

# Product Information

## EMOSAFE EN-60KDS

### Keystone Network Isolator with ESD- and Lightning Protection

#### Introduction

The Network Isolator EMOSAFE EN-60KDS is utilized in copper-based network connections (Ethernet), in order to protect a device linked with the network against external voltages of unknown origin. Such unwanted voltages can be caused by installation faults, switching operations, electrostatic discharges, potential differences or lightning strikes, and occur frequently in the building cabling. In addition, network isolators eliminate disturbing low-frequency signal components. In particular, problems due to mains hum can be prevented through the use of network isolators. EMOSAFE EN-60KDS Network Isolators were originally developed for medical use, but are also implemented in other technical fields.

#### Technology

The Network Isolator EMOSAFE EN-60KDS transmits high frequency alternating current voltages according to the principle of electromagnetic induction in the frequency band used for the transmission of data. Because of this transmission principle the EN-60KDS requires no power supply. An installation of drivers is not necessary. The task of a network isolator is to prevent any galvanic (= electrically conducting) connection between the connected devices. Therefore, in addition to the data lines, the cable shielding is also galvanically isolated.

#### Standard Conformity and Certification

The Network Isolator EMOSAFE EN-60KDS meets the requirements of IEC 60601-1:1988 A1:1991 and A2:1995 (2nd Edition), IEC 60601-1:2005 (3rd Edition), IEC 60601-1-1:2000, as well as IEC 60601-1-2:2007, as an electrical separation device, making it suitable for use in medical environments. This is confirmed by our current CE Declaration of Conformity which can be downloaded from our website.

All Network Isolators from EMO Systems GmbH are approved by UL International as 'Recognized Component' under the file number E249126 and are therefore suitable for use in the US and Canadian markets. Apart from the UL approval, the conformity of our Network Isolators to the standards UL 60601-1, CSA 22.2 No.601.1-M90, as well as IEC 60601-1 is

confirmed by an independent accredited laboratory. In order to gain access to the certificate, visit the [UL Online Directory](#) or contact us directly.

#### Applications

- Medical electrical devices and systems, where patients must be protected against leakage currents.
- Applications, in which valuable devices or those requiring special protection need to be protected against ripple and surge voltages from the network periphery.
- Electrical measuring and monitoring equipment, which needs to be protected against external and interference voltages.
- Computer systems, which are galvanically connected with each other over significant distances via Ethernet cabling and in which equipotential bonding currents are to be prevented.
- Audio applications, in which the transmission of low frequency alternating current voltages (mains hum) over the network connection is to be reduced to an imperceptible level.

#### Fixed Installation

The fixed installation of a network isolator in the wall outlet socket reliably prevents the required galvanic isolation between data network and medical device from being forgotten in the hustle and bustle of everyday medical routine. Therefore, medical devices which require an external galvanic isolation from the Ethernet,

as well as standard PCs connected to medical electrical systems, can all be safely and conveniently connected to the Ethernet.

#### Incorporation into Medical Devices (OEM)

For medical devices, supply systems and medical equipment carts which provide an Ethernet interface, electrical separation of the interface is usually stipulated. Here, installed network isolators form an ideal solution for original equipment manufacturers, fulfilling the requirements of relevant standards and regulations.



## ESD- and Lightning Protection

The transformers within the EN-60KDS Network Isolator already provide an effective protection against voltage surges of up to 10,000 volts. Brief over-voltage pulses (voltage transients), which are caused for example by electric switching, lightning, or electrostatic discharges, can however overcome the transformer under certain circumstances. Although the pulse voltages will be strongly attenuated, voltage levels can still be reached which could cause damage to the connected devices. The TVS diode circuitry incorporated into the EN-60KDS is capable of reducing the transmitted pulse energies and voltages to safe levels. Impulses of up to 300W can be dissipated by the integrated TVS diodes before reaching the connected devices. The RJ45 socket is also practically potential-free and therefore prevents spikes due to static discharges when plugging in the cable (ESD and CDE). The EN-60KDS is therefore recommended for applications in server rooms, laboratories, workshops or office environments, for devices with especially sensitive terminals, or requiring extra protection. For every device connected to the Ethernet through the EN-60KDS, a degree of protection is ensured, conforming to the stringent requirements of IEC 61000-4-2 (ESD; 15kV Air / 8kV Contact), IEC 61000-4-4 (EFT; 40A, 5/50ns) and IEC 61000-4-5 (Lightning; 12A 8/20  $\mu$ s).

