ETHERNET ISOLATOR
EI-0D2-10Y-10B

PROTECTING YOUR PROCESS
With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"
1 Safety

1.1 General

The operator of the system is responsible in terms of planning, mounting, commissioning, operating and maintenance.

Installation and commissioning of all devices must be performed by a trained professional only.

Protection of operating personnel and the system is not ensured if the product is not used in accordance with its intended purpose.

Laws and regulations applicable to the usage or planned purpose of usage must be observed. Devices are only approved for proper usage in accordance with intended purpose. Improper handling will result in voiding of any warrantee or manufacturer's responsibility.

The Declaration of Conformity, Certificate of Compliance, Statement of Conformity, EC-type-examination certificate and data sheets are an integral part of this document.

The data sheet contains the electrical data of the Declaration of Conformity, the Certificate of Compliance and the EC-type-examination certificate.

The documents mentioned are available from http://www.pepperl-fuchs.com or contact your local Pepperl+Fuchs representative.

1.2 Used Symbols

Safety-relevant Symbols

**Danger!**
This symbol indicates a warning about a possible danger.

In the event the warning is ignored, the consequences may range from personal injury to death.

**Warning!**
This symbol indicates a warning about a possible fault or danger.

In the event the warning is ignored, the consequences may course personal injury or heaviest property damage.

**Caution!**
This symbol warns of a possible fault.

Failure to observe the instructions given in this warning may result in the devices and any connected facilities or systems develop a fault or fail completely.
Informative Symbols

Note!
This symbol brings important information to your attention.

Action
This symbol marks an acting paragraph.

1.3 Declaration of Conformity
All products have been developed and manufactured taking into consideration applicable European standards and regulations.

Note!
A Declaration of Conformity can be requested from the manufacturer.

The manufacturer of this product, Pepperl+Fuchs GmbH in D-68301 Mannheim, Germany, has a certified quality assurance system in conformity with ISO 9001.

1.4 Intended Use
The Ethernet Isolator is used to generate a galvanically isolated intrinsically safe Ethernet signal from a non-intrinsically safe Ethernet signal. It may be used to lead a standard Ethernet cable through a hazardous Zone 0 or Zone 1 area. For bridging the intrinsically Ethernet line through a hazardous area one Ethernet Isolator has to be used at each end.

The device is designed for mounting on a 35-mm DIN rail according to DIN EN 60 715.

The device is constructed to satisfy the IP20 protection classification and must be protected accordingly from adverse environmental such as water spray or dirt exceeding the pollution severity level 2.
1.4.1 Marking

The modules are product-specifically marked with:

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EI-0D2-10Y-10B

Pepperl+Fuchs GmbH
68301 Mannheim/Germany
Ethernet Isolator
EI-0D2-10Y-10B
PTB 07 ATEX 2025 X

II (1) GD [Ex ia] II B

II 3 (1GD) G Ex nA [ia IIB] II T4
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1.5 Non-Intended Use

The Ethernet Isolators are not intended to be used for series connections of more than two Ethernet Isolators.

1.6 Installation and Commissioning

1.6.1 Requirements for installation within Zone 2

The device must be mounted for installation in the hazardous area in category 3G / Zone 2 in a housing which corresponds at least to protection class IP 54 per EN 60529 and which is suitable for this type of installation.

The connection and disconnection of non-power-limited circuits carrying current is permitted only during installation or maintenance, or for purposes of repair.

Devices being operated in connection with hazardous areas may not be changed or manipulated. If there is a defect, the product must always be replaced with an original part.

If devices have been operated in general electrical systems, they must not subsequently be operated in electrical systems related to explosive areas.

1.6.2 Installation in connection with intrinsically safe power circuits

The EC-type-examination certificate should be observed as first concern. It is especially important to observe the "special conditions for safe use" as far as contained in the certificate.

The installation of the intrinsically safe circuits has to be conducted in accordance with the relevant installation regulations particularly EN 60079-14 / IEC 60079-14.

Connect only devices that are approved by EC-type-examination certificate of the Ethernet Isolator for this kind of use, to the I.S. port of the Ethernet Isolator.

If devices have been operated in general electrical systems, they must not subsequently be operated in electrical systems related to explosive areas.
1.6.3 Intrinsically Safe Wiring and Cable Parameter

Only Ethernet cables which meet the requirements of the EC-type-examination certificate must be connected to the I.S. port of the Ethernet Isolator.

