



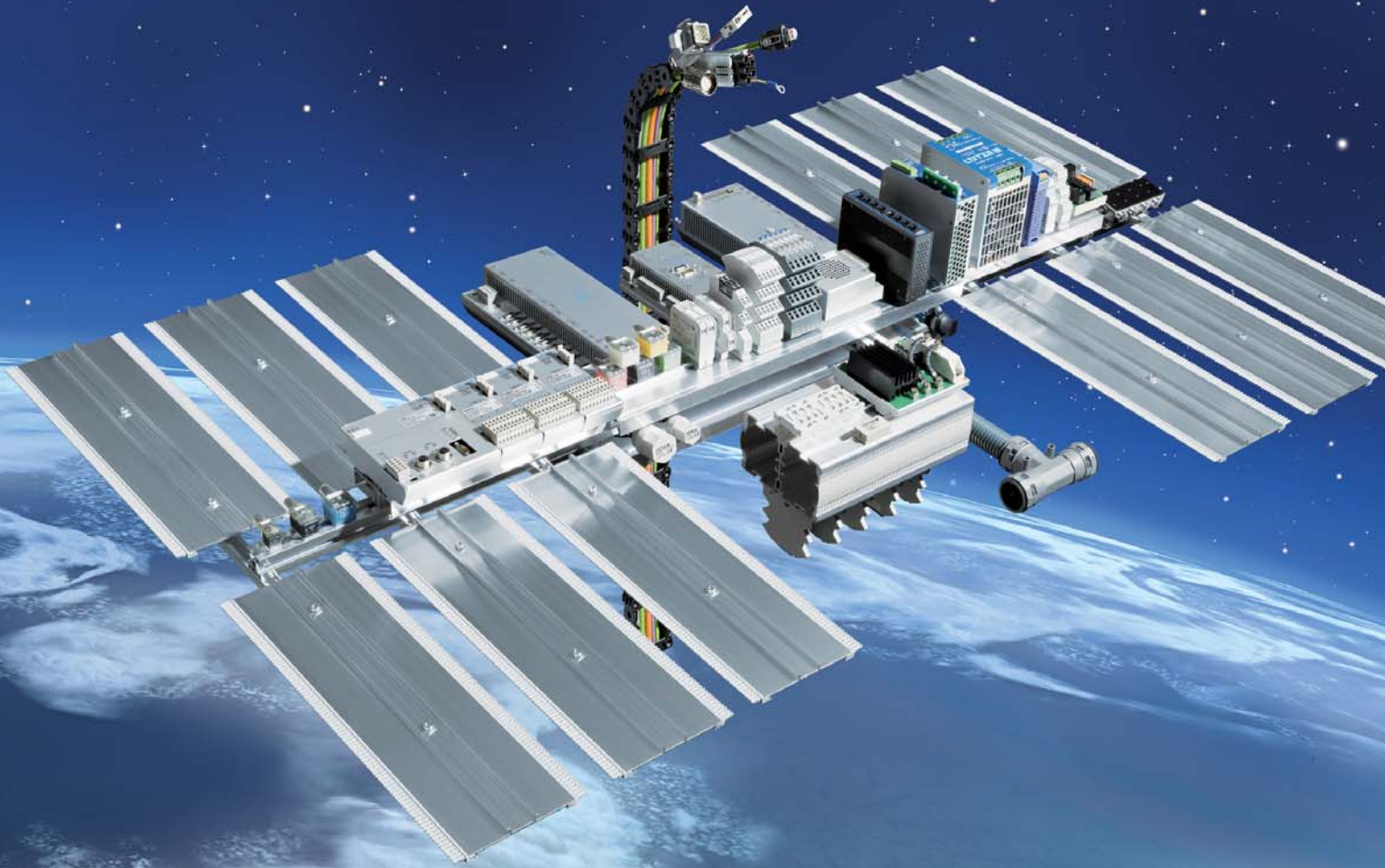
- Cable + Connectivity Solutions
- Control Solutions

# Ethernet Connectivity

Infrastructure solutions from a single source

# Efficiency in Automation

Cable • Connectivity • Cabinet • Control



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# Welcome to LÜTZE

## Cable Solutions



**Efficiency in Automation** - A reflection of our company philosophy

As an experienced specialist in automation technology, with solutions for flexible and high flexing cables, cable assemblies, interfaces, current control and cabinet wiring, we have had a focus on efficiency for many years.

## Connectivity Solutions



LÜTZE defines Efficiency in Automation field as the use of sustainable products and solutions to further increase the performance of our products in our customers applications.

We realise this by using components for highly efficient control systems, products with above average life cycles and raising energy efficiency in control cabinets by means of the LSC wiring system.

## Cabinet Solutions



Efficiency in Automation reflects our efforts in striving for efficient working relationships with our customers: in a medium sized family owned company we have short communication channels and a high level of manufacturing competence.

The value of a product or a solution from LÜTZE is determined by its sustainable qualities. Every innovation will only be successful in the future if it has a long term positive effect. Therefore, we provide long lasting as well as highly efficient components.

## Control Solutions



Thus LÜTZE creates value through efficiency. LÜTZE provides answers and demonstrates how to handle resources responsibly, with our environment and our future in mind.  
**LÜTZE - Efficiency in Automation**

**For more information on our solutions, please visit [www.luetze.com](http://www.luetze.com) or [www.lutze.com](http://www.lutze.com)**

## Transportation Solutions





# Business Management: Sustainable and forw



## The future is blue

Sustainable enterprise means thinking and planning ahead, understanding and embedding the belief that long lasting success is more important than short-term profit maximisation.

This is an attitude that has existed within LÜTZE for quite some time. Economic and environmental responsibilities complement each other well and are reflected in the sustainable management and

product policy - and from now in the **SkyBLUE** campaign.

We manufacture our products in a resourceful and energy-conscious manner. We use long lasting, environmentally-friendly materials. And our products, in turn, help our customers save energy and resources.

Good for everyone: for us, for the environment, for our customers a win-win-win situation.

# ard-looking

*„The competitiveness of our industry and of its suppliers depends quite substantially on how we succeed in developing practical results. The results that we produce together today, are our competitive advantages in the future.“*

Udo LÜTZE,

Member of the Executive Committee of  
the Green Carbody Innovation Alliance



## Goods with real value

The value of a product or a solution from LÜTZE is determined by its sustainable qualities as well. Every innovation is only as successful in the future if it has a long-term positive effect. Therefore, we provide long lasting as well as highly efficient components.

We are incorporating the necessary knowledge and manufacturing competence in numerous joint projects with the objective of improving energy efficiency and

sustainable technologies and industries. Thus, LÜTZE provides answers and demonstrates how to handle resources responsibly, with our environment and our future in mind.



## RoHS



# Structured networks - E



## Plug & Play in Industrial Ethernet

Save time, costs and stress: LÜTZE can cost-efficiently and quickly solve your assembly requirements.

### **LÜTZE ET Series - Reliable transmission even with Giga power**

The LÜTZE ET Series of switches and media converters enable you to set up a Plug & Play network infrastructure in industrial environments - without any configuration necessary.

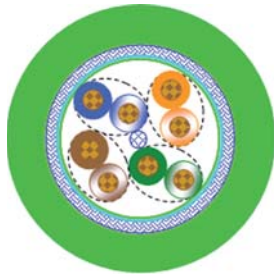
MDI/MDI-X functionality uncrossed cables can also be used between the switch and end device. Because industrial areas are synonymous with harsh environments, all of our systems feature aluminium housings, expanded temperature ranges from -40 °C / +75 °C and fibre-optic transmission..

#### **Additional features include:**

- Transfer rates of up to 1 Gbit/s

- Conforms to IEEE 802.3 and 802.3u
- Broadcast storm protection
- Auto negotiation, Auto Crossing, Auto Polarity
- Redundant infeed
- Wide range supply
- Full / half duplex data flow monitoring
- PoE variants

# ethernet connectivity



Category 5e cables are generally available at LÜTZE with an all-round braided shield (S/UTP).



LÜTZE provides category 6 and 7 shielded pair cables with an additional all-round braided-copper shield (S/FTP).



## Cables – a lot depends on them

The correct transmission of process data is absolutely essential. An important requirement is the correct choice of cables, connection technology and components.

Procurement, logistics and production all need to be organised perfectly. The quality of cable must comply with the system's requirements. Whether you are looking for

standard or customised applications, C-track or torsion-resistant cables: LÜTZE delivers customised solutions for your applications in CAT5, CAT6 or CAT7.

You can also take advantage of our comprehensive portfolio of connectors, outlets and wall bushings. The connectors conform to IEC 61076-3-106.

All connectors facilitate quick and easy assembly.

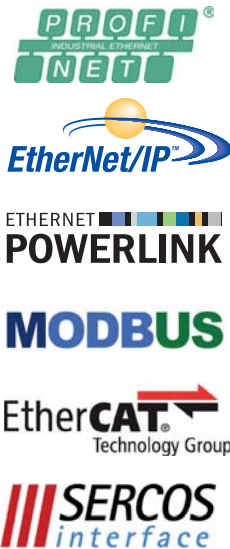
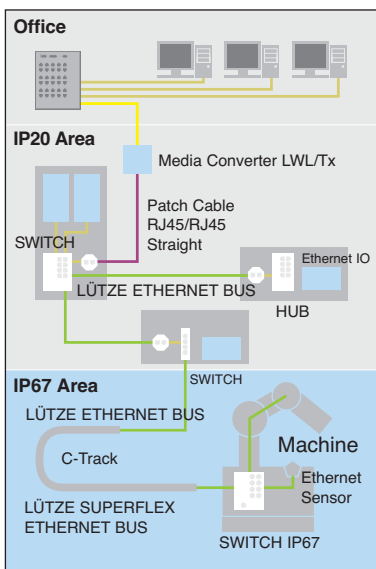
### **Customised Industrial Ethernet:**

Besides supplying standard products, LÜTZE can also produce customised solutions thanks to its years of expertise in Industrial Ethernet.

# LÜTZE – Ethernet Connectivity

## LÜTZE Ethernet Connectivity - Solutions from a single source

The requirements placed on efficient manufacturing systems are becoming more and more complex. Increased networking between production and management means that more and more automation systems are requiring the use of PC-based controllers and Ethernet communication networks. Ethernet is the name of a widely used, standardised communication infrastructure with various communication media. Together with higher-level communication software, Ethernet is today the basis for a large number of industrial local networks. In contrast to the office environment, communication in automation technology requires open, transparent system solutions. The seamlessness of information is a major priority here. This means that it is necessary to plan, install and administer industrial networks in such a way that they function reliably under the toughest conditions and in the harshest environments, while exhibiting controllable behaviour. The correct selection of suitable cables, connection technology and components is thus a significant factor in reliability. In this area LÜTZE offers a seamless system for designing network infrastructures.



Thanks to our many years of experience in the planning and implementation of industrial networks and the necessary components, we are also able to develop customer-specific solutions to satisfy your requirements optimally.

## Ethernet in industrial applications

In industry, communication takes place in a hierarchical system consisting of plant, management and field levels. The use of Ethernet is standard at plant and management levels. At field level, field buses such as Profibus DP, CAN or other protocol variants are still dominant. The reason for this is the considerably higher or differing requirements at field level. Here the network encounters interference factors that can have a significant effect on transmission quality. The risk of interference due to vibrations, dirt, moisture or harmful substances is especially high at the connection points. To meet

## Switched Ethernet

## INFO

In industrial applications, the following transmission requirements apply:

- very high network availability
- small data packets
- timely transmission

In order to cope with these requirements, the network has to be subdivided into logical and physical segments. This makes it possible in most cases to limit communication links between network nodes to a sub network, without affecting the bandwidth of other sub networks. The load sharing means that the full bandwidth is available in each segment.

these requirements, LÜTZE supplies a solution that will stand up to the sometimes adverse conditions encountered in light and heavy industry, railway tunnels, on board ships, or in other environments. The simplest form of load sharing is achieved through the use of switches.

A network in which each node is assigned exactly one port of a switch is called switched Ethernet. Ethernet switches are used to resolve collision domains into simple point-to-point connections between the switch and the other network nodes (terminals, infrastructure components).

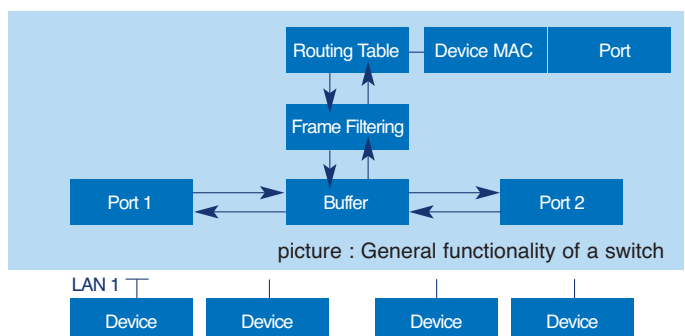
## Ethernet Switches

Simple switches work on the data link layer (OSI model, link 2), and can connect LANs with differing physical characteristics. If all of the protocols of

| OSI-Layer      | Classification         | DoD-Layer   | Classification        | Protocol Example                            | Units    | Coupling elements                         |
|----------------|------------------------|-------------|-----------------------|---------------------------------------------|----------|-------------------------------------------|
| 7 Application  | Application orientated | Application | End to End (Multihop) | HTTP<br>FTP<br>HTTPS<br>SMTP<br>LDAP<br>NCP | Data     | Gateway, Content-Switch, Layer 4-7-Switch |
| 6 Presentation |                        |             |                       |                                             |          |                                           |
| 5 Session      |                        |             |                       |                                             |          |                                           |
| 4 Transport    | Transport orientated   | Transport   | Point to Point        | TCP<br>UDP<br>SCTP<br>SPX                   | Segments | Router, Layer-3-Switch                    |
| 3 Network      |                        | Internet    |                       |                                             |          |                                           |
| 2 Data Link    |                        | Web entry   | Point to Point        | Ethernet<br>Token Ring<br>FDDI<br>ARCNET    | Frames   | Bridge, Switch                            |
| 1 Physical     |                        |             |                       |                                             |          |                                           |
|                |                        |             |                       |                                             | Bits     | Hub, Repeater                             |

picture : ISO / OSI Reference Model

the upper layers in the network are the same, then the switch is protocol-transparent. When a packet is received, the switch processes the 48-bit long MAC-address and creates an entry for it in the SAT (Source Address Table), which stores, in addition to the MAC address, the physical Port at which it is received. Each port of a switch constitutes a separate network segment, with the entire network bandwidth being available to each of these segments. Each individual port of a switch can receive and transmit data. The speed required for this is achieved via an internal high-speed bus (backplane). Data buffers ensure that as far as possible no data packets are lost. As a result, the network performance is increased not only in the network as a whole, but also in the individual segments. Switches examine each incoming data packet for the MAC address of the target segment, and can forward it there directly. The particular advantage of switches is their ability to connect ports with each other directly, i.e. being able to establish dedicated links. Switches break the Ethernet bus structure down into a bus and star structure. Sub-segments with a bus structure are now coupled in a star pattern, each via one port of the switch. Packets can be transmitted between the individual ports at the maximum Ethernet speed. Another major advantage is simultaneous data transmission between different segments. This increases the bandwidth in the entire network. However, to make use of the full performance capability of the switch technology it is necessary to implement a suitable network topology. This requires distributing the data load as evenly as possible among the individual ports. Furthermore, it is advisable to connect systems that communicate a great deal with each other to the same switch. The goal of this is to reduce the quantity of data that travels through more than one segment.



picture : General functionality of a switch

# LÜTZE – Ethernet Connectivity

## Cables - A lot depends on them

The classical Ethernet began with the coaxial cable. Today, new installations use only symmetric cables, so-called balanced cables, or fibre-optic cables.

## Copper cables

Various types of copper cable are used. The term "symmetric cable" does not refer to the structure of the cable, but rather exclusively to its electrical characteristics and the signal transmission. The symmetrical transmission of a signal requires two conductors; full duplex thus requires four conductors. A 10/100 MB Ethernet cable that is suitable for industrial use will thus have at least four conductors. The number of conductors increases by another four if the application requires 1Gbit.

## Twisted-Pair

In order to obtain the best possible interference suppression, the individual conductors have to be twisted. For different requirements, regarding the transmission, different types of twisted pair cables were developed. The difference between these cables is the shield :

### • UTP (Unshielded Twisted Pair):

The twisted signal pairs are stranded together without any screening under the outer jacket.

### • Overall shielded S/UTP or F/UTP:

The twisted pairs are stranded together and surrounded by a common screen made of a metal laminated polymer tape or a copper wire braid. The outer jacket encloses the screen.

### • Cables with shielded pairs FTP (Foiled Twisted Pair), also U/FTP, S/FTP: Each twisted pair is wrapped by a metallic screen (mostly a metal laminated polymer tape). In Germany often called PiMF (pair in metal foil). In most cases the PiMFs are stranded together and surrounded by a copper wire braid as a common screen. This provides an optimized EMC performance

The short term for shielded twisted pair cable - S/FTP, F/FTP or SF/FTP (Screened Foiled Twisted Pair) is used in a different way from various stan-

## CAT 2 - Class B

CAT 2 cables are suitable for maximum frequencies up to 1 or 1.5 MHz; they are used, for example, for cabling in buildings with an ISDN primary multiplex connection.

## CAT 3 - Class C

The 100BASE-T4 standard allows 100 Mbit/s over existing Category 3 installations, using all four conductor pairs. CAT 3 cables are no longer used in new installations; rather at least CAT 5 cables are used.

## CAT 5 - Class D

CAT 5 cables are most often encountered in installations today; they are used for signal transmission at high data transmission rates. Their specific standardised designation is EIA/TIA-568. CAT 5 cables are intended for operating frequencies up to 100 MHz. Due to the high signal frequencies, particular care must be taken during laying and assembly, especially for the connection points of the conductors. Category 5 cables are often used in structured cabling for computer networks, such as Fast Ethernet or Gigabit Ethernet. This has been encouraged by the widespread use of 1000BASE-T (Gigabit Ethernet), because it requires only one CAT 5 cable.

## CAT 5e - Class De

The CAT 5e cable is a more specialised version of CAT 5 that is mainly used in German speaking countries in Europe for 100BASE-T network connections over long distances. Carefully executed installations, originally made and approved as CAT 5, generally also satisfy the CAT 5e standard. The designations EIA/TIA-568A and EIA/TIA-568B are also used informally to mean the two assignments for the colour-coded conductor pairs to the connecting contact of the RJ45 connector that are defined in this standard; in this case, however, this does not say anything about the transmission quality.

## CAT 6 - Class E

CAT 6 cables are defined by EN50288. CAT 6 cables are intended for operating frequencies up to 300 MHz. The transmission speed suffers at longer lengths; however, slight excess lengths may be no problem, depending on the external influences. Ultimately reliability can be ensured by testing with an appropriate test device to verify compliance with the limit values of the current versions of EN50173-1, IS 11801 and EIA/TIA 568B2.1. The fields of application for CAT 6 are voice and data transmission, multimedia and ATM networks. Greater performance is provided by CAT 6a cables (500 MHz) .

## CAT 7 - Class F

CAT 7 cables have four individually shielded pairs of conductors (Screened/Foiled shielded Twisted Pair S/FTP) within an overall shield. CAT 7 cables are intended for operating frequencies up to 600 MHz. CAT 7 cables fulfill the requirements of standard IEEE 802.3an, and are thus suitable for 10-Gigabit Ethernet.

## Wiring Tips

According to the standardised approach, the combination of components of the same category is expected to achieve the correlating class. But experience reveals that this is not the case, especially when higher transmission performance is required. Therefore it is recommended to use matched components from a single source supplier especially in a harsh industrial environment.

Components of a higher category meet all the transmission requirements of the lower classes. They therefore provide an additional performance margin. For very critical applications (environment, EMC, distances) it is recommended to use this margin applying components of a higher category as required. Transmission safety can be achieved by testing the transmission performance using a suitable cabling tester which will verify the limits of the appropriate standards EN50173-1, ISO/IEC 11801, resp. EIA/TIA-568B2.1. Sometimes the terms EIA/TIA-568A and EIA/TIA-568B are used informally to show the different assignments of the colour coded pairs to the connector pins of the RJ45, in this case this is not a statement regarding the transmission quality.

## INFO



LÜTZE Cables of the category 5e offer generally an overall shield as braid (S/UTP).



LÜTZE provides category 6 and 7 shielded pair cables with an additional all-round braided-copper shield (S/FTP).

dards and various suppliers. In the current EN50173, these cables are designated "F" for a foil shield, and "S" for a copper mesh shield. The degree of coverage of the braid should be greater than 30% in order to achieve sufficient shielding against low-frequency fields. New designation according to ISO/IEC-11801 (2002)E is also : S/FTP (meshwork), F/FTP (foil), SF/FTP (braid+foil). Therefore the letter before the slash describes the overall shield, the letter behind the pair shield.

## Categories and Classes

CAT 3,5,6 or 7 describes the categories with regard to the cable and connector requirements. The transmission bandwidth is determined by the cable class (A - 100kHz, B - 1MHz, C - 16MHz, D - 100MHz, E - 300MHz, F - 600MHz). The requirements for the cable are defined in different parts of the standard EN 50288. The EN 50173 and ISO/IEC 11801 describe the installation of cables, connectors, and net structures.

## CAT 1 - Class A

Cat 1 cables are designed for maximum operating frequencies up to 100 kHz, and are thus not suitable for data transmission. They are used for voice transmission, for example in telephone applications. Only UTP cables.

# LÜTZE – Ethernet Connectivity

## Overview Data Rate / Transmission Medium

| Ethernet   | Data Rate<br>MBit/s | Transmission Medium                                   | IEEE    |
|------------|---------------------|-------------------------------------------------------|---------|
| 10Base5    | 10                  | RG 8 Coaxial Cable 50 Ohm,<br>500 m segment length    | 802.3   |
| 10Base2    | 10                  | RG 85 Coaxial Cable 50 Ohm,<br>500 m segment length   | 802.3a  |
| 10Broad36  | 10                  | Coaxial Cable 75 Ohm, max.<br>Expansion 3.600 m       | 802.3b  |
| 10BaseT    | 10                  | Twisted Pair Cable, Kat 3,<br>100 m segment length    | 802.3i  |
| 10BaseFL   | 10                  | Multi Mode Fibre, 850 nm<br>2.000 m segment length    |         |
| 10BaseFB   | 10                  | Multi Mode Fibre 850 nm<br>2.000 m segment length     |         |
| 1000BaseT  | 1000                | Twisted Pair Cable, Kat 5,<br>100 m segment length    | 802.3ab |
| 1000BaseSX | 1000                | Multi Mode Fibre, 830 nm<br>550 m segment length      | 802.3z  |
| 1000BaseLX | 1000                | Multi Mode Fibre, 1.270 nm,<br>5.000 m segment length | 802.3z  |
| 1000BaseCX | 1000                | Twinax-Copper Cable 150 Ohm,<br>25 m segment length   | 802.3z  |

| Ethernet   | Data Rate<br>MBit/s | Transmission Medium                                                                  |
|------------|---------------------|--------------------------------------------------------------------------------------|
| 100BaseTX  | 100                 | Twisted Pair Cable, Kat 5, 100 m segment length                                      |
| 100BaseT2  | 100                 | Twisted Pair Cable, Kat 3,<br>100 m segment length, 2 x 2 Wire                       |
| 100BaseT4  | 100                 | Twisted Pair Cable, Kat 3,<br>100 m segment length, 4 x 2 Wire                       |
| 100BaseFX  | 100                 | Multi Mode Fibre, 1.300 nm, 2.000 m<br>segment length                                |
| 10GBaseSR  | 10                  | Seriell, Multi Mode Fibre, 850 nm, 2.300 m<br>segment length, without WAN Adjustment |
| 10GBaseSW  | 10                  | Serial Fibre Optic, 850 nm, 2.300 m<br>segment length, with WAN Adjustment           |
| 10GBaseLR  | 10                  | Serial Fibre Optic, 1.310 nm, 2-10.000 m<br>segment length, without WAN Adjustment   |
| 10GBaseLW  | 10                  | Serial Fibre Optic, 1.310 nm, 2-10.000 m<br>segment length, with WAN Adjustment      |
| 10GBaseER  | 10                  | Serial Fibre Optic, 1.550 nm, 2-40.000 m<br>segment length, without WAN Adjustment   |
| 10GBaseEW  | 10                  | Serial Fibre Optic, 1.550 nm, 2-40.000 m<br>segment length, with WAN Adjustment      |
| 10GBaseLX4 | 10                  | Serial Fibre Optic, 1.310 nm, 2-10.000 m<br>WWDM-Technology with 4 Channels          |

## Installation instructions for copper cables

## INFO

- Strip cables for as short a length as possible
- Never kink cables by more than 90°
- Minimum bending radius is four times the diameter
- Do not subject cables to twisting, elongation or tensile loads
- Do not crush cables when fastening them
- Apply shielding on the equipotential bonding over a large area, on both ends and with low impedance
- Apply shielding for several cables at a single point of the equipotential bonding
- Do not undo twisting of the individual conductors by more than 13 mm.