## Performance

A new transmission technology has been developed by EMO Systems specifically for the EN-60 series, which for the first time allows an Ethernet cable route of up to 90m (Permanent Link) equipped with a Network Isolator to be certified according to ISO 11801/EN 50173 Class D or TIA 568B Cat.5e for Gigabit Ethernet. The EN-60KDS Network Isolator is however an additional component in the wiring route. In order to achieve certification in accordance with Class D / Cat.5e standards, the existing cable route must therefore provide a small reserve in network performance. The exact requirements for this Class D / Cat.5e performance reserve can be found in the EN-60KDS installation instructions. We recommend using Cat.6A components when establishing new network wiring routes which are to be fitted with EN-60KDS Network Isolators.

## Compliance Tests

Permanent network installations, fitted with an EN-60KDS Network Isolator, can be checked with cable certification devices which are suitable for testing electrically isolated cable sections. For example, Fluke produces a range of DTX Cable Analyzers, suited to such tests. These devices must have their *Twisted Pair* configuration changed - the *AC Wire Map* needs to be *Enabled*. The entire cable route, including the Network Isolator, can be tested to TIA 568 Cat.5e or ISO 11801 Class D. Testing of the cable shielding and the conductor resistance is not possible in this mode. If however, these tests are required, or if the quality of the cable route itself needs to be tested (without the Network Isolator), then testing can be performed by bypassing the Network Isolator, and connecting directly to the RJ45 socket, set back within the cable duct.

## Plugging Cycles and Faulty Plugging

Especially in the medical environment, there are many mobile devices which must be frequently plugged and unplugged. In this field, Ethernet interfaces are therefore more greatly stressed than in an office environment. For this reason, the contacts of the EN-60KDS are provided with a particularly thick layer of gold (50 $\mu$ m), which ensures a perfect contact, even after many hundreds of plugging operations.

Connector plugs of telephones, fax machines, or modems (RJ11, RJ12, or RJ25) are indeed constructed narrower and have only a maximum of 6 contacts, but because of their very similar design can be plugged into RJ45 sockets by mistake. With conventional sockets this often leads to damage to the contacts and subsequently to faulty contacts. Through its robust design, the EMOSAFE EN-60KDS withstands up to 100 such faulty plugging operations without damage.

## Design

The Network Isolator EN-60KDS is a Keystone module. It therefore fits into every outlet panel, whose module receptacle conforms to the Keystone specifications, and can be combined with Keystone-compatible outlet covers and module brackets of most manufacturers. Its small size is especially suitable for use in dado trunking, equipment carts, and medical supply systems.

The EN-60KDS has a flexible connector cable. This patented design (German Patent DE102007025160) offers several advantages:

- The EN-60KDS can easily be retrofitted in existing Keystone installations. To do this, the existing Keystone module must merely be shifted back within the cable duct. The EN-60KDS Network Isolator replaces the original module in the outlet cover.
- Fixed installations can be laid with future-proof Cat.6a or Cat.7 cabling, and can later be certified by bypassing the network isolator, easily connecting to the set-back original socket. Consequently, installation firms can fulfil the specifications for the fixed cabling, while still meeting their obligation to provide documented certification.
- Safety inspections can be carried out via an inspection cover directly at the place of installation.
- In contrast to a socket or an insulation displacement connection, the flexible connector cable enables a physically short design.

## Installation Notes

- It is recommended to keep the RJ45 socket between fixed cabling and Network Isolator accessible, in order to be able to carry out certification and to facilitate maintenance. This can be achieved with an inspection cover.
- The standard cable length is 20cm. Other cable lengths are available.
- A network isolator is designed for the transmission of data in the frequency range between 300kHz and 100MHz. Lower frequencies are strongly attenuated.

For this reason it is normally not possible to transmit signals from nurse call systems, TK-installations or analog video signals over a network isolator.

