Contents

HARTING®

Solutions for Industrial Ethernet

Chapter

Industrial
Ethernet

E
00
.
01

General information

It is the user's responsibility to check whether the components illustrated in this catalogue comply with different regulations from those stated in special fields of application which we are unable to foresee.

We reserve the right to modify designs in order to improve quality, keep pace with technological advancement or meet particular requirements in production.

Contents chapter E00

HARTING®

Industrial Ethernet – General information

Industrial Ethernet

E 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.

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 Ethernet)		
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

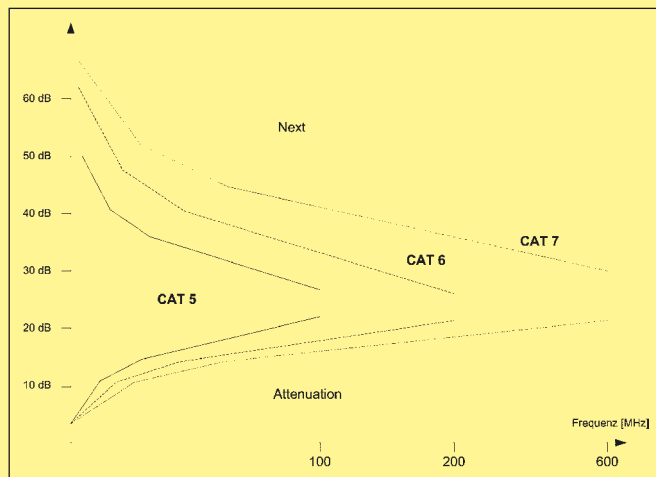[FD] = Full-duplex operation possible

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.

TE = Terminal Equipment

Industrial Ethernet

E
00
.
05
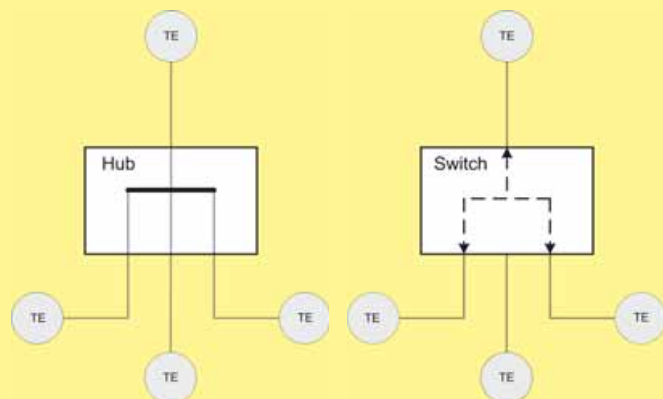
Industrial
Ethernet

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 multi-cast 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 self-learning 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. Additional-ly, 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
	Cut-through
	Modified cut-through

| Blocking: | Blocking |
| | Non-blocking |

| Management: | Managed |
| | Unmanaged |
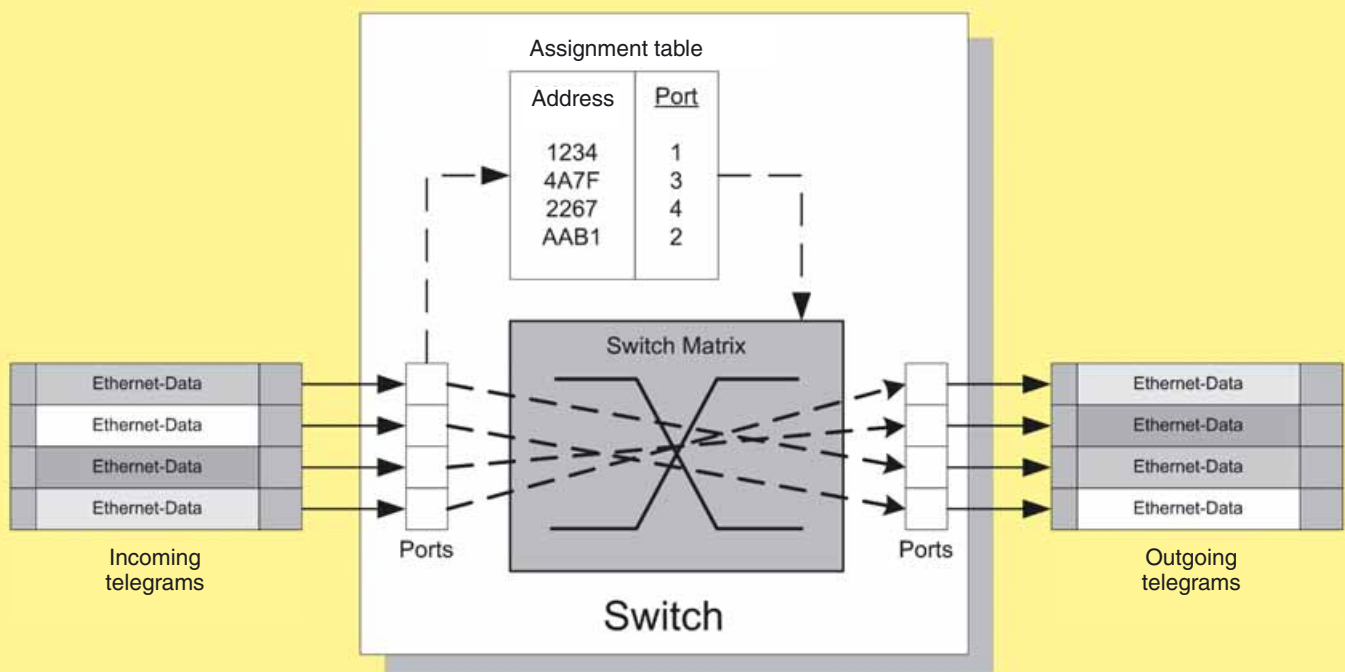
Principle of a switch

E
00.
06

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.
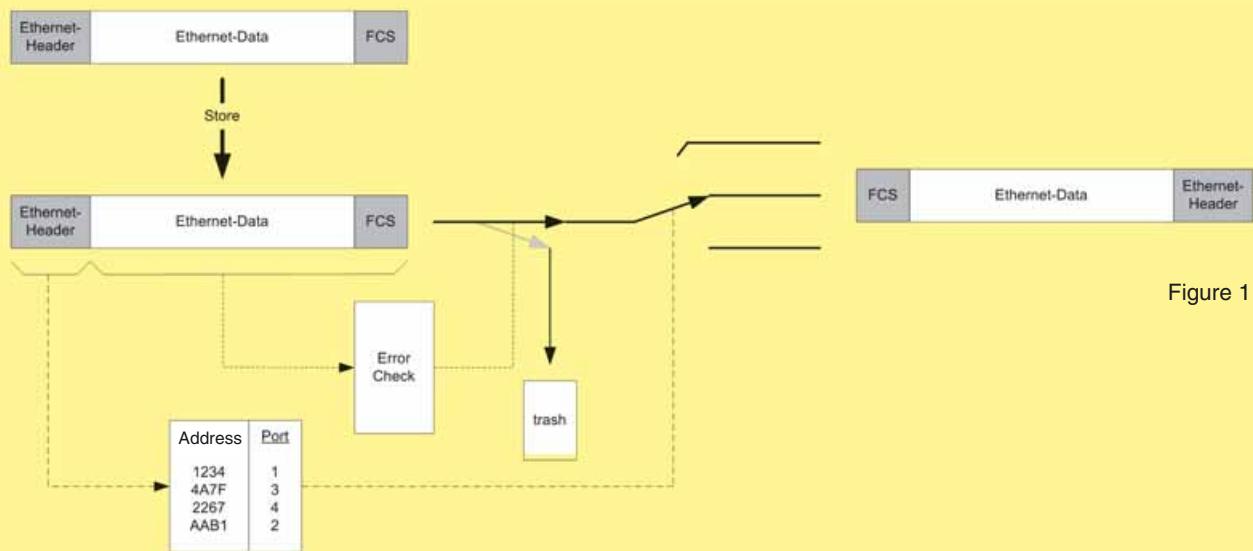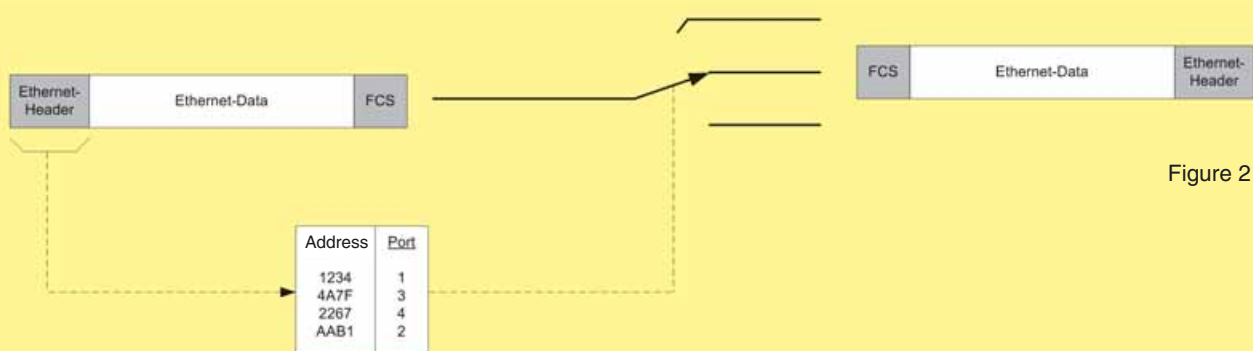
Industrial Ethernet

Figure 1

Figure 2

E 00.07

Industrial Ethernet

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

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.
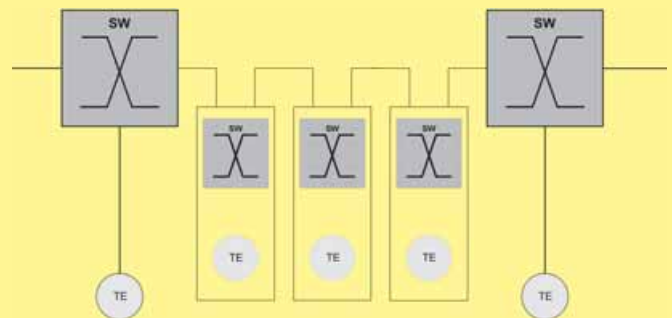
SW = Switch
TE = Terminal Equipment
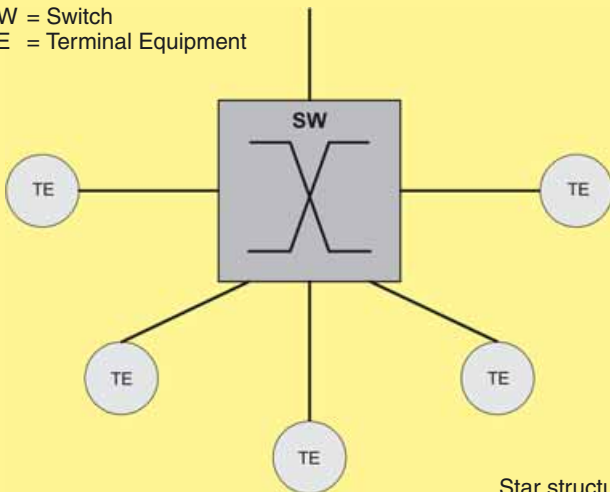
Star structure

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.

Industrial Ethernet

ISO / IEC 11801
Structured building network

Structured machine network
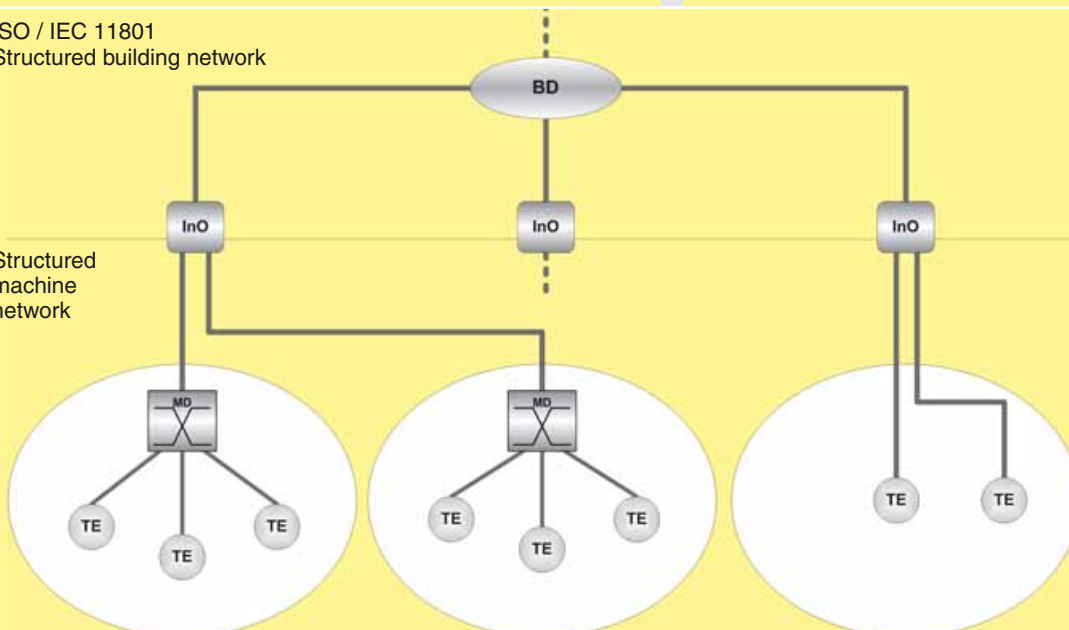
BD = Building Distributor

MD = Machine Distributor

InO = Industrial Outlet

TE   = Terminal Equipment

Manufacturing plant

Industrial Ethernet

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

Cabling

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 PMD = PROFInet® Machine Distributor	Area "inside"	Connector	Connector coupling

Table: Transmission route lengths

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.
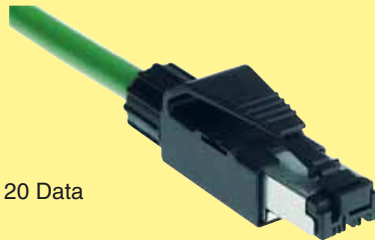
HARTING RJ Industrial® IP 20 Data

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®
IP 67 Push Pull
and *HARAX*® 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 contact-protected 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.

HARTING RJ Industrial® IP 67 Hybrid

Connector assignment
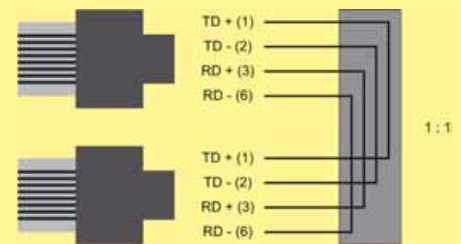
RJ 45

Signal	Function	Conductor colour	Pin assignment	
			RJ 45	M12
TD+	Transmission 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

Industrial Ethernet

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)
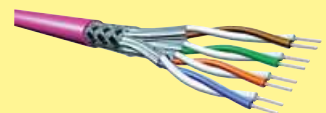

Figure 1: SF/UTP cable   Figure 2: S/FTP cable

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).