The current versions of relevant national and international laws, regulations and standards will always be binding. It may also be necessary to observe company standards. This then leads to additional requirements for installation, such as: Design in accordance with DIN EN 50174-1/2/3, Compliance with EMC Directives EN 55022, EN 50310 and DIN VDE 0878, Secure isolation between data and power cables, VDE 0804/DIN57804, Shielding measures, VDE 0100, TN-S, Power supply according to TN-S method, Observance of the earthing concept according to VDE 0100, Fire regulations, Accident prevention regulations, and perhaps others.

## Pin assignment

The most commonly used Ethernet connector is the so called RJ45 connector, which is available in shielded and unshielded variants. Of the RJ45 connector's eight pins, four are used for 10/100MBit/s, and all eight for 1000MBit/s.

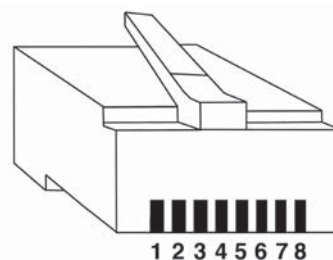
## Pin assignment RJ45:

| PIN-Nr. | 10BaseT        | 100BaseT       | 1000BaseT              |
|---------|----------------|----------------|------------------------|
| 1       | TD+ (Transmit) | TD+ (Transmit) | BI_DA+ (Bidirectional) |
| 2       | TD- (Transmit) | TD- (Transmit) | BI_DA- (Bidirectional) |
| 3       | RD+ (Recieve)  | RD- (Recieve)  | BI_DB+ (Bidirectional) |
| 4       | -              | -              | BI_DC+ (Bidirectional) |
| 5       | -              | -              | BI_DC- (Bidirectional) |
| 6       | RD- (Receive)  | RD- (Receive)  | BI_DB- (Bidirectional) |
| 7       | -              | -              | BI_DD+ (Bidirectional) |
| 8       | -              | -              | BI_DD- (Bidirectional) |

## Colour coded according to EN 50173 - hard wiring

In the EN 50173 standard, two colour codings are defined for installation, namely T568A and T568B. The user is free to choose between them, but should ensure during installation that the selected coding is maintained throughout the entire installation. Mixing the two codings will result in malfunctions

| PIN-No. | Pair<br>(T568A) | Pair<br>(T568B) | Colour<br>(T568A)                                                                     | Colour<br>(T568B)                                                                     |
|---------|-----------------|-----------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1       | 3               | 2               |  |  |
| 2       | 3               | 2               |  |  |
| 3       | 2               | 3               |  |  |
| 4       | 1               | 1               |  |  |
| 5       | 1               | 1               |  |  |
| 6       | 2               | 3               |  |  |
| 7       | 4               | 4               |  |  |
| 8       | 4               | 4               |  |  |



PIN Position

## Plug in Connector:

| Plug in Connector<br>Type | Connection | IEC         | Organisation<br>67076-3 106 | LÜTZE |
|---------------------------|------------|-------------|-----------------------------|-------|
| RJ45                      | Bajonet    | Version 1   | IAONA, ODVA                 |       |
| RJ45                      | Snap in    | Version 2   |                             |       |
| RJ45                      | Screw      | Version 3   |                             |       |
| RJ45                      | Push Pull  | Version 4   | PNO                         |       |
| RJ45                      | with Lock  | Version 5   | PNO                         |       |
| RJ45                      | Push Pull  | Version 6   | IAONA, IDA                  | •     |
| RJ45                      | with Lock  | Version 7   | PNO                         |       |
| RJ45                      | Screw      | Version 8   |                             |       |
| RJ45                      | Screw      | Version 9   |                             |       |
| RJ45                      | Pulse Lock | Version 10  |                             |       |
| M12 D                     | Screw      | IEC         | IAONA, ODVA                 |       |
| kod                       |            | 61076-2-101 | PNO                         |       |
| LWL                       | LWL        | IEC         | PNO                         |       |
|                           |            | 60874-74    |                             |       |

# LÜTZE – Ethernet Connectivity

## Fibre-optic cables

The advantages of fibre-optic cables are clear: wide bandwidth, data integrity, data security, immunity to interference and larger maximum length. They also offer additional interesting benefits compared to copper-based solutions, such as high quality electrical isolation between the individual components, low cable weight per meter, no electromagnetic radiation, laying directly next to high-energy cables and the immunity of the bit error rate to any type of electromagnetic disturbance.

Operation of a fibre-optic line thus requires no additional measures with regard to shielding, equipotential bonding or overvoltage protection. The main disadvantages compared to twisted pair cables are the price and the complicated assembly of the connections.

## POF

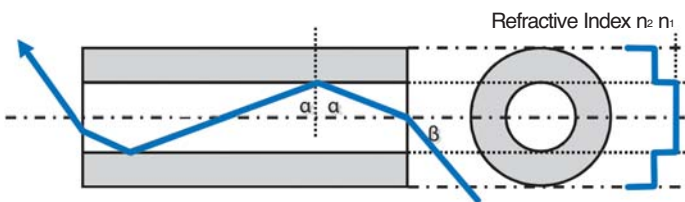
One way to bring the costs of assembly down to the same level as with twisted pairs is the use of POF (Polymer Optical Fibre) technology. This makes it possible to use economical, easy-to-assemble connectors, and preparing the connector interface is only a simple step. Although only distances of up to 50 m can be implemented, this provides adequate scope for typical practice-oriented decentralisation of active components.

## HCS

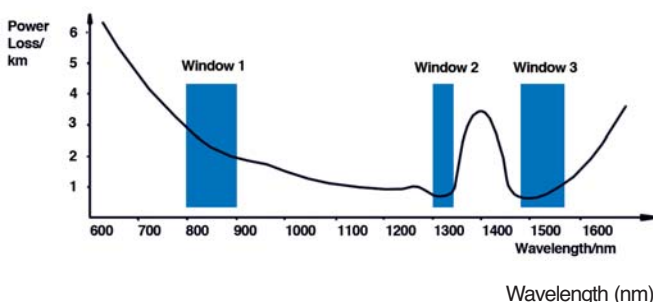
If a system requires lines longer than 50 m, HCS (Hard Clad Silica) can be used. The cable contains a 200  $\mu\text{m}$  thin glass fibre core with polymer cladding, and thus has less attenuation than the polymer fibres. It is possible to achieve distances of up to 100 m, although the costs of assembly are increased due to the smaller core diameter, due to the more precise connector mechanism that is required.

## Glass fibre

Glass fibre cables consist of a core and a cladding. A super-thin silicate or quartz glass fibre is used as the core, this in turn is clad in a lower-density glass. The difference in density between the two materials results in total reflection of injected light pulses, thus guiding light along the core.

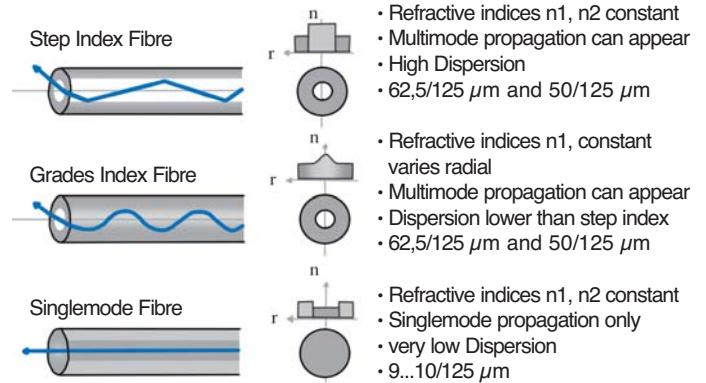


Information is transmitted using infrared light with wavelengths of 850 nm, 1300 nm or 1550 nm. With these wavelengths the attenuation is especially low - they are also called "optical windows".



The propagation velocity is directly dependent on the wavelength. This

naturally results in differences in propagation times, which are called dispersion. Likewise the entrance angles of the light beams (modes) are different, which leads to differences in the path lengths through the conductor itself. These processes change the shape of the signal that was originally fed in, which can result in transmission errors. Therefore when selecting a cable it is important to know the bit error performance that can be achieved.



Either the so-called bandwidth length product or the bit rate length product is used here. The bandwidth (B) depends on the length (L) of the fibre-optic cable, and produces the constant:

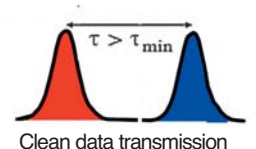
$$B \times L = \text{constant}$$

This constant can be used to calculate the usable bandwidth of a fibre-optic cable as a function of the transmission distance.

## Bandwidth:

The bandwidth is defined by the time distance needed to resolve two consecutive signals.

$$B = \frac{1}{\tau_{\min}} \text{ Mbps}$$



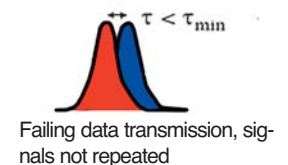
## Modal Bandwidth:

Bandwidth decreases reciprocal to fibre length. Thus the modal bandwidth is a fibre specific constant unit: MHz x km.

Step Index Fibre: typ.: 5 - 10 MHz x km

Graded Index Fibre typ.: 200-300 MHz x km

Singlemode Fibre: typ.: > 2 GHz x km



## Multimode

Because there are multiple possible light paths, the signal is affected (there are differences in propagation times); for this reason, multimode fibres are not suitable for communication over larger distances at high bandwidths. Multimode fibres for communication have an inner core diameter of up to 62.5  $\mu\text{m}$  (US standard), and for thinner versions it is only 50  $\mu\text{m}$  (EU standard). However, for both versions the outer diameter is almost always 125  $\mu\text{m}$  (140  $\mu\text{m}$  for older models). The maximum transmission distance for multimode is approximately 550 m for a core diameter of 50  $\mu\text{m}$ , and approx. 275 m for 62.5  $\mu\text{m}$ . Newer fibres have lower attenuation (which has, however, in practice no significance whatsoever for the transmission distance), and allow distances of up to several kilometers (also depending on the power of the transmitter and the sensitivity of the receiver). Greater ranges cannot, however, be achieved merely with greater power, but rather there are higher technical requirements which must be met to shape the light pulses in a highly complex manner. This special shaping takes into account the modal dispersion (differences in propagation times for the individual light beams).

The thicker optical fibres for high-powered lasers (here the energy density in the core of the fibre has to be reduced, because otherwise it would be

# LÜTZE – Ethernet Connectivity

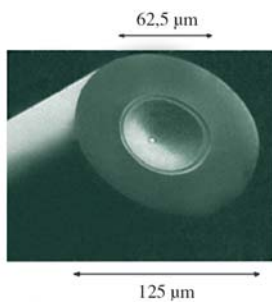
melted or torn) or for lighting (here single-mode operation is not possible due to the many different wavelengths that have to be transmitted at the same time) and measuring purposes (because here there are often short distances between the detector and the test specimen, and the handling is simpler, e.g. beam injection) are in principle multi-mode fibres.

## Mono- / Singlemode

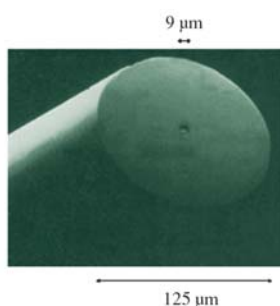
In single-mode fibres, the refractive index profile is dimensioned so that the problem of multiple-path propagation (intermodal dispersion) that arises with multi-mode fibres does not occur - in a single-mode fibre the signal light propagates in only a single guided waveguide mode, which is why it is called single-mode. This allows significantly greater transmission distances and/or bandwidths. However, there is a different dispersion which becomes significant: the material dispersion. Here it is understood that due to the wavelength-dependent index of refraction, the speed of light within the medium is also wavelength-dependent. In practice this means that the light used for transmission should be as chromatic as possible. This is provided by laser diodes, which come very close to the ideal. Single-mode fibres, which are sometimes also called mono-mode fibres, typically have a core diameter of 9  $\mu\text{m}$ ; their outer diameter is likewise 125  $\mu\text{m}$ . The actual transmission of the information takes place in the core of the fibre.

The fact that only laser components with wavelengths greater than 1250 nm are used means that they are still expensive to use. On the other hand, the bandwidth of 10 GHz/km means that distances of more than 100 km can be covered.

62,5/125  $\mu\text{m}$   
Graded Index Fibre



9/125  $\mu\text{m}$   
Singlemode Fibre



## Fibre-optic cables suitable for industrial use

Here two fibres are combined into a cable with a longitudinally water-tight cladding. The fibres are often clad with aramid or Kevlar yarn for strain relief. For outdoor applications the cables are often also provided with metal elements to reduce torsion and/or with protection against rodents and termites.

The following basic specifications apply here:

- Halogen-free according to IEC 60754-2
- Flame-retardant according to IEC 60332-3 (C3)
- Low smoke according to IEC 61034

## Overview fibre optics:

|                                | Singlemode | Multimode |          | HCS               | POF      |
|--------------------------------|------------|-----------|----------|-------------------|----------|
| Fibre                          |            |           |          |                   |          |
| IEC 60793                      | B1         | A1a       | A1b      | A3c               | A4a      |
| Material                       | glass      | glass     | glass    | glass/<br>plastic | plastic  |
| Ø Core/<br>fibre $\mu\text{m}$ | 9/125      | 50/125    | 62,5/125 | 200/230           | 980/1000 |
| Attenuation                    |            |           |          |                   |          |
| max. dB/km                     | 1,0        | 1,5       | 1,5      | 10                | 180      |
| @nm                            | 1.300      | 1.300     | 1300     | 650               | 650      |
| Bandwith                       |            |           |          |                   |          |
| max MHz*km                     |            | 500       | 500      | 70                | 35       |
| Cable length                   |            |           |          |                   |          |
| max. phys. m                   | 10.000     | 2.000     | 2.000    | 100               | 50       |

In order to prevent damage to fibre-optic cables, whether immediately or during use, great care should be taken when laying them. The VDE laying regulations always apply. In addition, further specifications for indoor and outdoor laying according to DIN VDE 0899 Part 3 must be observed.

## Fibre-optic cable connectors

In day-to-day industrial applications, four different types of connector are mainly used. These are SC, (V)ST, FSMA and MTRJ connectors. Other types of connector, such as ESCON, MIC, Mini-BNC, FC/PV, LC or Volition have to date been used on a very small scale.

The connector used most often in industry is the type SC:



## Power over Ethernet

Since 2003 the international standard IEEE 802.3af "DTE Power via MDI" has existed, which is also called Power over Ethernet (PoE), Power over LAN (PoL) or Active Ethernet. PoE technology makes it possible to supply power to low power consumption network nodes directly over the Ethernet cable. Furthermore, PoE devices can easily be connected to uninterruptible power supplies. This means that fewer new cables have to be laid and existing resources can be used more efficiently.

When using PoE it must be ensured that all of the infrastructure components present in the network are PoE compatible and that the transmission speed of such networks is limited to 10MBit/s and/or 100MBit/s.

IEEE 802.3af makes a distinction between two core components:

## Power Sourcing Equipment (PSE)

These devices feed the required power into the network, such as active network components with direct PoE support or PoE patch panels.

## Power Devices (PD)

These are units that are supplied remotely and do not have an external power connection.

For Power Sourcing Equipment, a distinction is made between two types of device:

## Endspan Insertion

PSE devices supply PDs with power directly via their ports, while at the same time supplying the PDs with data. These devices are almost exclusively switches, such as the Lütze PoE switches 772020 and 772021.

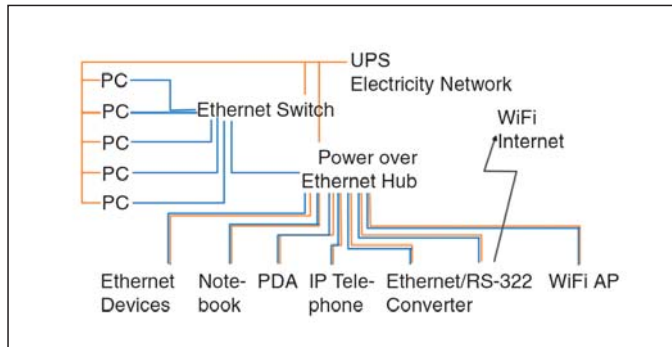
## Midspan Insertion

These are devices that convey the data of the active devices, while at the same time feeding power into the Ethernet cable. This device category includes splitters, such as Lütze item 772022. These devices are mainly used to upgrade an existing network structure for use.

# LÜTZE - Ethernet Connectivity

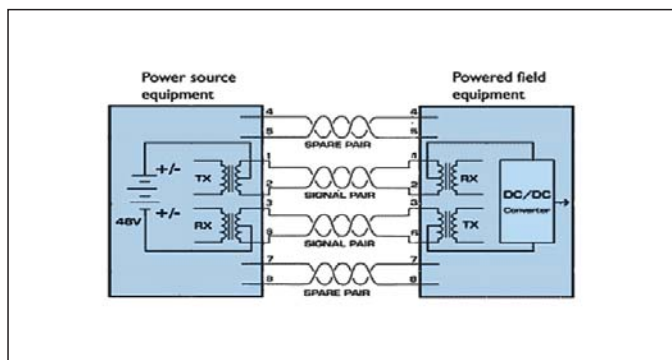
## Ethernet components need power:

The elimination of local power supplies by use of Power over Ethernet (PoE) can provide significant cost savings with systems such as VoIP, Web-Cams, embeded PCs, IP sensors, local automation and security systems.

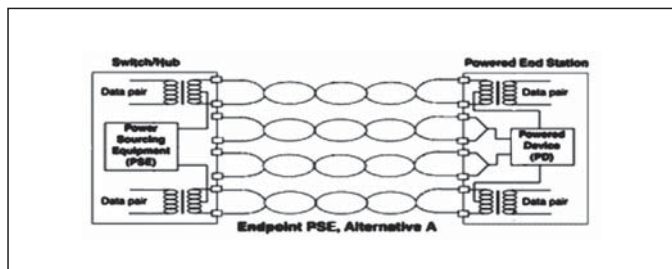


## Standardised as 802.3af:

- CAT5 Infrastructure for Data and Power
- Voltage between 44 and 57 Volt
- max. Current 550 mA
- max. Trigger Current 500 mA
- typical Current 10 mA ... 350 mA
- Overload recognition 350 mA - 500 mA
- mind. 5 mA-Idle Current

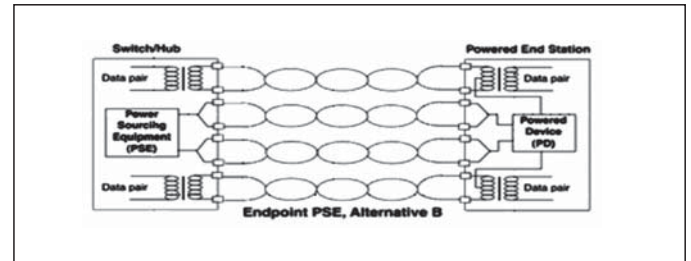


Power supply via data cables; Supply via the centre points of the isolating transformer:



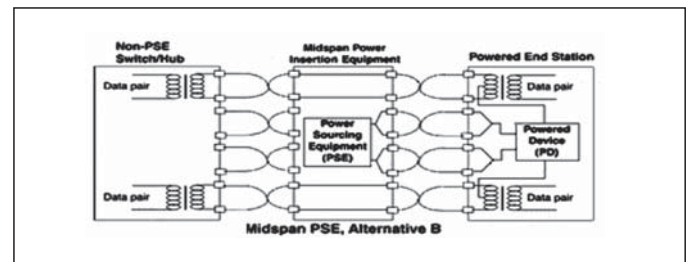
Endpoint PSE Alternative A.

Power supply via free conductor pairs; Positive and negative voltage sides are transmitted via two conductor pairs  
Cannot be used for T4 transmission (Gbit Ethernet)



Endpoint PSE Alternative B.

Power supply via supply sources used; the power supply is looped into the data path



Midspan PSE, Alternative C.

## Comments on wiring the variants

In order to prevent voltage drops, all 4 pairs can be used for the power supply. The current trend is to make use of the unused conductor pairs, because this provides better insulation.

| Wire | Variant A<br>MDI-X | Variant A<br>MDI | Variant B<br>All |
|------|--------------------|------------------|------------------|
| 1    | -V Port            | +V Port          |                  |
| 2    | -V Port            | +V Port          |                  |
| 3    | +V Port            | -V Port          |                  |
| 4    |                    |                  | +V Port          |
| 5    |                    |                  | +V Port          |
| 6    | +V Port            | -V Port          |                  |
| 7    |                    |                  | -V Port          |
| 8    |                    |                  | -V Port          |

# Ethernet Connectivity · Product Overview

## Unmanaged Switches



5 port  
10/100 Mbit



5 port  
10/100/1000 Mbit



8 port  
10/100 Mbit



8 port  
10/100/1000 Mbit



16+2G port  
10/100/1000 Mbit



4+1,2 FX port  
10/100 Base TX

|         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|
| Page 16 | Page 17 | Page 18 | Page 19 | Page 20 | Page 21 |
|---------|---------|---------|---------|---------|---------|

## Unmanaged PoE Switches, PoE splitter



5 port  
10/100 Mbit



10/100/1000 Mbit

|         |         |
|---------|---------|
| Page 22 | Page 23 |
|---------|---------|

## Media converter



10/100 Mbit

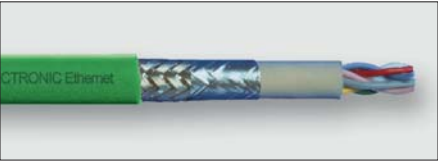


1000 Mbit

|         |         |
|---------|---------|
| Page 24 | Page 25 |
|---------|---------|

# Ethernet Connectivity · Product Overview

## Ethernet Bus cables



Standard                      C-track compatible

Page 28                      Page 29

## Actuator sensor interface network cables



PROFINET  
Male M12  
PUR cable



PROFINET  
Male M12  
PUR cable



PROFINET  
M12 panel  
connectors

Page 30                      Page 31                      Page 32

## Actuator sensor interface connector



M12, Male  
X coded  
Cat 6A



M12, Male  
D coded  
Cat 5e



M12, Female  
D coded  
Cat 5e



RJ45 straight  
AWG 27-22  
Cat 6A



RJ45 gewinkelt  
AWG 27-22  
Cat 6A

Page 35                      Page 36                      Page 37                      Page 38                      Page 39

## Actuator sensor interface panel connector and module holder



RJ45  
Front installation



M12 - RJ45  
Control cabinet  
bushing



RJ45 Female /  
IDC

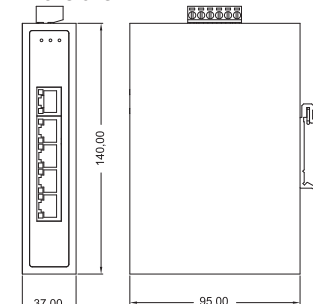
Page 40                      Page 41                      Page 42

# Ethernet · Unmanaged switch 5 ports

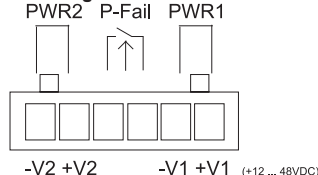
10 / 100 Mbit, autonegotiation, Auto MDI/MDI-X, DC 12 V / 24 V, redundant  
5 Fast Ethernet ports, Broadcast storm protection  
ESD 4 kV, surge 3 kV, expanded temperature range



## Dimensions



## PIN assignment



| Description                 |                | Part-No. | Type      | PU |
|-----------------------------|----------------|----------|-----------|----|
| 5 port, RJ45                |                |          |           |    |
| Operation temperature range | -10 °C – 60 °C | 772000   | ET-SWU5ST | 1  |
|                             | -40 °C – 75 °C | 772001   | ET-SWU5ET | 1  |

| Communication                 | 772000                                                                                                                                                                                                                              | 772001         |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Standard                      | IEEE 802.3, 802.3u, 802.3x                                                                                                                                                                                                          |                |
| LAN                           | 10 / 100 Base-TX                                                                                                                                                                                                                    |                |
| Cable length (segment)        | Max. 100 m                                                                                                                                                                                                                          |                |
| Rate of transmission          | Max. 100 Mbps                                                                                                                                                                                                                       |                |
| Connection technology (data)  | 5 × RJ45                                                                                                                                                                                                                            |                |
| Broadcast Storm Rate Limit    | 200 pps (200M), 20 pps (10M)                                                                                                                                                                                                        |                |
| Status Indication             | P1, P2, P-Fail, 10/100T(x): link/activity, duplex/collision                                                                                                                                                                         |                |
| General                       |                                                                                                                                                                                                                                     |                |
| Operation voltage range       | DC 12 V - DC 48 V, redundant                                                                                                                                                                                                        |                |
| Power consumption             | 3 W                                                                                                                                                                                                                                 |                |
| Operation temperature range   | -10 °C – 60 °C                                                                                                                                                                                                                      | -40 °C – 75 °C |
| Storage temperature range     | -40 °C – 85 °C                                                                                                                                                                                                                      |                |
| Relative humidity (operation) | 5% - 95% (non-condensing)                                                                                                                                                                                                           |                |
| Relative humidity (storage)   | 0% - 95% (non-condensing)                                                                                                                                                                                                           |                |
| Protection class              | IP 30                                                                                                                                                                                                                               |                |
| Standards                     | UL 60950-1, CAN/CSA-C22.2 No.60950<br>U.S.A.: FCC Part 15 CISPR 22<br>EU: EN 55011, EN 61000-6-4, EN 55022 Class A, EN 61000-3-2/3, EN 55024, IEC 61000-4-2/3/4/5/6/8<br>EN 61000-6-2, IEC60068-2-27, IEC 60068-2-32, IEC 60068-2-6 |                |

## Approvals

| Safety                     |                 |
|----------------------------|-----------------|
| ESD (Ethernet)             | DD 4 kV         |
| Surge (EFT for power)      | DC 3 kV         |
| Reverse voltage protection | Yes             |
| Rated over load protection | 0.9 A @ DC 12 V |

## Mechanics

|                        |                                                  |
|------------------------|--------------------------------------------------|
| Dimensions (w × h × d) | 37.0 × 140.0 × 95.0 mm                           |
| Housing material       | Metal                                            |
| Field installation     | Snaps on to TS 35 rail (EN 50022), wall mounting |
| Installation position  | Any                                              |
| Weight (kg/piece)      | 0.600                                            |
| Termination            | Screw terminal, plug-in: 0.2–2.5 mm <sup>2</sup> |

## Monitoring

|                                 |                        |
|---------------------------------|------------------------|
| Power supply voltage monitoring | Relay, 1 normally open |
| Switching voltage               | AC 120 V / DC 28 V     |
| Switching current               | 1 A @ DC 24 V          |
| Insulation voltage              | DC 500 V               |

## Note

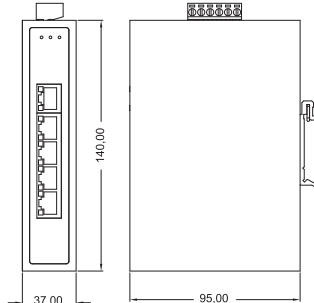
For more information on LED definition, see the data sheet.

