

WHITEPAPER –

The preLink® System –

Modular Ethernet cabling for a wide range of applications



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A large part of communication systems is based on transmission through Ethernet protocols. They ensure the transport of data in all areas of our lives - from the data centre, infrastructure and telecommunications to automation and production.

High-performance cabling suitable for industrial use is the basis for a reliable and future-proof communication infrastructure. Industrial Ethernet systems, like PROFINET, EtherNet/IP, EtherCAT etc., also require data interfaces suitable for industrial use. This results in cabling systems with high and diverse requirements. This is due to many different areas of application.

This white paper shows a future-proof and sustainable cabling system, which:

- the high and diverse requirements of different application areas are met,
- Thanks to the two-part design, ease of use and process reliability are guaranteed and
- is future-proof and sustainable due to its design concept.



The preLink® concept

The outstanding feature of the preLink® concept is the separation of the formerly fixed connection of cable, connection technology and connector. A reusable preLink® connection block takes the place of connection techniques such as insulation displacement connectors, crimps, clamps, screw connections or the like. This is firmly connected to the cable. The block can then be connected to and disconnected from any preLink® data interface. Cable and connector receive a detachable and yet absolutely reliable connection.

HARTING Electronics GmbH

Marienwerderstraße 3, D-32339 Espelkamp, Germany
preLink@HARTING.com

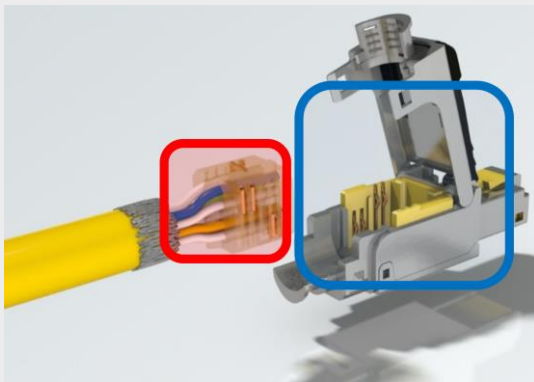
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preLink® connection block connected to the
cable using IDC technology

preLink® Data interface

Figure 1: preLink® Data interface and connected preLink® connection block

As shown in Figure 1, the two components, cable connection and data interface, are designed as separate components. This means that, regardless of the preLink® component used, the cable connection is always identical.

The connection block itself is equipped with insulation displacement connectors (IDC) and can be used for flexible and solid conductors. Depending on the wire cross-section used, different connection blocks are available (see Figure. 2). The transparent yellow block is designed for AWG 22/24 (left), the transparent block for AWG 26/27 (right) and the black block (centre) for typical 2-pair industrial Ethernet cables with AWG 22.



Figure 2: preLink® connection blocks for different core cross-section ranges

The Data interface with an always identical receptacle for the preLink® connection block can be flexibly selected from connectors, sockets, a PCB jack and a bulkhead. RJ45 (IP20 and IP65/67) as well as M12 D- and X-coded plug-in faces are available. A variety of accessories such as panel feed-throughs can also be combined.

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The Assembly of preLink® components

The connection of the data cables to the preLink® connection blocks is always identical, regardless of the connector used. After preparing the Ethernet cable used, i.e. removing the cable sheath, the braided shield and, if necessary, the foil shield, the electrical connection is always made in the same three assembly steps for all products.

Assembly step 1: The individual data wires are threaded according to the selected ANSI/TIA A or B connection scheme or industrial connection assignment. The position of the wires can be seen directly on the connection block or on a sticker with possible assignment variants. As is usual for Ethernet networks, care must be taken to use the same connection diagram for all configurations. Factory or customer standards as well as user groups often determine the connection scheme to be used. For PROFINET, for example, the 4-wire industrial connection is predominantly used and EtherNet/IP specifies the 8-wire connection according to ANSI/TIA B.

