

# EMOSAFE EN-76

Product Datasheet

## Ultra-compact Network Isolators



## 1 FEATURES AND ADVANTAGES

- Conforms to IEC 60601-1
- Suitable for use within medical supply units
- UL Recognized Component
- RoHS compliant
- Suitable for devices with supply voltages up to 400 V AC
- Dielectric strength 6.0 kV AC or 8.5 kV DC
- Transient voltage suppression on all signal lines
- ISO/IEC 11801 Class E<sub>A</sub> as well as TIA/EIA-568 Cat 6A Ethernet Performance
- Extremely low insertion losses; thereby total cable lengths of 100 metres are achievable
- Ultra-compact
- Suitable for stand-alone operation as well as incorporation into racks, devices, and products
- 100% inspection by our Quality Control

## 2 GENERAL DESCRIPTION

EMOSAFE EN-76 network isolators interrupt the electrically conductive connection (wires and shield) between devices that are connected to each other via copper-guided Ethernet cabling. They prevent equipotential bonding currents and protect connected devices and their users from transient over voltages that have been directly or inductively coupled into the network cable because of installation errors, lightning, switching operations, or electrostatic discharges.

Built into a medical electrical (ME) product, the EMOSAFE EN-76 Network Isolator facilitates the safe Ethernet connection of this ME product within the patient environment. The EN-76 satisfies all construction requirements of IEC 60601-1 in the formation of two means of patient protection (MOPP) within the network interface, thereby practically eliminating the risk of electrical shocks arising from such stray external voltages at the network connection. With its UL approval, the EN-76 is also suitable for devices destined for export to the North American markets.

The EMOSAFE EN-76 is an efficient and compact 10Gigabit Ethernet network isolator, characterised by exceptional Ethernet performance and a very high dielectric withstanding voltage. As a Keystone module, it can be used in all Keystone-compatible outlet sockets, patch panels, and panel cut-outs. The construction with socket and cable stub provides the physical functionality of an extension cable.


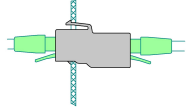

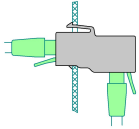

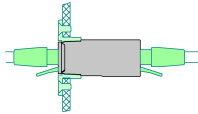

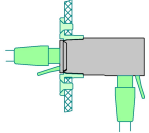

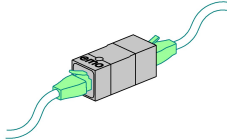
The EMOSAFE EN-76 Network Isolator transmits high-frequency signals through the principle of electromagnetic induction. This results in the EN-76 not requiring any external power supply. There are no software drivers to be installed.

### 3 APPLICATIONS

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- **Patient protection**  
Electrical separation of Ethernet interfaces of medical electrical (ME) devices and systems, where patients must be protected from dangerous leakage currents, in conformity with applicable standards.
- **Equipment protection**  
Applications, in which valuable devices or those requiring special protection need to be protected against ripple, mains hum, and surge voltages from the network periphery.
- **Measurement technology**  
Electrical measuring and monitoring equipment, which needs to be protected against external voltages and interference voltages arising from the Ethernet periphery.
- **Potential differences (Technical building systems)**  
Computer systems, which are electrically connected with each other over significant distances via Ethernet cabling, where current flows caused by potential differences must be prevented.
- **Audio**  
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.
- **Power over Ethernet (PoE)**  
Network isolators of type EN-76 can be used in a PoE network without restrictions, but PoE end devices cannot be supplied with voltage behind the location of the galvanic isolation.

## 4 SUMMARY OF VARIANTS

<h1>EN-76</h1> <p>Ultra-compact Network Isolators</p>		Name Article number	Special features	TVS-Diodes	Configuration
<p><b>Keystone (horizontal)</b></p> 	<p><b>EN-76HE-K</b> A10179</p>	For use in Keystone-compatible outlets. Straight connector	✓		
<p><b>Keystone (vertical)</b></p> 	<p><b>EN-76VE-K</b> A10180</p>	For use in Keystone-compatible outlets. 90° connector	✓		
<p><b>SnapFit (horizontal)</b></p> 	<p><b>EN-76HE-S</b> A10175</p>	For use with EMOSAFE SnapFit accessories. Straight connector	✓		
<p><b>SnapFit (vertical)</b></p> 	<p><b>EN-76VE-S</b> A10176</p>	For use with EMOSAFE SnapFit accessories. 90° connector	✓		
<p><b>Standard</b></p> 	<p><b>EN-76HE</b> A10174</p>	For easy upgrade of existing equipment.	✓		