# Ethernet · Unmanaged switches 5 ports

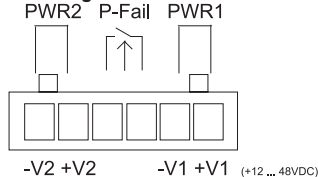
**10 / 100 / 1000 Mbit, autonegotiation, Auto MDI/MDI-X, DC 12 V / 24 V, redundant**  
**5 Fast Ethernet ports, frame transmission up to 9 kB (Jumbo frames)**  
**ESD 4 kV, surge 3 kV, expanded temperature range**



## Dimensions



## PIN assignment



| Description                 |                | Part-No. | Type       | PU |
|-----------------------------|----------------|----------|------------|----|
| 5 port, RJ45                |                |          |            |    |
| Operation temperature range | -10 °C – 60 °C | 772010   | ET-SWGU5ST | 1  |
|                             | -40 °C – 75 °C | 772011   | ET-SWGU5ET | 1  |

| Communication                   | 772010                                                                                          | 772011         |
|---------------------------------|-------------------------------------------------------------------------------------------------|----------------|
| Standard                        | IEEE 802.3, 802.3u, 802.3x                                                                      |                |
| LAN                             | 10 / 100 Base-TX, 10 / 1000 Base-T                                                              |                |
| Cable length (segment)          | Max. 100 m (4-wire Cat.5e, Cat.6 RJ45 cable)                                                    |                |
| Rate of transmission            | Max. 1000 Mbps                                                                                  |                |
| Connection technology (data)    | 5 × RJ45                                                                                        |                |
| Broadcast Storm Rate Limit      | 7926 pps                                                                                        |                |
| Status Indication               | P1, P2, P-Fail; 10/100T(x): Link/Activity, Duplex/Collision                                     |                |
| General                         |                                                                                                 |                |
| Operation voltage range         | DC 12 V - DC 48 V, redundant                                                                    |                |
| Power consumption               | 4.6 W                                                                                           |                |
| Operation temperature range     | -10 °C – 60 °C                                                                                  | -40 °C – 75 °C |
| Storage temperature range       | -40 °C – 85 °C                                                                                  |                |
| Relative humidity (operation)   | 5% - 95% (non-condensing)                                                                       |                |
| Relative humidity (storage)     | 0% - 95% (non-condensing)                                                                       |                |
| Protection class                | IP 30                                                                                           |                |
| Standards                       |                                                                                                 |                |
|                                 | UL 60950-1, CAN/CSA-C22.2 No.60950                                                              |                |
|                                 | U.S.A.: FCC Part 15 CISPR 22                                                                    |                |
|                                 | EU: EN 55011, EN 61000-6-4, EN 55022 Class A, EN 61000-3-2/3, EN 55024, IEC 61000-4-2/3/4/5/6/8 |                |
|                                 | EN 61000-6-2, IEC60068-2-27, IEC 60068-2-32, IEC 60068-2-6                                      |                |
| Approvals                       | cULus, CE, FCC                                                                                  |                |
| Safety                          |                                                                                                 |                |
| ESD (Ethernet)                  | DD 4 kV                                                                                         |                |
| Surge (EFT for power)           | DC 3 kV                                                                                         |                |
| Reverse voltage protection      | Yes                                                                                             |                |
| Rated over load protection      | 0.9 A @ DC 12 V                                                                                 |                |
| Mechanics                       |                                                                                                 |                |
| Dimensions (w × h × d)          | 37.0 × 140.0 × 95.0 mm                                                                          |                |
| Housing material                | Metal                                                                                           |                |
| Field installation              | rail TS 35 (EN 50022)                                                                           |                |
| Installation position           | Any                                                                                             |                |
| Weight (kg/piece)               | 0.600                                                                                           |                |
| Termination                     | Screw terminal, plug-in: 0.2–2.5 mm <sup>2</sup>                                                |                |
| Monitoring                      |                                                                                                 |                |
| Power supply voltage monitoring | Relay, 1 normally open                                                                          |                |
| Switching voltage               | AC 120 V / DC 28 V                                                                              |                |
| Switching current               | 1 A @ DC 24 V                                                                                   |                |
| Insulation voltage              | DC 500 V                                                                                        |                |

## Note

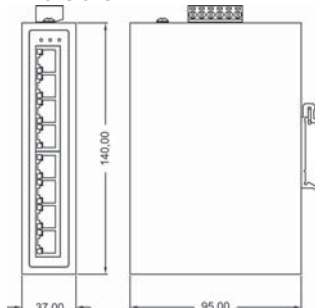
For more information on LED definition, see the data sheet.

# Ethernet · Unmanaged switch 8 ports

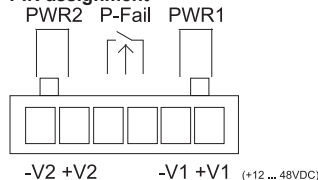
10 / 100 Mbit, autonegotiation, Auto MDI/MDI-X, DC 12 V / 24 V, redundant  
8 Fast Ethernet ports, Broadcast storm protection  
ESD 4 kV, surge 3 kV, expanded temperature range



## Dimensions



## PIN assignment



| Description                     | Part-No.                                                                                                                                                                                                                            |        | Type           | PU |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------|----|
| 8 port, RJ45                    |                                                                                                                                                                                                                                     |        |                |    |
| Operation temperature range     | -10 °C – 60 °C                                                                                                                                                                                                                      | 772002 | ET-SWU8ST      | 1  |
|                                 | -40 °C – 75 °C                                                                                                                                                                                                                      | 772003 | ET-SWU8ET      | 1  |
|                                 |                                                                                                                                                                                                                                     |        |                |    |
| Communication                   | 772002                                                                                                                                                                                                                              |        | 772003         |    |
| Standard                        | IEEE 802.3, 802.3u, 802.3x                                                                                                                                                                                                          |        |                |    |
| LAN                             | 10 / 100 Base-T(X)                                                                                                                                                                                                                  |        |                |    |
| Cable length (segment)          | Max. 100 m                                                                                                                                                                                                                          |        |                |    |
| Rate of transmission            | Max. 100 Mbps                                                                                                                                                                                                                       |        |                |    |
| Connection technology (data)    | 8 × RJ45                                                                                                                                                                                                                            |        |                |    |
| Broadcast Storm Rate Limit      | 200 pps (200M), 20 pps (10M)                                                                                                                                                                                                        |        |                |    |
| Status Indication               | P1, P2, P-Fail, 10/100T(x): link/activity, duplex/collision                                                                                                                                                                         |        |                |    |
| General                         |                                                                                                                                                                                                                                     |        |                |    |
| Operation voltage range         | DC 12 V - DC 48 V, redundant                                                                                                                                                                                                        |        |                |    |
| Power consumption               | 5 W                                                                                                                                                                                                                                 |        |                |    |
| Operation temperature range     | -10 °C – 60 °C                                                                                                                                                                                                                      |        | -40 °C – 75 °C |    |
| Storage temperature range       | -40 °C – 85 °C                                                                                                                                                                                                                      |        |                |    |
| Relative humidity (operation)   | 5% - 95% (non-condensing)                                                                                                                                                                                                           |        |                |    |
| Relative humidity (storage)     | 0% - 95% (non-condensing)                                                                                                                                                                                                           |        |                |    |
| Protection class                | IP 30                                                                                                                                                                                                                               |        |                |    |
| Standards                       | UL 60950-1, CAN/CSA-C22.2 No.60950<br>U.S.A.: FCC Part 15 CISPR 22<br>EU: EN 55011, EN 61000-6-4, EN 55022 Class A, EN 61000-3-2/3, EN 55024, IEC 61000-4-2/3/4/5/6/8<br>EN 61000-6-2, IEC60068-2-27, IEC 60068-2-32, IEC 60068-2-6 |        |                |    |
| Approvals                       | cULus, CE, FCC                                                                                                                                                                                                                      |        |                |    |
| Safety                          |                                                                                                                                                                                                                                     |        |                |    |
| ESD (Ethernet)                  | DD 4 kV                                                                                                                                                                                                                             |        |                |    |
| Surge (EFT for power)           | DC 3 kV                                                                                                                                                                                                                             |        |                |    |
| Reverse voltage protection      | Yes                                                                                                                                                                                                                                 |        |                |    |
| Rated over load protection      | 0.9 A @ DC 12 V                                                                                                                                                                                                                     |        |                |    |
| Mechanics                       |                                                                                                                                                                                                                                     |        |                |    |
| Dimensions (w × h × d)          | 37.0 × 140.0 × 95.0 mm                                                                                                                                                                                                              |        |                |    |
| Housing material                | Metal                                                                                                                                                                                                                               |        |                |    |
| Field installation              | rail TS 35 (EN 50022)                                                                                                                                                                                                               |        |                |    |
| Installation position           | Any                                                                                                                                                                                                                                 |        |                |    |
| Weight (kg/piece)               | 0.600                                                                                                                                                                                                                               |        |                |    |
| Termination                     | Screw terminal, plug-in: 0.2–2.5 mm <sup>2</sup>                                                                                                                                                                                    |        |                |    |
| Monitoring                      |                                                                                                                                                                                                                                     |        |                |    |
| Power supply voltage monitoring | Relay, 1 normally open                                                                                                                                                                                                              |        |                |    |
| Switching voltage               | AC 120 V / DC 28 V                                                                                                                                                                                                                  |        |                |    |
| Switching current               | 1 A @ DC 24 V                                                                                                                                                                                                                       |        |                |    |
| Insulation voltage              | DC 500 V                                                                                                                                                                                                                            |        |                |    |

## Note

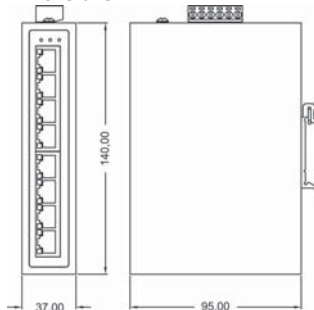
For more information on LED definition, see the data sheet.

# Ethernet · Unmanaged switch 8 ports

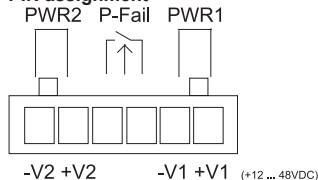
10 / 100 / 1000 Mbit, autonegotiation, Auto MDI/MDI-X, DC 12 V / 24 V, redundant  
8 Fast Ethernet ports, frame transmission up to 9 kB  
ESD 4 kV, Surge 3 kV



## Dimensions



## PIN assignment



| Description                     | Part-No.                                                                                                                                                                                                                            | Type   | PU         |   |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------|---|
| Description                     | 8 port, RJ45                                                                                                                                                                                                                        | 772012 | ET-SWGU8ST | 1 |
|                                 |                                                                                                                                                                                                                                     |        |            |   |
| Communication                   |                                                                                                                                                                                                                                     | 772012 |            |   |
| Standard                        | IEEE 802.3, 802.3u, 802.3x                                                                                                                                                                                                          |        |            |   |
| LAN                             | 10 / 100 Base-TX, 10 / 1000 Base-T                                                                                                                                                                                                  |        |            |   |
| Cable length (segment)          | Max. 100 m (4-wire Cat.5e, Cat.6 RJ45 cable)                                                                                                                                                                                        |        |            |   |
| Rate of transmission            | Max. 1000 Mbps                                                                                                                                                                                                                      |        |            |   |
| Connection technology (data)    | 8 × RJ45                                                                                                                                                                                                                            |        |            |   |
| Broadcast Storm Rate Limit      | 7926 pps                                                                                                                                                                                                                            |        |            |   |
| Status Indication               | P1, P2, P-Fail, 10/100T(x): link/activity, duplex/collision                                                                                                                                                                         |        |            |   |
| General                         |                                                                                                                                                                                                                                     |        |            |   |
| Operation voltage range         | DC 12 V - DC 48 V, redundant                                                                                                                                                                                                        |        |            |   |
| Power consumption               | 4.6 W                                                                                                                                                                                                                               |        |            |   |
| Power output                    | —                                                                                                                                                                                                                                   |        |            |   |
| Operation temperature range     | -10 °C – 60 °C                                                                                                                                                                                                                      |        |            |   |
| Storage temperature range       | -40 °C – 85 °C                                                                                                                                                                                                                      |        |            |   |
| Relative humidity (operation)   | 5% - 95% (non-condensing)                                                                                                                                                                                                           |        |            |   |
| Relative humidity (storage)     | 0% - 95% (non-condensing)                                                                                                                                                                                                           |        |            |   |
| Protection class                | IP 30                                                                                                                                                                                                                               |        |            |   |
| Standards                       | UL 60950-1, CAN/CSA-C22.2 No.60950<br>U.S.A.: FCC Part 15 CISPR 22<br>EU: EN 55011, EN 61000-6-4, EN 55022 Class A, EN 61000-3-2/3, EN 55024, IEC 61000-4-2/3/4/5/6/8<br>EN 61000-6-2, IEC60068-2-27, IEC 60068-2-32, IEC 60068-2-6 |        |            |   |
| Approvals                       | cULus, CE, FCC                                                                                                                                                                                                                      |        |            |   |
| Safety                          |                                                                                                                                                                                                                                     |        |            |   |
| ESD (Ethernet)                  | DD 4 kV                                                                                                                                                                                                                             |        |            |   |
| Surge (EFT for power)           | DC 3 kV                                                                                                                                                                                                                             |        |            |   |
| Reverse voltage protection      | Yes                                                                                                                                                                                                                                 |        |            |   |
| Rated over load protection      | 1.6 A @ DC 12 V                                                                                                                                                                                                                     |        |            |   |
| Mechanics                       |                                                                                                                                                                                                                                     |        |            |   |
| Dimensions (w × h × d)          | 37.0 × 140.0 × 95.0 mm                                                                                                                                                                                                              |        |            |   |
| Housing material                | Metal                                                                                                                                                                                                                               |        |            |   |
| Field installation              | rail TS 35 (EN 50022)                                                                                                                                                                                                               |        |            |   |
| Installation postition          | Any                                                                                                                                                                                                                                 |        |            |   |
| Weight (kg/piece)               | 0.600                                                                                                                                                                                                                               |        |            |   |
| Termination                     | Screw terminal, plug-in: 0.2–2.5 mm <sup>2</sup>                                                                                                                                                                                    |        |            |   |
| Monitoring                      |                                                                                                                                                                                                                                     |        |            |   |
| Power supply voltage monitoring | Relay, 1 normally open                                                                                                                                                                                                              |        |            |   |
| Switching voltage               | AC 120 V / DC 28 V                                                                                                                                                                                                                  |        |            |   |
| Switching current               | 1 A @ DC 24 V                                                                                                                                                                                                                       |        |            |   |
| Insulation voltage              | DC 500 V                                                                                                                                                                                                                            |        |            |   |

## Note

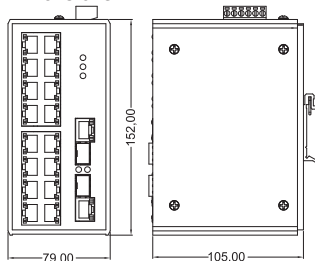
For more information on LED definition, see the data sheet.

# Ethernet · Unmanaged switch 16+2G ports

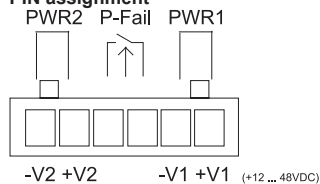
10 / 100 / 1000 Mbit, autonegotiation, Auto MDI/MDI-X, DC 12 V / 24 V, redundant  
Simple and flexible expansion to fibre optic with SFP base



Dimensions



PIN assignment



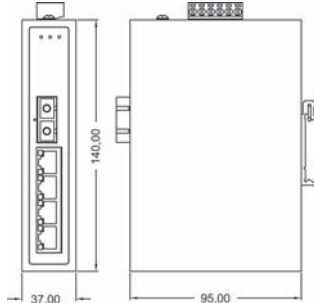
| Description                                                 | Part-No.                                                                                                                                                                                                                            | Type   | PU          |   |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------|---|
| Description                                                 | 16 port<br>+ 2G, RJ45/SFP                                                                                                                                                                                                           | 772014 | ET-SWGU18ST | 1 |
|                                                             |                                                                                                                                                                                                                                     |        |             |   |
| Communication                                               |                                                                                                                                                                                                                                     | 772014 |             |   |
| Standard                                                    | IEEE 802.3, 802.3ab, 802.3u, 802.3x, 802.3z                                                                                                                                                                                         |        |             |   |
| LAN                                                         | 100 Base-TX, 10 / 1000 Base-T, 1000 Base-SX/LX/LHX/XD/ZX/EZX                                                                                                                                                                        |        |             |   |
| Cable length (segment)                                      | Max. 100 m (4-wire Cat.5e, Cat.6 RJ45 cable)                                                                                                                                                                                        |        |             |   |
| Rate of transmission                                        | Ethernet : 10/100 Mbps, gigabit converter : 10/100/1000 Mbps                                                                                                                                                                        |        |             |   |
| Connection technology (data)                                | 16 RJ45 + 2 RJ45/SFP (mini GBIC)                                                                                                                                                                                                    |        |             |   |
| Broadcast Storm Rate Limit                                  | —                                                                                                                                                                                                                                   |        |             |   |
| Status Indication                                           | PWR1, PWR2, P-Fail, Gigabit Chopper: Link/Activity, Speed (1000MBps), Gigabit SFP: Link/Activity                                                                                                                                    |        |             |   |
| General                                                     |                                                                                                                                                                                                                                     |        |             |   |
| Operation voltage range                                     | DC 12 V - DC 48 V, redundant                                                                                                                                                                                                        |        |             |   |
| Power consumption                                           | 6.5 W                                                                                                                                                                                                                               |        |             |   |
| Operation temperature range                                 | -10 °C – 60 °C                                                                                                                                                                                                                      |        |             |   |
| Storage temperature range                                   | -40 °C – 85 °C                                                                                                                                                                                                                      |        |             |   |
| Relative humidity (operation)                               | 5% - 95% (non-condensing)                                                                                                                                                                                                           |        |             |   |
| Relative humidity (storage)                                 | 0% - 95% (non-condensing)                                                                                                                                                                                                           |        |             |   |
| Protection class                                            | IP 30                                                                                                                                                                                                                               |        |             |   |
| Standards                                                   | UL 60950-1, CAN/CSA-C22.2 No.60950<br>U.S.A.: FCC Part 15 CISPR 22<br>EU: EN 55011, EN 61000-6-4, EN 55022 Class A, EN 61000-3-2/3, EN 55024, IEC 61000-4-2/3/4/5/6/8<br>EN 61000-6-2, IEC60068-2-27, IEC 60068-2-32, IEC 60068-2-6 |        |             |   |
| Approvals                                                   | cULus, CE, FCC                                                                                                                                                                                                                      |        |             |   |
| Safety                                                      |                                                                                                                                                                                                                                     |        |             |   |
| ESD (Ethernet)                                              | DD 4 kV                                                                                                                                                                                                                             |        |             |   |
| Surge (EFT for power)                                       | DC 3 kV                                                                                                                                                                                                                             |        |             |   |
| Reverse voltage protection                                  | Yes                                                                                                                                                                                                                                 |        |             |   |
| Rated over load protection                                  | 3.5 A @ DC 12 V                                                                                                                                                                                                                     |        |             |   |
| Mechanics                                                   |                                                                                                                                                                                                                                     |        |             |   |
| Dimensions (w × h × d)                                      | 79.0 × 152.0 × 105.0 mm                                                                                                                                                                                                             |        |             |   |
| Housing material                                            | Metal                                                                                                                                                                                                                               |        |             |   |
| Field installation                                          | rail TS 35 (EN 50022)                                                                                                                                                                                                               |        |             |   |
| Installation position                                       | Any                                                                                                                                                                                                                                 |        |             |   |
| Weight (kg/piece)                                           | 1.100                                                                                                                                                                                                                               |        |             |   |
| Termination                                                 | Screw terminal, plug-in: 0.2–2.5 mm <sup>2</sup>                                                                                                                                                                                    |        |             |   |
| Monitoring                                                  |                                                                                                                                                                                                                                     |        |             |   |
| Power supply voltage monitoring                             | Relay, 1 normally open                                                                                                                                                                                                              |        |             |   |
| Switching voltage                                           | AC 120 V / DC 28 V                                                                                                                                                                                                                  |        |             |   |
| Switching current                                           | 1 A @ DC 24 V                                                                                                                                                                                                                       |        |             |   |
| Insulation voltage                                          | DC 500 V                                                                                                                                                                                                                            |        |             |   |
| Note                                                        |                                                                                                                                                                                                                                     |        |             |   |
| For more information on LED definition, see the data sheet. |                                                                                                                                                                                                                                     |        |             |   |

# Ethernet · Unmanaged switches 4+1/2FX ports

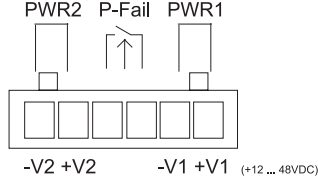
**10/100Base TX, 100Base FX Multi Mode, Auto MDI/MDI-X, DC 12 V / 24 V, redundant**  
**4 Fast Ethernet ports, 1× Multimode SC, 2× Single Mode SC**  
**ESD 4 kV, surge 3 kV, full/half duplex operation, broadcast storm protection**



## Dimensions



## PIN assignment



| Description |                                     | Part-No. | Type          | PU |
|-------------|-------------------------------------|----------|---------------|----|
| Description | 4 port, RJ45,<br>1 port Multimode   | 772005   | ET-SWU4-1STSC | 1  |
|             | 4 port, RJ45,<br>2 port single mode | 772007   | ET-SWU4-2STS  | 1  |

| Communication                | 772005                                                      | 772007 |
|------------------------------|-------------------------------------------------------------|--------|
| Standard                     | IEEE 802.3, 802.3u, 802.3x                                  |        |
| LAN                          | 10 / 100 Base-T(X), 100 Base FX                             |        |
| Cable length (segment)       | Copper max. 100 m, multi-mode fibre max. 2000 m             |        |
| Rate of transmission         | Max. 100 Mbps                                               |        |
| Connection technology (data) | 4 × RJ45, 1 × SC or 4 × RJ45, 2 × SC                        |        |
| Broadcast Storm Rate Limit   | 200 pps (200M), 20 pps (10M)                                |        |
| Status Indication            | P1, P2, P-Fail, 10/100T(x): link/activity, duplex/collision |        |

## Fibre-optic cables (Multi Mode)

|                |                        |   |
|----------------|------------------------|---|
| Wavelength     | 1310 nm                | — |
| Tx Power       | -14 / -20 dBm          | — |
| Rx sensitivity | -31 dBm                | — |
| Parameters     | 50/125 µm, 62.5/125 µm | — |

## Fibre-optic cables (Single Mode)

|                |   |              |
|----------------|---|--------------|
| Wavelength     | — | 1310 nm      |
| Tx Power       | — | -8 / -15 dBm |
| Rx sensitivity | — | -34 dBm      |
| Parameters     | — | 9 / 125 µm   |

## General

|                               |                                                                                                                                                                                                                                     |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation voltage range       | DC 24 V - DC 48 V, redundant                                                                                                                                                                                                        |
| Power consumption             | 5 W (1SC), 6.5 W (2SC)                                                                                                                                                                                                              |
| Operation temperature range   | -10 °C – 60 °C                                                                                                                                                                                                                      |
| Storage temperature range     | -40 °C – 85 °C                                                                                                                                                                                                                      |
| Relative humidity (operation) | 5% - 95% (non-condensing)                                                                                                                                                                                                           |
| Relative humidity (storage)   | 0% - 95% (non-condensing)                                                                                                                                                                                                           |
| Protection class              | IP 30                                                                                                                                                                                                                               |
| Standards                     | UL 60950-1, CAN/CSA-C22.2 No.60950<br>U.S.A.: FCC Part 15 CISPR 22<br>EU: EN 55011, EN 61000-6-4, EN 55022 Class A, EN 61000-3-2/3, EN 55024, IEC 61000-4-2/3/4/5/6/8<br>EN 61000-6-2, IEC60068-2-27, IEC 60068-2-32, IEC 60068-2-6 |

## Approvals

cULus, CE, FCC

## Safety

|                            |                                              |
|----------------------------|----------------------------------------------|
| ESD (Ethernet)             | DD 4 kV                                      |
| Surge (EFT for power)      | DC 3 kV                                      |
| Reverse voltage protection | Yes                                          |
| Rated over load protection | 0.9 A @ DC 12 V (1SC), 1.6 A @ DC 12 V (2SC) |

## Mechanics

|                        |                                                  |
|------------------------|--------------------------------------------------|
| Dimensions (w × h × d) | 37.0 × 140.0 × 95.0 mm                           |
| Housing material       | Metal                                            |
| Field installation     | rail TS 35 (EN 50022)                            |
| Installation position  | Any                                              |
| Weight (kg/piece)      | 0.600                                            |
| Termination            | Screw terminal, plug-in: 0.2–2.5 mm <sup>2</sup> |

## Monitoring

|                                 |                        |
|---------------------------------|------------------------|
| Power supply voltage monitoring | Relay, 1 normally open |
| Switching voltage               | AC 120 V / DC 28 V     |
| Switching current               | 1 A @ DC 24 V          |
| Insulation voltage              | DC 500 V               |

## Note

For more information on LED definition, see the data sheet.