Special care must be taken about the inductance / resistance-ratio (H/Ω) of the used Ethernet cable, because this value is an indicator for the stored energy within the cable (see chapter 2.4).

The length of the I.S. cable between the two Ethernet Isolators may not exceed 100m.

The shield contact of the intrinsically safe port is connected to the shield contact of the non-intrinsically safe port and the power supply connection within the Ethernet Isolator.

1.6.4 Special Requirements at Low Ambient Temperatures

At an ambient temperature of -40°C to -25°C the Ethernet interface contacts (RJ45) of the device must not be plugged or un-plugged or mechanically stressed in any other way.

1.7 Transport, Storage and Service

In case of defect, the device must be removed and replaced with a new one.

Store all devices in a clean and dry environment.

1.8 Disposal

Disposal of devices and their packaging material must be performed in compliance with the applicable laws and guidelines of the corresponding country.

The devices do not contain batteries which need to be disposed of separately from the products.
2 Product Specifications

2.1 Function

The Ethernet Isolator may be installed within the safe area and the Zone 2 hazardous area. As an associated apparatus it is certified to lead intrinsically safe instrumentation into Zone 0 and Zone 1 hazardous areas. It is a one-to-one data connector with automatic speed detection. Data is passed through without buffering.

The Ethernet Isolator can be used for any Ethernet-based application. This includes current and future PROFINET and FF HSE installations. This intrinsically safe solution is well suited for:

• mobile machinery and equipment in harsh environments
• assemblies that are often removed, replaced or reworked
• where cable breakage is a risk

The intrinsically safe energy limitation eliminates any need for protected installation. Intrinsically safe Ethernet can be connected and disconnected during normal plant operation without requiring a hot work permit.

The galvanic isolation eliminates the need for equipotential bonding between the safe area and the hazardous area. Significant cost savings are realized through reduced installation material and effort.

The internal design of the Ethernet Isolator includes a galvanically isolating fibre optic bridge and a voltage and current limiting circuit. Additionally it is following the stringent requirements for energy-efficient design and low heat dissipation leading to reduced cooling requirements and if necessary highest packing density in the installation cabinet or equipment.
2.2 Typical Applications

The figure below (view Figure 2.1 on page 10) shows the typical usage of Ethernet Isolators within an Ethernet network. Using standard Ethernet cable (for cable parameters see chapter 2.4) and hardware, an up to 100 m long intrinsically safe connection can be established to connect the hazardous area and the network in the safe area. It is also a fast and easy way to bridge the Ethernet network through a Zone 0 or Zone 1 hazardous area. One Ethernet Isolator is required at each end of the intrinsically safe line.

The Ethernet Isolator requires a 24 VDC power supply.
2.3 Component Overview and Dimensions

1. LED Communication active intrinsically safe port
2. LED Power
3. LED Transfer rate
4. LED Communication active non-intrinsically safe port
5. Intrinsically safe connector female
6. Non-Intrinsically safe connector female
7. Power supply connection

All dimensions in millimeters (mm) and inch (") without tolerance indication.
2.4 Technical Data EI-0D2-10Y-10B

Power supply
- Rated voltage: 19.2 ... 35 V
- Rated current: 150 ... 100 mA
- Power loss: 3 W

Ethernet Interface
- Intrinsically safe port: 10 BASE-T/100 BASE-TX
- Non-intrinsically safe port: 10 BASE-T/100 BASE-TX
- Connection type: 2 x RJ-45, IEC 60603-7
- Connector pinout: Connector, female; TIA/EIA-568-B
- Transfer rate: 10/100 MBit/s, Auto-Negotiation
- Operating mode: Half/Full Duplex
- Cable type: Cat5e S/FTP AWG 24, Installation cable, L/R ratio max. 10 μH/Ω of all strand combinations
- Total cable length: 10 MBit/s: typ. 100 m / 20 °C
  100 MBit/s: typ. 200 m / 20 °C
- Number of isolators: max. 2 in series connection

Ambient conditions
- Ambient temperature: -40 ... 60 °C
- Storage temperature: -40 ... 85 °C
- Relative humidity: ≤ 95 % non-condensing
- Shock resistance: 15 g 11 ms
- Vibration resistance: 1 g 10 ... 150 Hz
- Degree of soiling: max. 2, according to IEC 60664

Mechanical specifications
- Connection type: terminals
- Core cross-section: up to 2.5 mm²
- Housing material: Polyamide PA 66
- Protection degree: IP 20 according to EN 60529
- Mass: 195 g
- Mounting: DIN rail mounting
3 Installation and Commissioning

3.1 Mounting

Read the chapter on Safety and, in particular, the section on Installation and Commissioning (see chapter 1.6) before installing the device.

