# HARTING



# Solutions for Industrial Ethernet



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Solutions for Industrial Ethernet Chapter		
Industrial Ethernet – General information	00	
Active and passive network components	01	
System cables	02	
Connectors	03	
Accessories	04	
List of part numbers	10	
Company addresses	20 O	0



General information

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Contents chapter 00	HARTING	
Industrial Ethernet – General information	Page	
Ethernet principles		
What is Ethernet?	00.04	General formation
Classic Ethernet	00.04	Ē
Ethernet transmission media in common use	00.04	
Fast Ethernet	00.05	
Switched Ethernet	00.05	
The Industrial Ethernet network		
General requirements for Industrial Ethernet networks	00.08	
PROFINET transmission system and wiring	00.10	
Gigabit Ethernet in structured building cabling	00.12	
Network installation in accordance with Industrial Ethernet standards	00.14	
Glossary	00.15	00 03



#### What is Ethernet?

Ethernet is a well established specification for serial data transmission, originally published by Xerox in 1975. In 1985 Ethernet was standardized in IEEE 802.3, since when it has been extended a number of times. "Classic" Ethernet operates at a data transmission rate of 10 Mbit/s.

General nformation

Since the 1990s, Ethernet has developed in the following areas:

- Transmission media
- Data transmission rates
  - Fast Ethernet at 100 Mbit/s (1995)
- Gigabit Ethernet at 1 Gbit/s (1999)
- There are plans for Ethernet running at 10 gigabits
- Networked topologies
   Switched Ethernet
- Industrial Ethernet

Nowadays Ethernet is the most widespread base technology in the world in commercial DP systems, and is also gaining importance in industrial automation. The use of Ethernet creates a homogenous and standardized communication infrastructure, extending seamlessly from the office environment to the machine.

#### **Classic Ethernet (Shared Ethernet)**

All network users have the same rights under Ethernet. Any user can exchange data of any size with another user at any time.

Because Ethernet was conceived as a logical bus system, any network device that is transmitting is heard by all other users. Each Ethernet user filters the data packets that are intended for it out from the stream, ignoring all the others. Telegrams that are intended for all devices are an exception to this rule. These are known as broadcast or multicast telegrams.

#### The CSMA/CD network access procedure

In Classic Ethernet, also frequently called shared Ethernet, all the network users share one collision domain. In Ethernet, network access is controlled by the CSMA/CD procedure (Carrier Sense Multiple Access with Collision Detection).

If a network user wishes to transmit data, it first checks whether the network is free (carrier sense). If so, it starts to transmit data. At the same time it checks whether other users have also begun to transmit (collision detection). If that is the case, a collision occurs. All the network users concerned now stop their transmission, wait for a period of time determined according to a randomising principle, and then start retransmission.

The result of this is that the time required to transmit data packets depends heavily on the network load, and cannot be determined in advance. The more collisions occur, the "slower" the entire network becomes. Shared Ethernet therefore only has limited suitability for industrial automation.

The physical size of the network is also limited. It depends on the data transmission rate being used and on the maximum permissible transmission time of data packets.

#### Approaches to improved performance

A number of approaches have been tried to improve performance:

Segmentation: -> subdividing the collision domains Higher

bandwidths: -> Fast Ethernet, Gigabit Ethernet

Switching: -> Switched Ethernet

and combinations of these.

Only with the implementation of these approaches does Ethernet become interesting and useful for industrial automation. For this reason, only Switched Ethernet and Fast Ethernet will be considered further in the following chapters.

Ethernet installations are primarily characterised by two parameters: the Category of the cable (Category) and the Class of the channel (Class).

#### Ethernet transmission media in common use

Description Meaning		Distance
10 Mbit/s system		
10 Base T [FD]	2 conductor pairs, min. Category 3, UTP and STP	>100 m
10 Base FX [FD] Fibre-optic cable		Depends on fibre type
100 Mbit/s system (Fast E	thernet)	
100 Base TX [FD]	2 conductor pairs, Category 5, UTP and STP	100 m
100 Base FX [FD]	Fibre-optic cable	Depends on fibre type
[FD] = Full-duplex operation	possible	

The cable is identified by its Category in accordance with its electrical transmission and high-frequency properties, as follows:

Category 1:	not specified
Category 2:	up to 1 MHz
Category 3:	up to 16 MHz
Category 4:	up to 20 MHz
Category 5:	up to 100 MHz
Category 6:	up to 250 MHz
Category 7:	up to 600 MHz

The channel is the point-to-point part of the transmission process, and is specified as follows:

Class A:	up to 100 kHz
Class B:	up to 1 MHz
Class C:	up to 16 MHz
Class D:	up to 100 MHz
Class E:	up to 250 MHz
Class F:	up to 600 MHz

The higher the alphabetical sequence of the letter, the tougher are the requirements on the transmission channel, and therefore also on the cable. If, for instance, only Category 5 components are used in a system, the capacity of a Class D cable is required. The same applies to Category 6 and Class E, as to Category 7 and Class F.



Next = Near end crosstalk

### **Fast Ethernet**

Fast Ethernet, according to IEEE 802.3, is not a new standard, but an extension of Classic Ethernet to include the following new properties:

- A data rate of 100 Mbit/s
- Switching
- Full duplex operation

These form the basis of industrially useful Ethernet networks. Autonegotiation provides compatibility with Classic Ethernet in accordance with IEEE 802.3.

### **Switched Ethernet**

#### Definition

Switched Ethernet refers to a network in which each Ethernet user is assigned a port in a switch.

Switches separate former collision domains into individual point-to-point connections between the network components and the relevant user equipment.

Preventing collisions makes the full network bandwidth available to each point-to-point connection. The second pair of conductors in the Ethernet cable, which otherwise is necessary for the detection of collisions, can now be used as an additional transmission medium, so providing a significant increase in data transfer rate.

The use of switches allows any desired network configuration, such as star, ring, tree or linear, to be implemented.

# Switched Ethernet offers the following important advantages:

- The possibility of scaling the collision regions to match the needs of the application, going as far as fully collision-free networks in which only one user is assigned to each port
- Very fast packet transfer between the collision regions
- A considerable increase in data transfer rate through "true" full duplex operation
- Preventing collisions allows deterministic operation

#### **Network size**

There is no theoretical limit to the physical extent of a Switched Ethernet network. The maximum length of conductor between the ends of a point-to-point connection is only determined by the physical transmission properties and is, according to the specification, 100 m. In practice, the connectors and cables used have a decisive effect on the transmission length that can actually be achieved.





# The switch – the central network component in Switched Ethernet

Switches are active infrastructure components that operate according to IEEE 801.3 on layer 2 of the OSI reference model. Switches analyse all the data packets as they arrive, directing them on to the port where the corresponding user is located. Only multicast and broadcast telegrams are an exception to this. They are passed on to all the active ports and switches.

Each switch requires an address/port assignment table in order to correctly redirect the telegrams. The assignment of a destination address to a specific port in the switch is stored in this table. The destination address of an incoming data packet is analysed with the aid of this table, and the data packet is passed on immediately to the corresponding port. The address/port assignment table is usually generated and maintained automatically by the switch in a selflearning process. One switch can learn several thousand addresses. This is necessary when more than one item of user equipment is connected to one or more ports. This allows a number of independent subnets to be connected to one switch.

In this way, each of the ports in a switch generates its own collision region. This prevents data collision with users attached through other ports. In Switched Ethernet, only one user is assigned to any port. In this way collisions are avoided altogether. Guaranteed freedom from collisions provides a significant increase in the effective data transfer rate. Additionally, full duplex operation is now possible, since one pair of conductors in the Ethernet cable, otherwise required to detect collisions, can be used as an additional data transfer medium. With Fast Ethernet operating in full duplex mode (100 Base TX), 100 Mbit/s can be transferred simultaneously in the two directions. This corresponds to doubling the data rate.

Thanks to the switching technology it is possible to construct Industrial Ethernet networks that satisfy the requirements both for reliability and for real-time performance.

#### **Different types of switches**

Switches are chiefly distinguished according to the following features:

Modes of operation:Store and forward<br/>Cut-through<br/>Modified cut-throughBlocking:Blocking<br/>Non-blockingManagement:Managed<br/>Unmanaged





#### A comparison of the operating modes

#### Store and forward (Figure 1)

In this mode of operation, the switch temporarily stores the entire data packet, checks it for errors and, if it is free of errors, passes it on to the appropriate port.

#### Cut-through / Modified cut-through (Figure 2)

In this mode of operation only enough bytes from the data packet are placed into temporary storage as are necessary for the evaluation in the address/port assignment table.

Once this has been done, all the incoming bytes from the data packet are passed on immediately to the corresponding port without any intermediate storage.

In modified cut-through, the switch waits for precisely 64 bytes before making a decision according to the address/port assignment table.

#### Blocking

A switch has a certain number of ports available to it, and these are connected through the switch matrix. If the switch matrix is capable of handling all the connections without delay at full data rate immediately, then it is called a non-blocking switch. If the number of simultaneous connections at full data rate is limited, the switch is said to be blocking.

#### Management

An unmanaged switch handles all the data traffic on the basis of the address/port assignment table. The user has no options for manipulating this.

A managed switch controls the data flow in accordance with certain parameters or rules. The basis for this activity is provided by the switch management software. Modern switches support SNMP management and web-based management. These provide a variety of options for manipulation by the user. The capabilities of the management software differ from one switch to another.

#### **Time behaviour**

In Switched Ethernet, all the uncertainties of time that result from Ethernet's collision management algorithm (CSMA/CD) are eliminated. If correctly dimensioned, Switched Ethernet thus becomes a deterministic system. For the purposes of industrial automation it is necessary to select the switches and to dimension the network in such a way that the switches operate within their deterministic range under all operating conditions.





#### **The Industrial Ethernet network**

# General requirements for Industrial Ethernet networks

The international standard ISO/IEC 11801 and its European equivalent, EN 50173, define an application-neutral standard form of information networking for a building complex. The contents of the two standards are largely identical. Both standards assume that the buildings are used in a way similar to an office, and aim to be neutral towards particular applications. The specific requirements for Ethernet networks in industrial environments, such as

- equipment-specific cabling
- individually adapted levels of networking for each machine/plant
- linear network structures
- robust, industrial cables and connectors meeting special requirements for EMC, temperature, humidity, dust and vibration

are not considered in either of these standards.

	Office areas	Production and other industrial areas
Installation conditions	<ul> <li>Fixed basic installation in the building</li> <li>Cables laid in false floor</li> <li>Devices connected at workstation vary frequently</li> <li>Prefabricated connecting cables</li> <li>Largely standard work places (desk with PC,)</li> <li>Tree network structures</li> </ul>	<ul> <li>Wiring depends heavily on the equipment</li> <li>Equipment-specific cabling</li> <li>Connection points are rarely modified</li> <li>Device connections may be assembled on site</li> <li>Each machine/plant requires individual levels of networking</li> <li>Linear or (redundant) ring network structures are common</li> </ul>
Transmission capacity	<ul> <li>Large data packets (e.g. images)</li> <li>Medium network availability</li> <li>Transmission time on the scale of seconds</li> <li>Predominantly acyclic transmission</li> <li>No isochronism</li> </ul>	<ul> <li>Small data packets (measurement data)</li> <li>Very high network availability</li> <li>Transmission time on the scale of microseconds</li> <li>High proportion of cyclic transmission</li> <li>Isochronism</li> </ul>
Environmental requirements	<ul> <li>Moderate temperatures</li> <li>Low dust levels</li> <li>No humidity</li> <li>Little shock or vibration</li> <li>Low EMI exposure</li> <li>Low mechanical hazard</li> <li>Low UV radiation</li> <li>Very little chemical hazard</li> </ul>	<ul> <li>Extreme temperatures</li> <li>High dust levels</li> <li>Humidity possible</li> <li>Vibrating machines</li> <li>High EMI exposure</li> <li>Risk of mechanical damage</li> <li>UV exposure out of doors</li> <li>Chemical hazard from oily or aggressive atmospheres</li> </ul>

Table: Differing requirements of office and industrial areas



#### Network topologies

The topologies of Industrial Ethernet networks are oriented toward the requirements of the equipment that must be connected. Star, linear, tree and ring structures are amongst the most common. In practice, a real installation often consists of a mixture of the individual structures considered below.

#### Star

A star structure is characterised by a central signal distributor (switch) with single connections to all the network's end devices. Star network structures are best applied to areas where the density of devices is high and the physical distances between them is small, such as small production cells or an individual production machine.



#### Tree

A tree topology is formed when a number of stars are combined into one network. It is used when a complex installation is divided into smaller regions.

#### Linear

A linear structure can be implemented by a switch close to the end device requiring connection, or by a switch integrated into the end device. Linear structures are most often used in installations that are physically extensive, such as conveyor systems, and for the connection of manufacturing cells.



SW = Switch TE = Terminal Equipment Linear structure

#### **Ring** (redundancy)

If the ends of a line are closed by an additional connection, a ring structure results. Ring topologies are used to protect against line breaks or the failure of one network component in installations with high requirements for availability.





#### **PROFINET transmission system and wiring**

The "PROFINET transmission system and wiring" guideline defines a method of cabling for Industrial Ethernet, suitable for industrial application, on the basis of the fundamental requirements of ISO/IEC 11801.

The PROFINET guideline sets new standards, because:

- The component manufacturer is provided with unambiguous interface specifications
- The user is provided with simple rules for the installation
- He is therefore able to implement networks without additional Ethernet-specific planning, as with a field bus.

The PROFINET guideline specifies cables and connectors with which the user can create an installation without special calculations relating to the transmission routes.

Detailed information can be found on the internet under www.profibus.com

Cables in an industrial environment may be exposed

to extreme mechanical stresses. To ensure adequate mechanical protection special industrialised cable

may be required, and this can have an effect on

the transmission properties, which may mean that only relatively short transmission routes can be implemented. Signal transmission along symmetric copper cables (twisted pair) must be in accordance with 100 BASE-TX at 100 Mbit/s (Fast Ethernet). The transmission medium contains two pairs of twisted, screened copper cables (twisted pair or star quad) with a characteristic impedance of 100 Ohms. Only screened cables and connectors are permitted. The individual components must satisfy the requirements for Category 5 in accordance with ISO/IEC 11801. The entire transmission route must satisfy the requirements for Class D in accordance with ISO/IEC 11801. Removable connections on the cable side are made using either RJ 45 or M12 male connectors. On the device connections are in the form of female mating connectors. Connecting cables (device connecting cables and routing cables) accordingly have male connectors at both ends. Each device is connected through an active network component. The transmission cable therefore has identical connectors at both ends which simplifies installation as the connecting cable fulfils the function of a patch lead. The maximum cable length is 100 m.

As long as the cable and the connectors meet with the above specifications a maximum cabling length of 100 m can be achieved with up to six connector pairs. The combination of a male and female connector is regarded as one pair.

	•	
Wiring example	Number of connector pairs	Maximum cabling length
	2	100 m
	2	100 m
	2	100 m
	4	100 m
	4	100 m
	6	100 m
	6	100 m
TE = Terminal Equipment Area PMD = PROFINET Machine Distributor "inside"	Connector	Connector

# General nformation

Cabling

General information

#### Connectors

An important criterion for industrial applications is the ease with which connection equipment can be handled on site. Connectors for M12 and for RJ 45 are available for this purpose. They can easily be assembled on site using standard tools.

In the control cabinet area, PROFINET uses RJ45 in an IP 20 implementation. It is compatible with office connectors.



Connectors outside the control cabinet must be capable of withstanding the stresses of industrial applications. RJ 45 or M12 connectors with protection to IP 65 or IP 67 are used in this environment. The RJ 45 in IP 65 / IP 67 implementation has a robust housing with push pull locking. Special versions allow a level of protection up to IP 68 to be achieved. The M12 connectors use the screened, D-coded, 4-pin version, as included by DKE for Industrial Ethernet in the IEC standard.

HARTING RJ Industrial<sup>®</sup> IP 67 Push Pull and *HARAX*<sup>®</sup> M12-L shielded



Hybrid connectors can be used where distributed field devices require connection to both the data network and to a low voltage power supply. A fully contactprotected connector allows the connectors to be identical at both ends, since the integrated contact protection means that it is not necessary to alternate between male and female contact. An RJ 45 providing IP 67 protection is used to connect twin-pair, screened data lines for communication and four electrical contacts provide connection to the power supply.





	Data +	Yellow	1	1
TD-	Transmission Data -	Orange	2	3
RD+	Receiver Data +	White	3	2
RD-	Receiver Data -	Blue	6	4

#### Switches

Switches are devices located in the transmission path between end devices, and which regenerate signals they receive before passing them on to their destinations. They are used to construct networks, and permit data communication over long distances. Switches suitable for PROFINET are designed for Fast Ethernet (100 Mbit/s, IEEE 802.3u) and for full duplex transmission. In full duplex operation, a switch simultaneously sends and receives data at the same port. Collisions do not occur. No bandwidth is therefore lost through the Ethernet collision process. Network planning is made significantly more straightforward, because it is not necessary to examine route lengths within a collision domain. Industrialised switches are used for applications in the industrial environments. Switches designed for the office environment can only be used under certain conditions. One reason for this is that they are not suitable for harsh industrial surroundings. Secondly, large numbers of ports can become expensive.

#### **Industrial Outlets**

The interface between the structured building network in accordance with ISO/IEC 11801 and the PROFINET plant cabling is provided by the Industrial Outlet, or InO. Its function corresponds to the socket outlet used in the office environment. The InO is manufactured to meet protection levels IP 65 / IP 67 and is suitable for the harsh conditions found in the industrial environment.

Source: PROFINET Technologie und Anwendung (PROFINET Technology and Application), November 2002 PROFINET transmission system and wiring, November 2002



# Gigabit Ethernet in structured building cabling

The Ethernet cable used in structured building cabling is also finding a wide range of applications in industrial environments. Even today, entire production cells and machinery are connected with Fast Ethernet to the existing building cabling.

The change from field bus networks to 100 Mbit Fast Ethernet networks itself provides the user with several times the bandwidth. In comparison with Fast Ethernet, Gigabit Ethernet multiplies the bandwidth a further 10 times.

The currently applicable standards for structured building cabling are:

- ISO/IEC 11801:2002 (international standard)
- EN 50173-1:2002 (European standard)
- DIN EN 50173-1:2002 (German standard)
- TIA/EIA 568:2002 (North American standard)

Gigabit Ethernet exploits structured cabling differently from 10/100 Mbit/s Ethernet.

The most important difference is this: Gigabit Ethernet uses all four pairs of conductors in full duplex mode, i.e. for communication in both directions simultaneously, in order to keep the bandwidth per conductor, required for transmission as low as possible. Methods by which Gigabit Ethernet can be transmitted over two pairs are being worked on at this time.

#### Access procedure

In addition to the larger bandwidth, one of the advantages of Gigabit Ethernet is that the structure of the data packets and the access procedure are identical to those of Fast Ethernet and Ethernet, with the consequence that hardly any changes are needed to the network operating systems or to the application and management software.

Gigabit Ethernet, like the existing IEEE 802.3 (10 Mbit/s) and IEEE 802.3u (100 Mbit/s) Ethernet standards, uses the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) collision protocol.

#### **Topologies**

Because the network operating systems necessary for Gigabit Ethernet are identical, the network topologies described in ISO IEC 11801 have been adopted. It is therefore not necessary to change the installations from 100 Mbit Fast Ethernet to 1000 Mbit Gigabit Ethernet. The physical components, e.g. is the cables and connectors, must, however, be appropriate for the higher bandwidth. For this reason, almost all buildings nowadays are fitted with Gigabit Ethernet cabling, even though most of the devices that are connected to this cabling are only equipped with a 100 Mbit Fast Ethernet protocol chip. However, because the demand for bandwidth can be expected to increase in future, this type of cabling offers the most secure path for future upgrades.