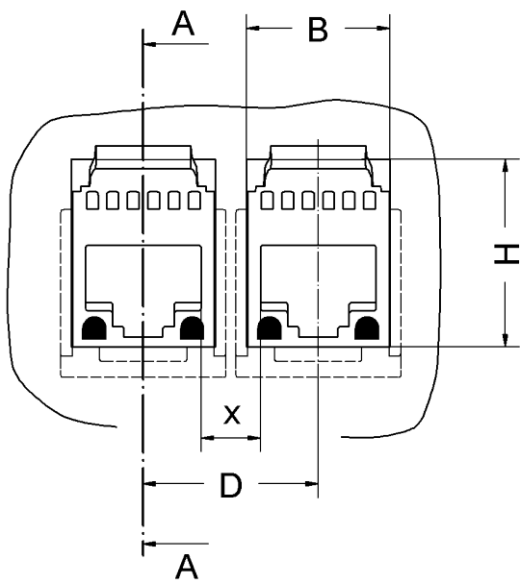
- The EN-60KDS Network Isolator can be used in a PoE network without restriction; however due to the galvanic isolation, PoE devices can generally not be supplied with power through a network isolator.
- To ensure that two adjacent EN-60KDS Network Isolators also meet the creepage distance requirements of IEC 60601-1, a centre-to-centre distance of at least 20mm is required, as listed in Table 1. If equipment is

intended to be operated with voltages greater than 250VAC, and an EN-60KDS Network Isolator is to be used to provide galvanic isolation, the centre-to-centre distance must be increased to at least 24mm. However, by increasing the creepage distances (for example, through the use of non-conductive ridges), the centre-to-centre distance can be reduced down to 17.5mm. The combination of an EN-60KDS Network Isolator with non-isolated Keystone modules within a multi-module holder is not recommended.