RJ 45 pin assignment of different networks:

| Ethernet 10/100 | Token ring | ATM | Analogue telephone | ISDN | Gigabit Ethernet |

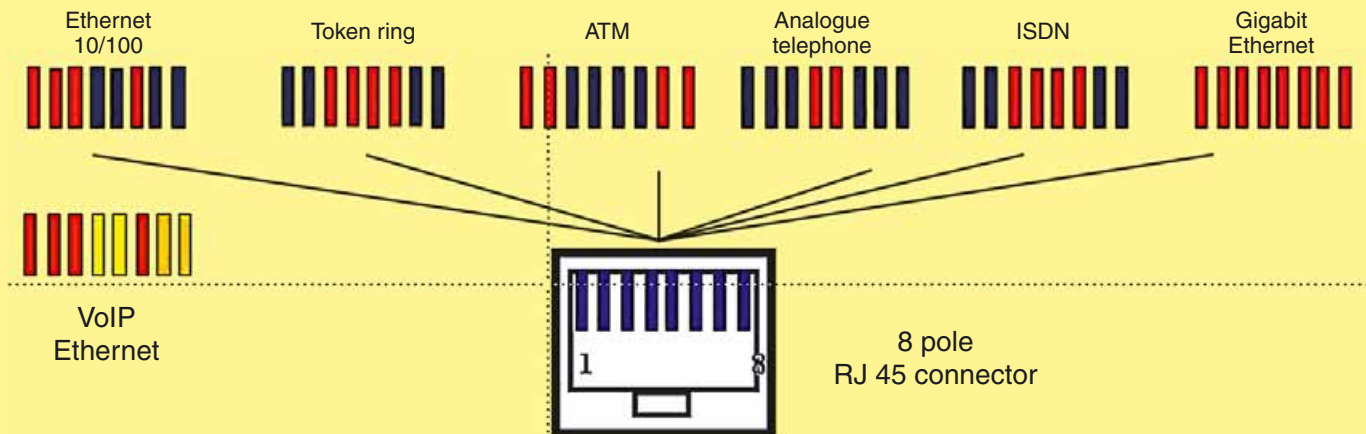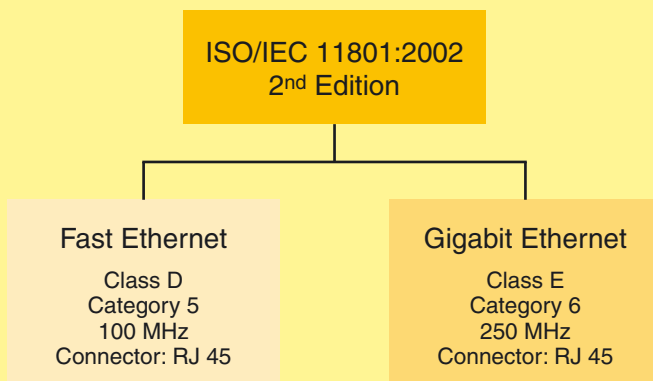VoIP Ethernet

8 pole RJ 45 connector

Figure 3: Pin assignment

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

ISO/IEC 11801:2002
2nd Edition

Fast Ethernet

Class D
Category 5
100 MHz
Connector: RJ 45

Gigabit Ethernet

Class E
Category 6
250 MHz
Connector: RJ 45

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:

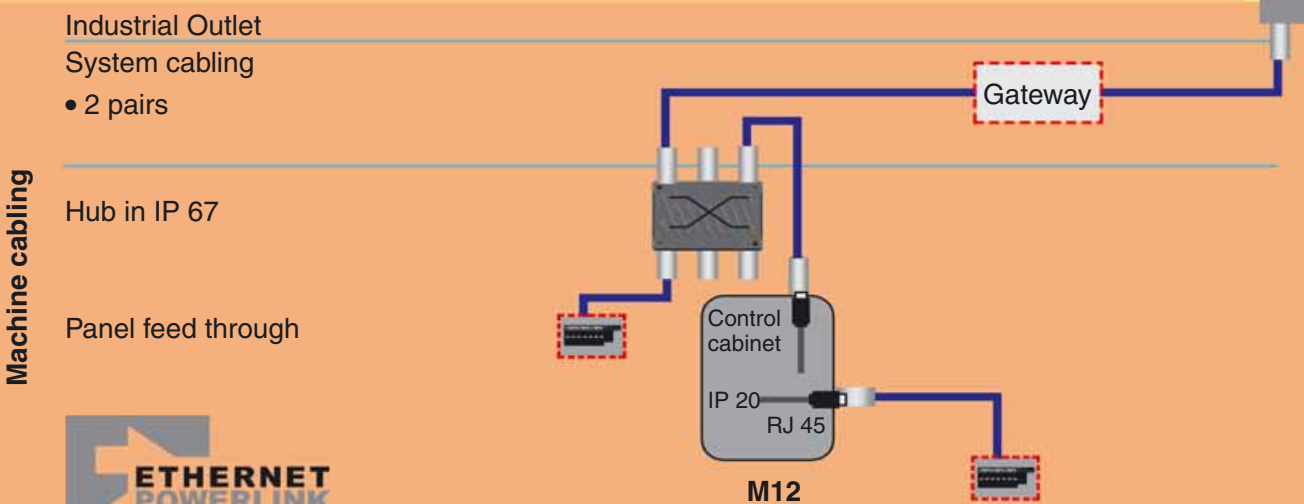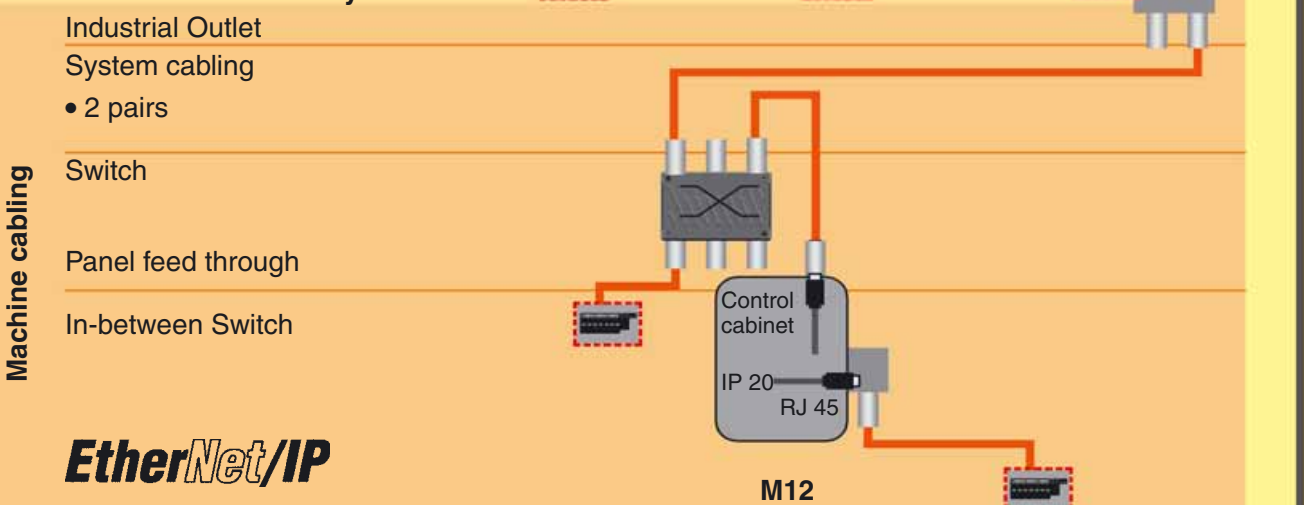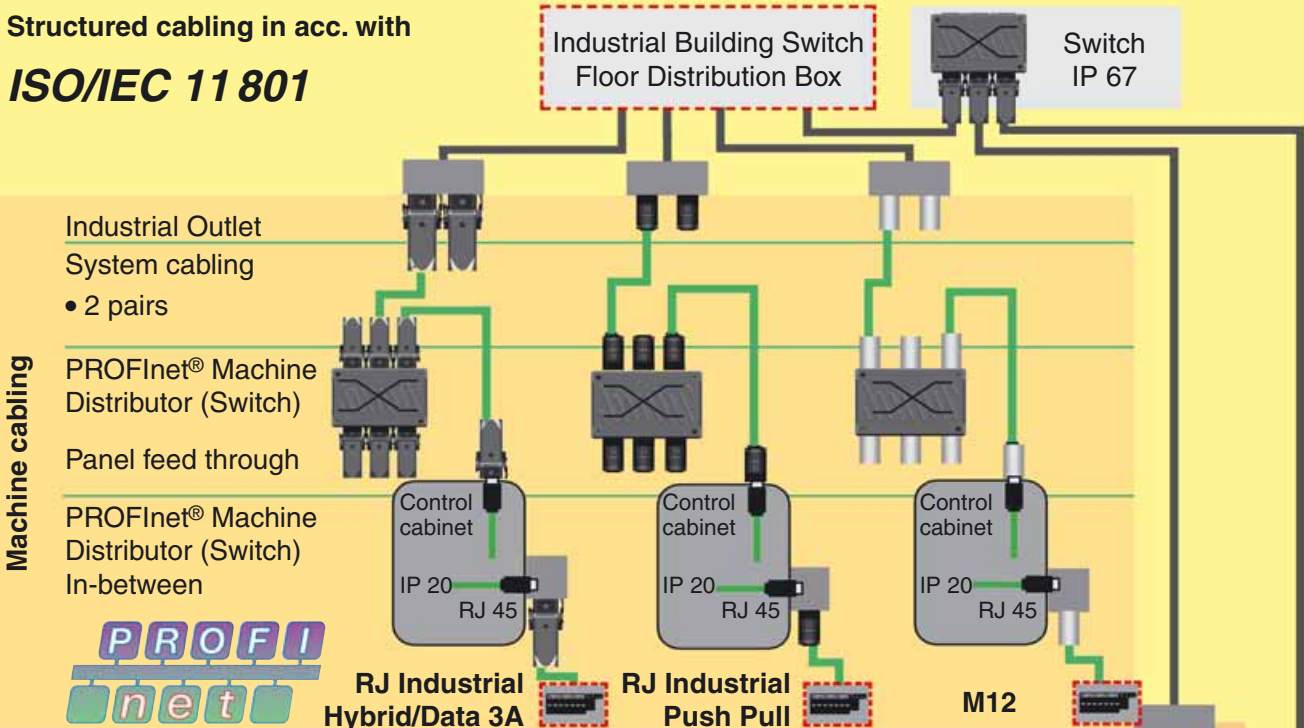– Class E cables (250 MHz) together with a Category 6 (250 MHz) connector.

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.

Network installation in accordance with Industrial Ethernet standards

Structured cabling in acc. with

ISO/IEC 11 801

Industrial Ethernet

Industrial Building Switch
Floor Distribution Box

Switch
IP 67

Machine cabling

Industrial Outlet

System cabling

• 2 pairs

PROFInet® Machine
Distributor (Switch)

Panel feed through

PROFInet® Machine
Distributor (Switch)
In-between

PROFI net

Control cabinet

IP 20

RJ 45

**RJ Industrial
Hybrid/Data 3A**

**RJ Industrial
Push Pull**

M12

Machine cabling

Industrial Outlet

System cabling

• 2 pairs

Switch

Panel feed through

In-between Switch

EtherNet/IP

Control cabinet

IP 20

RJ 45

M12

Machine cabling

Industrial Outlet

System cabling

• 2 pairs

Gateway

Hub in IP 67

Panel feed through

ETHERNET
POWERLINK
STANDARDIZATION GROUP

Control cabinet

IP 20

RJ 45

M12

No HARTING products

Industrial Ethernet

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 mm²
AWG 24 corresponds to a conductor wire gauge of 0.21 - 0.25 mm²
AWG 26 corresponds to a conductor wire gauge of 0.13 - 0.15 mm²

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.

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

Industrial Ethernet

Ethernet Switches

Ethernet Hub

Industrial Outlets

ESC 67-10 TP05U
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

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)

Industrial Ethernet

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	-40 °C … +70 °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
Interference emission	EN 50011, Class A

Ethernet Switch

ESC 67-10 TP05U
HARTING RJ Industrial® IP 67 Data 3A
Ethernet Switch for industrial applications

Identification	Part No.	Drawing	Dimensions in mm
ESC 67-10 TP05U Fast Ethernet Switch HARTING RJ Industrial® IP 67 Data 3A	**20 70 305 3921**	 ca.101 87 120 45	

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® 4A connector, redundant power supply (incl. fixing screw 09 20 000 9918, to maintain IP 67)
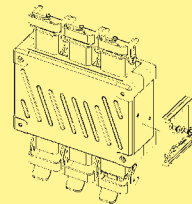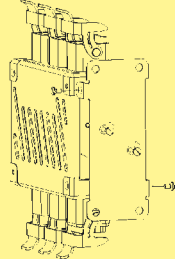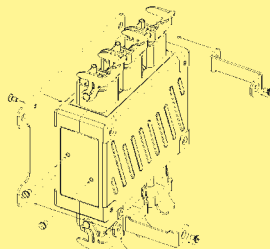
Ethernet Interface

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® Data 3A connectors, auto-crossing function
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173

E
10.
04

Stock items in bold type

Industrial Ethernet

Identification	Part No.	
	Power termination	Ethernet termination
Straight hood metal, straight, metric	**19 20 003 1440**[1]	
Protection covers Han® 3A	**09 20 003 5422**	**09 20 003 5425**
Han® 4A female insert	**09 20 004 2711**	
Cable gland metal IP 65, metric M20, cable diameter: 5 - 9 mm	**19 00 000 5080**	
Connector set HARTING RJ Industrial® IP 67 Data 3A in metal		**09 45 115 1100**[2]
Coding pin set		**09 45 820 0000**

Identification	Part No.	
System Cables for Industrial Ethernet, pre-assembled at both ends[3] IP 65 / 67 metal	Length: 1.5 m **09 45 715 1123** 3.0 m **09 45 715 1125** 5.0 m **09 45 715 1127** 10.0 m **09 45 715 1151** 20.0 m **09 45 715 1153** 50.0 m **09 45 715 1156** 100.0 m **09 45 715 1161**	Connectors: 2 x HARTING RJ Industrial® IP 67 Data 3A in metal with IDC fast termination technology Protection level connectors: IP 65 / 67 (when mated)

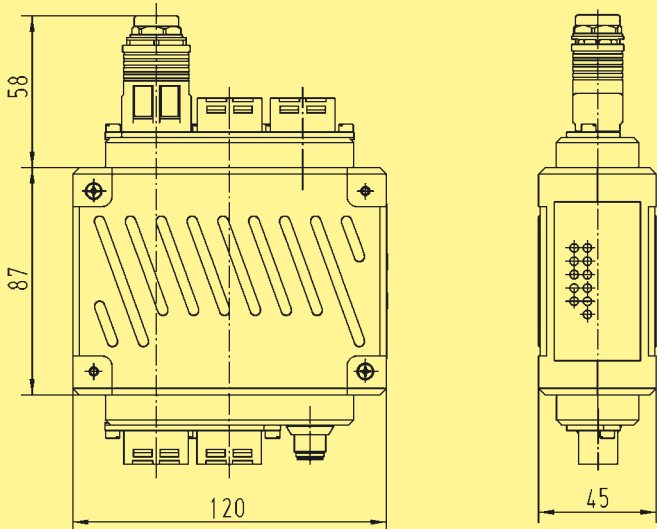| Identification	Part No.	Drawing	Dimensions in mm
Set for assembly on standard rail acc. to DIN EN 60 715	**20 80 000 0003**		
Set for panel mounting upright assembly	**20 80 010 0001**		
Set for panel mounting flat assembly	**20 80 024 0002**		

[1] Order insert fixing screw 09 20 000 9918 separately
[2] Further connector sets see chapter E70
[3] Further system cables see chapter E60

Stock items in bold type

Ethernet Switch

PROFI net

ESC 67-10 TP05U
HARTING RJ Industrial® 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**	58 87 120	45

Technical characteristics

Power supply

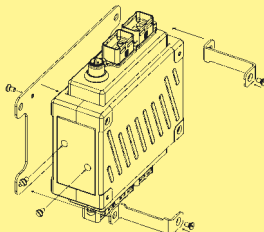|	
Input voltage	24 V DC (18 … 30 V DC)
Current consumption	100 mA (at 24 V DC)
Connections	compatible with *HARAX*® M12-L connector, redundant power supply
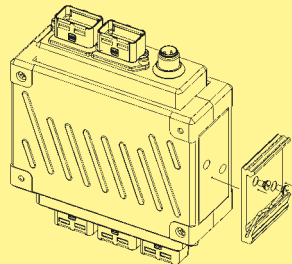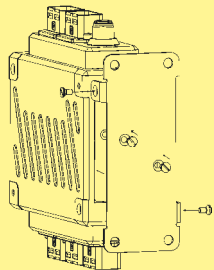
Ethernet Interface

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® Push Pull 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	Part No.	
	Power termination	Ethernet termination
HARAX® M12-L circular connector A-Coding	**21 03 212 2305**[1]	
Connector set HARTING RJ Industrial® IP 67 Push Pull		**09 45 145 1100**[1]
Protection covers M12	**21 01 000 0003**	**21 01 000 0003**

Identification	Part No.	