5 DRAWINGS

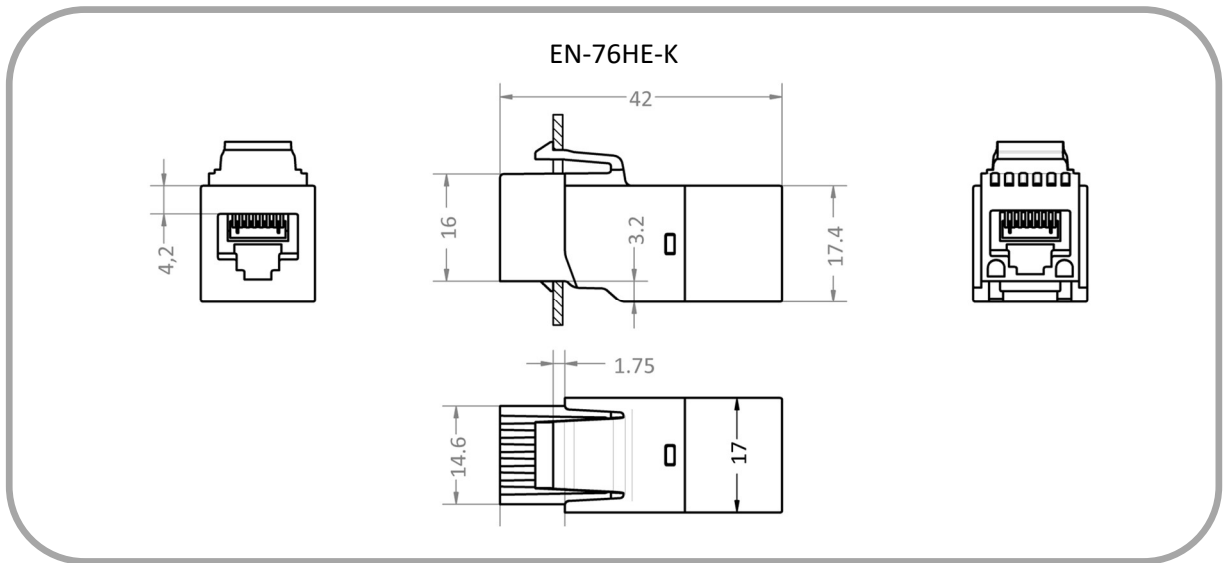


Figure 1 Technical drawings for EN-76HE-K. All dimensions are in millimetres.

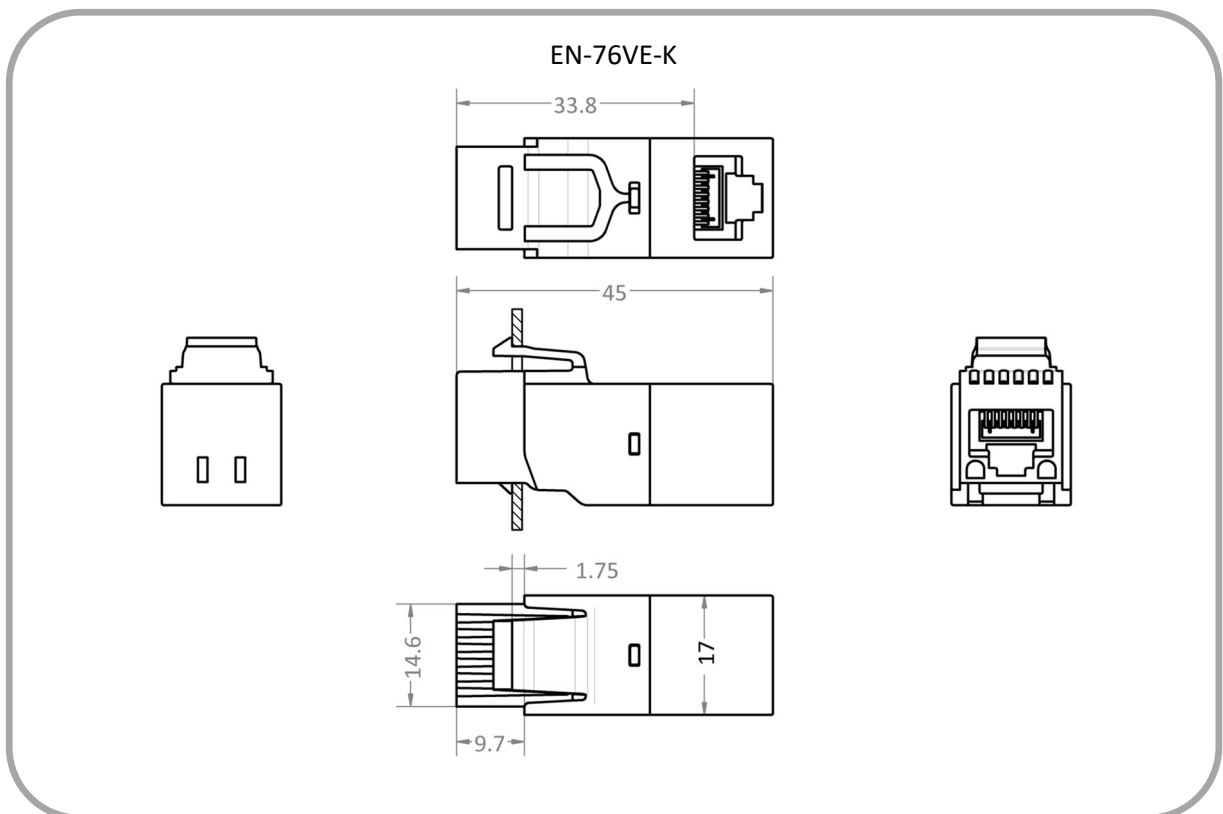


Figure 2 Technical drawings for EN-76VE-K. All dimensions are in millimetres.

