HARTING

Pushing Performance

HARTING
User's Guide Transportation

General Notes

It is the customer's responsibility to evaluate the suitability of the components described herein and the applicability of the specified regulations for use in any special applications which have not been anticipated by HARTING. HARTING reserves the right to make construction changes without prior notice in response to manufacturing requirements, improved quality, advances in the design, or for other miscellaneous reasons. This information describes the components but should not be considered as a guarantee of certain properties. Binding information will only be issued upon request by the appropriate HARTING employee. You will be assigned a contact partner in the contact information supplied by HARTING.
Additional information can be found in the catalogues "Industrial Connectors Han®", "Device Connectivity", "Smart Network Infrastructure – Intelligent Network Solutions" and "Connectors DIN 41 612".

It is explicitly stated that users have to comply with the relevant safety requirements.

Research and standards are constantly evolving and driving the current state of technology. HARTING has taken great care to ensure that this information is current and state-of-the-art. The user is nevertheless obligated to verify – by means of standards and other original documentation – that the information presented herein does not deviate in any way from this original documentation or from the particular application.

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The information on components provided by this guide should only be used for commercial purposes. Please note that usage for private purposes is not appropriate.

German substantive laws shall apply exclusively.

Standards and other technical regulations

The standards, directives and other technical regulations cited in this document refer to the current editions available at the editorial deadline. Only the most current standard, however, is authoritative for the user of that standard.

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I – Foreword

The railway industry and the HARTING Technology Group have enjoyed a successful partnership marked by a long tradition of trust and cooperation. HARTING has delivered connectors and rail accessories to the railway industry for many years. The expertise and data that we have gathered over these many years of cooperation has provided the foundation for many of our innovations.

This document is not a replacement for our catalogue; instead it provides an overview for the use of HARTING products and solutions in railway vehicles and stationary rail applications.

We have brought together the information that we think will make the user's job easier: whether that job is in construction, development or in production. Not only installation instructions are included here – you will also find descriptions of the certifications, regulations and directives that are relevant to the railway industry (and with which HARTING products are naturally in compliance).

This book is structured so that a variety of information relevant to specific interest groups can be found quickly and simply. Sample applications are used to provide the reader with an overview of the many uses for HARTING products. A selection of products based on connection methods, supplemented with the corresponding installation instructions, is also included. The products are organized and shown according to their applications, whether for indoor or outdoor usage, for data transfer or for carrying high-currents. In other chapters, you can find information about RFID (Radio Frequency Identification), the new product range of current sensors and the ever-increasing area of network technology. Solutions and products for Ethernet networks, for use on the station platform and on-board the train, are described here. HARTING develops solutions jointly with the customer to meet individual requirements. Chapter VIII presents you with a selection of them.

HARTING was founded as a company in 1945. Today the HARTING Technology Group now employs over 400 engineers to design a variety of products and tailor-made solutions in the fields of machine construction, railway systems, wind power facilities, factory automation and telecommunications. HARTING group currently employs nearly 4,000 employees through its 37 regional subsidiaries.

In May 2006, HARTING became one of the first companies in Europe to be certified for IRIS compliance (the International Railway Industry Standard). From this comes the requirement and challenges that HARTING will continue to face in the future in terms meeting the needs and wishes of the rail industry.

Connections and network systems for railway vehicles

Electrical connections for communication and power transfer are normally made using plug connectors.

In recent years, such connectors have been playing a greater role in railway vehicles. This is because of the enormous time and cost pressures that operators are put under. Modern railway vehicles have a modular design in order to help meet these requirements.

As a result, vehicle components are often manufactured at different sites and supplied by different contractors. The individual components are then installed by the provider of the end system.

Modularity offers the advantage of accelerating the initial commissioning process.It also significantly shortens the down time associated with maintenance and repair work.

Connectors can play a very important role in a modular design. Because they can easily be plugged in and out, connectors make it possible for electrical systems to be swapped out quickly. The efficient Plug & Play capability allows you to save time during commissioning or re-commissioning.The complex process of wiring up the connection cables is a thing of the past.

In the past few years, HARTING has designed a product line more clearly aligned with the requirements of railway customers.

Products used in railway vehicles must also be fully railway compliant because they are exposed to very extreme conditions including temperature fluctuations, moisture, vibrations, ballast strikes and electromagnetic radiation.

What significance does all this have for the product?

Robustness, reliability and durability: these are the key product requirements.

A complete line of tests are carried out to ensure that HARTING products are good enough to meet these strict requirements.These tests are carried out by HARTING's own certified laboratory and are also used during product development. These tests are subject not only to electrical standards (such as DIN EN 61 984) but also to the appropriate railway standards (such as EN 50 467, DIN EN 45 545 etc.).

A comprehensive product line, application expertise and excellent quality: these are the factors that have brought HARTING success in the railway sector.These are also the strengths that we will use to support our future collaboration.

II – Application Examples

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II-1 Overview

Several typical railway applications that make use of HARTING products are described in this section.

Wagon couplings

Sub-systems such as current converter and climate control devices

Electrical cabinet

Passenger information/ data communication

Driver's console

Measurement and sensor systems

Power supply

Network systems

Train coupling

Figure II-1.1
Overview

II-2 Integrating connectors into the design phase of railway vehicles

All HARTING connectors and housings have been tested and approved for use in railway vehicles. A distinction must be made based on where the connector will be used on the vehicle.

Housings with the Han-Easy Lock® locking lever (Han® B and Han® EMC/B series) are intended for unrestricted use within vehicle interiors. The user-friendly Han-Easy Lock® locking lever requires only a minimal amount of force when moving it. When planning for exterior vehicular use, however, this feature would not be desired or beneficial. Outside events (such as snow, gravel and stones strikes, or vandalism) present a risk that the lever could be opened unintentionally which could lead to a vehicle malfunction.

Housings intended for outside use are fitted with a screw interlock mechanism (the Han® HPR series) or with a press-knob lock (the Han *Yellock*® series) in order to prevent any such uncontrolled opening. These locking types have an advantage over the locking levers in that they can be only opened in a controlled fashion.

Along with the screw interlock mechanism, HPR housings give the protection class IP68 (IP69K) when they are locked. They are corrosion protected and have very good EMC properties.

The Han® M and Han® M Plus series are rail-compliant options for some applications. They provide the same high level of corrosion protection but have a smaller size compared to the Han® B series and do not have a screw interlock mechanism. The robust stainless steel lever is designed so that the locking force is applied by the Han-Easy Lock® locking lever. It is also a good idea to implement additional measures, dependent on the installation location, in order to prevent an unintended opening. Such measures include blocking devices, protective panels and the proper choice of location for the installation.

II-3 Motor connection

Traction bogie motors are designed to be pluggable, so that they can be quickly and flexibly connected to the vehicle. The advantage is that it can be pre-assembled and tested before the final assembly of the connector. The two-part connector Han® 24 HPR EasyCon is the ideal solution for the varied performance requirements and the quickly changing trip phases of rail vehicles thanks to its innovative shielding connection concept.

Figure II-3.1
Munich Underground (source: Stadtwerke München)

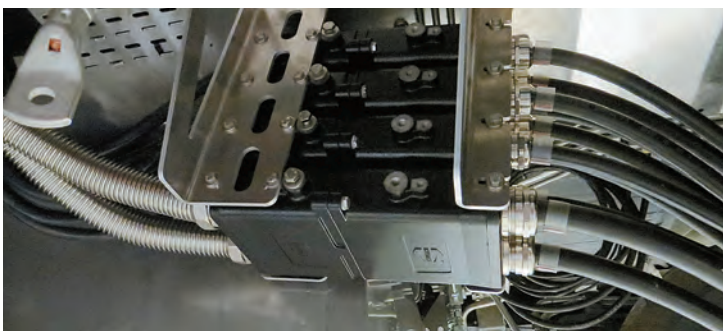

Figure II-3.2
Han® 24 HPR EasyCon

II-4 Connectors for wagon couplings

Connectors from the Han-Modular® series are often used in the wagon couplings of various vehicle manufacturers. The modules provide a pluggable solution for the following rail vehicle applications, as examples:

- Internal train bus (MVB) with the Han-Quintax® module (four poles) or Han® Megabit module (4 poles)
- Low voltage supply and digital signals with the Han DD® module
- Transmission of mid-range power with the Han® EE module
- Transmission of higher powers (batteries, air condition units) with modules for power levels of 40 to 200 A
- Video and other data transmission using Han® Gigabit modules

Housings from the Han® HPR series in size 24 B are used to provide reliable protection against environmental factors and adverse weather conditions.

No type of higher-level protection against water and dust is needed for wagon couplings which are mounted within the train. A system with protection class IP20 is sufficient in these cases. Modified hoods can be used here from the Han® HPR series. These are open on the sides and screwed directly onto the supporting wall using the riveting nuts. The bulkhead mounted housing on the bottom side can be omitted. Savings in both cost and weight are positive knock-on effects.

Figure II-4.1
Double-decker train (Stadler Rail)

Figure II-4.2
Connector on the wagon coupling

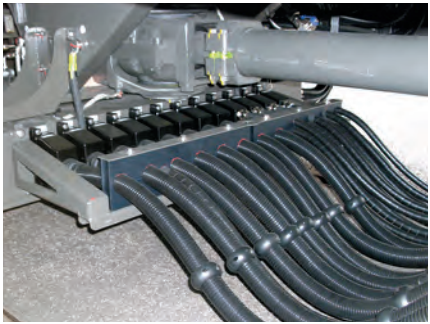

Figure II-4.3
Connector on the short coupling

Figure II.-4.4
IP20 wagon coupling
with modified housing

II-5 Connectors for termination in the smallest space in the driver's console

Trains are manufactured in sub-assemblies. Driver's consoles have also been constructed in a modular way for many years. To be able to connect the individual components electrics quickly, securely and without errors, various connector series are used. In addition, Han-Snap® offers a reduced-weight solution which can be used to transmit data, signals and power in the smallest spaces.

Figure II-5.1
Driver's console

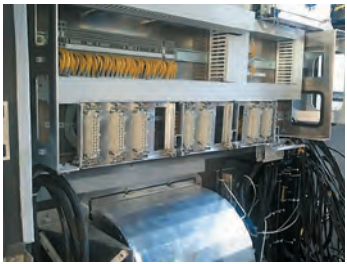

Figure II-5.2
Han-*Snap*® *connector*
in the driver's console

II-6 Termination of sensors

Safety-relevant sensors must be terminated reliably and fault-free. The installation locations are often subject to extreme environmental conditions such as vibrations or the influence of the elements. The components used here must therefore be resistant against corrosion, stone strike and strong vibrations. For this reason, the housings from the Han® HPR series are particularly recommended as they have been designed specifically to meet these extreme challenges. This housing series also offers good EMC characteristics.

Thanks to the sensors being made pluggable, a quicker exchange without increased installation effort is guaranteed during servicing.

Figure II-6.1
Connector
on the temperature sensor

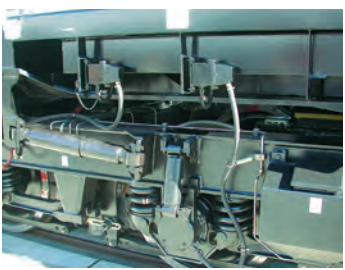

Figure II-6.2
Connector with junction
cable to speed sensor

II-7 Data communication

An example of data communication in rail vehicles is the passenger information and entertainment system. The application shown here is based on Ethernet communication. HARTING provides the system components for the network (the switches, connectors and system cable).

Figure II-7.1
Passenger information and entertainment system (PIES)

Figure II-7.2
Train control unit with Ethernet

Figure II-7.3
HARTING products for this application (from left to right)

- *Ethernet Switch Ha-VIS eCon 9070-B*
- *M12 connector*
- *D-Sub full-metal housing*

II-8 Stationary rail equipment

Not just in moving railway vehicles, HARTING components are often used for stationary railway applications too. Examples of this are: DIN rails on axle counters, heavy-duty connectors on rail-side systems, connectors and network technology in control centres.

These applications are often subject to environmental requirements similar to those on trains (among other things vibration and temperature). In addition, special proofs may also be required, for example to certify use in tunnels.

Figure II-8.1
The axle counter system

Figure II-8.2
A detailed view of the axle counter system with DIN plastic housing

Figure II-8.3
Han-*Yellock*® *on the CONTEC point drive*

II-9 Connectors for use in interiors of railway vehicles

The following applications show the use of connectors in trains.

The connectors shown are used to make power supplies as well as control and data lines pluggable.

Due to the different installation conditions, metal housings, plastic housings as well as grip frame solutions are used.

Contact inserts can be chosen, depending on the pluggable connection, from the Han® Q 5 / 0, Han® Q 7 / 0, Han E®, Han® EE, Han DD®, Han-Modular® and Han® K 6 / 6 series.

Figure II-9.1
Han-Eco® on train control unit

Figure II-9.2
Han® B with central locking mechanism, used for a current converter

Figure II-9.3
Han® EE and Han® ESS with grip panel

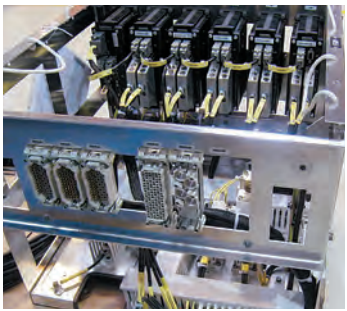

Figure II-9.4
Control unit for a tram (source: Stadler Rail)

II-10 Sub-floor container

Sub-floor containers are needed in order to supply voltage to the different functional units (such as the lighting, air conditioning or ventilator motors).

Modern sub-floor containers have a modular design so that plug-in connectors can be used for connecting to the corresponding train components.

Since the containers are mounted under the floor, the contact inserts must be reliably protected against environmental influences. This is the reason that housings from the Han® HPR series are used.

Contact inserts for both power transmission (the Han® K 6/6 and Han® E) and for control and bus data (Han-Modular®) are used to connect to the corresponding components.

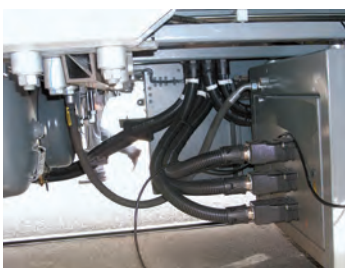

Figure II-10.1
Han® HPR on a mounted sub-floor container

Figure II-10.2
Han® HPR on a sub-floor distribution box

Figure II-10.3
Complete view of the sub-floor container

Figure II-10.4
Sub-floor container, back side with the HARTING Han® connectors

II-11 Connectors in the electrical cabinet

The central elements of the electrical and electronic systems are mounted in electrical cabinets in the inside of the train vehicles as well as in the stationary units. Electrical cabinets have a pluggable design so that time and money can be saved during servicing and initial commissioning. All electrical requirements from power through signal to data are included in this pluggable design concept. HARTING also provides the additional service of offering pre-assembled and tested connector inserts as well as custom-made electrical cabinets. This means the customer can benefit from a significantly shorter installation time for the electrical cabinets.

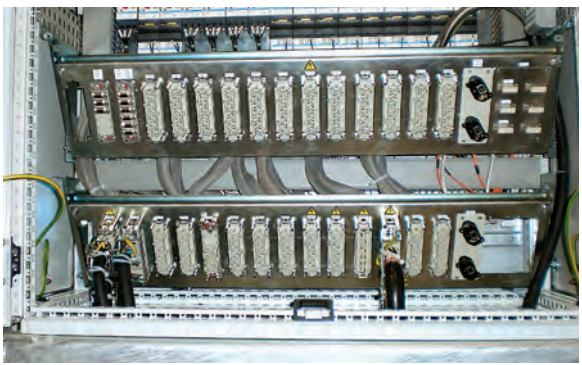

Figure II-11.1
Grip panel solution on a swing frame in the electrical cabinet

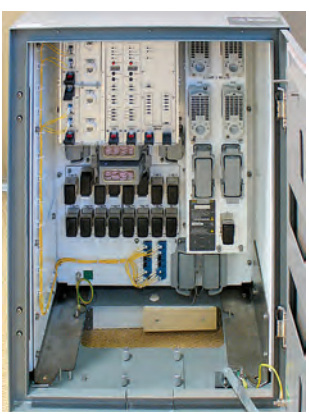

Figure II-11.2
Han® connectors in the electrical cabinet

II-12 Controlling pantographs

To allow quick assembly and an efficient service, control devices for the pantographs are fitted with connectors.

Figure II-12.1
Roof pantograph
Type DSA 200,
from Stemmann Technik

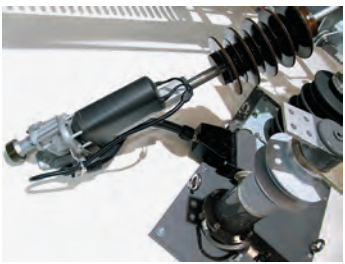

Figure II-12.2
Close-up shot connector
Han® HPR on pantograph

Side pantographs, the so-called pantographs for the third rail, also employ connectors to transfer the control signals for the pantograph stand on the system.

As the connectors sit directly on the pantograph, and are therefore directly exposed to the elements, heavy-duty housings from the Han® HPR series are recommended for this application.

Figure II-12.3
Complete view of the model Fb 218
third-rail pantograph

Figure II-12.4
Han® Q 5 / 0 in the Han® 3 A HPR
housing

II-13 Connectors used in the coupling area of railway vehicles

To make the connection on commissioning easier and to improve the service, electrical train connections to the vehicle are designed to be pluggable. Outside the rail vehicles (underfloor), the same strict requirements in terms of safety and reliability apply as in the other vehicle areas. For this reason, exclusively connectors in housings from the Han® HPR or Han® M series are used here too. Contact inserts are used here to for transmission of power as well as data and bus signals.

Figure II-13.1
Han® HPR interface between coupling unit and vehicle

Figure II-13.2
Automatic E-coupling unit with Han-Modular®

II-14 Monitoring unit for the brake system

Products from the DIN 41 612 series are used inside a rail vehicle, for example on brake control units. The DIN metal housings, mounted on a push-in frame to control and monitor the brake system stand out with their low space requirements and their continuous screening concept. They thereby achieve a very good signal quality which is absolutely essential for an error-free data transmission of the sensor and actuator signals.

Since the push-in frame is used in the vehicle interior, an IP30 level of protection is completely adequate.

Figure II-14.1
Sapsan (Siemens Velaro RUS)

Figure II-14.2
Brake controls (InnoTrans)

Figure II-14.3
D20 full-metal housing

II-15 List of references

Since our founding in 1945, HARTING has delivered various connectors to the railways, and more recently active devices and Ethernet cables too. The following list shows some examples of rail projects.

• **Locomotives**	Europe – TRAXX Europe – Vectron United Kingdom – Euro Light South Africa – Euro 4000 South Africa – Euro Dual PRASA USA – Metra
• **Trams (LRV)**	China – Nanjing – Line Qilin Germany – Freiburg Germany – Karlsruhe Germany – Rostock United Kingdom – Sheffield Canada – Ottawa Poland – Warsaw Russia – Moscow Taiwan – Kaohsiung Hungary – Budapest
• **Metro trains**	Azerbaijan – Baku Chile – Santiago de Chile China – Hangzhou – Line 2 United Kingdom – London – Docklands Hong Kong – Island South Line India – Chennai Italy – Milan – Line 5 Taiwan – Taipei USA – Honolulu USA – Washington – WMATA

• **Regional trains, fast surface trains**	Brazil – Sao Paulo – CPTM China – CRH3A Germany – Deutsche Bahn United Kingdom – Electrostar India – Mumbai – Western Railways Italy – North Milan – TSR for Ferrovie Italy – VIVALTO for Trenitalia New Zealand – Auckland Poland – Wielkopolska Russia – Moscow – Aeroexpress
• **Long-distance and high-speed trains**	China – CRH380B United Kingdom – Voyager Trains Italy – Milan to Rome – ETR 1000 Poland – Pendolino PKP Russia – Velaro RUS (Sapsan) Saudi Arabia – SRO

Notes

III – Connectivity Products

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III-1 Introduction

This chapter introduces the products that are currently being used for electrical connections in the railway industry. The requirements of this industry are taken into consideration at the earliest design stages.

The following criteria should be considered when selecting a product:

- The place of use and the environmental surroundings for the connector (a criterion for selecting the hood and/or housing)
- Current and voltage (a criterion for selecting the contact inserts and contacts)
- Wire construction (a criterion for selecting the type of termination)
- EMC and shielding (a criterion for selecting the housing and cable clamp)

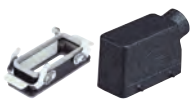
The modular design of HARTING products allows almost all contact inserts to be combined with all types of hoods and housings. It is also possible to put together inappropriate combinations. Contact us if you are unsure of the best combination.

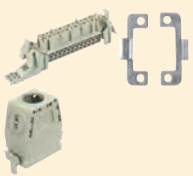
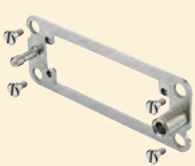
The following pages describe the HARTING products that are most often used in railway applications.

Additional information can be found in the catalogues: “Han® Industrial Connectors”, “Device Connectivity”, “Hall Effect Current Sensors”, and “Smart Network Infrastructure - Intelligent Network Solutions”.