#### **Copper wire**

The Gigabit Ethernet cables for the tertiary level (horizontal wiring) of cabling structured in accordance with EN 50173-1:2002 are individually shielded twisted pairs in which the strand bunches have a diameter of AWG 22 - AWG 24. The pair as a whole may also be shielded, depending on the needs of the application. The use of twisted pairs with an additional shield for each conductor provides even better and cleaner differential signal transmission than ordinary twisted pair cables (where the individual conductors are not shielded), and should eliminate common mode interference.

The cables are classified as follows:

- SF/UTP Shielded Foiled / Unshielded Twisted Pair cable (see Figure 1)
- S/FTP Shielded / Foiled Twisted Pair cable (see Figure 2)



Figure 1: SF/UTP cable

Figure 2: S/FTP cable

These service-neutral cables are capable of transmitting the following protocols:

- Ethernet 10 BaseT
- Fast Ethernet 100 BaseT
- Gigabit Ethernet 1000 BaseT
- ATM 155 Mbit/s
- TP-PMD 125 Mbit/s
- Cable sharing (using the same or different services)
- CDDI/TPDDI (FDDI over copper)
- Token Ring at 4/16 Mbit/s
- Analogue telephone services, ISDN

The service to be carried depends on the pin assignment (see summary).





The four free contacts in 100 Mbit Fast Ethernet wiring are often used to supply power to the end device.

The cables and connectors used must satisfy the requirements of ISO/ IEC 11801:2002.

- 2 classes of wiring are distinguished:
- Fast Ethernet at 100 Mbit/s
- Gigabit Ethernet at 1000 Mbit/s



For a transmission route with Fast Ethernet this means:

 Class D cables (100 MHz) are used together with a Category 5 (100 MHz) connector.

A transmission route with Gigabit Ethernet uses:

 Class E cables (250 MHz) together with a Category 6 (250 MHz) connector.

#### Connectors

The RJ 45 connectors used with Gigabit Ethernet must have 8 contacts for the 4 pair cable. These contacts must meet the high requirements of a Category 6 component. This is only possible with a perfect interplay between the individual components of the connector (contacts and insulator), and a perfect connection of the Class E cables. The pin assignment has been designated for contact pairs 1-2, 3-6 and 4-5, 7-8, because of the round geometry of the cable and the relative positions of the cores associated with this.

A tool is required to connect the cable by forcing the piercing contacts through the outer jacket of the conductor so as to make the electrical contact. This tool must be matched specifically to the connector, as a reliable contact cannot otherwise be guaranteed. In order to meet the high requirements of the transmission route it is also necessary to locate the shield of each individual conductor in the twisted pairs as closely as possible to the connector's insulator. This minimises crosstalk between the data signals within the connector.



General information



#### Glossary

#### 10 Base T

The standard for data transmission of 10 Mbit/s Ethernet through unscreened twisted pair cables (Category 3, 4 or 5). Each connection is made using two pairs of wires, one pair being used for data transmission and the other for data reception.

#### 10 Base FX

The standard for data transmission of 10 Mbit/s Ethernet through optical fibres. Each connection is made using two fibres, one fibre being used for data transmission and the other for data reception.

#### 100 Base TX

The standard for data transmission of 100 Mbit/s Ethernet through twisted pair cables (Category 5). Each connection is made using two pairs of wires, one pair being used for data transmission and the other for data reception.

#### 100 Base FX

The standard for data transmission of 100 Mbit/s Ethernet through optical fibres. Each connection is made using two fibres, one fibre being used for data transmission and the other for data reception.

#### **Auto-negotiation**

A procedure defined in Fast Ethernet in which the devices agree upon a transmission mode with one another before the actual data transmission begins (100 Mbit/s or 10 Mbit/s, full or half duplex).

#### Auto-crossing (1:1 cable; cross-over cable)

This function makes it possible to cross the send and receive lines of twisted pair interfaces automatically. Devices such as switches that support this function can be joined through a cable that is wired 1:1 instead of a cross-over cable.

#### AWG (American Wire Gauge)

The AWG value describes a cable in terms of the wire thickness and the permissible attenuation.

Depending on the structure of the cable:

AWG 22 corresponds	to a conductor
	wire gauge of 0.33 - 0.38 mm <sup>2</sup>
AWG 24 corresponds	to a conductor
	wire gauge of 0.21 - 0.25 mm <sup>2</sup>
AWG 26 corresponds	to a conductor
	wire gauge of 0.13 - 0.15 mm <sup>2</sup>

#### **Broadcast telegram**

A broadcast telegram is defined as a call to all network devices ("one to all").

#### **CSMA/CD** procedure

Carrier Sense Multiple Access/Collision Detection

Access procedure in Ethernet according to IEEE 802.3. Before sending a message, each network user first checks whether the transmission medium is free (Carrier Sense). It then begins to transmit, checking at the same time whether other devices (Multiple Access) have also begun to transmit data. If two or more devices transmit at the same time, a collision takes place. The devices stop transmitting their data (Collision Detection). After a randomly chosen time the next attempt is made when the line is free. In the CSMA/CD procedure the physical size of the network is limited by the maximum permissible transmission time of the data signals across the network, and this depends on the data rate.

#### Ethernet

The name of a data network that has been standardised in IEEE 802.3 since 1985. The term "Ethernet" is often used as a general term, without distinguishing between the different versions (Ethernet, Fast Ethernet etc.).

#### **Fast Ethernet**

A fast data network specified in IEEE 802.3 in 1995. Important parameters: transmission speed 100 Mbit/s, variable packet length 64 - 1522 bytes (with optional 4 byte tag field).

#### FEXT (Far End Cross Talk)

A form of crosstalk in which the signals from devices located at the opposite ends of a twisted pair cable are superimposed on one another.

#### **Full Duplex**

A mode of operation in which one device can simultaneously send and receive data.

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#### **Gigabit Ethernet**

A fast data network specified in IEEE 802.3 in 1999. Important parameters: transmission speed 1000 Mbit/s, variable packet length 64 – 1518 bytes.

#### Half Duplex

A mode of operation in which a device either sends or receives data at any one time. Collision detection is active in Ethernet for half duplex operation. The physical size of the network is limited by the transmission time delays in the devices and the transmission media.

#### Hub

The central point in a star arrangement.

A hub – often also called a star coupler – can be used to connect a number of devices in a star arrangement. In this arrangement, data packets must take turns to pass through the hub one after another. Data packets received at one port are immediately transmitted again on all the other ports.

#### **Industrial Ethernet**

A name for the form of Ethernet used in automation engineering. Because of the conditions encountered in industrial applications, the network components must e.g. withstand greater ranges of temperature and in general satisfy tougher requirements in terms of availability and reliability of the network.

#### **Collision Domain**

The CSMA/CD access procedure restricts the transmission time of a data packet from one network device to another. In accordance with the data rate, this yields a spatially limited network referred to as a collision domain. The maximum size of a collision domain is 4250 m at 10 Mbit/s (Ethernet) and 412 m at 100 Mbit/s (Fast Ethernet). If a connection operates in full duplex mode, the physical size can exceed these limits, because collisions do not then occur. This requires bridges or switches to be used.

#### LAN (Local Area Network)

A name for local networks extending up to 10 km.

#### **Multicast Telegram**

A multicast telegram is sent to a group of defined receivers. This group can be reached through one address (cf. Broadcast Telegram).

#### **NEXT** (Near End Cross Talk)

A form of crosstalk in which the signals from devices located at the same end of a twisted pair cable are superimposed on one another.

#### **POF** (Polymere Optical Fibre)

A name for an optical fibre whose core and sheath are formed of plastic. POF fibres have a typical core diameter of 0.98 mm.

#### PROFINET

A network concept that defines the communication from the field level to the control level utilising Profibus and Ethernet, along with a model for the network engineering of the entire plant. See also: www.profibus.com

#### **Queue / Queuing**

Queue is a general term for a series of elements or tasks awaiting sequential processing. In a data transmission system, a queue is a number of messages or data packets that are waiting for further processing or to be transmitted elsewhere. They are temporarily sorted, and are processed one after another under the control of appropriate queueing procedures.

#### Segmentation / Network Segmentation

Network segmentation is used to set limits to collision domains, allowing Ethernet networks to achieve higher performance. A network can be segmented with the aid, for instance, of switches.

#### Switched Network

A name for an Ethernet network constructed using switches.



Active and passive network components	Page	
Ethernet Switches		etwork nponents
		COL
General Information ESC 67-10 TP050         ESC 67-10 TP05U HARTING RJ Industrial <sup>®</sup> IP 67 Data 3A         ESC 67-10 TP05U HARTING RJ Industrial <sup>®</sup> Push Pull         ESC 67 10 TP05U HARTING RJ Industrial <sup>®</sup> Push Pull	01.02 01.04 01.06 01.08	
ESC 67-10 TP05U Han-Max RJ 45	01.12 01.14	
General information ESC 67-30 TP05U	01.16	
ESC 67-30 TP05U HARTING RJ Industrial <sup>®</sup> IP 67 Data 3A ESC 67-30 TP05U M12 D-Coding	01.18 01.20	
10 Port Switches unmanaged		
General information ESC 67-10 TP10U ESC 67-10 TP10U HARTING RJ Industrial <sup>®</sup> IP 67 Data 3A	01.22 01.24	
Ethernet Hubs		
General information EHB 67-10 TP05	01.26	
EHB 67-10 TP05 HARTING RJ Industrial® IP 67 Data 3A	01.28	
EHB 67-10 TP05 M12 D-Coding	01.30	
Industrial Outlets		
Conoral information	01 22	
Metal Industrial Outlets	01.33	
Push Pull Outlet	01.40	01 01

### ESC 67-10 TP05U

Network components

Fast Ethernet Switch for industrial applications

### General description

Switches divide former collision domains into point-to-point connections between the network components and the user equipment involved. Constructing the network this way prevents collisions.

The ESC 67-10 TP05U Fast Ethernet Switch allows up five items of user equipment to be connected through shielded twisted pair cable in accordance with IEC 802.3. The protection level, temperature range and mechanical stability satisfy the toughest demands. The Fast Ethernet Switch can therefore be directly used in industrial environments.

It allows the amount of cabling needed to construct industrial networks to be reduced. The ESC 67-10 TP05U facilitates any kind of network configuration. All connections are plugged, which means that assembly and disassembly is fast and reliable. All Ethernet interfaces are protected against over-voltage.

### **Advantages**

- High IP 65 / IP 67 protection level
- Robust metal housing
- Can be used directly in industrial environments
- EMI, temperature range and mechanical stability for the toughest demands
- PROFINET compatible





### **Application fields**



- Industrial automation
- Automotive industry
- Wind power
- Power distribution systems
- Railway applications



Function	Ethernet Switch in accordance with IEEE 802.3, store and forward switching mode non-blocking, 5 ports unmanaged, auto-crossing, auto-negotiation, Ethernet (10 Mbit/s) and Fast Ethernet (100 Mbit/s) diagnostic LEDs (link status, data, power)		
Mechanica	al data		
	Housing type	Robust metal housing of zinc die-cast	ork ients
	Dimensions	45 x 120 x 87 (W x D x H in mm, without connectors)	<u>Vetwo</u>
	Mounting	35 mm standard rail according to DIN EN 60715, panel mounting, both upright and flat assembly	<u>- 9</u>
	Weight	approx. 0.8 kg	
	Protection level	IP 65 / IP 67	
Environme	ental conditions Operating temperature range Relative humidity for operation	-40 °C +70 °C 30% to 95%, non-condensing	
Mechanica	al stability		
	Shock / vibration	IEC 68-2-27-Ea / IEC 68-2-6-Fc	
ЕМІ	Interference immunity Interference emission	EN 61000-4-2 EN 61000-4-6, EN 61000-4-8 EN 50011, Class A	
Railway st	andards	DIN EN 50 155 DIN EN 50 121-3-2	

### **Ethernet Switch**



Network components ESC 67-10 TP05U HARTING RJ Industrial<sup>®</sup> IP 67 Data 3A Ethernet Switch for industrial applications





Technical characteristics		
Power supply		
Input voltage	24 V DC (18 30 V DC)	
Current consumption	100 mA (at 24 V DC)	
Connections	compatible with Han <sup>®</sup> 4A connector, redundant power supply (incl. fixing screw 09 20 000 9918, to maintain IP 67)	

Ports	5
Data transmission rate	10 or 100 MBit/s / auto-negotiation
Cable	Shielded-Twisted Pair (STP) or Unshielded-Twisted-Pair (UTP), Category 5
Available device	HARTING RJ Industrial <sup>®</sup> Data 3A connectors, auto-crossing function
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173
	Stock items in bold type

01 04

# Accessories



Identification	Part Power termination	No. Ethernet termination	
Straight hood metal, straight, metric	<b>19 20 003 1440</b> 1)		
Protection covers Han® 3A	09 20 003 5422	09 20 003 5425	
Han® 4A female insert	09 20 004 2711		rk
Cable gland metal IP 65, metric M20, cable diameter: 5 - 9 mm	19 00 000 5080		Netwo
Connector set HARTING RJ Industrial® IP 67 Data 3A in metal		09 45 115 1100 <sup>2)</sup>	
Coding pin set		09 45 820 0000	
Identification	Part No.		
System Cables for Industrial Ethernet, pre-assembled at both ends3)Length:1.5 mIP 67/65 (when mated)3.0 mIP 67/65 (when mated)5.0 m20.0 m50.0 m100.0 m	09 45 715 1123 09 45 715 1125 09 45 715 1127 09 45 715 1151 09 45 715 1153 09 45 715 1156 09 45 715 1156	Cable type:Industrial Ethernet Standard Cable, 2 x 2 x AWG 22/1, star quad, double shieldingConnectors:2 x HARTING RJ Industrial® IP 67 Data 3A in metal with IDC fast termination technology	
Identification	Part No.	Drawing Dimensions in mm	
Set for assembly on standard rail acc. to DIN EN 60 715	20 80 000 0003		
Set for panel mounting upright assembly	20 80 010 0001		
Set for panel mounting flat assembly	20 80 024 0002		0 <u>1</u> 05

Order insert fixing screw 09 20 000 9918 separately
 Further connector sets see chapter 03
 Further system cables see chapter 02

## **Ethernet Switch**

#### PROFU® NETO®

ESC 67-10 TP05U HARTING RJ Industrial<sup>®</sup> Push Pull Ethernet Switch for industrial applications



Identification	Part No.	Drawing	Dimensions in mm
ESC 67-10 TP05U Fast Ethernet Switch HARTING RJ Industrial® Push Pull	20 70 305 3931		

<b>Technical cha</b>	aracteristics
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#### **Power supply**

Input voltage	24 V DC (18 30 V DC)
Current consumption	100 mA (at 24 V DC)
Connections	compatible with Push Pull Power connector, redundant power supply

#### **Ethernet Interface**

Ports	5
Data transmission rate	10 or 100 MBit/s / auto-negotiation
Cable	Shielded-Twisted Pair (STP) or Unshielded-Twisted-Pair (UTP), Category 5
Available device	HARTING RJ Industrial <sup>®</sup> Push Pull connectors auto-crossing function
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173

01 06

## Accessories



Identification		Part Power termination	No. Ethernet termination		
Push Pull Power		09 46 145 4400			
Connector set HARTING RJ Industrial®			09 45 145 1100 <sup>1)</sup>		
					ork nents
					Netw
		DestNe			
System Cables for Industrial Ethernet,		Part No.			
pre-assembled at both ends <sup>2)</sup> IP 67/65 (when mated)					
Standard System Cable Length:	: 1.5 m	09 45 745 1123	Cable type: Indust	rial Ethernet Standard	
tor Industrial Ethernet	3.0 m	09 45 745 1125 09 45 745 1127	Cable, 2 x 2 > double	AWG 22/1, star quad,	
	10.0 m	09 45 745 1151			
	20.0 m 50.0 m	09 45 745 1153 09 45 745 1156	IP 67 with IE	Push Pull OC fast termination and	
1	100.0 m	09 45 745 1161	lockinę	g technology	
Identification		Part No.	Drawing	Dimensions in mm	
Set for assembly on standard rail acc. to DIN EN 60 715		20 80 000 0003			
Set for panel mounting					
upright assembly		20 80 010 0001			
Set for panel mounting flat assembly		20 80 024 0002			0 <u>1</u> 07

 $^{1)}$  Further connectors see chapter 03  $^{2)}$  Further system cables see chapter 02

Stock items in bold type

# **Ethernet Switch**



Network components ESC 67-10 TP05U M12 D-Coding Ethernet Switch for industrial applications



Identification	Part No.	Drawing	Dimensions in mm
ESC 67-10 TP05U Fast Ethernet Switch M12 D-Coding	20 70 305 3941		
Technical characteristics			

#### **Power supply**

Input voltage	24 V DC (18 30 V DC)
Current consumption	100 mA (at 24 V DC)
Connections	compatible with <i>HARAX®</i> M12-L connector, redundant power supply

#### **Ethernet Interface**

01 08

Ports	5
Data transmission rate	10 or 100 MBit/s / auto-negotiation
Cable	Shielded-Twisted Pair (STP) or Unshielded-Twisted-Pair (UTP), Category 5
Available device	M12 circular connector, D-Coding auto-crossing function
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173
Accessories see pages 01.09 and 01.	10 Stock items in bold type

# Accessories



Identification	Part No.				
HARAX <sup>®</sup> M12-L circular connector A-Coding		21 03 212 2305 <sup>1)</sup>			
HARAX <sup>®</sup> M12-L circular connector shielded, 4 male contacts, D-Coding			<b>21 03 281 1405</b> <sup>1)</sup>		twork
Protection covers M12		21 01 000 0003	21 01 000 0003		Comi
Identification		Part No.			
System Cables for Industrial Ethernet, pre-assembled at both ends <sup>2</sup> ) IP 67/65 (when mated) metal 2 x circular connector	Length: 1 m	21 03 483 1401	Cable: AWG 2	26 / 0.14 mm²	
M12 D-Coding, straight 2 x circular connector M12 D-Coding, angled	3 m 5 m 1 m 3 m 5 m	21 03 483 1403 21 03 483 1405 21 03 483 1400 <sup>3)</sup> 21 03 483 3401 21 03 483 3403 21 03 483 3405 21 03 483 3400 <sup>3)</sup>	Male Ler	ngth	
2 x circular connector I M12 D-Coding, straight	Length: 1 m 3 m 5 m	21 03 485 1401 21 03 485 1403 21 03 485 1405 21 03 485 1400 <sup>3)</sup>	Cable: AWG 2	22 / 0.34 mm <sup>2</sup>	
2 x circular connector M12 D-Coding, angled	1 m 3 m 5 m	21 03 485 3401 21 03 485 3403 21 03 485 3405 21 03 485 3400 <sup>3)</sup>	Ler in acco with PROFINET	ngth ordance installation guide	

# Accessories



	Identification	Part No.	Drawing Dimensions in mm
Network components	Set for assembly on standard rail acc. to DIN EN 60715	20 80 000 0003	
	Set for panel mounting upright assembly	20 80 010 0001	
	Set for panel mounting flat assembly	20 80 024 0002	





### **Ethernet Switch**



ESC 67-10 TP05U Han-Max RJ 45 Ethernet Switch for industrial applications



Input voltage	24 V DC (18 30 V DC)
Current consumption	100 mA (at 24 V DC)
Connections	compatible with 7/8" connector, redundant power supply

#### **Ethernet Interface**

01 12

Ports	5
Data transmission rate	10 or 100 MBit/s / auto-negotiation
Cable	Shielded-Twisted Pair (STP) or Unshielded-Twisted-Pair (UTP), Category 5
Available device	Han-Max RJ 45 connectors, auto-crossing function
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173
	Stock items in bold type

### Accessories





## **Ethernet Switch**

HARTING



ESC 67-10 TP05U Han-Brid® Quintax 3A Ethernet Switch for industrial applications

Identification	Part No.	Drawing	Dimensions in mm
ESC 67-10 TP05U Fast Ethernet Switch Han-Brid® Quintax 3A	20 70 305 3961		
Technical characteristics			

### **Technical characteristics**

Power	supply	

Input voltage	24 V DC (18 30 V DC)
Current consumption	100 mA (at 24 V DC)
Connections	compatible with Han <sup>®</sup> 8D connector, redundant power supply (incl. fixing screw 09 20 000 9918, to maintain IP 67)

#### **Ethernet Interface**

01 14

Ports	5
Data transmission rate	10 or 100 MBit/s / auto-negotiation
Cable	Shielded-Twisted Pair (STP) or Unshielded-Twisted-Pair (UTP), Category 5
Available device	Han-Brid <sup>®</sup> Quintax 3A connectors, auto-crossing function
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173

Stock items in bold type

# Accessories



Identification		Par Power termination	t No. Ethernet termination		
Straight hood metal, straight, metric		<b>19 20 003 1440</b> <sup>1)</sup>			
Protection covers Han® 3A		09 20 003 5422	09 20 003 5425		
Han® 8D female insert		09 36 008 3101			rk ents
Cable gland metal IP 65, metric M20, cable diameter: 5 - 9 mm		19 00 000 5080	19 00 000 5080		Netwo compon
Quintax male insert			09 15 003 3001		
Quintax-Z male insert			09 15 004 3013		
Identification	Wire gauge (mm²)	Par Male contacts	t No. Female contacts		
Crimp contacts					
silver plated	0.14-0.37 0.5 0.75 1.0 1.5 2.5	09 15 000 6104 09 15 000 6103 09 15 000 6105 09 15 000 6102 09 15 000 6101 09 15 000 6106	09 15 000 6204 09 15 000 6203 09 15 000 6205 09 15 000 6202 09 15 000 6201 09 15 000 6206		
Identification		Part No.	Drawing	Dimensions in mm	
Set for assembly on standard rail acc. to DIN EN 60 715		20 80 000 0003			
Set for panel mounting upright assembly		20 80 010 0001			
Set for panel mounting flat assembly		20 80 024 0002			01 15

<sup>1)</sup> Order insert fixing screw 09 20 000 9918 separately

Stock items in bold type

ESC 67-30 TP05U Fast Ethernet Switch for industrial applications

### General description

Switches divide what once were collision domains into point-to-point connections between the network components and the user equipment involved. Constructing the network this way prevents collisions.

