end Ethernet with SPE (Ethernet only).
- Develop a proof of concept for SPE interoperability.
- Raise public awareness of SPE through increased marketing activities, growing membership, collaboration with other SPE organizations, and easier access to SPE products.

The Goal:

Achieve technical maturity and broad market acceptance, providing users with the highest possible level of futureproofing.

For more information about the Single Pair Ethernet Association, please visit:
www.singlepairethernet.com

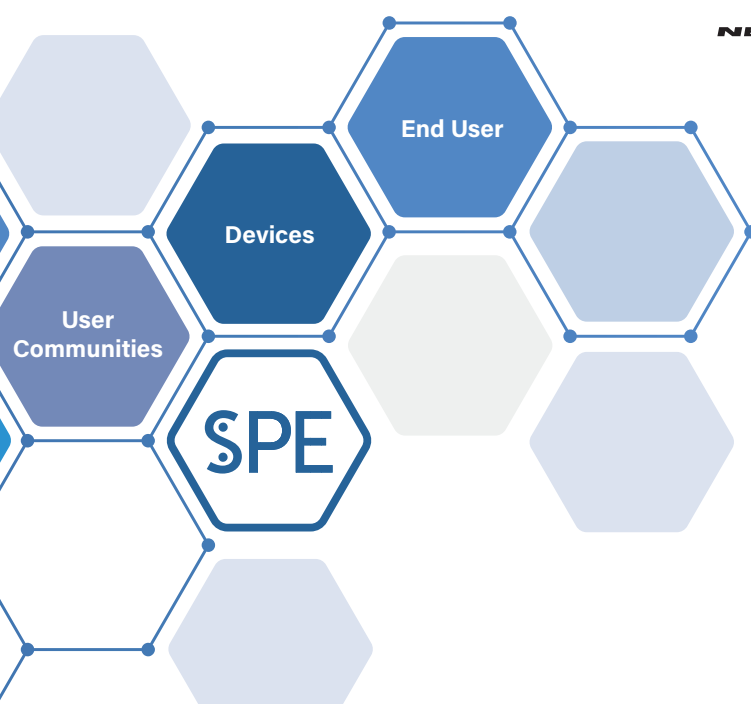


Members

Status: August 2026



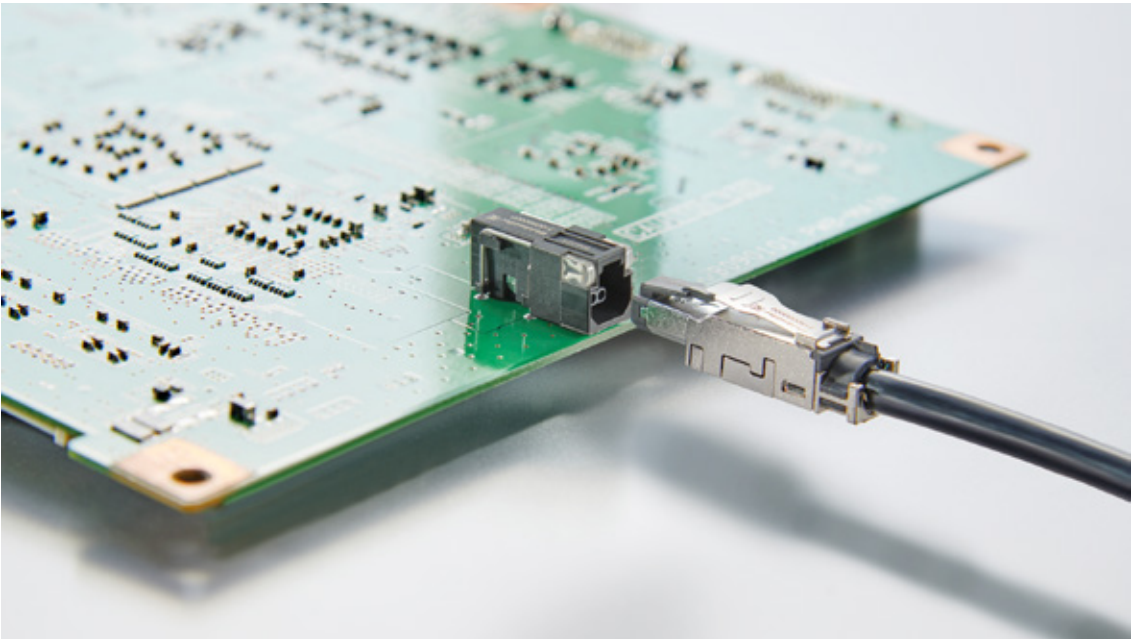
... and others.



