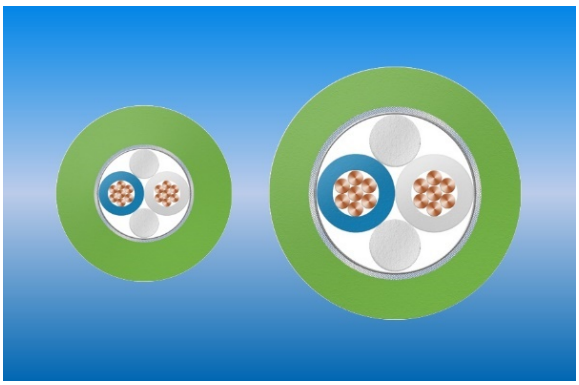
INDUSTRIAL
PARTNER
NETWORK

APPLICATION NOTE

SINGLE PAIR ETHERNET – CABLE STANDARDS AND CONSTRUCTION



With IIoT, the industry is placing ever tougher demands on network technology. In the future, even small devices should be connected to the company network as simply as possible. The trend towards miniaturisation ensures that ever smaller volumes are available for network technology and the cables used. At the same time, the demands on the possible data transmission rates are increasing.

Single Pair Ethernet is the technology that perfectly meets these requirements. Central elements of the standard are the Single Pair Ethernet cables. In the IEC 61156 series of standards, the International Electrotechnical Commission (IEC) has defined and standardized the structure and the high electrical properties. The IEC 61156 standard divides the Single Pair Ethernet cables into the following categories: type of installation, maximum length and data transmission rate.

For a transmission rate of 1 Gbit/s over a transmission distance of 40 m the standards IEC 61156-11 (fixed installation) and IEC 61156-12 (flexible application) define the requirements. In order to realize the high transmission rate over a single pair, particularly demanding electrical properties are required. In the past, this transmission was realized with four pairs as standard. In order to implement the data rates, it is necessary to increase the bandwidth considerably compared to conventional Industrial Ethernet Cat 5e data lines. For this reason, the cables are specified for a frequency of up to 600 MHz.

Furthermore, the SPE lines with Power over Data Line (PoDL) can be used to supply the network's end devices with power of up to 50 W. The cable cross-section can be AWG 22 or AWG 26. The AWG 22 cables are characterized by particularly good attenuation and high power transmission via PoDL. In contrast, the AWG 26 cable has the advantage of a particularly small diameter.

Compared to conventional four-pair data lines, the diameter is reduced by about a quarter and the corresponding weight of the line is even halved. This means that SPE can be easily installed even where there is almost no space available for the cables.

For longer transmission distances, IEC 61156-13 (fixed installation) and IEC 61156-14 (flexible application) are currently being developed. These standards form the basis for 10 Mbit/s transmission over up to 1000 m according to IEEE 802.3cg for 10BASE-T1L.

In addition to the standardized cable types, special versions for various mechanical loads such as torsion, drag chain or robot applications are currently under development. The selection is rounded off by various hybrid cables that combine the SPE with additional elements.

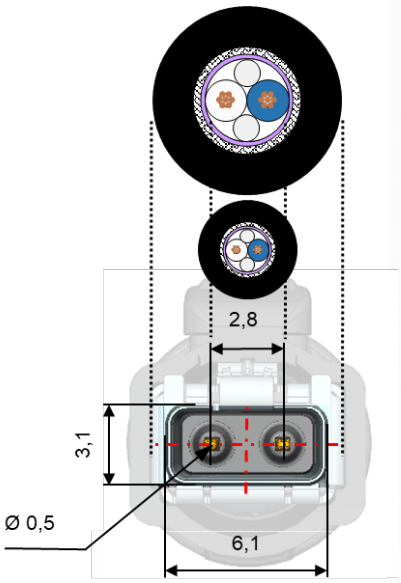
PROPERTIES

- Transfer rates up to 1 Gbit/s at 600MHz
- Up to 40 m distance with 1 Gbit/s (1000BASE-T1)
- Up to 1000 m distance with 10 Mbit/s (10BASE-T1L)
- Power over Data Line (PoDL) with up to 50 W

CHARACTERISTICS FOR INDUSTRIAL AUTOMATION

- Drag chains and robotic designs
- Jacket materials: PUR, FRNC, PVC, FEP
- Oil resistance
- UL and CSA

Furthermore, the compatibility of the cables with the connectors must be taken into account when designing the cables. During the development of the SPE mating face according to IEC 63171-6, it was already taken into account that both thinner AWG 26 cables for short link lengths and AWG 18/16 cables for the 1,000 m 10BASE-T1L link can be connected. The adjacent figure shows the size ratios between mating face and cable construction.



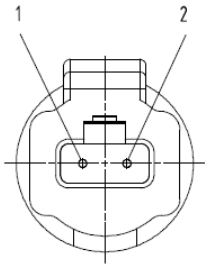
PREFERRED VALUES FOR THE ESSENTIAL CABLE PARAMETER

Wire cross section	Wire diameter	Cable diameter
AWG 26	1,0 – 1,3 mm	4 – 5 mm
AWG 22	1,5 – 2,0 mm	5 – 6 mm
AWG 18	2,35 – 2,7 mm	6,5 – 8 mm
AWG 16	3,0 – 3,4 mm	8 – 10 mm

The cable sheath colour can be selected in green RAL 6018 according to DESINA specifications. Outdoor cables are usually provided with a black cable sheath due to the technical conditions.

WIRE COLOURS AND PIN ASSIGNMENT

Contakt	PMA signal	Wire colour
1	BI_DA+	Blue
2	BI_DA-	White



SPE DATA CABLE FOR INDUSTRY

Cross section	Data rate	Application
AWG 26	1 Gbit/s 1000BASE-T1 up to 40m	Type A - permanent installation
		Type B – flexible installation
		Type C - dynamische Anwendung e.g. Drag chain
		Type R - Robotics
AWG 22	1 Gbit/s 1000BASE-T1 up to 40m (PoDL optimized)	Type A - permanent installation
		Type B - flexible installation
		Type C - dynamic application
		e.g. Drag chain
AWG 18	10 Mbit/s 10BASE-T1 up to 1000m	Type R - Robotics
		Type A - permanent installation

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DOCUMENT INFORMATION

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