The In-between Ethernet Switch ESC 67-30 TP05U is an integrated solution, combining an Ethernet Switch with a through panel connection in one device. The compact housing is mounted directly on the external wall of a control cabinet or a terminal box. Up to 3 ports in IP 20, with which Ethernet devices can be networked, are available for connection inside. For networking outside the control cabinet, the Ethernet Switch ESC 67-30 TP05U offers two Ethernet ports with protection class IP 65 / 67.

The Ethernet Switch ESC 67-30 TP05U supports both linear and star topologies as well as mixed forms which, beginning from a control cabinet, connect the further Ethernet users directly in or at the machine/plant. The LEDs integrated into the Ethernet switch support network diagnostics even with the control cabinet closed. An alarm contact additionally allows a fault signal to be sent directly to the higher level controller or to the control room.

### **Advantages**

- High IP 65 / IP 67 protection level
- Robust metal housing
- Can be used directly in industrial environments
- Active panel feed through
- EMI, temperature range and mechanical stability for the toughest demands
- PROFINET compatible



Application fields



- Industrial automation
- Automotive industry
- Wind power
- Power distribution systems



Function	<ul> <li>Ethernet Switch in accordance with IEEE 802.3, store and forward switching mode non-blocking, 5 ports unmanaged, auto-crossing, auto-negotiation, Ethernet (10 Mbit/s) and Fast Ethernet (100 Mbit/s) diagnostic LEDs (link status, data, power, error)</li> <li>Up to 4 priority levels</li> <li>Alarm signal contact, maskable via DIP connectors</li> </ul>			
			ts	
Mechanica	Il data		Network	
	Housing type	Robust metal housing of aluminium die-cast	0	
	Dimensions	105 x 40 x 105 (W x D x H in mm, without connectors)		
	Mounting	directly on control cabinets and terminal boxes		
	Protection level	IP 65 / IP 67 for the connector on the outside of the control cabinet <sup>1</sup> )		
		IP 20 Inside the control cabinet		
Environme	ental conditions			
	Operating temperature range	-40 °C +70 °C		
	Relative humidity for operation	30% to 95%, non-condensing		
Mechanica	Il stability			
	Shock / vibration	IEC 68-2-27-Ea / IEC 68-2-6-Fc		
EMI	Interference immunity	EN 61000-4-2 EN 61000-4-6, EN 61000-4-8		
	Interference emission	EN 50011, Class A		

<sup>1)</sup> The protection level between the device and the control cabinet/terminal box depends on the wall thickness and the nature of the surface on which it is mounted. Use of the mounting plates, available as accessories, is recommended to improve the seal quality.

### **Ethernet Switch**



ESC 67-30 TP05U HARTING RJ Industrial® IP 67 Data 3A Ethernet Switch for industrial applications





# Technical characteristics

24 V DC (18 30 V DC)		
100 mA (at 24 V DC)		
Screw terminal with 5 contacts, plug-in, for redundant power supply (on the inside of the control cabinet)		
Change-over contact, potential-free, 24 (on the inside of the control cabinet) Screw terminal with 3 contacts, plugga	4 V DC / 0.5 A .ble	
5 (2 x IP 67 / 3 x IP 20)		
10 or 100 MBit/s / auto-negotiation		
Shielded-Twisted Pair (STP) or Unshielded-Twisted-Pair (UTP), Category 5		
On the outside of the control cabinet:	2 x HARTING RJ Industrial® Data 3A connectors	
On the inside of the control cabinet: auto-crossing function	3 x RJ 45 connectors	
100 m (with Category 5 cable) in accord	rdance with EN 50 173	
	<ul> <li>24 V DC (18 30 V DC)</li> <li>100 mA (at 24 V DC)</li> <li>Screw terminal with 5 contacts, plug-in (on the inside of the control cabinet)</li> <li>Change-over contact, potential-free, 24 (on the inside of the control cabinet)</li> <li>Screw terminal with 3 contacts, pluggar</li> <li>5 (2 x IP 67 / 3 x IP 20)</li> <li>10 or 100 MBit/s / auto-negotiation</li> <li>Shielded-Twisted Pair (STP) or Unshie</li> <li>On the inside of the control cabinet:</li> <li>On the inside of the control cabinet:</li> <li>auto-crossing function</li> <li>100 m (with Category 5 cable) in according</li> </ul>	

Stock items in bold type

01 18


Identification			Part No. Ethernet termination			
Connector set HARTING RJ Industr IP 67 Data 3A in metal	ial®		<b>09 45 115 1100</b> <sup>1)</sup>			
Coding pin set			09 45 820 0000			
Mounting plate to the inside control cabinet			20 80 000 0004			work onents
Identification			Part No.	Technical detai	ls	Net
System Cables for Industrial Ethern pre-assembled at both ends <sup>2)</sup> IP 67/65 (when mated)	et,					
Standard System Cable for Industrial Ethernet	Length:	1.5 m 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m 100.0 m	09 45 715 1123 09 45 715 1125 09 45 715 1127 09 45 715 1151 09 45 715 1153 09 45 715 1156 09 45 715 1161	Cable type: Connectors:	Industrial Ethernet Standard Cable, 2 x 2 x AWG 22/1, star quad, double shielding 2 x HARTING RJ Industrial <sup>®</sup> IP 67 Data 3A with IDC fast termination technology and zinc die-cast full metal housing	
Stranded System Cable for Industrial Ethernet	Length:	1.5 m 3.0 m 5.0 m 20.0 m 50.0 m 100.0 m	09 45 715 1164 09 45 715 1166 09 45 715 1168 09 45 715 1173 09 45 715 1175 09 45 715 1178 09 45 715 1183	Cable type: Connectors:	Industrial Ethernet Stranded Cable, 2 x 2 x AWG 22/7, star quad, double shielding 2 x HARTING RJ Industrial® IP 67 Data 3A with IDC fast termination technology and zinc die-cast full metal housing	

## Details for panel holes



01 19 Stock items in bold type

# **Ethernet Switch**



ESC 67-30 TP05U M12 D-Coding Ethernet Switch for industrial applications



01 20 Identification Part No. Drawing Dimensions in mm ESC 67-30 TP05U Fast Ethernet Switch M12 D-Coding 105 86,5 40 20 73 305 3941 LC. 104,1 86, 10,5 6,6 M12x1

# Technical characteristics

Power supply	
Input voltage	24 V DC (18 30 V DC)
Current consumption	100 mA (at 24 V DC)
Connections	Screw terminal with 5 contacts, plug-in, for redundant power supply (on the inside of the control cabinet)
Alarm signal contact	Change-over contact, potential-free, 24 V DC / 0.5 A (on the inside of the control cabinet) Screw terminal with 3 contacts, pluggable
Ethernet Interface	
Ports	5 (2 x IP 67 / 3 x IP 20)
Data transmission rate	10 or 100 MBit/s / auto-negotiation
Cable	Shielded-Twisted Pair (STP) or Unshielded-Twisted-Pair (UTP), Category 5
Available device	On the outside of the control cabinet: 2 x M12 circular connector, D-Coding
	On the inside of the control cabinet: 3 x RJ 45 connectors auto-crossing function
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173

Stock items in bold type

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Ethernet Swit ESC 87-38



Identification	1			E	Part No. Ethernet termination		
HARAX® shielded, 4	M12-L circular connector 4 male contacts, D-Coding				<b>21 03 281 1405</b> 1)		
Protection	cover M12				21 01 000 0003		رم س
Mounting to the insid	plate de control cabinet				20 80 000 0004		Network component
Identification	1				Part No.		
System Ca pre-assen IP 67/65 (v metal	ables for Industrial Ethernet, hbled at both ends <sup>2)</sup> when mated)						
	2 x circular connector M12 D-Coding, straight	Length:	1 m 3 m 5 m		21 03 483 1401 21 03 483 1403 21 03 483 1405 21 03 483 1400 <sup>3)</sup>	Cable: AWG 26 / 0.14 mm <sup>2</sup> Male	
	2 x circular connector M12 D-Coding, angled		1 m 3 m 5 m		21 03 483 3401 21 03 483 3403 21 03 483 3405 21 03 483 3400 <sup>3)</sup>	Length	
	2 x circular connector M12 D-Coding, straight	Length:	1 m 3 m 5 m		21 03 485 1401 21 03 485 1403 21 03 485 1405 21 03 485 1400 <sup>3)</sup>	Cable: AWG 22 / 0.34 mm <sup>2</sup> Male	
	2 x circular connector M12 D-Coding, angled		1 m 3 m 5 m		21 03 485 3401 21 03 485 3403 21 03 485 3405 21 03 485 3400 <sup>3)</sup>	Length	
						in accordance with PROFINET installation guide	

## Details for panel holes



01 21 Stock items in bold type

## General information



#### ESC 67-10 TP10U 10 Port Fast Ethernet Switch for industrial applications



Switches divide former collision domains into point-to-point connections between the network components and the user equipment involved. Constructing the network this way prevents collisions.

The ESC 67-10 TP10U Fast Ethernet Switch allows up ten items of user equipment to be connected through shielded twisted pair cable in accordance with IEC 802.3. The protection level, temperature range and mechanical stability satisfy the toughest demands. The Fast Ethernet Switch can therefore be directly used in industrial environments.

It allows the amount of cabling needed to construct industrial networks to be reduced. The ESC 67-10 TP10U facilitates any kind of network configuration. All connections are plugged, which means that assembly and disassembly is fast and reliable. All Ethernet interfaces are protected against over-voltage.

# Advantages

- High IP 65 protection level
- Robust metal housing
- Can be used directly in industrial environments
- EMI, temperature range and mechanical stability for the toughest demands
- PROFINET compatible





- Industrial automation
- Automotive industry
- Wind power
- Power distribution systems
- Railway applications





Function	Ethernet Switch in accordance 10 ports unmanaged, auto-o (100 Mbit/s) diagnostic LEDs • Up to 4 priority levels • Alarm signal contact, maska	e with IEEE 802.3, store and forward switching mode non-blocking, crossing, auto-negotiation, Ethernet (10 Mbit/s) and Fast Ethernet (link status, data, power, error) able via DIP connectors	
Mechanica	Il data		Network mponents
	Housing type	Robust metal housing of zinc die-cast	- 5
	Dimensions	90 x 120 x 87 (W x D x H in mm, without connectors)	
	Mounting	Panel mounting, both upright and flat assembly	
	Weight	approx. 1.4 kg	
	Protection level	IP 65	
Environme	ental conditions Operating temperature range Relative humidity for operation	-40 °C +70 °C 30% to 95%, non-condensing	
Mechanica	al stability		
moonamoo	Shock / vibration	IEC 68-2-27-Ea / IEC 68-2-6-Fc	
ЕМІ	Interference immunity Interference emission	EN 61000-4-2 EN 61000-4-6, EN 61000-4-8 EN 50011, Class A	
Railway st	andards	DIN EN 50 155	
,,		DIN EN 50 121-3-2	

## **Ethernet Switch**

PROFD® INVITANE ETHERNET ARTING

ESC 67-10 TP10U HARTING RJ Industrial<sup>®</sup> IP 67 Data 3A 10 Port Ethernet Switch for industrial applications



Power supply	
Input voltage	24 V DC (18 30 V DC)
Current consumption	appr. 180 mA (at 24 V DC)
Connections	compatible with Han <sup>®</sup> 4A connector, redundant power supply (incl. fixing screw 09 20 000 9918, to maintain IP 65)
Alarm signal contact	Change-over contact, potential-free, 24 V DC / 0.5 A
	compatible with Han <sup>®</sup> 3A connector (incl. fixing screw 09 20 000 9918, to maintain IP 65)
Ethernet Interface	
Ports	10
Data transmission rate	10 or 100 MBit/s / auto-negotiation
Cable	Shielded-Twisted Pair (STP) or Unshielded-Twisted-Pair (UTP), Category 5
Available device	HARTING RJ Industrial <sup>®</sup> Data 3A connectors, auto-crossing function
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173



Identification		Power termination	Part No. Ethernet termination	Alarm signal contact	
Straight hood metal, straight, metric		19 20 003 1440 <sup>1)</sup>		<b>19 20 003 1440</b> <sup>1)</sup>	
Protection covers Han® 3A		09 20 003 5422	09 20 003 5425	09 20 003 5425	
Han <sup>®</sup> 4A female insert		09 20 004 2711			rk ents
Han <sup>®</sup> 3A female insert				09 20 003 2711	Netwo
Cable gland metal IP 65, metric M20, cable diameter:	5 - 9 mm	19 00 000 5080		19 00 000 5080	Ö
Connector set HARTING RJ Indust IP 67 Data 3A in metal	rial®		09 45 115 1100 <sup>2)</sup>		
Coding pin set			09 45 820 0000		
Identification		Part No.			
System Cables for Industrial Ethernet, pre-assembled at both ends <sup>3)</sup> IP 67/65 (when mated)	Length: 1.5 m 3.0 m 5.0 m 20.0 m 50.0 m 100.0 m	09 45 715 1123 09 45 715 1125 09 45 715 1127 09 45 715 1151 09 45 715 1153 09 45 715 1156 09 45 715 1161	Cable type: Indu Stai 2 x qua Connectors: 2 x Bat IDC tech	ustrial Ethernet Indard Cable, 2 x AWG 22/1, star d, double shielding HARTING Industrial <sup>®</sup> IP 67 a 3A in metal with fast termination mology	
Identification		Part No.	Drawing	Dimensions in mm	
Set for panel mounting upright assembly		20 80 010 0002			
					01

Order insert fixing screw 09 20 000 9918 separately
 Further connector sets see chapter 03
 Further system cables see chapter 02

Stock items in bold type

)1 25

## General information



EHB 67-10 TP05 Ethernet Hub for industrial applications

## General description

Network components

> Ethernet Hubs are located in the Ethernet network where Ethernet Switches are not essential (e.g. Ethernet Powerlink Networks).

> The EHB 67-10 TP05 Ethernet Hub allows up five items of user equipment to be connected through shielded twisted pair cable in accordance with IEC 802.3. The protection level, temperature range and mechanical stability satisfy the toughest demands. The Ethernet Hub can therefore be directly used in industrial environments.

It allows the amount of cabling needed to construct industrial networks to be reduced. The EHB 67-10 TP05 facilitates any kind of network configuration. All connections are plugged, which means that assembly and disassembly is fast and reliable. All Ethernet interfaces are protected against over-voltage.

## Application fields



- Industrial automation
- Automotive industry
- Wind power
- Power distribution systems

## **Advantages**

- High IP 65 / IP 67 protection level
- Robust metal housing
- Can be used directly in industrial environments
- EMI, temperature range and mechanical stability for the toughest demands
- All terminations pluggable

#### Mechanical data

Housing type	Robust metal housing of zinc die-cast
Dimensions	45 x 120 x 87 (W x D x H in mm, without connectors)
Mounting	35 mm standard rail according to DIN EN 60715, panel mounting, both upright and flat assembly
Weight	approx. 0.8 kg
Protection level	IP 65 / IP 67

#### **Environmental conditions**

Operating temperature range	O °C +60 °C
Relative humidity for operation	30% to 95%, non-condensing

#### Mechanical stability

Shock / vibration IEC 68-2-27-Ea / IEC 68-2-6-Fc

EMI	Interference immunity	EN 61000-4-2 EN 61000-4-6, EN 61000-4-8
	Emitted radiation	EN 50011, Class A



# Ethernet Hub



#### EHB 67-10 TP05 HARTING RJ Industrial<sup>®</sup> IP 67 Data 3A Ethernet Hub for industrial applications



in mm

Identification	Part No.	Drawing	Dimensions in
EHB 67-10 TP05 Ethernet Hub HARTING RJ Industrial® IP 67 Data 3A	20 70 305 3922		

Power supply	
Input voltage	24 V DC (18 30 V DC)
Current consumption	125 mA (at 24 V DC)
Connections	compatible with Han <sup>®</sup> 4A connector, redundant power supply (incl. fixing screw 09 20 000 9918, to maintain IP 67)

120

Ethernet Interface	
Ports	5
Data transmission rate	10 or 100 MBit/s / auto-sensing
Cable	Shielded-Twisted Pair (STP) or Unshielded-Twisted-Pair (UTP), Category 5
Available device	HARTING RJ Industrial® Data 3A connectors
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173



Identification		Part Power termination	No. Ethernet termination		
Straight hood metal, straight, metric		<b>19 20 003 1440</b> <sup>1)</sup>			
Protection covers Han® 3A		09 20 003 5422	09 20 003 5425		
Han® 4A female insert		09 20 004 2711			k ote
Cable gland metal IP 65, metric M20, cable diameter: 5	- 9 mm	19 00 000 5080			Networ
Connector set HARTING RJ Industri IP 67 Data 3A in metal	al®		09 45 115 1100 <sup>2)</sup>		
Coding pin set			09 45 820 0000		
Identification		Part No.			
System Cables for Industrial Ethernet, pre-assembled at both ends <sup>3)</sup> IP 67/65 (when mated)	Length: 1.5 m 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m 100.0 m	09 45 715 1123 09 45 715 1125 09 45 715 1127 09 45 715 1151 09 45 715 1153 09 45 715 1156 09 45 715 1161	Cable type: Ind Sta 2 x qua Connectors: 2 x RJ Dat IDC tech	ustrial Ethernet ndard Cable, 2 x AWG 22/1, star d, double shielding HARTING Industrial <sup>®</sup> IP 67 a 3A in metal with c fast termination nnology	
Identification		Part No.	Drawing	Dimensions in mm	
Set for assembly on standard rail acc. to DIN EN 60715		20 80 000 0003			
Set for panel mounting upright assembly		20 80 010 0001			
Set for panel mounting flat assembly		20 80 024 0002			01 29
1) Order insert fixing screw 09 20 000 9918 ser	parately		St	ock items in bold type	<u>e</u>