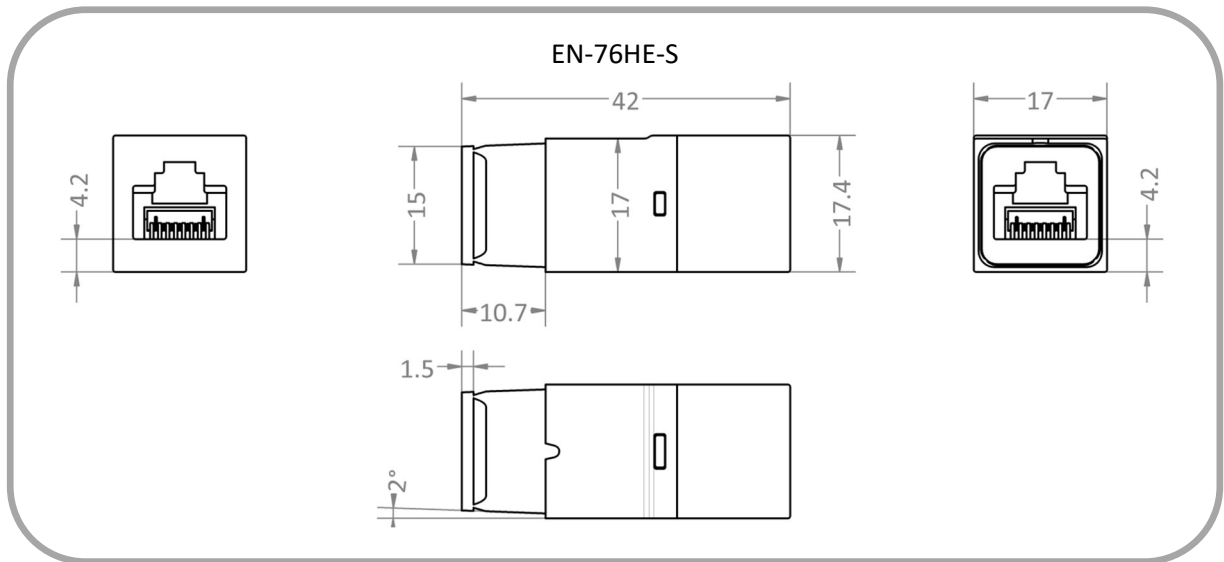


Figure 3 Figure 1 Technical drawings for EN-76HE-S. All dimensions are in millimetres.