III-2 Hoods and housings overview

III-2.1 Overview of Han® hoods and housings and contact insert holders

Product	Features	Area of use	Product photo
Hood and housing Han® HPR	IP68, (IP69K), corrosion resistance, EMC-safe, screw interlock	External use on railway wagons	
Hood and housing Han® M	For harsh environmental requirements, IP65, stainless steel locking lever	External use on railway wagons	
Hood and housing Han® M Plus	For harsh environmental requirements	External use on railway wagons	
Hood and housing Han® B Han® B IP67	IP65, IP66 / IP67 Han-Easy Lock® locking lever	Internal use on railway wagons	
Hoods and housings Han® EMV Han® EMV/B	IP65, EMC-safe, screw locking, Han-Easy Lock® locking lever	Internal use on railway wagons	
Hoods and housings Han-*Yellock*® Han-*Yellock*® Outdoor	IP65/IP67, press-button interlock, inner locking mechanism	Internal/ external use on railway wagons	
Hoods and housings Han-Eco® Han-Eco® Outdoor	Plastic, IP65, locking lever	Internal/ external use on railway wagons	

Product	Features	Area of use	Product photo
Hoods and housings Han® B HMC	For max. 10000 mating cycles; IP65; Han-Easy Lock® HMC locking mechanism	Internal use on railway wagons	
Hoods and housings Han-Snap®	Resistant to shock and vibration, in compliance with IEC 60 068 / BN 74 018	Internal use on railway wagons; electrical cabinets, distributor boxes	
Screw adapter; refer to the “Installation Instructions” for additional details.	Interlock by means of knurled screws; gripping area for the shield connection and strain relief	Internal use on railway wagons; electrical cabinets, distributor boxes	
Han® Docking frame	Docking frame with floating bearing; fits for all contact inserts in the Han B® housing series; also for Han® Com and Han-Modular®.	Ideal for transportation applications	
Han-Modular® docking frame	Plastic docking frame with floating bearing; fits with all Han-Modular® modules	Ideal for plug-in slot systems; can be attached directly to the panel cut out	

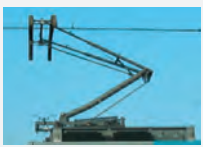
Note: A HARTING mounting frame should be used when installing housings to thin-walled metal panels or when arranging multiple housings in a row (refer to Chapter III-8.1).

III-2.2 Installation location of the hoods and housings

The overview in III-2.2.1 shows which hood and housing types can be used in which locations and for which rail applications. This overview can be used as a starting point. Several different housing types can be used for some applications. The details should be determined depending on your actual project.

III-2.2.1 Hoods and housings overview / Installation location of the industrial connectors

Installation location (Interior/inside)	Han® HPR	Han® M	Han® B	Han-*Yellock*® [+Outdoor]	Han-Eco® [+Outdoor]	Han-Snap®	Screw adapter
Driver's console 			✔	✔	✔	✔	✔
Machine room 			✔	✔	✔		
Electrical cabinet 			✔	✔		✔	✔
Interior of passenger wagon 			✔	✔	✔	✔	✔

Installation location (Exterior/outside)	**Han® HPR**	**Han® M**	**Han® B**	**Han-*Yellock*® [+Outdoor]**	**Han-Eco® [+Outdoor]**	**Han-Snap®**	**Screw adapter**
Under the wagon floor 	✔						
Roof 	✔	✔[1] (Light rail, trolley bus)		✔[1]	✔[1]		
Wagon coupling 	✔						

[1] Depending on the particular project requirements

III

III-2.2.2 Overview of products and installation locations for interface / DIN connectors

Installation location (Interior/inside)	InduCom	InduCom 9	DIN 41 612	DIN D20
Driver's console 	✔	✔	✔	✔
Brake controls 	✔		✔	✔
Train controls 	✔	✔	✔	✔
Interior of passenger wagon 	✔	✔		

Installation location (Exterior/outside)	**InduCom**	**InduCom 9**	**DIN 41 612**	**DIN D20**
Roof-mounted air conditioning system 	✔	✔		
Point controls 	✔		✔	✔
Signaling facilities 	✔		✔	✔

III-2.3 Overview of Han® HPR hoods

Figure III-2.1
Han® 3 A HPR hood and housing, long version

The following table provides an overview of the different sizes and versions for the Han® HPR housings. HARTING also offers customer-specific housings; a small selection of these is described in Chapter III-2.6.

Table III-2.1
Overview of Han® HPR hoods

Size	Size of cable clamp	Inserts	Remarks
3 A	1 x M20	All contact inserts in size Han® 3 A	Remove the O-ring for male inserts
3 A	1 x M25	All contact inserts in size Han® 3 A	Extra Han-Brid® Quintax for MVB, WTB bus connections
6 B	1 x M20 1 x M25 1 x M32 1 x M40	Standard contact inserts Han-Modular® Han® HC Modular	Also available with RFID tag
10 B	2 x M20 1 x M25 1 x M32 1 x M40	Standard contact inserts Han-Modular® Han® HC Modular	Also available with RFID tag
16 B	1 x M25 2 x M25 1 x M32 1 x M40 1 x M50	Standard contact inserts Han-Modular® Han® HC Modular	Also available with RFID tag
16 B enlarged	4 x M25	Han® HC Modular 250	

Size	Size of cable clamp	Inserts	Remarks
24 B	4 x M20 2 x M25 3 x M25 3 x M25 / 1 x M20 4 x M25 1 x M32 2 x M32 3 x M32 3 x M32 / 1 x M10 1 x M40 2 x M40 2 x M40 / 1 x M10 1 x M40 / 2 x M16 4 x M40 4 x M25 1 x M50 1 x M63	Standard contact inserts Han-Modular® Han® HC Modular	Also available with RFID tag
24 B enlarged	4 x M25 3 x M32 1 x M50 1 x M63	Han® HC Modular	

III-2.4 Han® B hood with M50 cable entry

HARTING offers a Han® B hood variant with an M50 cable entry. This hood is available in a version with a straight cable entry and a side entry for two lever lockings on the housing. It also comes with a side cable entry and a central lever. The cable entry angle is 30°. These hoods also feature a large cabling space and are fully compatible with all of the corresponding Han® B housings.

Figure III-2.2
Han® B

III-2.5 Han® Easy Hood

This hood makes it significantly easier to install connectors. It can be separated and this provides the best handling when working with large cable cross-sections or with high-pole contact inserts.

Additional advantages:

- Quicker installation
- Wiring is visible in the connection area
- Integrated cable clamp
- Strain relief
- Captive screws
- Cable entry with optimal angle

The hood is available in sizes 16 B and 24 B. It can fit on all corresponding housings by means of two locking levers. Cable seals for a range of cable diameters are available separately. HARTING also offers threaded adapters for M25 and M32 as an extra accessory.

Figure III-2.3
Han® Easy Hood

III-2.6 Han® HPR and Han® M hood and housing

HARTING also offers many customer-specific hood and housing variants in addition to the wide variety of hoods and housings available in the Han® B, Han® M and Han® HPR series (as detailed in our Han® Industrial Connectors Catalogue).

Several examples of such customized products are described below: the Han® 24 HPR enlarged, the Han® 48 HPR, and the Han® M size 48 B series with ratchet on the locking lever. These products were developed in response to specific customer requirements and are now part of our standard product offering.

III-2.6.1 Han® 24 HPR enlarged hood and housing

Figure III-2.4
Han® 24 HPR enlarged

The Han® 24 HPR series offers a pluggable solution for the motors and drives used in railway wagons. The outer dimensions of these hoods and housings correspond to the size of the 24 HPR. They are designed exclusively for supporting the Han® HC Modular 350 or Han® HC Modular 650 high-current contacts. In contrast to the other HPR hoods, this hood stands 9 mm higher. It has a total height of 120 mm. Bulkhead mounted and surface mounted housings are available for mounting horizontally on the bottom section. Special frames which fit only in this housing type are available for holding the high-current contacts.

The following variants of frames and housings are available:

Frame	Housings (hood and surface mounted housing)
3 x Han® HC Modular 350	3 x M32
3 x Han® HC Modular 650	3 x M32
4 x Han® HC Modular 350	4 x M25

The variant with four high-current contacts of type Han® HC Modular 350 allows you to fabricate pluggable connectors with three power connections + N or 2 + 2.

Please note the following concerning this housing:

- The bulkhead mounted housing must be ordered separately from the surface mounted housing.
- When using Han® HC Modular contacts, remember that the maximum current load of each contact depends on the selected wire cross-sections.
- When using four Han® HC Modular 350, a shrink sleeve must be pulled over the cable.

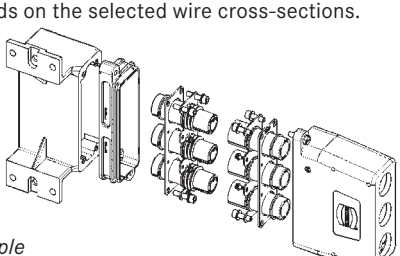


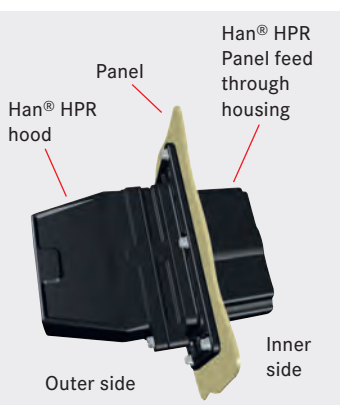
Figure III-2.5
Assembly principle

III-2.6.2 Han® HPR Panel feed through housings

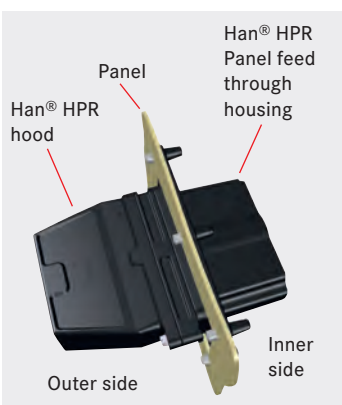
HARTING has added the new Han® Panel feed through housing to its Han® HPR housing series. This housing features all the well-known advantages of the Han® HPR series: robust design, vibration resistance, resistance to harsh environmental conditions, and a high degree of protection. The mating profile is identical to the standard bulkhead mounted housing. This means that you can continue to use your existing hoods.

These new housings have been specially designed for applications which require an IP66/IP68 seal on both the device side and the cable side. Such seals are typically required for panel feed through connections which are exposed to dust and moisture on both sides.

This closed connector system is particularly well suited for installations that connect two different fire compartments. The closed seals on both sides prevent the spread of smoke and gases to other sections.



III-2.6
Han® HPR HPR Panel feed through housing, for exterior installation



III-2.7
Han® HPR Panel feed through housing, for interior installation

Table III-2.2
Han® HPR Panel feed through housing

Part number	Size	Cable clamps	Inserts	Special features
For interior installation				
19 40 006 1113	6B	1 x M40	All contact inserts which fit into the standard Han® HPR housings.	- It is possible to completely pre-assemble the connector. - Cable-to-cable connections are possible.
19 40 010 1113	10B	1 x M40		
19 40 016 1114	16B	1 x M50		
19 40 024 1114	24B	1 x M50		
For exterior installation				
19 40 006 1118	6B	1 x M40	All contact inserts which fit into the standard Han® HPR housings.	- It is possible to completely pre-assemble the connector. - Cable-to-cable connections are possible.
19 40 010 1118	10B	1 x M40		
19 40 016 1119	16B	1 x M50		
19 40 024 1119	24B	1 x M50		

III-2.6.3 Han® 48 HPR hood and housing

Figure III-2.6
Han® 48 HPR

This housing series was designed in cooperation with railway system suppliers. The goal was to design a pluggable solution for motors and drives with four high-current contacts. The hood and housing needed to have the same high quality and technical characteristics of the other HPR series in sizes 3 A, 6 B, 10 B, 16 B and 24 B. HARTING developed the Han® 48 HPR hood and housing based on these requirements. This housing series includes the hood, surface mounted housing and bulkhead mounted housing.

The contacts and the contact inserts are mounted in a frame. This frame is screwed onto the cover. Then, the complete unit is inserted into the corresponding housing. This assembly diagram is illustrated in Figure III-2.7.

Note that there are two variants of the bulkhead mounted housing:

- A version for installing high-current contacts
- A version for installing contact inserts (Han® Monoblock and Han-Modular®) of size 16 B

A protective cover is also available in this series that can be mounted onto bulkhead mounted housings and surface mounted housings.

The Han® 48 HPR housings provide the excellent technical characteristics of all HPR housings and these additional advantages:

- A varying number of high-current contacts
- Some available options:
  - 4 x Han® HC Modular 350
  - 5 x Han® HC Modular 350
  - 6 x Han® HC Modular 350
  - 10 x Han® HC Modular 350
  - 4 x Han® HC Modular 650
  - 4 x Han® HC Modular 650 and 1 x Han® HC Modular 350
- Or alternatively:
  - 4 contact inserts (Han® Monoblock and/or Han-Modular®) in size 16 B
- Option for pre-assembly and for inspection of pre-assembled cables before the final installation

Assembly illustration for the Han® 48 HPR hood and housing

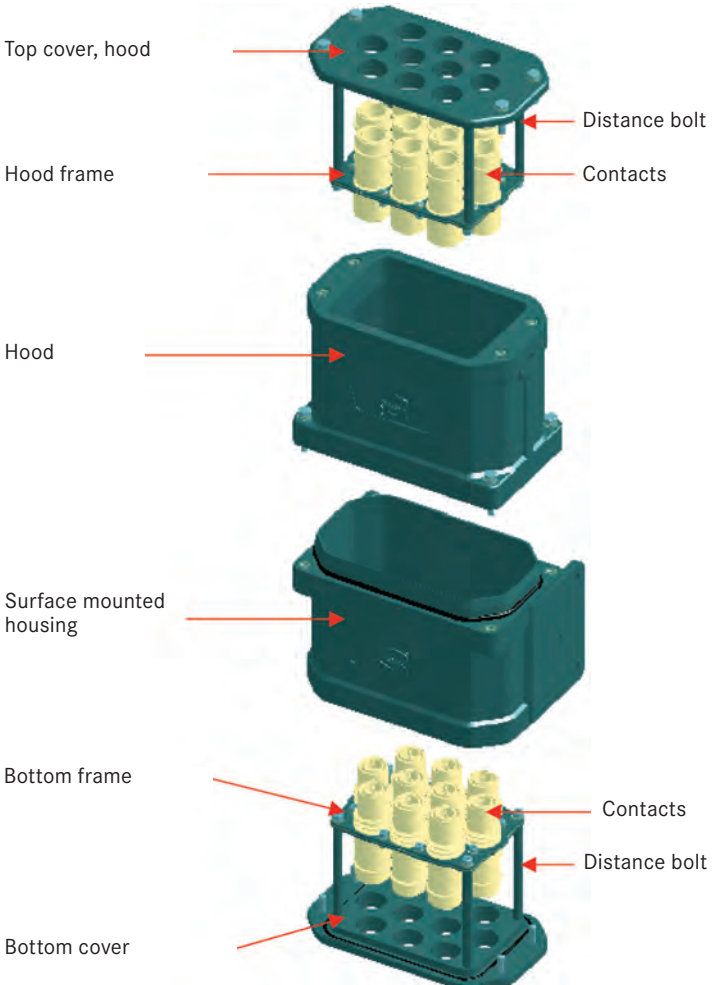


Figure III-2.9
Han® 48 HPR assembly illustration

III-2.6.4 Han® 48 M hood and housing

This housing series is one of our product lines that can be used on the outside of railway wagons. The locking lever for the bulkhead mounted housing and surface mounted housing has been fitted with an extra ratchet. Specially designed to meet the requirements of the railway industry, this ratchet must be actuated before opening the locking lever. This prevents the connector from accidentally opening.

The products listed below feature an extra ratchet on their locking levers:

Part number	Description
09 37 048 0311	Han® 48 M bulkhead mounted housing, cover
19 37 048 0298	Han® 48 M surface mounted housing 2 x M40, cover
19 37 048 0299	Han® 48 M surface mounted housing 2 x M50, cover

The specification sheets for these housings are available on request.

Figure III-2.10
Assembly illustration Han® 48 M
Locking lever on housing
with ratchet

Figure III-2.11
Han® 48 HPR
Locking lever on housing
without ratchet

III-2.7 Han-Eco® hood and housing

Like the Han® B series, the Han-Eco® hoods and housings are available in the sizes 6 B, 10 B, 16 B and 24 B. This housing series is made not from die-cast aluminium like the Han® B series, but from glass-fibre-reinforced polyamide.

This housing series features optimized weight, space and installation requirements. The series now includes a product line featuring a special FPM seal for external applications. This makes the Han-Eco® a complete outdoor solution.

The assembly process is carried out without any screws or tools – a simple "click and mate" snap-in connection provides a reliable, quick solution.

The high-performance plastic used in the housing is extremely resistance to environmental influences. The plastic also features excellent mechanical properties. IP65 protection, in accordance with DIN EN 60 529, is ensured when the housing is mated and locked. The material complies with all flammability requirements detailed in UL 94 V 0, NFF 16101 (F2 / I3) and EN 45545-2 (R22-HL2 / R23-HL3). The Han-Eco® series is available with a straight or side cable entry. A cable-to-cable hood is also available for all sizes. The frame and the cable clamp are part of the hood, so they do not need to be ordered separately. The module frame is also integrated into the housing with the bulkhead mounted housing, which reduces the number of article numbers required.

Table III-2.3
Overview of the Han-Eco® hood and housing

Han-Eco® – plastic hood and housing for industrial applications			
Part number	**Size**	**Cable clamps**	**Designation**
19 41 106 0522 19 41 110 0522	6 B 10 B 16 B 24 B	1 x M32	Hood with cable entry on side
19 41 116 0523 19 41 124 0523		1 x M40	
19 41 106 0422 19 41 110 0422		1 x M32	Hood with straight cable entry
19 41 116 0423 19 41 124 0423		1 x M40	
19 41 006 5406 19 41 010 5406			Covers for hoods
19 41 016 5406 19 41 024 5406			

III

Han-Eco® – plastic hood and housing for industrial applications			
Part number	**Size**	**Cable clamps**	**Designation**
19 41 006 5407 19 41 010 5407 19 41 016 5407 19 41 024 5407	6 B 10 B 16 B 24 B		Covers for hoods with cords
19 41 006 0301 19 41 010 0301 19 41 016 0301 19 41 024 0301			Bulkhead mounted housing
19 41 106 0232 19 41 110 0232 19 41 116 0233 19 41 124 0233		1 x M32 1 x M40	Surface mounted housing with side cable entry
19 41 106 0272 19 41 110 0272 19 41 116 0273 19 41 124 0273		2 x M32 2 X M40	Surface mounted housing with side cable entry
19 41 106 0722 19 41 110 0722 19 41 116 0723 19 41 124 0723		1 x M32 1 x M40	Cable to cable housing
19 41 006 5405 19 41 010 5405 19 41 016 5405 19 41 024 5405			Housing covers
19 41 006 5404 19 41 010 5404 19 41 016 5404 19 41 024 5404			Covers for housings with cords

Table III-2.4
Overview of the Han-*Eco*® *hood and housing*

Han-Eco® – plastic hood and housing for outdoor applications			
Part number	**Size**	**Cable clamps**	**Designation**
19 41 206 0301 19 41 210 0301	6 B 10 B 16 B 24 B	1 x M32	Bulkhead mounted housing
19 41 216 0301 19 41 224 0301		1 x M40	
19 41 306 0232 19 41 316 0232		1 x M32	Surface mounted housing with side cable entry
19 41 316 0233 19 41 324 0233		1 x M40	
19 41 306 0272 19 41 316 0272		2 x M32	Surface mounted housing with side cable entry
19 41 316 0273 19 41 324 0273		2 X M40	
19 41 306 0722 19 41 316 0722		1 x M32	Cable to cable housing
19 41 316 0723 19 41 324 0723		1 x M40	

Figure III-2.12
Layout of the Han-Eco®

III-2.8 Han® B housing locking mechanisms

Locking levers are used to ensure that the connectors cannot be disconnected accidentally. Several different interlock mechanisms are available for the Han® B hood and housing series. The type of locking most appropriate for use depends on your particular application.

Table III-2.5
Overview of interlock types

Type of locking	
Two levers on housing Han-Easy Lock® (double locking lever system)	
One lever on housing Han-Easy Lock® (single locking lever system)	
Central lever aligned in middle on hood (one central locking lever locking system)	
Two levers on hood Han-Easy Lock® (double locking lever system)	

III-2.9 InduCom hood
(Industrial Communication)

Figure III-2.13
InduCom

The InduCom line of full-metal hoods is protected against radiated interference. InduCom is suited for 9-pole to 50-pole D-Sub connectors in accordance with DIN 41 652, IEC 60 807 and MIL-DTL-24-308. They are predominantly used for bus systems in industrial or railway applications.

Key features:

- Outstanding shielding attenuation characteristics
  - Labyrinth and double labyrinth constructions: Electromagnetic fields surrounding the connector are not able to interfere with the signal transmission inside the connector.
- Mechanical stability
  - The crimp flange connection provides a very effective strain relief and anti-twist protection for the cable, even under extremely harsh industrial conditions.
- Extra large interior space
  - This simplifies the process of connecting the connector and enclosing the wires.
  - The InduCom 9 series enables circuit boards for bus systems or customer-specific applications to be integrated.

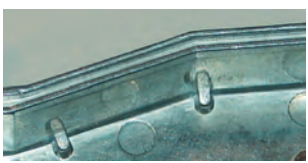


Figure III-2.14
Double labyrinth

Figure III-2.15
Labyrinth

Figure III-2.16
Crimp flange and crimp sleeve and cable crimp

In addition, cables with a diameter of up to about 13.5 mm can easily be connected to the housing for a 9-pole D-Sub connector.
Refer to Chapter VI, Installation Instructions.

The crimp flange provides you with consistent, repeatable high quality that doesn't depend on your technician – whether in production or when installing on-site. This is particularly significant for Fieldbus systems, because they have many slave interfaces.

The following graph shows the shielding attenuation behaviour for HARTING's InduCom connectors.

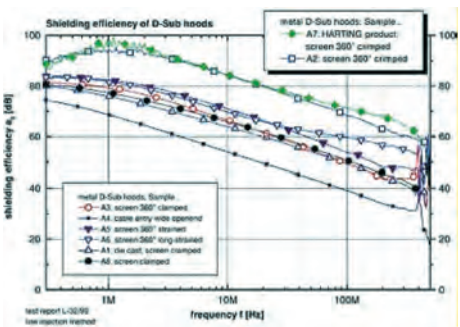


Figure III-2.17
Attenuation graph for the InduCom

The labyrinth design of the InduCom 9 housing, combined with the crimp flange, provide for excellent EMC characteristics and a shield attenuation of greater than 60 dB up to 500 MHz. In order to achieve this level, the entire shielding braid (360°) is connected to the housing using the optimal combination of crimp flange, sleeve and crimping tool to form the perfect low-resistant connection.

