



Figure 1: Fiber-optic data connectors for the smart production of tomorrow – the M12 Optic can be used in a vast range of applications, thanks to a wide variety of fiber types.

Well rounded Fiber-Optic M12 Data Connectors

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Executive summary

Robust connectors for data and signal transmission are in demand anywhere with strict cabling reliability requirements. These locations include the harsh environmental conditions of factory automation as well as continual data, signal, and media streams in process automation. Fiber-optic circular connectors optimize data transmission from the field to the control level.

The M12 circular connector has made a name for itself in industrial applications – a wide variety of coding, connection, and mounting options are therefore available. As the required data volumes and transmission speeds increase with the automation level, copper-based data cabling has its limits. New M12 Optic connectors meet the requirements of complex automation processes. Based on fiber optics, the M12 Optic combines high data transmission rates with reliable protection against mechanical, electromagnetic, and environmental interference.

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In the industrial environment, three different fiber types are often used for parallel in multimode transmission. This is required for automation processes with varying data rates. For many years now, polymer-clad fiber (PCF) and pure glass optical fiber (GOF) have been used in the fiber-optic cables in harsh industrial environments alongside the commonly used polymer optical fiber (POF).

Fiber types for a diverse range of applications

The M12 Optic product family comprises different connection cables with these fiber types. The POF fiber-optic cables, with fibers measuring 980/1000 μm in diameter, offer the largest fiber diameter in the industrial environment. These plastic fiber-optic cables are intended for short transmission lines of up to 50 meters as well as for low data rates of up to 100 Mbps. In the M12 Optic product family, these fibers are installed in the commonly used Profinet type B round cable. This cable, made from polyurethane (PUR), is halogen-free, as well as ozone and UV resistant.

For data rates of up to 100 Mbps and transmission lines of up to 300 meters, the PCF-GI fibers, previously known as HCS-GI, are the ideal choice with a gradient index profile of 200/230 μm . The PCF-GI fiber is used in Profinet type C type

M12 Optic data connectors at a glance

- IP65/67-protected round connectors that accommodate two fiber-optic cables
- Designed as duplex connectors with two spring-loaded 2.5 mm ferrules
- Standardized in accordance with IEC 61754-27
- Product range comprises connectors, couplings, and transceivers
- Listed in the current Profinet guidelines as an alternative to the SC-RJ Push Pull OF Connector
- Profinet compliant for POF applications with 980/1,000 μm fibers and PCF applications with 200/230 μm fibers as of today

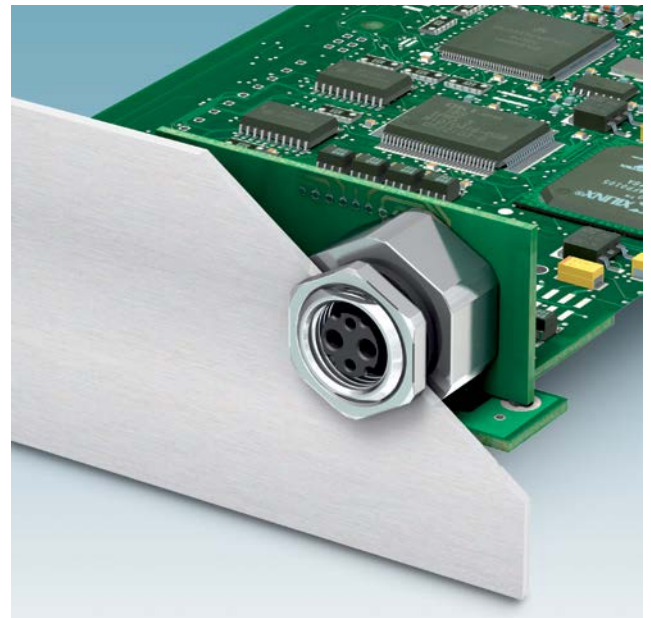


Figure 2: Installed in the electronics housing – M12 Optic transceivers for multimode applications can be used as IP-protected panel feed throughs.

cables – a highly flexible round cable, ideally suited for use in drag chains and similar applications.

For higher data rates from 1 Gbps, patch cables come into their own with GOF fiber multimode and a fiber diameter of G50/125 μm . The OM2 fiber is the ideal solution for transmission lines of up to 550 meters at a wavelength of 1,300 nanometers. The round cables can be used either for indoor or outdoor applications, allowing reliable data cabling solutions in industrial systems or infrastructure applications.