# Ethernet · Unmanaged PoE switches 5 ports

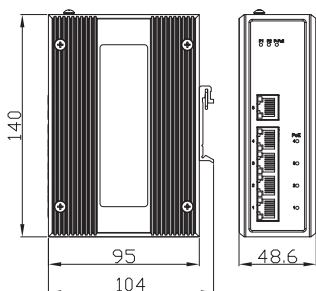
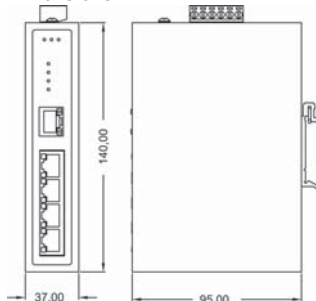
10 / 100 Mbit, Auto MDI/MDI-X, DC 48 V, redundant

5 Fast Ethernet ports, autonegotiation

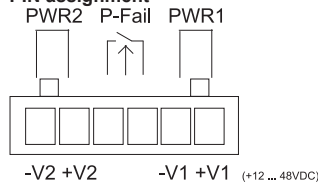
ESD 4 kV, Surge 3 kV



## Dimensions



## PIN assignment



| Description | Part-No.                   | Type      | PU |
|-------------|----------------------------|-----------|----|
| Description | PoE 5 port, 48 V 772020    | ET-PU5ST  | 1  |
|             | PoE 5 port, 24/48 V 772021 | ET-PU5AST | 1  |

| Communication                 | 772020                                                                                                                                                                                                                              | 772021               |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Standard                      | IEEE 802.3, 802.3u, 802.3x, 802.3af                                                                                                                                                                                                 |                      |
| LAN                           | 10 / 100 Base-TX                                                                                                                                                                                                                    |                      |
| Cable length (segment)        | Max. 100 m (4-wire Cat.5e, Cat.6 RJ45 cable)                                                                                                                                                                                        |                      |
| Rate of transmission          | Max. 100 Mbps                                                                                                                                                                                                                       |                      |
| Connection technology (data)  | 5 × RJ45                                                                                                                                                                                                                            |                      |
| Broadcast Storm Rate Limit    | —                                                                                                                                                                                                                                   |                      |
| Status Indication             | P1, P2, P-Fail, 10/100T(x): link/activity, duplex/collision                                                                                                                                                                         |                      |
| General                       |                                                                                                                                                                                                                                     |                      |
| Operation voltage range       | DC 48 V redundant                                                                                                                                                                                                                   | DC 24/48 V redundant |
| Power consumption             | 65 W full load PoE                                                                                                                                                                                                                  | 62.5 W full load PoE |
| Operation temperature range   | -10 °C – 60 °C                                                                                                                                                                                                                      |                      |
| Storage temperature range     | -40 °C – 85 °C                                                                                                                                                                                                                      |                      |
| Relative humidity (operation) | 5% - 95% (non-condensing)                                                                                                                                                                                                           |                      |
| Relative humidity (storage)   | 0% - 95% (non-condensing)                                                                                                                                                                                                           |                      |
| Protection class              | IP 30                                                                                                                                                                                                                               |                      |
| Standards                     | UL 60950-1, CAN/CSA-C22.2 No.60950<br>U.S.A.: FCC Part 15 CISPR 22<br>EU: EN 55011, EN 61000-6-4, EN 55022 Class A, EN 61000-3-2/3, EN 55024, IEC 61000-4-2/3/4/5/6/8<br>EN 61000-6-2, IEC60068-2-27, IEC 60068-2-32, IEC 60068-2-6 |                      |

## Approvals

| Safety                     |                              |
|----------------------------|------------------------------|
| ESD (Ethernet)             | DD 4 kV                      |
| Surge (EFT for power)      | DC 3 kV                      |
| Reverse voltage protection | Yes                          |
| Rated over load protection | 15,4 W @ 48 V (per PoE port) |

| Mechanics              |                                                  |
|------------------------|--------------------------------------------------|
| Dimensions (w × h × d) | 37.0 × 140.0 × 95.0 mm 48.6 × 140.0 × 95.0 mm    |
| Housing material       | Metal                                            |
| Field installation     | rail TS 35 (EN 50022)                            |
| Installation position  | Any                                              |
| Weight (kg/piece)      | 0.600 0.800                                      |
| Termination            | Screw terminal, plug-in: 0.2–2.5 mm <sup>2</sup> |

| Monitoring                      |                        |
|---------------------------------|------------------------|
| Power supply voltage monitoring | Relay, 1 normally open |
| Switching voltage               | AC 120 V / DC 28 V     |
| Switching current               | 1 A @ DC 24 V          |
| Insulation voltage              | DC 500 V               |

## Note

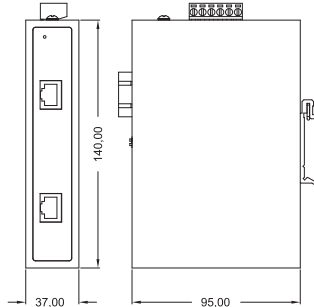
For more information on LED definition, see the data sheet.

# Ethernet · PoE splitter

**10 / 100 / 1000 Mbit, PoE input and data output**  
**12.95 W with DC 24 V, DC 48 V IN, DC 24 V OUT**  
**IEC 802.3af compatible, -40°C – +75°C, ESD 4 kV, surge 3 kV**



## Dimensions



## PIN assignment



Output DC 24V

| Description                     | Part-No.                                                                                                                                                                                                                            | Type   | PU       |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------|
| Description                     | Power splitter                                                                                                                                                                                                                      | 772022 | ET-PSPET |
| 1                               |                                                                                                                                                                                                                                     |        |          |
| Communication                   |                                                                                                                                                                                                                                     | 772022 |          |
| Standard                        | IEEE 802.3, 802.3u, 802.3x, 802.3af, 802.3ab                                                                                                                                                                                        |        |          |
| LAN                             | 10 / 100 Base-TX, 10 / 1000 Base-T                                                                                                                                                                                                  |        |          |
| Cable length (segment)          | Max. 100 m (4-wire Cat.5e)                                                                                                                                                                                                          |        |          |
| Rate of transmission            | Max. 100 Mbps                                                                                                                                                                                                                       |        |          |
| Connection technology (data)    | PoE IN, OUT: RJ 45                                                                                                                                                                                                                  |        |          |
| Broadcast Storm Rate Limit      | —                                                                                                                                                                                                                                   |        |          |
| Status Indication               | Power, Link/Activity, Duplex/Collision                                                                                                                                                                                              |        |          |
| General                         |                                                                                                                                                                                                                                     |        |          |
| Operation voltage range         | DC 44 V - DC 57 V                                                                                                                                                                                                                   |        |          |
| Power consumption               | 17.8 W @ 48 V                                                                                                                                                                                                                       |        |          |
| Power output                    | 12.95 W @ 24 V                                                                                                                                                                                                                      |        |          |
| Operation temperature range     | -40 °C – 75 °C                                                                                                                                                                                                                      |        |          |
| Storage temperature range       | -40 °C – 85 °C                                                                                                                                                                                                                      |        |          |
| Relative humidity (operation)   | 5% - 95% (non-condensing)                                                                                                                                                                                                           |        |          |
| Relative humidity (storage)     | 0% - 95% (non-condensing)                                                                                                                                                                                                           |        |          |
| Protection class                | IP 30                                                                                                                                                                                                                               |        |          |
| Standards                       | UL 60950-1, CAN/CSA-C22.2 No.60950<br>U.S.A.: FCC Part 15 CISPR 22<br>EU: EN 55011, EN 61000-6-4, EN 55022 Class A, EN 61000-3-2/3, EN 55024, IEC 61000-4-2/3/4/5/6/8<br>EN 61000-6-2, IEC60068-2-27, IEC 60068-2-32, IEC 60068-2-6 |        |          |
| Approvals                       | cULus, CE, FCC                                                                                                                                                                                                                      |        |          |
| Safety                          |                                                                                                                                                                                                                                     |        |          |
| ESD (Ethernet)                  | DD 4 kV                                                                                                                                                                                                                             |        |          |
| Surge (EFT for power)           | DC 3 kV                                                                                                                                                                                                                             |        |          |
| Reverse voltage protection      | Yes                                                                                                                                                                                                                                 |        |          |
| Rated over load protection      | 0.539 A @ DC 24 V                                                                                                                                                                                                                   |        |          |
| Mechanics                       |                                                                                                                                                                                                                                     |        |          |
| Dimensions (w × h × d)          | 37.0 × 140.0 × 95.0 mm                                                                                                                                                                                                              |        |          |
| Housing material                | Metal                                                                                                                                                                                                                               |        |          |
| Field installation              | rail TS 35 (EN 50022)                                                                                                                                                                                                               |        |          |
| Installation postition          | Any                                                                                                                                                                                                                                 |        |          |
| Weight (kg/piece)               | 0.600                                                                                                                                                                                                                               |        |          |
| Termination                     | Screw terminal, plug-in: 0.2–2.5 mm <sup>2</sup>                                                                                                                                                                                    |        |          |
| Monitoring                      |                                                                                                                                                                                                                                     |        |          |
| Power supply voltage monitoring | —                                                                                                                                                                                                                                   |        |          |
| Switching voltage               | —                                                                                                                                                                                                                                   |        |          |
| Switching current               | —                                                                                                                                                                                                                                   |        |          |
| Insulation voltage              | —                                                                                                                                                                                                                                   |        |          |

## Note

For more information on LED definition, see the data sheet.

# Ethernet · Media converter

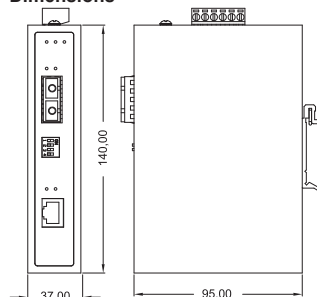
1×10/100 Mbps RJ45; 1×10/100 Mbps SC, Auto MDI/MDI-X auto crossover

DC 12 V - DC 48 V, redundant

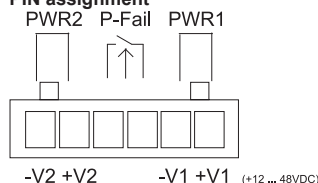
Full/half duplex operation, autonegotiation, ESD 4 kV, surge 3 kV



## Dimensions



## PIN assignment



| Description                         | Part-No.           | Type          | PU |
|-------------------------------------|--------------------|---------------|----|
| <b>MM=Multimode, SM=Single Mode</b> |                    |               |    |
| Description                         | Media Converter MM | 772032 MC2032 | 1  |
|                                     | Media Converter SM | 772033 MC2033 | 1  |

| Communication                | 772032                                                                           | 772033 |
|------------------------------|----------------------------------------------------------------------------------|--------|
| Standard                     | IEEE 802.3, 802.3u, 802.3x                                                       |        |
| LAN                          | 10 / 100 Base-TX, 100 Base-FX                                                    |        |
| Cable length (segment)       | Ethernet: max. 100 m, Fibre: 2000 m (multimode), 30,000 m (single mode)          |        |
| Rate of transmission         | Max. 100 Mbps                                                                    |        |
| Connection technology (data) | 1 × RJ45, 1 × SC, 6-pin connector                                                |        |
| Broadcast Storm Rate Limit   | —                                                                                |        |
| Status Indication            | P1, P2, P-Fail, Fibre: HDX/FDX, Link/Activity, Ethernet: 10/100 M, Link/Activity |        |

## Fibre-optic cables (Multi Mode)

|                |                            |   |
|----------------|----------------------------|---|
| Wavelength     | 850 nm                     | — |
| Tx Power       | -4/-9.5 dBm                | — |
| Rx sensitivity | -18 dBm                    | — |
| Parameters     | 50 / 125 µm, 62.5 / 125 µm | — |

## Fibre-optic cables (Single Mode)

|                |   |             |
|----------------|---|-------------|
| Wavelength     | — | 1310 nm     |
| Tx Power       | — | -3/-9.5 dBm |
| Rx sensitivity | — | -20 dBm     |
| Parameters     | — | 9 / 125 µm  |

## General

|                               |                                                                                                                                                                                                                                     |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DIP switch                    | Port / Power Alarm, LFP, Fibre: HDX/FDX, converter/switch                                                                                                                                                                           |
| Operation voltage range       | DC 12 V - DC 48 V, redundant                                                                                                                                                                                                        |
| Power consumption             | Max. 5 W                                                                                                                                                                                                                            |
| Operation temperature range   | -10 °C – 60 °C                                                                                                                                                                                                                      |
| Storage temperature range     | -40 °C – 85 °C                                                                                                                                                                                                                      |
| Relative humidity (operation) | 5% - 95% (non-condensing)                                                                                                                                                                                                           |
| Relative humidity (storage)   | 0% - 95% (non-condensing)                                                                                                                                                                                                           |
| Protection class              | IP 30                                                                                                                                                                                                                               |
| Standards                     | UL 60950-1, CAN/CSA-C22.2 No.60950<br>U.S.A.: FCC Part 15 CISPR 22<br>EU: EN 55011, EN 61000-6-4, EN 55022 Class A, EN 61000-3-2/3, EN 55024, IEC 61000-4-2/3/4/5/6/8<br>EN 61000-6-2, IEC60068-2-27, IEC 60068-2-32, IEC 60068-2-6 |

Approvals cULus, CE, FCC

## Safety

|                            |                             |
|----------------------------|-----------------------------|
| ESD (Ethernet)             | DD 4 kV                     |
| Surge (EFT for power)      | DC 3 kV                     |
| Reverse voltage protection | Yes                         |
| Rated over load protection | 0.9 A @ DC 12 V, resettable |

## Mechanics

|                        |                                                  |
|------------------------|--------------------------------------------------|
| Dimensions (w × h × d) | 37.0 × 140.0 × 95.0 mm                           |
| Housing material       | Metal                                            |
| Field installation     | rail TS 35 (EN 50022)                            |
| Installation position  | Any                                              |
| Weight (kg/piece)      | 0.600                                            |
| Termination            | Screw terminal, plug-in: 0.2–2.5 mm <sup>2</sup> |

## Monitoring

|                                 |                        |
|---------------------------------|------------------------|
| Power supply voltage monitoring | Relay, 1 normally open |
| Switching voltage               | AC 120 V / DC 28 V     |
| Switching current               | 1 A @ DC 24 V          |
| Insulation voltage              | DC 500 V               |

## Note

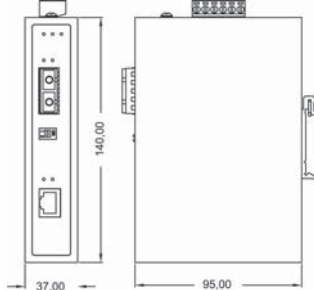
For more information on LED definition, see the data sheet.

# Ethernet · Media converter

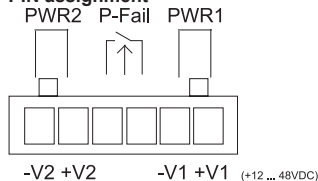
1×1000 Mbps RJ45, 1×1000 Mbps SC, Auto MDI/MDI-X auto crossover  
DC 12 V - DC 48 V, redundant  
Full/half duplex operation, autonegotiation, ESD 4 kV, surge 3 kV



## Dimensions

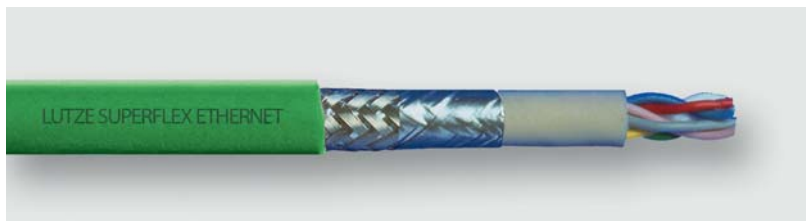


## PIN assignment



| Description                                                 |                                                                                                                                                                                                                                     | Part-No. | Type        | PU |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------|----|
| MM=Multimode, SM=Single Mode                                |                                                                                                                                                                                                                                     |          |             |    |
| Description                                                 | Media Converter MM                                                                                                                                                                                                                  | 772030   | MC2030      | 1  |
|                                                             | Media Converter SM                                                                                                                                                                                                                  | 772031   | MC2031      | 1  |
|                                                             |                                                                                                                                                                                                                                     |          |             |    |
| Communication                                               |                                                                                                                                                                                                                                     | 772030   | 772031      |    |
| Standard                                                    | IEEE 802.3, 802.3u, 802.3x, 802.3ab, 802.3z                                                                                                                                                                                         |          |             |    |
| LAN                                                         | 10 / 100 / 1000 Base-TX, 1000 Base-SX, 1000 Base-LX                                                                                                                                                                                 |          |             |    |
| Cable length (segment)                                      | Ethernet: max. 100 m, Fibre: 550 m (multimode), 10,000 m (single mode)                                                                                                                                                              |          |             |    |
| Rate of transmission                                        | Max. 1000 Mbps                                                                                                                                                                                                                      |          |             |    |
| Connection technology (data)                                | 1 × RJ45, 1 × SC, 6-pin connector                                                                                                                                                                                                   |          |             |    |
| Broadcast Storm Rate Limit                                  | –                                                                                                                                                                                                                                   |          |             |    |
| Status Indication                                           | P1, P2, P-Fail, Fibre: Link/Activity, Ethernet: 1000 M, Link/Activity                                                                                                                                                               |          |             |    |
| Fibre-optic cables (Multi Mode)                             |                                                                                                                                                                                                                                     |          |             |    |
| Wavelength                                                  | 850nm                                                                                                                                                                                                                               |          | –           |    |
| Tx Power                                                    | -4/-9.5 dBm                                                                                                                                                                                                                         |          | –           |    |
| Rx sensitivity                                              | -18 dBm                                                                                                                                                                                                                             |          | –           |    |
| Parameters                                                  | 50 / 125 µm, 62.5 / 125 µm                                                                                                                                                                                                          |          | –           |    |
| Fibre-optic cables (Single Mode)                            |                                                                                                                                                                                                                                     |          |             |    |
| Wavelength                                                  | –                                                                                                                                                                                                                                   |          | 1310 nm     |    |
| Tx Power                                                    | –                                                                                                                                                                                                                                   |          | -3/-9.5 dBm |    |
| Rx sensitivity                                              | –                                                                                                                                                                                                                                   |          | -20 dBm     |    |
| Parameters                                                  | –                                                                                                                                                                                                                                   |          | 9 / 125 µm  |    |
| General                                                     |                                                                                                                                                                                                                                     |          |             |    |
| DIP switch                                                  | Port Alarm, LFP                                                                                                                                                                                                                     |          |             |    |
| Operation voltage range                                     | DC 12 V - DC 48 V, redundant                                                                                                                                                                                                        |          |             |    |
| Power consumption                                           | 5.18 W                                                                                                                                                                                                                              |          | 5.30 W      |    |
| Operation temperature range                                 | -10 °C – 60 °C                                                                                                                                                                                                                      |          |             |    |
| Storage temperature range                                   | -40 °C – 85 °C                                                                                                                                                                                                                      |          |             |    |
| Relative humidity (operation)                               | 5% - 95% (non-condensing)                                                                                                                                                                                                           |          |             |    |
| Relative humidity (storage)                                 | 0% - 95% (non-condensing)                                                                                                                                                                                                           |          |             |    |
| Protection class                                            | IP 30                                                                                                                                                                                                                               |          |             |    |
| Standards                                                   | UL 60950-1, CAN/CSA-C22.2 No.60950<br>U.S.A.: FCC Part 15 CISPR 22<br>EU: EN 55011, EN 61000-6-4, EN 55022 Class A, EN 61000-3-2/3, EN 55024, IEC 61000-4-2/3/4/5/6/8<br>EN 61000-6-2, IEC60068-2-27, IEC 60068-2-32, IEC 60068-2-6 |          |             |    |
| Approvals                                                   | cULus, CE, FCC                                                                                                                                                                                                                      |          |             |    |
| Safety                                                      |                                                                                                                                                                                                                                     |          |             |    |
| ESD (Ethernet)                                              | DD 4 kV                                                                                                                                                                                                                             |          |             |    |
| Surge (EFT for power)                                       | DC 3 kV                                                                                                                                                                                                                             |          |             |    |
| Reverse voltage protection                                  | Yes                                                                                                                                                                                                                                 |          |             |    |
| Rated over load protection                                  | 0.9 A @ DC 12 V, resettable                                                                                                                                                                                                         |          |             |    |
| Mechanics                                                   |                                                                                                                                                                                                                                     |          |             |    |
| Dimensions (w × h × d)                                      | 37.0 × 140.0 × 95.0 mm                                                                                                                                                                                                              |          |             |    |
| Housing material                                            | Metal                                                                                                                                                                                                                               |          |             |    |
| Field installation                                          | rail TS 35 (EN 50022)                                                                                                                                                                                                               |          |             |    |
| Installation position                                       | Any                                                                                                                                                                                                                                 |          |             |    |
| Weight (kg/piece)                                           | 0.600                                                                                                                                                                                                                               |          |             |    |
| Termination                                                 | Screw terminal, plug-in: 0.2–2.5 mm <sup>2</sup>                                                                                                                                                                                    |          |             |    |
| Monitoring                                                  |                                                                                                                                                                                                                                     |          |             |    |
| Power supply voltage monitoring                             | Relay, 1 normally open                                                                                                                                                                                                              |          |             |    |
| Switching voltage                                           | AC 120 V / DC 28 V                                                                                                                                                                                                                  |          |             |    |
| Switching current                                           | 1 A @ DC 24 V                                                                                                                                                                                                                       |          |             |    |
| Insulation voltage                                          | DC 500 V                                                                                                                                                                                                                            |          |             |    |
| Note                                                        |                                                                                                                                                                                                                                     |          |             |    |
| For more information on LED definition, see the data sheet. |                                                                                                                                                                                                                                     |          |             |    |

# LÜTZE - Ethernet cables • Overview



## ELECTRONIC Industrial Ethernet / PROFINET / ETHERCAT

|                          |                               |                               |                              |
|--------------------------|-------------------------------|-------------------------------|------------------------------|
| Category                 | Cat5                          | Cat5                          | Cat6a                        |
| Application according to | ProfiNet Typ A                | Profinet Typ B                |                              |
| Dimensions               | 2x2xAWG22/1                   | 2x2xAWG22/7                   | 4x2xAWG22/1                  |
| Part-No.                 | 104301                        | 104307                        | 104397                       |
| Screen                   | SF / UTQ                      | SF / UTC                      | S / FTP                      |
| Jacket                   | PVC                           | PVC                           | PVC                          |
| UL                       | CMG, PLTC,<br>AWM 20201 600 V | CMG, PLTC,<br>AWM 20201 600 V | CMG, PLTC,<br>AWM 2570 600 V |