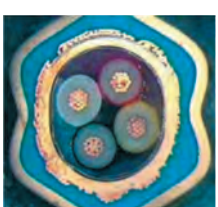


Figure III-2.18
Crimp flange
with full-surface contact

Figure III-2.19
InduCom full-metal hoods

III-2.9.1 InduCom metal hoods and housings

Table III-2.6
Overview of InduCom hoods and housings

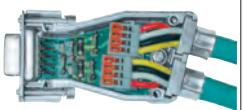
Product	Features	Area of use	Product photo
InduCom housing with 3 straight 5° cable entries, 37-pole and 50-pole (easy Access)	360° shield connection. Very space saving compact design. Large space for wiring.	Interior of railway wagons; Contact for serial and parallel signals in MVB1) applications	
InduCom housing With straight or side cable entry, for screw locking		Interior of railway wagons; electrical cabinet, distributor boxes, contact of serial and parallel signals in bus application or interface applications.	
InduCom housing With side (40°) cable entry for screw locking			
InduCom housing With cable outlets straight or to the side for quick interlock	360° shield connection. Very space saving compact design. Large space for wiring. Quick locking mechanism.	Interior of railway wagons; electrical cabinet, distributor boxes, contact of serial and parallel signals in bus application or interface applications.	
InduCom housing With cable outlets straight or to the side for quick interlock			

Tab. III-2.7
Overview of number of contacts to cable entries

Number of contacts	Number of cable entries
9	1 (straight)
15	1 (straight)
25	3
37	3
50	3

III-2.9.2 Interfaces for industrial bus systems

Table III-2.8
Overview of interfaces for industrial bus systems

Product	Features	Area of use	Product photo
InduCom9 MVB connector set	Cage tension-spring connection with integrated T-functionality. 360° shield connection. Very space saving compact design. Large space for wiring. Max. wire cross-section for connecting: 0.5 mm^2; 0.75 mm^2 with screw terminal available on request	Interior of railway wagons; Contact for serial and parallel signals in MVB[1] applications	
InduCom9 WTB connector set		Interior of railway wagons; Contact for serial and parallel signals in MTB[2] applications	
InduCom9 CAN connector set		Interior of railway wagons; Contact for serial and parallel signals in CAN bus applications	
InduCom9 Profibus connector set		Interior of railway wagons; Contact for serial and parallel signals in Profibus applications	
InduCom9 housing with straight cable outlets	Empty housing	Interior of railway wagons; electrical cabinet, distributor boxes, contact for serial and parallel signals in bus or interface applications	

[1] MVB = multi vehicle bus

[2] WTB = wire train bus

III-2.9.3 Crimp termination

HARTING offers turned (machined) D-Sub contacts for industrial and transportation applications. These contacts are more robust than the stamped variants. They comply with the specifications of requirement level 1 and are approved for 500 mating cycles. The requirements of IEC 60 512 and CECC 75 301-500 are met.
The stripping length for the D-Sub contacts is 4 mm.

Figure III-2.20
Overview of turned (machined) D-Sub contacts

III-2.9.4 High-end female contacts

Extreme applications (e.g. when improper plugging angles are expected) subject the female contacts to more stress so that a robust contact design is required. HARTING offers the “high-end” D-Sub contact for such applications. Special features:

- The contact is stamped and rolled. It is located within a turned sleeve.
  - The actual contact is completely protected.
  This prevents the spring from expanding.
- The contacts points are positioned at 120° angles to each other.
  - Optimum contact and improved guiding for the male contact
  - Less force required for mating and unmating
  - Improved vibration characteristics.

Figure III-2.21
High-end D-Sub contacts

The crimp contacts are inserted into (clicked into) the D-Sub connectors for crimp termination.

Figure III-2.22
D-Sub crimp body

Refer to Chapter VI, Installation Instructions.

III-2.10 Housing DIN 41 612 / IEC 60 603-2

Table III-2.9
Overview of Housing DIN 41 612 / IEC 60 603-2

Product	Features	Area of use	Product photo
Plastic shell housing D20 for types B, C, 2C, 3C, D, E, har-bus 64, F, H and MH	Robust plastic housing with good flammability characteristics	Interior of railway wagons; mechanical protection for signal lines that do not have special shielding requirements, metallic variants also available	
Shell housing D20 metal for shapes F, H and MH	Robust full-metal housing with good shielding characteristics	Interior of railway wagons; electrical cabinets, distributor boxes, contact for analogue and digital signals in interface applications	
Shell housing D20 metal HF with nickel-plated surface	Robust full-metal housing with good shielding characteristics and shield connections	Interior of railway wagons; electrical cabinets, distributor boxes, contact for analogue and digital signals in interface applications	

The above housings are used for electrical installation on trains and in stationary applications.

III-3 Housings for electromagnetic compatibility

As technology advances, larger amounts of sensitive signals are being transmitted. So it is important to implement the proper installation technology to ensure that your electrical equipment achieves high reliability and availability. Electromagnetic compatibility (EMC) is an important factor, whereby components should emit the lowest level of interference (emissions) with the high level of interference resistance (immission). The ideal method is minimizing electromagnetic signals at the source. HARTING supports the installation of electrical equipment with enclosures that have very good EMC properties because of their special (e.g. labyrinth) construction.

Table III-3.1
Han® housing series with excellent EMC characteristics

◦ Han® EMV	◦ Han® 3 A EMV
◦ Han® HPR	◦ Han® 3 A HPR
◦ Han® EMV / B	◦ Han-Modular® Compact
◦ Han-*Yellock*® 10	◦ Han-Compact®

A continuous, homogeneous transmission of the shielding screen will ensure optimal EMC quality for a connector. The transitions between the different connector components are the critical factors.
The homogeneous shielding screen is interrupted at these transitions. The best EMC performance, however, is insured when these junctures are overlapping. They should also cover a large area, be of low impedance and cover the entire circumference.

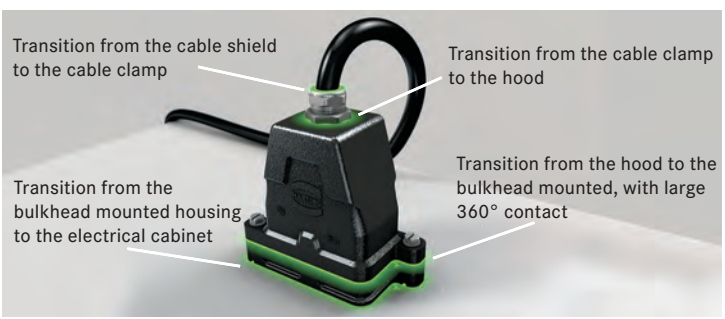


Figure III-3.1
Key points for EMC shielding

Transfer impedance is a measure for assessing EMC as required by EN 50467 and is also used to test the shielding effect of HARTING connectors. The following section illustrations the typical range of transfer impedances (the area between the green and blue lines in Table III-3.1) for HARTING EMC connectors and other connectors, in relation to varying frequency. This shows clearly that these types of housing are significantly below the normative limits.

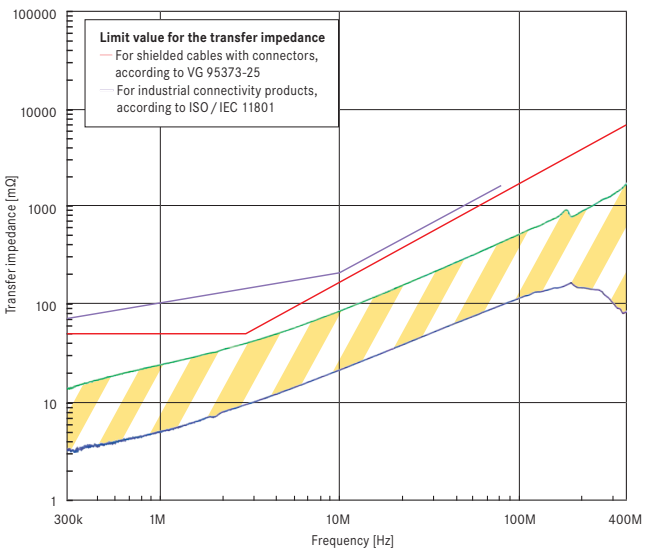


Figure III-3.2
Transfer impedance of the Han® EMV and the Han® HPR connector housings: The measured values depend on the size and range between the green and blue graphed zones.
(Test setup according to DIN EN 60512-23-3, parallel wiring method)

The very low transfer impedance of the HARTING connectors over the entire frequency range is achieved by a large 360° contact and is essential for optimum and continuous shielding.

III-4 Contact inserts and contacts

The contacts and contact inserts of the Han® industrial connectors can be used in electrical interfaces with currents ranging from just a few milliamps all the way up to 650 amps. Multi-pole contact inserts such as the Han E®, Han® EE or Han D® series, Han DD®, modules from the Han-Modular® series and high-current contacts from the Han® HC series are all available for these connections. These product series are described on the following pages.

Typical contact inserts and contacts for railway applications are listed in tables III-4.1 and III-4.2.

HARTING's connectivity products are plug-in connectors.

As with all plug-in connectors, you should never pull out the connectors while there is a "live" voltage present!

The Han® industrial connectors have been designed in accordance with IEC 61 984.

They have the following technical specifications:

Insulation resistance:	> 10^{10} Ω
Mating cycles:	≥ 500 (with contact resistance ≤ 5 mΩ)

The DIN 41 612 / IEC 60 603-2 directive is valid for DIN 41 612 connectors.

Insulation resistance:	> 10^{12} Ω
Mating cycles:	≥ 500 mating cycles; hazardous gas test; IEC 60 603-2 requirements level 1

The InduCom connector and D-Sub are subject to the DIN 41 652 / IEC 60 807 directive.

Insulation resistance	≥ 10^{10} Ω
Plugging cycles	≥ 500 plugging cycles; hazardous gas test; CECC 75 301-802, requirements level 1

III-4.1 Han® multi-pole contact inserts

HARTING offers a variety of multi-pole contact inserts (with from 2 to 108 poles) for use within the industrial connector. The pole count ranges from 2 to 108. The contact inserts are designed for rated currents from 10 to 40 A.

III-4.2 Han-Com® combination connector

Many applications require one connector that combines both power transmission and control signal transmission. The Han-Com® series of contact inserts provide for a great variety of combinations.

For high-power requirements, rated currents from 16 to 200 A can be transmitted. For control applications, the rated currents range from 10 to 16 A.

The following directives regulate the consolidation of multiple circuits into a single cable or connector:

DIN EN 60 664-1 §411.1.3.2 and DIN EN 60 204/11.98 § 14.1.3

The name of the contact inserts describes the contacts in use. The example given here is the Han® K 4/8:

Han®	the Han® industrial connector
K	the Han® K / Han-Com® series
4	the number of power contacts
8	the number of control contacts

III-4.3 Han-Modular®

This series features many modules that satisfy a variety of customer requirements.

Han-Modular® is the logical next step for the Han-Com® series. The key advantage for Han-Modular® is the ability to put together customer-specific modules. Thus, the customer receives a connector that is tailored to their requirements. This series can be used for signal transmissions (i.e., in bus cables) or for transmitting rated currents of up to 200 A.

The following figure shows the assembly process for the Han-Modular®.

The Han-Modular® system is designed to be installed in housings from the Han® B, Han-Eco®, Han-Yellock®, Han® EMV/B, Han® M and Han® HPR series. The tall design should be used whenever possible with the hood and surface mounted housings (with the exception of the Han® HPR).

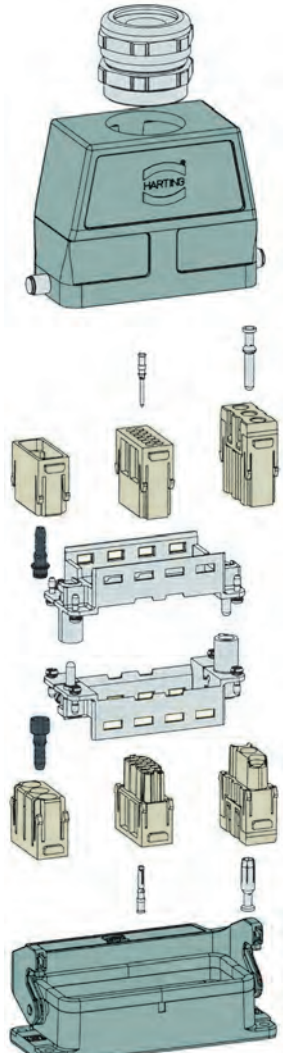
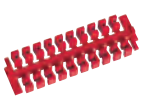


Figure III-4.1
Han-Modular®

III-4.4 Han® HC Modular

This series is used for rated currents from 250 to 650 A. The wires are connected using the axial screw method or with crimp contacts. The contacts are attached to the frame mounted in the housing. The frames are designed only to be used in the Han® HPR and Han® 48 M housing series.

Table III-4.1
Han® industrial connectors – an overview of contact inserts and modules

Current [A]	Series	Contact insert / module / contact / accessory	Area of use	Product photo
–	Han-Modular®	Hinged frame for 2, 3, 4 and 6 modules For modular use	Accessories	
–	Han-Modular®	HMC hinged frame for 2, 3, 4 and 6 modules For modular use	High number of mating cycles (HMC)	
–	Han-Modular®	Plastic locking element for Han-Modular® hinged frames	Accessories	
–	Han-Modular®	Metal or plastic adapter for the module carrier For the Han-Quintax® module In metal: For a conductive connection between the housing and the shielding potentials	Accessories	
–	Han-Modular®	Guide pins and sockets for the D-Sub module	Accessories	
–	Han-Modular®	Multi-contact module 4-pole for Han® Coax contacts, crimp/solder connection	Data transmission	

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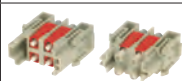
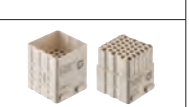
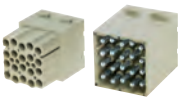
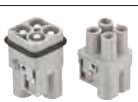
Current [A]	Series	Contact insert / module / contact / accessory	Area of use	Product photo
–	Han-Modular®	Han-Quintax® module for holding the Han® Coax and Han-Quintax® contacts, 4-pole and 8-pole	Data transmission	
–	Han-Modular®	Han® SC module, 4-pole	For fibre optic cables	
1	Han-Modular®	Han® USB module USB 2.0 Connection via a patch cable	Data transmission	
4	Han-Modular®	Han® shielded module, 20-pole, 32V, crimp termination	Transmits very sensitive signals (e.g. bus signals)	
5	Han-Modular®	Han® D-Sub module 9-pole, 50 V Crimp termination	Data transmission, including Ethernet	
5	Han-Modular®	Han® Gigabit module 8-pole + shield 50 V, for Ethernet Cat. 6, crimp termination	Data transmission, including Ethernet	
5	Han-Modular®	Han-Quintax® high-density contact 8-pole plus shield, 50 V, crimp termination Install in Han-Quintax® module	Data transmission	
6,5	Han® Q High Density	Han® 3 A for D-Sub contacts, 21 pole, 50 V AC, 120 V DC	Data transmission	
10	Han-Modular®	Han D® Coax contact 1-pole plus shield For coax cable For Han D® contacts Crimp termination Impedance: 75 Ω Install in Han-Quintax® module	Video signal transmission	

Current [A]	Series	Contact insert / module / contact / accessory	Area of use	Product photo
10	Han-Modular®	Han-Quintax® contact 4-pole plus shield 50 V Crimp termination Install in Quintax® module	Data transmission, including Ethernet	
10	Han-Modular®	Han® Megabit module, 8-pole, 50 V, crimp termination	Data transmission, including Ethernet Cat. 5e	
10	Han®	Han D® 7-, 15-, 25-, 40-, 64-pole + PE, 250 V Crimp termination	Transmission of mid-range power and data	
10	Han®	Han DD® 24-, 42-, 72-, 108-pole + PE, 250 V Crimp connection	Transmission of mid-range power and data	
10	Han®	Han® 8 D 8-pole, 50 V AC / 120 V DC, crimp termination Han-Easy Lock® connection	Data transmission	
10	Han®	Han® Q 7/0 7-pole plus PE 400 V, Crimp termination	Transmission of mid-range power and data	
10	Han®	Han® Q 12/0 12-pole plus PE, 400 V Crimp termination (power contact) Han-Quick Lock® connection (PE)	Transmission of mid-range power and data	
10	Han-Modular®	Han DD® module 12-pole, 250 V Crimp termination Han-Quick Lock® connection	Transmission of mid-range power and data	
10	Han-Modular®	Han DD® Quad module, 42-pole, 150 V Crimp termination	Transmission of mid-range power and data	

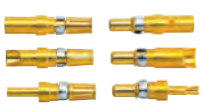
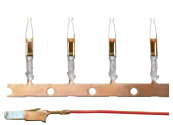
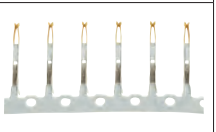
Current [A]	Series	Contact insert / module / contact / accessory	Area of use	Product photo
10	Han-Modular®	Han® DDD module 17-pole, 160 V Crimp termination	Transmission of mid-range power and data	
16	Han®	Han E®, Han® ES 6-, 10-, 16-, 24-pole + PE 500 V Crimp, screw, and cage clamp connections	Transmission of mid-range power and data	
16	Han®	Han® EE 10-, 18-, 32-, 46-pole + PE, 500 V Crimp termination	Transmission of mid-range power and data	
16	Han®	Han® EEE 40-, 64-pole + PE, 500 V Crimp termination	Transmission of mid-range power and data	
16	Han®	Han® Q 5 / 0 5-pole + PE, 230 / 400 V Crimp termination Han-Quick Lock® connection	Transmission of mid-range power and data	
16	Han-Com®	Han® K 8 / 24 8- / 24-pole + PE power range 16 A 230 / 400 V Control range 10 A 160 V, Crimp termination	Combines power and signals in a single connector	
16	Han-Modular®	Han E® module 6-pole, 500 V Crimp termination	Transmission of mid-range power and data	
16	Han-Modular®	Han® ES module 5-pole, 400 V Caged clamp connection	Transmission of mid-range power and data	
16	Han-Modular®	Han® EE module 8-pole, 400 V Crimp termination Han-Quick Lock® connection	Transmission of mid-range power and data	

Current [A]	Series	Contact insert / module / contact / accessory	Area of use	Product photo
16	Han-Modular®	Han® EEE module 20-pole, 500 V Crimp termination	Transmission of mid-range power and data	
16	Han-Modular®	Han E® coax contact, 1-pole plus shield Impedance: 50 Ω Crimp termination Install in Han-Quintax® module	Transmission of data and ETCS S21 Eurobalise (4 mm²)	
16	Han-Brid®	Han® ECTS Coax, 1-pole + shield with crimp flange, 50 V, crimp termination	For Euro-balise coax cable	
40	Han®	Han® Q 2 / 0 2-pole + PE 400 V Axial screw termination	Power trans-mission	
40	Han®	Han® Q 2 / 0 2-pole + PE 830 V (only with shrink sleeve) Axial screw termination	Power trans-mission	
40	Han®	Han® Q 3/0, 3-pole + PE, 400 V, crimp termination	Power trans-mission	
40	Han-Modular®	Han® 40 A module 2-pole, 1000 V Axial screw termination Crimp termination	For high power trans-missions	
40	Han-Modular®	Han® C module 3-pole, 400 / 690 V Axial screw termination Crimp termination	For high power trans-missions	

Current [A]	Series	Contact insert / module / contact / accessory	Area of use	Product photo
63	Han-Com®	Han® K 4 / 4 4- / 4-pole + PE Power range 63 A 690 V Control range 16 A 230 V Axial screw termination Caged clamp connection	Combines power and signals in a single connector	
70	Han-Modular®	Han® 70 A module 2-pole, 1000 V Axial screw termination Crimp termination	For high power trans-missions	
80	Han-Com®	Han® K 4 / 2 4- / 2-pole + PE Power range 80 A 830 V Control range 16 A 400 V Screw termination	Combines power and signals in a single connector	
80	Han-Com®	Han® K 4 / 8 4- / 8-pole + PE Power range 80 A 400 V Control range 16 A 400 V Screw termination	Combines power and signals in a single connector	
100	Han-Com®	Han® K 6 / 6 6-/ 6-pole + PE Power range: 100 A 690 V Control range: 16 A 400 V Axial screw termination (for power) Screw termination (for controls)	Combines power and signals in a single connector	
100	Han-Com®	Han® K 8 / 0 8-pole + PE 690 V Axial screw termination	For high power trans-missions	
100	Han-Modular®	Han® 100 A single module, 1-pole, 830 V Crimp termination	For high power trans-missions	

Current [A]	Series	Contact insert / module / contact / accessory	Area of use	Product photo
100	Han-Modular®	Han® 100 A module 2-pole, 1000 V Axial screw termination Crimp termination	For high power transmissions	
200	Han-Com®	Han® K 3/0 3-poles 1150 / 2000 V Axial screw termination	For high power transmissions	
200	Han-Modular®	Han® 200 A module 1-pole, 1000 V Axial screw termination Crimp termination	For high power transmissions	
250	Han® HC Modular	Insert (male / female) for holding the crimp contact Han® TC 250 1-pole, 2000 V Crimp termination	For high power transmissions	
350	Han® HC Modular	Han® HC Modular 350 1-pole, 4000 V Axial screw termination Crimp termination	For high power transmissions	
650	Han® HC Modular	Han® HC Modular 650 1-pole, 4000 V Axial screw termination Crimp termination	For high power transmissions	

Table III-4.2
Overview of contacts and high-current contacts

Product	Features	Product photo
D-Sub contacts[1)]	Rated current: 5 A Cross-section: 0.08 – 0.75 mm² Surface: gold plated	
Special contacts for D-Sub Mixed coax contacts	Impedances 50 and 75 Ω Frequency up to 2 GHz Solder/crimp termination or crimp/crimp termination Surface: gold plated	
Special contacts for D-Sub Mixed high voltage contacts for cable applications	Rated current: 2 A Operating voltage up to 3 kV Surface: gold plated Wire cross-section: 0.25 – 0.56 mm²	
Special contacts for D-Sub. Mixed high-current contacts for cable applications	Rated current: up to 40 A (depending on contact) Surface: gold plated Wire cross-section: 0.52 – 10.0 mm²	
DIN 41 6122[2)] FC contacts Signal contacts for cable usage	Rated current: 6 A Surface: gold plated Wire cross-section: 0.09 – 1.5 mm²	
DIN 41612 BC Crimp contacts	DIN 41 612 BC contacts Signal contacts for cable applications Rated current: 2 A Surface: gold plated Wire cross-section: 0.09 – 0.5 mm²	
Han D® (R15) contacts	Rated current: 10 A Cross-section: 0.14 – 2.5 mm² Surface: gold plated silver plated GoldTec®	

Product	Features	Product photo
Han E® contacts	Rated current: 16 A Cross-section: 0.14 – 4 mm² Surface: gold plated silver plated GoldTec® Switching contacts (silver plated) 0.75-1; 1.5; 2.5 mm²	
Han-*Yellock*® contacts	Rated current: 20 A Cross-section: 0.14 – 4 mm² Surface: gold plated silver plated	
Han® C contacts	Rated current: 40 A Cross-section: 1.5 – 10 mm² Surface: silver plated	

[1] Refer to the “Device Connectivity” Catalogue for more details on the D-Sub contacts.