System Cables for Industrial Ethernet,
pre-assembled at both ends
  IP 65 / 67 (when mated)
  metal		

Identification		Part No.	Cable type / Connectors
Standard System Cable for Industrial Ethernet	Length: 1.5 m	**09 45 745 1123**	Cable type: Industrial Ethernet Standard Cable, 2 x 2 x AWG 22/1, shielded twisted pair
	3.0 m	**09 45 745 1125**	
	5.0 m	**09 45 745 1127**	
	10.0 m	**09 45 745 1151**	Connectors: 2 x HARTING RJ Industrial® IP 67 Push Pull with IDC fast termination and locking technology, fit for field assembly
	20.0 m	**09 45 745 1153**	
	50.0 m	**09 45 745 1156**	
	100.0 m	**09 45 745 1161**	

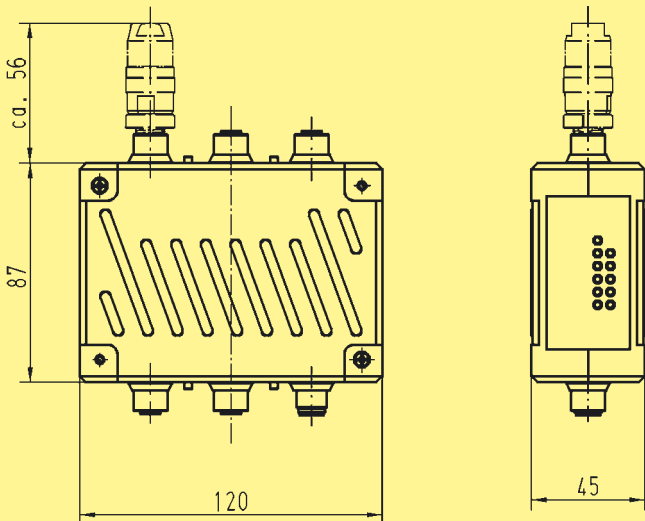| Identification	Part No.	Drawing	Dimensions in mm
Set for assembly on standard rail acc. to DIN EN 60 715	**20 80 000 0003**		
Set for panel mounting upright assembly	**20 80 010 0001**		
Set for panel mounting flat assembly	**20 80 024 0002**		

[1] Further connectors see chapter E70
[2] Further system cables see chapter E60

Stock items in bold type

Ethernet Switch

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

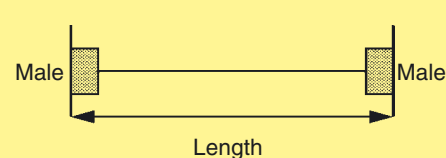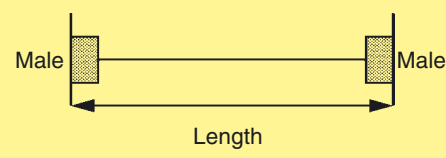| Identification	Part No.	Drawing	Dimensions in mm
ESC 67-10 TP05U Fast Ethernet Switch M12 D-Coding	**20 70 305 3941**	ca. 56 87 120 45	

Technical characteristics

Power supply

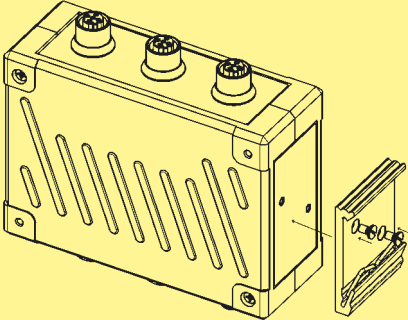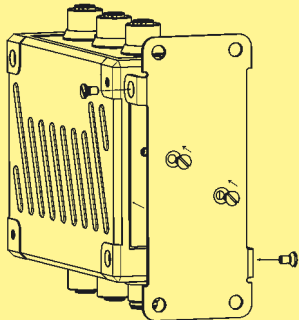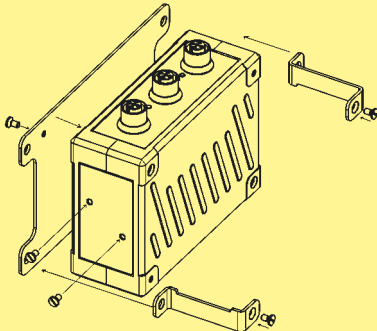|	
Input voltage	24 V DC (18 … 30 V DC)
Current consumption	100 mA (at 24 V DC)
Connections	compatible with *HARAX*® M12-L connector, redundant power supply

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	M12 circular connector, D-Coding auto-crossing function
Maximum cable length	100 m (with Category 5 cable) in accordance with EN 50 173

Stock items in bold type

Accessories

HARTING

Industrial Ethernet

Identification	Part No. Power termination	Ethernet termination	
HARAX® M12-L circular connector A-Coding	**21 03 212 2305**[1]		
HARAX® M12-L circular connector shielded, 4 male contacts, D-Coding		**21 03 281 1405**[1]	
Protection covers M12	**21 01 000 0003**	**21 01 000 0003**	

Identification	Part No.	
System Cables for Industrial Ethernet, pre-assembled at both ends[2] IP 65 / 67 (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[3]	Cable: AWG 26 / 0.14 mm² Male —— Male Length
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[3]	
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[3]	Cable: AWG 22 / 0.34 mm² Male —— Male Length
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[3]	in accordance with PROFInet® installation guide

[1] Further connectors see chapter E70
[2] Further system cables see chapter E60
[3] Please state length separately

Stock items in bold type

E 10.09

Accessories

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**		

Stock items in bold type

Notes

General information

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 • 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)

• Up to 4 priority levels

Mechanical data

Housing type	Robust metal housing of aluminium die-cast
Dimensions	105 x 40 x 120 (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[1]
	IP 20 inside the control cabinet

Environmental conditions

Operating temperature range	-40 °C … +70 °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
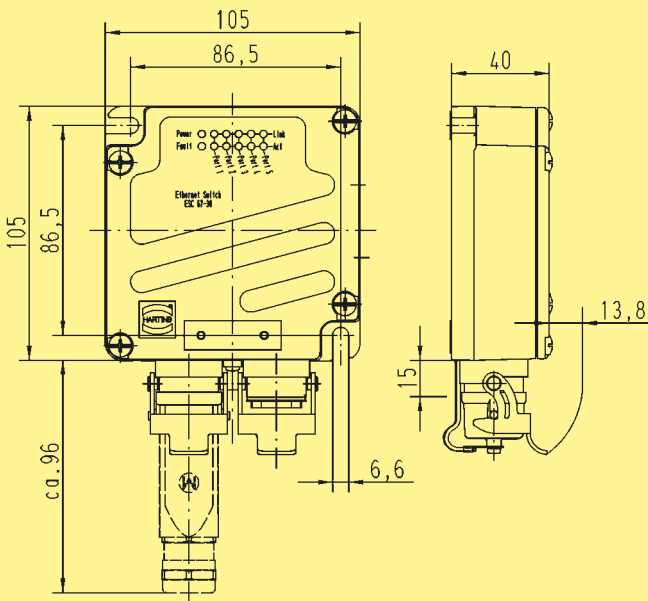
Interference immunity	EN 61000-4-2 … EN 61000-4-6, EN 61000-4-8
Interference emission	EN 50011, Class A

[1] 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

Identification	Part No.	Drawing	Dimensions in mm
ESC 67-30 TP05U Fast Ethernet Switch HARTING RJ Industrial® IP 67 Data 3A	**20 73 305 3921**		

Technical characteristics

Power supply

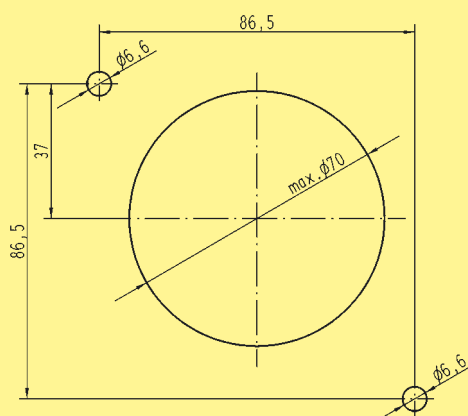|	
Input voltage	24 V DC (18 … 30 V DC)
Current consumption	100 mA (at 24 V DC)
Connections	Screw terminal with 4 contacts, plug-in, for redundant power supply (on the inside of the control cabinet)

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 HARTING RJ Industrial® Data 3A connectors
	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

Accessories

Identification	Part No. Ethernet termination	
Connector set HARTING RJ Industrial® IP 67 Data 3A in metal	**09 45 115 1100**[1]	
Coding pin set	**09 45 820 0000**	
Mounting plate to the inside control cabinet	**20 80 000 0004**	

Identification		Part No.	Technical details	
System Cables for Industrial Ethernet, pre-assembled at both ends[2]				
Standard System Cable for Industrial Ethernet	Length: 1.5 m	**09 45 715 1123**	Cable type:	Industrial Ethernet Standard Cable, 2 x 2 x AWG 22/1, shielded twisted pair
	3.0 m	**09 45 715 1125**		
	5.0 m	**09 45 715 1127**		
	10.0 m	**09 45 715 1151**		
	20.0 m	**09 45 715 1153**	Connectors:	2 x HARTING RJ Industrial® IP 67 Data 3A with IDC fast termination technology and zinc die-cast full metal housing, fit for field assembly
	50.0 m	**09 45 715 1156**		
	100.0 m	**09 45 715 1161**		
Stranded System Cable for Industrial Ethernet	Length: 1.5 m	**09 45 715 1164**	Cable type:	Industrial Ethernet Stranded Cable, 2 x 2 x AWG 22/7, shielded twisted pair
	3.0 m	**09 45 715 1166**		
	5.0 m	**09 45 715 1168**		
	10.0 m	**09 45 715 1173**		
	20.0 m	**09 45 715 1175**	Connectors:	2 x HARTING RJ Industrial® IP 67 Data 3A with IDC fast termination technology and zinc die-cast full metal housing, fit for field assembly
	50.0 m	**09 45 715 1178**		
	100.0 m	**09 45 715 1183**		

Details for panel holes

[1] Further connector sets see chapter E70
[2] Further system cables see chapter E60

Stock items in bold type

Ethernet Switch

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

Identification	Part No.	Drawing	Dimensions in mm

ESC 67-30 TP05U
 	
  Fast Ethernet Switch
 	
  M12 D-Coding
	20 73 305 3941		

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 4 contacts, plug-in, for redundant power supply (on the inside of the control cabinet)

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

Accessories

Identification	Part No. Ethernet termination	
HARAX® M12-L circular connector shielded, 4 male contacts, D-Coding	**21 03 281 1405**[1]	
Protection cover M12	**21 01 000 0003**	
Mounting plate to the inside control cabinet	**20 80 000 0004**	

Identification				Part No.	
System Cables for Industrial Ethernet, pre-assembled at both ends[2] IP 65 / 67 (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[3]	Cable: AWG 26 / 0.14 mm² Male ▭───────────▭ Male Length
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[3]	
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[3]	Cable: AWG 22 / 0.34 mm² Male ▭───────────▭ Male Length
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[3]	in accordance with PROFInet® installation guide

Details for panel holes
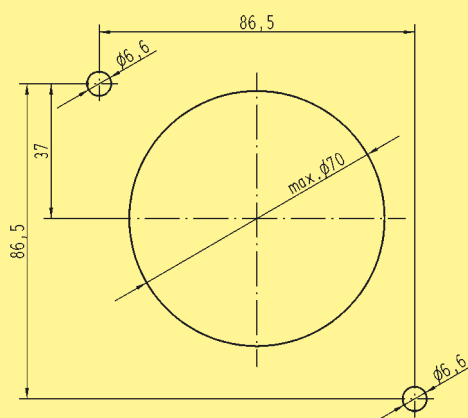
86,5

37

86,5

ø6,6

ø6,6

ø6,6

max. ø70

[1] Further connectors see chapter E70
[2] Further system cables see chapter E60
[3] Please state length separately

Stock items in bold type

EHB 67-10 TP05
Ethernet Hub for industrial applications

General description

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.

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

Application fields

- Industrial automation

- Automotive industry

- Wind power

- Power distribution systems

Industrial Ethernet

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	0 °C … +60 °C
Relative humidity for operation	30% to 95%, non-condensing
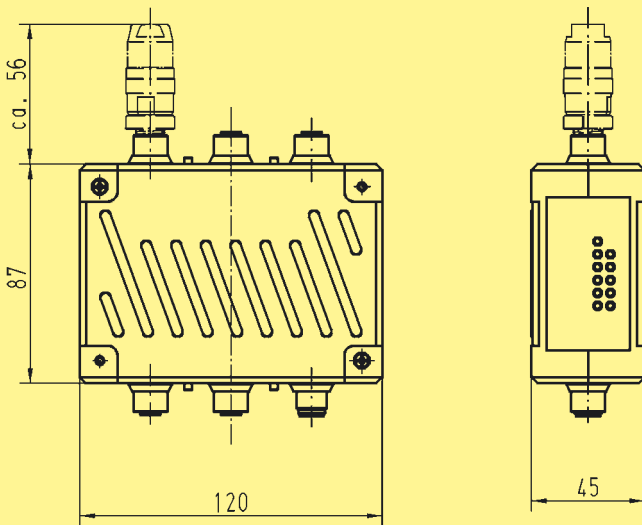
Mechanical stability

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

Ethernet Hub

HARTING

ETHERNET POWERLINK
STANDARDIZATION GROUP

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

Identification	Part No.	Drawing	Dimensions in mm
EHB 67-10 TP05 Ethernet Hub M12 D-Coding	**20 70 305 3942**	ca. 56 87 120 45	

Technical characteristics

Power supply

Input voltage	24 V DC (18 … 30 V DC)
Current consumption	125 mA (at 24 V DC)
Connections	compatible with *HARAX®* 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

Stock items in bold type

Identification	Part No.	
	Power termination	Ethernet termination
HARAX® M12-L circular connector A-Coding	**21 03 212 2305**[1]	
HARAX® M12-L circular connector shielded, 4 male contacts, D-Coding		**21 03 281 1405**[1]
Protection covers M12	**21 01 000 0003**	**21 01 000 0003**

Identification			Part No.	
System Cables for Industrial Ethernet, pre-assembled at both ends[2] IP 65 / 67 (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[3]	Cable: AWG 26 / 0.14 mm²
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[3]	Male ———— Male 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[3]	Cable: AWG 22 / 0.34 mm²
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[3]	Male ———— Male Length

Industrial Ethernet

[1] Further connectors see chapter E70
[2] Further system cables see chapter E60
[3] Please state length separately

Stock items in bold type

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**		

Stock items in bold type

Industrial
Ethernet

Metal Industrial Outlet

General description

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.

The robust metal housing means that the outlet can even be used in the neighbourhood of welding robots. It can easily be mounted on walls, pillars, beams or production cells.

The proven LSA+ 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.
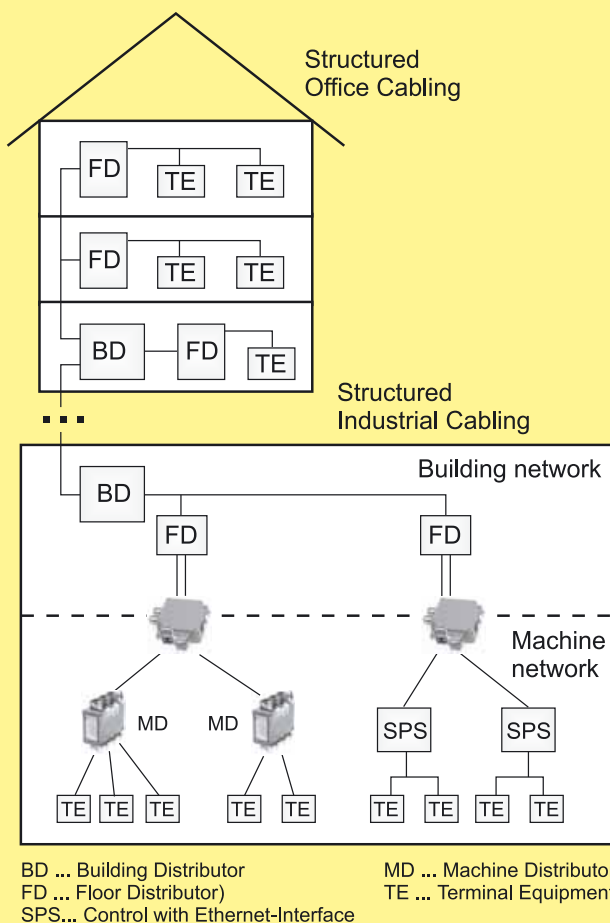
The connection socket provides an interface to the specified Industrial Ethernet cabling in accordance with PROFInet® in the HARTING RJ Industrial® Metal Outlet device.