## Technical Features

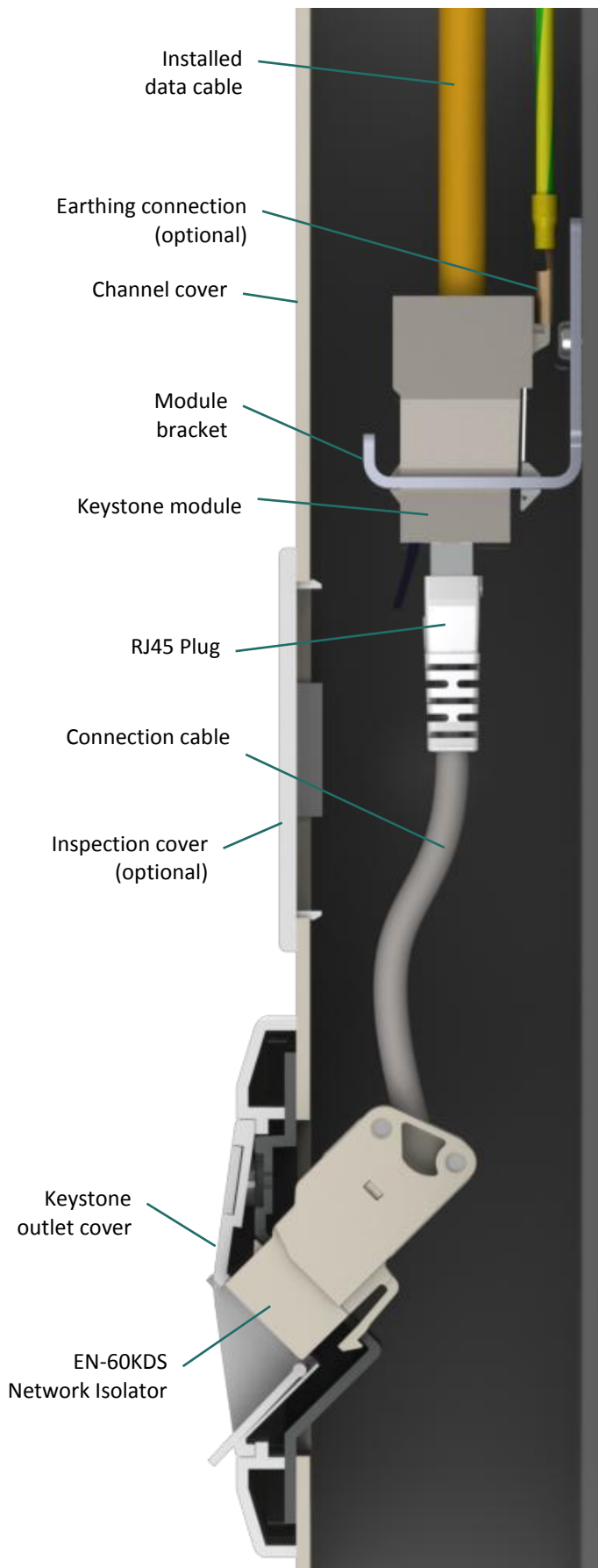
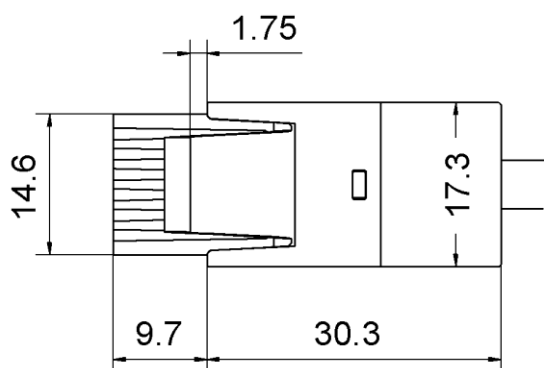
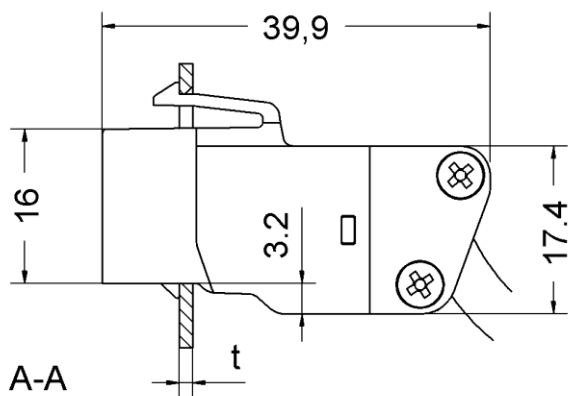
	Standard or Test Criterion	
Designation		EN-60KDS
Housing colour		White, similar to RAL9010
Design		Keystone module RJ45 with connector cable and RJ45 plug
Cable length	Length of the flexible section	20cm (other lengths available upon request)
Supported network protocols	IEEE802.3	
Ethernet performance	ISO11801; EN50173; TIA568B	Class D/Cat5e achievable in Permanent Link
Attenuation (Insertion Loss)	1MHz < f < 100MHz	< 1dB (for 20cm cable length)
Return Loss	1MHz < f < 100MHz	≤ 18dB
Suitable for the protection of Ethernet interfaces of medical devices	EN 60601-1:2006 / EN60601-1-1:2002 / UL 60601-1	ME-devices of protection class I + II + independent power supply; with application parts B, BF and CF
Provided isolation distances		12mm clearance / 7mm creepage
Isolation		Reinforced
Dielectric strength		AC: 6kV @ 50Hz / 1min DC: 8.5kV / 1min
Leakage current	275V <sub>AC</sub> , 50Hz	< 25µA
Max. working voltage (max. mains voltage) of the connected devices	EN 60601-1:2006 / EN 60601-1-1:2002 / UL 60601-1	≤ 400VAC / ≤ 450VDC
Plugging cycles	RJ45 Plug to RJ45 socket	> 1000
Mismatched connector plugging cycles	with RJ11/RJ12/25 connectors	Up to 100
Housing dimensions: W×H×D	Housing without cable	17.3mm × 24mm × 39.9mm
Min. cable bend radius		25mm
Max. short-term tensile cable strength		70N for < 10s
Protection rating	DIN EN 60529	IP20
Protection against transient voltages	Line to Line	TVS Diode Circuit
Max. pulse power (tp=8/20µs)	P <sub>pk</sub>	300W
Reverse blocking voltage	V <sub>RWM</sub>	5V
Clamping voltages	I <sub>pp</sub> = 1A, tp=8/20µs	12.5V
	I <sub>pp</sub> = 5A, tp=8/20µs	17.5V
	I <sub>pp</sub> = 12A, tp=8/20µs	25V
Markings		CE, UL, RoHS conformity, lead-free
Environmental conditions (operation)	Temperature Humidity Air Pressure	10 to 45°C 10 – 90% (non-condensing) 860 to 1060hPa
Environmental conditions (storage and transportation)	Temperature Humidity Air Pressure	-10 to 75°C 10 – 90% (non-condensing) 600 to 1060hPa