[2] Refer to the “DIN 41 612 Connectors” Catalogue for more details on the DIN contacts.

Product	Features	Connection type	Product photo
Han® TC70	Rated current: 70 A Cross-section: 6 mm² 10 mm² 16 mm² 25 mm² For Han-Modular®	Crimp	
Han® TC100	Rated current: 100 A Cross-section: 10 mm² 16 mm² 25 mm² 35 mm² For Han-Modular®	Crimp	
Han® TC200	Rated current: 200 A Cross-section: 25 mm² 35 mm² 50 mm² 70 mm² For Han-Modular®	Crimp	

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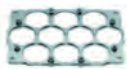
Product	Features	Connection type	Product photo
Han® TC250	Rated current: 250 A Cross-section: 35 mm² 50 mm² 70 mm² For Han® HC Modular 250	Crimp	
Han® HC Modular 350 power contact, PE contact	Rated current: 350 A Axial contact Cross-section: 20 – 35 mm² 35 – 70 mm² 95 – 120 mm² PE contact: Cross-section: 35 – 70 mm² Screw terminal contact Cross-section: up to 120 mm² Crimp contact Cross-section: 35 mm² 50 mm² 70 mm² 95 mm² 120 mm² For Han® HC Modular 350 For Han® HPR and Han® M housings size 48	Axial screw Screw terminal contact for cable shoes (only for mounting in bulkhead mounted housings) Crimp	
Han® HC Modular 650	Rated current: 650 A Axial contact Cross-section: 70 – 120 mm² 150 – 185 mm² Screw terminal contact Cross-section: 70–240 mm² Crimp contact Cross-section: 70 – 240 mm² For Han® HC Modular 650 For HPR housing	Axial screw Screw termination (for cable lugs from 70 to 240 mm², only install in bulkhead mounted housing) Crimp	

Table III-4.3
Overview of frames for the Han® HC Modular contacts

Product	Product photo	Housing Han® HPR size
4 x Han® HC Modular 250		24 B
1 x Han® HC Modular 350		6 B
2 x Han® HC Modular 350		16 B
2 x Han® HC Modular 350		24 B
3 x Han® HC Modular 350		24 B
3 x Han® HC Modular 350 + 1 x PE		Han® M housing Size 48 B
1 x Han® HC Modular 650		6 B
2 x Han® HC Modular 650		24 B
4 x Han® HC Modular 350 + 2 x Q 5 / 0		48 B
4 x Han® HC Modular 350 + 1 x PE		48 B

Product	Product photo	Housing Han® HPR size
6 x Han® HC Modular 350		48 B
10 x Han® HC Modular 350		48 B
For holding four contact inserts and/or four hinged frames, for Han-Modular® size 16 B		48 B
3 x Han® HC Modular 350		24 HPR enlarged
3 x Han® HC Modular 650		24 HPR enlarged
4 x Han® HC Modular 350 Delivered with shrink sleeve		24 HPR enlarged

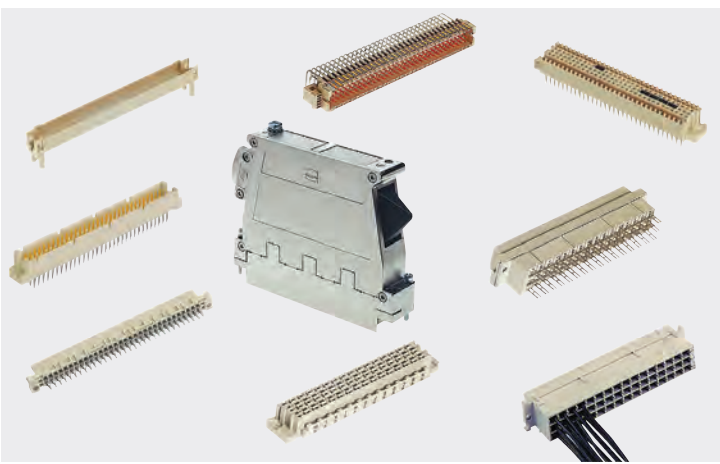
III-4.5 Connectors in accordance with DIN 41 612 / IEC 60 603-2

DIN 41 612 connectors in compliance with IEC 60603-2 are suitable for use with any application of electronic devices in the railway industry, both on-board trains or stationary.

HARTING offers a wide range of DIN 41 612 connectors with the following features:

- From 3 to 160 contacts
- Operating current from 1 to 15 A; max. 40 A (with special contacts)
- Various PCB and cable wire termination techniques

- SMC (surface mount compatible) connectors for reflow soldering
- Variants with CTI > 400 for higher voltages between adjacent contacts
- Leading, standard and lagging pins
- Special variants for the railway sector (EN 45545-2 R22 HL3, NFF I2 / F1 clearances)
- Extensive range of shell housings in plastic, metallised and full metal
- Locking elements, locking lever and adapter
- Shrouds
- Connectors with rear finishing for mid-plane technology
- Encoding options for all types of constructions
- Tooling for press and crimp terminations
- Servicing designs for SMC and press-in technology
- Approvals:
  - o UL-listed E 102079 (M)
  - o IEC 60 603-2 / 61 076-4-113
  - o CECC 75 101-801
  - o NFF 16-101



Tab. III-4.4
DIN signal connectors

DIN signal layouts	Male connectors (m) Female connectors (f)	Angled (a) Straight (s)	THT solder termination	SMC solder termination	Solder lug connection	Press-in termination	Crimp termination	Wire wrap termination	IDC termination	FASTON sleeve termination	Cage clamp termination
B	m	a / s	X	X							
	f	s	X	X	X	X	X	X	X		
2B	m	a / s	X	X							
	f	s	X	X		X		X			
3B	m	a / s	X	X							
	f	s	X	X		X					
C	m	a / s	X	X							
	f	s	X	X	X	X	X	X	X		
2C	m	a / s	X	X							
	f	s	X	X	X	X	X	X			
3C	m	a / s	X	X							
	f	s	X	X		X	X				
M	m	a	X								
	f	s	X			X	X				
M flat	f	s	X			X					
M inverse	m	s	X			X		X			
	f	a	X								
R	m	s	X	X		X		X			
	f	a	X	X							
2R	m	s	X	X		X		X			
	f	a	X								
3R	m	s	X	X		X		X			
R (HE 11)	m	s	X					X			
	f	a	X								
RM	m	s				X					
Q	m	s	X			X		X			
	f	a	X								
2Q	m	s	X			X		X			
	f	a	X								
3Q	m	s	X	X		X		X			
har-bus® 64	m	a	X	X							
	f	a / s	X			X	X				

Tab. III-4.5
DIN power connectors

DIN power layouts	Male connectors (m) Female connectors (f)	Angled (a) Straight (s)	THT solder termination	SMC solder termination	Solder lug connection	Press-in termination	Crimp termination	Wire wrap termination	IDC termination	FASTON sleeve termination	Cage clamp termination
D	m	a / s	X	X							
	f	a / s	X		X		X	X			
E	m	a	X	X							
	f	a / s	X		X	X	X	X			
E Interface I	m	s	X								
F	m	a	X	X							
	f	a / s	X		X	X	X	X			
F Interface I	m	s	X				X	X			
F9	m	s					X				
	f	s					X				
FM	m	a	X				X				
	f	s	X				X	X			
2F	f	s					X				
2F Interface I	m	s					X				
H15	m	a / s	X							X	
	f	s	X			X				X	X
H16	m	a	X								
	f	s								X	
H3	m	a	X								
	f	s	X								
MH 24+7	m	a / s	X							X	
	f	s	X				X	X			
MH 21+5	m	a	X								
	f	s	X								

III-5 Power connectors

The power connectors for motors and drives used in railway vehicles are a key factor when it comes to saving time and money during the installation. Depending on the type of railway wagon, the electrical and mechanical parameters are specified by different requirements.

The HARTING industrial connectors have a modular design that allows you to make many combinations of housings and contact inserts. They can be used with shielded or unshielded cables.

The power connectors are based on sized-24 B housings from the Han® HPR series. These are available as one-part (enclosed housing) or two-part (opened housing with mounting cover) variants. The variant with two-part housing provides a high degree of convenience and safety while processing shielded cables.

III-5.1 Power connector with one-part housing

In order to help the user with their selection, the overviews in this section illustrate the many combination options of housings, contact inserts and contacts.

Possible combinations are marked with a "✔".

An overview of the typical cable clamp sizes (M threaded size and clamping range) is provided to compliment the connector components overview.

Connectors for 100 to 200 A – Han® 24 HPR housings

Table III-5.1
Han® 24 HPR hood section overview

	Hood 4 x M20	Hood 3 x M25	Hood 4 x M25	Hood 4 x M20	Hood 3 x M32	Hood 1 x M63	Hood 3 x M25, 1 x M20	Hood angled 3 x M25
100 A Module U = 1000 V I = 100 A 6 - 10 mm² 10 - 25 mm² 16 - 35 mm², 38 mm²	✓	✓	✓	✓	✓	✓		
200 A Module U = 1000 V I = 200 A 25 - 40 mm² 40 - 70 mm²	✓	✓	✓	✓	✓	✓		
Han® K 3 / 0 U = 1150 / 2000 V I = 200 A 25 - 35 mm² 35 - 70 mm²		✓		✓	✓	✓		
Han® K 3 / 0 angled U = 1150 / 2000 V I = 200 A 35 - 70 mm²								✓
Han® K 3 / 2 U = 1150 / 2000 V I = 200 A 16 - 35 mm² (PE) 35 - 70 mm²	✓		✓			✓	✓	
Han® K 3 / 2 angled U = 1150 / 2000 V I = 200 A 16 - 35 mm² (PE) 35 - 70 mm²								on request

Hinged frame necessary

Connectors for 100 to 200 A – Han® 24 HPR housings

Table III-5.2
Han® 24 HPR housing section overview

	Housings, buldkhead mounting	Housings, surface mounting horizontal 3 x M25	Housings, surface mounting horizontal 3 x M25 1 x M20	Housings, surface mounting 3 x M25
100 A Module U = 1000 V I = 100 A 6 - 10 mm² 10 - 25 mm² 16 - 35 mm², 38 mm²	✓	✓		✓
200 A Module U = 1000 V I = 200 A 25 - 40 mm² 40 - 70 mm²	✓	✓		✓
Han® K 3 / 0 U = 1150 / 2000 V I = 200 A 25 - 35 mm² 35 - 70 mm²	✓	✓		✓
Han® K 3 / 0 angled U = 1150 / 2000 V I = 200 A 35 - 70 mm²	✓			
Han® K 3 / 2 U = 1150 / 2000 V I = 200 A 16 - 35 mm² (PE) 35 - 70 mm²	✓		✓	
Han® K 3 / 2 angled U = 1150 / 2000 V I = 200 A 16 - 35 mm² (PE) 35 - 70 mm²	✓			

Hinged frame necessary

Connectors for 250 to 650 A – Han® 24 HPR housings

Table III-5.3
Han® 24 HPR housing overview

	Hood 4 x M20	Hood 3 x M25	Hood 4 x M25	Hood 3 x M32	Hood 2 x M40	Housings, buldkhead mounting	Housings, surface mounting horizontal 3 x M25	Housings, surface mounting 3 x M25
HC Modular 250 U = 2 kV I = 250 A 35 - 70 mm² Crimp termination	✓		✓			✓		
HC Modular 350 U = 2 kV / 4 kV[1] I = 350 A 20 - 120 mm² Axial Screw termination Crimp termination		✓ [1]		✓ [1]	✓	✓	✓	✓
HC Modular 350 U = 4 kV I = 350 A Screw terminal for cable lug up to max. 120 mm²						✓		
HC Modular 650 U = 4 kV I = 650 A Axial: 70-120 mm² 150-185 mm² Crimp: 70-240 mm²					✓	✓		
HC Modular 650 U = 4 kV I = 650 A Screw terminal for cable lug 70 - 240 mm²						✓		

- separate PE contact
- (16 - 35 mm²) available

[1] with hexagonal adapter

Frame necessary

Connectors for 250 to 650 A – Han® 24 HPR enlarged hood and housings

Table III-5.4
Han® 24 HPR enlarged housing overview

	Hood 3 x M32	Hood 4 x M25	Housings, buildkhead mounting 3 and 4 poles	Housings, surface mounting horizontal 3 x M32	Housings, surface mounting horizontal 4 x M25
HC Modular 250 U = 2 kV I = 250 A 35 - 70 mm² Crimp termination		on request	on request		↘
HC Modular 350 U = 2 kV / 4 kV[1] I = 350 A 20 - 120 mm² Axial screw termination Crimp termination	↘ [1]	↘ [1]	↘	↘	↘
HC Modular 350 U = 2 kV I = 350 A Screw terminal for cable lug up to max. 120 mm²			↘	↘	
HC Modular 650 U = 4 kV[1] I = 650 A Axial: 70-120 mm² 150-185 mm² Crimp: 70-240 mm²	↘ [1]		↘	↘ [1]	
HC Modular 650 U = 4 kV I = 650 A Screw terminal for cable lug 70 - 240 mm²			↘		

- separate PE contact
- (16 - 35 mm²) available

- Frame necessary
- Hoods only in combination with frames
- For surface mounted housings, the bulkhead mounted housing must be ordered separately

[1] with hexagonal adapter

III-5.2 Han® 24 HPR EasyCon – High power connector with two-part housing

The Han® 24 HPR EasyCon is based on sized-24 B housings from the Han® HPR series. But in contrast to these housings, it consists mainly of a hood with cover and contact frame. The open system achieved as a result significantly simplifies the assembly process.

With this system, you no longer need to first route the cable completely through the cable clamps and housing and then push it back after the contacts are connected. The assembly process for the new system is completely accessible. Only at the end, is the hood is pushed over the assembled connector and fastened.

The Han® 24 HPR EasyCon can be constructed as a three-pole variant with Han® HC Modular 250, Han® HC Modular 350 and with HC 650 contacts with M25 or M32 cable clamps. A four-pole variant is also possible with Han® HC Modular 250 and with Han® HC Modular 350 contacts and M25 cable clamps.

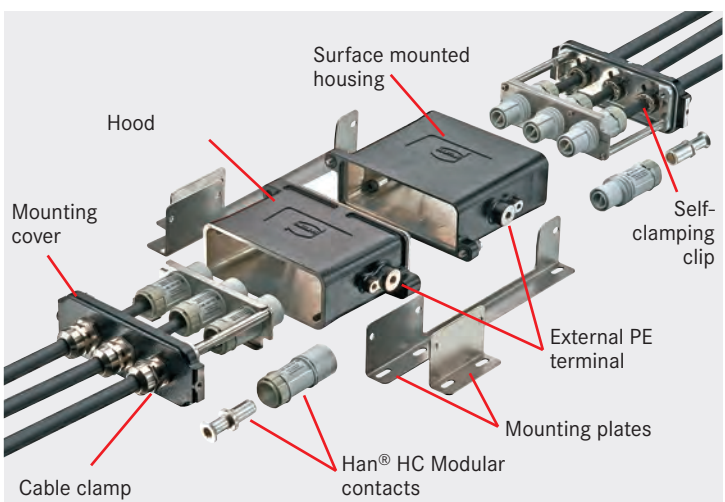


Figure III-5.1
Basic construction

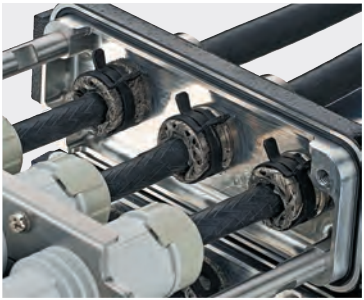


Figure III-5.2
Mounting cover with cable clamp and self-clamping clip

Table III-5.5
Technical details

Housing type	Han® 24 HPR EasyCon
IP protection degree	IP68 / 69K
Material	Die-cast aluminium
Interlock mechanism	Screw interlock system, M6 stainless steel
Contacts	Han® HC Modular 250 Han® HC Modular 350 Han® HC Modular 650
Frame for holding the contacts	Stainless steel 3 or 4 contacts: Han® HC Modular 250 and Han® HC Modular 350 3 contacts: Han® HC Modular 650
Cable clamp	Special cable clamp with self-clamping clip for contact with shield, M25 or M32 Alternative: Standard cable clamp, M25 or M32

III-5.3 Han® HC Individual: the scalable high-current interface

The Han® HC Individual is a new HARTING product line offering a wide range of contact arrangement options. Individually sealed 350 A contacts (featuring IP66 protection, with IP68 pending) can be arranged side by side with up to six connections onto a single carrier rail and up to three levels. This interface is very easy to lock together or disconnect, thanks to its stainless steel clip-lock system with integrated contact guide. Individual connections can be assembled separately, individually snapped in or replaced. The coding elements ensure that the insertion and removal processes are quick and error-free. It is also possible to mark the contacts using a carrier module.

The existing version can be used with a wire cross-section range from 25 mm^2 to 120 mm^2, with up to 350 A rated current and up to 4000 V rated voltage. All components have been tested for vibration and shock resistance in accordance with IEC 61 373. They have flammability characteristics I2/F2, in accordance with NFF 16-101/102. They also meet the R23 (outdoor application) requirements for Hazard Level HL2, in accordance with EN 45 545-2. These flammability characteristics, together with the contact arrangement possibilities, qualify the Han® HC Individual for use in railway applications such as wagon couplings, traction motors and power converters.

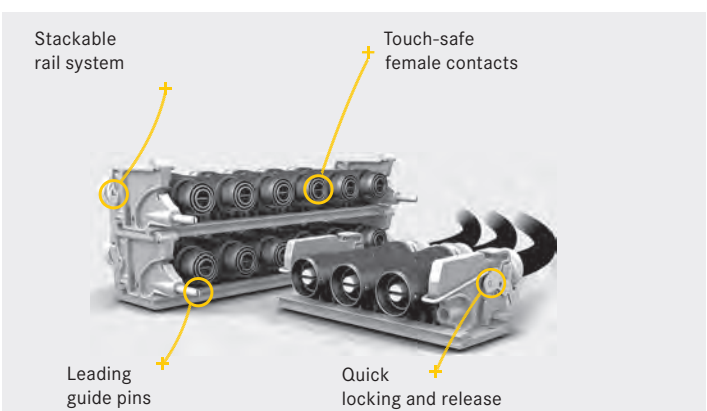


Figure III-5.3
The scalable Han® HC Individual interface

III-6 Han-Yellock® and Han-Yellock® Outdoor housings and contact inserts

Han-*Yellock*® is ideal for use in electrical cabinets and driver's console inside of railway wagons. With its special chromated surface, the Han-*Yellock*® Outdoor was specially designed for the harsher environmental requirements of outdoor applications. The new connector design offers a variety of innovative features in addition to an attractive new look. These new functions include:

- A new type of housing interlock mechanism on the interior
- Assembly with only one type of contact
- Multiplication of potentials from multiple contacts carried out directly in the housing.

The Han-*Yellock*® also features two newly designed modules with "Han-Quick Lock®" and "Crimp" termination methods. Both module variants have five contacts with a current-carrying capacity of 20 A per contact and a rated dielectric strength of up to 500 V.

In addition to the classic one-to-one contact, the five contacts can also be bridged with two-way, three-way, four-way or five-way bridges. This quick and service-friendly function – already widely used with terminal blocks – is now available for the constricted space within a connector. The PE contact is on the housing and can be made using either Han-Quick Lock® or crimp contacts.

The flange seal around the circumference also covers the retaining covers and screws. It ensures IP67 protection in accordance with DIN EN 60 529. The wide range of coding possibilities also

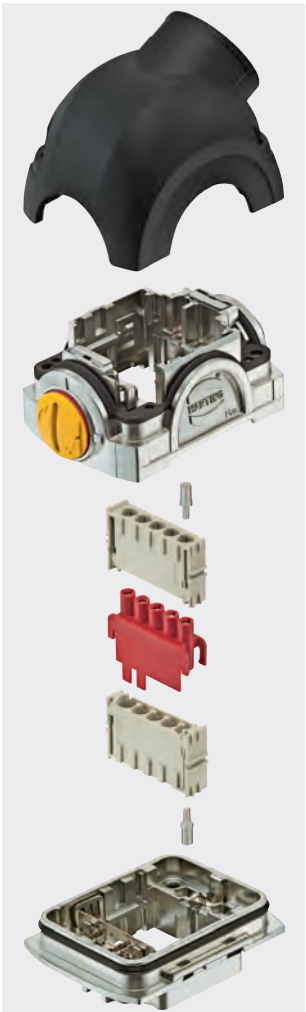


Figure III-6.1
Han-*Yellock*® *schematic view*

protects the connector from being inserted improperly. An adapter frame for use together with the Han-Modular® series of modules is also available. Vibration and shock resistance is ensured in compliance with EN 61 373.