## ELECTRONIC Industrial Ethernet / Ethernet IP

|            |              |              |              |              |
|------------|--------------|--------------|--------------|--------------|
| Category   | Cat5e        | Cat5e        | Cat6a        | Cat7         |
| Dimensions | 4x2xAWG 26/7 | 4x2xAWG 24/7 | 4x2xAWG 26/7 | 4x2xAWG 26/7 |
| Part-No.   | 104335       | 104336       | 104338       | 104331       |
| Screen     | SF / UTP     | SF / UTP     | S / FTP      | S / FTP      |
| Jacket     | PVC          | PVC          | PVC          | PVC          |
| UL         | CMG          | CMG          | CMG          | CMG          |

## SUPERFLEX Industrial Ethernet / ProfiNet / Ethercat

|            |               |              |
|------------|---------------|--------------|
| Category   | Cat5          | Cat5         |
| Dimensions | 2x2xAWG 22/19 | 2x2xAWG 22/7 |
| Part-No.   | 104302        | 104303       |
| Screen     | SF / UTQ      | SF / UTC     |
| Jacket     | PUR           | PUR          |
| UL         | CMX           | CMX          |

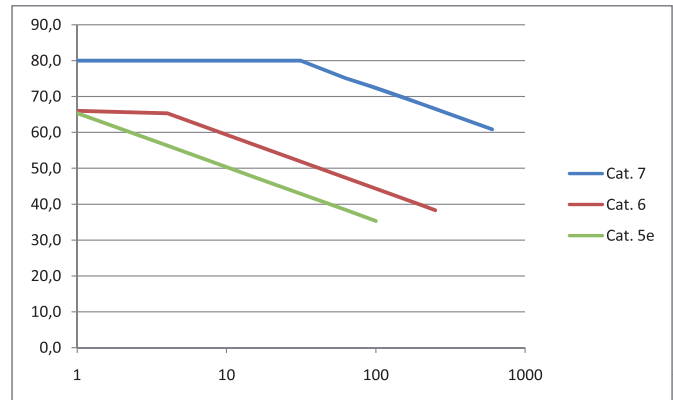
## SUPERFLEX Industrial Ethernet / Ethernet IP

|            |               |               |               |               |
|------------|---------------|---------------|---------------|---------------|
| Category   | Cat5e         | Cat5e         | Cat5e         | Cat6          |
| Dimensions | 2x2xAWG 26/19 | 4x2xAWG 24/19 | 4x2xAWG 26/19 | 4x2xAWG 26/19 |
| Part-No.   | 104379        | 104337        | 104396        | 104347        |
| Screen     | SF / UTQ      | SF / UTP      | SF / UTP      | SF / UTP      |
| Jacket     | PUR           | PUR           | PUR           | PUR           |
| UL         | AWM           | AWM           | AWM           | CMX           |

# LÜTZE - Ethernet Cables • Transmission Parameters

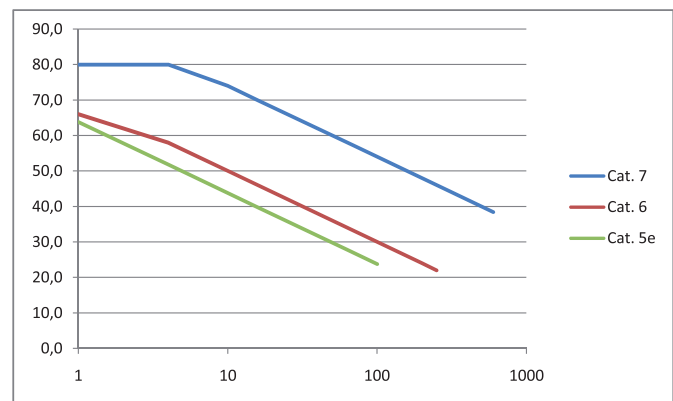
min. Near End Crosstalk (NEXT)

| Frequenz  | EN 50288-2-2 |        |        | [Unit] |
|-----------|--------------|--------|--------|--------|
|           | Cat. 5e      | Cat. 6 | Cat. 7 |        |
| 1 MHz     | 65,3         | 66,0   | 80,0   | dB     |
| 4 MHz     | 56,3         | 65,3   | 80,0   | dB     |
| 10 MHz    | 50,3         | 59,3   | 80,0   | dB     |
| 16 MHz    | 47,2         | 56,2   | 80,0   | dB     |
| 20 MHz    | 45,8         | 54,8   | 80,0   | dB     |
| 31,25 MHz | 42,9         | 51,9   | 80,0   | dB     |
| 62,5 MHz  | 38,4         | 47,4   | 75,1   | dB     |
| 100 MHz   | 35,3         | 44,3   | 72,4   | dB     |
| 155 MHz   | -            | 41,4   | 69,6   | dB     |
| 200 MHz   | -            | 39,8   | 67,9   | dB     |
| 250 MHz   | -            | 38,3   | 66,5   | dB     |
| 300 MHz   | -            | -      | 65,3   | dB     |
| 600 MHz   | -            | -      | 60,8   | dB     |



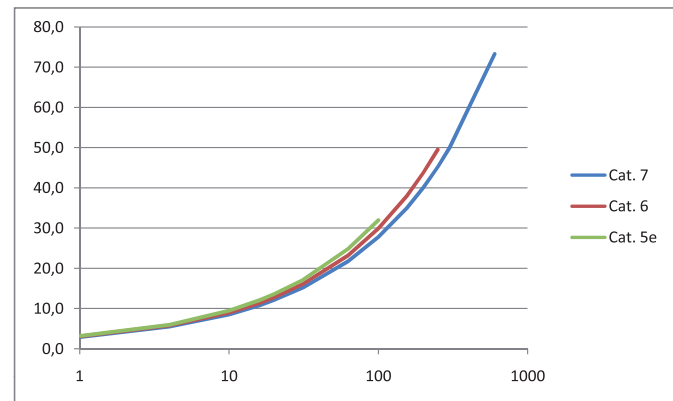
min. Far End Crosstalk (FEXT)

| Frequenz  | EN 50288-2-2 |        |        | [Unit] |
|-----------|--------------|--------|--------|--------|
|           | Cat. 5e      | Cat. 6 | Cat. 7 |        |
| 1 MHz     | 63,8         | 66,0   | 80,0   | dB     |
| 4 MHz     | 51,8         | 58,0   | 80,0   | dB     |
| 10 MHz    | 43,8         | 50,0   | 74,0   | dB     |
| 16 MHz    | 39,7         | 45,9   | 69,9   | dB     |
| 20 MHz    | 37,8         | 44,0   | 68,0   | dB     |
| 31,25 MHz | 33,9         | 40,1   | 64,1   | dB     |
| 62,5 MHz  | 27,9         | 34,1   | 58,1   | dB     |
| 100 MHz   | 23,8         | 30,0   | 54,0   | dB     |
| 155 MHz   | -            | 26,2   | 50,2   | dB     |
| 200 MHz   | -            | 24,0   | 48,0   | dB     |
| 250 MHz   | -            | 22,0   | 46,0   | dB     |
| 300 MHz   | -            | -      | 44,5   | dB     |
| 600 MHz   | -            | -      | 38,4   | dB     |



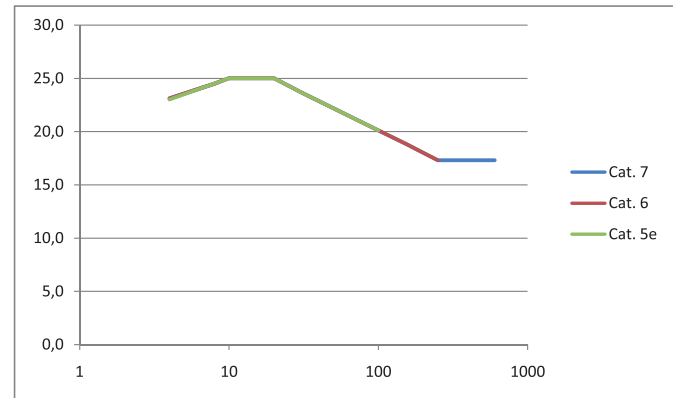
max. Attenuation (α)

| Frequenz  | EN 50288-2-2 |        |        | [Unit]  |
|-----------|--------------|--------|--------|---------|
|           | Cat. 5e      | Cat. 6 | Cat. 7 |         |
| 1 MHz     | 3,2          | 3,1    | 2,9    | dB/100m |
| 4 MHz     | 6,0          | 5,8    | 5,5    | dB/100m |
| 10 MHz    | 9,5          | 9,0    | 8,5    | dB/100m |
| 16 MHz    | 12,1         | 11,4   | 10,8   | dB/100m |
| 20 MHz    | 13,6         | 12,8   | 12,1   | dB/100m |
| 31,25 MHz | 17,1         | 16,1   | 15,2   | dB/100m |
| 62,5 MHz  | 24,8         | 23,2   | 21,7   | dB/100m |
| 100 MHz   | 32,0         | 29,9   | 27,8   | dB/100m |
| 155 MHz   | -            | 38,0   | 35,0   | dB/100m |
| 200 MHz   | -            | 43,7   | 40,1   | dB/100m |
| 250 MHz   | -            | 49,5   | 45,3   | dB/100m |
| 300 MHz   | -            | -      | 50,0   | dB/100m |
| 600 MHz   | -            | -      | 73,3   | dB/100m |



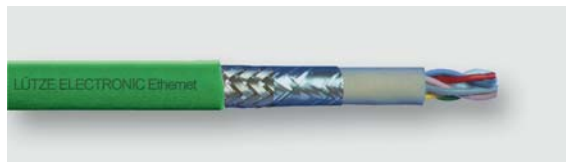
Return Loss (RL)

| Frequenz  | EN 50288-2-2 |        |        | [Unit] |
|-----------|--------------|--------|--------|--------|
|           | Cat. 5e      | Cat. 6 | Cat. 7 |        |
| 4 MHz     | 23,0         | 23,1   | 23,1   | dB     |
| 8 MHz     | 24,5         | 24,5   | 24,5   | dB     |
| 10 MHz    | 25,0         | 25,0   | 25,0   | dB     |
| 16 MHz    | 25,0         | 25,0   | 25,0   | dB     |
| 20 MHz    | 25,0         | 25,0   | 25,0   | dB     |
| 31,25 MHz | 23,6         | 23,6   | 23,6   | dB     |
| 62,5 MHz  | 21,5         | 21,5   | 21,5   | dB     |
| 100 MHz   | 20,1         | 20,1   | 20,1   | dB     |
| 155 MHz   | -            | 18,8   | 18,8   | dB     |
| 200 MHz   | -            | 18,0   | 18,0   | dB     |
| 250 MHz   | -            | 17,3   | 17,3   | dB     |
| 350 MHz   | -            | -      | 17,3   | dB     |
| 600 MHz   | -            | -      | 17,3   | dB     |



# PVC Bus cables · ETHERNET

## LÜTZE ELECTRONIC ETHERNET (C) PVC



### Application

- For the cabling of industrial field bus systems with the globally accepted TCP/IP protocol
- For fixed installation or mobile use without continuous flexing in automation technology, transport, conveyor technology and machine tools

### Properties

- High active and passive interference resistance (EMC)
- Silicone free
- RoHS-compliant

### Technical data

|                                  |                                                                                                         |
|----------------------------------|---------------------------------------------------------------------------------------------------------|
| Rated voltage                    | 300 V                                                                                                   |
| Test voltage                     | 1500 V                                                                                                  |
| Impedance                        | nom. 100 Ω                                                                                              |
| Loop resistance                  |                                                                                                         |
| Wire AWG 22/1= 0.34 <sup>2</sup> | <110 Ω/km                                                                                               |
| Wire AWG 24/7= 0.22 <sup>2</sup> | <165 Ω/km                                                                                               |
| Wire AWG 26/7=0.14 <sup>2</sup>  | <273 Ω/km                                                                                               |
| Operating capacitance            | <50 pF/m                                                                                                |
| Temperature range                |                                                                                                         |
| moving                           | -5 °C to +70 °C                                                                                         |
| run                              | -30 °C to +80 °C                                                                                        |
| Minimum bending radius           |                                                                                                         |
| moving                           | D × 12                                                                                                  |
| fixed                            | D × 6                                                                                                   |
| Burning behavior                 | Flame-retardant according to VDE 0482 part 265-2; IEC 60332-1 UL 1581 section VW-1 Flame-Test, CSA FT 4 |
| Approvals                        | cULus CMG<br>cULus PLTC<br>cURus AWM                                                                    |

### Construction

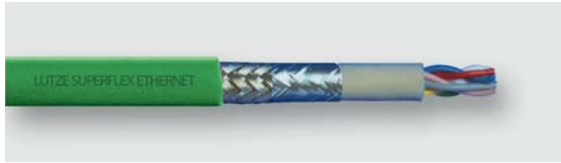
- Bare copper wire
- Wire according to AWG
- Conductor insulation Special polyolefin
- ST static shield
- Braid from tinned copper wire, optical coverage ≥ 85 %
- Jacket PVC, matte, adhesion-free surface
- Jacket color green RAL 6018

| Part-No.                                                | Number of strands/cross-section/<br>strand colors                                                                                                           | Outer Ø<br>ca. mm | Weight<br>kg/100 m | Cu-Index<br>kg/100 m |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------|----------------------|
| <b>ELECTRONIC Industrial Ethernet/Profinet/EtherCat</b> |                                                                                                                                                             |                   |                    |                      |
| 104301                                                  | (2x2xAWG22/1)StC<br>CMG, PLTC, AWM 20201 600 V<br>Cat5 100 MHz, SF/UTQ<br>Star quad, FC, ProfiNet type A<br>Transmission pair white/blue, yellow/<br>orange | 6.5               | 6.9                | 3.2                  |
| 104307                                                  | (2x2xAWG22/7)StC<br>CMG, PLTC, AWM 20201 600 V<br>Cat5 100 MHz, SF/UTQ<br>Star quad, FC, ProfiNet type B<br>Transmission pair white/blue, yellow/<br>orange | 6.5               | 6.8                | 3.2                  |
| 104397                                                  | (4x(2xAWG22/1)St)C<br>CMG, PLTC, AWM 2570 600 V<br>Cat6a 600 MHz, S/FTP<br>whiteblue/blue, whiteorange/orange,<br>whitegreen/green, whitebrown/brown        | 9.6               | 11.2               | 5.3                  |
| <b>ELECTRONIC Industrial Ethernet/Ethernet IP</b>       |                                                                                                                                                             |                   |                    |                      |
| 104335                                                  | (4x2xAWG26/7 StC)<br>CMG<br>Cat5e 100 MHz, SF/UTP<br>whiteblue/blue, whiteorange/orange,<br>whitegreen/green, whitebrown/brown                              | 6.3               | 5.5                | 3.0                  |
| 104336                                                  | (4x2xAWG24/7 StC)<br>CMG<br>Cat5e 100 MHz, SF/UTP<br>whiteblue/blue, whiteorange/orange,<br>whitegreen/green, whitebrown/brown                              | 7.3               | 6.9                | 3.8                  |
| 104338                                                  | (4x(2xAWG26/7)St)C<br>CMG<br>Cat6a 500 MHz, S/FTP<br>whiteblue/blue, whiteorange/orange,<br>whitegreen/green, whitebrown/brown                              | 6.4               | 5.8                | 3.3                  |
| 104331                                                  | (4x(2xAWG26/7)St)C<br>CMG<br>Cat7 600 MHz, S/FTP<br>whiteblue/blue, whiteorange/orange,<br>whitegreen/green, whitebrown/brown                               | 6.4               | 5.8                | 3.3                  |

CE These products are in conformity with the EU Low Voltage Directive 2006/95/EC

# PUR Bus cables · ETHERNET · C-track compatible

## LÜTZE SUPERFLEX® ETHERNET (C) PUR For highest requirements



### Application

- For the cabling of industrial field bus systems with the globally accepted TCP/IP protocol
- For fixed installation or mobile use without continuous flexing in automation technology, transport, conveyor technology and machine tools

### Properties

- High active and passive interference resistance (EMC)
- Silicone free
- Halogen free
- RoHS-compliant

### Technical data

|                        |                                                                                                          |
|------------------------|----------------------------------------------------------------------------------------------------------|
| Rated voltage          | 250 V                                                                                                    |
| Test voltage           | 1500 V                                                                                                   |
| Impedance              | nom. 100 Ω                                                                                               |
| Loop resistance        |                                                                                                          |
| AWG 22/7=              | 0.34 <sup>2</sup>                                                                                        |
| AWG 22/19=             | 0.34 <sup>2</sup>                                                                                        |
| AWG 24/19=             | 0.24 <sup>2</sup>                                                                                        |
| AWG 26/19=             | 0.14 <sup>2</sup>                                                                                        |
| Operating capacitance  | <50 pF/m                                                                                                 |
| Temperature range      |                                                                                                          |
| moving                 | -30 °C to +70 °C                                                                                         |
| fixed                  | -40 °C to +80 °C                                                                                         |
| Minimum bending radius |                                                                                                          |
| moving                 | D × 12                                                                                                   |
| fixed                  | D × 6                                                                                                    |
| Burning behavior       | Flame-retardant according to VDE 0482 part 265-2; IEC 60332-1, UL 1581 section VW-1 Flame-Test, CSA FT 1 |
| Halogen free           | according to EN 50267-2-1                                                                                |
| Approvals              | cULus CMX<br>cURus AWM                                                                                   |

### Construction

- Bare copper wire
- Wire according to AWG
- Conductor insulation Special polyolefin
- ST static shield
- Halogen-free sub jacket
- Braid from tinned copper wire, optical coverage ≥ 85 %
- Jacket special-PUR, matte, adhesion-free surface
- Jacket color green RAL 6018

| Part-No.                                               | Number of strands/cross-section/<br>strand colors                                                                                 | Outer Ø<br>ca. mm | Weight<br>kg/100 m | Cu-Index<br>kg/100 m |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------|----------------------|
| <b>SUPERFLEX Industrial Ethernet/ProfiNet/Ethercat</b> |                                                                                                                                   |                   |                    |                      |
| 104302                                                 | (2×2×AWG22/19)StC<br>CMX<br>Cat5 100 MHz, SF/UTQ<br>Star quad<br>Transmission pair white/blue, yellow/<br>orange                  | 6.6               | 6.3                | 3.2                  |
| 104303                                                 | (2×2×AWG22/7)StC<br>CMX<br>Cat5 100 MHz, SF/UTQ<br>Star quad, Profinet type C<br>Transmission pair white/blue, yellow/<br>orange  | 6.5               | 6.5                | 3.0                  |
| <b>SUPERFLEX Industrial Ethernet/Ethernet IP</b>       |                                                                                                                                   |                   |                    |                      |
| 104379                                                 | (2×2×AWG26/19)<br>AWM 21198<br>Cat5e 100 MHz, SF/UTQ<br>white, blue, yellow, orange                                               | 5.3               | 3.5                | 1.8                  |
| 104337                                                 | (4×2×AWG24/19)<br>AWM 21198<br>Cat5e 100 MHz, S/UTP<br>whiteblue/blue, whiteorange/orange,<br>whitegreen/green, whitebrown/brown  | 7.8               | 8.5                | 4.4                  |
| 104396                                                 | (4×2×AWG26/19)<br>AWM 21198<br>Cat5e 100 MHz, SF/UTP<br>whiteblue/blue, whiteorange/orange,<br>whitegreen/green, whitebrown/brown | 6.7               | 5.1                | 2.8                  |
| 104347                                                 | (4×2×AWG26/19)<br>CMX<br>Cat6 350 MHz, SF/UTP<br>whiteblue/blue, whiteorange/orange,<br>whitegreen/green, whitebrown/brown        | 7.9               | 7.4                | 3.4                  |

CE These products are in conformity with the EU Low Voltage Directive 2006/95/EC

# Actuator sensor interface · Network cables PROFINET

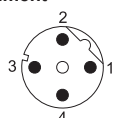
Male M12 straight with PUR cable, shielded 360°, open end  
self-locking screwed connection  
c-track compatible, halogen free



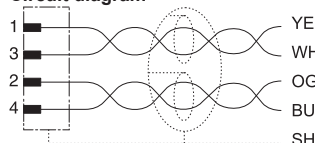
Dimensions



PIN assignment



Circuit diagram



| Description      |      | Part-No.    | Type                | PU |
|------------------|------|-------------|---------------------|----|
| Cable length (m) | 2.0  | 475300.0200 | STG4-M12/PN 2M-PUR  | 1  |
|                  | 5.0  | 475300.0500 | STG4-M12/PN 5M-PUR  | 1  |
|                  | 10.0 | 475300.1000 | STG4-M12/PN 10M-PUR | 1  |

## Technical data

|                             |            |     |      |
|-----------------------------|------------|-----|------|
| Nominal voltage             | AC/DC 24 V |     |      |
| Nominal voltage range       | max. 30 V  |     |      |
| Rated current               | 4 A        |     |      |
| Pol number                  | 4          |     |      |
| Cable length (m)            | 2.0        | 5.0 | 10.0 |
| Status Indication           | —          |     |      |
| Current Consumption per LED | —          |     |      |
| Coding                      | D          |     |      |
| Shielding                   | 360°       |     |      |

## General

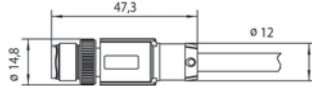
|                                          |                                         |             |           |
|------------------------------------------|-----------------------------------------|-------------|-----------|
| Form                                     | M12 × 1, male straight                  |             |           |
| Rated insulation voltage (EN 50178)      | 250 V                                   |             |           |
| Test voltage                             | 1.5 kV                                  |             |           |
| Pollution degree                         | 3                                       |             |           |
| Insulation resistance                    | >10 <sup>9</sup> Ω                      |             |           |
| Contact resistance                       | < 5 mΩ                                  |             |           |
| Class of flammability according to UL 94 | V0                                      |             |           |
| Protection class                         | IP65/IP67                               |             |           |
| Housing material                         | TPU black                               |             |           |
| Contact material                         | CuSn, gold plated nickel                |             |           |
| Thread material                          | Zinc die-casting, nickel-plated         |             |           |
| Gasket                                   | —                                       |             |           |
| Cable construction                       | 1 × 4 × AWG 22/7                        |             |           |
| Cable jacket                             | PUR, RAL 6018 green                     |             |           |
| Conductor insulation                     | white/yellow/blue/orange                |             |           |
| Cable diameter                           | 6.5 mm                                  |             |           |
| Bending radius                           | 10 x cable diameter                     |             |           |
| Storage temperature range                | -40 °C – 90 °C                          |             |           |
| Temperature range connector              | -25 °C – 90 °C                          |             |           |
| Temperature range cable fixed            | -40 °C – 70 °C                          |             |           |
| Temperature range cable moving           | -40 °C – 70 °C                          |             |           |
| Mechanical service life                  | —                                       |             |           |
| Weight (kg/piece)                        | 0.140                                   | 0.330       | 0.640     |
| Approvals                                | the cable is UL, CSA certified 80° 300V |             |           |
| <b>Accessories</b>                       | <b>Article number</b>                   | <b>Type</b> | <b>PU</b> |
| Cable markers 4×23mm                     | 499988                                  | LB M8/M12   | 5         |
| Torque setting tool M12                  | 490091                                  | DM-SET M12  | 1         |

# Actuator sensor interface · Network cables PROFINET

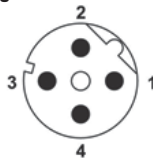
Male M12 straight on male M12 straight with PUR cable, shielded 360°  
self-locking screwed connection  
c-track compatible, halogen free



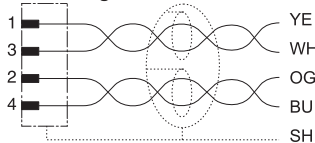
## Dimensions



## PIN assignment



## Circuit diagram



| Description      | Part-No. | Type        | PU                              |
|------------------|----------|-------------|---------------------------------|
| Cable length (m) | 0.3      | 475400.0030 | STG4-M12/STG4-M12/PN 0,3M PUR 1 |
|                  | 0.6      | 475400.0060 | STG4-M12/STG4-M12/PN 0,6M PUR 1 |
|                  | 1.0      | 475400.0100 | STG4-M12/STG4-M12/PN 1,0M PUR 1 |
|                  | 1.5      | 475400.0150 | STG4-M12/STG4-M12/PN 1,5M PUR 1 |
|                  | 2.0      | 475400.0200 | STG4-M12/STG4-M12/PN 2,0M PUR 1 |
|                  | 5.0      | 475400.0500 | STG4-M12/STG4-M12/PN 5,0M PUR 1 |