Field installation cable

Machinery installation cable
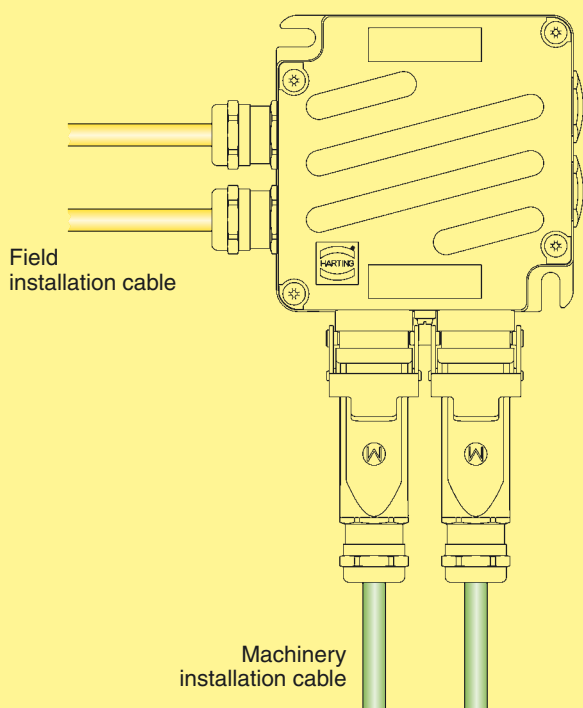
Industrial Outlet for PROFInet®

Advantages

- High IP 65 / IP 67 protection level
- Robust metal housing
- Can be used directly in industrial environments
- Easy mounting on walls or beams
- LSA+ connection technology makes installation straightforward
- Optimum connector technology with high data security
- PROFInet® compatible
- Label for individual customer marking

Structured Office Cabling

FD — TE — TE

FD — TE — TE

BD — FD — TE

Structured Industrial Cabling

Building network

BD

FD   FD

Machine network

MD   MD   SPS   SPS

TE TE TE   TE TE   TE TE   TE TE

BD ... Building Distributor
FD ... Floor Distributor)
SPS... Control with Ethernet-Interface

MD ... Machine Distributor
TE ... Terminal Equipment

Mechanical data

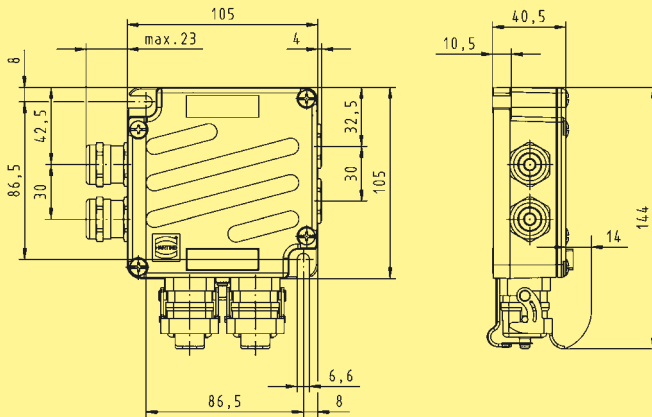|	
Housing type	Robust metal housing of aluminium die-cast
Dimensions	105 x 120 x 40.5 (W x D x H in mm)
Mounting	Panel mounting
Weight	approx. 0.6 kg
Protection level	IP 67 / IP 65

Ethernet Interface

Suitable for	Fast Ethernet, Ethernet
Horizontal cable termination	2 x LSA+ connection technology
Interface for field cabling	2 x HARTING RJ Industrial® IP 67 Data 3A interface with RJ 45 mating face in accordance with IEC 60 603-7
	or
	2 x *HARAX®* M12 with D-Coding

Environmental conditions

Operating temperature range	0 °C … +55 °C

Industrial Outlet

Metal Industrial Outlet
HARTING RJ Industrial® Metal Outlet

Industrial Outlet type	Part No.	Drawing	Dimensions in mm
HARTING RJ Industrial® Metal Outlet Industrial Outlet Set incl. 2 x metal cable gland, M20 for cable diameter 5 – 9 mm 2 x metal blanking piece, M20 1 x label (36 x 9 mm) 1 x assembly instructions	**09 45 815 1100**		

Technical characteristics

Ethernet Interface

Suitable for	Fast Ethernet / Ethernet
Transmission characteristics	Link performance class D in accordance with ISO/IEC 11 801:2002 and EN 50 173-1:2002 for PROFInet® cabling
Horizontal cable termination	2 x LSA+ connection technology
Core diameter	AWG 26-22 (0.35 - 0.65 mm)
Core isolation	0.7 - 1.6 mm (PE or PVC isolation) 0.7 - 1.85 mm (foamed isolation)
Interface for field cabling	2 x HARTING RJ Industrial® IP Data 3A interface
Mating face	RJ 45 in accordance with IEC 60 603-7

Stock items in bold type

Accessories

Identification	Part No. Ethernet termination	
Connector set HARTING RJ Industrial®		
IP 67 Data 3A in metal, 2 pairs	**09 45 115 1100**[1]	
IP 67 Data 3A in metal, 4 pairs	**09 45 115 1500**[1]	
Coding pin set	**09 45 820 0000**	

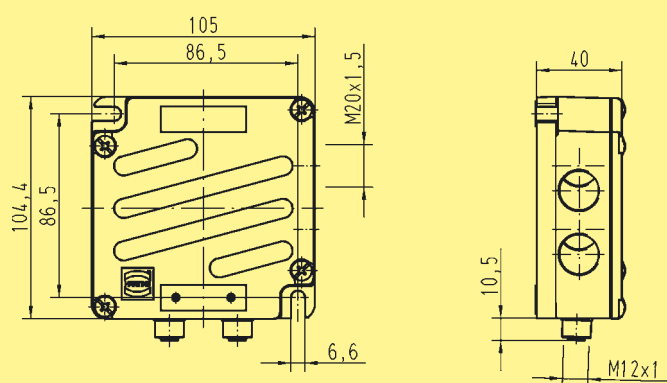| Identification		Part No.	Technical details	
System Cables for Industrial Ethernet, pre-assembled at both ends[2]				
Standard System Cable for Industrial Ethernet	Length: 1.5 m	**09 45 715 1123**	Cable type:	Industrial Ethernet Standard Cable, 2 x 2 x AWG 22/1, shielded twisted pair
	3.0 m	**09 45 715 1125**		
	5.0 m	**09 45 715 1127**		
	10.0 m	**09 45 715 1151**	Connectors:	2 x HARTING RJ Industrial® IP 67 Data 3A with IDC fast termination technology and zinc die-cast full metal housing, fit for field assembly
	20.0 m	**09 45 715 1153**		
	50.0 m	**09 45 715 1156**		
	100.0 m	**09 45 715 1161**		
Stranded System Cable for Industrial Ethernet	Length: 1.5 m	**09 45 715 1164**	Cable type:	Industrial Ethernet Stranded Cable, 2 x 2 x AWG 22/7, shielded twisted pair
	3.0 m	**09 45 715 1166**		
	5.0 m	**09 45 715 1168**		
	10.0 m	**09 45 715 1173**	Connectors:	2 x HARTING RJ Industrial® IP 67 Data 3A with IDC fast termination technology and zinc die-cast full metal housing, fit for field assembly
	20.0 m	**09 45 715 1175**		
	50.0 m	**09 45 715 1178**		
	100.0 m	**09 45 715 1183**		

[1] Further connector sets see chapter E70
[2] Further system cables see chapter E60

Stock items in bold type

PROFInet ODVA

Metal Industrial Outlet
INO 67 M12
M12 D-Coding

Industrial Outlet type	Part No.	Drawing	Dimensions in mm
INO 67 M12 M12 D-Coding Industrial Outlet Set incl. 2 x metal cable gland, M20 for cable diameter 5 – 9 mm 2 x metal blanking piece, M20 1 x label (36 x 9 mm)	20 73 302 4941		

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
Cable termination	2 x LSA+ connection technology 2 x mateable exit, pluggable with connector M12 D-Coding

Accessories

Identification	Part No. Ethernet termination	
Cable gland metal IP 65, metric M20, cable diameter: 5 - 9 mm	**19 00 000 5080**	
Blanking piece metal IP 65, metric M20	**19 00 000 5070**	
HARAX® M12-L circular connector shielded, male, 4poles, D-Coding	**21 03 281 1405**[1]	
Protection cover M12	**21 01 000 0003**	

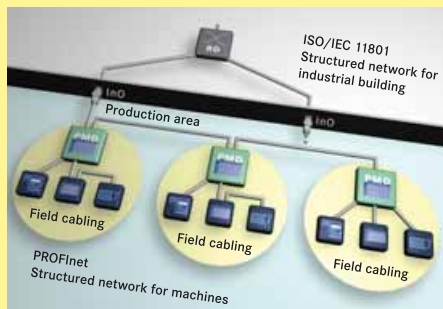| Identification	Part No.	
System Cables for Industrial Ethernet, pre-assembled at both ends[2] IP 65 / 67 (when mated) metal		
2 x circular connector Length: 1 m M12 D-Coding, straight 3 m 5 m	21 03 483 1401 21 03 483 1403 21 03 483 1405 21 03 483 1400[3]	Cable: AWG 26 / 0.14 mm² Male ▭——————▭ Male Length
2 x circular connector 1 m M12 D-Coding, angled 3 m 5 m	21 03 483 3401 21 03 483 3403 21 03 483 3405 21 03 483 3400[3]	
2 x circular connector Length: 1 m M12 D-Coding, straight 3 m 5 m	21 03 485 1401 21 03 485 1403 21 03 485 1405 21 03 485 1400[3]	Cable: AWG 22 / 0.34 mm² Male ▭——————▭ Male Length
2 x circular connector 1 m M12 D-Coding, angled 3 m 5 m	21 03 485 3401 21 03 485 3403 21 03 485 3405 21 03 485 3400[3]	in accordance with PROFInet® installation guide

[1] Further connectors see chapter E70
[2] Further system cables see chapter E60
[3] Please state length separately

Stock items in bold type

Thermoplastic Industrial Outlet
HARTING RJ Industrial® Outlet Push Pull

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 cross-level wiring. The locations for these wall sockets are specified in the course of designing the network for a factory floor. The building network cable is connected to an outlet at pillars or production cells. The plant-specific cabling starts here. 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.

Installation options

The HARTING RJ Industrial® Outlet Push Pull is the central element in this family. It 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 push-pull 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® 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 HARTING RJ Industrial® Push Pull is presently being considered by the Industrial Premises Task Group (IPTG) – a working group within ISO / IEC developing the new version of the 11801 cabling standard – as the possible connector pattern for the connection of industrial cabling to office networks. 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. Dummy plugs can be inserted into both push-pull interfaces, 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® IP 20 connector and usual standard RJ 45 connectors.

Thermoplastic Industrial Outlet
HARTING RJ Industrial® Outlet Push Pull

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+ 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 proven KRONE KM8 socket module with LSA+ technology. This allows solid and flexible AWG 24-22 industrial 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°.
In this way, the both link and the

(Source: KRONE)

component performance are guaranteed to comply with Category 6 of ISO / IEC 11801 or EN 50173-1:2002.

Integrated cable manager for secure, reliable cable guidance

Category 6 performance is further supported by an integrated cable manager. It assures the user that the building 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

(Source: KRONE)

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® connecting socket 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.

Industrial Ethernet

Mechanical data

Housing type	Robust plastic housing
Mounting	Panel mounting
Protection level	IP 67 / IP 65
Colour	Black or white

Ethernet Interface

Suitable for	Gigabit Ethernet, Fast Ethernet, Ethernet
Horizontal cable termination	2 x KRONE LSA+ fast termination technology
Interface for field cabling	2 x HARTING RJ Industrial® Push Pull interface, specified for PROFInet®
Mating face	RJ 45 in accordance with IEC 60 603-7

Environmental conditions

Operating temperature range	-20 °C … +70 °C

Industrial Ethernet

General information

Installation operations

Very few steps are required to mount the Industrial Outlet and to connect the building cable. The cable can be introduced from below or from above.

Introducing the cable from below

1. Drill mounting holes. We recommend that the liner from the packaging is used as a template to mark the holes to be drilled.

2. Mount the base of the outlet with four screws.

3. Disengage the cable manager with an ordinary screwdriver (w_{max} = 4 mm) and remove it.
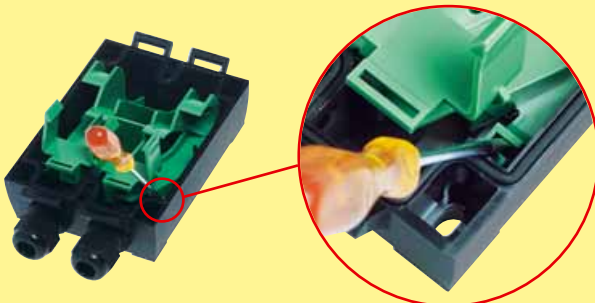
4. Mount the cover opposite the threaded gland holes, insert the building cable (dia. = 6 - 9 mm), fix with the screw-type cable gland and remove insulation as far as the marking on the housing cover.

Marking on the cover

14^{+1} mm 60^{+10} mm
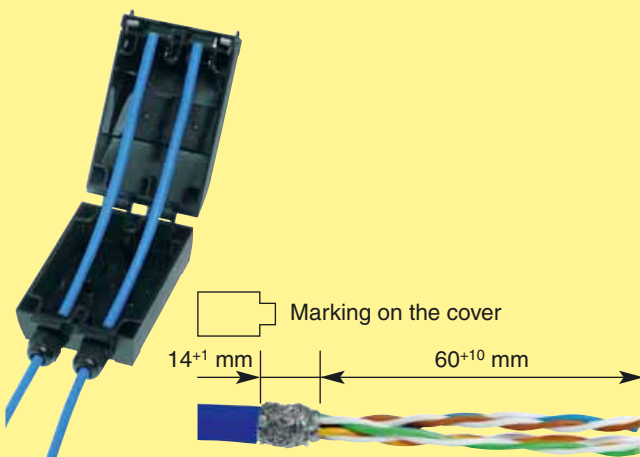
5. Connect the cable to the included KRONE KM8 modules (instructions on the packaging).

6. Insert the cable manager into the outlet (with the arrow pointing to the engaging nose), and press it gently until it engages with an audible click.