Table III-6.1
Han-*Yellock*® *hoods and housings overview*

Size	Size of cable clamp	Inserts	Combinations
10	1 x M20 1 x M25	All contact inserts in size Han® 3 A	
30*	1 x M20 1 x M25 1 x M32	Han-*Yellock*® modules Han-*Yellock*® Quick Lock module Han-*Yellock*® Monoblock Han-*Yellock*® adapter frame (for Han-Modular®)	3 Han-*Yellock*® modules 2 Han-Modular® modules 1 Han-*Yellock*® Monoblock 1 Han-*Yellock*® modules + 1 Han-Modular® module
60*	1 x M25 1 x M32 1 x M40 2 x M25 1 x M20 + 1 x M25	Han-*Yellock*® modules Han-*Yellock*® Quick Lock module Han-*Yellock*® Monoblock Han-*Yellock*® adapter frame (for Han-Modular®)	6 Han-*Yellock*® modules 4 Han-Modular® modules 1 Han-*Yellock*® Monoblock 4 Han-*Yellock*® modules + 1 Han-Modular® module 2 Han-*Yellock*® modules + 2 Han-Modular® modules
* The data modules are only available on request.			

Figure III-6.2
The Han-*Yellock*®
hood and bulkhead mounted housing

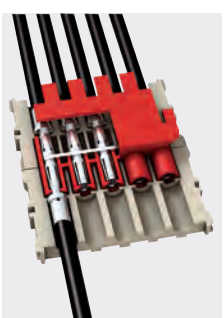


Figure Figure III-6.3
Han-*Yellock*®
multiplying the potentials in the connector

III-7 Types of connections used in connectors

HARTING connectors can be selected with a variety of wire connection types, depending on the following factors:

- Wire layout
- Tool availability
- Installation location
- The installation location of the connector

The wire connection methods used for railway applications include crimp, cage clamp, screw and axial termination connections. All of these connections offer a high degree of quality and reliability.

Additional information can be found in the Industrial Connectors Han®, Device Connectivity and Connectors DIN 41 612 Catalogues.

Table III-7.1
Overview of contact inserts and termination types

Wire termination technique	HARTING series
Screw terminal	Han E® Han® HsB Han Hv E® Han® K 6 / 12 Han® K4 / x Han A®
Cage clamp termination	Han® ES Han® ESS Han® ES module Han® K 4 / 4 (control contacts) InduCom9 MVB InduCom9 WTB InduCom9 CAN InduCom9 Profibus DIN 41 612 size H15
Han-Quick Lock® termination	Han® 3 A Han® 4 A Han® 7 D Han® 8 D Han® Q 5 / 0 Han® Q 12 / 0 (PE contact)
Crimp termination	Han E® Han® EE Han D® Han DD® Han® C module Han® 40 A Crimp module Han® 70 A Crimp module Han® 200 A Crimp module Han® HC Modular 250 Han® HC Modular 350 Han® HC Modular 650 Han Hv E® an® K 6 / 36 Han® K 8 / 24 Han® K 12 / 2 Han® Q 5 / 0 Han® Q 12 / 0 (power contacts) InduCom 9 InduCom D-Sub DIN 41 612 Signal DIN 41 612 Power

Axial screw termination	Han® Q 2 / 0 Han® Q 2 / 0 High Voltage Han® K 4 / 4 (power contacts) Han® K 6 / 6 Han® K 8 / 0 Han® C Axial module Han® 40 A Axial module Han® 70 A Axial module Han® 100 A Axial module Han® 200 A Axial module Han® K 3 / x Han® HC Modular 350 Han® HC Modular 650
THT solder termination	DIN 41 612 Signal DIN 41 612 Power
Press-in termination	DIN 41 612 Signal DIN 41 612 Power
IDC termination	DIN 41 612 Signal *HARAX*® M12 HA-VIS preLink® RJ 45 HA-VIS preLink® M12

These connection methods are described in the text below.

III-7.1 Screw terminal

The screw terminals are designed according to DIN EN 60 999. A distinction is made between terminals with wire protection and terminals that offer no wire protection. The wire protection mechanism consists of a metal tongue that is pressed down by the terminal screw onto the wire (refer to Figure III-7.1). This prevents the wire strands from shearing off during the installation. The wire ends do not need to be prepared in any special way other than merely stripping them.

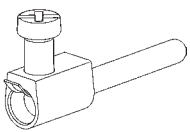


Figure III-7.1
Screw terminal
with wire protection

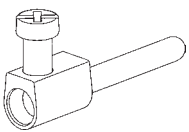


Figure III-7.2
Screw terminal
without wire protection

There is no metal tongue on the screw terminals that have no wire protection (Figure III-7.2). So wire ends must be fitted properly with wire-end ferrules.

The following table lists the required tightening torque and testing torque for the screw terminals.

Table III-7.2
Tightening and test torque for screw terminals

Wire cross-section (mm^2)	1.5	2.5	4	6	10	16
Screw thread	M3	M3	M3.5	M4	M4	M6
Test tightening torque (Nm)	0.5	0.5	0.8	1.2	1.2	1.2*
Min. pull-out force for stranded wire (N)	40	50	60	80	90	100

* For lock discs without heads (Han® K 4 / 8)

III-7.2 Cage-clamp terminal

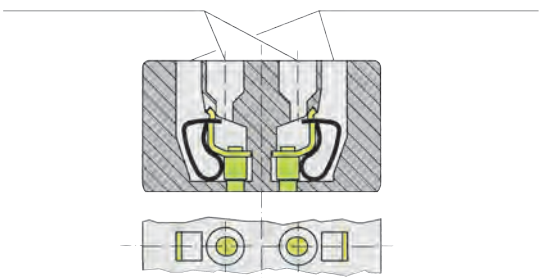
This termination technique uses the force of a spring to clamp down the wire. The advantage of this type of connection is that there is minimal operational overhead or tool work. It offers a high level of functional reliability since the spring is constantly pressing on the contact. DIN EN 60 999 specifies the requirements for the construction and inspection of the spring terminals.

The advantages:

- Use with solid and stranded wires
- No need to process the wire ends in any special way
- Strong clamping force applied as wire cross-section increases
- Wire connection is resistant to vibrations and shock
- Cage-clamp terminal has a constant, low voltage drop

One wire per termination point

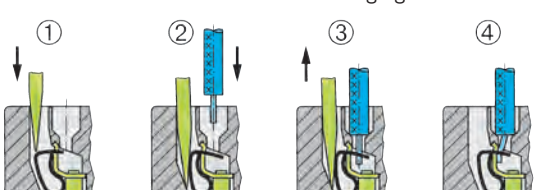
Slot for screwdriver



Assembly:

- Wire cross-section 0.14 – 2.5 mm²
- Insulation stripping length
  o Han® ES, Han® HvES, Han® K 4/4 (control contacts): 7 – 9 mm
  o Han® ESS: 9 – 11 mm

An installation schematic is shown in the following figure.



Screwdriver width: 3.0 x 0.5 mm

III-7.3 Han-Quick Lock® termination technique

Han-Quick Lock®

The Han-Quick Lock® termination technique was designed to increase efficiency during the assembly of plug-in connectors.

This termination technique combines the reliability and ease of use of the standard cage clamp termination with the minimal space requirement of the crimp connection. It is the only connection method that can be installed in the field that features a contact density comparable to a crimp connection.

Features:
- Quick, simple and robust termination technique
- Can be installed on-site without any special tools
- Resistant to shock and vibration just like the standard cage clamp termination
- Mating compatible with the other proven Han® contact inserts

Figure III-7.3 shows the layout of a contact with the Han-Quick Lock® termination technique. Note the spring which applies radial clamping pressure around the wire strands. This special connection method is characterized by a reduced contact resistance.

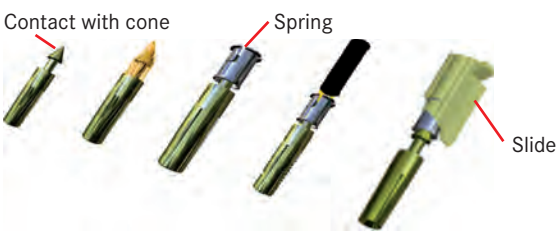
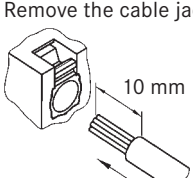


Figure III-7.3
Schematic of the Han-Quick Lock® termination technique

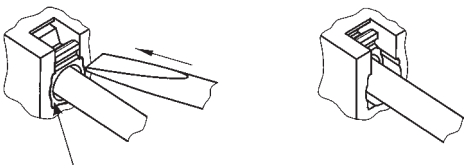
Installation instructions

Remove the cable jacket and strip the stranded wires.



Do not twist the wire strands!

Push the stranded wires into the Han-Quick Lock® contact and push the slide with a screw driver until it comes to a stop.



Slide

- blue (0.5 ... 2.5 mm², AWG 20 ... 14)
- black (0.25 ... 1.5 mm², AWG 22 ... 16)

Removal instructions

Please insert the screw driver at an angle of 45° into the opening and lever the slide out.

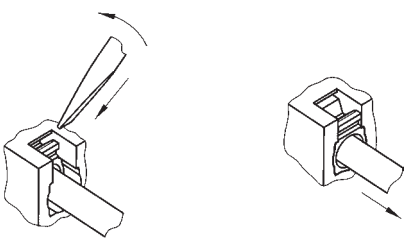


Table III-7.3
Technical details

Terminal cross-section	0.25 – 1.5 mm²	0.5 – 2.5 mm²
	AWG 22 – 16	AWG 20 – 14
Slide	black	blue
Insulation diameter	max. 3.0 mm	max. 3.6 mm

Further information and a video can be found on our home page at www.HARTING.com

III-7.4 Crimp termination

Crimp wire connections are classified as “solder-free electrical connections”. The specifications for this connection method are defined in DIN EN 60 352-2. The goal is to create solder-free electrical connections using Hand crimp tools or crimping machine which then fulfil the specified mechanical, electrical and climatic conditions.

The key to this process is making sure that the tool, crimping sleeve and wire are all well matched to each other.

The advantages of the crimp termination technique are:

- Can be processed with crimping machines or with manual crimping tools
- Connections are produced efficiently
- Crimp quality is consistently high when the tools are used properly
- No change in resistance as result of heat
- Wire under the crimp connection remains flexible

The test of a good crimp connection is the wire pull-out force. This force is specified in DIN IEC 60 352-2 for stranded wires with cross-sections up to 10 mm^2. These specified pull-out forces for the crimp contacts are maintained when HARTING crimping tools are used in a proper fashion. The wire pull-out forces are listed in the following table.

VDE 0220 is valid for crimp connections of wire cross-sections greater than 10 mm^2.

Table III-7.4
Pull-out forces for crimp connections in accordance with DIN IEC 60 352-2, A2

Wire gauge / cross-section mm^2	AWG	Pull-out force N	HARTING contacts
0.14	26	18	Han D®, Han E®, D-Sub, DIN 41 612, Han-*Yellock*®
0.22	24	28	Han D®, Han E®, D-Sub, DIN 41 612, Han-*Yellock*®
0.25		32	Han D®, Han E®, D-Sub, DIN 41 612, Han-*Yellock*®
0.32	22	40	Han D®, Han E®, D-Sub, DIN 41 612, Han-*Yellock*®
0.50	20	60	Han D®, Han E®, D-Sub, DIN 41 612, Han-*Yellock*®
0.75		85	Han D®, Han E®, D-Sub, DIN 41 612, Han-*Yellock*®
0.82	18	90	Han D®, Han E®, DIN 41 612, Han-*Yellock*®
1.00		108	Han D®, Han E®, DIN 41 612, Han-*Yellock*®
1.30	16	135	Han D®, Han E®, DIN 41 612, Han® C, Han-*Yellock*®
1.50		150	Han D®, Han E®, DIN 41 612, Han® C, Han-*Yellock*®
2.10	14	200	Han D®, Han E®, Han® C, Han-*Yellock*®
2.50		230	Han D®, Han E®, Han® C, Han-*Yellock*®
3.30	12	275	Han E®, Han® C, Han-*Yellock*®
4.00		310	Han E®, Han® C, Han-*Yellock*®
6.00	10	360	Han® C
10.00	8	380	Han® C

III-7.4.1 Crimp connections for wire cross-sections of 10 – 240 mm²

Crimp contacts are available for wire cross-sections from 10 to 240 mm². They can be processed using the crimping jaws according to DIN EN 46 235.

The crimps can thus be processed with pressing tools (e.g. from the company Klauke).

Refer to Chapter VI for more information about processing crimp contacts.

Table III-7.5
Stripping lengths 10 – 240 mm²

Contact	Part number	Cross-section [mm²]	Insulation stripping length [mm]	Remarks
Han® TC70	09 11 000 6131 / 6231	10	15.5	Han® 70 A Crimp module
	09 11 000 6132 / 6232	16	15.5	
	09 11 000 6133 / 6233	25	15.5	
Han® TC100	09 11 000 6116 / 6216	16	19	Han® 100 A Crimp module
	09 11 000 6125 / 6225	25	19	
	09 11 000 6135 / 6235	35	16	
Han® TC200	09 11 000 6120 / 6220	25	22.5	Han® 200 A Crimp module
	09 11 000 6121 / 6221	35	22.5	
	09 11 000 6122 / 6222	50	22.5	
	09 11 000 6123 / 6223	70	22.5	
Han® TC250	09 11 000 6127 / 6227	35	22	Han® HC Modular 250
	09 11 000 6128 / 6228	50	22	
	09 11 000 6129 / 6229	70	22	

Contact	Part number	Cross-section [mm²]	Insulation stripping length [mm]	Remarks
Han® TC350	09 11 000 6139 / 6239	25	26	Han® HC Modular 350
	09 11 000 6140 / 6240	35	26	
	09 11 000 6141 / 6241	50	28	
	09 11 000 6142 / 6242	70	28	
	09 11 000 6143 / 6243	95	30	
	09 11 000 6144 / 6244	120	24	
Han® TC650	09 11 000 6161 / 6261	70	42	Han® HC Modular 650
	09 11 000 6162 / 6262	95	42	
	09 11 000 6163 / 6263	120	42	
	09 11 000 6164 / 6264	150	42	
	09 11 000 6165 / 6265	185	42	
	09 11 000 6168 / 6268	240	46	

III-7.4.2 Connecting multiple wire strands in a single crimp contact

It is not forbidden to crimp multiple strands in a single crimping sleeve. In order to create a reliable connection, be sure to follow these points:

- The wire combination should be appropriate for the material and surface.
- The cross-section in the crimping sleeve must be appropriate in relation to the total cross-section of the wire.
- The requirements concerning the tensile strength and contact resistance for the connection, according to EN 60 352-2, must be met.
- All processing steps should be carried out carefully.
- The wire strands may not be twisted.
- Be sure to maintain the creepage and clearance distances according to the relevant standards.

III-7.5 Axial screw termination

An axial screw wire termination can be used to connect stranded and finely stranded wires. This connection method was designed for connecting wires with large cross-sections in a tight space without any special tools. Wire cross-sections from 2.5 to 185 mm^2 can be connected.

This connection method is suitable for use in railway wagon applications because it offers excellent reliability and resistance to shock and vibration.

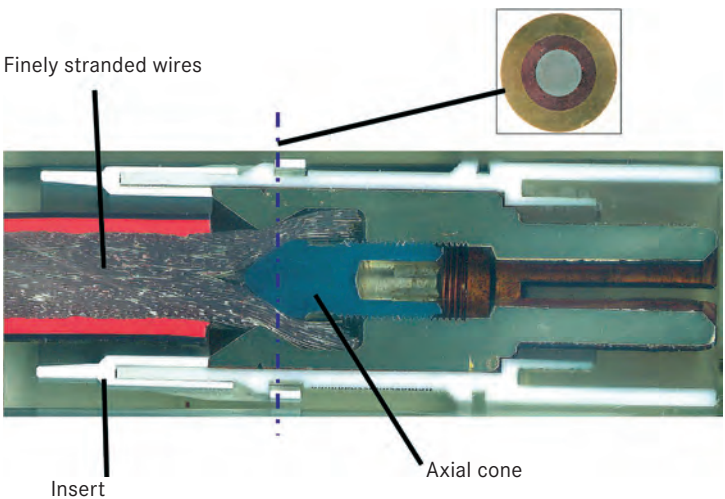


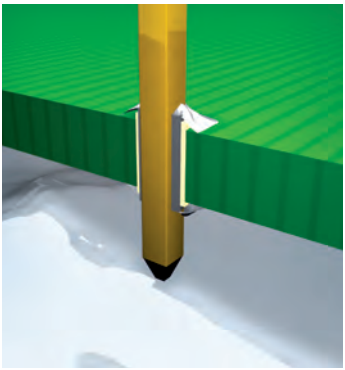
Figure III-7.4
A schematic of the axial screw termination

Figure III-7.4 shows a cut-out view of a contact with an axial screw termination.

The installation instructions for the corresponding contact inserts are described in Chapter VI “Installation Instructions”.

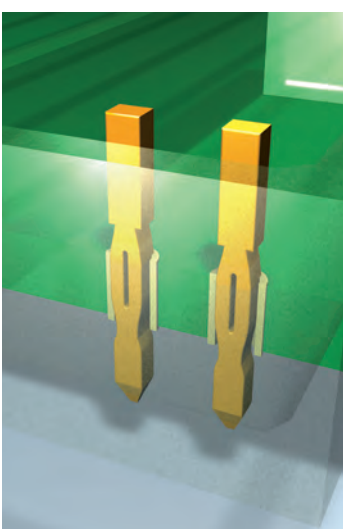
III-7.6 THT solder termination

Conventional soldering technology has been proven over decades and provides maximum mechanical stability and process safety. The soldering pins of the connectors are inserted into plated-through circuit board holes and can then be automatically and simultaneously wave soldered to other components.

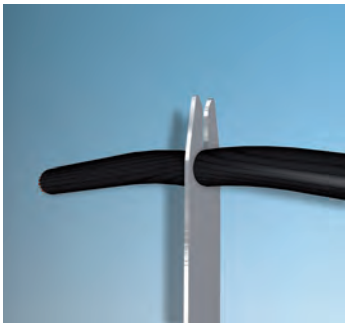


III-7.7 Press-in technology

This solderless connection technology is based on pressing a pin in a plated-through hole printed circuit board. By using a modern, elastically deformable press-in zone, the tolerances of the PCB hole can be compensated for. The high electrical and mechanical requirements, as well as the insertion force and high holding force can thus be met. The press-in technology is an affordable and unlimited processing method, especially for selective gold plating of pins for backplane bus systems.



III-7.8 IDC (insulation displacement connection)



IDC (insulation displacement connections) can be used to provide easy and safe contacting of solid and stranded wires. In one step, the IDC cutting terminal penetrates into the wire insulation and resiliently contacts the wires. The gas-tight connection provides maximum safety for even the smallest currents and voltages. A special feature of the *HARAX*® IDC is that the cutting terminal is combined with a wire guide element – enabling simple on-site assembly without special tools.

The technical requirements for IDC technology are standardized in IEC 60 352-3.

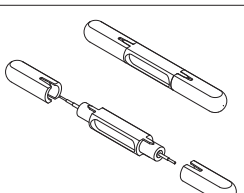
III-8 Overview of tools and accessories

Table III-8.1
Crimping tools

Product	Features	Product photo
Crimping tools		
Standard crimping tool 09 99 000 0110 Locator Han-*Yellock*® 09 99 000 0341	Wire cross-section: Han D®: 0.14 – 1.5 mm² AWG 26 – AWG 16 Han E®: 0.5 – 4.0 mm² AWG 20 – AWG 12 Han® C: 1.5 – 4.0 mm² AWG 16 – AWG 12 Han-*Yellock*®: 0.5 – 4.0 mm² AWG 20 – AWG 12	
Crimping tool 09 99 000 0303	Wire cross-section: Han® C: 4.0 – 10 mm² AWG 12 – 8	
Crimping tool 09 99 000 0377	Wire cross-section: Han® C: 6 – 10 mm² AWG 10 – 8	
Wire ferrules crimping tool 10 mm² 09 99 000 0374	Wire cross-section: 10 mm² and 16 mm² AWG 8 and AWG 6 Allows direct connection of 10-mm² wire ferrules to the existing Han-Modular® hinged frame	

III

Product	Features	Product photo
Crimping tools		
Wire ferrules crimping tool 16 / 25 mm^2 09 99 000 0830	For wire ferrules 16 und 25 mm^2, allows direct connection of 25-mm^2 wire ferrules to the Han-Eco® PE contact module.	
Four-indent crimping tool 09 99 000 0888	Wire cross-section: Han D®: 0.14 – 2.5 mm^2 AWG 26 – AWG 14 Han E®: 0.14 – 4.0 mm^2 AWG 26 – AWG 12 Han® C: 1.5 – 4 mm^2 AWG 16 – AWG 12 Han-*Yellock*®: 0.14 – 4.0 mm^2 AWG 26 – AWG 12 Includes swivel locator for Han D® / Han E® / Han® C and Han-*Yellock*® It is not necessary to check the crimping depth!	
Go / no-go gauge 09 99 000 0889	For optional functional testing of the Four-indent crimp tool 09 99 000 0888	

Product	Features	Product photo
Crimping tools		
Buchanan four-point crimping tool 09 99 000 0001	Wire cross-section: Han D®: 0.14 – 2.5 mm² AWG 26 – AWG 14 Han E®: 0.14 – 4.0 mm² AWG 26 – AWG 12 Han® C: 1.5 – 4 mm² AWG 16 – AWG 12 Attention: The locators and adjusting pin must be ordered separately! Han-*Yellock*®: 0.14 – 4.0 mm² AWG 26 – AWG 12	
Locator for the Buchanan four-point crimping tool 09 99 000 0311 09 99 000 0310 09 99 000 0308 09 99 000 0342	For Han D® contacts For Han E® contacts For Han® C contacts For Han-*Yellock*® contacts	
Adjusting pin for the Buchanan four-point crimp tool (for setting the crimping depth) 09 99 000 0379[1)]	Han D®, Han E®, Han® C, Han-*Yellock*® contacts	

[1)] Han D® contacts:
Only the male contact (09 15 000 6107) or the female contact (09 15 000 6207) should be used for wire cross-sections of 0.14 and 0.25 mm².