Single Pair Ethernet Solutions acc. to IEC 63171-7

Ordering data

Connecting components				
	Type	Versions	Qty.	Order No.
	IE-PS-SP0-S-FH-2-180	Field attachable plug IP20, Male	1	3150000000
	IE-PS-MSPE-P-FH*	Field attachable plug IP67, M12, Male	1	3239620000*
*Note: First IP67 products compliant with IEC 63171-7 will be available after the standard is published.				



PCB components

	Type	Versions	Qty.	Order No.
	SPE P20 R1H 2.1 6 N/N TU	PCB connector, IP20, 90°, THR, female contact, Tube	62	3150600000
	SPE P20 R1H 2.1 6 N/N RL	PCB connector, IP20, 90°, THR, female contact, Tape-on-Reel	100	3234500000
	SPE P20 R1H 2.1 6 YG/YG TU	PCB connector, IP20, 90°, LED, THR, female contact, Tube	62	3150590000
	SPE P20 R1H 2.1 6 YG/YG RL	PCB connector, IP20, 90°, LED, THR, female contact, Tape-on-Reel	100	3234510000
	SPE M12F DD RV 2.0 6 TY*	PCB connector, Dome, M12, IP67, 180°, THR, female contact, Tray	10	3180870000*
	SPE M12F DC BPM16 RV 2.0 6 TY*	M12 PCB connector, IP67, rear panel mounting, 180°, THR, female contact, Tray	10	3228140000*
	SPE M12F DC FPM16 RV 2.0 6 TY*	M12 PCB connector, IP67, front panel mounting, 180°, THR, female contact, Tray	10	3228130000*
	LM SPE 5.08/02/135 3.5SN OR BX	PCB terminal block, 5.08 mm, number of poles: 2, 135°, Tension clamp connection connection	500	3089370000
	LM SPE 5.08/03/135 3.5SN OR BX	PCB terminal block, 5.08 mm, number of poles: 3, 135°, Tension clamp connection connection	500	3089380000
	LSF-SMT SPE 3.50/02/135 3.5SN BK TU	PCB terminal block, 3.50 mm, number of poles: 2, 135°, PUSH IN	71	3077550000
	LSF-SMT SPE 3.50/03/135 3.5SN BK TU	PCB terminal block, 3.50 mm, number of poles: 3, 135°, PUSH IN	49	3077560000
	LSF-SMT SPE 5.00/02/135 3.5SN BK TU	PCB terminal block, 5.00 mm, number of poles: 2, 135°, PUSH IN	60	3077570000
	LSF-SMT SPE 5.00/03/135 3.5SN BK TU	PCB terminal block, 5.00 mm, number of poles: 3, 135°, PUSH IN	39	3077630000
	MTS SPE 5/02 H T4 B T	PCB terminal block, 5.00 mm, number of poles: 2, 90°, SNAP IN	44	3095900000
	MTS SPE 5/03 H T4 B T	PCB terminal block, 5.00 mm, number of poles: 3, 90°, SNAP IN	31	3095910000
	MTS SPE 5/02 V T4 B T	PCB terminal block, 5.00 mm, number of poles: 2, 180°, SNAP IN	44	3095920000
	MTS SPE 5/03 V T4 B T	PCB terminal block, 5.00 mm, number of poles: 3, 180°, SNAP IN	31	3095980000
*Note: First IP67 products compliant with IEC 63171-7 will be available after the standard is published.				

See the current portfolio in
the eShop and order your PCB
samples:





Ethernet-APL

The two-wire solution for the process industry



Ethernet-compatible interfaces are increasingly needed in the process industry to access data from the field via IIoT. More and timely information is required from sensors and devices, even over long distances. This requires the integration of IIoT devices into the network infrastructure.

Ethernet-APL as an internationally standardised two-wire solution enables direct access right down to the field and device level. This leads to increased system availability and access to production data.