DIN-Rail Mounting of the Ethernet Isolator

Snap the device onto the DIN rail as follows:

3.2 Power Supply and Ethernet Wiring

Additional information about auto crossover

The Ethernet Isolator does not support auto crossover functionality. Therefore connection problems may happen if the Ethernet Isolator is installed between two devices with activated auto crossover function. In general the deactivation of the auto crossover function at one device solves the problem. In certain cases you have to switch off auto crossover at both sides.

To prevent those connection problems Pepperl+Fuchs recommends a fixed setup of the transfer polarity.

Additional information about signal attenuation

Because of derating effects at raising ambient temperatures the max. possible Ethernet cable length may be reduced by 0.3 – 0.4 m per °C depending on the cable quality and signal attenuation (refer to the specifications of the cable manufacturer).

Warning!
Risk of short circuit

Injuries and damage to the device are possible when working with live parts.

- Before working on the device, always disconnect the supply voltage.
- Connect the device to the supply voltage only after completion of the work.
Power Supply Wiring

The easiest way to connect the power supply to the Ethernet Isolator is to prepare the cabling first on the removed connector plug and to plug it to the device afterwards.

1. Remove the power supply connector plug from the bottom side of the Ethernet Isolator.
2. Plug and screw the leads to the connector plug like follows:

3. Then hook up the wired connector plug into the power supply socket of the Ethernet Isolator.
**Ethernet Wiring**

1. Plug in the standard, non-specific Ethernet cable into the non-I.S.-ports of the device.
2. Now interconnect the two Ethernet Isolators by plugging in an Ethernet cable into both I.S.-ports of the devices.

### 3.2.1 Ethernet Cabel Overview for Interconnection

The cross-table below gives a general idea which Ethernet cable has to be used for interconnection of two Ethernet Isolators or an Ethernet Isolator to another device.

<table>
<thead>
<tr>
<th></th>
<th>Ethernet Isolator I.S.-port</th>
<th>Ethernet Isolator non-I.S.-port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet Isolator I.S.-port</td>
<td>Crossover cable</td>
<td>not allowed</td>
</tr>
<tr>
<td>Switched standard-port</td>
<td>not allowed</td>
<td>Crossover cable</td>
</tr>
<tr>
<td>Switch uplink-port</td>
<td>not allowed</td>
<td>Standard patch cable</td>
</tr>
<tr>
<td>Notebook</td>
<td>not allowed</td>
<td>Standard patch cable</td>
</tr>
<tr>
<td>Workstation</td>
<td>not allowed</td>
<td>Standard patch cable</td>
</tr>
<tr>
<td>Device with auto-crossover functionality</td>
<td>not allowed</td>
<td>Standard patch cable</td>
</tr>
</tbody>
</table>

**General Information about Standard Ethernet Patch and Crossover Cables**

The TIA/EIA-568-B Ethernet connector specification defines two types of pin assignment for an Ethernet cable. The standard Ethernet patch cable is a straight through connection of where both RJ45 ends wired the same. The Ethernet crossover cable has the RX and TX pairs switched between the end terminals.
In order to guarantee the communication across the cable the transmit signal of terminal device A has to connect to the receive port of terminal device B and vice versa. The signal has to be crossed at least once in a connection. A switched hub (switch) typically performs signal crossing internally and this is why a standard Ethernet patch cable is to be used to connect to another non-crossing device as well if a device supports an auto-crossover detection function. The crossover cable on the other hand is used when connecting two devices that do either both not cross or do both cross the signals. In this case the crossover must be done externally.