III

Product	Features	Product photo
Crimping tool		
Crimping tool 09 99 000 0503	For coaxial contacts Attention: Crimp dies must be ordered separately!	
Crimping jaw 09 99 000 0508	For crimping tool 09 99 000 0503	
Crimping tool 09 99 000 0501	For D-Sub contacts Wire cross-section 0.08 – 0.82 mm² AWG 28 – 18 Attention: Locator must be ordered separately!	
Locator 09 99 000 0531	For crimping tool 09 99 000 0501 AWG 28 - 18	
TK-M crimping machine 09 98 000 6000	Han D®, Han E® contacts Wire cross-section 0.14 – 4.0 mm² AWG 26 – 12 Performs both stripping and crimping processes (refer to the Han® Industrial Connectors Catalogue)	
TC-SC crimping machine 09 98 000 8000	Han D®, Han E®, Han® C, Han-*Yellock*® and D-Sub contacts Wire gauge / cross-section 0.14 – 10.0 mm² AWG 26 – 8 Performs both the stripping and crimping (refer to the Han® Industrial Connectors Catalogue)	

Product	Features	Product photo
Crimping tool		
TC crimping machine Han D®: 09 98 000 9001 Han E®: 09 98 000 9002 Han® C: 09 98 000 9003	Han D®, Han E® and Han® C contacts Wire cross-section 0.14 – 6.0 mm^2 AWG 26 – 10 Performs crimping (refer to the Han® Industrial Connectors Catalogue)	
BK crimping machine 09 98 000 5000	D-Sub contacts and DIN 41 612 Wire gauge / cross-section 0.08 – 1.5 mm^2 AWG 28 – 16 Performs both the stripping and crimping (refer to the Han® Industrial Connectors Catalogue)	

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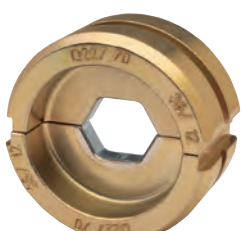
Product	Features	Product photo
Crimping tool		
Hydraulic crimping tool with rechargeable battery, 60 kN 09 99 000 0850	For processing TC 70 – TC 650 up to 70 mm², together with 9 mm wide DIN 46 235 dies	
Hydraulic crimping tool, 60 kN 09 99 000 0851	For processing TC 70 – TC 650 up to 70 mm², together with 9 mm wide DIN 46 235 dies	
10 mm² crimping jaw for 60 kN tool (D6) 09 99 000 0852	Fits to the tools 09 99 000 0850 and 09 99 000 0851	
16 mm² crimping jaw for 60 kN tool (D8) 09 99 000 0853		
25 mm² crimping jaw for 60 kN tool (D10) 09 99 000 0854		
35 mm² crimping jaw for 60 kN tool (D12) 09 99 000 0855		
50 mm² crimping jaw for 60 kN tool (D14) 09 99 000 0856		
70 mm² crimping jaw for 60 kN tool (D16) 09 99 000 0857		

Product	Features	Product photo
Crimping tool		
Hydraulic crimping tool with rechargeable battery, 130 kN 09 99 000 0860	For processing TC 70 – TC 650 up to 240 mm², together with DIN 46 235 jaws	
Manually operated hydraulic crimping tool, 130 kN 09 99 000 0861	For processing TC 70 – TC 650 up to 240 mm², together with DIN 46 235 jaws	
10 mm² crimping jaws for 130 kN tool (D6) 09 99 000 0862	Fits to the tools 09 99 000 0860 and 09 99 000 0861	
16 mm² crimping jaw for 130 kN tool (D8) 09 99 000 0863		
25 mm² crimping jaw for 130 kN tool (D10) 09 99 000 0864		
35 mm² crimping jaw for 130 kN tool (D12) 09 99 000 0865		
50 mm² crimping jaw for 130 kN tool (D14) 09 99 000 0866		

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Product	Features	Product photo
Crimping tool		
70 mm² crimping jaw for 130 kN tool (D16) 09 99 000 0867	Fits to the tools 09 99 000 0860 and 09 99 000 0861	
95 mm² crimping jaw for 130 kN tool (D16) 09 99 000 0868		
120 mm² crimping jaw for 130 kN tool (D16) 09 99 000 0869		
150 mm² crimping jaw for 130 kN tool (D18) 09 99 000 0870		
185 mm² crimping jaw for 130 kN tool (D25) 09 99 000 0871		
240 mm² crimping jaw for 130 kN tool (D28) 09 99 000 0872		
HARTING pneumatic crimping tool 09 99 000 0810 Tool heads (refer to the Han® Industrial Connectors Catalogue)	Wire cross-section: Han D®: 0.14 – 1.5 mm² AWG 26 – 16 Han E®: 0.14 – 4.0 mm² AWG 26 – 12 Han® C: 1.5 – 10.0 mm² AWG 16 – 8	

Product	Features	Product photo
Crimping tool		
Crimping tool 09 99 000 0075 09 99 000 0076 09 99 000 0077	For individual contacts BC / FC 1 / *har-bus® 64* FC 2 FC 3	
Locator 09 99 000 0640 09 99 000 0641 09 99 000 0642	For individual contacts BC / FC 1 / *har-bus® 64* FC 2 FC 3	
Crimping tool for reel-packaged contacts DIN 41 612 09 99 000 0248 09 99 000 0247 09 99 000 0119 09 99 000 0120	 For reels with 500 BC contacts For reels with 500 contacts FC1 FC2 FC3	
Crimping tool for individual contacts (servicing tool) 09 99 000 0191	For FC1, FC2 and FC3 contacts Locator included in delivery.	
Manual crimping tool 61 03 600 0020	For crimp flange and crimp barrel	

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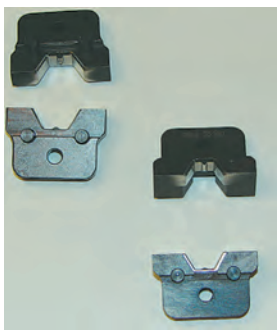
Table III-8.2
Tool inserts

Product	Features	Product photo
Tool inserts	**For manual crimping tools 61 03 600 0020 SW[1] [mm]**	
61 03 000 0179	5.0	
61 03 000 0180	5.5	
61 03 000 0098	6.0	
61 03 000 0099	6.5	
61 03 000 0100	7.0	
61 03 000 0101	7.5	
61 03 000 0102	8.0	
61 03 000 0103	8.5	
61 03 000 0104	9.0	
61 03 000 0105	9.5	
61 03 000 0174	10.0	
61 03 000 0172	10.5	
61 03 000 0168	11.0	
61 03 000 0169	11.5	
61 03 000 0175	12.0	
61 03 000 0176	12.5	
61 03 000 0177	13.0	
61 03 000 0178	13.5	
61 03 000 0173	14.0	



[1] SW = spanner width

Table III-8.3
Removal/disassembly tools

Product	Features	Product photo
Installation/removal tools		
Han D® 09 99 000 0012	Open the contact cavity on the plug side. Pull out the wire strands with the contact on the termination side.	
Han E® 09 99 000 0319	Open the contact cavity and pull out the wire strands with the crimped-on contact on the termination side.	
Han® C 09 99 000 0305	Open the contact cavity and pull out the wire strands with the crimped-on contact on the termination side.	
Han-Quintax® 09 99 000 0323	Removal tool for removing the Quintax® contacts from the Quintax® module	
Han-Modular® in plastic frame 09 99 000 0331 09 99 000 0828 09 99 000 0842	For removing single or double modules from plastic frames (e.g. the Han-Eco®)	

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Product	Features	Product photo
Installation/removal tools		
D-Sub contacts 09 99 000 0171	Assembly and removal tool	
D-Sub contacts 09 99 000 0368 (Industrial)	Assembly and removal tool for industrial applications	
Han 200 A Crimp module 09 99 000 0820	Open the contact cavity and pull out the wire strands with the crimped-on contact on the termination side.	
Han 100 A Crimp module 09 99 000 0383		
Han 100 A Single modules 09 99 000 0827		
Coaxial contacts 09 99 000 0512	Removal tool	
D-Sub contacts 09 99 000 0511	Assembly and removal tool	
BC contacts 09 99 000 0101	Removal tool	
FC1, FC2, FC3 contacts 09 99 000 0087	Removal tool	

Table III-8.4
Assembly tools

Product	Features	Product photo
Assembly tools		
Assembly tool for crimp contacts 09 99 000 0847	Recommended for wire sizes < 0.75 mm² (AWG 18), for Han D® and Han E® contacts, with retractable interchangeable blade	
Stripping tool 09 99 000 0159	For stranded and solid wires 0.08 – 10 mm² AWG 28 – AWG 6	
Torque set HC 5 – 14 Nm 09 99 000 0833	Variable torque wrench 5 – 14 Nm, including interchangeable blades SW 4 + 5, axial screw termination	
Torque set for power contacts, 1 – 5 Nm 09 99 000 0834	Variable torque wrench 5 – 14 Nm, including interchangeable blades SW 2 + 2.5, + various bits and adapter blade	
Torque set for screw terminal 09 99 000 0835	Two torque screwdrivers, 0.5 + 1.2 Nm For screw terminals and PE termination	
Torque set for guide pins (male and female) 09 99 000 0840	Torque screwdriver 0.5 Nm and special ¼" bit for safe, easy assembly	

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Product	Features	Product photo
Assembly tools		
Assembly tool 09 99 000 0367	For contact inserts with cage clamp connection	
Assembly tool 09 99 000 0100	For BC contacts	
Assembly tool 09 99 000 0088	For FC1, FC2 and FC3 contacts	
Allen hex screw-driver with ball head 61 03 600 0021	For housings with hex-head screws	
Assembly tool 61 03 600 0017 61 03 600 0018	For crimp flange assembly: D-Sub housing, 9 – 37 poles, D-Sub housing, 50 poles	

[1] SW = spanner width

III-8.1 Mounting frame for Han® housing

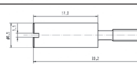
Table III-8.5
Mounting frame for Han® housing

Product	Features	Product photo
Mounting frame For Han® B housings Size: Product No. 6 B: 09 40 000 9921 10 B: 09 40 000 9922 16 B: 09 40 000 9923 24 B: 09 40 000 9924	For strengthening the mounting surfaces; intended for use with Han® B and Han® HPR hoods and housings, sizes 6 B – 24 B, on thin-walled panels It is recommended to use the mounting frame when installing multiple housings in a row.	
For Han® HPR housings Size: Product No. 6 B: 09 40 000 9901 10 B: 09 40 000 9902 16 B: 09 40 000 9903		
16 B: 09 40 000 9956 when using 4 x HC 250 in 16 HPR enlarged		
24 B: 09 40 000 9904		
24 B: 09 40 000 9955 when using 4 x HC 250 in Han® 24 HPR housings and when using HC 650 in Han® 24 HPR and Han ® 24 HPR enlarged housings		
48 B: 09 40 000 9965		

III-8.2 Coding elements

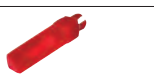
If an application is using multiple connectors of the same type, then it is very important to take steps to ensure that the connectors cannot be mixed up and connected improperly. DIN EN 60 204-1 (VDE 0113) specifies that connectors must be labelled clearly. It recommends using a mechanical coding system to ensure that improper mating insertion is not possible. HARTING offers coding elements, listed in the following table, for this purpose. The “Installation Instructions and Tips” chapter describes the installation and gives an overview of the coding options.

Table III-8.6
Coding elements

Coding elements / Product No.		
Locking stud (for standard) 09 30 000 9901[1)]	6 coding options[3)] for housings with one insert / two inserts	
Locking stud (for Han-Modular®) 09 14 000 9901[1)]	6 coding options[3)] for housings with one insert / two inserts	
Guide pin (Standard) 09 33 000 9808[4)] 09 33 000 9908[2)]	16 coding options[3)] for hoods and housings with one insert (15 coding options with two inserts)	
Female guiding pin (Standard) 09 33 000 9809[4)] 09 33 000 9909[2)]	16 coding options[3)] for hoods and housings with one insert (15 coding options with two inserts)	
Guide pin (Standard) 09 33 000 9937[2)]	With extended thread	
Female guiding pin (Standard) 09 33 000 9938[2)]	With extended thread	
Guide pin (Han-Modular®) 09 14 000 9908[2)] 09 14 000 9981[4)]	16 coding options[3)] for housings with one hinged frame (15 coding options with two hinged frames)	
Female guiding pin (Han-Modular®) 09 14 000 9909[2)] 09 14 000 9982[4)]	16 coding options[3)] for housings with one hinged frame (15 coding options with two hinged frames)	

1) 4 pieces / connector (upper and lower part)
2) 4 pieces / connector
3) Refer to Chapter IV Installation Instructions, Coding Elements
4) For applications with grip frame and screw adapter

HARTING offer further coding options on demand.

Coding elements / Product No.		
Coding pin (Han E®, Han® EE, Han® Q 5 / 0, Han® Q 8 / 0) 09 33 000 9954	Coding with loss of a contact. The male contact opposite the coding pin cannot be used.	
Coding pin (Han D®, Han DD®) 09 44 000 9915	Coding with loss of a contact. The male contact opposite the coding pin cannot be used.	
Coding pin for male insert (Han® Q 7/0) 09 12 000 9901	6-way coding without loss of any contacts	
Coding pin for female insert (Han® Q 7/0) 09 12 000 9902	6-way coding without loss of any contacts	
Coding pin (Han® Q 12/0) 09 12 000 9924	16-way coding without loss of any contacts	
Coding peg (Han-*Yellock*®) 11 00 000 9501	25 coding options without loss of any contact, with clear position mark on cast part of housing	

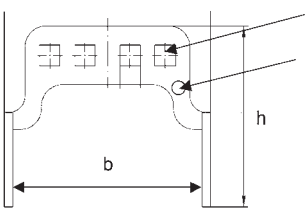
III-8.3 Accessories: Clamps and strain-relief frame

When working with connectors, the issue of strain-relief mechanisms for the shield or PE connection is a continually reoccurring theme. HARTING offers a comprehensive line of frame products designed to help customers reduce the strain and tension on shield/PE connections. We are also able to deliver customer-specific solutions on request.

The following table (Table III-8.7) is an overview of the products available in this area.

Dimensioning examples

For Han® Monoblock inserts



Through hole

thread

For Han® HC Modular

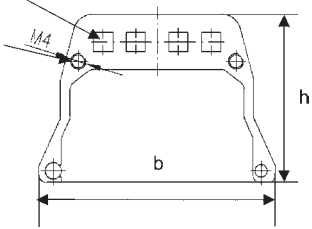
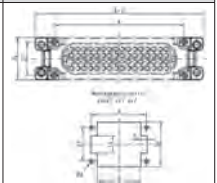
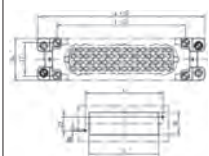
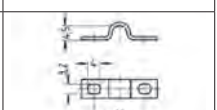
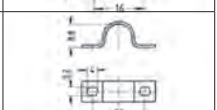


Table III-8.7
Shield frame, grip panel, screw adapter, clamps

Product number	Description	Size	Series usage	Technical specifications Height h (mm) / total width w (mm)	Material	Depictions (examples)
09 00 000 5206	Shield frame	6 B	For Han E®, Han® EE, Han DD® in bulkhead mounted / hood housing, tall size, Han-Snap®,	43.5 / 33	Galvanized steel	
09 00 000 5256	Shield frame	6 B	For Han-Modular® in bulkhead mounted housing	63.7 / 48.5	Galvanized steel	
09 00 000 5207	Shield frame	10 B	For Han E®, Han® EE, Han DD® in bulkhead mounted / hood housing, tall size, Han-Snap®,	43.5 / 46	Galvanized steel	
09 00 000 5257	Shield frame	10 B	For Han-Modular® in bulkhead mounted housing	63.7 / 61.6	Galvanized steel	
09 00 000 5208	Shield frame	16 B	For Han E®, Han® EE, Han DD® in bulkhead mounted / hood housing, tall size, Han-Snap®	43.5 / 66.5	Galvanized steel	
09 00 000 5258	Shield frame	16 B	For Han-Modular® in bulkhead mounted housing	63.7 / 82	Galvanized steel	
09 00 000 5210	Shield frame	24 B	For Han E®, Han® EE, Han® DD® in bulkhead mounted / hood housing, tall size, Han-Snap®,	67.1 / 93	Galvanized steel	
09 00 000 5280	Shield frame	24 B	For Han E®, Han® EE, Han DD® in bulkhead mounted / hood housing, tall size, Han-Snap®	43.5 / 93	Galvanized steel	

Product number	Description	Size	Series usage	Technical specifications Height h (mm) / total width w (mm)	Material	Depictions (examples)
09 00 000 5211	Shield frame	24 B	For Han-Modular® in bulkhead mounted housing	63.7 / 108.5	Galvanized steel	
09 00 000 5298	Shield frame	24 B	For Han-Modular® in bulkhead mounted housing or hood housing, tall size	42.2 / 108.5	Galvanized steel	
09 00 000 5235	Shield frame	24 B	For Han-Quintax® in bulkhead mounted housing	42.2 / 108.5	Galvanized steel	
09 00 000 5209	PE frame	24 B	For Han-Modular® in bulkhead mounted housing or hood housing, tall size	38.2 / 108.5	Galvanized steel	
09 00 024 5601	Grip panel	24 B	Han® 64 D, 108 DD Han® 24 E, ES, ESS Han® 46 E Han® 64 EEE	100 / 111.8	Galvanized steel	
09 00 024 5611*	Grip panel with screw adapter and screw (*only in connection with 09 00 000 5602)	24 B	Han® 64 D, 108 DD Han® 24 E, ES, ESS Han® 46 E Han® 64 EEE	98 / 111.8	Galvanized steel	

Product number	Description	Size	Series usage	Technical specifications Height h (mm) / total width w (mm)	Material	Depictions (examples)
09 00 000 5602*	Screw adapter bulkhead mounted side (*only in connection with 09 00 024 5611)			Size / Han® 6 B / Han® 10 B / Han® 16 B / Han® 24 B a: 44 / 57 / 77.5 / 104 b: 35 / 48 / 68.5 / 95	Die-cast zinc	
09 00 000 5603	Screw adapter bulkhead mounting side		Die-cast zinc	Size / Han® 6 B / Han® 10 B / Han® 16 B / Han® 24 B a: 52 / 65 / 85.5 / 112 b: 65 / 78 / 98.5 / 125		
09 00 000 5341	Clamps	4.5	For 5 mm cable diameter		Galvanized steel	
09 00 000 5342	Clamps	8.8	For 10 mm cable diameter		Galvanized steel	

The corresponding data sheets can be found at www.harkis.harting.com
Additional grip panels, shield frames and clamps are available on request.

III-8.4 Han® EE Multiplier

The Han® EE Multiplier was designed for the purpose of distributing data and signals within railway wagons.

Figure III-8.1
Han® EE Multiplier

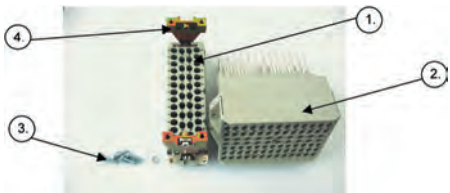


Figure III-8.2
Han® EE Multiplier variants

This product is designed to be used with the Han® 46 EE contact insert. It is available in two variants.

III-8.2
Han® 46 EE Multiplier variants

Variants	Product number	Consisting of	Positions in Fig. III-8.2
Male version	09 32 046 5651	One Han® 46 EE contact insert (M), unpopulated	1
		One Han® 46 EE Multiplier equipped with 46 long male contacts	2
		4 M3 fixing screws	3
		2 PE panels (pre-mounted to insert)	4
Female version	09 32 046 5751	One Han® 46 EE contact insert (F) equipped with 46 female contacts	1
		One Han® 46 EE Multiplier equipped with 46 short male contacts	2
		4 M3 fixing screws	3
		2 PE panels (pre-mounted to insert)	4

Note: The female version has an additional contact between the multiplier and the Han® 46 EE female insert. The male version has contacts that are measured so that they are long enough to be inserted through the Han® 46 EE male insert. The correct contact length is then derived automatically.

The Han® 46 EE contact insert consists of a total of 46 contacts plus PE. They are distributed across four rows (2 outer rows with 13 contacts each and 2 inner rows with 10 contacts each).

The multiplier is designed so that the data on both outer rows can be multiplied three times per contact. The connections on both middle rows have one-to-one through contacts. The multiplier can be installed in the sized-24 B bulkhead mounted housing. Figure III-8.3 illustrates the layout.

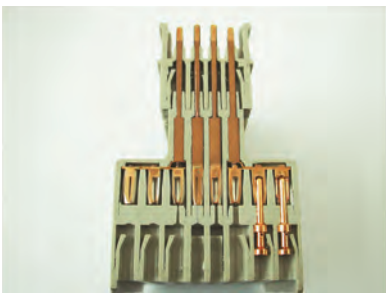


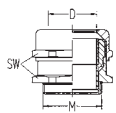
Figure III-8.3
Han® 46 EE sectional view

The installation instructions for this product are described in the “Installation Instructions” Chapter.