# Installation Drawings



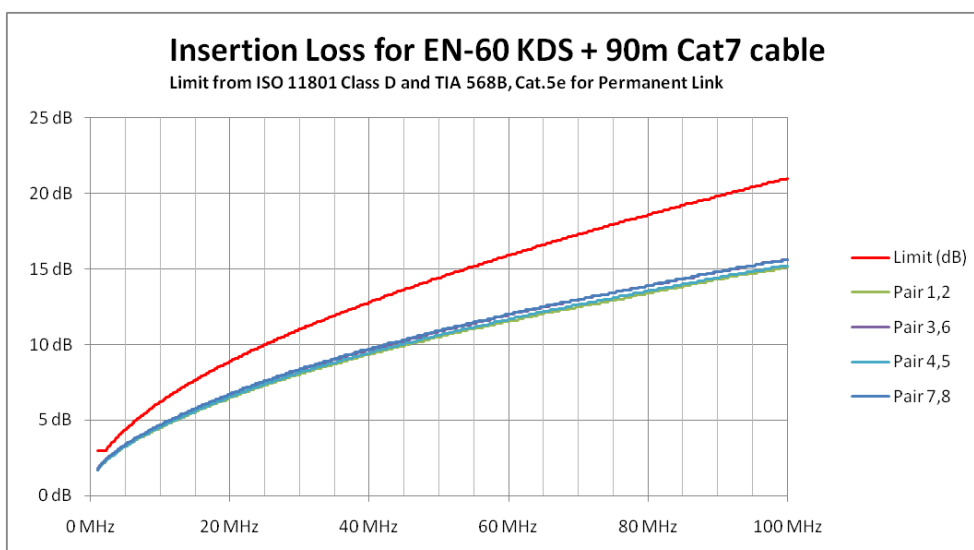
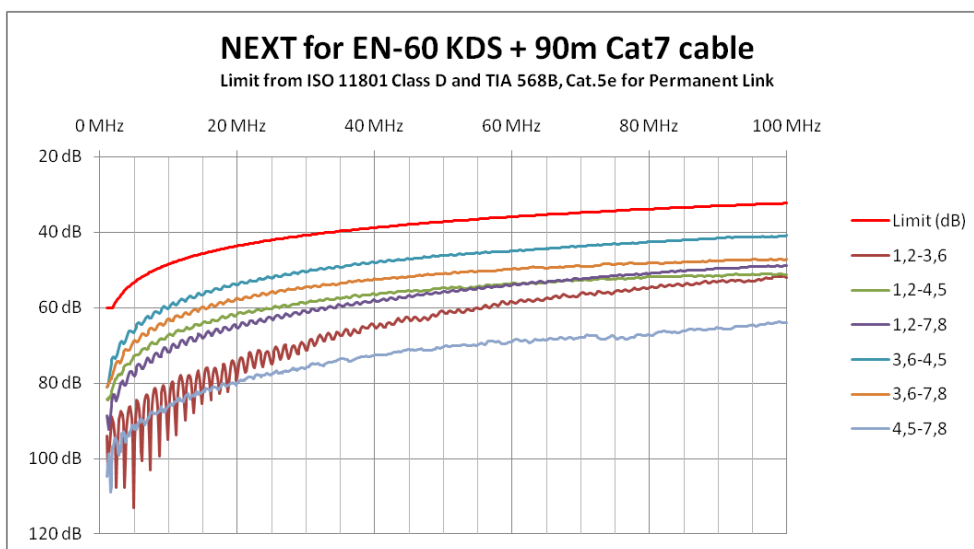
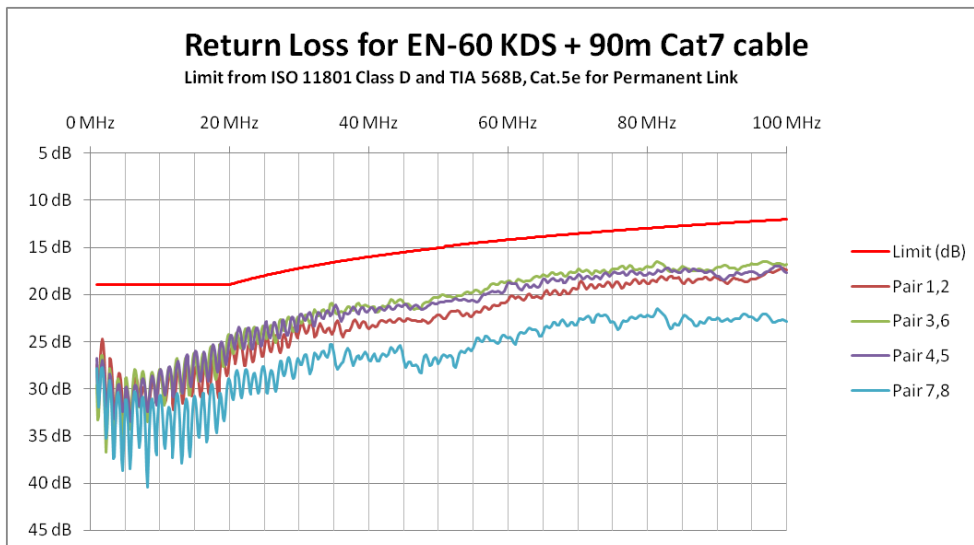
**Table 1**