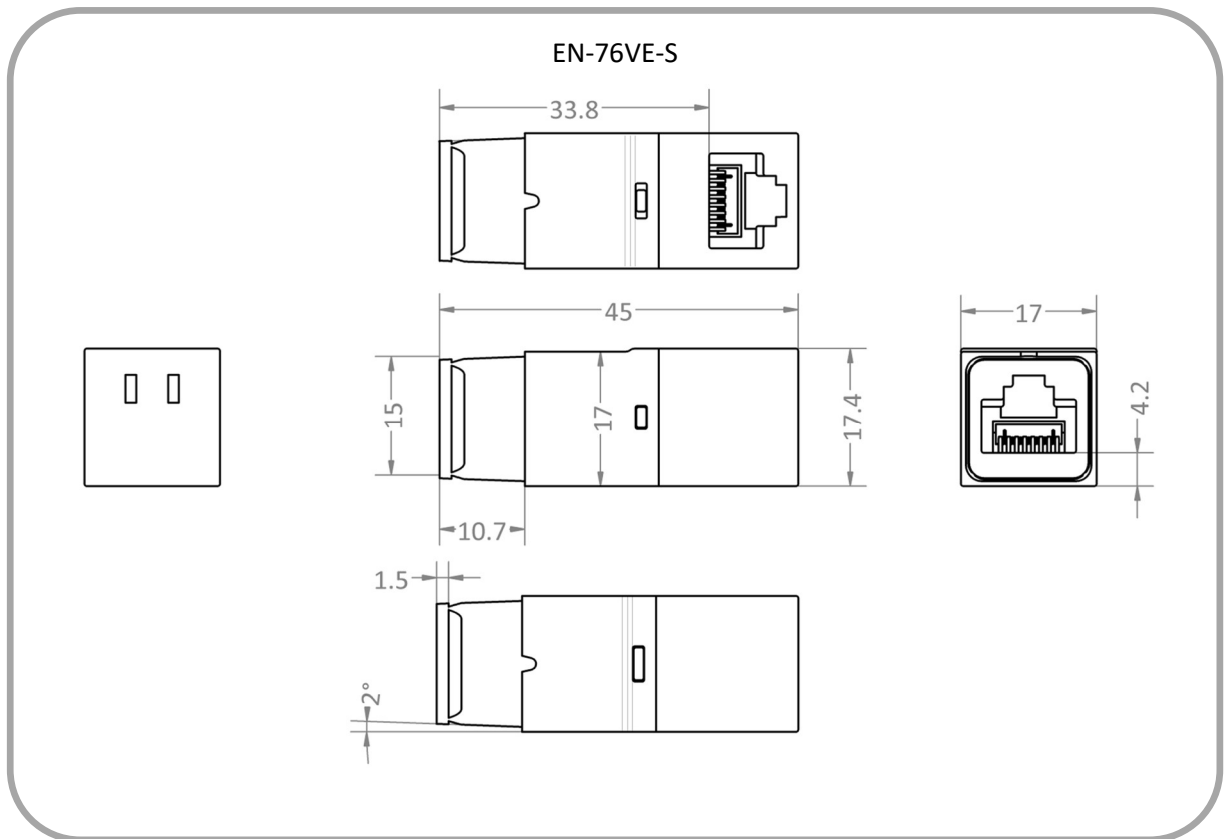


Figure 4 Technical drawings for EN-76VE-S. All dimensions are in millimetres.

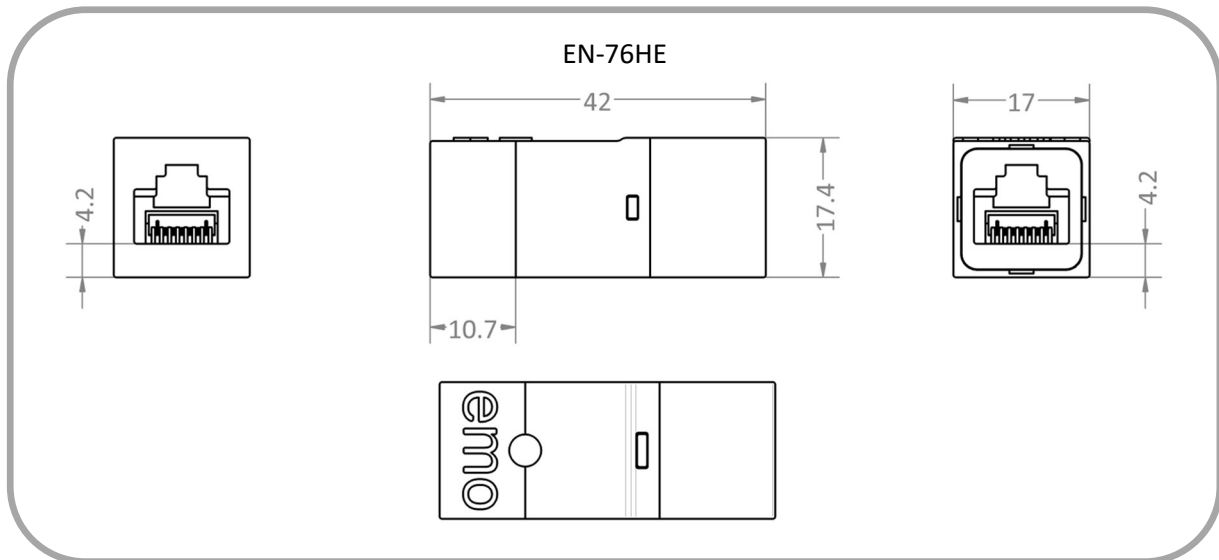


Figure 5 Technical drawings for EN-76HE. All dimensions are in millimetres.

## 6 INSTALLATION INFORMATION

### 6.1 EQUIPMENT INSTALLATION

When designing Network Isolators into equipment or devices, it is essential that the manufacturer observes the applicable creepage and clearance distances. Specifically, the creepage and clearance distances between exposed metal surfaces of Ethernet patch cables plugged into the Network Isolator, and the next-closest electrically conducting components of the equipment or device to be protected. These distances must be designed to comply with the relevant requirements and standards. If needs be, this next-closest electrically conducting component must be appropriately bonded to the protective earth connection.

### 6.2 EN-76HE-K AND EN-76VE-K

EN-76HE-K and EN-76VE-K Network Isolators can be snapped into any housing aperture which satisfies the Keystone dimension requirements.

The Network Isolators also disconnect the shield connections in Ethernet cabling. If the cable shield of the incoming data cable is to be connected with the room or equipment potential, such a connection must be carried out separately before the Network Isolator, effectively bypassing the Network Isolator.