Order insert fixing screw 09 20 000 9918 separately
 Further connector sets see chapter 03
 Further system cables see chapter 02

# Ethernet Hub



#### EHB 67-10 TP05 M12 D-Coding Ethernet Hub for industrial applications



# **Technical characteristics**

#### **Power supply**

Input voltage	24 V DC (18 30 V DC)
Current consumption	125 mA (at 24 V DC)
Connections	compatible with <i>HARAX®</i> M12-L connector, redundant power supply

#### **Ethernet Interface**

Ports	5
Data transmission rate	10 or 100 MBit/s / auto-sensing
Cable	Shielded-Twisted Pair (STP) or Unshielded-Twisted-Pair (UTP), Category 5
Available device	M12 circular connector, D-Coding
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173
Accessories see pages 01.31 and 01.3	32 Stock items in bold type

HARTIN



n			Part Power termination	No. Ethernet termination		
M12-L circular connector			21 03 212 2305 <sup>1)</sup>			
M12-L circular connector 4 male contacts, D-Coding				<b>21 03 281 1405</b> 1)		work onents
n covers M12			21 01 000 0003	21 01 000 0003		Net
n			Part No.			
Cables for Industrial Ethernet, nbled at both ends <sup>2)</sup> (when mated)						
2 x circular connector M12 D-Coding, straight	Length:	1 m 3 m 5 m	21 03 483 1401 21 03 483 1403 21 03 483 1405 21 03 483 1400 <sup>3)</sup>	Male	a 26 / 0.14 mm <sup>2</sup>	
2 x circular connector M12 D-Coding, angled		1 m 3 m 5 m	21 03 483 3401 21 03 483 3403 21 03 483 3405 21 03 483 3400 <sup>3)</sup>	L	ength	
2 x circular connector M12 D-Coding, straight	Length:	1 m 3 m 5 m	21 03 485 1401 21 03 485 1403 21 03 485 1405 21 03 485 1400 <sup>3)</sup>	Cable: AWO	6 22 / 0.34 mm <sup>2</sup>	
2 x circular connector M12 D-Coding, angled		1 m 3 m 5 m	21 03 485 3401 21 03 485 3403 21 03 485 3405 21 03 485 3400 <sup>3)</sup>	L	ength	
	n M12-L circular connector 4 male contacts, D-Coding n covers M12 n Cables for Industrial Ethernet, nbled at both ends <sup>2</sup> ) (when mated) 2 x circular connector M12 D-Coding, straight 2 x circular connector M12 D-Coding, angled 2 x circular connector M12 D-Coding, straight 2 x circular connector M12 D-Coding, straight	n M12-L circular connector 4 male contacts, D-Coding n covers M12 n Cables for Industrial Ethernet, mbled at both ends <sup>2</sup> ) (when mated) 2 x circular connector Length: M12 D-Coding, straight 2 x circular connector M12 2 x circular connector Length: M12 D-Coding, angled	n M12-L circular connector 4 male contacts, D-Coding n covers M12 n Cables for Industrial Ethernet, mbled at both ends <sup>2</sup> (when mated) 2 x circular connector M12 D-Coding, straight 2 x circular connector M12 D-Coding, angled 3 m 5 m 2 x circular connector M12 D-Coding, straight 1 m 3 m 5 m	nPower terminationM12-L circular connector21 03 212 2305"M12-L circular connector21 01 000 0003A male contacts, D-Coding21 01 000 0003n covers M1221 01 000 0003nPart No.Sables for Industrial Ethernet, mbled at both ends? (when mated)21 03 483 1401 21 03 483 1401 21 03 483 1405 21 03 483 14062x circular connector M12 D-Coding, angled1 m 3 m 21 03 485 1406 21 03 485 1406 21 03 485 1406 21 03 485 14062x circular connector M12 D-Coding, straightLength: 1 m 3 m 21 03 485 1406 21 03 485 1406 21 03 485 1406 21 03 485 14062x circular connector M12 D-Coding, angled1 m 3 m 21 03 485 1406 21 03 485 14062x circular connector M12 D-Coding, angled1 m 3 m 21 03 485 1406 21 03 485 1406 21 03 485 14062x circular connector M12 D-Coding, angled1 m 3 m 21 03 485 1406 21 03 485 1406 21 03 485 1406	n       Power termination       Ethernet termination         M12-L circular connector       21 03 212 2305''       21 03 281 1405''         M12-L circular connector       21 01 000 0003       21 01 000 0003         n covers M12       21 01 000 0003       21 01 000 0003         n       Part No.       21 03 483 1401       21 03 483 1401         ables for Industrial Ethernet, mbled at both ends <sup>2</sup> Length: 1 m       21 03 483 1401       Cable: AWC         2 x circular connector       Length: 1 m       21 03 483 1401       Cable: AWC         M12 D-Coding, angled       3 m       21 03 483 3401       Lu         2 x circular connector       1 m       21 03 483 3401       Lu         M12 D-Coding, angled       3 m       21 03 485 3401       Lu         2 x circular connector       1 m       21 03 485 1401       Lu         M12 D-Coding, angled       3 m       21 03 485 1401       Lu         2 x circular connector       1 m       21 03 485 1401       Mate       Lu         2 x circular connector       1 m       21 03 485 1401       Mate       Lu         2 x circular connector       1 m       21 03 485 1401       Mate       Lu         2 x circular connector       1 m       21 03 485 1403 <t< td=""><td>nPower terminationPetterminationM12-L circular connector21 03 212 2306''21 03 281 1405''M12-L circular connector21 01 000 000321 01 000 0003n covers M1221 01 000 000321 01 000 0003nPart No.Sables for Industrial Ethernet, mbled at both ends<sup>2</sup>) (when mated)21 03 483 1401 21 03 483 1403 5 m21 03 483 1401 21 03 483 1403 21 03 483 3403 21 03 483 3403<b< td=""></b<></td></t<>	nPower terminationPetterminationM12-L circular connector21 03 212 2306''21 03 281 1405''M12-L circular connector21 01 000 000321 01 000 0003n covers M1221 01 000 000321 01 000 0003nPart No.Sables for Industrial Ethernet, mbled at both ends <sup>2</sup> ) (when mated)21 03 483 1401 21 03 483 1403 5 m21 03 483 1401 21 03 483 1403 21 03 483 3403 21 03 483 3403 <b< td=""></b<>



	Identification	Part No.	Drawing Dimensions in mm
Network components	Set for assembly on standard rail acc. to DIN EN 60715	20 80 000 0003	
	Set for panel mounting upright assembly	20 80 010 0001	
	Set for panel mounting flat assembly	20 80 024 0002	

## General information

HARTING



Industrial Outlets

## General description

#### The Industrial Outlet as an interface between office and factory floor

Effective communication is becoming more and more of a crucial factor in competitive business life. Existing office networks are therefore increasingly being sewn together with industrial machine networks to link the production area into structured building cabling.

This presents the user with the need for vertically integrated wiring, and for defined transition areas that take the requirements of the two environments into account. The Industrial Outlet provides the transition within this kind of crosslevel wiring.



The Industrial Outlet permits structured building cabling in accordance with ISO/IEC 11801:2002 or with EN 50173:2002 to be continued in the industrial environment through to the machine.

With their robust housing the outlets are applicable in every environment with demands beyond the office area:

- Laboratories
- Workshops
- Assembly, storage and shipment departments
- Production facilities
- Transport and logistic centres

By the easy on-wall mounting the outlets can be smoothly installed on walls, pillars, beams or production cells and be connected to the building network cable (horizontal cable).

The proven LSA-PLUS<sup>®</sup> connection system lets the installer install the cable quickly and easily. The Industrial Ethernet cabling for equipment and machines is continued through to the production level using pluggable RJ 45 or M12 connectors.

HARTING has developed a family of products for this purpose, RJ Industrial, which is ideally adapted to the machine network whilst nevertheless remaining compatible with common office standards.

The Push Pull and Metal type of the outlet provide an interface to the specified Industrial Ethernet cabling in accordance with PROFINET.

## Advantages

- High IP 65 / IP 67 protection level
- Robust housing
- Can be used directly in industrial environments
- Easy on-wall mounting
- LSA-PLUS<sup>®</sup> connection technology makes installation straightforward
- Optimum connector technology with high data security
- PROFINET compatible
- Label for individual customer marking

# Industrial Outlet

PROFD<sup>®</sup>

HARTING



## HARTING RJ Industrial® Metal Outlet



## Description

With its zinc die cast housing the Metal Outlet fulfills even the hardest requirements in production facilities. Thus it is possible to install a network access directly inside the unprotected environment of machines, welding robots etc.

With a data transmission rate of up to 100 Mbit/s (Fast Ethernet) and an extremely robust Data 3A interface the Metal Outlet covers the complete heavy duty range of industrial applications.

# Industrial Outlet



## HARTING RJ Industrial® Metal Outlet

# **Technical characteristics**

Transmission performance	Suitable for class D links acc. to ISO / IEC 11801
Transmission rate	10 - 100 Mbit/s (Ethernet and Fast Ethernet)
Transmission frequency	max. 100 MHz
Termination	2 x LSA-PLUS <sup>®</sup> module, Category 5
Wiring	IDC, min. 50 times repairable with LSA-Punch Down Tool (HARTING part no. 09 45 800 0020, s. chapter 04)
Strands diameter	AWG 26 - 22 solid (stranded, others on request) 0.35 - 0.65 mm
Ø strands isolation	0.7 -1.6 mm (PE- or PVC isolation) 0.7 - 1.85 mm (foamed isolation)
Sheath diameter	5 - 9 mm (others on request)
Cable type	2- and 4-pair installation cables, Category 5, 6 and 7 acc. to IEC 11801
Cable feeding	1 to 2 cables from the left or right side
Connector	HARTING RJ Industrial <sup>®</sup> Data 3A Metal (PROFINET-compliant)
Mating face	RJ 45 acc. to IEC 60603-7 compatible to all standard RJ 45 connectors
Mating cycles	min. 500
Shielding	360°, electrically isolated from the housing
Mounting	On-wall mounting with 2 screws
Dimensions	105 x 105 x 40.5 mm
Protection degree	IP 67 and 65, mated and unmated by Han <sup>®</sup> 3A protective caps
Ambient temperature	-40 °C+70 °C
Housing material	Aluminum die cast
Colour	Grey, RAL 7037

Network components

Network components

Identification			Part No. Ethernet termination		
Connector set HARTING RJ Indust IP 67 Data 3A in metal, 2 pairs	rial®		09 45 115 1100 <sup>1)</sup>		
IP 67 Data 3A in metal, 4 pairs			09 45 115 1500 <sup>1)</sup>		
Coding pin set			09 45 820 0000		
Identification			Part No.	Technical details	3
System Cables for Industrial Ethern pre-assembled at both ends <sup>2)</sup> IP 67/65 (when mated)	net,				
Standard System Cable for Industrial Ethernet	Length:	1.5 m 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m 00.0 m	09 45 715 1123 09 45 715 1125 09 45 715 1127 09 45 715 1151 09 45 715 1153 09 45 715 1156 09 45 715 1161	Cable type: Connectors:	Industrial Ethernet Standard Cable, 2 x 2 x AWG 22/1, star quad, double shielding 2 x HARTING RJ Industrial <sup>®</sup> IP 67 Data 3A with IDC fast termination technology and zinc die-cast full metal housing
Stranded System Cable for Industrial Ethernet	Length:	1.5 m 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m 00.0 m	09 45 715 1164 09 45 715 1166 09 45 715 1168 09 45 715 1173 09 45 715 1175 09 45 715 1178 09 45 715 1183	Cable type: Connectors:	Industrial Ethernet Stranded Cable, 2 x 2 x AWG 22/7, star quad, double shielding 2 x HARTING RJ Industrial <sup>®</sup> IP 67 Data 3A with IDC fast termination technology and zinc die-cast full metal housing
Trailing System Cable for Industrial Ethernet	Length:	1.5 m 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m	09 45 715 0023 09 45 715 0025 09 45 715 0027 09 45 715 0051 09 45 715 0053 09 45 715 0056 09 45 715 0061	Cable type: Connectors:	Industrial Ethernet Trailing Cable, 2 x 2 x AWG 22/7, star quad, double shielding 2 x HARTING RJ Industrial® IP 67 Data 3A with IDC fast termination technology and zinc die-cast full metal housing





## **Industrial Outlet**



Metal Industrial Outlet INO 67 M12 M12 D-Coding



## **Technical characteristics**

#### **Ethernet Interface** Suitable for Ethernet / Fast Ethernet Transmission characteristics in accordance with Category 5, ISO/IEC 11 801:2002 and EN 50 173-1:2002 Horizontal cable termination 2 x LSA-PLUS<sup>®</sup> connection technology Interface for field cabling 2 x HARAX® M12 with D-Coding **Mechanical data** Robust metal housing of aluminium die-cast Housing type **Dimensions** 105 x 120 x 40.5 (W x D x H in mm) Mounting Panel mounting Weight approx. 0.6 kg **Protection level** IP 67 / IP 65 **Environmental conditions**

38 Operating temperature range

01

0 °C ... +55 °C

Network components HARTING



Identification		Part No. Ethernet termination		
Cable gland metal IP 65, metric M20, cable diameter: 5 - 9	9 mm	19 00 000 5080		
Blanking piece metal IP 65, metric M20		19 00 000 5070		
HARAX <sup>®</sup> M12-L circular connector shielded, male, 4poles, D-Coding		<b>21 03 281 1405</b> <sup>1)</sup>		Vetwork mponents
Protection cover M12		21 01 000 0003		<u>- §</u>
Identification		Part No.		
System Cables for Industrial Ethernet, pre-assembled at both ends <sup>2)</sup> IP 67/65 (when mated) metal				
2 x circular connector M12 D-Coding, straight	Length: 1 m 3 m 5 m	21 03 483 1401 21 03 483 1403 21 03 483 1405 21 03 483 1400 <sup>3)</sup>	Cable: AWG 26 / 0.14 mm <sup>2</sup> Male	
2 x circular connector M12 D-Coding, angled	1 m 3 m 5 m	21 03 483 3401 21 03 483 3403 21 03 483 3405 21 03 483 3400 <sup>3)</sup>	Length	
2 x circular connector M12 D-Coding, straight	Length: 1 m 3 m 5 m	21 03 485 1401 21 03 485 1403 21 03 485 1405 21 03 485 1400 <sup>3)</sup>	Cable: AWG 22 / 0.34 mm <sup>2</sup>	
2 x circular connector M12 D-Coding, angled	1 m 3 m 5 m	21 03 485 3401 21 03 485 3403 21 03 485 3405 21 03 485 3405	Length	
		21 03 465 3400%	in accordance with PROFINET installation guide	
				01
				33

## General information

Category 6

Network components

#### HARTING RJ Industrial® Outlet Push Pull

#### **Installation options**

The Push Pull Outlet consists of an impact resistant IP 67 plastic housing with two inlets for the building cable and two outlets for the field wiring with a pushpull interface. The building cable can optionally be brought in from above or from below, and the user is



therefore given flexible options for mounting the outlet on walls, pillars, production cells and so forth. Hinges join the captive lid to the base.

# Push-pull interface with automatic protective flaps

The HARTING RJ Industrial<sup>®</sup> Push Pull is used as an interface to the machine cabling. This connector needs 50% less space than any other RJ 45 connector in IP 67 available on the market. The Push Pull interface of the outlet is specified for PROFINET because of its compatibility with this connector. The Industrial Outlet is fitted with self-closing protective covers, because it is possible that at certain times no connector will be inserted. As soon as the connector



is withdrawn, these covers close the outlet automatically to protection class IP 67 / 65. In this way the socket is reliably protected at all times without the need for additional covers. The Push Pull interfaces offer blind mating and they can be sealed against unauthorised connection. For test and diagnostic purposes, it is of course also possible



to connect the HARTING RJ Industrial<sup>®</sup> IP 20 connector and usual standard RJ 45 connectors.

#### Labelling in IP 67 environments

So that the ports in a network can be clearly identified even under unfavourable environmental conditions, the HARTING RJ Industrial® Outlet Push Pull includes an integrated transparent protective label cover. This allows the socket to be labelled even in an

IP 67 environment. In this way the labelling on the sockets remains readable, even after years of use in industrial and outdoor areas.



#### Time saved through field-proven LSA-PLUS<sup>®</sup> connection technology

Time is one of the most critical factors in production. The assembly time for the outlet has therefore been reduced to a minimum. Markings on the cover and the base of the connection socket identify the specified cable lengths required for the connection. This allows the installer to determine the cable lengths and the length of insulation to be stripped quickly and easily. The building cable is attached with the aid of the

## General information

Category 6

# Network components

HARTING RJ Industrial® Outlet Push Pull

proven KRONE KM8 socket module with LSA-PLUS® technology. This allows solid and flexible AWG 24-22 installation cables to be connected up to 200 times. The cable is connected directly via the connector. An additional PCB is not required. The user is therefore



handling familiar technology. The connection is made entirely using standard tools. The unambiguous colour-coding according to EIA / TIA 568 A / B simplifies assignment of the individual conductors,

and therefore reduces the working time. A die-cast zinc housing and a plug-in shielded





spring shield the KRONE KM8 module all 360°. The most important feature of this

(Source: KRONE)

keystone jacks is its Category 6 performance. This enables the use in Gigabit Ethernet applications.



#### Integrated cable manager for secure, reliable cable guidance

High transmission performance is further supported by an integrated cable manager. It assures the user that the installation cable is laid correctly according to the defined bending radii. Kinked cables, which can lead to faults in data transmission, are effectively avoided. The innovative design of the cable





manager has made it possible to sharply reduce the external dimensions of the outlet whilst nevertheless

maintaining the bending radii necessary for Category 6 cables. This cable guide system also makes the installer's work easier, since he can be certain that the cable is following the correct path inside the housing. This reduces the amount of measurement work needed. It is also possible to introduce the building cable from above, simply by turning the cable manager and the housing cover through 180°.

The HARTING RJ Industrial® Outlet thus incorporates all the properties necessary for networking the office and field levels together simply and consistently. Thanks to the Category 6 performance, it represents a secure investment for the future. It can at the same time be installed anywhere, saving time and

money. And finally, the entire system is packed into an attractive yet highly functional housing. For the different application fields it is available in black or in white.



#### **Installation Instructions**

- 1. Mount the bottom part of the outlet. Use the enclosed template for the hole center distance.
- 2. Remove the cable manager.



3. Attach the top cover to the bottom part, insert the cables from bottom or top side.



4. Strip the cable up to the marking inside the cover/ bottom part of the outlet and terminate it with the enclosed keystone jack (for instructions please see the packaging).



5. Insert the cable manager with the arrow pointing onto the locking nose and engage it with an audible "CLICK".



6. Insert the keystone jacks into the cable manager and engage them with an audible "CLICK". Make sure that the modules are seated correctly!



7. Close the top cover and tighten it. Recommended torque: 0.6 ... 0.8 Nm.



8. Close not used cable glands with the enclosed blind plug.

#### Labelling

1. Disengage the cover of the label.



2. Insert a labelled paper (appr. 50 x 14 mm) and close the cover with an audible "CLICK".

## Locking

The protective flaps of the outlet can be locked against unauthorised plugging with two lugs.