## Technical data

|                             |            |     |     |     |     |     |
|-----------------------------|------------|-----|-----|-----|-----|-----|
| Nominal voltage             | AC/DC 24 V |     |     |     |     |     |
| Nominal voltage range       | max. 30 V  |     |     |     |     |     |
| Rated current               | 4 A        |     |     |     |     |     |
| Pol number                  | 4          |     |     |     |     |     |
| Cable length (m)            | 0.3        | 0.6 | 1.0 | 1.5 | 2.0 | 5.0 |
| Status Indication           | —          |     |     |     |     |     |
| Current Consumption per LED | —          |     |     |     |     |     |
| Coding                      | D          |     |     |     |     |     |
| Shielding                   | 360°       |     |     |     |     |     |

## General

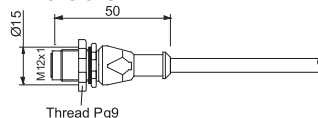
|                                          |                                                 |             |       |       |       |           |
|------------------------------------------|-------------------------------------------------|-------------|-------|-------|-------|-----------|
| Form                                     | M12 × 1, male straight / M12 × 1, male straight |             |       |       |       |           |
| Rated insulation voltage (EN 50178)      | 250 V                                           |             |       |       |       |           |
| Test voltage                             | 1.5 kV                                          |             |       |       |       |           |
| Pollution degree                         | 3                                               |             |       |       |       |           |
| Insulation resistance                    | >10 <sup>9</sup> Ω                              |             |       |       |       |           |
| Contact resistance                       | < 5 mΩ                                          |             |       |       |       |           |
| Class of flammability according to UL 94 | V0                                              |             |       |       |       |           |
| Protection class                         | IP65/IP67                                       |             |       |       |       |           |
| Housing material                         | TPU black                                       |             |       |       |       |           |
| Contact material                         | CuSn, gold plated nickel                        |             |       |       |       |           |
| Thread material                          | Tin die casting, nickel-plated                  |             |       |       |       |           |
| Gasket                                   | —                                               |             |       |       |       |           |
| Cable construction                       | 1 × 4 × AWG 22/7                                |             |       |       |       |           |
| Cable jacket                             | PUR, RAL 6018 green                             |             |       |       |       |           |
| Conductor insulation                     | white/yellow/blue/orange                        |             |       |       |       |           |
| Cable diameter                           | 6.5 mm                                          |             |       |       |       |           |
| Bending radius                           | 10 x cable diameter                             |             |       |       |       |           |
| Storage temperature range                | -30 °C – 90 °C                                  |             |       |       |       |           |
| Temperature range connector              | -25 °C – 90 °C                                  |             |       |       |       |           |
| Temperature range cable fixed            | -40 °C – 70 °C                                  |             |       |       |       |           |
| Temperature range cable moving           | -40 °C – 70 °C                                  |             |       |       |       |           |
| Mechanical service life                  | —                                               |             |       |       |       |           |
| Weight (kg/piece)                        | 0.060                                           | 0.070       | 0.090 | 0.110 | 0.150 | 0.325     |
| Approvals                                | the cable is UL, CSA certified 80° 300V         |             |       |       |       |           |
| <b>Accessories</b>                       | <b>Article number</b>                           | <b>Type</b> |       |       |       | <b>PU</b> |
| Cable markers 4×23mm                     | 499988                                          | LB M8/M12   |       |       |       | 5         |
| Torque setting tool M12                  | 490091                                          | DM-SET M12  |       |       |       | 1         |

# Actuator sensor interface · Network cables PROFINET

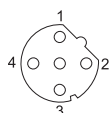
M12 panel connectors using PG9 thread for rear panel installation, open end  
Female - D coded (Ethernet Cat. 5e)  
shielded



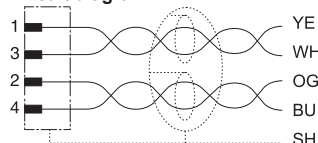
## Dimensions



## PIN assignment



## Circuit diagram



| Description                              |       | Part-No.                                | Type                | PU |
|------------------------------------------|-------|-----------------------------------------|---------------------|----|
| Cable length (m)                         | 2.0   | 475500.0200                             | KUGE-M12/PN 2M PUR  | 1  |
|                                          | 5.0   | 475500.0500                             | KUGE-M12/PN 5M PUR  | 1  |
|                                          | 10.0  | 475500.1000                             | KUGE-M12/PN 10M PUR | 1  |
|                                          |       |                                         |                     |    |
| Technical data                           |       |                                         |                     |    |
| Nominal voltage                          |       | AC/DC 24 V                              |                     |    |
| Nominal voltage range                    |       | max. 30 V                               |                     |    |
| Rated current                            |       | 4 A                                     |                     |    |
| Pol number                               |       | 4                                       |                     |    |
| Cable length (m)                         | 2.0   | 5.0                                     | 10.0                |    |
| Status Indication                        |       | –                                       |                     |    |
| Current Consumption per LED              |       | –                                       |                     |    |
| Coding                                   |       | D                                       |                     |    |
| Shielding                                |       | 360°                                    |                     |    |
| General                                  |       |                                         |                     |    |
| Form                                     |       | M12 × 1, female                         |                     |    |
| Rated insulation voltage (EN 50178)      |       | 250 V                                   |                     |    |
| Test voltage                             |       | 1.5 kV                                  |                     |    |
| Pollution degree                         |       | 3                                       |                     |    |
| Insulation resistance                    |       | >10 <sup>9</sup> Ω                      |                     |    |
| Contact resistance                       |       | < 5 mΩ                                  |                     |    |
| Class of flammability according to UL 94 |       | –                                       |                     |    |
| Protection class                         |       | IP65/IP67                               |                     |    |
| Housing material                         |       | TPU black                               |                     |    |
| Contact material                         |       | CuSn, gold plated nickel                |                     |    |
| Thread material                          |       | nickel-plated                           |                     |    |
| Gasket                                   |       | –                                       |                     |    |
| Cable construction                       |       | 1 × 4 × AWG 22/7                        |                     |    |
| Cable jacket                             |       | PUR, RAL 6018 green                     |                     |    |
| Conductor insulation                     |       | white/yellow/blue/orange                |                     |    |
| Cable diameter                           |       | 6.5 mm                                  |                     |    |
| Bending radius                           |       | 10 x cable diameter                     |                     |    |
| Storage temperature range                |       | -40 °C – 90 °C                          |                     |    |
| Temperature range connector              |       | -25 °C – 90 °C                          |                     |    |
| Temperature range cable fixed            |       | -40 °C – 70 °C                          |                     |    |
| Temperature range cable moving           |       | -40 °C – 70 °C                          |                     |    |
| Mechanical service life                  |       | –                                       |                     |    |
| Weight (kg/piece)                        | 0.140 | 0.330                                   | 0.640               |    |
| Approvals                                |       | the cable is UL, CSA certified 80° 300V |                     |    |
| Accessories                              |       |                                         |                     |    |
| Cable markers 4×23mm                     |       | Article number                          | Type                | PU |
|                                          |       | 499988                                  | LB M8/M12           | 5  |
| Torque setting tool M12                  |       | 490091                                  | DM-SET M12          | 1  |



# Classification Ethernet Cable and - connector

## Connector RJ45 and M12



RJ45 Connector  
straight

Page 38



RJ45 Connector  
angled

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M12 Connector  
D coded

Page 36



M12 Connector  
X coded

Page 35

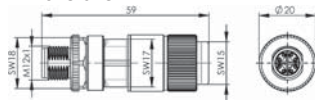
| Connector |  |  | RJ45 T568B<br>Part-No. 490129 / 490152 |  |  |  |  |  | RJ45 T568A<br>Part-No. 490128 / 490151 |  |  |  |  |  | RJ45 T568B AWG26<br>Part-No. 490138 / 490153 |  |  |  |  |  | M12 D coded<br>Part-No. 490074 |  |  |  |  |  | M12 X-coded<br>Part-No. 490150 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|           |  |  | Cat 6 <sub>A</sub>                     |  |  |  |  |  | Cat 6 <sub>A</sub>                     |  |  |  |  |  | Cat 6 <sub>A</sub>                           |  |  |  |  |  | Cat 5e                         |  |  |  |  |  | Cat 6 <sub>A</sub>             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|           |  |  |                                        |  |  |  |  |  |                                        |  |  |  |  |  |                                              |  |  |  |  |  |                                |  |  |  |  |  |                                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

# Actuator sensor interface · M12 - connector

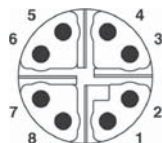
Field wireable connector, M12 straight shielded  
Male - X coded Cat 6<sub>A</sub> (Ethernet, Profinet)  
IDC quick-connect technology



## Dimensions

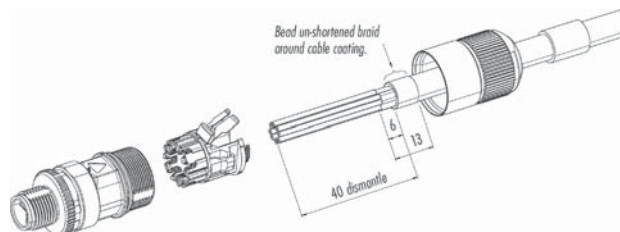


## Pin layout



| Description                              | Part-No.                                      | Type           | PU                               |    |
|------------------------------------------|-----------------------------------------------|----------------|----------------------------------|----|
| Male                                     |                                               |                |                                  |    |
| Pol number                               | 8                                             | 490150         | STGK8-M12(C) 8pol. X-cod. Cat.6A | 1  |
|                                          |                                               |                |                                  |    |
| Technical data                           |                                               | Male           |                                  |    |
| Nominal voltage                          | AC/DC 48 V                                    |                |                                  |    |
| Rated current                            | 0.5 A                                         |                |                                  |    |
| Pol number                               | 8                                             |                |                                  |    |
| Coding                                   | X                                             |                |                                  |    |
| Shielding                                | 360°                                          |                |                                  |    |
| General                                  |                                               |                |                                  |    |
| Form                                     | M12 × 1, male                                 |                |                                  |    |
| Pollution degree                         | 3                                             |                |                                  |    |
| Insulation resistance                    | >10 <sup>10</sup> Ω                           |                |                                  |    |
| Class of flammability according to UL 94 | V0                                            |                |                                  |    |
| Contact resistance                       | ≤5 mΩ                                         |                |                                  |    |
| Protection class                         | IP 67, in screwed condition                   |                |                                  |    |
| Housing material                         | Zinc die-casting, nickel-plated               |                |                                  |    |
| Contact material                         | CuZn, gold-plated                             |                |                                  |    |
| Gasket                                   | NBR                                           |                |                                  |    |
| Strand diameter                          | 0.9 – 1.6 mm                                  |                |                                  |    |
| Cable diameter                           | 5.5 – 9.0 mm                                  |                |                                  |    |
| Storage temperature range                | -40 – 85 °C                                   |                |                                  |    |
| Temperature range connector              | -40 °C – 85 °C                                |                |                                  |    |
| Termination                              | Insulation displacement connection technology |                |                                  |    |
| Cross section                            | AWG24/1 – AWG22/1, AWG27–AWG22/7              |                |                                  |    |
| Mechanical service life                  | ≥ 100 insertion cycles                        |                |                                  |    |
| Weight (kg/piece)                        | 0.073                                         |                |                                  |    |
| Accessories                              |                                               | Article number | Type                             | PU |
| matching cables                          |                                               | 104338         | (4x(2xAWG26/7)St)C               |    |
|                                          |                                               | 104331         | (4x(2xAWG26/7)St)C               |    |
|                                          |                                               | 104347         | (4x2xAWG26/19) CMX               |    |

## Mounting diagram

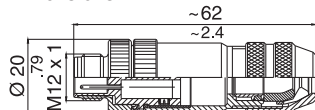


# Actuator sensor interface · M12 - connector

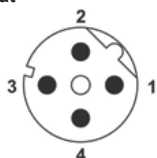
## Field wireable connector, M12 straight shielded Male - D coded Cat 5e (Ethernet, Profinet) Screw terminal



### Dimensions

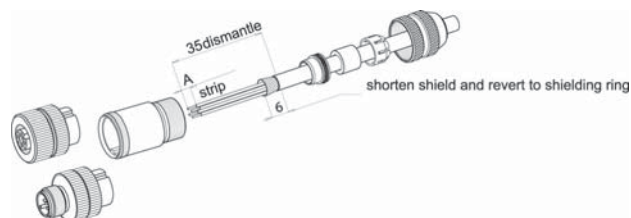


### Pin layout



| Description                                        | Part-No. | Type   | PU                                                                          |   |
|----------------------------------------------------|----------|--------|-----------------------------------------------------------------------------|---|
| Male                                               |          |        |                                                                             |   |
| Pol number                                         | 4        | 490074 | STGK4-M12 (C)-D                                                             | 1 |
|                                                    |          |        |                                                                             |   |
| Technical data                                     |          |        |                                                                             |   |
| Nominal voltage                                    |          |        | AC/DC 24 V                                                                  |   |
| Nominal voltage range                              |          |        | max. 60 V                                                                   |   |
| Rated current                                      |          |        | 4 A                                                                         |   |
| Pol number                                         |          |        | 4                                                                           |   |
| Cable length (m)                                   |          |        | –                                                                           |   |
| Status Indication                                  |          |        | –                                                                           |   |
| Current Consumption per LED                        |          |        | –                                                                           |   |
| Coding                                             |          |        | D                                                                           |   |
| Shielding                                          |          |        | 360°                                                                        |   |
| General                                            |          |        |                                                                             |   |
| Form                                               |          |        | M12 × 1, male                                                               |   |
| Test voltage                                       |          |        | 2.95 kV                                                                     |   |
| Rated insulation voltage (EN 50178)                |          |        | 250 V                                                                       |   |
| Pollution degree                                   |          |        | 3                                                                           |   |
| Insulation resistance                              |          |        | >10 <sup>10</sup> Ω                                                         |   |
| Contact resistance                                 |          |        | <3 mΩ                                                                       |   |
| Class of flammability according to UL 94           |          |        | HB                                                                          |   |
| Protection class                                   |          |        | IP 67, in screwed condition                                                 |   |
| Housing material                                   |          |        | Zinc die-casting, nickel-plated                                             |   |
| Contact material                                   |          |        | CuZn, gold-plated                                                           |   |
| Thread material                                    |          |        | CuSn nickel plated                                                          |   |
| Gasket                                             |          |        | NBR                                                                         |   |
| Cable construction                                 |          |        | –                                                                           |   |
| Cable jacket                                       |          |        | –                                                                           |   |
| Conductor insulation                               |          |        | –                                                                           |   |
| Cable diameter                                     |          |        | 6 – 8 mm                                                                    |   |
| Bending radius                                     |          |        | –                                                                           |   |
| Storage temperature range                          |          |        | -40 °C – 90 °C                                                              |   |
| Temperature range connector                        |          |        | -25 °C – 85 °C                                                              |   |
| Termination                                        |          |        | Screw terminal                                                              |   |
| Cross section                                      |          |        | without AE: 0.25–0.75 mm <sup>2</sup><br>with AE: 0.14–0.75 mm <sup>2</sup> |   |
| Mechanical service life                            |          |        | >100 insertion cycles                                                       |   |
| Weight (kg/piece)                                  |          |        | 0.045                                                                       |   |
| Approvals                                          |          |        | –                                                                           |   |
| Comments                                           |          |        |                                                                             |   |
| suitable for Ethernet and Profinet, see bus cables |          |        |                                                                             |   |

### Mounting diagram

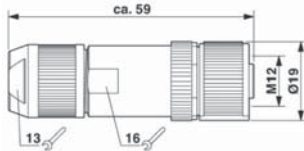


# Actuator sensor interface · M12 - connector

Field wireable connector, M12 straight shielded  
Female - D coded Cat 5e (Ethernet, Profinet)  
Shield termination via iris spring, cage clamp



## Dimensions



## Pin layout

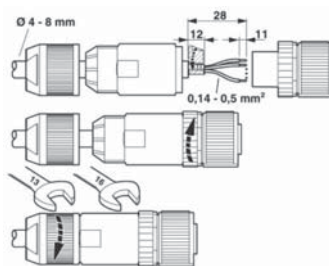


| Description                              | Part-No. | Type                                                                    | PU              |
|------------------------------------------|----------|-------------------------------------------------------------------------|-----------------|
| <b>Female</b>                            |          |                                                                         |                 |
| Description                              | Female   | 490095                                                                  | KUGK4-M12 (C)-D |
|                                          |          |                                                                         | 1               |
| <b>Technical data</b>                    |          |                                                                         |                 |
|                                          |          | <b>4</b>                                                                |                 |
| Nominal voltage                          |          | AC/DC 24 V                                                              |                 |
| Nominal voltage range                    |          | max. 60 V                                                               |                 |
| Rated current                            |          | Max. 4 A per contact                                                    |                 |
| Pol number                               |          | 4                                                                       |                 |
| Cable length (m)                         |          | —                                                                       |                 |
| Status Indication                        |          | —                                                                       |                 |
| Current Consumption per LED              |          | —                                                                       |                 |
| Coding                                   |          | D                                                                       |                 |
| Shielding                                |          | 360°                                                                    |                 |
| <b>General</b>                           |          |                                                                         |                 |
| Form                                     |          | M12 × 1, female                                                         |                 |
| Rated insulation voltage (EN 50178)      |          | 60 V                                                                    |                 |
| Test voltage                             |          | 0.8 kV                                                                  |                 |
| Pollution degree                         |          | 3                                                                       |                 |
| Insulation resistance                    |          | >10 <sup>10</sup> Ω                                                     |                 |
| Contact resistance                       |          | <8 mΩ                                                                   |                 |
| Class of flammability according to UL 94 |          | V0                                                                      |                 |
| Protection class                         |          | IP 67, in screwed condition                                             |                 |
| Housing material                         |          | Zinc die-casting, nickel-plated                                         |                 |
| Contact material                         |          | CuSn, gold-plated                                                       |                 |
| Thread material                          |          | CuSn nickel plated                                                      |                 |
| Gasket                                   |          | NBR                                                                     |                 |
| Cable construction                       |          | —                                                                       |                 |
| Cable jacket                             |          | —                                                                       |                 |
| Conductor insulation                     |          | —                                                                       |                 |
| Cable diameter                           |          | 4 – 8 mm                                                                |                 |
| Bending radius                           |          | —                                                                       |                 |
| Storage temperature range                |          | -40 °C – 90 °C                                                          |                 |
| Temperature range connector              |          | -40 °C – 85 °C                                                          |                 |
| Termination                              |          | Cage clamp 0.14 mm <sup>2</sup> – 0.5 mm <sup>2</sup> / 26 AWG – 20 AWG |                 |
| Mechanical service life                  |          | ≥ 100 insertion cycles                                                  |                 |
| Weight (kg/piece)                        |          | 0.042                                                                   |                 |
| Approvals                                |          | —                                                                       |                 |

## Comments

suitable for Ethernet and Profinet, see bus cables

## Mounting diagram



# Actuator sensor interface · RJ45 connector

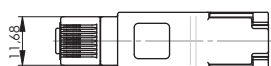
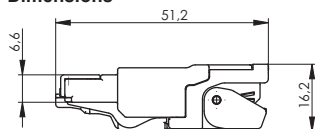
## Industrial connector RJ45

solid metal housing, quick-connect technology AWG 27–22

Cat 6A

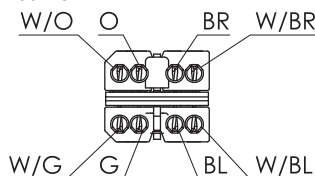


### Dimensions

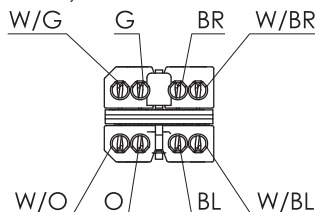


### Connection assignment

#### 490128



#### 490129, 490138



| Description |                                   | Part-No. | Type                            | PU |
|-------------|-----------------------------------|----------|---------------------------------|----|
| Description | Connection according to TIA 568 B | 490128   | RJ45-M 8pol. Cat.6A T568B       | 1  |
|             | Connection according to TIA 568 A | 490129   | RJ45-M 8pol. Cat.6A T568A       | 1  |
|             | Connection according to TIA 568 B | 490138   | RJ45-M 8pol. Cat.6A T568B AWG26 | 1  |

| Technical data                           | 490128 | 490129                                    | 490138                        |
|------------------------------------------|--------|-------------------------------------------|-------------------------------|
| Nominal voltage                          |        | 30 V                                      |                               |
| Nominal voltage range                    |        | –                                         |                               |
| Rated current                            |        | Max. 1.0 A per contact                    |                               |
| Pol number                               |        | 8                                         |                               |
| Cable length (m)                         |        | –                                         |                               |
| Transmission frequency                   |        | 10 Gigabit/s                              |                               |
| Category                                 |        | 6A (ISO/IEC 11801, DIN EN 50173-1)        |                               |
| Contact type                             |        | Penetration contacts                      |                               |
| Shielding                                |        | yes                                       |                               |
| General                                  |        |                                           |                               |
| Form                                     |        | RJ45 (IEC 60603-7-51)                     |                               |
| Rated insulation voltage (EN 50178)      |        | –                                         |                               |
| Test voltage                             |        | –                                         |                               |
| Pollution degree                         |        | 1                                         |                               |
| Insulation resistance                    |        | ≥500 MΩ                                   |                               |
| Contact resistance                       |        | ≤20 mΩ                                    |                               |
| Class of flammability according to UL 94 |        | V0                                        |                               |
| Protection class                         |        | IP 20                                     |                               |
| Housing material                         |        | Zinc die-casting, nickel-plated/PBT black |                               |
| Coverage                                 |        | PBT black                                 |                               |
| Contact material                         |        | Spring steel 0.8 µm gold-plated           |                               |
| Field installation                       |        | –                                         |                               |
| Installation depth                       |        | –                                         |                               |
| Strand diameter                          |        | 0.85 – 1.6 mm                             | 0.85 – 1.1 mm                 |
| Cable construction                       |        | –                                         |                               |
| Cable jacket                             |        | –                                         |                               |
| Cable diameter                           |        | 5 – 9 mm                                  |                               |
| Cross section                            |        | AWG 24/1-22/1, AWG 27/7-22/7              | AWG 26/1, AWG 26/7, AWG 26/19 |
| Operation temperature range              |        | –40 °C – 70 °C                            |                               |
| Storage temperature range                |        | –40 °C – 70 °C                            |                               |
| Mechanical service life                  |        | ≥ 750 insertion cycles                    |                               |
| Dimensions (w × h × d)                   |        | 13.8 × 16.2 × 53.1 mm                     |                               |
| Weight (kg/piece)                        |        | 0.025                                     |                               |
| Approvals                                |        | cULus                                     |                               |
| Standards                                |        | IEC 60603-7-51                            |                               |

### Comments

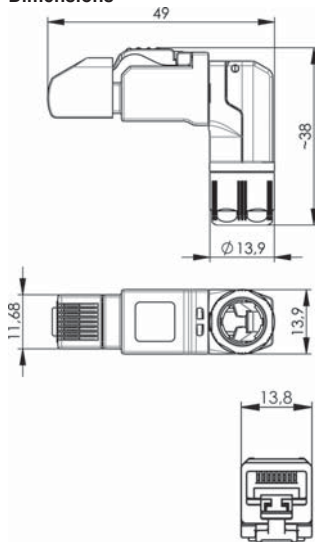
Geeignet für Profinet, SERCOS3, Ethercat, Ethernet/IP, Powerlink, VARAN, Power over Ethernet+ (PoE+IEEE 802.3at)  
Geeignete Leitungen, siehe Übersicht Zuordnung Ethernetleitungen zu Stecker.