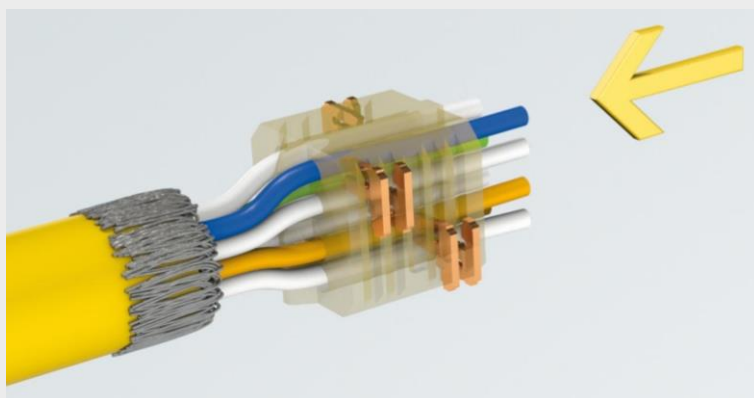


Figure 3: Assembly step 1 – Thread single wires into the preLink® connection block

It is advantageous for faster insertion of the wires to trim the wire-pairs according to the chosen connection scheme and always insert the four cores in a row at the same time. A slightly diagonal cut is helpful for this. Shortening a row of four cores by a few millimetres also makes threading easier. After threading the longer cores, the four shortened ones follow.

The preLink® connection block is then pushed as close as possible to the cable end (see figure 3). Once the terminal block is correctly positioned, twisting the ends of the wires coming out of the preLink® block helps to fix the position of the terminal block. Twisting of the wire also simplifies the following step.

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Assembly step 2: The cable with the assembled connection block is inserted into the preLink® assembly tool. To avoid errors, this is only possible in the correct position. By closing the preLink® assembly tool, the insulation displacement connectors in the preLink® connection block are pressed in and the conductors are contacted. In the same step, the protruding wires are shortened to fit exactly. After complete assembly, the tool opens automatically and the assembled terminal block can be removed.



Figure 4: Assembly step 2 – Process-safe assembly with the preLink® assembly tool

In this way, the complete and always process-safe assembly of the data cable to the connection block takes place in one work step.

Assembly step 3: In the third step, the pre-assembled preLink® cable is inserted into the selected data interface. Depending on the design, the cables are additionally fixed with cable glands or cable ties.

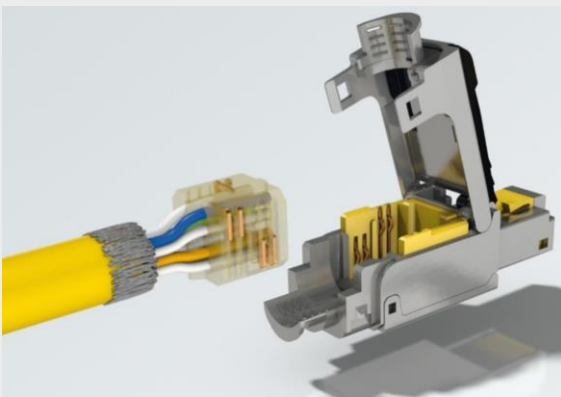


Figure 5: Assembly step 3 – Inserting the assembled preLink® cable into the selected connector

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Advantages of the assembly process

This patented assembly process is unique on the market. Consistent and process-reliable assembly is always guaranteed. This also ensures that the high-frequency properties are not influenced by tolerances in the assembly process. Due to the always identical assembly steps of the preLink® product range, less training is required for the user. The quality of the assemblies is permanently guaranteed. In this way, the user can assemble Cat. 6_A / Class E_A cabling easily, error-free and safely, even without intensive training.

The preLink® Product range

As shown in Table 1, the preLink® product range includes all typical interfaces from IP20 RJ45, through IP65/67 protected RJ45 variants up to M12 D- and X-coded types. Both the connectors and the corresponding sockets are available. The product range is **fully compliant with international standards and compatible with PROFINET, EtherCAT, EtherNet/IP, CCLink-IE, VARAN, SERCOS und other Industrial Ethernet systems.**

Table 1 lists the available product categories and their preferred areas of application. It provides the user with a good basis for selecting the most suitable interface for the application.

The preLink® system is supplemented by patch panels, DIN-rail outlets and various junction boxes with IP20, IP44 and IP65/67 protection. Of course, ready-made preLink® system cables with different Ethernet cables and lengths are also available. Customer-specific cable assemblies are also possible.