# Industrial Outlet

#### PROFD<sup>®</sup> Neto

Network components

## HARTING RJ Industrial® Outlet Push Pull



6

Category

## Advantages

- Universal solution for most industrial applications
- Meets the requirements of both IT AND production
- Future-proof due to Category 6 de-embedded
- Flexible installation by cable feeding from bottom or top side
- The cable management avoids kinked cables
- Termination without special tools
- Easy one-hand locking and unlocking of the connector (Push Pull)
- Self-closing protective flaps
- Integrated IP 67 label tag for durable identification

# Industrial Outlet



## HARTING RJ Industrial® Outlet Push Pull

# Technical characteristics

Category 6 for class E links acc. to ISO / IEC 11801
10 - 1.000 Mbit/s (Ethernet, Fast Ethernet and Gigabit Ethernet)
max. 250 MHz
2 x KRONE KM8 RJ 45 keystone jack, Category 6 vibration proof located
IDC without special tools (2 x LSA-PLUS <sup>®</sup> ) min. 200 times repairable
AWG 24 - 22 solid and stranded 0.5 - 0.65 mm
0.7 -1.6 mm
6 - 9 mm
2- and 4-pair installation cables, Category 5, 6 and 7 acc. to IEC 11801
1 to 2 cables from bottom or top side
HARTING RJ Industrial <sup>®</sup> Push Pull (PROFINET compliant)
RJ 45 acc. to IEC 60603-7 compatible to all standard RJ 45 connectors
min. 750
360°
On-wall mounting with 4 screws
152 x 90 x 69 mm
IP 67 and 65, mated and unmated by self-closing protective flaps
-20 °C+70 °C
Polycarbonate, shock-resistant halogen free, UL 94-V0
black, RAL 9011 white, RAL 9010

HARTIN

Category 6

Network components

Identification	Part No. Ethernet termination		
Connector set HARTING RJ Industrial®			
IP 67 Push Pull, 2 pairs	09 45 145 1100 <sup>1)</sup>		
IP 67 Push Pull, 4 pairs	09 45 145 1500 <sup>1)</sup>		
Identification	Part No.	Technical details	
System Cables for Industrial Ethernet, pre-assembled at both ends <sup>2)</sup>			
Stranded System CableLength: 1.5 mfor Industrial Ethernet3.0 m5.0 m10.0 m20.0 m	09       45       745       1523         09       45       745       1525         09       45       745       1527         09       45       745       1551         09       45       745       1553	Cable type:	ndustrial Ethernet Stranded Cable, Category 6, 4 x 2 x AWG 27/7, shielded twisted pair 2 x HARTING RJ ndustrial® IP 67 Push Pull, 4 pairs, Category 6
Length: 1.5 n 3.0 n 5.0 n 10.0 n 20.0 n 50.0 n	09         45         745         1164           09         45         745         1166           09         45         745         1168           09         45         745         1173           09         45         745         1173           09         45         745         1175           09         45         745         1178	Cable type:	ndustrial Ethernet Stranded Cable, 2 x 2 x AWG 22/7, star quad, double shielding
100.0 n	09 45 745 1183	Connectors: 2	2 x HARTING RJ ndustrial <sup>®</sup> IP 67 Push Pull with IDC fast termination and locking technology
Trailing System Cable Length: 1.5 n for Industrial Ethernet 3.0 n 5.0 n 10.0 n 20.0 n 50.0 n	09         45         745         0023           09         45         745         0025           09         45         745         0027           09         45         745         0051           09         45         745         0053           09         45         745         0053           09         45         745         0056           09         45         745         0061	Cable type:	ndustrial Ethernet Trailing Cable, 2 x 2 x AWG 22/7, star quad, double shielding
		Connectors: 2 I	2 x HARTING RJ ndustrial <sup>®</sup> IP 67 Push Pull with IDC fast termination and locking technology
Stranded System CableLength: 1.5 mfor Industrial Ethernet3.0 m5.0 m10.0 m20.0 m20.0 m	09         45         701         1164           09         45         701         1166           09         45         701         1168           09         45         701         1168           09         45         701         1173           09         45         701         1175	Cable type:	ndustrial Ethernet Stranded Cable, 2 x 2 x AWG 22/7, star quad, double shielding
50.0 n 100.0 n	09 45 701 1178 09 45 701 1183	Connectors:	1 x HARTING RJ ndustrial <sup>®</sup> IP 67 Push Pull 1 x HARTING RJ ndustrial <sup>®</sup> IP 20Data, both with IDC fast termination technology

01 46  $^{1)}$  Further connector sets see chapter 03  $^{2)}$  Further system cables see chapter 02

Contents	chapter	02
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System cables	Page	
General information	02.02	
Cables for Industrial Ethernet	02.03	System cables
Cable assemblies for Industrial Ethernet		
RJ Industrial Fieldpatch IP 20	02.07	
RJ Industrial overmoulded IP 20	02.08	
RJ Industrial Fieldpatch IP 67 Push Pull	02.10	
RJ Industrial Fieldpatch IP 67 Push Pull / IP 20	02.11	
RJ Industrial Fieldpatch IP 67 Data 3A	02.12	
RJ Industrial Fieldpatch IP 67 Hybrid	02.13	
M12 D-Coding IP 67	02.14	
Cable assemblies for Gigabit Ethernet		
RJ Industrial Fieldpatch IP 20	02.15	
RJ Industrial Fieldpatch IP 67 Push Pull	02.16	
RJ Industrial Fieldpatch IP 67 Data 3A	02.17	
Customer specific solutions		
Housing with integrated patch cable	02.18	02 01



The cabling represents the backbone of a network. Mistakes during the selection and laying of cables may lead to serious errors in data transfer, data loss and even total network failure. Especially in the industrial environment, reliable and fully functional cables are a crucial element in planning and implementing high-performance networks ensuring a high degree of availability.

HARTING offers a wide range of diverse Ethernet cables, which are specially designed for use in a harsh industrial environment. Data transfer in the categories 5 and 6 to ISO/IEC 11801 is supported by means of solid, stranded, or hybrid cable, which may also be used in dynamic cable carriers. Oil resistance, high mechanical stability and halogen-free, are only a few of the features HARTING demand from on its cables.

The combination of these industrial cables and the robust HARTING RJ Industrial<sup>®</sup> connectors results in high-grade and long-lasting system cables. The consistent application of a modular system to both for our connectors and system cables allows HARTING to cover a wide field of applications. HARTING offers a range from the compact molded IP 20 connectors up to robust IP 67 components. The matrix below shows the supported combinations.

HARTING offers Gigabit system cables with degrees of protection IP 20 and IP 67, for use in demanding applications to Category 6 or Class E.

Customized system cables, in different lengths and selectable RJ Industrial connectors are available on request.



System cables			HARTING
	8		R
Cable for Industrial Ethernet			<b>N</b>
Description	Part No.	Technical characteristics	
PROFINET type A cable for fixed installation Length: 20 m 50 m 100 m 500 m	09 45 600 0130 09 45 600 0140 09 45 600 0100 09 45 600 0110	Cabling standard in acc. with ISO/IEC 11 801: Structure: Sheath: Cores: Service temperature: Minimum bending radius: Max. permissible tension:	Category 5 radially symmetrical arranged as star quad, double shielding PVC green, $\emptyset$ 6.5 mm solid, 2 x 2 x AWG 22/1 ( $\emptyset$ 0.64 mm) -40 °C +70 °C multiple bending 7.5 x $\emptyset$ one time 3 x $\emptyset$ 150 N
PROFINET type B cable for flexible installation Length: 20 m 50 m 100 m 500 m	09 45 600 0132 09 45 600 0142 09 45 600 0102 09 45 600 0112	Cabling standard in acc. with ISO/IEC 11 801: Structure: Sheath: Cores: Service temperature: Minimum bending radius: Max. permissible tension:	Category 5 radially symmetrical arranged as star quad, double shielding PVC green, $\emptyset$ 6.5 mm stranded, 2 x 2 x AWG 22/7 ( $\emptyset$ 0.75 mm) -40 °C +70 °C multiple bending 5 x $\emptyset$ one time 3 x $\emptyset$ 150 N
PROFINET type C cable for power chains Length: 20 m 50 m 100 m 500 m	09 45 600 0131 09 45 600 0141 09 45 600 0101 09 45 600 0111	Cabling standard in acc. with ISO/IEC 11 801: Structure: Sheath: Cores: Service temperature: Minimum bending radius: Max. permissible tension:	Category 5 radially symmetrical arranged as star quad, double shielding PUR green, $\emptyset$ 6.5 mm stranded, 2 x 2 x AWG 22/7 ( $\emptyset$ 0.75 mm) -40 °C +70 °C multiple bending 7 x $\emptyset$ one time 3 x $\emptyset$ power chain: 200 mm 150 N

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System cables

#### Cable for Industrial Ethernet

Sys cal	Description	Part No.	Technical characteristics	
02	PROFINET type B Hybrid cable for flexible installationLength: 20 m 50 m 100 m	09 45 600 0330 09 45 600 0340 09 45 600 0300	Cabling standard in acc. with ISO/IEC 11 801: Structure: Sheath: Data cores: Power supply cores: Service temperature: Minimum bending radius: Max. permissible tension:	Category 5 two wires twisted to a pair, double shielding, plus 4 power supply cores, filler as a central element FRNC green, Ø 10.3 mm stranded, 2 x 2 x AWG 22/7 (Ø 0.75 mm) stranded, 1.5 mm <sup>2</sup> -20 °C +70 °C multiple bending 10 x Ø one time 5 x Ø 200 N
	PROFINET type B cable for flexible installation Length: 20 m 50 m 100 m 500 m	09 45 600 0135 09 45 600 0145 09 45 600 0105 09 45 600 0115	Cabling standard in acc. with ISO/IEC 11 801: Structure: Sheath: Cores: Service temperature: Minimum bending radius: Max. permissible tension:	Category 5 radially symmetrical arranged as star quad, double shielding PVC black, UV protected, $\emptyset$ 6.5 mm stranded, 2 x 2 x AWG 22/7 ( $\emptyset$ 0.76 mm) -45 °C +60 °C multiple bending 7 x $\emptyset$ one time 3 x $\emptyset$ 150 N

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## Cable for Industrial Ethernet

Description	Part No.	Technical characteristics		S
Industrial Ethernet cable, 4 pairs for flexible installation Length: 20 m 50 m 100 m	09 45 600 0133 09 45 600 0143 09 45 600 0103	Cabling standard in acc. with ISO/IEC 11 801: Structure: Sheath: Cores: Service temperature: Minimum bending radius: Max. permissible tension:	Category 5 two wires twisted to a pair, 4 pairs twisted with shielding foil PVC green, $\emptyset$ 5.8 mm stranded, 4 x 2 x AWG 26/7 ( $\emptyset$ 0.15 mm) -20 °C +60 °C multiple bending 8 x $\emptyset$ one time 4 x $\emptyset$ 100 N	
Gigabit Ethernet cable, 4 pairs for flexible installation Length: 20 m 50 m 100 m	09 45 600 0530 09 45 600 0540 09 45 600 0500	Cabling standard in acc. with ISO/IEC 11 801: Structure: Sheath: Cores: Service temperature: Minimum bending radius: Max. permissible tension:	Category 6 two wires twisted to a pair, shielded, 4 pairs twisted with shielding PVC green, $\emptyset$ 6.8 mm stranded, 4 x 2 x AWG 27/7 ( $\emptyset$ 0.15 mm) -10 °C+70 °C multiple bending 8 x $\emptyset$ one time 4 x $\emptyset$ 70 N	02 05



System cables

## Cable for Industrial Ethernet

ς Ω	Description	Part No.	Technical characteristics	
	Industrial Ethernet cable, 4 pairs for flexible installation and fast mounting		Cabling standard in acc. with ISO/IEC 11 801:	Category 5
	with the Stripping Tool		Structure:	two wires twisted to a pair, 4 pairs twisted with shielding foil
	Length: 20 m	09 45 600 0230	Sheath:	PVC black, UV protected, Ø 6.7 mm
	50 m 100 m	09 45 600 0240 09 45 600 0200	Cores:	stranded, 4 x 2 x AWG 26/7 (Ø 0.16 mm)
			Service temperature:	-45 °C +60 °C
			Minimum bending radius:	multiple bending 8 x Ø one time 4 x Ø
	Available Q3/2005 Outdoor		Max. permissible tension:	100 N
	Industrial Ethernet cable, 4 pairs		Cabling standard in acc. with ISO/IEC 11 801:	Category 5
	with the Stripping Tool		Structure:	two wires twisted to a pair, 4 pairs twisted with shielding foil
	Length: 20 m	09 45 600 0430	Sheath:	PUR green, Ø 6.7 mm
	50 m 100 m	09 45 600 0440 09 45 600 0400	Cores:	stranded, 4 x 2 x AWG 26/7 (Ø 0.16 mm)
			Service temperature:	-45 °C +60 °C
			Minimum bending radius:	multiple bending 8 x Ø one time 4 x Ø
	Available Q3/2005		Max. permissible tension:	100 N
02				
06				

System cables						HARTING	
RJ Industrial Fieldpatch IP 20	,						E S
Description	Part No.	Technica	I characteristics				Syste
System Cables for Industrial Ethernet, pre-assembled at both ends		Transmis accordar 11 801:20	sion properties in ice with ISO/IEC 002: Cl	ass D			
pre-assembled at both ends		Mating fa	ace: 2 :	x RJ 45 in ac	cc. with IE	EC 60603-7	
for the cabling of Industrial Ethernet net- works in accordance with the PROFINET		Protecior	n level: IP	20 (when m	ated)		
guideline, based on RJ 45 connectors.		Pin assi	gnment in accordance	with PROF	INET sp	ecification:	
Applications: control cabinets and industri- al environments with low environmental stress on the connector.		Signal	Function	Conductor colour	RJ 45 pin no. right	RJ 45 pin no. left	
		TD+	Transmission Data+	Yellow	1	1	
		TD-	Transmission Data-	Orange	2	2	
		RD+	Receiver Data+	White	3	3	
		RD-	Receiver Data-	Blue	6	6	
Standard System Cable for Industrial Ethernet Length: 1.5 m 3.0 m 5.0 m	09 45 751 1123 09 45 751 1125 09 45 751 1127	Cable typ	be: Industrial Ether 2 x 2 x AWG 22	met Standar 2/1, star qua	d Cable, d, double	shielding	
10.0 m 20.0 m 50.0 m 100.0 m	09 45 751 1151 09 45 751 1153 09 45 751 1156 09 45 751 1161	Sneath: Connecto	ors: 2 x HARTING F with IDC fast te	5.5 mm RJ Industrial ermination te	<sup>®</sup> IP 20 D chnology	ata	
Stranded System Cable for Industrial Ethernet Length: 1.5 m 3.0 m 5.0 m	09 45 751 0023 09 45 751 0025 09 45 751 0027	Cable typ	De: Industrial Ether 2 x 2 x AWG 22	net Strande 2/7, star qua	d Cable, d, double	shielding	
10.0 m 20.0 m 50.0 m 100.0 m	09 45 751 0051 09 45 751 0053 09 45 751 0056 09 45 751 0061	Connecto	ors: 2 x HARTING F with IDC fast te	RJ Industrial <sup>®</sup> rmination te	<sup>®</sup> IP 20 Da chnology	ata	
Trailing System Cable for Industrial Ethernet Length: 1.5 m 3.0 m 5.0 m	09 45 751 1164 09 45 751 1166 09 45 751 1166 09 45 751 1168	Cable typ	be: Industrial Ether 2 x 2 x AWG 22	rnet Trailing ( 2/7, star qua	Cable, d, double	shielding	
10.0 m	09 45 751 1173	Sheath:	PUR green, Ø	6.5 mm			
20.0 m 50.0 m 100.0 m	09 45 751 1175 09 45 751 1178 09 45 751 1183	Connecto	ors: 2 x HARTING F with IDC fast te	RJ Industrial <sup>6</sup> rmination te	<sup>®</sup> IP 20 D chnology	ata	02
							VI

Further system cables available on request.

Stock items in bold type

PROFO<sup>®</sup> Industrial ethernet INETO

System cables RJ Industrial overmoulded IP 20

Description Part No. Technical characteristics Transmission properties in System Cables accordance with ISO/IEC for Industrial Ethernet, Class D 11 801:2002: pre-assembled at both ends 2 x RJ 45 in acc. with IEC 60603-7 Mating face: Protecion level: IP 20 (when mated) for the cabling of Industrial Ethernet networks in accordance with the PROFINET Electrical characteristics at 20 °C guideline, based on RJ 45 connectors. Contact resistance:  $\leq$  20 m $\Omega$ Insulation resistance: ≥ 500 MΩ Applications: control cabinets and industrial environments with low environmental Dielectric withstanding voltage: 1 kV contact - contact stress on the connector. 1.5 kV contact - ground Electrical characteristics after damp heat cycles Contact resistance:  $\leq$  20 m $\Omega$ Insulation resistance:  $\geq$  100 M $\Omega$ Dielectric withstanding voltage: contact - contact 1 kV contact - ground 1.5 kV Standard System Cable for Industrial Ethernet Length: 1.5 m 09 45 771 0023 Industrial Ethernet Standard Cable, overmoulded Cable type: 09 45 771 0025 3.0 m 2 x 2 x AWG 22/1, star quad, double shielding 09 45 771 0027 5.0 m 09 45 771 0051 10.0 m Sheath: PVC green, Ø 6.5 mm 09 45 771 0053 20.0 m Connectors: 2 x HARTING RJ Industrial® IP 20 Data 09 45 771 0056 50.0 m with overmoulded housings 100.0 m 09 45 771 0061 Stranded System Cable for Industrial Ethernet 09 45 771 1123 Length: 1.5 m overmoulded Cable type: Industrial Ethernet Stranded Cable, 3.0 m 09 45 771 1125 2 x 2 x AWG 22/7, star quad, double shielding 5.0 m 09 45 771 1127 10.0 m 09 45 771 1151 Sheath: PVC green, Ø 6.5 mm 20.0 m 09 45 771 1153 2 x HARTING RJ Industrial® IP 20 Data Connectors: 50.0 m 09 45 771 1156 with overmoulded housings 100.0 m 09 45 771 1161 Trailing System Cable for Industrial Ethernet Length: 1.5 m 09 45 771 1164 overmoulded Cable type: Industrial Ethernet Trailing Cable. 3.0 m 09 45 771 1166 2 x 2 x AWG 22/7, star quad, double shielding 5.0 m 09 45 771 1168 10.0 m 09 45 771 1173 Sheath: PUR green, Ø 6.5 mm 09 45 771 1175 20.0 m 2 x HARTING RJ Industrial® IP 20 Data Connectors: 50.0 m 09 45 771 1178 with overmoulded housings 09 45 771 1183 100.0 m

Eurther system

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Further system cables available on request.
System cables				Available Q4/2005		HARTING	
		-					
RJ Industrial overmoulded IP 20							bystem
Description System Cables for Industrial Ethernet, pre-assembled at both ends for the cabling of Industrial Ethernet net- works in accordance with the PROFINET guideline, based on RJ 45 connectors. Applications: control cabinets and industri- al environments with low environmental stress on the connector.	Part No.	Technica Transmis accordar 11 801:20 Mating fa Protecion Pin assi Signal	I characteristics sion properties in nee with ISO/IEC 002: Cl ace: 2 n level: IP gnment in accordance Function	ass D x RJ 45 in a 20 (when m with PROF Conductor colour	cc. with IE nated) FINET sp RJ 45 pin no. right	EC 60603-7 ecification: RJ 45 pin no. left	
Overmoulded housings can be supplied with left, upper or lower entry as well.		TD+ TD- RD+ RD-	Transmission Data+ Transmission Data- Receiver Data+ Receiver Data-	Yellow Orange White Blue	1 2 3 6	1 2 3 6	
Standard System Cable for Industrial Ethernet overmoulded 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m 100.0 m	09 45 771 4023 09 45 771 4025 09 45 771 4027 09 45 771 4051 09 45 771 4053 09 45 771 4056 09 45 771 4061	Cable typ Sheath: Connecte	be: Industrial Ether 2 x 2 x AWG 2 PVC green, Ø brs: 2 x HARTING I with overmould right entries	rnet Standar 2/1, star qua 6.5 mm RJ Industrial led housings	d Cable, d, double ® IP 20 D s, 90° ang	e shielding ata Iled,	
Stranded System Cable for Industrial Ethernet overmoulded 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m 100.0 m	09 45 771 4123 09 45 771 4125 09 45 771 4127 09 45 771 4127 09 45 771 4151 09 45 771 4153 09 45 771 4156 09 45 771 4161	Cable typ Sheath: Connecte	be: Industrial Ether 2 x 2 x AWG 2 PVC green, Ø brs: 2 x HARTING I with overmould right entries	rnet Strande 2/7, star qua 6.5 mm RJ Industrial led housings	d Cable, d, double ® IP 20 D s, 90° ang	e shielding ata Iled,	
Trailing System Cable for Industrial Ethernet overmoulded 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m 100.0 m	09 45 771 4164 09 45 771 4166 09 45 771 4168 09 45 771 4173 09 45 771 4175 09 45 771 4178 09 45 771 4178	Cable typ Sheath: Connecte	be: Industrial Ether 2 x 2 x AWG 2 PUR green, Ø brs: 2 x HARTING I with overmould right entries	rnet Trailing 2/7, star qua 6.5 mm RJ Industrial led housings	Cable, d, double ® IP 20 D s, 90° ang	e shielding ata Jled,	02

Further system cables available on request.