Advantages of Ethernet-APL

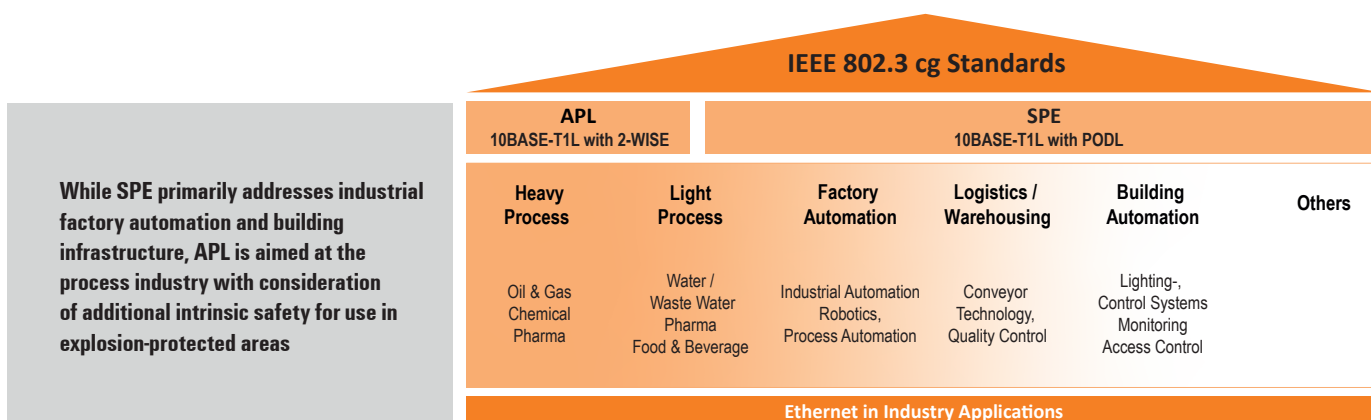
- High data rates: 10 Mbit/s communication with ranges of up to 1,000 m in accordance with IEEE 802.3cg-2019.
- PoDL (Power over data line): Supports remote power supply in accordance with IEEE 802.3bu.
- Direct connection to field devices: Integration of sensors and actuators.
- Scalability: Ideal for networking small to large industrial systems.
- Increased system availability through information on individual devices.
- No gateway required between field and company IT.





Ethernet-APL and Single Pair Ethernet in comparison

What is the difference between APL and SPE?



	Ethernet-APL	Single Pair Ethernet
Technology	Two-wire technology	Two-wire technology
Ethernet Standards	10BASE-T1L, IEC TS 60079-47 (2-WISE)	10BASE-T1S, 10BASE-T1L, 100BASE-T1, 1000BASE-T1
Data transmission	10 Mbit/s	10 Mbit/s up to 10 Gbit/s
Power Transmission	2-WISE (2-Wire Intrinsically Safe Ethernet) power supply limits current in hazardous areas, supports various power levels, and minimizes sparking.	PoDL (Power over Dateline) transmits up to 50W over a single pair
Cable / conductor length	Up to 1,000 m	15 to 1,000 m
Main application	Process industry	Factory automation and building infrastructure
Special features	The extension of the 10BASE-T1L standard in accordance with IEEE 802.3cg includes additional safety precautions that are specially tailored to the needs of the process industry in potentially explosive atmospheres.	Miniaturisation, industrial suitability, simplicity, future-proofing
Connection technology	Classic terminal blocks with screw or tension spring connection, like Omnimate® PCB components, built-in and field-attachable connectors (M12).	Connectors with miniaturised mating faces, patch cables, field attachable plugs, M8 adapters as well as IP20 and IP67 sockets in different outlet directions.