H	19.3 – 19.61 mm
B	14.78 – 15.04 mm
t	1.22 – 1.54 mm
D	≥ 20 mm
x	≥ 8 mm

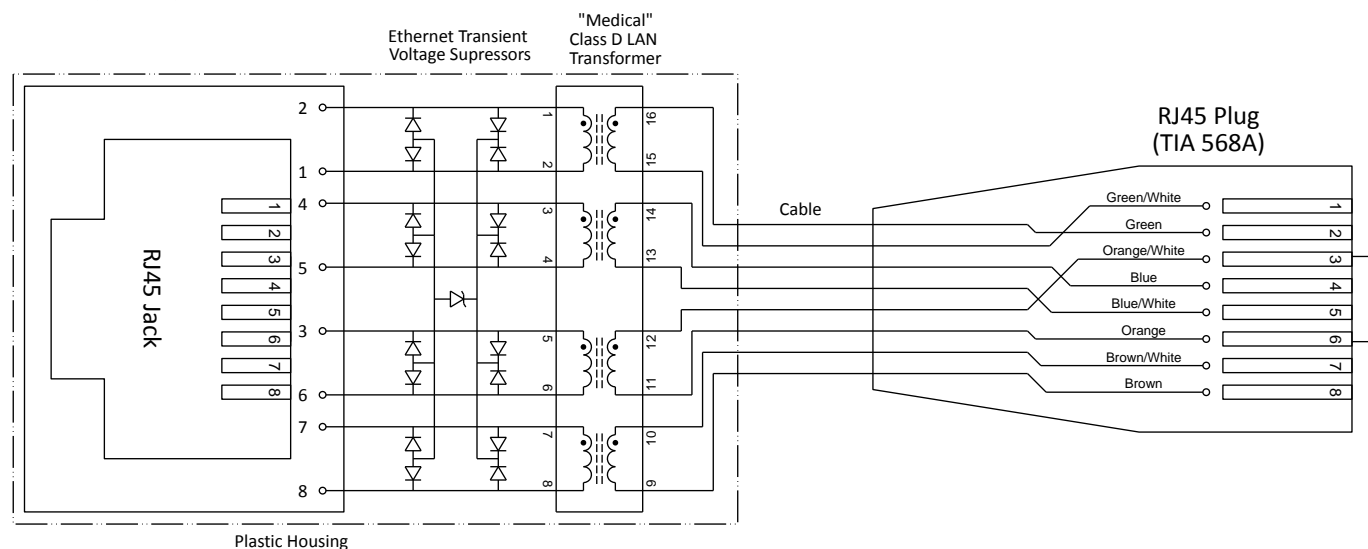


## Characteristic Value Diagrams

The characteristic value diagrams shown below represent achievable frequency characteristics. Actual frequency characteristics are dependent upon the components used and the installation, and can therefore differ from those shown below.



## Wiring Diagram



## Safety Inspections

Safety inspections are not prescribed for network isolators in medical use, as network isolators themselves do not fulfil any diagnostic or therapeutic purpose, and therefore are not classified as medical products. However, together with a connected medical device, network isolators form a medical electrical system, which altogether may be subject to inspection. For this reason, safety inspections on network isolators are meaningful where the risk of an inadmissible electrical stress of the patient should be reliably excluded throughout the path of the Ethernet connection. The following checks are recommended:

1. The device is to be checked for external damage by means of visual inspection.

2. Inspection for foreign objects, especially liquids.

3. Function test

4. Insulation test

5. Availability and completeness of the documentation.

For the electrical tests a test device for testing the electrical safety according to EN 60601 or VDE0751 is required. The EMOSAFE EN-60KDS is connected to this test device at both sides with a suitable test adapter. The test adapter connects all conductors, including the cable shield, to the test device. Suitable test adapters are available from EMO Systems upon request.

## Contact Information

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