# System cables



System cables

#### RJ Industrial Fieldpatch IP 67 Push Pull

Description	Part No.	Technical	characteristics			
Description System Cables for Industrial Ethernet, pre-assembled at both ends for the cabling of Industrial Ethernet net- works in accordance with the PROFINET guideline, based on RJ 45 connectors. Applications: industrial environments with high environmental stress, small mounting dimensions and frequent mating cycles.	Part No.	Technical Transmiss accordan 11 801:20 Mating fa Protecion Pin assig Signal TD+ TD- RD+	characteristics sion properties in ce with ISO/IEC 02: C ce: 2 level: 1 Inment in accordanc Function Transmission Data+ Transmission Data- Receiver Data+	Class D 2 x RJ 45 in ac P 67/65 (when e with PROF Conductor colour Yellow Orange White	CC. with IE mated) TINET spectrum RJ 45 pin no. right 1 2 3	C 60603-7 ecification: RJ 45 pin no. left 1 2 3
		RD-	Receiver Data-	Blue	6	6
Standard System Cable for Industrial Ethernet Length: 1.5 m 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m 100.0 m Stranded System Cable for Industrial Ethernet Length: 1.5 m	09 45 745 1123 09 45 745 1125 09 45 745 1127 09 45 745 1151 09 45 745 1153 09 45 745 1156 09 45 745 1161	Cable typ Sheath: Connecto	e: Industrial Etho 2 x 2 x AWG 2 PVC green, 2 rs: 2 x HARTING with IDC fast technology	ernet Standard 22/1, star quad 6.5 mm RJ Industrial <sup>6</sup> termination ar	d Cable, d, double <sup>®</sup> IP 67 Pt nd locking	shielding ısh Pull
Ior industrial Ethemiet         Length:         1.5 m           3.0 m         5.0 m           10.0 m         20.0 m           50.0 m         100.0 m	09 45 745 1164 09 45 745 1166 09 45 745 1168 09 45 745 1173 09 45 745 1175 09 45 745 1178 09 45 745 1183	Cable typ Sheath: Connecto	e: Industrial Ethe 2 x 2 x AWG 2 PVC green, 2 rs: 2 x HARTING with IDC fast technology	ernet Stranded 22/7, star quad 6.5 mm RJ Industrial <sup>6</sup> rermination ar	d Cable, d, double <sup>®</sup> IP 67 Pu nd locking	shielding ısh Pull
Trailing System Cable for Industrial Ethernet Length: 1.5 m 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m 100.0 m	09 45 745 0023 09 45 745 0025 09 45 745 0027 09 45 745 0051 09 45 745 0053 09 45 745 0056 09 45 745 0061	Cable typ Sheath: Connecto	e: Industrial Etho 2 x 2 x AWG 2 PUR green, Ø rs: 2 x HARTING with IDC fast technology	ernet Trailing ( 22/7, star qua 6.5 mm RJ Industrial <sup>(</sup> ermination ar	Cable, d, double <sup>®</sup> IP 67 Pu nd locking	shielding ush Pull

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System cables						HARTING	
		/					
	-						
   RJ Industrial Fieldpatch IP 67 Pus	h Pull / IP 20						
							stem
Description	Part No.	Technica	l characteristics				S
System Cables for Industrial Ethernet, pre-assembled at both ends		Transmis accordar 11 801:20	sion properties in nce with ISO/IEC 002: Cl	ass D			
for the colling of Industrial Ethernot not		Mating fa	ice: 2	x RJ 45 in ac	cc. with IE	EC 60603-7	
works in accordance with the PROFINET		Protecior	n level: IP	67/65 (whe	n mated)		
Applications industrial environmentors.		Pin assi	gnment in accordance	with PROF	INET sp	ecification:	
high environmental stress, small mounting dimensions and frequent mating cycles.		Signal	Function	Conductor colour	RJ 45 pin no. right	RJ 45 pin no. left	
		TD+	Transmission Data+	Yellow	1	1	
		TD-	Transmission Data-	Orange	2	2	
		RD+	Receiver Data+	White	3	3	
		RD-	Receiver Data-	Blue	6	6	
Standard System Cable for Industrial Ethernet Length: 1.5 m 3.0 m	09 45 701 1123 09 45 701 1125	Cable typ	be: Industrial Ether 2 x 2 x AWG 2	rnet Standar 2/1, star qua	d Cable, d, double	shielding	
5.0 m	09 45 701 1127	Sheath:	PVC green, Ø	6.5 mm			
10.0 m	09 45 701 1151	Connecto	ors: 1 x HARTING I	RJ Industrial	<sup>®</sup> IP 67 P	ush Pull	
50.0 m	09 45 701 1153					) ata	
100.0 m	09 45 701 1161		with IDC fast te	ermination te	chnology	ala	
Stranded System Cable for Industrial Ethernet Length: 1.5 m	09 45 701 1164	Cable typ	be: Industrial Ether	rnet Strande	d Cable,		
3.0 m	09 45 701 1166		2 x 2 x AWG 22	2/7, star qua	d, double	shielding	
5.0 m 10.0 m	09 45 701 1168 09 45 701 1173	Sheath:	PVC green, Ø	6.5 mm	_		
20.0 m	09 45 701 1173 09 45 701 1175	Connecto	ors: 1 x HARTING I with IDC fast te	RJ Industrial	IP 67 P Ind locking	ush Pull I	
50.0 m	09 45 701 1178		technology 1 x HARTING I	RJ Industrial	® IP 20 D	ata	
100.0 m	09 45 701 1183		with IDC fast te	ermination te	chnology		
Trailing System Cable for Industrial Ethernet Length: 1.5 m 3.0 m	09 45 701 0023 09 45 701 0025	Cable typ	be: Industrial Ether 2 x 2 x AWG 22	rnet Trailing ( 2/7, star qua	Cable, d, double	shielding	
5.0 m	09 45 701 0027	Sheath:	PUR green, Ø	6.5 mm			
10.0 m	09 45 701 0051	Connecto	ors: 1 x HARTING I	RJ Industrial	® IP 67 P	ush Pull	
20.0 m	09 45 701 0053 09 45 701 0056		technology	ermination ar			
100.0 m	09 45 701 0061		1 x HARTING I with IDC fast te	ermination te	chnology	ata	02
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Further system cables available on request.

Stock items in bold type

System cables

#### System cables

#### RJ Industrial Fieldpatch IP 67 Data 3A



System cables						HARTING	
	8.						
RJ Industrial Fieldpatch IP 67 Hy	brid						Eø
Description	Part No.	Technica	l characteristics				Systel cable
System Cables for Industrial Ethernet, pre-assembled at both ends for the cabling of Industrial Ethernet net- works in accordance with the PROFINET		Transmis accordar 11 801:20 Sheath: Mating fa	sion properties in nce with ISO/IEC 002: C F nce: 2 p	lass D RNC green, s x RJ 45 in ad lus 4 x powel	Ø 10.3 mr cc. with IE r supply	n C 60603-7	
guideline, based on RJ 45 connectors.		Protecior	n level: IF	P 67/65 (whe	n mated)		
the need for simultaneous data and energy supply and with a high environmental stress on the connector.		Pin assignal	gnment in accordance	Conductor	-INE I spe RJ 45 pin no.	RJ 45 pin no.	
		TD+	Transmission Data+	Yellow	ngni 1	1	
		TD-	Transmission Data-	Orange	2	2	
		RD+	Receiver Data+	White	3	3	
		RD-	Receiver Data-	Blue	6	6	
Hybrid System Cable for Industrial Ethernet Length: 1.5 m 3.0 m 5.0 m 10.0 m 20.0 m 50.0 m 100.0 m	09 45 725 1323 09 45 725 1325 09 45 725 1327 09 45 725 1351 09 45 725 1353 09 45 725 1356 09 45 725 1361	Cable typ	be: Industrial Ethe 2 x 2 x AWG 2 brs: 2 x HARTING with IDC fast t	rnet Hybrid ( 2/7 plus 4 x p RJ Industrial ermination te	Cable, power sup ® IP 67 Hy chnology	iply /brid	
							02 13

## System cables



M12 D-Coding IP 67

Description Part No. **Technical characteristics** Cable type: Shielded Twisted Pair **System Cables** Standard Cable for Industrial Ethernet, Transmission properties in pre-assembled at both ends accordance with ISO/IEC 11 801:2002: Class D, 100% tested for the cabling of Industrial Ethernet net-Mating face: M12 D-Coding in accordance works in accordance with the PROFINET with IEC 61 076-2-101 guideline, based on circular connectors Protection level: IP 65/67 (when mated) M12 D-coded. Pin assignment in accordance with PROFINET specification: Signal Function Conductor Pin no. colour TD+ Transmission Data+ Yellow 1 TD-3 Transmission Data-Orange RD+ White 2 Receiver Data+ RD-Blue 4 **Receiver Data-**2 x circular connector M12 D-Coding, straight Length:1 m 21 03 483 1401 3 m 21 03 483 1403 5 m 21 03 483 1405 Cable: AWG 26 / 0.14 mm<sup>2</sup> 21 03 483 14001) Male /lale 2 x circular connector M12 D-Coding, angled Length:1 m 21 03 483 3401 Length 3 m 21 03 483 3403 5 m 21 03 483 3405 21 03 483 34001 2 x circular connector M12 D-Coding, straight Length:1 m 21 03 485 1401 21 03 485 1403 3 m 21 03 485 1405 5 m Cable: AWG 22 / 0.34 mm<sup>2</sup> 21 03 485 14001) Male /lale 2 x circular connector M12 D-Coding, angled Length:1 m 21 03 485 3401 Length 3 m 21 03 485 3403 5 m 21 03 485 3405 21 03 485 3400<sup>1</sup> in accordance with PROFINET installation guide

System cables

<sup>1)</sup> Mention length separately

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14



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Further system cables available on request.



	System cables			Available Q3/2005
u s	Housing with integrated patch cab	le		
Syste cable	Description	Part No.	Technical chara	cteristics
	System Cables for Industrial Ethernet, pre-assembled at both ends for the application neutral cabling of Indus- trial networks in accordance with ISO/IEC 11 801, based on RJ 45 connectors.		Transmission pr accordance with 11 801:2002: Sheath: Mating face:	roperties in h ISO/IEC Class D PVC green, Ø 6.8 mm RJ 45 in acc. with IEC 60603-7
	Housing IP 67 Push Pull / IP 20 Length: 1.5 m 3.0 m 5.0 m	09 45 751 0123 09 45 751 0125 09 45 751 0127	Housing: Connector:	IP 67 Push Pull HARTING RJ Industrial® IP 20 Data, 4 pairs
	Housing IP 67 Data 3A / IP 20 Length: 1.5 m 3.0 m 5.0 m	09 45 715 0123 09 45 715 0125 09 45 715 0127	Housing: Connector:	IP 67 Data 3A metal, grey HARTING RJ Industrial® IP 20 Data, 4 pairs
02				

Contents	chapter	03
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Connectors

Connectors	Page	
HARTING RJ Industrial® – RJ 45 connectors		
General information	03.02	S
IP 20 Data connectors	03.05	Connecto
IP 67 Push Pull connectors / panel feed through	03.06	
IP 67 Data 3A connectors / panel feed through	03.09	
IP 67 Hybrid connectors / panel feed through	03.13	
4 pairs Category 6 connectors, Gigalink	03.16	
Han-Max connectors	03.22	
HARAX® M12 connectors		
Technical characteristics	03.24	
HARAX <sup>®</sup> circular connector M12-L, shielded	03.25	
Customer specific connectors		
Han-Brid® Quintax 3A	03.26	
Accessories	03.28	03 01

#### **RJ** Industrial

General information

HARTIN



#### HARTING RJ Industrial<sup>®</sup> Ethernet connector family

The modular HARTING RJ Industrial® family of connectors is based on the standard RJ 45 connector pattern, and is specifically developed for use in harsh industrial environments. It points the way forward in connecting Ethernet devices in industrial applications. In many circumstances it is necessary for connectors to be assembled on site, regardless of whether they are being used for power or communication. HARTING is making consistent use of their HARAX® rapid termination technology, which has been proven in many industrial applications. With HARAX® the user can terminate the cable at the connectors without the need for special tools. The design of the HARTING RJ Industrial® family of connectors allows for quick and easy termination and connection to Ethernet devices in either data only or hybrid networks.

HARTING RJ Industrial<sup>®</sup> is the first RJ 45 connector in the world that allows robust Ethernet cables with a solid and stranded AWG 22 cross section to be connected using IDC technology. The heart of each of these connectors is the RJ 45 data module with fast termination technology. This functions without needing to prestrip insulation from the cores and without special tools, creating a gas-tight connection, which is secure against vibration. The data module has four *HARAX*<sup>®</sup> fast termination contacts. These make reliable contact with stranded, industrystandard Category 5 cables with dimensions from AWG 22 to 24, and solid cables with conductor cross-sections from AWG 22 to 23.

HARTING has developed a complete family of connectors around this innovative data module, meeting all the needs of industrial environments. Solutions for IP 20 and IP 67 protection levels, standard, push pull and latching clip-locks are available.



Data and hybrid cables can be used. The user can fit stranded cores with a cross section of 1.5 mm<sup>2</sup> for the IDC power contacts on the Hybrid version, and these can be loaded with up to 16 A.

At the device end, panel feed throughs or couplings integrated directly into the device can be accomodated. Consistent application of SMD components for both data and power at the device end keeps manufacturing costs low, and permits high packing density within the assembly.

# Field assembly of Industrial Ethernet connectors

The facility of on-site assembly was given high priority in the development of the new HARTING RJ Industrial<sup>®</sup> family of connectors. As a result, the connector is not just faster to terminate, but is also easier to handle due to the reduced number of individual parts.

All of the HARTING RJ Industrial<sup>®</sup> range connectors can be re-terminated up to ten times. An electrician can carry out assembly of the IP 20 Data version on site in less than one minute, while the IP 67 Hybrid version requires less than three minutes. Dismantling is just as quick. New personnel can also learn the individual steps involved very quickly and carry them out reliably.

Another advantage of the quick-connection technology is provided by the industrial-quality shielding of the data module in the connector. Termination of the shield which in the past has been achieved by crimping is no longer necessary. In the RJ Industrial connection technology,

a pair of shielding plates are simply pushed over the data module, and pressed together with an audible "click". With this, complete, 360 degree connection of the shield and the sheath is achieved.

Various special tools for handling the RJ 45 data module and the power leads are unnecessary. HARTING supplies all the necessary components in a complete set.

#### General information



#### **Specified for PROFINET**



From the very beginning, HARTING saw it as its task to set a broad standard for Ethernet in industrial environments through a uniform connector solution. Through its involvement in the PNO (PROFIBUS Nutzerorganisation e.V.), the IAONA (Industrial Automation Open Networking Alliance e.V.), the DKE (Deutsche Kommission Elektrotechnik Elektronik Informationstechnik) and also with the IEC (International Electrotechnical Committee), HARTING contributed to advancing the specification of industry-standard Ethernet connectors. At the beginning of 2003, the PNO decided to use the HARTING solution of the RJ Industrial family as the general concept for PROFINET.

In addition to this an international standardisation process was initiated, because the HARTING approach is not a proprietary system, but an open solution for Industrial Ethernet interfaces.

			Device side		
		IP 20 Data Standard RJ 45 jack	IP 67 Push Pull	IP 67 Hybrid	IP 67 Data 3A
	IP 20 Data				
Cable side	IP 67 Push Pull				
	IP 67 Hybrid				
	IP 67 Data 3A				

Mating compatibility of the HARTING RJ Industrial® family



#### Assembly operations HARTING RJ Industrial<sup>®</sup> IP 20 Data

Only a few steps are necessary to quickly and reliably connect an Industrial Ethernet cable to a HARTING RJ Industrial<sup>®</sup> connector with IDC connection technology.

- 1 Push the housing complete with cable gland over the outer insulation of the cable
- (2) Strip the correct length of outer insulation and shielding braid
- (3) Prepare the cores to match the splicing piece in accordance with the colour code
- (4) Insert the cores into the splicing piece to the required depth
- (5) Place the splicing piece on the RJ 45 data module and engage it

- (6) Place the data module and the splicing piece into the supplied IDC assembly tool
- (7) Press the data module and the IDC assembly tool together, to make the insulation displacement contact
- (8) Remove the assembled data module from the IDC assembly tool
- (9) Put on the upper shield plate, and push it over the cable shield
- (10) Put the lower shield plate in place, and latch it to the upper shield plate with an audible click
- (11) Push the housing over the assembled data module, latching it into place with an audible click
- (12) Tighten the cable gland



# **RJ** Industrial Connectors <u>PROF</u>O nnett IP 20 Data connectors

# Connectors

Dimensions in mm

# Drawing Connector set Mating face compatible to IEC 60603-7 incl. housing, cable gland and instruction manual В A 09 45 151 1100 13,97 max N\*2

Part No.

# **Technical characteristics**

Identification

Transmission properties in accordance with Category 5 ISO/IEC 11 801:2002 and EN 50173-1

Protection level:	IP 20
-------------------	-------

Mating interface: RJ 45 in accordance with IEC 60603-7

Wire gauge data<sup>1)</sup>: AWG 22 - 24 stranded AWG 22 - 23 solid

-40 °C ... +70 °C Temperature range:

Cable sheath diameter: 6.5 mm - 6.9 mm

Mating cycles: min. 750

Housing material: Polycarbonate, black UL 94-V0

# General information

The IP 20 Data connector complies with the requirements of industrial applications. This RJ 45 Ethernet connector can be connected to AWG-22 cables with IDC technology and is designed with a standard pitch of just 14 mm, which guarantees maximum packing density in the application. An additional latching clip on the housing makes its significantly easier to unlock the connector.

This connector can be assembled on site, permitting Industrial Ethernet installation cable to be connected directly to IP 20 devices located inside a control cabinet. A special panel feed through to provide the transition between protection level IP 67 and IP 20 is therefore not necessary. This lessens the installation work required from the customer, while the reduced number of contact points offers increased reliability.