III-8.5 Cable clamps

Table III-8.9
Metal and plastic cable clamps with metric threads

	Product number	Thread M	Clamping range, D	SW	E	Nm
Metal	19 00 000 5080	20	5- 9 mm	22	24.4	10
	19 00 000 5082	20	6-12 mm	22	24.4	10
	19 00 000 5084	20	10-14 mm	24	26.5	10
	19 00 000 5090	25	9-16 mm	30	33.5	15
	19 00 000 5092	25	13-18 mm	30	33.5	15
	19 00 000 5094	32	13-20 mm	40	44	15
	19 00 000 5096	32	18-25 mm	40	44	15
	19 00 000 5097	40	20-26 mm	50	55	20
	19 00 000 5098	40	22-32 mm	50	55	20
	19 00 000 5086	50	32-38 mm	57	60	24
Plastic, white	19 00 000 5180	20	5- 9 mm	24	26.4	8
	19 00 000 5182	20	6-12 mm	24	26.4	8
	19 00 000 5184	20	10-14 mm	27	29.8	10
	19 00 000 5190	25	9-16 mm	33	36.5	12
	19 00 000 5192	25	13-18 mm	33	36.5	12
	19 00 000 5194	32	13-20 mm	42	46.8	15
	19 00 000 5196	32	18-25 mm	42	46.8	15
	19 00 000 5197	40	20-26 mm	53	58.8	15
	19 00 000 5198	40	22-32 mm	53	58.8	15



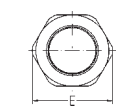
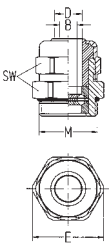


Table III-8.10
EMC cable clamps for metric threads (IP68)

Product number	thread M	cable-Ø D min.	cable-Ø D max.	shield-Ø B min.	shield-Ø B max.	SW	E
19 62 000 5080	20	6.5	9.5	3.5	8.5	22	24.4
19 62 000 5081	20	4.0	6.5	2.5	6.5	22	24.4
19 62 000 5082	20	7.0	10.5	6.5	10.5	22	24.4
19 62 000 5084	20	9.0	13.0	6.5	10.5	22	24.4
19 62 000 5090	25	6.5	9.5	3.0	8.0	28	31.2
19 62 000 5092	25	9.0	13.0	4.8	8.0	28	31.2
19 62 000 5094	32	11.5	15.5	8.0	13.5	35	38.5
19 62 000 5096	32	14.0	18.0	9.0	14.5	35	38.5
19 62 000 5097	40	17.0	20.5	15.0	20.0	43	47.3
19 62 000 5098	40	20.0	25.0	15.0	20.0	43	47.3



III

Table III-8.11
Blind grommet for metric threads, metal

Product number	thread M	SW	E
19 00 000 5070	20	22	25.4
19 00 000 5071	25	28	32.3
19 00 000 5072	32	35	40.4
19 00 000 5073	40	44	50.8

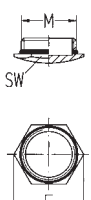
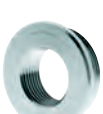


Table III-8.12
Reducers for metric threads, metal

Product number	thread D	thread M
19 00 000 5060	16	20
19 00 000 5067	20	32
19 00 000 5068	25	32



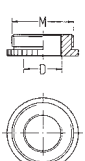


Table III-8.13
Covers for Han® HPR hoods

Covers		
Transport protective cover HPR	For bulkhead mounted housing / surface mounted housing IP20 protection To snap on	
09 40 003 5406	Size HPR 3 A	
09 40 006 5406	Size HPR 6 B	
09 40 010 5406	Size HPR 10 B	
09 40 016 5406	Size HPR 16 B	
09 40 024 5406	Size HPR 24 B	
Covers HPR	For bulkhead mounted housing / surface mounted housing IP68 protection, screw locking	
09 40 003 5412[1)]		
09 40 703 5412	Size HPR 3 A	
09 40 006 5411	Size HPR 6 B	
09 40 010 5411	Size HPR 10 B	
09 40 016 5411	Size HPR 16 B	
09 40 024 5411	Size HPR 24 B	
09 40 048 5401	Size HPR 48 B	
HPR covers	For hoods IP68 protection, screw locking	
09 40 006 5414	Size HPR 6 B	
09 40 010 5414	Size HPR 10 B	
09 40 016 5414	Size HPR 16 B	
09 40 024 5414	Size HPR 24 B	

[1)] Chromatiert

III-9 Spare parts

The following table lists information on screws (PE, retaining and interlock screws) and seals (flange, profile and O-ring seals) for Han® B and HPR hoods and housings. Additional information is included about interlock mechanisms that are also available as spare parts.

Table III-9.1
Screws, locking levers, seals

Product Screws	Features	Product photo
PE screw for Han A®, Han 15, 25 D® 09 20 000 9919	M3.5	
PE screw for Han E® etc. 09 33 000 9925	M4	
PE screw for Han-Com®, Han® HsB 09 33 000 9926	M5	
Fixing screw 09 16 000 9903	For all standard inserts	
Contact screw 09 30 000 9997	For Staf®, Han® 3 A, 4 A	
Han® 3 A fixing screw 09 20 000 9995 09 20 000 9918	 Without sealing ring With seal (IP65)	
Knurled screw 09 00 000 5611	For screw adapter	
Han® HPR locking screw 09 40 000 9932	M6 For HPR hood Sizes 6 B, 10 B, 16 B and 24 B	
Han® HPR locking screw 09 40 000 9929	M3 For HPR hood Size 3 A with screw locking 19 40 x03 041x	
Han® HPR locking screw 09 40 000 9937	M6 For HPR hood housing Size 48 B With screw locking	

III

Product Locking lever	Features	Product photo
Han Easy-Lock® single locking lever 09 00 000 5222 09 00 000 5228 09 00 000 5229 09 00 000 5230 09 00 000 5224 09 00 000 5225	Sizes 6 B 10 B 16 B 24 B 10 A 16 A	
Han Easy-Lock® double locking lever 09 00 000 5221 09 00 000 5223 09 00 000 5231	Sizes 10 B / 16 B / 24 B 32 A 32 B	
Han Easy-Lock® X single locking lever[1)] 09 00 000 5401 09 00 000 5264 09 00 000 5403 09 00 000 5288	Sizes 6 B 10 B 16 B 24 B	
Han Easy-Lock® X double locking lever[1)] 09 00 000 5204	Sizes 10 B / 16 B / 24 B	
Metal locking lever (complete) 09 00 000 5205 Stainless steel	Size 48 B	
Metal locking lever with ratchet 09 00 000 5295 Stainless steel	Size 48 B	Illustration is similar to the 09 00 000 5205 but without the fixing material
Locking roll 09 30 000 9998	Size 48 B (two per housing)	
Locking panel[2)] (for Han Easy-Lock® double locking lever) 09 30 000 9986	For Han® B bulkhead mounted housings, sizes 10 B/16 B/24 B	
Locking panel[2)] (for metal double locking lever) 09 30 000 9987	For Han® B bulkhead mounted housings, sizes 10 B/16 B/24 B	
Locking panel[2)] (for Han-Easy Lock® single locking lever): on request	For Han® B bulkhead mounted housings, sizes 6 B/10 B/16 B/24 B	

[1)] Han-Easy Lock® X: Locking lever is for use in harsh environmental conditions. It can only be delivered as a spare part.

[2)] Locking panel: The panel is simply put over the locked lever and the flexible tongue snaps in. For removal, the tongue is pressed in with a screwdriver.

Seals			
Flange seal Material NBR[1] 09 20 000 9991 09 20 000 9992 09 20 000 9993 09 20 000 9994 09 30 000 9991 09 30 000 9992 09 30 000 9993 09 30 000 9994 09 30 000 9996	FPM[2] 09 37 000 9912 09 37 000 9948 09 37 000 9949 	Size 3 A 10 A 16 A 32 A 6 B 10 B 16 B 24 B 48 B	
Flange seal (self-retaining) Material NBR[1,3] 09 40 000 9980[4] 09 30 000 9801 09 30 000 9802 09 30 000 9803 09 30 000 9804		Size 6 B 10 B 16 B 24 B	
Gasket Material NBR 09 70 000 9991 09 20 000 9996 09 20 000 9997 09 30 000 9941 09 30 000 9942 09 30 000 9943 09 30 000 9944 09 30 000 9995	FPM[2] 09 21 000 9906 	Size 3 A (mounts on male insert) 10 A 16 A 6 B 10 B 16 B 24 B 48 B	
Han® HPR O-ring seal[4] 09 40 000 9910 09 40 000 9911 09 40 000 9912 09 40 000 9913 09 40 000 9914		Size HPR 3 A HPR 6 B HPR 10 B HPR 16 B HPR 24 B	

[1] For Han® A and B housings
[2] For Han® M housings
[3] Only suitable for Han® B bulkhead mounted housings with retaining surface of flange
[4] For Han® HPR housing

Flange seal: Used only with bulkhead mounted housings. It is used to seal between the housing and the mounting surface.

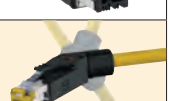
Gasket: Required for all housings (bulkhead mounted, surface mounted and coupling housing types). It ensures the proper seal between the hood and bottom housing section.

O-ring seal: Used for Han® HPR and Han® EMV/B housing series. It is positioned at the housing overlay and at the sealed area between the hood and housing.

III-10 Data interfaces

HARTING offers suitable interfaces for transmitting various types of data. The following table contains a selection of interfaces that are typically used in railway applications.

Table III-10
Overview of data interfaces

Product	Mating profile	Pole count	Termination type	Remarks	Product photo
M12	A	3, 4, 5, 8	Crimp / *HARAX*®	-	
M12	B	2, 5	Crimp / *HARAX*®	-	
M12	D	4	Crimp / *HARAX*® / preLink®	Cat. 5	
har-speed M12	X	8	Crimp / preLink®	Cat. 6	
HARTING RJ Industrial®	RJ 45	8	IDC	Cat. 5	
HARTING RJ Industrial®	RJ 45	4	IDC	Cat. 6	
har-port	RJ 45	8		Cat. 6	
har-port	USB	4		USB 2.0	

Product	Mating profile	Pole count	Termination type	Remarks	Product photo
har-port	USB	9		USB 3.0	
Han® USB module	USB	4	Patch cable / screw termination	USB 2.0	
Han-Quintax® module		4	Crimp	Cat. 5	
Han-High Density Quintax® module		8	Crimp	MVB	
Han® Coax D module		1	Crimp	Video	
Han® Coax E module		1	Crimp	ETCS	
Han® Coax ETCS module		1	Crimp	ETCS for larger wire cross-sections	
Han® Megabit module		4	Crimp	Cat. 5	
Han® Gigabit module		8	Crimp	Cat. 6	
Han® SC module		4	Crimp, adhesive	Fibre optic	
Han-Modular® LC module		6	Adhesive	Fibre optic	

III-10.1 har-port service interfaces

The har-port series includes service interfaces for Ethernet and USB applications (USB 2.0 and USB 3.0). The service interfaces are mounted in a wall cut-out (as required for control and signaling devices by IEC / DIN EN 60947-5-1) using a M22 central fixing nut. Users save time during the installation because the cable is pre-connected and the patch cables are easy to plug in. Snap-on labels, blind grommets and various protective covers in IP65/IP67 are available as accessories.

Typical railway applications include:

- Service interface for Ethernet and USB
- Connectivity interface for viewing schedules, work rosters, reports, guidelines, etc.

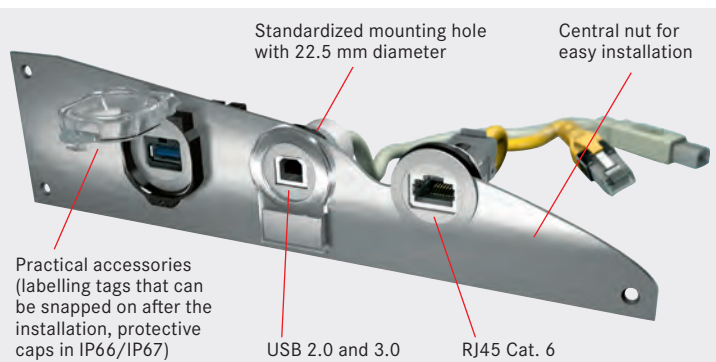


Figure III-10.1
har-port variants

IV – RFID for Railway Applications

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IV-1 RFID – Radio Frequency Identification

RFID is a wireless identification technology that uses radio wave transmissions. RFID features extended functionality and represents more than merely an alternative to barcodes. The UHF (ultra high frequency from 865 to 928 MHz) technology implemented by HARTING enables us to reach a range from 1 cm to 15 m and integrate sensors within applications. The technology also fits well for railway usage because it is robust, maintenance-free, reliable and durable.

Characteristic	Advantage for railway applications
Identification without visual contact	Not sensitive to dirt or contamination
Up to 300 objects per second can be identified	Saves time / Object identification up to speed limits of 200 km / h
Quick read-outs and reliable detection of moving objects (vehicles moving up to 200 km/h)	Excellent safety
Built-in memory (3.3 kbit)	Data is directly accessible at the object
A part of the sensor	Wireless detection of temperature measurements, deformation or component loss
Antenna with range from 1 cm to 15 m (depending on application)	Versatile integration of RFID into your electrical/electronic infrastructure
IP69K protection	The transponders can withstand the extreme requirements of use for railway vehicles (e.g. at the boogie).
Extended temperature range for the transponder: -65°C ... +210°C	Can be used in the proximity of motors and gears
Operational for 20 to 30 years: no batteries required	No maintenance required

Table IV-1
The advantages of RFID

IV-2 RFID System

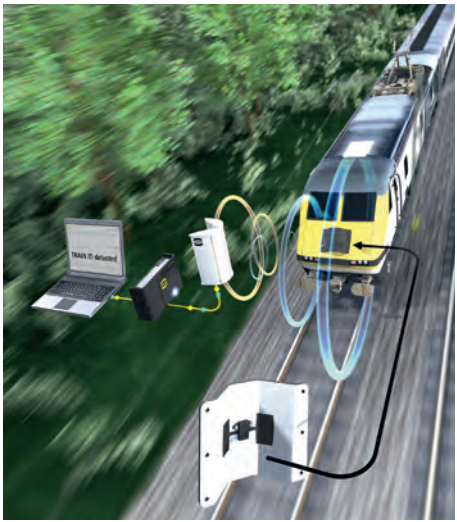

Figure IV-1
RFID System with reader, antenna and transponder from HARTING

Components	Function
RFID transponder (tag)	Identification using a globally unique EPC (electronic product code) Features up to 3.3 kbit memory and built-in sensor
Reader (the reading/writing device)	Supplies energy to the transponder and controls the communications
Middleware / interface to PLC	Filters and transfers data to the user's system (the on-board unit or server/PC)

Table IV-2
Functions of the RFID components

IV-3 Standards, specifications and approvals

Figure IV-2
RFID Box
(electrical cabinet
and RFID reader)

HARTING's RFID delivers many advantages to users:

- It complies with many standard specifications around the world and has already received the necessary approvals.
- It uses established standards such as GS1.
- It has received radio usage approvals throughout the world (EU, USA, Canada, Russia, China, Japan, etc.). Additional approvals for new regions and markets continue to come in.
- The manufacturer is an active participant in numerous standardization organizations.
- HARTING is capable of carrying out railway-relevant tests in its own accredited laboratory: such tests include EMC testing for the RFID Box (stainless steel electrical cabinet with RFID reader, switch, power supply and surge protection) for use on or in the rail bed, in accordance with DIN EN 50 121-4, DIN EN 61 439-1, DIN EN 61 000-6-2 and -4.
- Shock and durability testing for the RFID antennas are conducted to test suitability for mounting to rail vehicle bodies and bogies, in accordance with IEC 61 373:2010, categories 1B and 2.

IV-4 Customer-based solutions

Figure IV-3
The HARTING transponder: customized solutions

HARTING provide customized transponder solutions for their customers. Such solutions offer a wide range of functions, such as detecting shipping containers, managing the configuration of motors and control equipment, and identifying train axles.

IV-5 Application examples

IV-5.1 Readers on and in the train

The RFID reader and their antennas are located on and in the railway vehicles. The transponders are positioned on the crosstie/sleeper, the rail bed or the platform.

Train positioning using UHF-based RFIDs
Technical systems provide support to the railway personnel as they position the railway vehicles. For example, trains must be stopped at specific positions along the platform. The train doors must only be allowed to open when they are safely positioned at the platform. HARTING's RFID system can position trains exactly – with a precision of 5 cm. This system is also more reliable than conventional systems.

Signalling

New possibilities are available when an RFID reader is on-board the train: and the integration of the system into the existing on-board electronic communications requires only minimal effort. Thus it is possible for an RFID transponder located in the rail bed to signal the train engineer that he can accelerate. The RFID signal could also be used to trigger a curve lubrication.

IV-5.2 Readers on the rail bed

Tracking at the train station

Railway personnel no longer need to manage complex lists for controlling and managing their transport logistics. The RFID system provides a paperless solution for tracking goods and materials. This also makes it easier to service the railway vehicles. The system also provides quick answers to such question as “At which platform is the wagon located?”, “Is it time to service the wagon?” or “What can I do when the ratings plate is dirty or damaged?”.

Acquiring data from sensors

An increasing number of critical components are being equipped with sensors so that they can gather status information in real time. RFID sensors enable this information to be gathered using radio transmissions. You no longer need connecting cables between the sensors and the electrical cabinet. These sensors then have a transmission range of several meters and do not require batteries to operate. This provides a data gathering solution that is virtually maintenance-free.

Maintenance and configuration management

Locomotives are made up of many different components and modules that must be regularly serviced and inspected. In this case, a combined solution of stationary and mobile RFID provides customers with an automatic system for acquiring data and managing configuration. Individual components can be observed over their entire lifespan. Thus, in the event of a malfunction or complaint, the component’s entire history is clearly documented.

V – HARTING Hall-effect current sensors

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V-1 Current transformer

Current transformers take potential-free current measurements and can be used in modern inverters. Hall-effect sensors are a special type of current transformer. In addition to the alternating current from current transformers, these sensors can also detect DC currents and mixed currents. A distinction is made here between direct and compensating current sensors. The compensating current sensor is superior to its direct counterpart because it features better accuracy, linearity, response time and frequency range. This is why HARTING uses compensating current sensors (also referred to as zero-flow tranformers or closed-loop sensors) for its railway applications.

V-2 Compensating current sensor

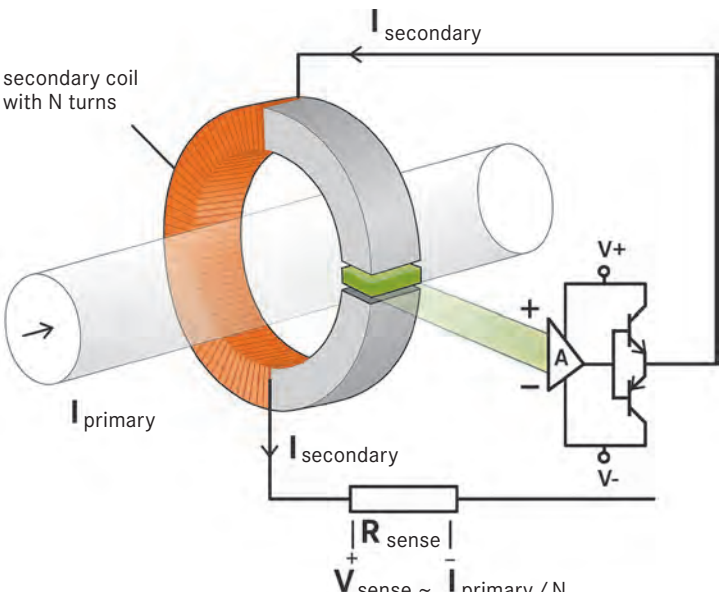


Figure V-1
Functionality of the compensating current sensor

Functional principles

- The primary current creates a magnetic field.
- The magnetic field concentrates in a core air gap and is then measured using a Hall sensor.
- Using a secondary coil, the Hall sensor and special electronics control a so-called compensation field.
- The current used to create the compensation field is an exact replica of the primary current.

Features

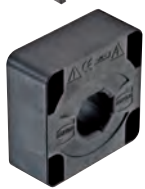
•Accuracy:	~ 0.5 % of IPn at 25 °C
•Accuracy:	~ 1 % at -40 ... 85 °C (max. error)
•Linearity:	< 0.1 %
•Response time:	~ 1 µs
•Frequency range:	0 – 150 kHz
•Supply voltage:	±15 V – 24 V
•Output signal at I_{PN}:	HCSR 500: 125 mA (1:4000) HCSR 1000: 200 mA (1:5000) HCSR 2000: 400 mA (1:5000)

Compensating current transformers operate very precisely throughout the entire temperature range. This precision is very important for control circuits in high-current applications (such as inverters) because it helps to prevent malfunctions, reduced efficiency and shutdowns.

V-3 HARTING Hall-Effect Current Sensors for Railway (HCSR)

- Hall-effect current sensors operate according to the principle of compensation.
- Measuring range: 500 – 2000 A (effective primary nominal current): HCSR 500; HCSR 1000 and HCSR 2000
- Transmission ratio: 5000:1
- Standard connection: four M5 screw connections
- Galvanic isolation between primary and secondary circuits
- Housing and sealing compound are self-extinguishing (UL94-V0, NF F 16-101 I3 F1)
- Complies with EN 50 155 (Electronic equipment used on railway vehicles)
- Shock and vibration resistance have been tested according to IEC 61373 Cat. 1B
- Extended temperature range: -40 ... +85°C
- Optional mounting foot for 500 A and 1000 A
- Protected against abnormal operating conditions:
  - ○ Short circuit protection
  - ○ Surge protection
- Internal EMC shielding ensures excellent operational safety

Table V-1
HCSR product overview

Identification	Part number	I_{PN}		
HCSR 500	20 31 050 9101	500 A	Without foot attachment	
	20 31 050 8101		With foot attachment	
	20 31 050 9201		With 1000 mm shielded connecting cable, without foot attachment	
	20 31 050 8201		With 1000 mm shielded connecting cable and foot attachment	
HCSR 1000	20 31 100 9101	1000 A	Without foot attachment	
	20 31 100 8101		With foot attachment	
	20 31 100 9201		With 1000 mm shielded connecting cable, without foot attachment	
	20 31 100 8201		With 1000 mm shielded connecting cable and foot attachment	
HCSR 2000	20 31 200 9101	2000 A	With foot attachment	
	20 31 200 9201		With 1000 mm shielded connecting cable & foot attachment	

Customer specific solutions

More information and data sheets for our HARTING current sensors can be found at www.HARTING.com. Are you unable to find a current sensor that matches your requirements? Then contact HARTING directly. HARTING develops and delivers customized solutions for special requirements, including specific termination techniques and customized winding numbers.

Figure V-2
Hall-effect current sensors for railway applications: Customer-specific solutions

Notes

VI – Assembly manuals

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VI-1 General Notes

This chapter contains instructions for the most commonly found connectors in the railway industry to make the assembly or the installation of connectors on site easier.