7. Insert the KRONE KM8 modules into the cable manager, and engage them with an audible click. Make sure that the modules are seated correctly!
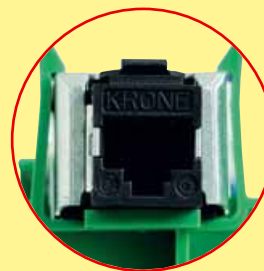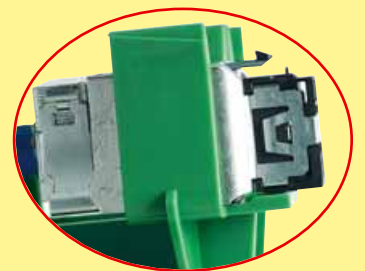
from the front   from the left

8. Close the cover and tighten it.

Introducing the cable from above
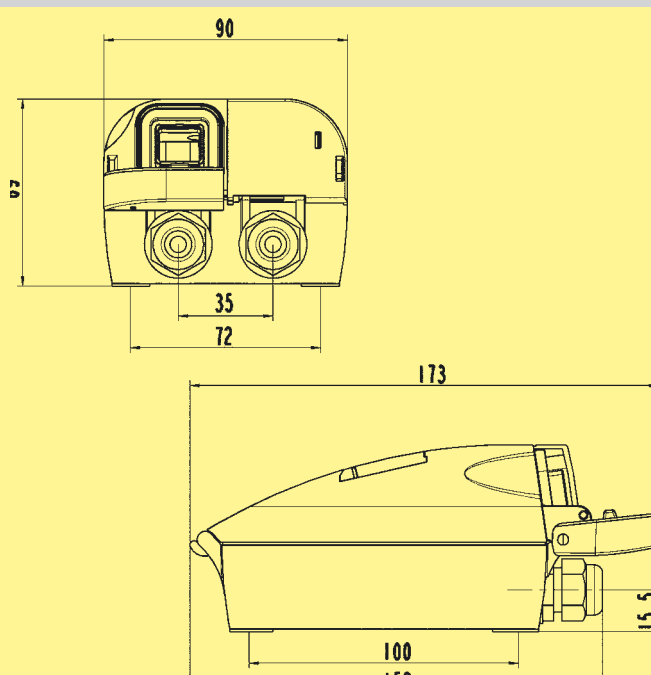
There are just three simple points that must be observed when introducing the cable from above:

1. Mount the base with the **screw-type cable glands facing upwards** (step 2).

2. Mount the cover on the **same side as the threaded gland holes** (step 4).

3. The **cable manager**, correspondingly, is to be inserted **turned 180°** (step 6).

Industrial Outlet

HARTING

Thermoplastic Industrial Outlet
HARTING RJ Industrial® Outlet Push Pull

Industrial Outlet type	Part No.	Drawing	Dimensions in mm

HARTING RJ Industrial®
Outlet Push Pull
 	
incl.
2 x plastic cable gland,
   M16 for cable diameter 6 – 9 mm,
   pre-assembled
2 x RJ 45 female module, KRONE KM 8,
   Category 6
1 x label in IP 67,
   integrated in housing
1 x assembly instructions			

Housing colour black	**09 45 845 1500**		
Housing colour white	**09 45 845 1501**		

Technical characteristics

Ethernet Interface

Suitable for	Gigabit Ethernet / Fast Ethernet / Ethernet
Transmission characteristics	Link performance class E in accordance with ISO/IEC 11 801:2002 and EN 50 173:2002
Horizontal cable termination	2 x KRONE LSA+ fast termination technology
Wire gauge	AWG 22 solid (0.65 mm) AWG 24 solid (0.5 mm)
Core isolation	0.7 - 1.6 mm Ø
Cable sheath diameter	6 - 9 mm
Interface for field cabling	2 x HARTING RJ Industrial® Push Pull interface, specified for PROFInet®

Stock items in bold type

Identification	Part No. Ethernet termination	
Connector set HARTING RJ Industrial®		
IP 67 Push Pull, 2 pairs	**09 45 145 1100**[1]	
IP 67 Push Pull, 4 pairs	**09 45 145 1500**[1]	

Identification	Part No.	Technical details	
System Cables for Industrial Ethernet, pre-assembled at both ends[2]			
Standard System Cable for Industrial Ethernet	Length: 1.5 m	**09 45 745 1123**	Cable type: Industrial Ethernet Standard Cable, 2 x 2 x AWG 22/1, shielded twisted pair
	3.0 m	**09 45 745 1125**	
	5.0 m	**09 45 745 1127**	
	10.0 m	**09 45 745 1151**	Connectors: 2 x HARTING RJ Industrial® IP 67 Push Pull with IDC fast termination and locking technology, fit for field assembly
	20.0 m	**09 45 745 1153**	
	50.0 m	**09 45 745 1156**	
	100.0 m	**09 45 745 1161**	
Stranded System Cable for Industrial Ethernet	Length: 1.5 m	**09 45 745 1164**	Cable type: Industrial Ethernet Stranded Cable, 2 x 2 x AWG 22/7, shielded twisted pair
	3.0 m	**09 45 745 1166**	
	5.0 m	**09 45 745 1168**	
	10.0 m	**09 45 745 1173**	Connectors: 2 x HARTING RJ Industrial® IP 67 Push Pull with IDC fast termination and locking technology, fit for field assembly
	20.0 m	**09 45 745 1175**	
	50.0 m	**09 45 745 1178**	
	100.0 m	**09 45 745 1183**	
	Length: 1.5 m	**09 45 745 1523**	Cable type: Industrial Ethernet Stranded Cable, Category 6, 4 x 2 x AWG 26/7, shielded twisted pair
	3.0 m	**09 45 745 1525**	
	5.0 m	**09 45 745 1527**	
	10.0 m	**09 45 745 1551**	
	20.0 m	**09 45 745 1553**	Connectors: 2 x HARTING RJ Industrial® IP 67 Push Pull, 4 pairs, Category 6
	50.0 m	**09 45 745 1556**	
	100.0 m	**09 45 745 1561**	

[1] Further connector sets see chapter E70
[2] Further system cables see chapter E60

Stock items in bold type

Industrial Ethernet

HARTING

System cables

PROFInet

Cable for Industrial Ethernet

Description	Part No.	Technical characteristics	
PROFInet® type A cable for fixed installation Length: 100 m reel	**09 45 600 0100**	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, Ø 6.5 mm solid, 2 x 2 x AWG 22/1 (Ø 0.64 mm) -40 °C ... +70 °C multiple bending 15 x Ø one time 6 x Ø 150 N
PROFInet® type B cable for flexible installation Length: 100 m reel	**09 45 600 0102**	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, Ø 6.5 mm stranded, 2 x 2 x AWG 22/7 (Ø 0.75 mm) -40 °C ... +70 °C multiple bending 5 x Ø one time 3 x Ø 150 N
PROFInet® type C cable for power chains Length: 100 m reel	**09 45 600 0101**	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, Ø 6.5 mm stranded, 2 x 2 x AWG 22/7 (Ø 0.75 mm) -40 °C ... +70 °C multiple bending 7 x Ø one time 3 x Ø power chain: 200 mm 150 N
PROFInet® type B Hybrid cable for flexible installation Length: 100 m reel	**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 mm² -20 °C ... +70 °C multiple bending 10 x Ø one time 5 x Ø 200 N

Stock items in bold type

System cables

Cable for Industrial Ethernet

Description	Part No.	Technical characteristics	
Industrial Ethernet cable, 4 pairs for flexible installation Length: 100 m reel	**09 45 600 0103**	Cabling standard in acc. with ISO/IEC 11 801:	Category 5
		Structure:	two wires twisted to a pair, 4 pairs twisted with shielding foil
		Sheath:	PVC green, Ø 5.8 mm
		Cores:	stranded, 4 x 2 x AWG 26/7 (Ø 0.15 mm)
		Service temperature:	-20 °C ... +60 °C
		Minimum bending radius:	multiple bending 8 x Ø one time 4 x Ø
		Max. permissible tension:	150 N
Gigabit Ethernet cable, 4 pairs for flexible installation Length: 100 m reel	**09 45 600 0500**	Cabling standard in acc. with ISO/IEC 11 801:	Category 6
		Structure:	two wires twisted to a pair, shielded, 4 pairs twisted with shielding
		Sheath:	PVC green, Ø 6.8 mm
		Cores:	stranded, 4 x 2 x AWG 26/7 (Ø 0.15 mm)
		Service temperature:	-40 °C ... +70 °C
		Minimum bending radius:	multiple bending 15 x Ø one time 10 x Ø
		Max. permissible tension:	150 N

Stock items in bold type

RJ Industrial Fieldpatch IP 20

Description	Part No.	Technical characteristics

System Cables for Industrial Ethernet, pre-assembled at both ends

for the cabling of Industrial Ethernet networks in accordance with the PROFInet® guideline, based on RJ 45 connectors.

Applications: control cabinets and industrial environments with low environmental stress on the connector.

Transmission properties in accordance with ISO/IEC 11 801:2002: Class D
Sheath: PVC green, Ø 6.5 mm
Mating face: 2 x RJ 45 in acc. with IEC 60603-7
Protecion level: IP 20 (when mated)

Pin assignment in accordance with PROFInet® specification:

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:	Part No.
1.5 m	**09 45 751 1123**
3.0 m	**09 45 751 1125**
5.0 m	**09 45 751 1127**
10.0 m	**09 45 751 1151**
20.0 m	**09 45 751 1153**
50.0 m	**09 45 751 1156**
100.0 m	**09 45 751 1161**

Cable type: Industrial Ethernet Standard Cable, 2 x 2 x AWG 22/1, shielded twisted pair

Connectors: 2 x HARTING RJ Industrial® IP 20 Data with IDC fast termination technology, fit for field assembly

Stranded System Cable for Industrial Ethernet

Length:	Part No.
1.5 m	**09 45 751 0023**
3.0 m	**09 45 751 0025**
5.0 m	**09 45 751 0027**
10.0 m	**09 45 751 0051**
20.0 m	**09 45 751 0053**
50.0 m	**09 45 751 0056**
100.0 m	**09 45 751 0061**

Cable type: Industrial Ethernet Stranded Cable, 2 x 2 x AWG 22/7, shielded twisted pair

Connectors: 2 x HARTING RJ Industrial® IP 20 Data with IDC fast termination technology, fit for field assembly

Stranded System Cable for Industrial Ethernet overmoulded

Length:	Part No.
1.5 m	**09 45 771 1123**
3.0 m	**09 45 771 1125**
5.0 m	**09 45 771 1127**
10.0 m	**09 45 771 1151**
20.0 m	**09 45 771 1153**
50.0 m	**09 45 771 1156**
100.0 m	**09 45 771 1161**

Cable type: Industrial Ethernet Stranded Cable, 2 x 2 x AWG 22/7, shielded twisted pair

Connectors: 2 x HARTING RJ Industrial® IP 20 Data with overmoulded housings

Further system cables available on request.

Stock items in bold type

System cables

RJ Industrial Fieldpatch IP 67 Push Pull

Description	Part No.	Technical characteristics

**System Cables
for Industrial Ethernet,
pre-assembled at both ends**

for the cabling of Industrial Ethernet networks 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.

Transmission properties in
accordance with ISO/IEC
11 801:2002:   Class D
Sheath: PVC green, Ø 6.5 mm
Mating face: 2 x RJ 45 in acc. with IEC 60603-7
Protecion level: IP 67/65 (when mated)

Pin assignment in accordance with PROFInet® specification:

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

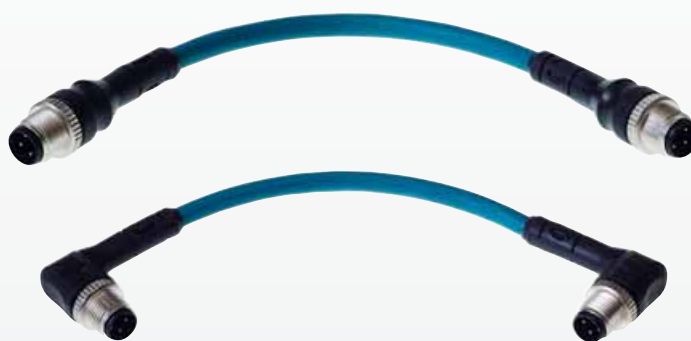| Length:	Part No.
1.5 m	**09 45 745 1123**
3.0 m	**09 45 745 1125**
5.0 m	**09 45 745 1127**
10.0 m	09 45 745 1151
20.0 m	**09 45 745 1153**
50.0 m	**09 45 745 1156**
100.0 m	**09 45 745 1161**

Cable type: Industrial Ethernet Standard Cable,
                         2 x 2 x AWG 22/1, shielded twisted pair

Connectors: 2 x HARTING RJ Industrial® IP 67 Push Pull
                         with IDC fast termination and locking
                         technology, fit for field assembly

Stranded System Cable for Industrial Ethernet

Length:	Part No.
1.5 m	**09 45 745 1164**
3.0 m	**09 45 745 1166**
5.0 m	**09 45 745 1168**
10.0 m	**09 45 745 1173**
20.0 m	**09 45 745 1175**
50.0 m	**09 45 745 1178**
100.0 m	**09 45 745 1183**

Cable type: Industrial Ethernet Stranded Cable,
                         2 x 2 x AWG 22/7, shielded twisted pair

Connectors: 2 x HARTING RJ Industrial® IP 67 Push Pull
                         with IDC fast termination and locking
                         technology, fit for field assembly

Further system cables available on request.

Stock items in bold type

HARTING

PROFI net

RJ Industrial Fieldpatch IP 67 Data 3A

Description	Part No.	Technical characteristics

**System Cables
for Industrial Ethernet,
pre-assembled at both ends**

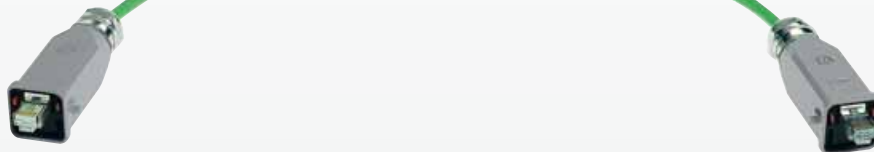for the cabling of Industrial Ethernet networks in accordance with the PROFInet® guideline, based on RJ 45 connectors.

Applications: industrial environments with high environmental stress and mechanical stress.

Transmission properties in accordance with ISO/IEC
11 801:2002:   Class D
Sheath: PVC green, Ø 6.5 mm
Mating face: 2 x RJ 45 in acc. with IEC 60603-7
Protecion level: IP 67/65 (when mated)

Pin assignment in accordance with PROFInet® specification:

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:	Part No.	
	1.5 m	**09 45 715 1123**	
	3.0 m	**09 45 715 1125**	
	5.0 m	**09 45 715 1127**	
	10.0 m	**09 45 715 1151**	
	20.0 m	**09 45 715 1153**	
	50.0 m	**09 45 715 1156**	
	100.0 m	**09 45 715 1161**	

Cable type: Industrial Ethernet Standard Cable,
                2 x 2 x AWG 22/1, shielded twisted pair

Connectors: 2 x HARTING RJ Industrial® IP 67 Data 3A
                with IDC fast termination technology and zinc
                die-cast full metal housing, fit for field assembly

Stranded System Cable for Industrial Ethernet	Length:	Part No.	
	1.5 m	**09 45 715 1164**	
	3.0 m	**09 45 715 1166**	
	5.0 m	**09 45 715 1168**	
	10.0 m	**09 45 715 1173**	
	20.0 m	**09 45 715 1175**	
	50.0 m	**09 45 715 1178**	
	100.0 m	**09 45 715 1183**	

Cable type: Industrial Ethernet Stranded Cable,
                2 x 2 x AWG 22/7, shielded twisted pair

Connectors: 2 x HARTING RJ Industrial® IP 67 Data 3A
                with IDC fast termination technology and zinc
                die-cast full metal housing, fit for field assembly

Further system cables available on request.

Stock items in bold type

Industrial Ethernet

System cables

PROFI net ODVA

M12 D-Coding IP 67

Description	Part No.	Technical characteristics

**System Cables
for Industrial Ethernet,
pre-assembled at both ends**

for the cabling of Industrial Ethernet networks in accordance with the PROFInet® guideline, based on circular connectors M12 D-coded.

Cable type:	Shielded Twisted Pair Standard Cable
Transmission properties in accordance with ISO/IEC 11 801:2002:	Class D, 100% tested
Mating face:	M12 D-Coding in accordance with IEC 61 076-2-101
Protection level:	IP 65/67 (when mated)

Pin assignment in accordance with PROFInet® specification:

Signal	Function	Conductor colour	Pin no.
TD+	Transmission Data+	Yellow	1
TD-	Transmission Data-	Orange	3
RD+	Receiver Data+	White	2
RD-	Receiver Data-	Blue	4
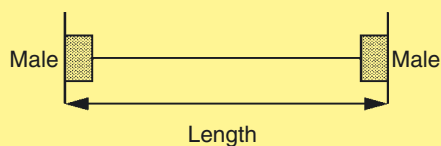
Description		Part No.	Technical characteristics
2 x circular connector M12 D-Coding, straight	Length:1 m 3 m 5 m	21 03 483 1401 21 03 483 1403 21 03 483 1405 21 03 483 1400[1]	Cable: AWG 26 / 0.14 mm²
2 x circular connector M12 D-Coding, angled	1 m 3 m 5 m	21 03 483 3401 21 03 483 3403 21 03 483 3405 21 03 483 3400[1]	Male ⸺ Male 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[1]	Cable: AWG 22 / 0.34 mm²
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[1]	Male ⸺ Male Length in accordance with PROFInet® installation guide
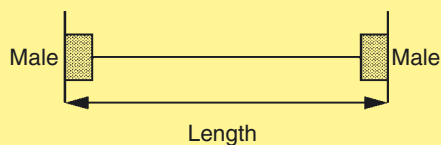
[1] Mention length separately

RJ Industrial Fieldpatch IP 20

Category 6
NEW

Description	Part No.	Technical characteristics	
System Cables for Industrial Ethernet, pre-assembled at both ends		Transmission properties in accordance with ISO/IEC 11 801:2002:	Class E
		Sheath:	PVC green, Ø 6.8 mm
for the application neutral cabling of Industrial networks in accordance with ISO/IEC 11 801, based on RJ 45 connectors.		Mating face:	2 x RJ 45 in acc. with IEC 60603-7
		Protecion level:	IP 20 (when mated)
Applications: control cabinets and industrial environments with low environmental stress on the connector, and applications where 4 pairs or high end Ethernet Cabling is required.			