Figure 6: preLink® Patch field and different industrial outlets

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Connector types	Typical application fields
	<p>preLink® RJ45 IP20 connectors and sockets Cabling in buildings, in the control cabinet and everywhere where high requirements for the protection class are not necessary.</p>
	<p>preLink® RJ45 IP65/67 Han® PushPull V14 connectors and sockets Wiring of industrial control cabinets and field devices in IP65/67 environments, which can be connected and changed quickly and easily using the PushPull lock, such as sensors, IO distributors and actuators or similar. Typical field of application: robot cabling</p>
	<p>preLink® RJ45 IP65/67 Han® 3 A connectors and sockets Cabling of industrial control cabinets and machines in IP65/67 environments. Typical field of application: mechanical and plant engineering</p>
	<p>preLink® IP65/67 M12 D-coded connectors and sockets Wiring of field devices in IP65/67 environments, such as sensors, IO distributors and actuators or similar. Reliable Fast-Ethernet interface.</p>
	<p>preLink® IP65/67 M12 X-coded connectors and sockets Wiring of field devices in IP65/67 environments, such as sensors, IO distributors and actuators or similar. Reliable Gigabit-Ethernet interface.</p>
	<p>preLink® Extender Possibility to connect two preassembled preLink® cables. Important for: (1) extending existing links, (2) making repairs, (3) changing from rigid installation cables to flexible cable types.</p>
	<p>preLink® PCB jack For cost-effective integration of preLink® connection technology directly onto the PCB. Clever cable-to-board solution for Ethernet applications. Particularly suitable for small installation spaces.</p>

Table 1: Overview of preLink® designs and typical fields of application

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Advantages

The unique preLink® concept offers the user a whole range of advantages that no other cabling system on the market can offer in this way and with such completeness.

Uniform connection technology and assembly

No matter which data interface is required, whether socket, connector or PCB connection, the connection technique is always identical and very easy to carry out. This reduces the training effort for the user and at the same time increases the process reliability during processing. For many customers, this is a main argument for using the preLink® cabling system, because statistically, cabling errors are the main cause of network problems. With the preLink® cabling system, not only are assembly times saved, but assembly errors are also avoided. This results in potential savings during commissioning, troubleshooting, maintenance and minimisation of downtimes.

Flexibility - investment security and sustainability

At the same time, flexibility in practical application increases. Almost all applications can be equipped with just a few preLink® components. Connectors can also be easily exchanged during the service life. This may be necessary to adapt the network to new devices with other interfaces, to make extensions or to carry out necessary repairs to e.g. damaged cables or connectors worn out by many plugging cycles. A change can be carried out in just a few seconds. This avoids unnecessary consumption of resources, reduces costs and promotes the important idea of sustainability in a very practical way.

Continuous Cat. 6A performance

The essential characteristic of data cabling is the transmission properties. All preLink® components (except the 4-pole D-coded M12 products) are designed for Cat. 6A. This means that class E_A cabling routes can be set up for a data transmission rate of 10 Gbit/s. The preLink® cabling system secures transmission for the future.

Robustness for industrial use

Use in industrial environments poses particularly tough challenges for the data infrastructure. Dust, liquids, vibrations and interference radiation are just some of the influences, but they make it clear why the preLink® system is also designed for use in harsh industrial environments. The components are made of die-cast zinc and all contact surfaces have a high-quality gold coating. Continuous 360° shielding prevents EMC interference. Special attention was paid to high shock and vibration resistance. All products, including the RJ45 variants, are designed for the tough requirements of the railway

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industry. Years of experience in the use of these components show that contact interruptions are effectively avoided even in moving industrial applications such as robotics.

Standard-compliant and compatible

The complete product portfolio and the mating faces used are fully compliant and compatible with the standards used on the market, such as PROFINET, EtherCAT, CCLink-IE, VARAN, SERCOS and other Industrial Ethernet systems.

Application examples

Machinery and plant engineering

Whether in series machine construction or in special machine and plant construction, the preLink® system fits everywhere. If large quantities of identical machines are to be wired, pre-assembled preLink® system cables are ideal. If the interfaces change during the course of the project, flexibility is required and with the preLink® components the interface can be changed quickly and easily, e.g. from RJ45 to M12, without having to cut off the connector and reassemble it. Simply open the preLink® data interface, remove the respective preLink® connector block and disconnect the cable with preLink® connector block. The cable fits any other preLink® component and can be reassembled up to 20 times. This creates the necessary flexibility for a simple project process and a long system or machine service life.

Railway and transport technology

The rolling stock and transport technology often have a long service life. The strengths of the preLink® system such as robustness and flexibility can be ideally used.