3.3 Demounting

Demounting from the DIN-Rail

Use a screw driver to loose the fixing trap and remove the module from the DIN rail.
4 Operation

4.1 LED Indication and Basic Troubleshooting

<table>
<thead>
<tr>
<th>LED Indication</th>
<th>Meaning</th>
<th>Help</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR</td>
<td>Ethernet Isolator active and powered</td>
<td></td>
</tr>
<tr>
<td>PWR</td>
<td>Ethernet Isolator not powered</td>
<td>Check power supply and wiring</td>
</tr>
<tr>
<td></td>
<td>Device defect</td>
<td>Send the device to Pepperl+Fuchs</td>
</tr>
<tr>
<td>PWR 10/100</td>
<td>Ethernet Isolator active Ethernet transfer rate 10 Mbit/s</td>
<td></td>
</tr>
<tr>
<td>PWR 10/100</td>
<td>Ethernet Isolator active Ethernet transfer rate 100 Mbit/s</td>
<td></td>
</tr>
<tr>
<td>PWR I.S. Port Act</td>
<td>Ethernet Isolator active I.S. Port is receiving data</td>
<td></td>
</tr>
<tr>
<td>Non-I.S. Port Act</td>
<td>Ethernet Isolator active Non-I.S. Port is receiving data</td>
<td></td>
</tr>
</tbody>
</table>

Compatibility in accordance with EN 61326

The electromagnetic compatibility – EMC – requirements applicable for electrical equipment for measurement, control and laboratory use in general are anchored in the European Standard EN 61326. Three different categories of device performances are distinguished:

A category A device – operates as intended during the test. This device can withstand the immunity tests without any noticeable performance degradations within the specification limits of the manufacturer.

A category B device – operates as intended after the test. The device shows temporary degradation or loss of function of performance during the test but self-recover from that state when the exposures are ceased.

A category C device – has loss of function, may need manual restoration. During the test a temporary loss of function is allowed as long as an operator can restore the device back to operation.

Conducted EMC tests:

**Immunity**

<table>
<thead>
<tr>
<th>Result</th>
<th>Category</th>
<th>Standard</th>
<th>Immunity Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passed</td>
<td>A*</td>
<td>EN 61000-4-2</td>
<td>Electrostatic discharge Direct contact</td>
</tr>
<tr>
<td>Passed</td>
<td>A*</td>
<td>EN 61000-4-2</td>
<td>Electrostatic discharge Indirect air</td>
</tr>
<tr>
<td>Passed</td>
<td>A</td>
<td>EN 61000-4-3</td>
<td>Electromagnetic field Radiated, radio frequency</td>
</tr>
<tr>
<td>Passed</td>
<td>A*</td>
<td>EN 61000-4-4</td>
<td>Fast transients Burst</td>
</tr>
<tr>
<td>Passed</td>
<td>A</td>
<td>EN 61000-4-5</td>
<td>Slow transients Surge</td>
</tr>
<tr>
<td>Passed</td>
<td>B</td>
<td>EN 61000-4-6</td>
<td>Electromagnetic field Conducted, radio frequency</td>
</tr>
</tbody>
</table>

*EN 61326 just demands Category B here, but NAMUR NE 21 recommends Category A

**Emission**

<table>
<thead>
<tr>
<th>Result</th>
<th>Level</th>
<th>Standard</th>
<th>Emission Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passed</td>
<td>Class A</td>
<td>EN 55011</td>
<td>Electromagnetic field Radiated</td>
</tr>
<tr>
<td>Passed</td>
<td>Class A</td>
<td>EN 55011</td>
<td>Electromagnetic field Conducted</td>
</tr>
</tbody>
</table>
Compatibility in accordance with NAMUR NE 21

Compared to EN 61326, the NE 21 of the international user association of automation technology for process industries NAMUR recommends passing category level A for ESD and Burst.

In general category A conformity has a lasting effect on increasing the application’s availability just in case and is an everlasting argument for the product’s quality. Conformity to a lower category will become a limiting factor on the overall performance of the whole installation. Especially for wired communications technology this leads to:

- increased number of immediate transmission retries
- retries at upper protocol level
- prolonged overall data transfer time
- dead times in control cycles
- control loops oscillating due to missing telegrams

In comparison category A conformity gives you:

- stable and less distorted signal quality
- least impact on communication signal
- no unnecessary telegram re-transmissions
- constant throughput and guaranteed deterministic timings