The patch cables from the M12 Optic series comprise various cable lengths from M12 to M12, from M12 to the Profinet SC-RJ standard typical for Profinet (for POF and PCF-GI), and for LC-Duplex (for GOF). The SC-RJ and LC-Duplex IP20 connector types enable direct use with existing switches, controllers, or media converters. As active components, special M12 transceivers are available for data rates of 125 Mbps. The transceivers are offered for wavelengths of 650 and 1,300 nanometers, feature an I² interface, and can also be used as Ingress-Protected (IP) panel feedthroughs. Standard connectors for patch cables are also included in the product range, which can also be utilized as IP panel feedthroughs (Figure 2).

Reliable transmission solution in challenging conditions

In contrast to conventional optical rectangular connectors, the M12 Optic offers a number of advantages: thanks to its smaller design-in outline, the M12 design is also suitable for compact devices. The screw connector, which is already in use worldwide, also enables a stable connection between the device and the field cabling under mechanical load. Thanks to its recessed ferrules, the fiber ends of the M12 Optic can also be protected against damage during handling. Another advantage of optical M12 connectors is that they fulfill the requirements of protection class IP65/67, so they can protect against the ingress of dust and water.



Figure 3: Temperature cyclic test – preassembled M12 Optic test cables demonstrate their suitability for use in industrial applications during the cold phase.

The patch cables come delivered with the connectors sealed with caps, which ensures the connector profile remains free of dirt and contamination. The spring-loaded 2.5-mm ferrules on the PCF and GOF connectors are designed with high-quality ceramic material, resulting in a low-loss optical interface.

The custom measurement log for all patch cables with three selectable fiber types serves to document the product quality – only products with good attenuation values may leave the fiber-optic production line. The high return loss of the GOF patch cables of ≥ 45 dB indicates high-quality data transmission with low reflections.

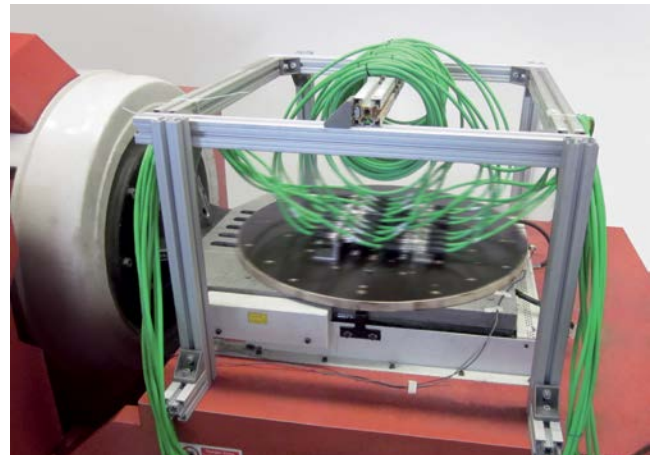


Figure 4: Vibration test – all components from the M12 Optic product range are subject to rigorous testing in harsh industrial environments.

Extensive testing regimen

As a result of the demanding conditions – temperature fluctuations, dust, moisture, vibrations, chemicals – the components used in industrial environments must be sturdier than those used in an office, residential building, or computer center. At the acceptance laboratory, all connectors and cabling solutions from the M12 Optic range are tested to ensure they can meet the transmission, climatic, mechanical, and environmental requirements in accordance with IEC 61753-1 – Category U (uncontrolled environment) (Figure 3).

An example of this is the temperature cycle test. This is regarded as a critical test for certification of fiber optic connectors, and by the same token is the most important environmental test. The test provides insight into the impact of various temperatures on the functioning of the fiber-optic connectors. With this in mind, return loss is measured before, during, and after the test.

In addition to environmental tests, the components are subjected to mechanical tests, such as vibration tests. This test is used to demonstrate that oscillations and vibrations do not limit the function of the connector. All components from the M12 Optic series have successfully passed these tests according to the IEC 61753-1 – Category U, opening the way for their use in harsh industrial environments (Figure 4).

Summary

Offering a standardized, globally established connector profile, fiber types for high data transfer rates and long transmission lines, and a high level of protection against EMC and ESD influences, Phoenix Contact's M12 Optic resolves a wide range of issues related to data transmission in complex automation processes. This allows system planners and operators to implement standardized cabling concepts from the field to the control level with a single connector profile.

This not only streamlines installation and maintenance, but also simplifies purchasing and warehousing. The integration of additional automation components into the existing cabling infrastructure is also made easier.

In the smart production of tomorrow, data rates will certainly increase, and the M12 Optic family has already laid the foundations for this.

ABOUT PHOENIX CONTACT

Phoenix Contact develops and manufactures industrial electrical and electronic technology products that power, protect, connect, and automate systems and equipment for a wide range of industries. Phoenix Contact GmbH & Co. KG, Blomberg, Germany, operates 50 international subsidiaries, including Phoenix Contact USA in Middletown, Pa.

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