Stranded System Cable for Industrial Ethernet	Length: 1.5 m	**09 45 751 1523**		
	3.0 m	**09 45 751 1525**	Cable type:	Industrial Ethernet Stranded Cable, Category 6, 4 x 2 x AWG 26/7, shielded twisted pair
	5.0 m	**09 45 751 1527**		
	10.0 m	**09 45 751 1551**		
	20.0 m	**09 45 751 1553**	Connectors:	2 x HARTING RJ Industrial® IP 20 Data, 4 pairs, Category 6
	50.0 m	**09 45 751 1556**		
	100.0 m	**09 45 751 1561**		
Stranded System Cable for Industrial Ethernet overmoulded	Length: 1.5 m	**09 45 771 1523**		
	3.0 m	**09 45 771 1525**	Cable type:	Industrial Ethernet Stranded Cable, Category 6, 4 x 2 x AWG 26/7, shielded twisted pair
	5.0 m	**09 45 771 1527**		
	10.0 m	**09 45 771 1551**		
	20.0 m	**09 45 771 1553**	Connectors:	2 x HARTING RJ Industrial® IP 20 Data with overmoulded housings, 4 pairs, Category 6
	50.0 m	**09 45 771 1556**		
	100.0 m	**09 45 771 1561**		

Further system cables available on request.

Stock items in bold type

RJ Industrial Fieldpatch IP 67 Push Pull

Description	Part No.	Technical characteristics
System Cables for Industrial Ethernet, pre-assembled at both ends		Transmission properties in accordance with ISO/IEC 11 801:2002: Class E
for the application neutral cabling of Industrial networks in accordance with ISO/IEC 11 801, based on RJ 45 connectors.		Sheath: PVC green, Ø 6.8 mm
		Mating face: 2 x RJ 45 in acc. with IEC 60603-7
Applications: industrial environments with high environmental stress, small mounting dimensions, frequent mating cycles and applications where 4 pairs or high end Ethernet Cabling is required.		Protecion level: IP 67/65 (when mated)

Description		Part No.	Technical characteristics	
Stranded System Cable for Industrial Ethernet	Length: 1.5 m	**09 45 745 1523**		
	3.0 m	**09 45 745 1525**		
	5.0 m	**09 45 745 1527**	Cable type:	Industrial Ethernet Stranded Cable, Category 6, 4 x 2 x AWG 26/7, shielded twisted pair
	10.0 m	**09 45 745 1551**		
	20.0 m	**09 45 745 1553**	Connectors:	2 x HARTING RJ Industrial® IP 67 Push Pull, 4 pairs, Category 6
	50.0 m	**09 45 745 1556**		
	100.0 m	**09 45 745 1561**		

Further system cables available on request.

Stock items in bold type

Category 6 NEW

RJ Industrial Fieldpatch IP 67 Data 3A

Description	Part No.	Technical characteristics
System Cables for Industrial Ethernet, pre-assembled at both ends		Transmission properties in accordance with ISO/IEC 11 801:2002: Class E Sheath: PVC green, Ø 6.8 mm Mating face: 2 x RJ 45 in acc. with IEC 60603-7 Protecion level: IP 67/65 (when mated)
for the application neutral cabling of Industrial networks in accordance with ISO/IEC 11 801, based on RJ 45 connectors. Applications: industrial environments with high environmental stress, mechanical stress and applications where Class E Ethernet or 4 pairs cabling is required.		

Description		Part No.	Technical characteristics
Stranded System Cable for Industrial Ethernet	Length: 1.5 m	**09 45 715 1523**	
	3.0 m	**09 45 715 1525**	Cable type: Industrial Ethernet Stranded Cable, Category 6, 4 x 2 x AWG 26/7, shielded twisted pair
	5.0 m	**09 45 715 1527**	
	10.0 m	**09 45 715 1551**	
	20.0 m	**09 45 715 1553**	Connectors: 2 x HARTING RJ Industrial® IP 67 Data 3A with zinc die-cast full metal housing, 4 pairs, Category 6
	50.0 m	**09 45 715 1556**	
	100.0 m	**09 45 715 1561**	

Further system cables available on request.   **Stock items in bold type**

Contents chapter E70

Connectors

Page

Industrial
Ethernet

E
70
.
01

Industrial Ethernet

HARTING RJ Industrial®
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® is the only 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®* fast termination contacts. These make reliable contact with stranded, industry-standard 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 mm² 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® 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® 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.

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.

Industrial Ethernet

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

Mating compatibility of the HARTING RJ Industrial® family

Industrial Ethernet

Assembly operations
HARTING RJ Industrial® IP 20 Data

Only a few steps are necessary to quickly and reliably connect an Industrial Ethernet cable to a HARTING RJ Industrial® 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

HARTING

PROFI net
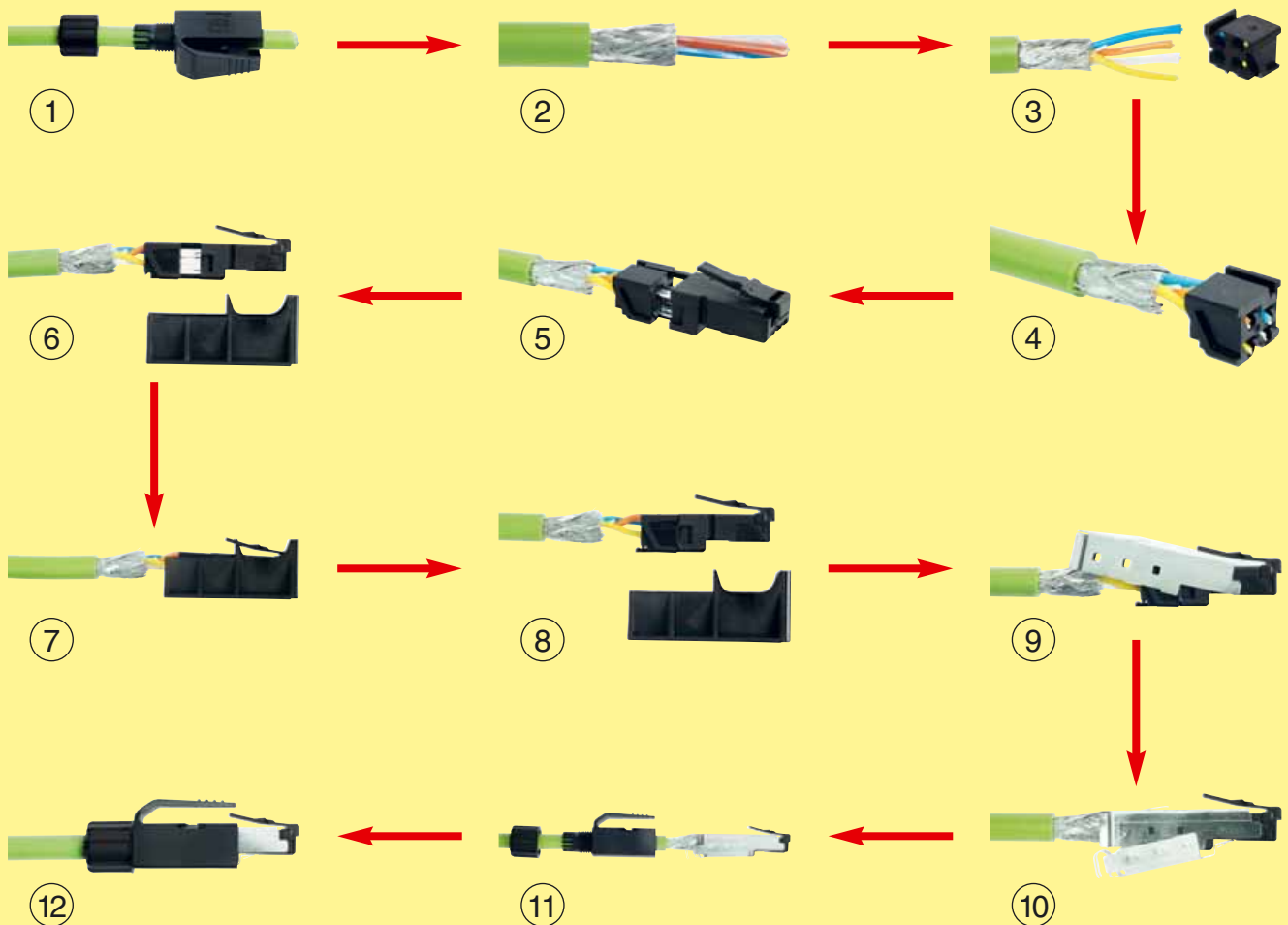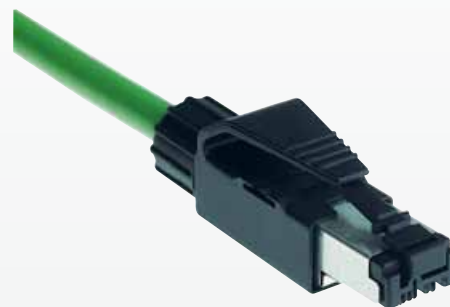
IP 20 Data connectors

Identification	Part No.	Drawing	Dimensions in mm

Connector set
    incl. housing, cable gland
    and instruction manual

09 45 151 1100
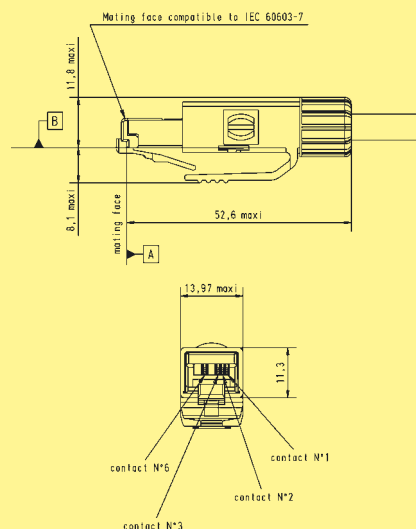
Mating face compatible to IEC 60603-7

11,8 maxi

B

8,1 maxi

mating face

52,6 maxi

A

13,97 maxi

11,3

contact N°6

contact N°1

contact N°2

contact N°3

Technical characteristics

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

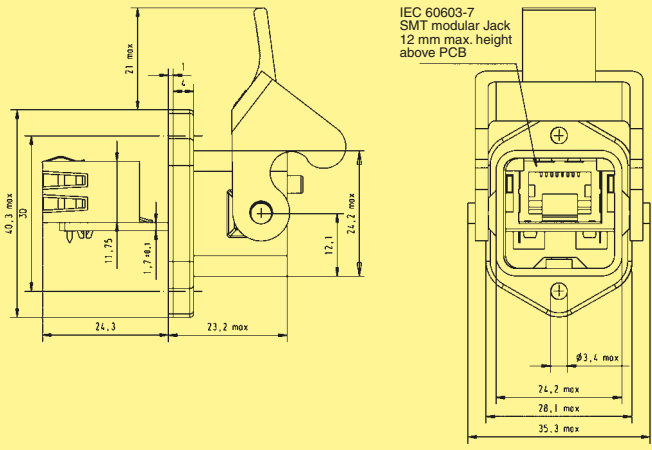|	
Protection level:	IP 20
Mating interface:	RJ 45 in accordance with IEC 60603-7
Wire gauge data[1]:	AWG 22 - 24 stranded AWG 22 - 23 solid
Temperature range:	-40 °C … +70 °C
Cable sheath diameter:	6.5 mm - 6.9 mm
Mating cycles:	min. 750
Housing material:	Thermoplastic, black UL 94-V0

General information
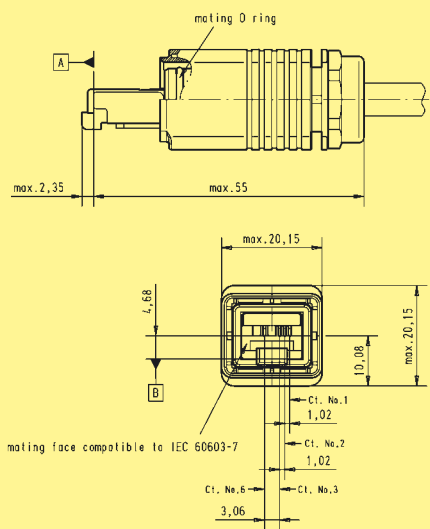
The IP 20 Data connector complies with the require-ments of industrial applications. This RJ 45 Ethernet connector can be connected to AWG-22 cables with IDC technology and is designed with a standard pitch of just 14 mm, which guarantees maximum packing density in the application. An additional latching 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.

E 70.05

[1] Details see technical data sheet

Stock items in bold type

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**		
Protection cover for connectors with cord, IP 67/65	**09 45 845 0001**		

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[1]:	AWG 22 - 24 stranded AWG 22 - 23 solid
Temperature range:	-40 °C … +70 °C
Cable sheath diameter:	6.5 mm - 7.2 mm
Mating cycles:	min. 750
Housing material:	Thermoplastic, 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® Push Pull is thus the smallest IP 67/65 Industrial Ethernet connector based on RJ 45 with IDC connection technology in the world.

[1] Details see technical data sheet

Stock items in bold type

E 70.06

HARTING

PROFI net

IP 67 Push Pull panel feed through

Identification	Part No.	Drawing	Dimensions in mm
Panel feed through set			
incl. housing and instruction manual	**09 45 245 1100**		
Protection cover for panel feed through			
with cord, IP 67/65	**09 45 845 0002**		

max.19,2   max.15,7
13,2
A   3,6
11,75
max.14,90
max.20,5
7,65
1,6±0,1
max.45
max.1,2

max.32,3
26,5
4,68
max.18
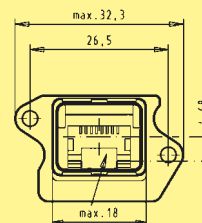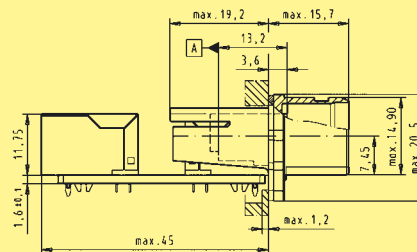
IEC 60603.7 modular jack

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
Mating cycles:	min. 750
Housing material:	Thermoplastic, black UL 94-V0

General information
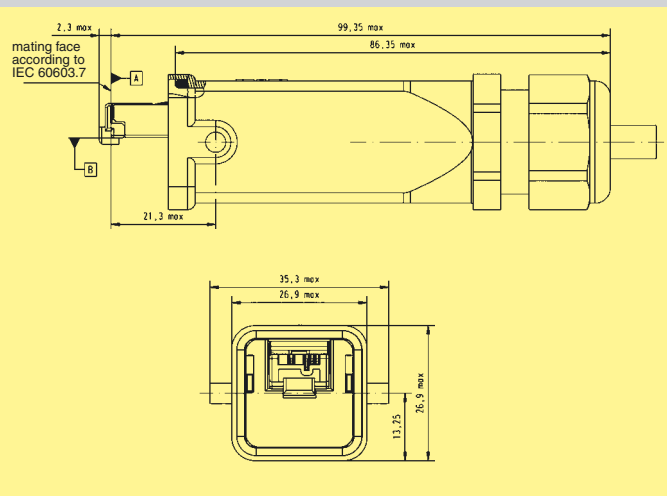
The IP 67 Data version in a push pull housing is fitted with innovative housing locking technology. The housing of the connector is locked securely to the hood by means of a surrounding locking sleeve. In spite of the high degree of protection, the panel feed through is very compact, having a space requirement 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.

E 70 . 07

PROFI net

IP 67 Data 3A connectors

Identification	Part No.	Drawing	Dimensions in mm

Connector set
incl. housing, cable gland and instruction manual

Plastic version — **09 45 125 1100**

Metal version — **09 45 115 1100**

Coding pin set — **09 45 820 0000**

Protection cover for connectors
with cord, IP 67/65

Plastic version — **09 20 003 5442**

Metal version — **09 20 003 5422**

Dimensions valid for plastic version

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[1]:	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
Housing material:	Thermoplastic, black UL 94-V0 Zinc die cast, grey

General information

The IP 67 Data version of the RJ Industrial is based on the RJ 45 Data module, integrated into a standard Han® 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.

Implementing a uniform pattern for all the connectors based on the Han® 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.