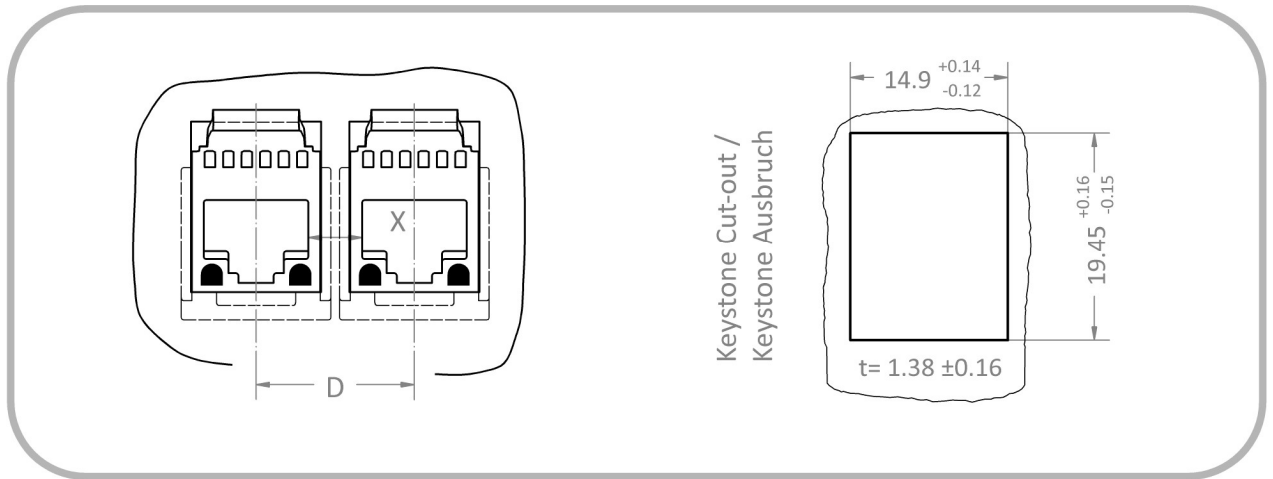


Figure 7. Mechanical dimensions for Keystone-compatible cut-outs, and required panel thickness.

The centre-to-centre separation "D" between two neighbouring Network Isolators is to be selected depending on the necessary clearance and creepage distance. Here, as a rule, the shortest separation "X" between the screening shields of the inserted Ethernet cables is crucial.

If it is intended that two or more EN-76 Network Isolators are to be installed side by side into a multiple module carrier, the mounting clearance must be considered. Crucial to this is the creepage distance between the screening shields of the patch cables inserted into neighbouring Network Isolators. The resulting creepage distance must not fall short of 8 mm in 250 V AC environments, and not less than 12 mm in 400 V AC environments.

Combining EN-76 Network Isolators and non-isolated modules within multiple module carriers is not recommended.

### 6.3 SAFETY NOTICE

During assembly, attention should be paid to ensure that the clearance and creepage distances required by IEC 60601-1 are met. The isolating effect of the Network Isolator must not be compromised by neighbouring conductive components. If, for example, the installation of the Network Isolator is to be within a metal plate, this plate must be connected to the ground potential (protective earth).

As a matter of principle, Network Isolators should be mounted as close as possible to the equipment requiring protection.

Damaged Network Isolators, and Network Isolators which are contaminated by dust or liquids, are to be replaced.

When used as directed, EMOSAFE Network Isolators are maintenance-free.

## 7 SPECIFICATIONS

### 7.1 GENERAL

Category	Standards or Test Criteria	Properties
Designation		EMOSAFE EN-76
Housing colour		EN-76xE-x: White EN-76HE: White and Black
Housing Material		Plastic
Construction		EN-76xE-K: Keystone-Modul EN-76xE-S: SnapFit-Modul EN-76HE: Standalone
Input Interface		RJ45 Jack, straight
Output Interface		EN-76HE-x: RJ45 Jack, straight EN-76VE-x: RJ45 Jack, angled
Weight		approximately 12 g
Protection rating	EN 60529	IP40
Mating cycles:	Correct: RJ45 plug in RJ45 socket	> 1000 cycles
	Mismatched: with RJ11 / RJ12 / RJ25	maximum of 100 cycles
Mean Time To Failure (MTTF)	SN 29500 Standard Temperature: 25°C Duty cycle: 100% (24 hours, 7 days)	3260 years
	SN 29500 Standard Temperature: 40°C Duty cycle: 100% (24 hours, 7 days)	3090 years

### 7.2 ETHERNET PERFORMANCE

Category	Standards or Test Criteria	Properties
Transmission Speeds and Supported Network Protocols	IEEE 802.3	100BASE-TX      bis 100 MHz*
		1000BASE-T      bis 100 MHz*
		2.5GBASE-T      bis 100 MHz*
		5GBASE-T      bis 250 MHz*
		10GBASE-T      bis 500 MHz*
	ISO/IEC 11801	Class D (CH & PL)      bis 100 MHz*
Class E (CH & PL)      bis 250 MHz*		
Class E <sub>A</sub> (CH)      bis 500 MHz*		
TIA/EIA-568	Cat 5e (CH & PL)      bis 100 MHz*	
	Cat 6 (CH & PL)      bis 250 MHz*	
	Cat 6A (CH)      bis 500 MHz*	

\* maximum bandwidth frequency



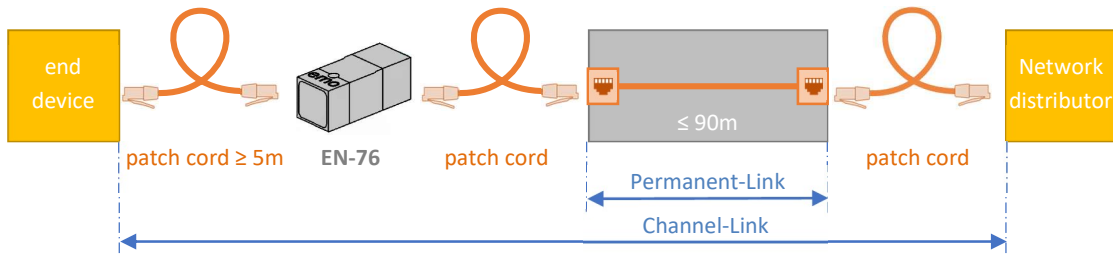


Figure 8 Recommended setup of the network isolator

The speed is classified, among other things, by adhering to limit values for the Insertion Loss (IL), the Return Loss (RL) and Near-End-Crosstalk (NEXT) of the system setup.