# Actuator sensor interface · RJ45 connector

## Industrial connector RJ45, angled solid metal housing, quick-connect technology AWG 27–22 Cat 6A

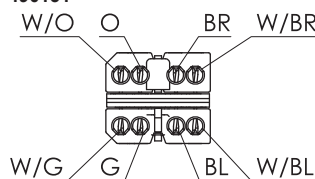


### Dimensions

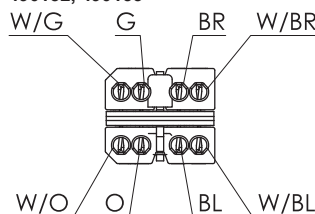


### Connection assignment

#### 490151



#### 490152, 490153



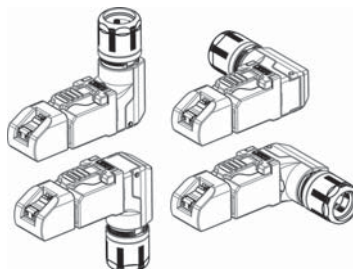
| Description |                                   | Part-No. | Type                            | PU |
|-------------|-----------------------------------|----------|---------------------------------|----|
|             |                                   |          |                                 |    |
| Description | Connection according to TIA 568 B | 490151   | RJ45-X 8pol. Cat.6A T568B       | 1  |
|             | Connection according to TIA 568 A | 490152   | RJ45-X 8pol. Cat.6A T568A       | 1  |
|             | Connection according to TIA 568 B | 490153   | RJ45-X 8pol. Cat.6A T568B AWG26 | 1  |

| Technical data                           | 490151 | 490152                                           | 490153                                  |
|------------------------------------------|--------|--------------------------------------------------|-----------------------------------------|
| Nominal voltage                          |        | 30 V                                             |                                         |
| Nominal voltage range                    |        | –                                                |                                         |
| Rated current                            |        | Max. 1.0 A per contact                           |                                         |
| Pol number                               |        | 8                                                |                                         |
| Cable length (m)                         |        | –                                                |                                         |
| Transmission frequency                   |        | 10 Gigabit/s                                     |                                         |
| Category                                 |        | 6A (ISO/IEC 11801, DIN EN 50173-1)               |                                         |
| Contact type                             |        | Penetration contacts                             |                                         |
| Shielding                                |        | yes                                              |                                         |
| <b>General</b>                           |        |                                                  |                                         |
| Form                                     |        | RJ45 (IEC 60603-7-51), cable output 90° rotating |                                         |
| Rated insulation voltage (EN 50178)      |        | –                                                |                                         |
| Test voltage                             |        | –                                                |                                         |
| Pollution degree                         |        | 1                                                |                                         |
| Insulation resistance                    |        | ≥500 MΩ                                          |                                         |
| Contact resistance                       |        | ≤20 mΩ                                           |                                         |
| Class of flammability according to UL 94 |        | V0                                               |                                         |
| Protection class                         |        | IP 20                                            |                                         |
| Housing material                         |        | Zinc die-casting, nickel-plated/PBT black        |                                         |
| Coverage                                 |        | PBT black                                        |                                         |
| Contact material                         |        | Spring steel 0.8 µm gold-plated                  |                                         |
| Field installation                       |        | –                                                |                                         |
| Installation depth                       |        | –                                                |                                         |
| Strand diameter                          |        | 1.0 – 1.6 mm                                     | 0.85 – 1.1 mm                           |
| Cable construction                       |        | –                                                |                                         |
| Cable jacket                             |        | –                                                |                                         |
| Cable diameter                           |        | 5.5 – 10.0 mm                                    |                                         |
| Cross section                            |        | AWG 24/1-22/1, AWG 27/7-22/7                     | AWG 26/1-24/1, AWG 27/7-24/7, AWG 26/19 |
| Operation temperature range              |        | –40 °C – 85 °C                                   |                                         |
| Storage temperature range                |        | –40 °C – 85 °C                                   |                                         |
| Mechanical service life                  |        | ≥ 750 insertion cycles                           |                                         |
| Dimensions (w × h × d)                   |        | 13.9 × 41.0 × 45.7 mm                            |                                         |
| Weight (kg/piece)                        |        | 0.030                                            |                                         |
| Approvals                                |        | cULus                                            |                                         |
| Standards                                |        | IEC 60603-7-51                                   |                                         |

### Comments

Geeignet für Profinet, SERCOS3, Ethercat, Ethernet/IP, Powerlink, VARAN, Power over Ethernet+ (PoE+IEEE 802.3at)  
Geeignete Leitungen, siehe Übersicht Zuordnung Ethernetleitungen zu Stecker.

### Mounting diagram

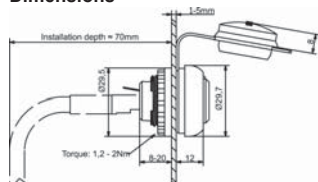


# Actuator sensor interface · RJ45 panel connector

RJ45 panel connector for front installation 22.5 mm  
female/female 1:1  
Cat 5e/6

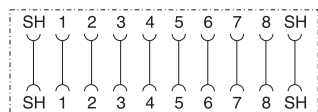


## Dimensions

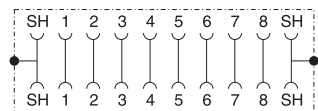


## Circuit diagram

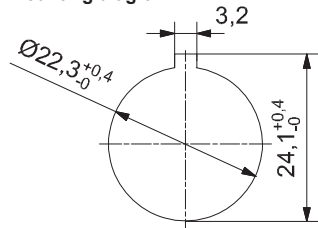
### 492075



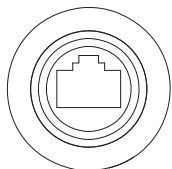
### 491075



## Mounting diagram



front view:



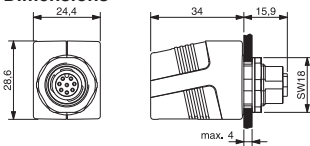
| Description                              | Part-No.                                                            | Type                | PU             |
|------------------------------------------|---------------------------------------------------------------------|---------------------|----------------|
| <b>Category</b>                          |                                                                     |                     |                |
| Cat.5e                                   | 492075                                                              | RJ45 F/F 8/8 Cat.5e | 1              |
| Cat.6                                    | 491075                                                              | RJ45 F/F 8/8 Cat.6  | 1              |
| <b>Technical data</b>                    | <b>492075</b>                                                       | <b>491075</b>       |                |
| Nominal voltage                          |                                                                     | AC 24 V             |                |
| Nominal voltage range                    | AC 50 V                                                             |                     | AC 150 V       |
| Rated current                            |                                                                     | 1.5 A               |                |
| Pol number                               |                                                                     | 8                   |                |
| Cable length (m)                         |                                                                     | —                   |                |
| Rate of transmission                     | 100 MHz                                                             |                     | 250 MHz        |
| Category                                 | 5e                                                                  |                     | 6              |
| Contact type                             |                                                                     | 1 : 1               |                |
| Shielding                                | shield connected through                                            |                     | 360° shielding |
| Coding                                   |                                                                     | —                   |                |
| <b>General</b>                           |                                                                     |                     |                |
| Form                                     |                                                                     | RJ45                |                |
| Rated insulation voltage (EN 50178)      |                                                                     | —                   |                |
| Test voltage                             |                                                                     | —                   |                |
| Pollution degree                         |                                                                     | 3                   |                |
| Insulation resistance                    |                                                                     | ≥100 MΩ             |                |
| Contact resistance                       |                                                                     | ≤30 mΩ              |                |
| Class of flammability according to UL 94 |                                                                     | V0                  |                |
| Protection class                         | IP 65 and NEMA UL Type 12 in closed and IP 20 in inserted condition |                     |                |
| Housing material                         | PA-GF25; PBT GF20; Coverage TPU                                     |                     |                |
| Coverage                                 | TPU                                                                 |                     |                |
| Contact material                         | CuSn, gold-plated                                                   |                     |                |
| Field installation                       | Front plate cutout D=22.5mm                                         |                     |                |
| Installation depth                       | approx. 70 mm                                                       |                     |                |
| Cable construction                       | 8 (4-pair)                                                          |                     |                |
| Cable jacket                             | —                                                                   |                     |                |
| Cable diameter                           | —                                                                   |                     |                |
| Bending radius                           | —                                                                   |                     |                |
| Operation temperature range              | -25 °C – 70 °C                                                      |                     |                |
| Storage temperature range                | -25 °C – 80 °C                                                      |                     |                |
| Mechanical service life                  | <750 insertion cycles                                               |                     |                |
| Dimension                                | (D) 29.5 × 29 mm                                                    |                     |                |
| Weight (kg/piece)                        | 0.016                                                               |                     |                |
| Approvals                                | cULus                                                               |                     |                |
| Standards                                | —                                                                   |                     |                |

# Actuator sensor interface · RJ45 panel connector

## Control cabinet bushing M12 - RJ45 female/female 1:1 Cat 5e (Ethernet, Profinet)

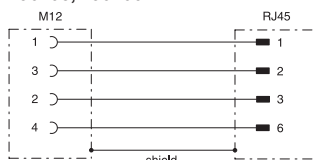


### Dimensions

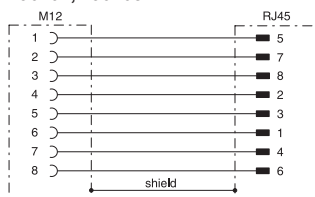


### Circuit diagram

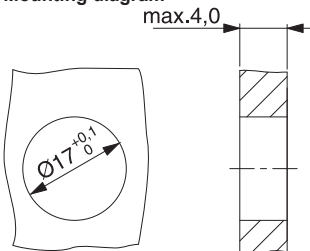
490105, 490106



490107, 490108



### Mounting diagram



| Description | Part-No. | Type                                 | PU |
|-------------|----------|--------------------------------------|----|
| 4 pole 90°  | 490105   | M12-R45 F/F 90° 4/4 Cat.5e PROFINET  | 1  |
| 4 pole 180° | 490106   | M12-R45 F/F 180° 4/4 Cat.5e PROFIBUS | 1  |
| 8 pole 90°  | 490107   | M12-R45 F/F 90° 8/8 Cat.5e           | 1  |
| 8 pole 180° | 490108   | M12-R45 F/F 180° 8/8 Cat.5e          | 1  |

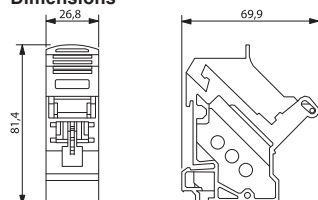
| Technical data                           | 490105 | 490106     | 490107                       | 490108   |
|------------------------------------------|--------|------------|------------------------------|----------|
| Nominal voltage                          |        |            | 24 V                         |          |
| Nominal voltage range                    |        |            | 50 V                         |          |
| Rated current                            |        |            | max. 1 A per contact         |          |
| Pol number                               | 4      |            |                              | 8        |
| Cable length (m)                         |        |            | —                            |          |
| Rate of transmission                     |        | 100 Mbit/s |                              | 1 Gbit/s |
| Category                                 | 5e     |            |                              | 6        |
| Contact type                             |        |            | 1 : 1                        |          |
| Shielding                                |        |            | 360° shielding               |          |
| Coding                                   | D      |            |                              | A        |
| <b>General</b>                           |        |            |                              |          |
| Form                                     |        |            | RJ45 / M12 x 1               |          |
| Rated insulation voltage (EN 50178)      |        |            | —                            |          |
| Test voltage                             |        |            | —                            |          |
| Pollution degree                         |        |            | 3                            |          |
| Insulation resistance                    |        |            | ≥100 MΩ                      |          |
| Contact resistance                       |        |            | ≤30 mΩ                       |          |
| Class of flammability according to UL 94 |        |            | V0                           |          |
| Protection class                         |        |            | IP 67 in screwed condition   |          |
| Housing material                         |        |            | PA                           |          |
| Coverage                                 |        |            | —                            |          |
| Contact material                         |        |            | Phosphor bronze, gold-plated |          |
| Field installation                       |        |            | —                            |          |
| Installation depth                       |        |            | approx. 70 mm                |          |
| Cable construction                       |        |            | —                            |          |
| Cable jacket                             |        |            | —                            |          |
| Cable diameter                           |        |            | —                            |          |
| Bending radius                           |        |            | —                            |          |
| Operation temperature range              |        |            | -25 °C – 85 °C               |          |
| Storage temperature range                |        |            | -25 °C – 85 °C               |          |
| Mechanical service life                  |        |            | ≥ 750 insertion cycles       |          |
| Dimension                                |        |            | (?×D) 29.5 × 29 mm           |          |
| Weight (kg/piece)                        |        |            | 0.037                        |          |
| Approvals                                |        |            | —                            |          |
| Standards                                |        |            | —                            |          |

# Interface Technology · Ethernet connectivity

## Module holder, RJ45, female / IDC For TS35 DIN rail Cat 6



### Dimensions



### Connection assignment

|   | TIA 568A | TIA 568 B | Profinet |
|---|----------|-----------|----------|
| 1 | WHGN     | WHOG      | YE       |
| 2 | GN       | OG        | OG       |
| 3 | WHOG     | WHGN      | WH       |
| 4 | BU       | BU        | -        |
| 5 | WHBU     | WHBU      | -        |
| 6 | OG       | GN        | BU       |
| 7 | WHBR     | WHBR      | -        |
| 8 | BR       | BR        | -        |

| Description                              |       | Part-No.               | Type                              | PU |
|------------------------------------------|-------|------------------------|-----------------------------------|----|
| Suitable for Ethernet applications       |       |                        |                                   |    |
| Description                              | 8-pin | 772104                 | MDT-RJ45 F Cat.6                  | 1  |
|                                          |       |                        |                                   |    |
| Technical data                           |       | 772104                 |                                   |    |
| Nominal voltage                          |       | 30 V                   |                                   |    |
| Nominal voltage range                    |       | –                      |                                   |    |
| Rated current                            |       | Max. 1.0 A per contact |                                   |    |
| Pol number                               |       | 8                      |                                   |    |
| Cable length (m)                         |       | –                      |                                   |    |
| Transmission frequency                   |       | 250 MHz                |                                   |    |
| Category                                 |       | 6                      |                                   |    |
| Contact type                             |       | IDC                    |                                   |    |
| Shielding                                |       | yes                    |                                   |    |
| General                                  |       |                        |                                   |    |
| Form                                     |       | RJ45                   |                                   |    |
| Rated insulation voltage (EN 50178)      |       | –                      |                                   |    |
| Test voltage                             |       | –                      |                                   |    |
| Pollution degree                         |       | 1                      |                                   |    |
| Insulation resistance                    |       | ≥100 MΩ                |                                   |    |
| Contact resistance                       |       | ≤50 mΩ                 |                                   |    |
| Class of flammability according to UL 94 |       | V0                     |                                   |    |
| Protection class                         |       | IP 20                  |                                   |    |
| Housing material                         |       | PC-GF grey             |                                   |    |
| Contact material                         |       | CuSn, gold-plated      |                                   |    |
| Field installation                       |       | –                      |                                   |    |
| Installation depth                       |       | –                      |                                   |    |
| Cable construction                       |       | –                      |                                   |    |
| Cable jacket                             |       | –                      |                                   |    |
| Cable diameter                           |       | 4.5 – 8 mm             |                                   |    |
| Cross section                            |       | AWG 24-22              |                                   |    |
| Operation temperature range              |       | -10 °C – 60 °C         |                                   |    |
| Storage temperature range                |       | -40 °C – 70 °C         |                                   |    |
| Mechanical service life                  |       | ≥ 750 insertion cycles |                                   |    |
| Dimensions (w × h × d)                   |       | 36.0 × 36.0 × 27.5 mm  |                                   |    |
| Weight (kg/piece)                        |       | 0.063                  |                                   |    |
| Approvals                                |       | –                      |                                   |    |
| Standards                                |       | –                      |                                   |    |
| Accessories                              |       | Article number         | Type                              | PU |
| Patch cable RJ45 Cat.5e                  |       | 192000.xxxx            | xxxx cable length from 0.5 - 30 m | 1  |
| Patch cable RJ45 Cat.6e                  |       | 192100.xxxx            | xxxx cable length from 0.5 - 30 m | 1  |



# LÜTZE - Ethernet Connectivity • Glossary

**AC Access Client** Radio-supported communication unit that has to log onto the Access Point (-> AP). Only after successful authentication is it possible for the Access Client to transmit data to the network, or to receive data from the network. (-> Wireless LAN)

**Access Protocol** Access procedure. Governs access to the medium. Ethernet: CSMA/CD; Token Ring: Token FDDI: Append Token; WLAN: CSMA/CA

**Access procedure** -> Access Protocol.

**ACK** Acknowledge Designates a positive confirmation of receipt. ACK is part of the communication protocol and is responsible for the confirmation of receipt of the transmission.

**ACR** attenuation to crosstalk ratio; corresponds to a signal-to-disturbance signal distance for interference from other pairs. Is determined by simple subtraction of the dB values

**ADSL** Asymmetric Digital Subscriber Line. Long-distance access

**AES** Advanced Encryption Standard. Encryption standard with 128-, 192- and 256-bit encryption. This symmetrical encryption is intended to replace the previous DES standard.

**Aging** Process (algorithm) for updating data, especially address memory. After a time elapses, an address is marked as "old" and deleted in the next pass, if it is not detected at a port before that.

**AP** Access Point. In wireless networks the Access Point is the -> bridge to the wire-bound networks. It can be connected directly to Ethernet, Token Ring or ATM. The access point is connected with all of the network accounts ("access clients"), and performs central functions such as roaming or security. (-> Wireless LAN)

**API** Application Programming Interface

**ARP** Address Resolution Protocol requests the associated MAC address via the IP address. -> RARP

**ARS** Automatic Rate Selection. Independent selection of the transmission speed by the access point (-> AP) depending on the connection quality (distance).

**ASN** 1 Abstract Syntax Notation One. Programming language of the -> MIB.

**ATM** Asynchronous Transfer Mode. Based on cells of 53 bytes. Suitable for telephone, video and other data transmission. Is primarily used in WAN applications.

**AUI** Attachment Unit Interface. Interface for physical isolation of transceivers from Ethernet controllers (cable up to a max. of 50 m)

**Autocrossing** A function that allow automatic crossing of the transmission and reception conductors at twisted pair interfaces. Switches that support this function can be connected to each other via a 1:1 wired cable instead of a crossover cable.

**Autonegotiation** Detects on the port the transmission parameters of the connected device, such as speed, duplex mode and flow control, and automatically adjusts itself to the optimal values.

**Autopolarity** A function of devices with a 10 BASE-T or 100 BASE-TX interface for automatic correction of wiring errors in twisted pair cables, which leads to a polarity reversal of the data signals.

**Autosensing** A function that allows a device to automatically detect the data rate (10 Mbit/s or 100 Mbit/s, 1 Gbit/s), and to transmit and receive using this data rate.

**Backpressure** Simulates a collision in HDX mode by generating a jam signal. -> Flow-Control

**Bandwidth** Amount of data that can be transferred in one second. For a single connection this is the same as the speed.

**Bandwidth-length product** Used to estimate what distance a multimode fibre supports with a certain data rate (speed). The gross rate must be used here.

**BFOC** Bayonet Fiber Optical Connector. Also known as an ST Connector (AT&T brand). Fibre-optic connector with bayonet connector. The only standardised connector for 10 Mbit/s Ethernet. Available for multimode and single mode glass fibres and also for -> POF.

**BGNW** The BGNW (Benutzergruppe Netzwerke / Network User Group) is a manufacturer-neutral, independent interest group for leading international users and manufacturers of Network systems. The goal of the association is to promote its participants and to facilitate the exchange of information among them, as well as developing recommendations for the planning, installation, and operation of networks.

**BGP** Border Gateway Protocol. Routing protocol in the -> WAN.

**BLP** -> Bandwidth Length Product

**BNC** Bayonet Neill-Concelman. Connector for connection of 10 Base2 coax cables to a -> MAU.

**BOOTP** Bootstrap Protocol. Supplies the statically assigned IP address for

an assigned MAC address. In comparison to -> RARP rootbar.

**Bridge** -> Switch

Broadcast data packet that is address to everyone in a network. Hubs and switches are transparent for broadcasts. Only routers limit a broadcast, if necessary. -> Multicast and Unicast.

**BT** Bit Time, duration of a bit.

**CCITT** Comité Consultatif International Téléphonique et Télégraphique.

Now -> ITU-T

**CC-Link** - Control and Communication Link, Industrial automation network based on Ethernet

**CCK** Complementary Code Keying. CCK is used in the 11 Mbit/s-version of the 802.11 LAN (80211b), and can pack a number of bits in a single symbol. This allow a higher transmission rate.

**CD** Collision Detect.

**CHAP** Challenge Handshake Authentication Protocol. PPP authentication method. Passwords are transmitted with a random number. Comparison -> PAP

**Cheapernet** coax cable according to Ethernet partial standard 10BASE2. Synonyms: ThinWire, RG58.

**CoS** Class of Service. A network with class of service makes it possible to transfer data with minimal delay in an environment in which a network is shared by many users, CoS classifies the data data traffic into categories such a high, medium and low (gold, silver and bronze)

**CRC** Cyclic Redundancy Check. Error check mechanism in which the recipient performs a polynomial calculation. The result is compared with a value saved in the frame that is determined by the transmitter using the same procedure. See also FCS.

**CSMA/CD** Carrier Sense Multiple Access Collision Detect. Access procedure for Ethernet. A station that wants to transmit listens whether the network is free (carrier sense). After that it begins to transmit, and at the same time check whether other stations have also begun to transmit (multiple access), which could lead to collisions (collision detection). The collision is detected by the station and they cancel the transmission. They start a new transmission attempt after a time determined by a random generator.

**Cut-Through** Switching method in which a packet is forwarded as soon as the target address is recognised. This means that the latency is short, but faulty packets are still forwarded. This is also known as "on-the-fly packet switching". Also see Store & Forward.

**DA** See Destination address.

Attenuation Ratio of power fed to power received on a transmission line, both for copper cables and for fibre-optic cables. Specified in dB per unit of length

**DBPSK** Differential Binary Phase Shift Keying. DBPSK is a modulation process for systems with 1 Mbit/s that is used with the -> DSSS transmission process according to the 802.11 standard.

**DCE** Data Communication Equipment, e.g. printers, modems. -> DTE

**DES** Data Encryption Standard. Systematic encryption algorithm. The same secret key is used for encryption and decryption; i.e. all instances that have to be able to encrypt and decrypt have to know the key. DES encodes with a 56-bit key. 3DES increases the security of the normal DES method by encrypting the data with a key that is three times longer (168 bits).

**Destination Address** Destination address in Ethernet, IP, etc. "Address on the data packet"

**DeviceNet** DeviceNet is a low cost industrial network that uses CAN technology. It links industrial components such as limit switches, valves, motor switches and drives with a PLC or a PC.

**DHCP** Dynamic Host Configuration Protocol. On request informs a device as to its IP address, which is fixed via the associated MAC address, or is assigned dynamically.

**Dispersion** - Signal spreading through propagation time differences, especially in optical fibres: Mode dispersion in multimode, chromatic dispersion in single mode)

**DNS** Domain Name System. Resets host name in IP addresses per DNS server or statically per "hosts" file.

**Domain** Broadcast domain: Network area that is only limited by routers, i.e. within which a broadcast can propagate freely. -> Collisions domain: Network area that is delimited by switches or routers, and in which collisions can propagate freely.

**DQPSK** Differential Quaternary Phase Shift Keying. DQPSK is a modulation process for systems with 1 Mbit/s or 2 Mbit/s, which is used with the DSSS transmission process, standard 802.11.

**DSC** Duplex straight connector. See also SC.

**DSL** Digital Subscriber Line. Technology to operate the Internet with 1.5 Mbit/s over copper cables.

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**DSSS** Direct Sequence Spread Spectrum. DSSS is a transmission method according to standard 802.11. By means of encoding, this method converts the narrowband signal into a broadband signal. In this way it is possible to use the entire frequency band, thus achieving a higher data transmission rate and lower susceptibility to interference.

**DTE** Data Terminal Equipment, e.g. computers. See also difference from **DCE** Pin assignment.

**Dual Homing Network technology** in which a device is linked to a network via two independent points of attachment. One point of attachment is the primary connection, while the other is standby connection that is activated if the primary connection fails.

**DVMRP** Distance Vector Multicast Routing Protocol: Internetwork gateway protocol, largely based on RIP. DVMRP uses IGMP to exchange routing datagrams with its neighbours.

**DWDM** Dense Wavelength Division Multiplex.

**Dynamic DNS:** Assigns the same name when there is a changing IP address.

**EMC** - electromagnetic compatibility

Electromagnetic compatibility. Interference immunity and emissions behaviour with regard to electromagnetic interference, Class A/B.

**EtherCat:** Industrial Ethernet system from the company Beckhoff

**Ethernet Data network**, standardised in IEEE 802.3 since 1983. Based on the access procedure --> CSMA/C. Variable packet length from 64 bytes to 1518 bytes (1522 with TAG field). Speeds/bandwidth: 10 Mbit/s, 100 Mbit/s (Fast Ethernet), 1000 Mbit/s (Gigabit Ethernet) and 10000 Mbit/s (10-gigabit Ethernet).

**EtherNet/IP** is a protocol stack for Ethernet that has been developed for industrial applications. EtherNet/IP is based on the standard TCP/IP protocol, and uses a common application layer with DeviceNet. It thus makes it easier to exchange information between device level networks and information systems at the plant level.

Industrial Ethernet system of the --> ODVA

**ETHERNET** Packet Designation for a data packet. Besides the actual user data, it also contains the destination and source address fields (DA and SA), the TAG field (4 bytes, optional) and the Length/Type field.

**FCS** Frame Check Sequence. Checksum at the end of an Ethernet packet; is calculated and entered by the sender. The recipient calculates the checksum based on the received packet and compares it with the entered value. See also CRC.

**FDB** Forwarding Data Base. Address table of a switch that it uses to decide what port a packet has to be sent to. In the address table, a MAC address is assigned to the port that is used to reach the corresponding device. The table is updated regularly (--> Aging).

**FDDI** Fiber Distributed Data Interface. Data network, standardised in ISO 9314, ANSI X3T9.5 and X3T1 2.

**FDX** Full Duplex. Transmission mode of a component: simultaneous transmitting and receiving is possible. No access procedure necessary. See also HDX.