1) Details see technical data sheet

#### Connectors

#### **RJ** Industrial

PROFO® Indiatal Engine



#### IP 67 Push Pull connectors

Identification	Part No.	Drawing Dimensions in mm
Connector set incl. housing, cable gland and instruction manual	09 45 145 1100	mox.2,35 mox.2,35 mox.2,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox.20,15 mox
Protection cover for connectors with cord, IP 67/65	09 45 845 0001	mating face compatible to IEC 60603-7 $C_{1, Ne, 5}$ $C_{1, Ne, 5}$ $C_{2, Ne, 5}$ $C_{1, Ne, 5}$

## **Technical characteristics**

Transmission properties in accordance with Category 5 ISO/IEC 11 801:2002 and EN 50173-1

Protection level:	IP 67/65
Mating interface:	RJ 45 in accordance with IEC 60603-7
Wire gauge data <sup>1)</sup> :	AWG 22 - 24 stranded AWG 22 - 23 solid
Temperature range:	-40 °C +70 °C
Cable sheath diameter:	6.5 mm - 8.6 mm
Mating cycles:	min. 750
Housing material:	Polyamide, black UL 94-V0

#### General information

The IP 67 Data version in a push pull housing is fitted with innovative housing locking technology. The housing of the connector is locked tightly to the hood by means of a locking sleeve that surrounds it. The connector can be locked and unlocked using one hand and only minimal force. In spite of its high degree of protection, the housing is very compact, and is ideally suited for compact industrial applications.

The HARTING RJ Industrial<sup>®</sup> Push Pull is thus the smallest IP 67/65 Industrial Ethernet connector based on RJ 45 with IDC connection technology in the world.

03 06



Technical characteristics and general information see page 03.08

Stock items in bold type

. 17

Connectors

# **RJ** Industrial

Connectors

HARTING

#### PROFU<sup>®</sup> NETO







IP 67 Push Pull panel feed through

#### **Technical characteristics**

Transmission properties in accordance with Category 5 ISO/IEC 11 801:2002 and EN 50173-1

Protection level:	IP 67/65
Mating interface internal and external:	RJ 45 jack in accordance with IEC 60603-7
Temperature range:	-40 °C +70 °C
Panel cut out:	21 x 27 mm
Fixing hole:	M2.5
Mating cycles:	min. 750
Housing material:	Polyamide, black
Material RJ 45 panel feed through:	Metal

## General information

The IP 67 Data version in a push pull housing is fitted with innovative housing locking technology. The housing of the connector is locked securely to the hood by means of a surrounding locking sleeve. In spite of the high degree of protection, the panel feed through is very compact, having a space requirement of just 21 x 27 mm, the same space as for a M12 connector.

The Push Pull panel feed through is compatible with RJ 45 connectors, which means that standard patch cables for service and test purposes can also be used here.

The data lines are connected at the rear via an RJ 45 jack meeting IP 20.

Optional the push pull interface can be integrated in the device directly, thus preventing the use of rear side data lines.



Stock items in bold type

)3 . .

Connectors

#### **RJ** Industrial

Connectors

Connectors



IP 67 Data 3A connectors

#### **Technical characteristics**

Transmission properties in accordance with Category 5 ISO/IEC 11 801:2002 and EN 50173-1

Protection level:	IP 67/65
Mating interface:	RJ 45 in accordance with IEC 60603-7
Wire gauge data <sup>1)</sup> :	AWG 22 - 24 stranded AWG 22 - 23 solid
Temperature range:	-40 °C +70 °C
Cable sheath diameter:	6.5 mm - 6.9 mm
Mating cycles:	min. 500
Plastic housing material <sup>2)</sup> :	Polyamide, black UL 94-V0
Standard metal housing material <sup>2)</sup> : Metal housing M	Zinc die cast, grey
material <sup>2</sup> ):	Zinc die cast, alodined, powder coating, black

#### General information

The IP 67 Data version of the RJ Industrial is based on the RJ 45 Data module, integrated into a standard Han<sup>®</sup> 3A industry housing that can be used for most industrial applications. The housing is available in plastic or metal, and offers protection level IP 67/65.

RJ Industrial is available in Han<sup>®</sup> M housings for higher environmental stress as well.

Implementing a uniform pattern for all the connectors based on the Han<sup>®</sup> 3A contour for data and hybrid solutions means that all versions are plug-compatible for data signals. Optional coding prevents incorrect mating up to four different connectors.

<sup>1)</sup> Details see technical data sheet

<sup>2)</sup> Details see catalogue "Industrial Connectors Han®"



Technical characteristics and general information see page 03.12

Stock items in bold type

#### **RJ** Industrial

#### Connectors

HAR

#### PROFI Industrial etherate NETO



IP 67 Data 3A panel feed through

#### **Technical characteristics**

Transmission properties in accordance with Category 5 ISO/IEC 11 801:2002 and EN 50173-1

Protection level: IP 67/65

Mating interface

internal and external: RJ 45 jack in accordance with IEC 60603-7

Panel cut out: 22 x 22 mm

Temperature range: -40 °C ... +70 °C

Mating cycles: min. 500

Plastic housing material<sup>1</sup>): Polyamide, black UL 94-V0 Standard metal housing material<sup>1</sup>): Zinc die cast, grey Metal housing M material<sup>1</sup>): Zinc die cast, alodi

Zinc die cast, alodined, powder coating, black

#### General information

The IP 67 panel feed through data version of the RJ Industrial is based on an RJ 45 jack, integrated into a Han<sup>®</sup> 3A housing that can be used for most industrial applications. The housing is available in plastic or metal, and offers protection level IP 67/65.

RJ Industrial is available in Han<sup>®</sup> M housings for higher environmental stress as well.

Implementing a uniform plug pattern for all the connectors based on the 3A contour for data and hybrid solutions means that all versions are plug-compatible for data signals. Optional coding prevents incorrect mating up to four different connectors. The panel feed through is compatible with RJ 45 connectors, which means that standard patch cables for service and test purposes can be used. The data lines are connected at the rear via an RJ 45 jack meeting IP 20.

03

#### Connectors

Connectors

#### **PROFO**<sup>®</sup> nnett

**RJ** Industrial

#### IP 67 Hybrid connectors



#### **Technical characteristics**

Transmission properties in accordance with Category 5 ISO/IEC 11 801:2002 and EN 50173-1

Protection level:	IP 67/65
Mating interface:	RJ 45 in accordance with IEC 60603-7 plus 4 x power supply
Wire gauge data:	AWG 22 - 24 stranded AWG 22 - 23 solid
Wire gauge power supply:	1.5 mm <sup>2</sup> stranded
Working voltage power supply:	48 V
Working current power supply:	see derating curve
Temperature range:	-40 °C +70 °C
Cable sheath diameter:	10 mm - 11 mm
Mating cycles:	min. 500
Housing material:	Polyamide, black UL 94-V0

# General information

With the RJ Industrial Hybrid connector, HARTING has developed an interface solution that integrates the data lines and the power supply into one connector for hybrid Ethernet networks. The connector's geometry nevertheless maintains a clear separation between the data and the power contacts. This brings a significant reduction in the costs of installation and of field devices suitable for industrial application with hybrid cabling.

The four power contacts of the hybrid module have also been designed with HARAX® rapid termination technology, allowing stranded cables of up to 1.5 mm<sup>2</sup> to be connected.

Derating curve "Power contacts"

2 Derating



Stock items in bold type

03

13



Technical characteristics and general information see page 03.15

Connectors

Stock items in bold type

## **RJ** Industrial

#### Connectors



PROFO INTOSTRIAL ETHERNET







IP 67 Hybrid panel feed through

#### **Technical characteristics**

Transmission properties in accordance with Category 5 ISO/IEC 11 801:2002 and EN 50173-1

Protection level:	IP 67/65
Mating interface external:	RJ 45 jack in accordance with IEC 60603-7 plus 4 x power supply
Mating interface internal:	RJ 45 jack in accordance with IEC 60603-7 plus 4 x power supply with cage clamp 1.5 mm <sup>2</sup>
Working voltage power supply:	48 V
Working current power supply:	see derating curve on page 03.13
Panel cut out:	22 x 22 mm
Temperature range:	-40 °C +70 °C
Mating cycles:	min. 500
Housing material:	Polyamide, black UL 94-V0
panel feed through:	Metal

#### General information

With the RJ Industrial Hybrid connector, HARTING has developed an interface solution that integrates the data lines and the power supply into one connector for hybrid Ethernet networks. The connector's geometry nevertheless maintains a clear separation between the data and the power contacts. This brings a significant reduction in the costs of installation and of field devices suitable for industrial application with hybrid cabling.

The panel feed through is compatible with RJ 45 connectors, which means that the standard patch cables for service and test purposes can be used. The data lines are connected at the rear via an RJ 45 jack, while the power lines use a cage clamp terminal.

Optional the hybrid interface can be integrated in the device directly, thus preventing the use of rear side data lines.

#### HARTING RJ Industrial<sup>®</sup> 4 pair

The HARTING RJ Industrial<sup>®</sup> Gigalink more than meets the tough requirements of Category 6 according to TIA/EIA 568 B.2-1:2002-06, EN 50173-1:2002 and ISO/IEC 11801:2002-09.

The integrated cable management system with simultaneous wiring radically reduces installation times in comparison with existing systems. The cable manager, which can be colour-coded, supports the simultaneous insertion of the cable strands, so avoiding the time-consuming manual placement of the individual conductors.

The RJ Industrial includes an integrated cable adjustment system, such that a high quality connection is maintained in tough industrial environments over long periods, even under conditions of heavy vibration. This ensures that the shielded twisted cores are reliably guided to their contacts within the connector. Without this innovation it would be possible for the shielding braid of the individual conductors to separate, resulting in a long-term deterioration in the crosstalk characteristic of the connector and therefore of the entire transmission line. The HARTING RJ Industrial<sup>®</sup> also exceeds the clearance and creepage requirements for industrial environments.

#### **Connector family**

Because of the innovative platform strategy implemented in the RJ Industrial Gigalink data module, all the other products in the RJ Industrial product family can also be used for Gigabit Ethernet.

This makes Gigabit Ethernet with Real CAT 6 also possible with IP 67 protection.



The used CAT 6 data module adapter fits into the shielding plates of the 4 core data module with quick-connection technology. For this reason an existing 100 Mbit Fast Ethernet transmission line with HARTING RJ Industrial<sup>®</sup> connectors can easily be converted into a 1000 Mbit Gigabit Ethernet transmission line, without having to modify the connector's interface. This makes the HARTING RJ Industrial<sup>®</sup> connector family as future-proof as possible.

# Minimising cross-connection through wire management

There is no difference under Gigabit Ethernet between uplink and downlink ports. Every network device automatically recognises whether the device to which it is connected is a network card or a switch. There is therefore no need for cross-connected and throughconnected cables found under 100 Mbit Fast Ethernet, where this functionality is not available.

The symmetrical structure of a 1:1 through-wired patch cable results in crossing of the wire pairs 2 and 4. This has a negative effect on the near-end crosstalk of the transmission route. For performance reasons, a symmetrical crossing of the pairs must be realized as near as possible to the connector. This is achieved by the colour-coded wire managers, which lead the conductor pairs in a defined way to the connection points on the RJ 45 jack (see figure "Wire manager"). Crossing the cross-connection in the cable manager instead of in the cable itself, so contributing to the high performance of the transmission route.



Connection of core pairs

#### Wiring the data module

For historical reasons, TIA/EIA 568:2002 has two ways to connect the conductors at the connector. These describe which individual colour-coded conductors are to be brought to which contact in the connector.

- TIA/EIA 568:2002 A is the most common connection variant. This configuration is also described in ISO IEC 11801.
- The TIA/EIA 568:2002 B connection variant is primarily used for the connection of ISDN networks (AT&T configuration).



Connection in acc. with TIA/EIA 568B (AT&T configuration)

The RJ 45 jack must be connected according to the appropriate scheme, depending on the application. For Gigabit Ethernet the connection is only to be made at the RJ 45 jack, not at the plug, since the conductor pairs in the patch leads are symmetrically routed due to the 1:1 auto-crossing.







#### **Technical characteristics**

Transmission properties in accordance with Category 6 ISO/IEC 11 801:2002 and EN 50173-1

Protection level:	IP 20
Mating interface:	RJ 45 in accordance with IEC 60603-7
Wire gauge data <sup>1)</sup> :	AWG 24-27 stranded
Temperature range:	-40 °C +70 °C
Cable sheath diameter:	6.5 mm - 6.9 mm
Mating cycles:	min. 750
Housing material:	Polycarbonate, black UL 94-V0

#### General information

The IP 20 data connector is an industrial type of RJ 45 connector for 4 pair and Gigabit Ethernet applications, to which flexible cables with AWG 26 may be connected.

The connector is optionally provided with a white or blue cable manager, so that optional Gigabit Ethernet crossover patch cables can be assembled.

With a standard pitch of only 14 mm, maximum packing density in application is guaranteed.

This connector can be assembled on site, permitting industrial Ethernet installation cables to be connected directly to IP 20 devices located inside a control cabinet. A special panel opening to provide the transition between protection class IP 67 and IP 20 is therefore not necessary. This reduces the installation work required from the customer, while the reduced number of contact points increases reliability.



#### **Technical characteristics**

Transmission properties in accordance with Category 6 ISO/IEC 11 801:2002 and EN 50173-1

Protection level: IP 67/65

Mating interface: RJ 45 in accordance with IEC 60603-7

Wire gauge data<sup>1</sup>): AWG 24-27 stranded

Temperature range: -40 °C ... +70 °C

Cable sheath diameter: 6.5 mm - 8.6 mm

Mating cycles: min. 750

Housing material: Polyamide, black UL 94-V0

## General information

contact no. 8

The IP 67 data version in push pull housing is fitted with innovative housing locking technology. The housing of the connector is locked tightly to the coupling by means of a surrounding locking sleeve. The connector can be locked and unlocked using one hand and only a little force. In spite of its high degree of protection, the housing is very compact, and is ideally suited for compact industrial applications.

contact no. 1

The HARTING RJ Industrial<sup>®</sup> Push Pull Category 6 is ideally suited to compact industrial applications that require 4 pair or Gigabit Ethernet wiring.

# RJ Industrial Gigalink Category 6

# Connectors

#### IP 67 Data 3A connectors, 4 pairs

Identification		Part No.	Drawing	Dimensions in mm
Connector set incl. housing, cable and instruction mar Plastic version Standard metal ver Metal version M Coding pin set	gland hual cable manager white <sup>1)</sup> cable manager blue <sup>1)</sup> sion cable manager white <sup>1)</sup> cable manager blue <sup>1)</sup> cable manager white <sup>1)</sup>	09 45 125 1500 09 45 125 1510 09 45 115 1500 09 45 115 1510 09 45 115 1502 09 45 115 1512 09 45 820 0000	mating face	e according to IEC 60 603-7
Protection cover f with cord, IP 67/65 Plastic version Standard metal ver Metal version M	for connectors	09 20 003 5442 09 20 003 5422 09 37 003 5402	Dimensions valid for t	35 -24 -24 -24 -24 -24 -24 -24 -24

#### **RJ** Industrial Gigalink

Connectors



IP 67 Data 3A connectors, 4 pairs

Category

#### **Technical characteristics**

Transmission properties in accordance with Category 6 ISO/IEC 11 801:2002 and EN 50173-1

Protection level:

Mating interface: RJ 45 in accordance with IEC 60603-7

IP 67/65

AWG 24-27 stranded Wire gauge data<sup>1</sup>):

Temperature range: -40 °C ... +70 °C

Cable sheath diameter: 6.5 mm - 6.9 mm

Mating cycles: min. 500

material<sup>2)</sup>:

Plastic housing material<sup>2</sup>): Polyamide, black UL 94-V0 Standard metal housing material<sup>2)</sup>:

Zinc die cast, grey Metal housing M Zinc die cast, alodined,

powder coating, black

# General information

The IP 67 Data version of the RJ Industrial is based on the RJ 45 Category 6 Data module, integrated into a standard Han<sup>®</sup> 3A industry housing that can be used in any industrial application. The housing is practically available in plastic or metal, and offers protection class IP 67/65.

RJ Industrial is available in Han® M housings for higher environmental stress as well.

Implementing a uniform connector pattern for all the connectors based on the 3A contour for data and hybrid solutions means that all versions are plug-compatible for data signals. Use of optional coding prevents up to four connectors being incorrectly mated.

The HARTING RJ Industrial® Data 3A Category 6 is ideally suited to harsh industrial applications that require 4 pair or Gigabit Ethernet wiring.



Technical characteristics and general information see page 03.23

Connectors

Han-Max	Connectors			
Han-Max connectors			C.M	
Technical characteristics				
Style	MAX <sup>®1)</sup> UTP	MAX <sup>®1)</sup> ScTP	HARTING RJ Industrial®	
Transmission characteristics	Category 5e	Category 5e	Category 5e	
Locking	Bayonet nut	Bayonet nut	Bayonet nut	
Degree of protection	IP 67	IP 67	IP 67	
Mating interface	RJ 45 acc. IEC 60 603-7	RJ 45 acc. IEC 60 603-7	RJ 45 acc. IEC 60 603-7	
Wire gauge	AWG 26 - 22	AWG 26 - 22	AWG 24 - 22 stranded AWG 24 - 22 solid	

-25 °C ... +85 °C

Zinc die-cast nickel-plated Zinc die-cast nickel-plated Zinc die-cast nickel-plated

4 - 8 mm

min. 500

shielded TP

ODVA

Field assembling

8

-40 °C ... +70 °C

4 - 8 mm

min. 500

shielded TP

Field assembling / toolless

4

#### General information

Temperature range

Mating cycles

Shielding

Approval

Termination

Housing material

Number of contacts

Cable sheath diameter

- Robust metal housing with bayonet nut
- Resistant against vibration and shock
- IP 67 for raw industrial environments
- Compatibel acc. Category 5e, shielded and unshielded

-25 °C ... +85 °C

4 - 8 mm

min. 500

unshielded TP

Field assembling

8

ODVA

• Field assembling

Connectors

#### M12-L, shielded

	Jordance with Diviso 175-1
Working voltage	32 V
Working current (see current carrying capacity)	4 A

Coding	D
Wire gauge	0.25 mm <sup>2</sup> - 0.34 mm <sup>2</sup> AWG 24 - AWG 22 stranded
Diameter of individual strands	> 0.1 mm
Conductor insulation material	PVC
Conductor diameter	1.2 mm - 1.6 mm
Cable diameter	5.5 mm - 7.2 mm
Working temperature	-25 °C +85 °C
Temperature during connection	-5 °C +50 °C
Protection level	IP 67
Number of terminations with same cable cross section	10

#### Assembly details



- 1. Remove cable sheath
- 2. Put shielding braid in place, and fix with sliding ring
- 3. Assemble HARAX® elements
- 4. Cut off the ends of the cables at the splicing ring and the shielding braid at the sliding ring
- Screw tight
- 6. The coupling ring must be screwed as far as the stop on the contact carrier.

#### Attention!

For reconnection cut off the used cable end and repeat steps 1 to 6.

#### Current carrying capacity

The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity-curve is valid for continuous, not interrupted current-loaded contacts of connectors when simultaneous power on all contacts is given, without exceeding the maximum temperature.

Control and test procedures according to DIN IEC 60 512-3.



1 = Wire gauge

0.34 mm<sup>2</sup>



# General information





- The cores are terminated automatically by screwing the coupling ring onto the contact carrier. This guides the cores through ducts in the splicing ring, positioning them accurately. A new design of insulation displacement contact blade, guided by contact ducts permits the individual cores to be terminated reliably.
- The shielding braid is passed laterally through the slotted seal, and is fixed by a sliding ring. The sliding ring provides a transition between the shield and the housing.
- After tightening the coupling ring, the sealing ring provides cable strain relief and protection to IP 67 against dust and water spray.

Ν

# HARAX<sup>®</sup> circular connector M12-L





Connectors

Stock items in bold type

03 25

HARTING

#### Han-Brid<sup>®</sup> Quintax 3A

#### General information

4 contacts + shielding + 2 power contacts For use in Han<sup>®</sup> 3A hoods with metric cable gland

#### Description

The Han-Brid<sup>®</sup> series combines a data and power interface for industrial communication in the smallest possible space.