Figure 9 and Figure 10 show the IL of the network isolator without the remaining Channel-Link components. Figure 11 and Figure 12 show the RL and the NEXT performance of the recommended structure on the end device side. The RL and the NEXT depend strongly on the structure of the system and do not behave additively with the rest of the structure.

More detailed information on system setup, classifications, performance and the basics of the individual parameters can be found in our white paper "[Ethernet Performance of Network Isolators](#)".

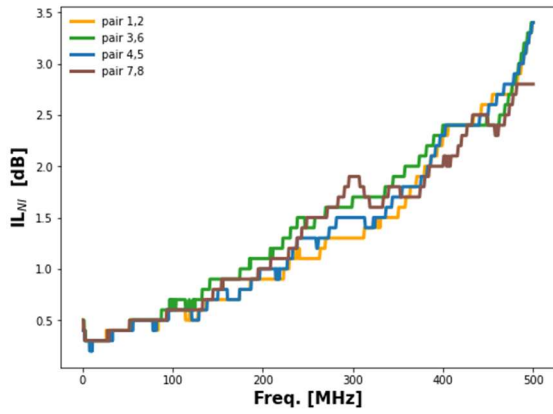


Figure 9 Insertion Loss of an EN-76

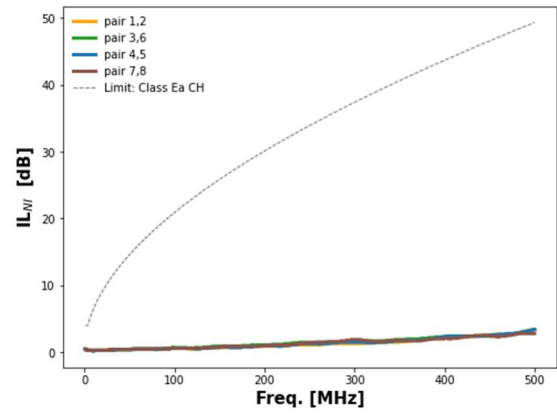


Figure 10 Insertion Loss of an EN-76 with the Class E<sub>A</sub> Channel-Link Limit

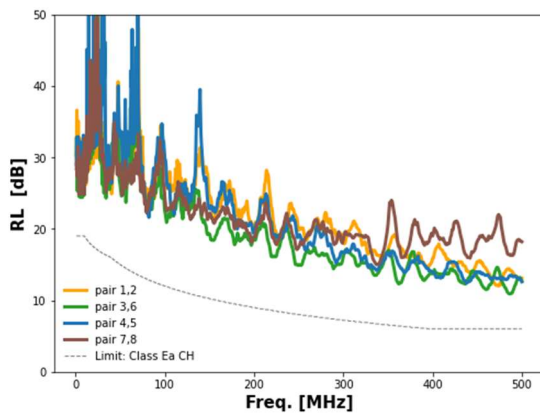


Figure 11 Return Loss of an EN-76 on the end device side of the setup of the recommended setup

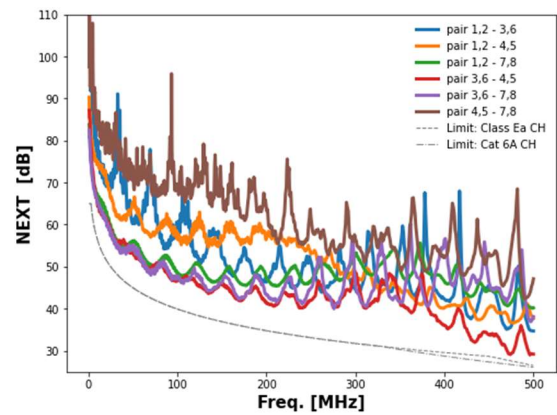


Figure 12 NEXT-Performance Loss of an EN-76 on the end device side of the setup of the recommended setup

### 7.3 ELECTRICAL

Category	Standards or Test Criteria		Properties
AC Dielectric Strength	at 50 Hz, for 60 seconds		6 kV
DC Dielectric Strength	for 60 seconds		8.5 kV
Reinforced Isolation	IEC 60601-1		✓
Coupling Capacitance / Channel			15 pF ±25%
Total Coupling Capacitance			60 pF ±25%
Total Leakage Current	275 V AC at 50 Hz	Typical:	12 µA
		Max.:	16 µA
TVS diode circuitry	Suppression of transients on the signal lines		✓