Ethernet-APL Solutions

Ordering data

PCB components

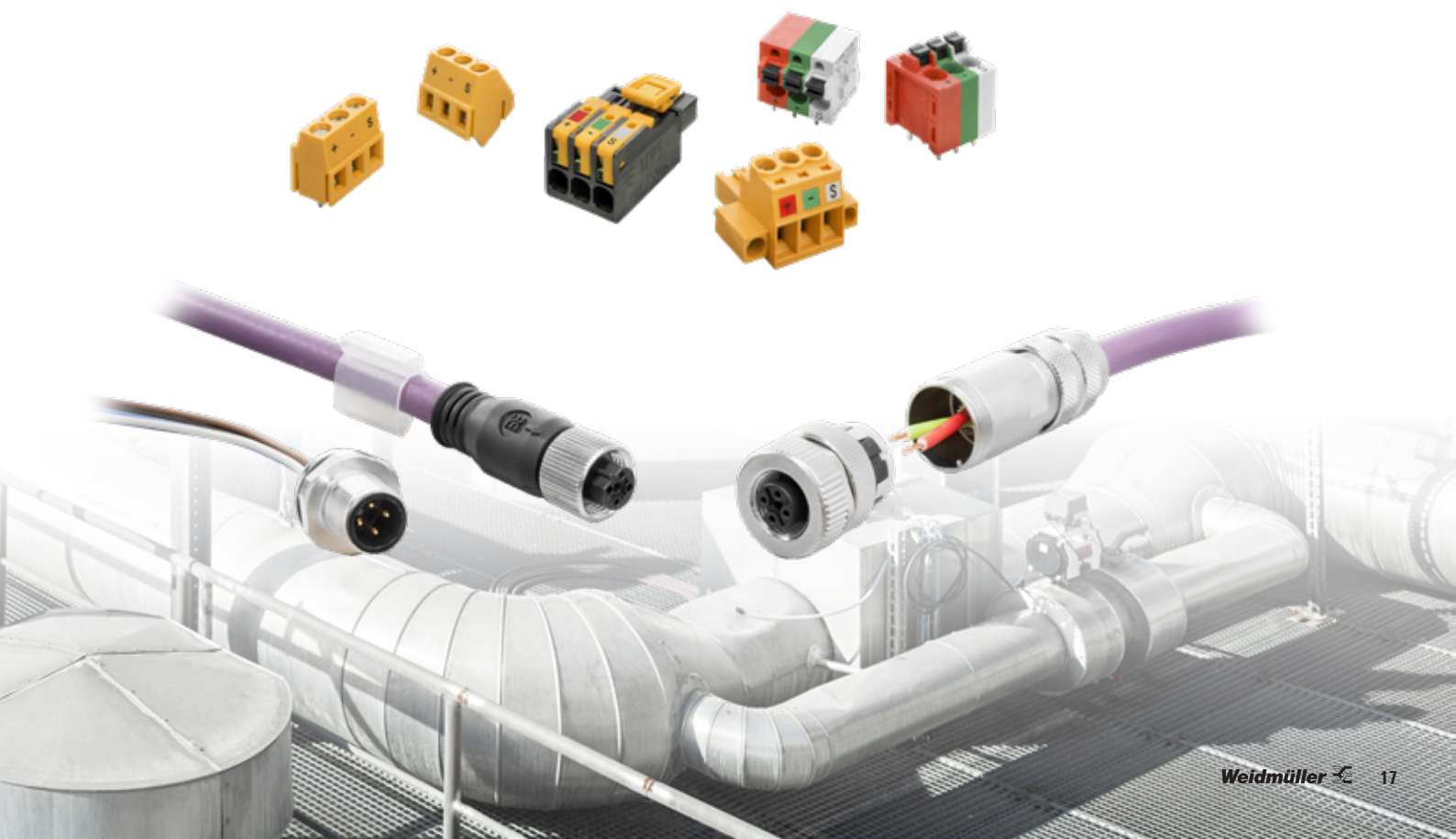
	Type	Versions	Qty.	Order No.
	LMF APL 5.00/03/180 3.5SN BX	PCB terminal block, 5.00 mm, number of poles: 3, 180°, PUSH IN	90	2873470000
	LMF APL 5.00/03/90 3.5SN BX	PCB terminal block, 5.00 mm, number of poles: 3, 90°, PUSH IN	90	2873480000
	LM APL 5.08/03/135 3.5SN OR BX	PCB terminal block, 5.08 mm, number of poles: 3, 135°, tension clamp connection	500	2873490000
	LM APL 5.08/03/90 3.5SN OR BX	PCB terminal block, 5.08 mm, number of poles: 3, 90°, tension clamp connection	500	2873500000
	BLZP APL 5.00HC/03/180F SN OR BX	PCB connector, female connector, 5.00 mm, number of poles: 3, 180°, tension clamp connection	72	2872550000
	MPS APL 5/03 S F2 TN B B D D	PCB connector, female connector, 5.00 mm, number of poles 3, 180°, SNAP IN	114	8000094097

Accessories

	Type	Versions	Qty.	Order No.
	SH ETH U	Shielding bracket, accessories, screw flange, galvanised, silver-grey, box	25	2903230000

M12 connectors

	Type	Versions	Qty.	Order No.
	SAIBM-4/8S-M12 4P A-ZF	Field attachable plug connector, M12, socket, straight	1	1784740002
	SAISM-4/8S-M12 4P A-ZF	Field attachable connector, M12, male, straight	1	1304280000
	SAIE-M12S-4-0.5U-PG9	Built-in connector, M12, male, straight, mounting thread: PG 9, number of poles: 4, wire/cable length: 0.5 m, front panel mounting	1	1861220000
	SAIE-M12B-4-0.5U-PG9	Built-in plug, M12, female, straight, mounting thread: PG 9, no. of poles: 4, wire/cable length: 0.5 m, front panel mounting	1	1861250000



Notes

Place for your notes

The Weidmüller Group

Industrial Connectivity: Electrification, automation, digitalisation, electrical connectivity and renewable energies – markets in which Weidmüller feels right at home. Established in 1850, the family-owned company is represented worldwide with production facilities and sales companies. As a global player in electrical connectivity and automation, Weidmüller stands for innovative products, solutions and services for industrial connectivity. The company is headquartered in Detmold, in the heart of the East Westphalia-Lippe region of Germany.

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