The components in this hybrid connector family all contain the facility to load power contacts rated at 50 V 10 A to provide a power supply for distributed devices. This means that power can be provided to all devices in a bus structure via a single connector.

• Han-Brid<sup>®</sup> Quintax 3A for 4-wire bus systems and Ethernet networks with continuous shield connection.

The contact inserts can be used either in the standard plastic hood or the metal hood from the Han<sup>®</sup> 3A series. The protection level of the hood corresponds to DIN EN 60 529, IP 65.

Power supply

- Standard Han D<sup>®</sup> male and female crimp contacts
- Rated current: 10 A
- Rated voltage: 50 V
- Connection range: 0.14 to 2.5 mm<sup>2</sup> stranded

UL

Approval:

26



#### Data interface

- Can be connected to shielded 4-wire cables
- Can be used for all 4-wire bus systems
- Accepts shielded cable with a diameter from 3 to 9.5 mm
- Continuity of shield is independent of hood potential
- Cable connection in accordance with DIN EN 50 173, Category 5

#### **Technical characteristics**

Transmission properties in accordance with Category 5 ISO/IEC 11 801:2002 and EN 50173-1

Protection level	IP 65
Wire gauge data:	0.14 - 2.5 mm <sup>2</sup> stranded AWG 26 - 14
Wire gauge power supply:	0.14 - 2.5 mm² stranded AWG 26 - 14
Temperature range:	-40 °C +70 °C
Cable sheath diameter:	3 mm - 9.5 mm
Mating cycles:	≥ 500

Connectors

HARTIN


For use in Han® 3A hoods with metric cable gland

4 contacts + shielding + 2 power contacts HARTING



Connectors



#### Quintax-Z-contact

- 1. Strip cable acc. to drawing 1 and fold the shielding over the cable.
- 8\* 15 13

1.

- 2. Crimp Han D<sup>®</sup> contacts onto the wires.
- 3. Insert Han D<sup>®</sup> contacts into corresponding cavaties of insulator until they are snapped in.
- 4. Fit the insert including the cable into the opened shielded bushing. The coding pin of the shielded bushing has to meet the groove of the insulator.
- 5. Clamp the tilt over the shielding onto the cable by means of the special clamp (small opening for cable diameter of 3 6 mm, large opening for cable diameter of 6 9.5 mm).
- 6. Check the wiring.
- 7. Close the shielded bushing with the cover and insert it into the corresponding cavity of the Quintax Module as usual.



Stock items in bold type

27

## Accessories

HARTING

Connectors

Identification	Wire gauge (mm <sup>2</sup> )	Part Male contacts	No. Female contacts	Drawing	Dimensions in mm							
Crimp contacts				¢10 910	ø <u>35</u>							
silver plated	0.14-0.37 0.5 0.75 1.0 1.5 2.5	09 15 000 6104 09 15 000 6103 09 15 000 6105 09 15 000 6102 09 15 000 6101 09 15 000 6106	09 15 000 6204 09 15 000 6203 09 15 000 6205 09 15 000 6202 09 15 000 6201 09 15 000 6206		21,5							
				Wire gauge (stranded)	ø Stripping length							
gold plated	0.14-0.37 0.5 0.75 1.0 1.5 2.5	09 15 000 6124 09 15 000 6123 09 15 000 6125 09 15 000 6122 09 15 000 6121 09 15 000 6126	09 15 000 6224 09 15 000 6223 09 15 000 6225 09 15 000 6222 09 15 000 6221 09 15 000 6226	0.14-0.37 mm <sup>2</sup> AWG 26-22 0.5 mm <sup>2</sup> AWG 20 0.75 mm <sup>2</sup> AWG 18 1 mm <sup>2</sup> AWG 18 1.5 mm <sup>2</sup> AWG 16 2.5 mm <sup>2</sup> AWG 14	0.90 mm 8 mm 1.10 mm 8 mm 1.30 mm 8 mm 1.45 mm 8 mm 1.75 mm 8 mm 2.25 mm 6 mm							

### Accessories





Below is shown the cable range of metric glands:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	mm
											M 20	)																				
					M 20																											
					M 20																											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	mm

### Inserts



Hoods metal

Size 3 A



<sup>1)</sup> for mounted female insert

Stock items in bold type

# Notes





# Contents chapter 04



# Tooling

Stock items in bold type

	Identification	Nire gaug (mm²)	ge Part No.	
ories	HARTING crimping tool with locators for all Han D <sup>®</sup> contacts 0.14 - 1.5 mm <sup>2</sup>		09 99 000 0021	72
Access	BUCHANAN crimping tool for all Han D <sup>®</sup> contacts 0.14 - 4.0 mm <sup>2</sup>		09 99 000 0001	
	Locator		09 99 000 0311	
	Crimping tool depth adjustment gauge	0.14-0.25 0.37 0.5-1.0 1.5 2.5	09 99 000 0203 09 99 000 0125 09 99 000 0007 09 99 000 0008 09 99 000 0007	
	Removal tool for Han D <sup>®</sup> contacts		09 99 000 0012	A removal tool is necessary if contacts are to be relocated within the insert. It is inserted from the mating face and pushed over the contact until a stop is noticeable. Additional pressure unlocks the contact and pushes it out of the wiring side.
	HARTING RJ Industrial® Gigalink Assembly Tool for 4 pairs HARTING RJ Industrial® Gigalink connectors		09 45 800 0500	With the RJ Industrial Gigalink Assembly Tool 4 pair connectors can be fast, easily and reliably connected to flexible cables.
	HARTING RJ Industrial <sup>®</sup> Stripping Tool Stripping Tool for 2 pairs PROFINET cables incl. blade cassotte		09.45.800.0000	
	Blade cassette		09 45 800 0001	The RJ Industrial Stripping Tool allows the insulation to be removed from 2 pair Industrial Ethernet cables with diameters between 2.5 - 8 mm quickly and easily. The tool is pre-set for a cable diameter of 6.5 mm. It allows the cable sheath and screening braid to be stripped consistently and simultaneously.
	HARTING RJ Industrial <sup>®</sup> LSA-Punch Down Tool		09 45 800 0020	A ROM STATE
04 02				The LSA-Punch Down Tool is used to wire RJ Industrial Metal Outlets (part no. 09 45 815 1100, see chapter 01). The various conductors are cut to length and inserted into the insulation displacement contacts in a single pass.



**Accessories** 

Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page
09 15 000 6101	01.15	09 45 115 1100	03.09	09 45 715 0023	01.36	09 45 745 0061	01.46	09 45 771 4164	02.09	20 80 024 0002	01.15
09 15 000 6101	03.28	09 45 115 1102	03.09	09 45 715 0023	02.12	09 45 745 0061	02.10	09 45 771 4166	02.09	20 80 024 0002	01.29
09 15 000 6102	01.15	09 45 115 1104	03.09	09 45 715 0025	01.36	09 45 745 1123	01.07	09 45 771 4168	02.09	20 80 024 0002	01.32
09 15 000 6103	01.15	09 45 115 1500	01.36	09 45 715 0027	01.36	09 45 745 1125	01.07	09 45 771 4175	02.09		
09 15 000 6103	03.28	09 45 115 1500	03.20	09 45 715 0027	02.12	09 45 745 1125	02.10	09 45 771 4178	02.09	21 01 000 0003	01.09
09 15 000 6104	03.28	09 45 115 1510	03.20	09 45 715 0051	02.12	09 45 745 1127	02.10	09 45 800 0000	04 02	21 01 000 0003	01.21
09 15 000 6105	01.15	09 45 115 1512	03.20	09 45 715 0053	01.36	09 45 745 1151	01.07	09 45 800 0001	04.02	21 01 000 0003	01.39
09 15 000 6106	01.15	09 45 125 1100	03.09	09 45 715 0056	01.36	09 45 745 1153	01.07	09 45 800 0020 09 45 800 0020	01.35	21 01 010 2003	03.25
09 15 000 6106	03.28	09 45 125 1300	03.13	09 45 715 0056	02.12	09 45 745 1153	02.10	09 45 800 0500	04.02		
09 15 000 6122	03.28	09 45 125 1500	03.20	09 45 715 0061	02.12	09 45 745 1156	02.10	09 45 815 1100	01.34	21 02 212 2205	01.00
09 15 000 6123	03.28	09 45 145 1100	01.07	09 45 715 0125	02.18	09 45 745 1161	02.10	09 45 815 1100	04.02	21 03 212 2305	01.31
09 15 000 6125	03.28	09 45 145 1100	01.46	09 45 715 0127	02.18	09 45 745 1164	01.46	09 45 820 0000	01.05	21 03 212 2305	03.25
09 15 000 6201	01.15	09 45 145 1500	01.46	09 45 715 1123	01.19	09 45 745 1166	01.46	09 45 820 0000	01.25	21 03 281 1405	01.09
09 15 000 6201	03.28	09 45 145 1500	03.19	09 45 715 1123	01.25	09 45 745 1166 09 45 745 1168	02.10	09 45 820 0000	01.29	21 03 281 1405	01.31
09 15 000 6202	03.28	09 45 151 1100	03.05	09 45 715 1123	01.36	09 45 745 1168	02.10	09 45 820 0000	03.09	21 03 281 1405	01.39
09 15 000 6203	03.28	09 45 151 1500	03.18	09 45 715 1125	02.12	09 45 745 1173	02.10	09 45 820 0000	03.14	21 03 281 2405	03.25
09 15 000 6204	01.15	09 45 151 1510	03.18	09 45 715 1125	01.19	09 45 745 1175	01.46	09 45 820 0000	03.20	21 03 483 1400	01.09
09 15 000 6205	01.15	09 45 215 1100 09 45 215 1102	03.11	09 45 715 1125	01.29	09 45 745 1178	01.46	09 45 845 0001	03.06	21 03 483 1400	01.21
09 15 000 6205	03.28	09 45 215 1107	03.11	09 45 715 1125	01.36	09 45 745 1178	02.10	09 45 845 0004	03.07	21 03 483 1400	01.39
09 15 000 6206	03.28	09 45 215 1108	03.11	09 45 715 1127	01.05	09 45 745 1183	02.10	09 45 845 1500 09 45 845 1501	01.44	21 03 483 1400 21 03 483 1401	02.14
09 15 000 6221 09 15 000 6222	03.28	09 45 215 1110	03.11	09 45 715 1127 09 45 715 1127	01.19	09 45 745 1523 09 45 745 1523	01.46			21 03 483 1401	01.21
09 15 000 6223	03.28	09 45 225 1100	03.11	09 45 715 1127	01.29	09 45 745 1525	01.46	09 46 145 4400	01.07	21 03 483 1401 21 03 483 1401	01.31
09 15 000 6224	03.28	09 45 225 1108	03.11	09 45 715 1127 09 45 715 1127	02.12	09 45 745 1525 09 45 745 1527	02.16			21 03 483 1401	02.14
09 15 000 6226	03.28	09 45 225 1300	03.14	09 45 715 1151	01.05	09 45 745 1527	02.16	09 99 000 0001	04.02	21 03 483 1403	01.21
09 15 003 3001	01.15	09 45 245 1101	03.07	09 45 715 1151	01.25	09 45 745 1551	02.16	09 99 000 0007	04.02	21 03 483 1403	01.31
09 15 003 3001	03.27	09 45 525 0000	03.14	09 45 715 1151	01.29	09 45 745 1553	01.46	09 99 000 0008 09 99 000 0012	04.02	21 03 483 1403	02.14
09 15 004 3013	01.15	09 45 545 0021	03.07	09 45 715 1151	02.12	09 45 751 0023	02.10	09 99 000 0021	04.02	21 03 483 1405	01.09
09 15 004 3013	03.27	09 45 551 1100	03.07	09 45 715 1153 09 45 715 1153	01.05	09 45 751 0025	02.07	09 99 000 0125	04.02	21 03 483 1405	01.31
09 15 004 3113	03.27	09 45 551 1100	03.14	09 45 715 1153	01.25	09 45 751 0027	02.07	09 99 000 0311	04.02	21 03 483 1405 21 03 483 1405	01.39
09 15 300 0302	03.22	09 45 551 1101	03.07	09 45 715 1153	01.29	09 45 751 0053	02.07			21 03 483 3400	01.09
09 15 300 0311	03.22	09 45 600 0100	02.03	09 45 715 1153	02.12	09 45 751 0056 09 45 751 0061	02.07	19 00 000 5070	01.39	21 03 483 3400	01.21
09 15 300 0401	03.22	09 45 600 0102	02.03	09 45 715 1156	01.05	09 45 751 0123	02.18	19 00 000 5070	01.05	21 03 483 3400	01.39
09 15 300 0402	01.13	09 45 600 0103	02.05	09 45 715 1156	01.25	09 45 751 0125	02.18	19 00 000 5080	01.15	21 03 483 3401	01.09
09 15 300 0412	01.13	09 45 600 0110	02.03	09 45 715 1156	01.36	09 45 751 1123	02.07	19 00 000 5080	01.29	21 03 483 3401	01.21
09 15 300 0412	03.22	09 45 600 0112	02.03	09 45 715 1156	02.12	09 45 751 1127	02.07	19 00 000 5080	01.39	21 03 483 3401	01.39
09 15 300 5411	01.13	09 45 600 0115	02.04	09 45 715 1161	01.19	09 45 751 1151	02.07	19 00 000 5082	03.29	21 03 483 3401 21 03 483 3403	02.14 01.09
09 15 300 5411	03.22	09 45 600 0131	02.03	09 45 715 1161	01.25	09 45 751 1156	02.07	19 00 000 5084	03.29	21 03 483 3403	01.21
		09 45 600 0132 09 45 600 0133	02.03	09 45 715 1161	01.36	09 45 751 1161 09 45 751 1164	02.07			21 03 483 3403 21 03 483 3403	01.31
09 20 000 9918	01.04	09 45 600 0135	02.04	09 45 715 1164	01.19	09 45 751 1166	02.07	19 20 003 1440 19 20 003 1440	01.05	21 03 483 3403	02.14
09 20 000 9918	01.14	09 45 600 0140	02.03	09 45 715 1164	01.36	09 45 751 1173	02.07	19 20 003 1440	01.25	21 03 483 3405	01.21
09 20 000 9918	01.24	09 45 600 0142	02.03	09 45 715 1166	01.19	09 45 751 1175	02.07	19 20 003 1440	03.29	21 03 483 3405 21 03 483 3405	01.31
09 20 000 9918	01.25	09 45 600 0145	02.04	09 45 715 1166	01.36	09 45 751 1183	02.07			21 03 483 3405	02.14
09 20 000 9918	01.29	09 45 600 0200	02.06	09 45 715 1168	01.19	09 45 751 1523	02.15	20 70 305 3921	01.04	21 03 485 1400	01.09
09 20 003 2711	01.25	09 45 600 0240	02.06	09 45 715 1168	02.12	09 45 751 1527	02.15	20 70 305 3922 20 70 305 3931	01.28	21 03 485 1400 21 03 485 1400	01.21
09 20 003 5422 09 20 003 5422	01.05	09 45 600 0300	02.04	09 45 715 1173	01.19	09 45 751 1553	02.15	20 70 305 3941	01.08	21 03 485 1400	01.39
09 20 003 5422	01.25	09 45 600 0340	02.04	09 45 715 1173	02.12	09 45 771 0023	02.08	20 70 305 3942 20 70 305 3951	01.30	21 03 485 1400	01.09
09 20 003 5422	03.09	09 45 600 0430	02.06	09 45 715 1175	01.19	09 45 771 0025 09 45 771 0027	02.08	20 70 305 3961	01.14	21 03 485 1401 21 03 485 1401	01.21
09 20 003 5422	03.20	09 45 600 0440 09 45 600 0500	02.06	09 45 715 1175	02.12	09 45 771 0051	02.08	20 70 310 3921	01.24	21 03 485 1401	01.39
09 20 003 5425	01.15	09 45 600 0530	02.05	09 45 715 1178	01.36	09 45 771 0053 09 45 771 0056	02.08			21 03 485 1401 21 03 485 1403	02.14 01.09
09 20 003 5425	01.25	09 45 000 0540	02.05	09 45 715 1178	02.12	09 45 771 0061	02.08	20 73 302 4941	01.38	21 03 485 1403	01.21
09 20 003 5425	03.11	09 45 701 0023	02.11	09 45 715 1183	01.36	09 45 771 1123	02.08	20 73 305 3921	01.18	21 03 485 1403 21 03 485 1403	01.31
09 20 003 5425	03.29	09 45 701 0027	02.11	09 45 715 1183 09 45 715 1523	02.12	09 45 771 1127	02.08	20 73 305 3941	01.20	21 03 485 1403	02.14
09 20 003 5442	03.13	09 45 701 0053	02.11	09 45 715 1525	02.17	09 45 771 1153	02.08		01.05	21 03 485 1405	01.21
09 20 003 5446	03.11	09 45 701 0056	02.11	09 45 715 1527	02.17	09 45 771 1156	02.08	20 80 000 0003	01.05	21 03 485 1405	01.31
09 20 003 5446	03.14	09 45 701 1123	02.11	09 45 715 1553	02.17	09 45 771 1164	02.08	20 80 000 0003	01.10	21 03 485 1405	02.14
09 20 004 2711	01.05	09 45 701 1125 09 45 701 1127	02.11	09 45 725 1323	02.13	09 45 771 1166 09 45 771 1168	02.08	20 80 000 0003	01.15	21 03 485 3400 21 03 485 3400	01.09
09 20 004 2711	01.29	09 45 701 1151	02.11	09 45 725 1325	02.13	09 45 771 1173	02.08	20 80 000 0003	01.29	21 03 485 3400	01.31
09 20 004 2711	03.29	09 45 701 1153	02.11	09 45 725 1351	02.13	09 45 771 1178	02.08	20 80 000 0004	01.19	21 03 485 3400	02.14
	0.1	09 45 701 1161	02.11	09 45 725 1356	02.13	09 45 771 1183	02.08	20 80 000 0004 20 80 000 3023	01.21 04.03	21 03 485 3401	01.09
09 36 008 3101	01.15	09 45 701 1164	02.11	09 45 725 1361	02.13	09 45 771 4025	02.09	20 80 010 0001	01.05	21 03 485 3401	01.31
		09 45 701 1166 09 45 701 1166	01.46	09 45 745 0023 09 45 745 0023	01.46 02.10	09 45 771 4027 09 45 771 4051	02.09	20 80 010 0001	01.07	21 03 485 3401 21 03 485 3401	01.39 02.14
09 37 003 5402	03.09	09 45 701 1168	01.46	09 45 745 0025	01.46	09 45 771 4053	02.09	20 80 010 0001	01.13	21 03 485 3403	01.09
09 37 003 5405	03.11	09 45 701 1168	01.46	09 45 745 0025	01.46	09 45 771 4056	02.09	20 80 010 0001	01.15	21 03 485 3403 21 03 485 3403	01.21
		09 45 701 1173	02.11	09 45 745 0027	02.10	09 45 771 4123	02.09	20 80 010 0001	01.32	21 03 485 3403	01.39
09 45 115 1100	01.05	09 45 701 1175	02.11	09 45 745 0051	02.10	09 45 771 4127	02.09	20 80 010 0002	01.25	21 03 485 3405	01.09
09 45 115 1100	01.19	09 45 701 1178	01.46	09 45 745 0053	01.46	09 45 771 4151 09 45 771 4153	02.09	20 80 024 0002 20 80 024 0002	01.05	21 03 485 3405	01.21
09 45 115 1100	01.29	09 45 701 1183	01.46	09 45 745 0056	01.46	09 45 771 4156	02.09	20 80 024 0002	01.10	21 03 485 3405	01.39
09 45 115 1100	01.36	09 45 701 1183	02.11	09 45 745 0056	02.10	09 45 771 4161	02.09	20 80 024 0002	01.13	21 03 485 3405	02.14

10

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Espelkamp / Germany - Plant 2



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Espelkamp / Germany - Plant 4



Espelkamp / Germany - Plant 5



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