### 7.4

### 7.5 OPERATING CONDITIONS AND AREA OF APPLICATION

Category	Standards or Test Criteria		Properties
Pollution Degree	IEC 61010		2 <sup>1</sup>
Overvoltage Category	IEC 60664-1		III
Maximum Working Voltage <sup>2</sup>	Maximum mains voltage of the connected devices, in accordance with IEC 60601-1		400 V AC 450 V DC
Temperature		Min.:	-10°C
		Max.:	+70°C
Air Humidity	Non-condensing	Min.:	10%
		Max.:	90%
Air Pressure		Min.:	700 hPa
		Max.:	1060 hPa
Altitude	Max.:		3200 m

<sup>1</sup> Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected

<sup>2</sup> The Network Isolator can be permanently exposed to this voltage level.

### 7.6 ENVIRONMENTAL CONDITIONS: STORAGE AND TRANSPORTATION

Category	Standards or Test Criteria		Properties
Temperature		Min.:	-40°C
		Max.:	+70°C
Air Humidity	Non-condensing	Min.:	10%
		Max.:	90%
Air Pressure		Min.:	500 hPa
		Max.:	1060 hPa

## 7.7 CERTIFICATES

Category	Properties
UL Recognized Component	✓
UL File No.	E362969
IEC 60601-1	✓
IEC 60601-1-2	✓
ANSI/AAMI ES 60601-1	✓
CAN/CSA-C22.2 No. 60601-1	✓
Low Voltage Directive	✓
EMC Directive	✓
RoHS Directive	✓
Lead-free	✓

The versions of the cited standards and directives to which our products comply with can be found in our Declaration of Conformity and our UL certificate on our website under "[Standard Conformity and Certificates](#)".

## 8 SCHEMATIC DIAGRAM

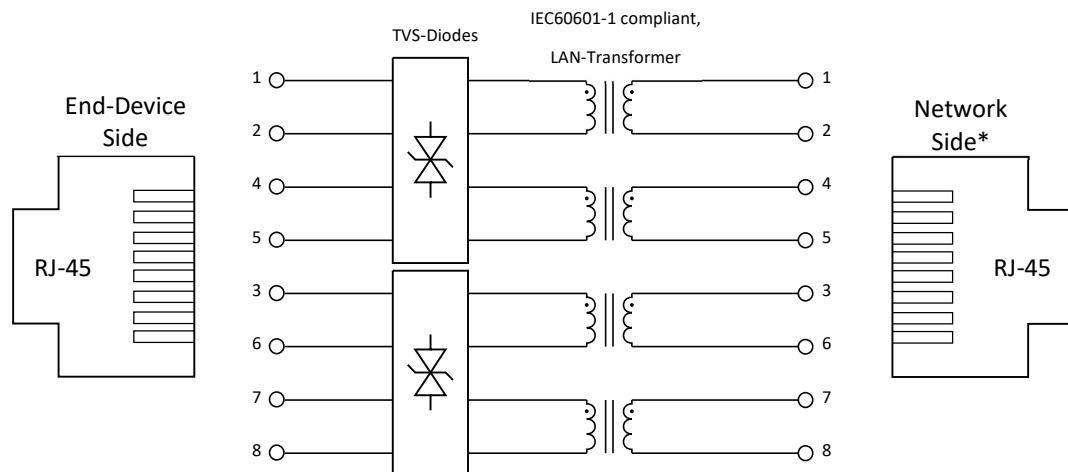


Figure 13 Circuit diagram for all EN-76 variants. \*The Network side is defined in the variants by the Keystone Modul, the Snap-Fit attachment or the black cap.

## 9 SCHEDULED MAINTENANCE

EMOSAFE network isolators are maintenance-free when used as intended.

## 10 PRODUCT MARKINGS

	Through this mark, the conformity of the product with all applicable EU Directives is confirmed.
	Marks the product as a UL "Recognised Component"; File No. E362969.
	The product may not be disposed of in domestic rubbish.
	This product meets the requirements of EU Directive concerning the limitation of the use of certain hazardous substances in electric and electronic equipment.