[1] Details see technical data sheet

Stock items in bold type

IP 67 Data 3A panel feed through

Identification	Part No.	Drawing	Dimensions in mm
Panel feed through set incl. housing and instruction manual			
Plastic version	**09 45 225 1100**		
Metal version	**09 45 215 1100**		
Coding pin set	**09 45 820 0000**		
Protection cover for panel feed through with cord, IP 67/65			
Plastic version	**09 20 003 5409**		
Metal version	**09 20 003 5430**		

IEC 60603-7
SMT modular Jack
12 mm max. height
above PCB

Dimensions valid for plastic version

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
Housing material:	Thermoplastic, black UI 94-V0 Zinc die cast, grey
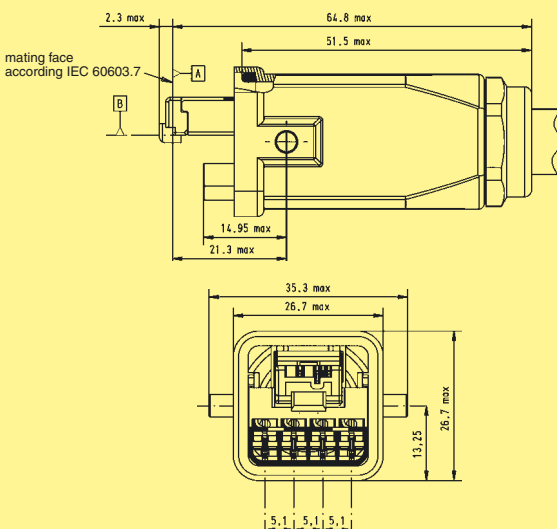
General information

The IP 67 panel feed through data version of the RJ Industrial is based on an RJ 45 jack, integrated into a Han® 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.

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.

Stock items in bold type

PROFI net

IP 67 Hybrid connectors

Identification	Part No.	Drawing	Dimensions in mm
Connector set incl. housing, cable gland and instruction manual	**09 45 125 1300**		
Protection cover for connectors with cord, IP 67/65	**09 20 003 5442**		

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 mm² 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:	Thermoplastic, 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 mm² to be connected.

Derating curve "Power contacts"
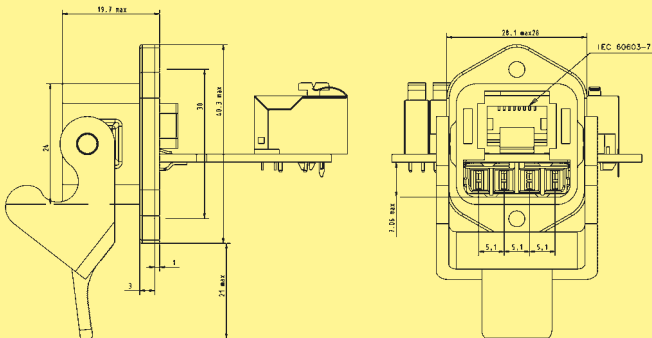
1 Temperature rise
2 Derating
3 Derating curve
  at I$_{max}$ * 0.8
  (DIN IEC 512)

Stock items in bold type

PROFI net
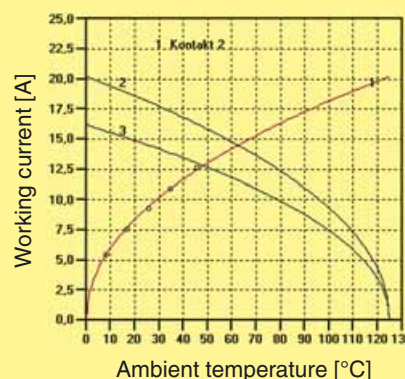
IP 67 Hybrid panel feed through

Identification	Part No.	Drawing	Dimensions in mm

Panel feed through set
  incl. housing
  and instruction manual
	09 45 225 1300		

Coding pin set	**09 45 820 0000**		
Protection cover **for panel feed through** with cord, IP 67/65	**09 20 003 5409**		

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 mm²

Working voltage
power supply: 48 V

Working current
power supply: see derating curve

Panel cut out: 22 x 22 mm

Temperature range: -40 °C … +70 °C

Mating cycles: min. 500

Housing material: Thermoplastic, 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 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.

Stock items in bold type

HARTING RJ Industrial® 4 pair

The HARTING RJ Industrial® 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® 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.
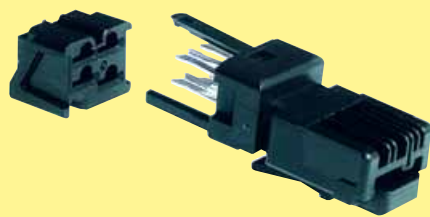
Data module, 2 pairs
AWG 22-24, Category 5
HARAX® IDC terminations
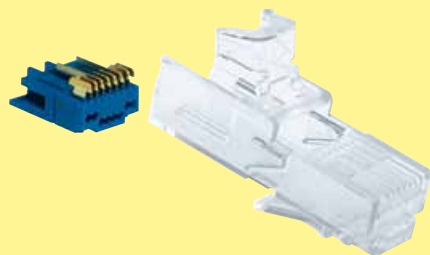
Gigalink data module,
4 pairs, AWG 24-26, Category 6
Crimp terminations

Same shielding
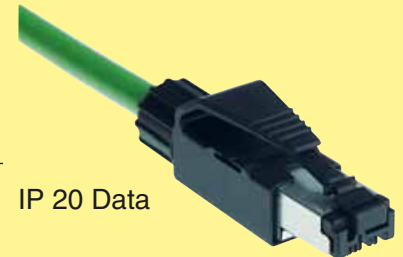
IP 20 Data

IP 67
Push Pull

IP 67 Data 3A

IP 67 Hybrid

Data module strategy

Industrial Ethernet

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® 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® connector family as future-proof as possible.

Minimising cross-connection through cable 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 through-connected 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 cross-connection of core pairs 2 and 4 in the cable. This cross-connection has a negative effect on the near-end crosstalk of the transmission route. For performance reasons, symmetrically crossing the core pairs in the cable must be carried out as near as possible to the connector. This demand is implemented through the colour-coded cable manager, which leads the conductor pairs in a defined way to the connection points on the RJ 45 jack. This implements the cross-connection in the cable manager instead of in the cable itself, so contributing to the high performance of the transmission route.

Pair Code	Pin No.	Colour
T1	5	White/Blue
R1	4	Blue/White
T2	3	White/Orange
R2	6	Orange/White
T3	1	White/Green
R3	2	Green/White
T4	7	White/Brown
R4	8	Brown/White

Pin	Function
1	Transmission +
2	Transmission –
3	Receive +
6	Receive –
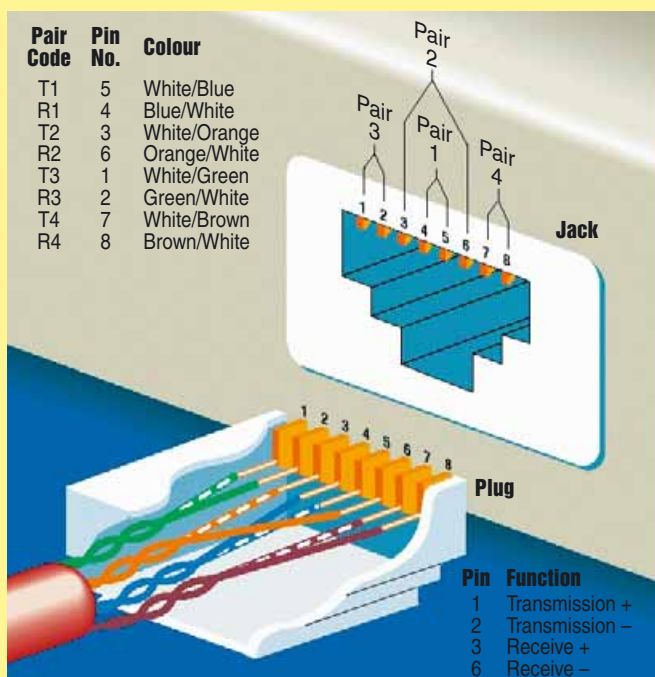
Connection of core pairs

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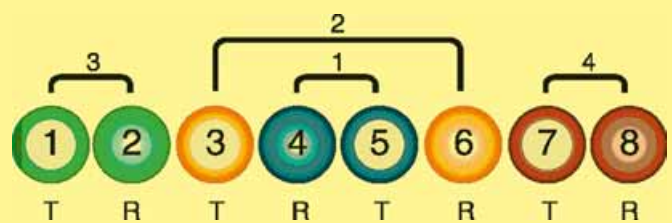
Connection in acc. with TIA/EIA 568A (preferred configuration)
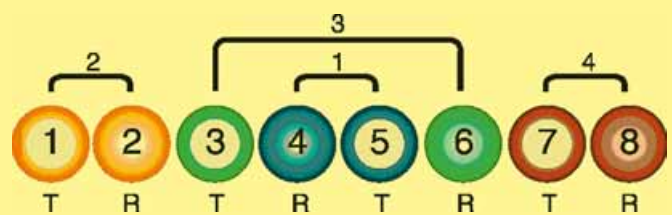
Connection in acc. with TIA/EIA 568B (AT&T configuration)

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.

IP 20 Data connectors, 4 pairs

Identification	Part No.	Drawing	Dimensions in mm

Connector set
    incl. housing, cable gland
    and instruction manual

cable manager white	**09 45 151 1500**
cable manager blue	**09 45 151 1510**
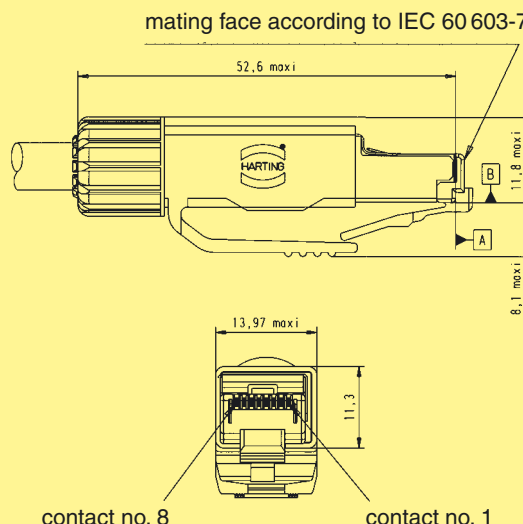
mating face according to IEC 60 603-7

52,6 maxi

11,8 maxi

8,1 maxi

13,97 maxi

11,3

contact no. 8   contact no. 1

Technical characteristics

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

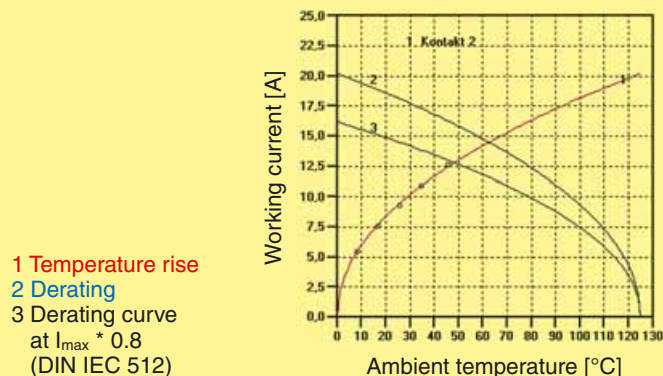|	
Protection level:	IP 20
Mating interface:	RJ 45 in accordance with IEC 60603-7
Wire gauge data[1]:	AWG 26 stranded
Temperature range:	-40 °C … +70 °C
Cable sheath diameter:	6.5 mm - 6.9 mm
Mating cycles:	min. 750
Housing material:	Thermoplastic, black UL 94-V0

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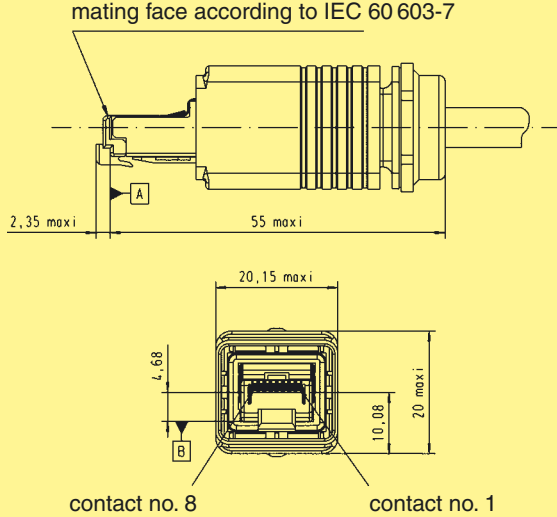
With a standard pitch of only 14 mm, maximum packing density in application is guaranteed.

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.

**E
70
.
14**

[1] Details see technical data sheet
RJ Industrial Gigalink crimping tool see chapter E90

Stock items in bold type

IP 67 Push Pull connectors, 4 pairs

Identification	Part No.	Drawing	Dimensions in mm

Connector set
incl. housing, cable gland
and instruction manual
 	
      cable manager white
 	
      cable manager blue
	09 45 145 1500
	
	09 45 145 1510		

Protection cover for connectors with cord, IP 67/65	**09 45 845 0001**		

mating face according to IEC 60 603-7

2,35 maxi   A   55 maxi

20,15 maxi

4,68   10,08   20 maxi

B

contact no. 8   contact no. 1

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[1]:	AWG 26 stranded
Temperature range:	-40 °C … +70 °C
Cable sheath diameter:	6.5 mm - 7.2 mm
Mating cycles:	min. 750
Housing material:	Thermoplastic, black UL 94-V0

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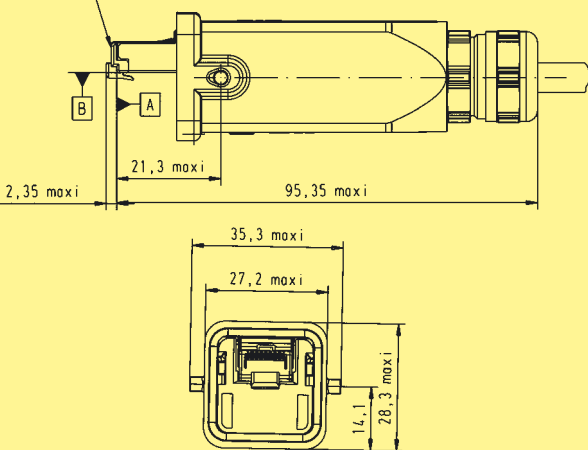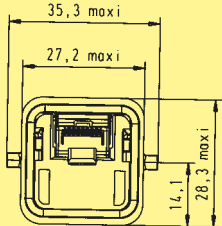
The IP 67 data version in push pull housing is fitted with innovative housing locking technology. The housing of the connector is locked tightly to the coupling by means of a surrounding locking sleeve. The connector can be locked and unlocked using one hand and only a little force. In spite of its high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

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

[1] Details see technical data sheet
RJ Industrial Gigalink crimping tool see chapter E90

Stock items in bold type

Industrial Ethernet

IP 67 Data 3A connectors, 4 pairs

Identification	Part No.	Drawing	Dimensions in mm

Connector set
incl. housing, cable gland
and instruction manual

Plastic version	cable manager white	**09 45 125 1500**
	cable manager blue	**09 45 125 1510**
Metal version	cable manager white	**09 45 115 1500**
	cable manager blue	**09 45 115 1510**
Coding pin set		**09 45 820 0000**

Protection cover for connectors
with cord, IP 67/65

Plastic version	**09 20 003 5442**
Metal version	**09 20 003 5422**

mating face according to IEC 60 603-7

B   A

21,3 max i
2,35 max i
95,35 max i

35,3 max i
27,2 max i
14,1
28,3 max i

Dimensions valid for metal version

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[1]:	AWG 26 stranded
Temperature range:	-40 °C … +70 °C
Cable sheath diameter:	6.5 mm - 6.9 mm
Mating cycles:	min. 500
Housing material:	Thermoplastic, black UL 94-V0 Zinc die cast, grey

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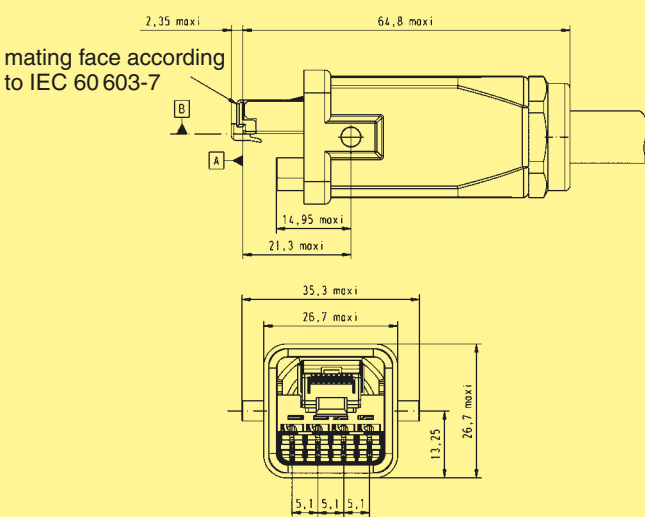
Implementing a uniform connector pattern for all the connectors based on the 3A contour for data and hybrid solutions means that all versions are plug-compatible for data signals. Use of optional coding prevents up to four connectors being incorrectly mated.