In railway technology, the M12 designs are predominantly used. Due to the long service life, the cabling is usually carried out with high-quality 4-pair Cat. 6_A or Cat. 7/7_A Ethernet cables approved for railway applications, such as the HARTING Ha-VIS EtherRail® cables. The terminal devices are equipped with different interfaces such as M12 D- or X-coded or sometimes RJ45. In practice, it is often necessary to change from Fast Ethernet to Gigabit Ethernet and thus from M12 D-coded to M12 X-coded. With the preLink® system, it is easy to adapt the interface type over the lifetime of the trains. Two features of the preLink® in particular can be used.

First Feature: If 4-pole connectors are connected to 8-core cables, EMC interference can spread over the unused cores and cause interference in the connection. A special feature of all D-coded preLink®

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connectors and sockets is that 100 Ohm terminating resistors are built in for unused wire pairs. EMC interference is effectively suppressed.

Second Feature: A preLink® termination block connected with a high-performance cable can be reconnected or upgraded in seconds in the event of an interface exchange. The change from M12 D-coded to M12 X-coded can thus be made easily, quickly and extremely economically.

The preLink® cabling system is also used for retrofit projects. The cabling is smoothly possible due to the system's two-part design. In narrow, obscure and angled areas, pre-assembled cables can be used or manufactured directly on site in a process-safe manner. In the last step, the required data interface is selected for connection to the unit.

Robot cabling

Cables on the robot are constantly exposed to changing torsional and bending stresses and must therefore be replaced regularly. The PROFINET-compliant Han® PushPull V14 connectors are the preferred choice for this purpose. This allows entire cable packages to be replaced quickly and easily. On large robots, such as those used in large numbers in vehicle production, there are up to six connection points and thus a large number of assemblies. A single faulty assembly on a robot can stop an entire assembly line. Troubleshooting is often time-consuming and the costs of the stoppage are high.

With the simple and safe preLink® components, the probability of errors decreases. Commissioning and maintenance times can be shortened. This is why the preLink® system is approved in many plants of well-known vehicle manufacturers and is made mandatory in some of them.

Building and infrastructure cabling

The preLink® system is of course also successfully used for the cabling of industrial halls, production facilities and other infrastructure. Adapted to the respective requirements, the different junction boxes with the different protection classes from IP20 to IP65/67 are used here.

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Summary

The requirements for Ethernet cabling in a wide variety of applications are diverse and difficult to fulfil with conventional cabling components across all application areas. As shown in this white paper, the use of the preLink® cabling system is advantageous in a wide range of applications. The system has been successfully used for many years in numerous applications in machine and plant construction, robot cabling, railway technology, building infrastructure and other areas.

System advantages:

- Fast, simple and 100% reliable assembly process
- Three always the same processed assembly steps
- Flexible use of various data interfaces from RJ45 (socket/plug in IP20 or IP65/67), M12 D- or X-coded (socket/plug), PCB sockets to diverse combination options with accessories such as wall bushings
- Transmission performance up to Cat. 6A & Class E_A for data rates up to 10 Gbit/s

Customer benefits:

- Reduced installation time and reduction of errors
- High flexibility and reduction of complexity
- Possibility to easily adapt interfaces and cabling to needs
- Easy reparability of cabling guarantees investment protection and sustainable cost savings
- Future-proof and investment-proof
- For trained and untrained installers
- Simple and quick upgrade from M12 D-coded to M12 X-coded

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Further sources:

Online-catalogue: <https://b2b.harting.com/ebusiness/Interface-connectors-preLinksup-sup-Ethernet-cabling-system/39589?page=0&sort=newproduct-asc>

Videos:

preLink[®] Introduction: https://www.youtube.com/watch?v=wqh6ALMa_ps

preLink[®] assembly videos:

General: <https://www.youtube.com/watch?v=F3uGvsmBVAA>

M12 connector: <https://www.youtube.com/watch?v=35DKv6bhadl>

RJ45 jack: <https://www.youtube.com/watch?v=IEL7KiivLR4>

RJ45 connector: https://www.youtube.com/watch?v=KA2j2uP_9z8 (2-pair cable)

Han[®] PushPull connector: <https://www.youtube.com/watch?v=tht92wGLJ6k> (2-pair cable)

Authors:

- Matthias Fritsche – Senior Specialist & Global Product Manager Ethernet Connectivity
- Maximilian Rohrer – Global Product Manager preLink[®] cabling system

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HARTING Electronics GmbH

Marienwerderstraße 3, D-32339 Espelkamp, Germany
preLink@HARTING.com