## 11 ACCESSORIES

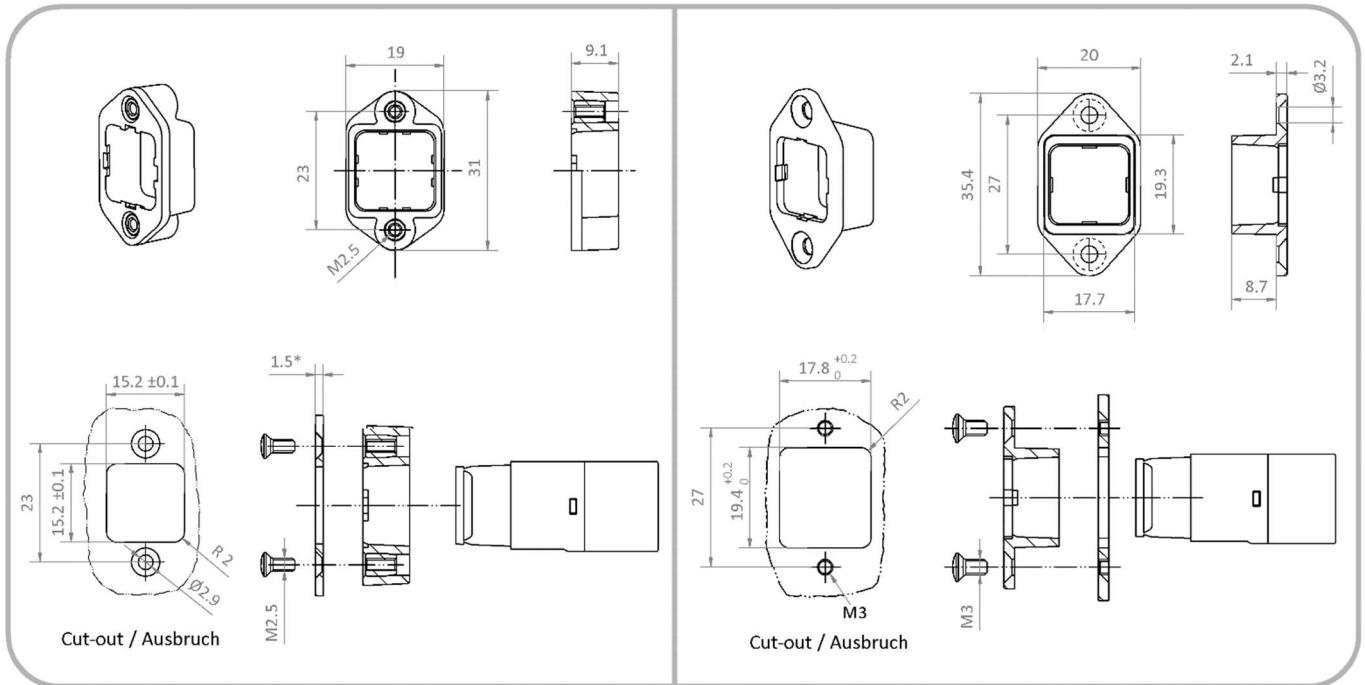
SnapFit installation frames are available as accessories. They are used to securely and play-free fastening of the EN-76HE-S and EN-76VE-S network isolators to housing walls. The square interface allows for four different attachment positions.

The production of customer specific SnapFit frames is possible upon request.

SnapFit <i>Installation frame for SnapFit variants</i>	Name	Special features	Configuration
	Article number		
	<b>Z-3-SF-INT</b> A10057	<ul style="list-style-type: none"> <li>Housing assembly for flush mounting</li> <li>Two M2.5 brass inserts</li> <li>Two snap-fit positions</li> <li>Material: polyamide, black</li> </ul>	
	<b>Z-4-SF-EXT</b> A10058	<ul style="list-style-type: none"> <li>Protruding housing assembly</li> <li>Two snap-fit positions</li> <li>Material: polyamide, black</li> </ul>	

**ATTENTION: SnapFit installation frames can no longer be removed once they have been plugged in and snapped into place.**

**Therefore, be sure to ensure the correct plug-in position when plugging it on!**



Dimensions of the SnapFit caps. All measurements in millimeters.

\* The dimension 1.5mm is recommended for flush mounting of the EN-665.  
However, different sheet thicknesses are possible.

## 12 QUALITY

EMO Systems GmbH maintains a certified quality management system for development and production in accordance with ISO 9001 and ISO 13485. Every network isolator is subjected to extensive quality control before delivery. Among other things, it is checked whether the achieved values for leakage current, dielectric strength, insertion loss, return loss and near crosstalk (NEXT) correspond to the specifications.

You will also find a declaration of conformity on our website confirming that the EMOSAFE network isolators comply with the requirements of the Low Voltage Directive (2014/35/EU), the Electromagnetic Compatibility Directive (2014/30/EU) and the Restriction of Use Directive hazardous substances in electrical and electronic equipment (2011/65/EU, RoHS).

## 13 PACKAGING

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The packaging label provides the following information:

- Article description
- Quantity
- Date of manufacture
- Serial number as 1D- (Code 128) and a 2D barcode (Data Matrix)

Contents:

- A network isolator of type EN-76HE-K, EN-76VE-K, EN-76HE-S, EN-76VE-S or EN-76HE
- This data sheet

## 14 ENVIRONMENTAL PROTECTION INFORMATION

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This device contains electronic components.

It must be returned to the manufacturer for disposal after use.

## 15 CONTACT AND SUPPORT

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You can find the current contact details on our website: <https://emosystems.de/en/contact/>

Or you can reach us by email at the following address: [support@emosystems.de](mailto:support@emosystems.de)

## 16 LEGAL NOTICE

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The information in this data sheet has been compiled to the best of our knowledge and with all care. However, we cannot guarantee that they are complete and error-free.

The user is responsible and liable for the correct use of this product. Neither EMO Systems GmbH nor EMO Systems Inc. assume liability.

This data sheet is subject to change without prior notice.