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

[1] Details see technical data sheet
RJ Industrial Gigalink crimping tool see chapter E90

Stock items in bold type

IP 67 Hybrid connectors, 4 pairs

Identification	Part No.	Drawing	Dimensions in mm
Connector set incl. housing, cable gland and instruction manual		mating face according to IEC 60 603-7	
cable manager white	**09 45 125 1700**		
cable manager blue	**09 45 125 1710**		
Protection cover for connectors with cord, IP 67/65	**09 20 003 5442**		

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 plus 4 x power supply
Wire gauge data:	AWG 26 stranded
Wire gauge power supply:	1.5 mm² 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:	Thermoplastic, black UL 94-V0

RJ Industrial Gigalink crimping tool see chapter E90

General information

The RJ Industrial Hybrid connector, which HARTING has developed an interface solution that integrates the data lines and the power supply into one cable for hybrid Ethernet networks.

Industrial-quality flexible conductors with AWG 26 and IDC technology can be connected for data. The four contacts of the hybrid module are implemented with fast connection technology, permitting the connection of flexible cables having a cross-section of up to 1.5 mm².

The HARTING RJ Industrial® Hybrid Category 6 is ideally suited to harsh industrial applications that require 4 pair or Gigabit Ethernet wiring plus power.

Derating curve "Power contacts"

1 Temperature rise
2 Derating
3 Derating curve at I_{max} * 0.8 (DIN IEC 512)

M12-L, shielded

Industrial Ethernet

Transmission characteristics in accordance with DIN 50 173-1

Working voltage	32 V
Working current (see current carrying capacity)	4 A
Coding	D
Wire gauge	0.25 mm² - 0.34 mm² 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

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.

M12-L, shielded

1 = Wire gauge
   0.34 mm²
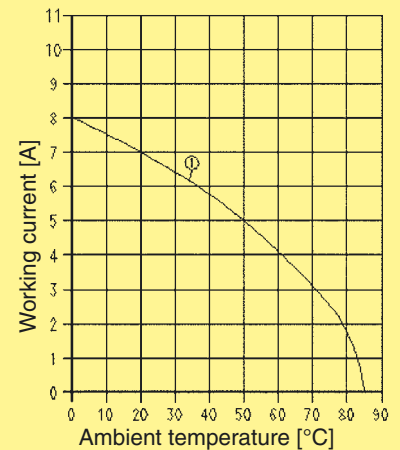
Assembly details
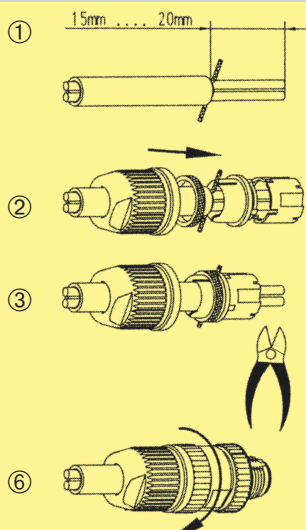
1. Remove cable sheath

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

5. 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.

General information

Shielding attenuation diagram
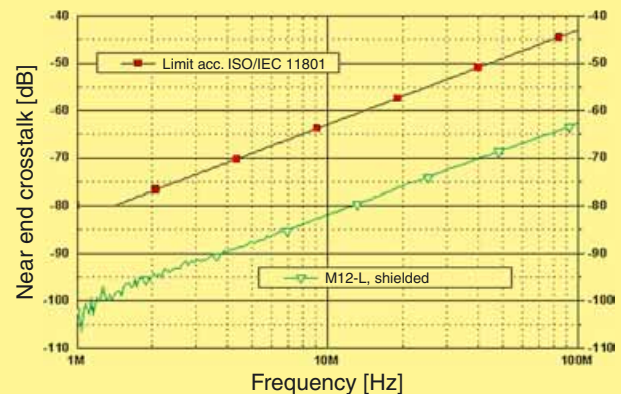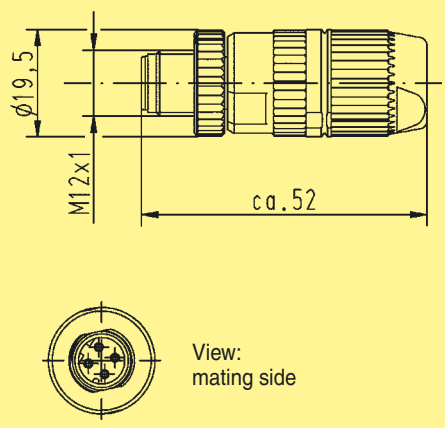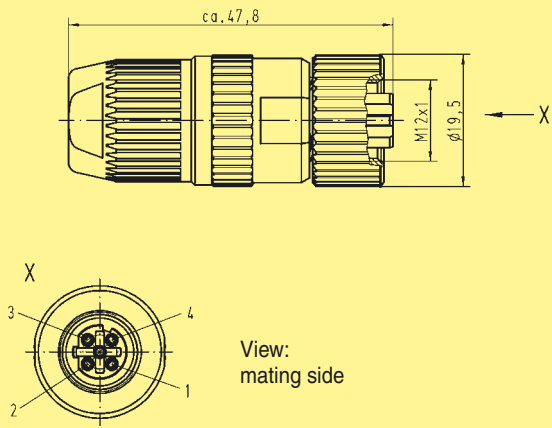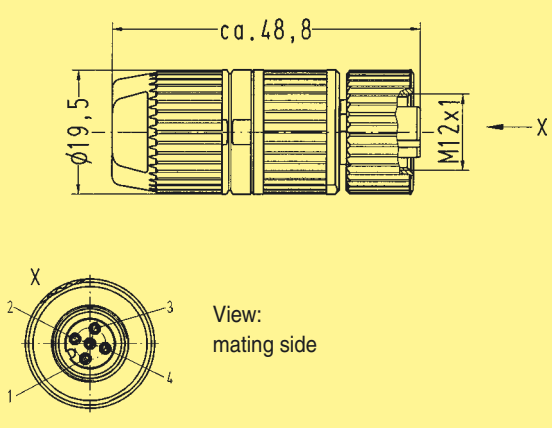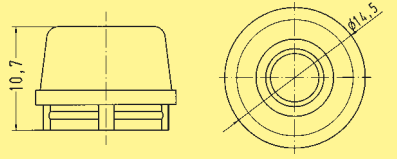
The *HARAX®* principle

• 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.

HARAX® circular connector M12-L

Identification	Series	No. of contacts	Part No.	Drawing	Dimensions in mm
Circular connector M12-L, shielded male D-Coding for Ethernet straight version	M12	4	**21 03 281 1405**		View: mating side
female D-Coding for Ethernet straight version	M12	4	**21 03 281 2405**		View: mating side
Circular connector M12-L A-Coding for power termination straight version	M12	4	**21 03 212 2305**		View: mating side
Seal M12-L	M12		21 01 010 2003		

Stock items in bold type

Han-Brid® Quintax 3A   General information

HARTING

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

Industrial Ethernet

Description

The Han-Brid® 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® 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® 3A series. The protection level of the hood corresponds to DIN EN 60 529, IP 65.

Power supply

- Standard Han D® male and female crimp contacts

- Rated current: 10 A

- Rated voltage: 50 V

- Connection range: 0.14 to 2.5 mm² stranded

- Approval: UL

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 mm² stranded
                            AWG 26 - 14

Wire gauge
power supply: 0.14 - 2.5 mm² stranded
                            AWG 26 - 14
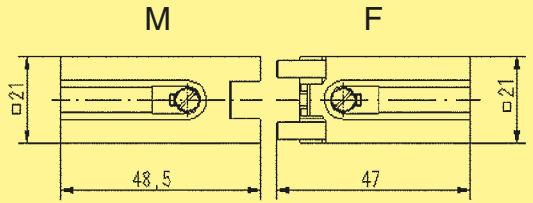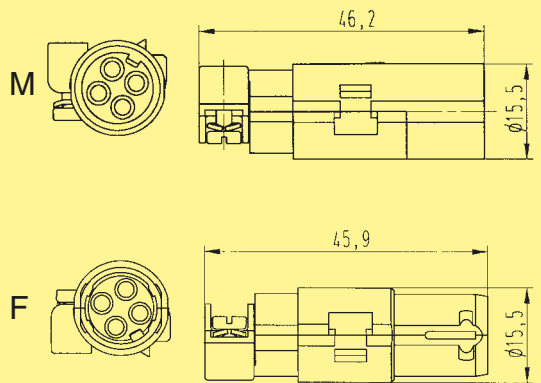
Temperature range: -40 °C … +70 °C

Cable sheath diameter: 3 mm - 9.5 mm

Mating cycles: ≥ 500

E 70.20

Han-Brid® Quintax 3A

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

Identification	Cable-Ø mm	Part No. Male insert (M)	Part No. Female insert (F)	Drawing	Dimensions in mm
Quintax insert	–	**09 15 003 3001**		M F	
	–		**09 15 003 3101**	□21 48,5 47 □21	
Quintax Z contact Zinc alloy Order crimp contacts separately see page E70.22 Cable clamp for cable diameter 3 - 6 and 6 - 9.5 mm is supplied with the inserts	3 - 9,5	**09 15 004 3013**	09 15 004 3113	M 46,2 Ø15,5	
				F 45,9 Ø15,5	

Assembly Manual
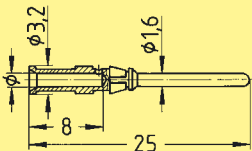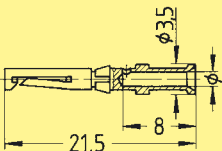
Quintax-Z-contact
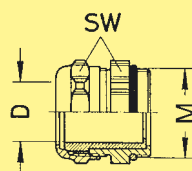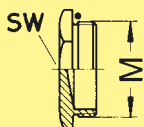
1. Strip cable acc. to drawing 1 and fold the shielding over the cable.

2. Crimp Han D® contacts onto the wires.

3. Insert Han D® 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.

1.   8*   15   13

2.

3.

4.

5.

6.

E 70 .21

Stock items in bold type
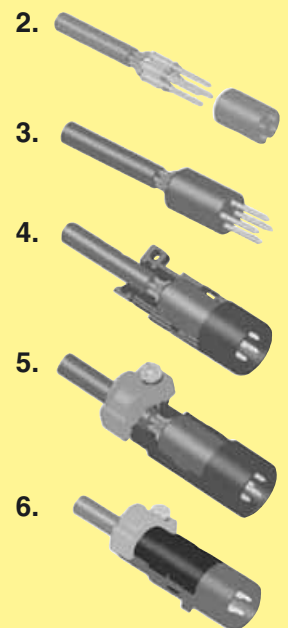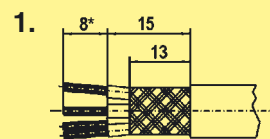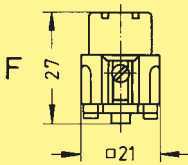
Identification	Wire gauge (mm²)	Part No.		Drawing	Dimensions in mm
		Male contacts	Female contacts		
Crimp contacts					
silver plated	0.14-0.37	09 15 000 6104	09 15 000 6204		
	0.5	09 15 000 6103	09 15 000 6203		
	0.75	09 15 000 6105	09 15 000 6205		
	1.0	09 15 000 6102	09 15 000 6202		
	1.5	09 15 000 6101	09 15 000 6201		
	2.5	09 15 000 6106	09 15 000 6206		
gold plated	0.14-0.37	09 15 000 6124	09 15 000 6224		
	0.5	09 15 000 6123	09 15 000 6223		
	0.75	09 15 000 6125	09 15 000 6225		
	1.0	09 15 000 6122	09 15 000 6222		
	1.5	09 15 000 6121	09 15 000 6221		
	2.5	09 15 000 6126	09 15 000 6226		

Wire gauge (stranded)		ø	Stripping length
0.14-0.37 mm²	AWG 26-22	0.90 mm	8 mm
0.5 mm²	AWG 20	1.10 mm	8 mm
0.75 mm²	AWG 18	1.30 mm	8 mm
1 mm²	AWG 18	1.45 mm	8 mm
1.5 mm²	AWG 16	1.75 mm	8 mm
2.5 mm²	AWG 14	2.25 mm	6 mm

E
70
.22

Accessories

Identification		Part No.	Drawing				Dimensions in mm

Cable entry protection for metric cable entries (IP 68)

metal

	Part No.
	19 00 000 5080
	19 00 000 5082
	19 00 000 5084

Thread M	Cable diameter D	SW
M 20	5 - 9 mm	22
M 20	6 - 12 mm	22
M 20	10 - 14 mm	24

Blanking piece for metric cable entries

metal

	Part No.
	19 00 000 5070

Thread	SW
M 20	20

Below is shown the cable range of metric glands:
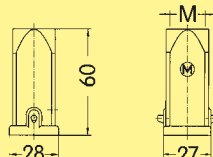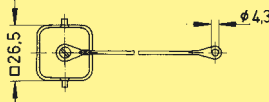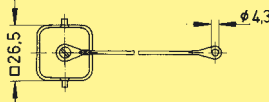
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	mm
									M 20																							
								M 20																								
				M 20																												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	mm

Inserts

Identification		Series	Part No. Female insert (F)	Drawing	Dimensions in mm

Screw terminal

Han® 4 A

Part No. Female insert (F)
09 20 004 2711

Contact arrangement
View from termination side

Hoods   metal

Size 3 A

Identification		M	Part No.	Drawing	Dimensions in mm

Hood
top-entry

20

Part No.
19 20 003 1440

Protection cover
for hoods

Part No.
09 20 003 5425[1]

[1] for mounted female insert

Stock items in bold type

Industrial Ethernet

Accessories

Industrial
Ethernet

Identification	Wire gauge (mm²)	Part No.	
HARTING crimping tool with locators for all Han D® contacts 0.14 - 1.5 mm²		**09 99 000 0021**	
BUCHANAN crimping tool for all Han D® contacts 0.14 - 4.0 mm²		**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® 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 Crimping Tool for 4 pairs HARTING RJ Industrial® Gigalink connectors		**09 45 800 0500**	With the RJ Industrial Gigalink crimping tool 4 pairs of connectors can be fast, easily and reliably connected to flexible AWG 26-24 cables.
HARTING RJ Industrial® Stripping Tool Stripping Tool for 2 pairs Ethernet cables incl. blade cassette		**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.

Stock items in bold type
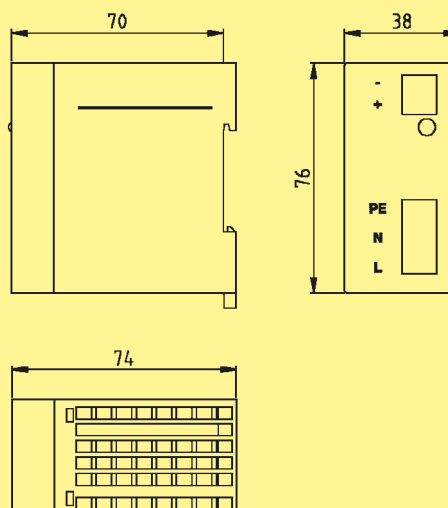
Power Supply

Identification	Part No.	Drawing	Dimensions in mm
Power Supply for mounting on 35 mm standard rails acc. to DIN 50 022	20 80 000 3023		

70

38

76

74

Termination: screw

Mounting: standard rail 35 mm acc. to DIN 50 022

Input voltage: AC 94-264 V, 50 - 60 Hz

Output voltage: DC 24 V / 1.25 A

Terminal assignment: clamp two fold DC 24 V / 0 V, max. 2.5 mm²
clamp three fold
AC 94-264 V / N / ground wire PE max. 2.5 mm²

Industrial Ethernet

E
90
.
04