**FEXT** Far End Crosstalk: Crosstalk at the far end in symmetrical copper cables.

**Flame-retardant** - Characteristic of a cable not to spread a flame (wicking effect) and/or to extinguish it.

**Flow-Control Strategy** in case of overload at the output port and the start of a memory overflow: discarding of packets at the input port or signalling to connected devices that they should stop transmitting by simulating a collision in HDX mode or by transmitting special "Pause" packets in FDX mode.

**F/O** Fiber optics.

**Frame Relay** Modified version of X.25 packet switching in a WAN.

**FTP** - Foiled Twisted Pair, foil-shielded symmetrical data cable

**FTP 1.** File Transfer Protocol. Protocol on Layer 5, uses TCP for transfer, therefore used in WANs. 2. Foiled Twisted Pair.

**FTTD** Fiber To The Desk Office wiring with fibre-optic cables as far as the end node

**Full Duplex** --> FDX

**GARE** Generic Attribute Registration Protocol. Protocol family for exchanging parameters between switches on Layer 2, at present there exist --> GMRP and --> GVRP.

**Gateway Component** above Layer 2 of the ISO/OSI Reference Model. On Layer 3 usually called a router. Converts protocols of these layers into each other.

**GBIC** Gigabit interface converter. See under SFP.

**Gbps** Gigabits per second, Gbit/s.

**GMRP** --> GARP Multicast Registration Protocol.

**GVRP** --> GARP VLAN Registration Protocol.

**Half Duplex** --> HDX

**Halogen-free:** In the event of a fire, halogen-free cables do not form any acidic fumes, which are very dangerous for both people and electronic devices

**HASH** Checksum that ensures the integrity of information.

**HCS**® Hard Polymer Clad Silica. Plastic fibre with a core of fused quartz. --> PCF --> POF.

**HDX** Half Duplex. Transmission mode of a component: Either transmitting or receiving is possible. In Ethernet, the access procedure CSMA/CD is required for this. --> FDX.

**HiRRP** Protocol for controlling redundant routers. If one of the two routers fails, then within 800 ms the remaining router completely assumes the tasks of the other one.

**Hops** Maximum number of router steps possible for a data packet. See also TTL.

**HSRP** Hot Standby Routing Protocol. Protocol for controlling redundant routers. See also VRRP.

**HTML** Hypertext Markup Language.

**HTTP** Hypertext Transfer Protocol. Protocol used by web browsers and web servers for transmitting data, such as text and images.

**HTTPS** --> HTTP Secure. HTTP communication encrypted in packets.

**Hub** Component on Layer 1 of the ISO/OSI Reference Model.

Regenerates the amplitude and the signal shape of the incoming signal and forwards it to all of the other ports. Synonyms: Star coupler, concentrator.

**IAONA** (Industrial Automation Open Networking Alliance Europe e.V) Europe was founded in 1999 at the SPS/IPC/Drives trade fair Nuremberg. IAONA is an association that now includes more than 130 leading international manufacturers and users of automation systems. The association's goal is to establish Ethernet on the international level as the standard application in all industrial environments. The purpose of this is to bring about uniform, interface-free communication through all levels of a company. This relates to all areas of factory, process and building automation. For further information: <http://www.iaona-eu.com/>

**ICMP** Internet Control Message Protocol. Best-known command: Ping.

**ID** Identifier.

**IDA** Interface for Distributed Automation. Open interface based on the TCP/IP stack, for automation applications.

**IEC** International Electrotechnical Commission. international standardisation body

**IEEE** Institute of Electrical and Electronics Engineers. Standardisation body for LANs with the important standards 802.3 for Ethernet, 802.1 for switches.

**IETF** Internet Engineering Task Force.

**IFG** Inter Frame Gap. Minimum gap between two packets. Synonym: Inter Packet Gap (IPG).

**IGMP** Internet Group Management Protocol. Layer 3 protocol for multicast transport, see also GMRP.

**IGMP Snooping** Internet Group Management Protocol Snooping. A function in which the switches examine IGMP packets and assign the membership of a node to a multicast group to the respective port. In this manner it is possible to send multicasts specifically to those segments that contain nodes of a group.

**IGP** Interior Gateway Protocol.

**IGRP** Interior Gateway Routing Protocol. Internet Protocol see IP.

**IP** Internet Protocol. Transmission protocol on Layer 3, widely used (> 80%).

IPv4: Vers. 4=4-byte addresses; IPv6: Vers. 6=16-byte addresses, IPnG=IPv6

**IP** address Logical address, assigned by the network operator. Address format (v4): 4 bytes in decimal code, separated by dots, e.g. 192.178.2.1. See also net mask.

**IPnG** IP next generation. Transmission protocol, see IP.

**IPsec** IP Security. Standard that makes it possible to ensure the authenticity of the sender, confidentiality and the integrity of data in IP datagrams by means of encryption. With IPsec a --> VPN can be set up on Layer 3. For encryption IPsec uses --> 3DES, for example.

**IPv4** IP Version 4. Transmission protocol, see IP.

**IPv6** IP Version 6. Transmission protocol, see IP.

**IPX** Internet Packet Exchange. Protocol stack from Novell, comparable to TCP/IP.

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**ISDN** Integrated Services Digital Network. WAN transmission protocol.

**ISO** International Organization for Standardization. Global standardisation body.

**ISO/OSI** --> OSI reference model..

**ISP** Internet Service Provider.

**Jabber** In Ethernet, a faulty frame with more than 1518 bytes.

**Jitter** Time variation of the signal edge.

**Kbps** Kilobits per second, kbit/s.

**L2TP** Layer 2 Tunneling Protocol. For setting up a --> VPN tunnel on Layer 2. --> IPsec.

**LACP** Link Aggregation Control Protocol.

**LAN** Local Area Network. Local network, e.g. Ethernet, FDDI and token ring. --> WLAN.

**LAP** Link Access Protocol.

**Latency** Time difference between the receipt and forwarding of data, generally between the last bit received and the first bit sent.

**Skew** Difference in propagation delays on various pairs, extremely important in full duplex parallel operation

**Propagation Delay** Time that an electromagnetic signal requires for a particular transmission line, inverse of the signal velocity

**Link Aggregation** Combination of several ports (maximum 4) into one virtual port. Parallel connection transmission with redundancy in case of failure of a port. Standard IEEE 802.3. Colloquially also called "trunking".

**LLC** Logical Link Control. Layer 2b.

**LSB** Least Significant Bit.

**Fibre-optic cable** Optical transmission medium

**LX** Long Wavelength (Gbit Ethernet).

**MAC** Medium Access Control. MAC address, hardware address of a component in the network. The MAC address is assigned by the manufacturer. Address format: 6 bytes in hex code, separated by colons, e.g. 00:80:63:01:A2:B3

**MAN** Metropolitan Area Network. For connecting various --> LANs within a city.

**Management Administration**, configuration and monitoring of network components. The management agent of the components being managed communicates with the management station (computer) via the management protocol SNMP

**MAU** Medium Attachment Unit. --> Transceiver.

**Mbps** Megabits per second, Mbit/s

**MD5** Message Digest 5. See also Hash Algorithm.

**MDI** Medium Dependent Interface.

**MDI-X** MDI-Crossover, see also MDI.

**MIB** Management Information Base. Contains the description of the objects and functions connected in a network.

**MII** Media Independent Interface.

**Mini-GBIC** Mini gigabit interface converter. --> SFP.

**MLPPP** Multi Link PPP. --> PPP.

**Modbus TCP**, industrial Ethernet system based on the Modbus protocol

**Modes** - Propagation paths of the light in an optical fibre

**MPLS** Multiprotocol Label Switching. Layer 3 protocol.

**MSB** Most Significant Bit.

**MTBF** Mean Time Between Failure.

**MTTR** Max Time To Repair.

**Multicast** Data packet directed to a group of devices, e.g. to all Lütze devices.

**Multimode fibres** Optical fibres with relatively large core diameters. In them, the light propagates over multiple paths - multiple modes. Typical core diameters are 100µm for step index fibres, for glass fibres, 200µm for PCS/HCS® fibres and 980 µm for POF fibres. Gradient index fibres are generally made of glass, and have a typical core diameter of 50 µm or 62.5 µm. Conditionally through these --> Single mode fibre.

**NAT** Network Address Translation.

**NAT-T** NAT Traversal. Normally --> IPsec does not function if there is a --> NAT Gateway between the two IPsec end points, because the IP address of the end point is also encrypted. This problem can be circumvented using NAT-T. If supported, NAT-T is switched on automatically if necessary when establishing a connection (handshake).

**NetBEUI** NetBIOS Extended User Interface. Extended version of the NetBIOS protocol, which is used by network software such as LAN Manager, LAN Server, Windows for Workgroups and Windows NT.

**Net Mask** The net mask marks all bits of an IP address that serve to identify the network and the subnetwork. --> IP address.

## Binary depiction

IP address 10010101.11011010.00010011.01011010  
Net mask 11111111.11111111.11111111.00000000  
--> Subnetwork  
10010101.11011010.00010011.00000000

## Decimal depiction

IP address 149.218.19.90  
Net mask 255.255.255.0  
--> Subnetwork 149.218.19.0

## Available address range

Node addresses 149.218.19.1 to 149.218.19.254  
Broadcast address 149.218.19.255

**NEXT** Near End Cross Talk.

**NIC** Network Interface Card. Network interface in the computer.

**NMS** Network management system.

**Node** Node in a data network (computer, printer, hub, switch, etc.), is sometimes erroneously used with the meaning "hub" or "switch".

**NRZ** Non Return to Zero. Signal code. --> NRZI.

**NRZI** Non Return to Zero Invert. Signal code. --> NRZ.

**NVRAM** Non-Volatile RAM. Non-volatile memory.

**ODVA** Open Device Vendor Association is an organisation that promotes the worldwide use of DeviceNet and Ethernet/IP network technologies and standards in industrial automation.

**OID** Object ID.

**OLE** Object Linking and Embedding is a technology for transmitting different data between devices.

**OPC** OLE for Process Control. Protocol in process automation for standardised data exchange between Windows applications.

**OSI** Open Systems Interconnection. International standardisation programme, originated by --> ISO and --> ITU-T, in order to create standards for data networks to ensure the compatibility of devices from various manufacturers.

**OSI Model** Model describing communication in a network. The functionality of the hardware is subdivided into 7 layers. In the lowest layer (physical layer), adaptation to the medium is performed.

**OSPF** Open Shortest Path First. Protocol for the exchange of routing information between routers. Faster than --> RIP and suitable for larger networks.

**OTDR** Optical Time Domain Reflectometer Versatile optical measuring device for fibre-optic networks.

**OUI** Organizationally Unique Identifier. The first three bytes of the --> MAC address indicate the manufacturer of the components.

Packet size Frame size. Ethernet: 64 ... 1518 bytes (1522 with VLAN tag, FDDI: ... 4500 bytes.

**PAP** Password Authentication Protocol. PPP authentication method.

Passwords are transmitted in unencrypted form. PAP is based on usernames.

**Parallel Detection** Subfunction of --> autonegotiation, to adjust settings for a partner that does not support autonegotiation. A port detects the speed based on FLP or NLP and sets itself to 100 Mbit/s or 10 Mbit/s accordingly. HDX is always used as the duplex mode.

**PCF** Plastic Cladding Silica Fiber. Plastic fibre with a core of fuse quartz. --> POF --> HCS®.

**PD** Powered Device. Describes the end device (e.g. an IP telephone, in the draft standard IEEE P802.3af (DTE Power via MDI). IEEE P802.3af defines how a power supply can be provided via an Ethernet twisted pair cable.

**PDU** Protocol Data Unit.

**PHY** Physical sublayer. Physical layer/components (on Level 1 b).

**PIMF** Pair in Metal Foil (data cable). --> STP.

**PLC** Programmable Logic Control. --> PLC - Programmable Logic Control.

**PMD** Physical Medium Dependent. Physical layer/components on Level 1 a.

**POE** Power over Ethernet.

**POF** Polymer Optical Fiber. Plastic optical fibre --> HCS® --> PCF.

**POL** Power over LAN.

**Port Mirroring** The data traffic of a port (In/Out) is mirrored (copied) on another port, for example to allow it to be examined with an analyzer.

**Port Trunking** --> Link Aggregation.

**PowerLink** Industrial Ethernet system from the company B&R

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**PLC** Programmable Logic Controller.

**PPP** Point-to-Point Protocol. Creates router-to-router and host-to-network connections. PPP works with protocols from various level, such as IP, IPX and ARA. PPP has integrated security mechanisms such as CHAP and RAR.

**PPPoE** --> Point-to-Point-Protocol over Ethernet.

**PPS** Packets Per Second. Data packets per second

**PPTP** Point-to-Point Tunneling Protocol.

Prioritisation Data packets are given priority handling based on defined criteria. Identification on Layer 2 with inserted --> tag field, on Layer 3 in the --> TOS field of --> IP.

**Private Key** --> Private/Public Key: In asymmetrical encryption algorithms, two keys are used: one public one (public key) and one private one (private key). The public key is made available by the future recipient of data to those who will be sending the data to him. The private key is kept only by the recipient. It is used to decrypt the received data.

ProfiNet, industrial Ethernet system from Siemens

**PS** Power Supply. --> PSU.

**PSE** Power Sourcing Equipment. Describes the device supplying power (e.g. a switch) in the draft standard IEEE P802.3af (DTE Power via MDI). IEEE P802.3af defines how a power supply can be provided via an Ethernet twisted pair cable.

**PSU** Power Supply Unit. --> PS.

**PTP** Precision Time Protocol. Protocol for time synchronisation acc. to IEEE 1588, with a precision of less than 1µs.

**Public Key** --> Private/Public Key

**PUR** - Polyurethane, high-quality jacket material for cables

**PVC** - Polyvinyl chloride, economical insulation and jacket material for cables

**PVV** Path Variability Value. Specified in bit times.

**QoS** Quality of Service. Quality of the transmission, e.g. speed, bandwidth, delay, reliability or priority. In Level 2 for IEEE 802.1D implemented only for priority. --> Prioritisation.

**RADIUS** Remote Authentication Dial In User Service. A RADIUS server authenticates access for a client that logs on with its name and password. Passwords are transmitted in encrypted form.

**RAM** Random Access Memory. Volatile memory

**RARP** Reverse Address Resolution Protocol. Supplies the statically assigned IP address for an assigned MAC address. See also BOOTP and DHCP.

**RAS** Remote Access System.

**Repeater** Components for signal regeneration on Level 1. Regenerates the amplitude, signal edge and cycle. Repeaters with more than 2 ports are also called hubs.

**RFC** Request For Comments. Pseudo-standard for the Internet, protocols and applications, issued by IETF.

**RG58** Coax cable with 50 characteristic impedance, also called ThinWire or 10BASE2.

**RIP** Routing Information Protocol. For exchanging routing information between routers in a LAN. There are two versions: RIP V1 and RIP V2. --> OSPF.

**RJ45** Connector for twisted pair. Typical for --> Ethernet and --> ISDN.

**RMON** Remote Monitoring.

**Router** Components on Layer 3 of the - ISO/OSI Reference Model. Connects networks on Layer 3. By means of additional paths to the destination, provides a choice of paths depending on de

**RS 232** Recommended Standard. Serial interface, also designated V.24. Strictly speaking, the supplement to V.24 according to a CCITT.

**RSTP** Rapid Reconfiguration Spanning Tree Protocol.

**RSVP** Resource Reservation Protocol. Reserves bandwidths in a WAN

**RTCP** Realtime Transport Control Protocol.

finable criteria, such as path costs.

**RTP** Real Time Protocol.

Return Loss Ratio of disruptive reflection to the transmitted signal power

**Rx** Receive (received).

**SA** Source Address

**SAN** Storage Area Network. Network for connecting servers and memory subsystems, such as hard disks, RAID and tape systems. Generally based on Fibre Channel.

**SAP 1.** Service Access Point. 2. Service Advertising Protocol.

**SC** Straight Connector. Connector --> DSC.

**SCADA** Supervision Control And Data Acquisition. Process visualisation

system for process control and visualisation. Windows-based

**Shielding attenuation** Ratio between the power of electromagnetic interference outside and inside of a shield. A measure of the effectiveness of the shielding, e.g. for cables or also connector housings.

Transfer impedance Current/voltage ratio on cable shields for assessing the shielding effect.

**Suitability for drag chains:** special cable designs have to be used for operation in energy supply chains.

Noise, broadband electromagnetic interference

**SD** Starting Delimiter.

**SDH** Synchronous Digital Hierarchy. Is related to the American SONET (Synchronous Optical Network) standard; with a basic SDH rate of 155.52 Mbit/s (STM-1) and multiples thereof.

**SERCOS III**, industrial Ethernet system based on the SERCOS interface

**SFD** Start Frame Delimiter.

**SFP** Small form-factor pluggable. A --> transceiver for 1 Gbit/s\_ networks that converts serial electric signals into optical signals and vice versa, see also GBIC.

**SHA-1** Secure Hash Algorithm 1. --> Hash.

**Single mode fibre** Fibre-optic cable in which, due to its small core diameter (max. 10 µm), the light can only propagate along one path starting with the cut-off wavelength. \_ Multimode fibre

**SLA** Service Level Agreement.

**SLIP** Serial Line Internet Protocol. Standard protocol for serial point-to-point connections, uses a serial interface (e.g. V24) for IP traffic.

**SMON** Switch Monitoring.

**SMTP** Simple Mail Transfer Protocol. Internet protocol that provides e-mail services.

**SNTP** Simple Network Time Protocol. Protocol for time synchronisation, based on NTP, with a precision of 1ms to 50ms. For higher precision, --> PTP (Precision Time Protocol acc. to IEEE 1588) is used.

**SNAP** Subnetwork Access Protocol.

**SNMP** Simple Network Management Protocol. Protocol standardised by IETF for communication between agents and the management station in network management. Used in more than 99% of LANs.

**SOHO** Small Office Home Office. Networks for small offices/branches and telecommuting workstations.

**Spanning Tree** Protocol that automatically dissolves network loops. When installed with switches, implements redundant paths for additional reliability if a connection fails. Change-over time 30 s to 60 s.

**SQE** Signal Quality Error. Signal that is sent back by a transceiver to the LAN controller (processor) in order to report that the packet was sent properly. Also called heartbeat.

**SSH** Secure Shell. Allows cryptographically secured communication over non-secure networks by means of authentication of the partners, and integrity and confidentiality of the data exchanged.

**Star coupler** Active star coupler --> Hub. A passive star coupler is a component in fibre-optic equipment with n inputs and m outputs without amplification of the signal.

**Store & Forward** Switching method in which a packet is first saved completely and only then forwarded. --> Cut-Through

**STP 1.** Shielded Twisted Pair. Cable with shielded twisted wire pairs. --> PIMF, UTP. 2. - Spanning Tree Protocol.

**Switch** Component of Layer 2 of the OSI Reference Model. Synonym: Bridge. Unlike a --> hub, forwards a packet only to the port to which the destination station is connected, which leads to switch disconnection of individual segments. Then no access procedure is required between two switches in full duplex operation. So-called Layer-3 and Layer-4 switches are now available that have also implemented sub-functions of these levels.

**Symmetry**, Symmetrical attenuation Ratio between the power of the normal-mode wave and that of the common-mode wave as a measure of the EMC properties of symmetrical copper cables (for shielded cables additionally --> shielding attenuation)

**SX** Short Wavelength (Gigabit Ethernet).

**Tag Field** Optional field in the Ethernet packet, inserted after the so

**TCO** Total Cost of Ownership.

**TCP** Transmission Control Protocol. Connection-oriented transmission protocol on Layer 4 of the TCP/IP protocol family. --> UDP.

**TCP/IP** Transmission Control Protocol/Internet Protocol. Most widely-used protocol family, from Layer 3 upwards. Standardised by --> IETF. Protocols that build upon each other:

Layer 3: IP; Layer 4: TCP, UDP; Layer 5: TFTP, SMTP, FTP, etc.

Layer 5 contains Layers 5 to 7 of the OSI model.

# LÜTZE - Ethernet Connectivity · Glossary

**Telnet** Virtual terminal program of the TCP/IP stack for remote access via network to the user interface of the serial interface.

**TFTP** Trivial File Transfer Protocol. Protocol on Layer 5, uses --> UDP for transfer, therefore used in --> LANs.

**Token Ring** Data network standardised in IEEE 802.5, but also proprietary solutions by IBM.

**TOS** Type Of Service. Field in IP packet for --> Prioritisation.

**TPE** - Thermoplastic elastomers, a category of plastics with special characteristics as an insulating and jacket material for cables

**TP** Twisted Pair. Symmetrical copper data cable.

**Transceiver Converts** data signals from AUI interfaces to another medium, e.g. twisted pair. New components have transceivers already implemented. For older components there are plug-on transceivers for multimode, twisted pair or coax.

**Trunking** --> Aggregation.

**TTL** Time To Live. Field in the IP protocol header that specifies how many hops are allowed for a packet before it is automatically deleted.

**Tx** Transmit. Transmission rate; speed of the transmission, also --> Bandwidth, Ethernet: 10, 100, 1000, 10000Mbit/s

Token Ring: 4 Mbit/s, 16 Mbit/s

FDDI: 100 Mbit/s

**UDP** User Datagram Protocol. Connectionless transport protocol on Layer 4 of the TCP/IP protocol family. --> TCP.

**Unicast** Data packet that is addressed to only one recipient, as opposed to multicast and broadcast.

**UPS** Uninterruptable Power Supply. --> USV

**URL** Universal Resource Locator. Standardised addressing scheme for access to hypertext documents and other services via a browser. Z.B. [www.luetze.de](http://www.luetze.de)

**USV** Uninterruptible power supply.

**UTP** Unshielded Twisted-Pair. Cable with unshielded twisted pairs of wires, generally with 4 pairs. --> STP

**VLAN** Virtual LAN, set up with switches. Goal: Limiting broadcasts to the network areas where the broadcast is useful. Is also used to subdivide networks for security reasons.

**VPN** Virtual Private Network A VPN joins a number of separate private networks (subnetworks) into a common network via a public network, e.g. the Internet. Confidentiality and authenticity is protected through the use of cryptographic protocols. A VPN thus offers a cost-effective alternative to dedicated lines when setting up a trans-regional company network.

**VRRP** Virtual Redundant Router Protocol. Protocol for controlling redundant routers. See also HSRP.

**WAN** Wide Area Network Public data and transfer network for connecting local networks. Transmission protocols: ISDN, frame relay, X.21 SDH, SONET, ATM.

**WDM** Wavelength Division Multiplex.

**WEP** Wired Equivalent Privacy. WEP is an encryption method in wireless LANs according to 802.11 for protecting the transmitted data.

**WFQ** Weighted Fair Queuing. Method for processing the priority queues in a switch. For example, the highest queue receives 50% of the bandwidth, the next 25%, etc. .

**WiFi** Wireless Fidelity. WiFi is a certification for wireless LANs (WLANs) according to standard 802.11, implemented by the WECA (Wireless Ethernet Compatibility Alliance). This certification confirms the interoperability of WLAN products. --> <http://www.wi-fi.net>

**Wireless LAN** Local Networks, that operate without cable connections.

**Wire-speed**, forwarding of the data packets with line speed.

**WLAN Wireless** --> LAN. According to IEEE 802.11, .15, .16 (Bluetooth).

**WDM** With the WDM system (Wide Wavelength Division Multiplex) it is possible to increase the transmission capacity of the optical fibres in fibre-optic networks. To do this, the system multiplexes a number of single-mode optical signals of various wavelengths to form a composite optical signal. In this manner several applications can be transmitted at the same time over a single fibre-optic cable pair. This means that it is not necessary to install additional fibre-optic cables, thus significantly reducing costs.

**WWW** World Wide Web.

**X.25** Data Packet Control Protocol, that is used in Datex-P, for example.

**XML** Extended Markup Language.

**XNS** Xerox Network Systems.

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**Industrial Switch Hub**, Model(s) ET-SWGUSET

**Pot Injector Industrial Switch**, Model(s) ET-PUSST

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**RJ45/RJ45 Coupler Module**, Model(s) RJ45 F/F R/B Cat. 5e (P/N 492075) (\*12), RJ45 F/F R/B Cat. 6 (P/N 491075) (\*12), RJ45 F/F R/B Cat. 3 (P/N 490075) (\*12)

**STP Plug**, Model(s) 490129, 490128, 490138

**USB Coupler Module**, Model(s) USB-3.0 A/A F/F (P/N 490112) (\*12)

**USB Patch Cord**, Model(s) USB-3.0 A/A F/M x.xM (P/N 490113.xxxx) (\*12), where suffixes denote cable length in meters.

(\*12) - Denotes additional rating of Type 12

NOTE - Models are intended for indoor use in telecommunication loop circuits or for use in Industrial Ethernet applications. Circuits, such as Industrial Ethernet applications.

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NOTE - Models are intended for indoor use in telecommunication loop circuits or for use in Industrial Ethernet applications. Circuits, such as Industrial Ethernet applications.

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