It is the customer's responsibility to evaluate the suitability of the components described here and the applicability of the specified regulations for use in any special applications which have not been anticipated by HARTING.

The company reserves the right to make construction changes in response to manufacturing requirements, improved quality or advances in the design. The information in this user handbook describes component assemblies. No characteristics are guaranteed.

Further information can be found in the "Han® Industrial Connectors", "Equipment connection systems" and "Smart Infrastructure Intelligent network solutions" catalogues.

VI-2 Inserts with axial screw termination systems

The axial screw connection was designed by HARTING for connecting wires with large cross-sections. In compliance with the HARTING philosophy, no special tools are required for the connection. Finely stranded wires can be safely connecting using a conventional hexagon torque wrench. Table VI-2.2 shows an overview of wire cross-sections, stripping lengths and the required tightening torque for selected Han® inserts with axial screw connection technology. The illustration Fig. VI-2.1 shows the designations used for the dimensions in the table which follows. The specified cross-sections of the wires refer to the geometric cross-sections of the cable being used. The specifications refer to the catalogue “Han® Industrial Connectors”.

According to DIN EN 60 228 / VDE 0295 concerning cables and insulated lines, a cable’s cross-section is determined by the conductivity (Ω/km) and the maximum wire diameter. A minimal wire cross-section is not specified (example: nominal cross section 95 mm^2 -> real geometrical cross-section 89 mm^2).

Users can check the cable which they wish to use before starting assembly at our accredited HARTING laboratory in regards to the possibility for connection.

Additional information about the axial screw wire termination method

Strain relief: The cable should be mechanically supported at an appropriate distance from the connector in order to avoid damage to the contact (e.g., damage resulting from twisting or pulling of the cable). The maximum gap for such a strain-relief support mechanism is specified in the following table.

Table VI-2.1
Retention gap for easily accessible cables, DIN VDE 0100-520: 2003-06

Outer diameter of the cable [mm]	**Maximum gap for the fixing support** [mm]	
	Horizontal	**Vertical**
D ≤ 9	250	400
9 < D < 15	300	400
15 < D < 20	350	450
20 < D < 40	400	550

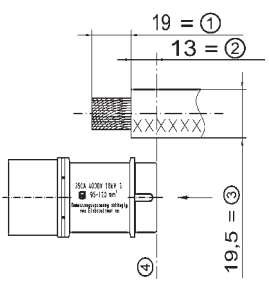
Maintenance for the terminal connections: In order to avoid any splitting of the wire strands, it is only permitted to reapply torque to the connection one time during the entire application lifespan.

Cable: The axial screw connection is suitable for finely stranded wires according to DIN EN 60 228 / VDE 0295 Class 5. Cable constructions that deviate should be checked separately.

Insert dimension (ISK) for the cable marking

Markings for the correct position on cables with contacts using the axial screw termination technique:

The user can attach a marker to the cable sheathing in order to specify the proper point for tightening the axial screw on the connecting cable. If the cable in pushed into the insulating base up to the marker (where the marker is flush with the upper edge of the insulating base), then the cable is in the proper position and may be connected. The figure VI-2.1 illustrates this process when using the Han® HC Modular 350 contact. The marker and the upper edge of the insert are at the same level (as indicated by the dashed line).



1: Stripping length
2: Insulator dimension (ISK dimension)
3: Max. cable insulation diameter
4: Sink line

Figure VI-2.1
Explanation dimensions using the sample of Han® HC Modular 350

Table VI-2.2
Overview of inserts and axial screw termination

Insert	Wire cross section (mm^2)	Stripping length (mm)	Tightening torque (Nm)	Max. cable insulation diameter (mm)	Hexagonal wrench size (SW)	Insert dimension for cable marking (mm)
Han® K 4/4 finger protected	6 ... 16	6 mm^2: 11+1 10 mm^2: 11+1 16 mm^2: 11+1	6 mm^2: 2 10 mm^2: 3 16 mm^2: 4	8.9	2.5	7.4 PE: 8.9
	10 ... 22	10 mm^2: 11+1 16 mm^2: 11+1 22 mm^2: 11+1	10 mm^2: 3 16 mm^2: 4 22 mm^2: 4	8.9 8.9 11	2.5	7.4 7.4 5.4 PE: 8.9
Han® K 4/4	6 ... 16	6 mm^2: 11+1 10 mm^2: 11+1 16 mm^2: 11+1	6 mm^2: 2 10 mm^2: 3 16 mm^2: 4	8.9	2.5	7.4 PE: 8.9
	10 ... 22	10 mm^2: 11+1 16 mm^2: 11+1 22 mm^2: 13+1	10 mm^2: 3 16 mm^2: 4 22 mm^2: 4	8.9 8.9 11	2.5	7.4 7.4 5.4 PE: 8.9
Han® K 6/12	2.5 ... 8	2.5 mm^2: 5+1 4 mm^2: 5+1 6 mm^2: 8+1 8 mm^2: 8+1	2.5 mm^2: 1.5 4 mm^2: 1.5 6 mm^2: 2 8 mm^2: 2	6.2	2	7.4
	6 ... 10	6 mm^2: 8+1 8 mm^2: 8+1 10 mm^2: 8+1	6 mm^2: 2 8 mm^2: 2 10 mm^2: 2	6.2	2	4.7

Insert	Wire cross section (mm^2)	Stripping length (mm)	Tightening torque (Nm)	Max. cable insulation diameter (mm)	Hexagonal wrench size (SW)	Insert dimension for cable marking (mm)
Han® K 6/6	10 ... 25	10 mm^2: 13+/-1 16 mm^2: 13+/-1 25 mm^2: 13+/-1	10 mm^2: 6 16 mm^2: 6 25 mm^2: 7	11.4	4	4.9
	16 ... 35	16 mm^2: 13+/-1 25 mm^2: 13+/-1 35 mm^2: 13+/-1	16 mm^2: 6 25 mm^2: 7 35 mm^2: 8	11.4	4	4.9
Han® K 8/0	10 ... 25	10 mm^2: 13+/-1 16 mm^2: 13+/-1 25 mm^2: 13+/-1	10 mm^2: 6 16 mm^2: 6 25 mm^2: 7	11.4	4	4.75
Han® Q 2/0 Han® Q 2/0 High Voltage	2.5 ... 10	2.5 mm^2: 8+1 4 mm^2: 8+1 6 mm^2: 8+1 10 mm^2: 8+1	2.5 mm^2: 1.8 4 mm^2: 1.8 6 mm^2: 1.8 10 mm^2: 1.8	7.3	2	5.6
Han® Q 4/2 Han® Q 4/2 with Han-Quick Lock®	4 ... 10	4 mm^2: 8+1 6 mm^2: 8+1 10 mm^2: 8+1	4 mm^2: 1.8 6 mm^2: 1.8 10 mm^2: 1.8	7.3	2	5.6
Han® 200 A module Han® 200 A module with PE	25 ... 40	25 mm^2: 16 40 mm^2: 16	25 mm^2: 8 40 mm^2: 8	12 16	5	0
	40 ...70	40 mm^2: 16 70 mm^2: 16	40 mm^2: 9 70 mm^2: 10	12 16	5	0

Insert	Wire cross section (mm^2)	Stripping length (mm)	Tightening torque (Nm)	Max. cable insulation diameter (mm)	Hexagonal wrench size (SW)	Insert dimension for cable marking (mm)
Han® 100 A module	6 ... 10	6 mm^2: 13+/-1 8 mm^2: 13+/-1 10 mm^2: 13+/-1	6 mm^2: 4 8 mm^2: 4 10 mm^2: 4	11.4	2.5	4.9
	10 ... 25	10 mm^2: 13+/-1 16 mm^2: 13+/-1 25 mm^2: 13+/-1	10 mm^2: 6 16 mm^2: 6 25 mm^2: 7	11.4	4	4.9
	16 ... 35	16 mm^2: 13+/-1 25 mm^2: 13+/-1 35 mm^2: 13+/-1	16 mm^2: 6 25 mm^2: 7 35 mm^2: 8	11.4	4	4.9
	38	38 mm^2: 13+/-1	38 mm^2: 8	11.4	4	4.9
Han® 70 A module	6 ... 16	6 mm^2: 11+1 10 mm^2: 11+1 16 mm^2: 11+1	6 mm^2: 2 10 mm^2: 3 16 mm^2: 4	8.9	2.5	7.4
	14 ... 22	14 mm^2: 12.5+1 16 mm^2: 12.5+1 22 mm^2: 12.5+1	14 mm^2: 4 16 mm^2: 4 22 mm^2: 4	10	2.5	5.9
Han® 40 A module	2.5 ... 8	2.5 mm^2: 5+1 4 mm^2: 5+1 6 mm^2: 8+1 8 mm^2: 11+1	2.5 mm^2: 1.5 4 mm^2: 1.5 6 mm^2: 2 10 mm^2: 2	4 4 6 10.5	2	4.7
	6 ... 10	6 mm^2: 8+1 10 mm^2: 11+1	6 mm^2: 2 10 mm^2: 2	6 10.5	2	4.7

Insert	Wire cross section (mm^2)	Stripping length (mm)	Tightening torque (Nm)	Max. cable insulation diameter (mm)	Hexagonal wrench size (SW)	Insert dimension for cable marking (mm)
Han® C module with axial screw terminal	2.5 ... 8	2.5 mm^2: 5+1 4 mm^2: 5+1 6 mm^2: 8+1 8 mm^2: 8+1	2.5 mm^2: 1.5 4 mm^2: 1.5 6 mm^2: 2 8 mm^2: 2	4 4 6 8.2	2	5.2
	6 ... 10	6 mm^2: 8+1 10 mm^2: 11+1	6 mm^2: 2 10 mm^2: 2	6 8.2	2	5.2
Han® K 3/0 straight	25 ... 40	25 mm^2: 22 40 mm^2: 22	25 mm^2: 8 40 mm^2: 8	15	5	8.2
	35 ... 70	35 mm^2: 22 50 mm^2: 22 70 mm^2: 22	35 mm^2: 8 50 mm^2: 9 70 mm^2: 10	15	5	8.2
Han® K 3/0 angled	25 ... 40	25 mm^2: 22 40 mm^2: 22	25 mm^2: 8 40 mm^2: 8	15	5	9
	35 ... 70	35 mm^2: 22 50 mm^2: 22 70 mm^2: 22	35 mm^2: 8 50 mm^2: 9 70 mm^2: 10	15	5	9
Han® K 3/2 straight	35 ... 70 PE: 25 ... 40	35 mm^2: 22 50 mm^2: 22 70 mm^2: 22 PE: 14	35 mm^2: 8 50 mm^2: 9 70 mm^2: 10	Power: 15 PE: 10	5	Power: 8.2 PE: 7.2

Insert	Wire cross section (mm^2)	Stripping length (mm)	Tightening torque (Nm)	Max. cable insulation diameter (mm)	Hexagonal wrench size (SW)	Insert dimension for cable marking (mm)
Han® K 3/2 angled	25 ... 40	25 mm^2: 22 40 mm^2: 22 PE: 14	25 mm^2: 8 40 mm^2: 8	Power: 15 PE: 10	5	Power: 9.0 PE: 7.2
	35 ... 70 PE: 25 ... 40	35 mm^2: 22 50 mm^2: 22 70 mm^2: 22	35 mm^2: 8 50 mm^2: 9 70 mm^2: 10	Power: 15 PE: 10	5	Power: 9.0 PE: 7.2
Han® HC Modular 350	20 ... 35	20 mm^2: 19+1 35 mm^2: 19+1	20 mm^2: 8 35 mm^2: 8	19.5	5	13
	35 ... 70	35 mm^2: 19+1 50 mm^2: 19+1 70 mm^2: 19+1	35 mm^2: 8 50 mm^2: 10 70 mm^2: 12	19.5	5	13
	95 ... 120	95 mm^2: 19+1 120 mm^2: 19+1	95 mm^2: 14 120 mm^2: 16	19.5	5	13
Ground contact for Han® HC Modular	35 ... 70	35 mm^2: 19+1 50 mm^2: 19+1 70 mm^2: 19+1	35 mm^2: 8 50 mm^2: 10 70 mm^2: 12	-	5	-

Insert	Wire cross section (mm^2)	Stripping length (mm)	Tightening torque (Nm)	Max. cable insulation diameter (mm)	Hexagonal wrench size (SW)	Insert dimension for cable marking (mm)
Han® HC Modular 650	60 ... 70	60 mm^2: 23+2 70 mm^2: 23+2	60 mm^2: 12 70 mm^2: 12	27	8	28
	70 ... 120	70 mm^2: 23+2 95 mm^2: 23+2 120 mm^2: 23+2	70 mm^2: 12 95 mm^2: 14 120 mm^2: 16	26.5	8	28
	150 ... 185	150 mm^2: 23+2 185 mm^2: 23+2	150 mm^2: 17 185 mm^2: 18	26.5	8	28

VI-3 General installation information for contacts with axial screw termination

Observe the following when connecting cables to contacts with the axial screw termination technique:

1. Strip the wire strands according to the preceding table. (The stripping length depends on the type of contact and insert that are being used.)

2. Insert the wires strands in the contact chamber until the insulation is flush with the contact.

3. Hold the wire strands in position. Use the corresponding hexagonal driver at the plug-in side and tighten with the proper torque.

The size of the hexagonal wrench and the torque value depend on the type of contact and contact insert being used. These values can be found in the preceding table.

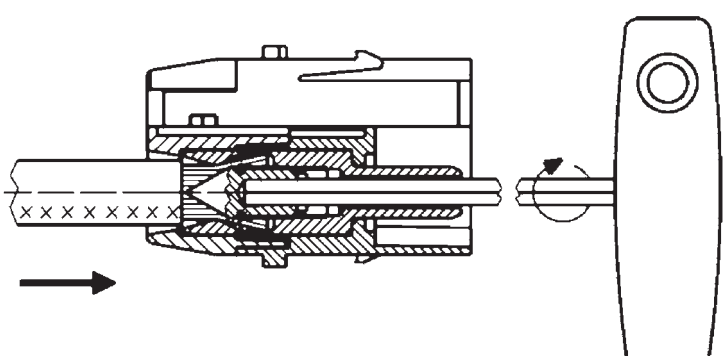


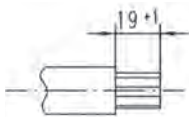
Figure VI-3.1
A schematic of the axial screw termination

VI-3.1 Han® HC Modular 350

The following assembly manual applies for both the one-pole and multi-pole connectors.

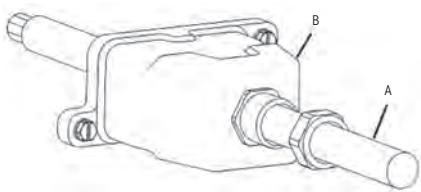
Step 1

The diameter of the cable's outer insulation may not be greater than 19.5 mm. Strip the cable to a length of 19 mm.



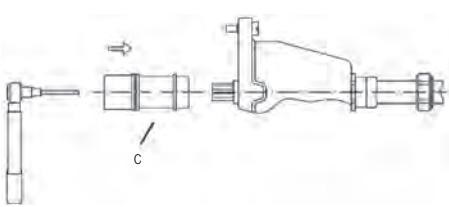
Step 2

Guide the cable (A) through the hood (B).



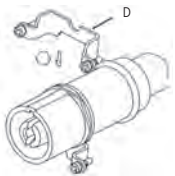
Step 3

Press the Han® HC Contact (C) onto the end of the cable. Hold the contact and cable end firmly in order to prevent twisting movement and torsion. Use a torque wrench to apply the specified torque according to Table VI-2.2. All cable strands must be completely inserted into the contact chamber.



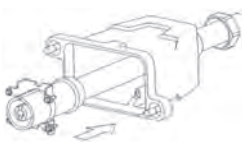
Step 4

Put the support frame (D) into the hexagon-shaped HC contact. The required coding for the HC contact can be made in 60° steps. The figure below shows an example of a one-pole variant. These steps are also valid for the multi-pole variants of the connector.



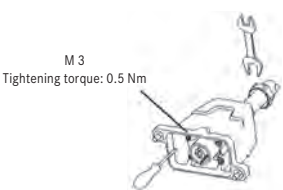
Step 5

Push the contact with the support frame into the hood.



Step 6

Tighten the four M3 fixing screws and attach the pressure screw on the cable gland according to the manufacturer's specifications.



Tools

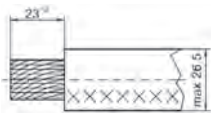
0.5 x 3.5 SW 5 (09 99 000 0371)

VI-3.2 Han® HC Modular 650

Note: The following instructions are valid for both the one-pole and multi-pole connectors.

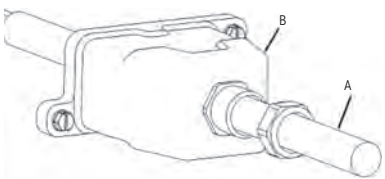
Step 1

The diameter of the cable's outer insulation may not be greater than 26.5 mm. Strip the cable to a length of 23 mm.



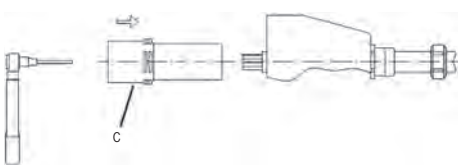
Step 2

Guide the cable (A) through the hood (B).



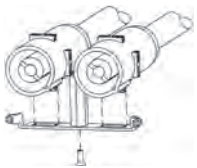
Step 3

Press the Han® HC contact (C) onto the end of the cable. Hold the contact and cable end firmly in order to prevent twisting movement and torsion. Use a torque wrench to apply the specified torque according to Table VI-2.2. All cable strands must be completely inserted into the contact chamber.



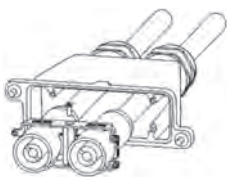
Step 4

Put the support frame into the H structure of the HC contact. The desired coding system of the HC contact can be adjusted in 90° steps.



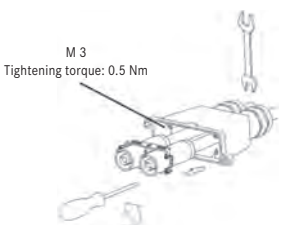
Step 5

Screw on the support frame on both sides with the hex bolts and using hexagonal screws (SW 2.5).

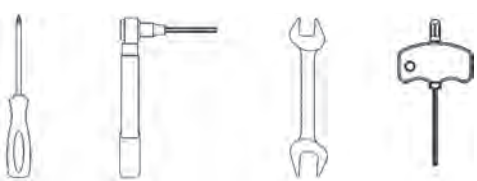


Step 6

Insert the contact packet into the hood. Tighten the four M3 fixing screws and attach the pressure screw on the cable gland according to the manufacturer's specifications.



Tools



0.5 x 3.5 SW 5 (09 99 000 0371) SW 2.5

VI-4 Assembly manual: Han® 24 HPR enlarged

The following instructions describe the installation steps for putting the Han® HC contacts 350 and 650 into the support frame for housings in the Han® 24 HPR enlarged series (also refer to chapter III-2.6.1)

Step 1

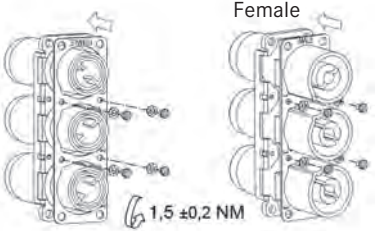
Male

Female

Step 2

Male

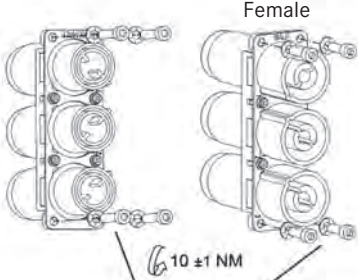
Female



Step 3

Male

Female



M6 screw x 30 – for bulkhead mounting housing
M6 screw x 20 – for hood

VI-5 Assembly of the high-current contacts in the Han® 48 HPR housing series

Figure VI-5.1
Han® 48 HPR

Figure VI-5.1 shows the assembly principle of the high-current contacts in housings of the Han® 48 HPR housing series.

The following instructions assume that:

- The cable glands have been installed already.
- The support frames with the contacts have already been fastened to the cover with the bolts.

Pre-assembled, customized connector sets are available on request.

When installing, you should connect the middle or inside contact first.

Guide the cable ends through the unscrewed fitting nut and seal.

The installation notes concerning the cable connection to the high-current contact can be found in Chapter VI of the assembly manual.

The housing can be assembled after the connection has been put together and inspected.

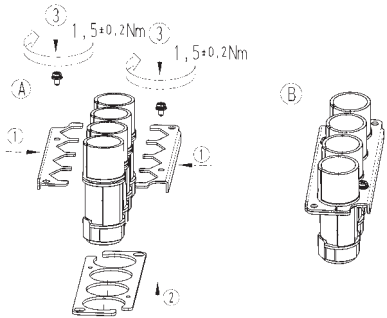
Here, the cover with the contacts on the support frame must be inserted into the housing (hood or surface mounting housing) from the connection side. The four screws for retaining the cover should be tightened with the specified torque.

VI-6 Assembly manuals: Han® 24 HPR EasyCon

Step 1

(A) Assemble the insert in the frame. Observe the specified tightening torque!

(B) The inserts are correctly fitted in the frame.

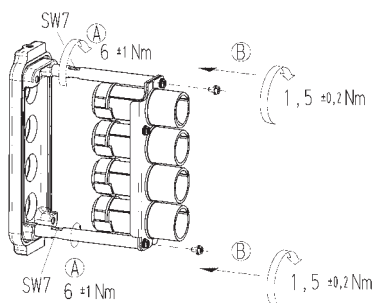


VI

Step 2

(A) Screw the spacer bolts to the assembly cover. Observe the specified tightening torque!

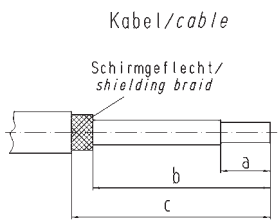
(B) Screw the spacer bolts to the frame. Observe the specified tightening torque!



Step 3

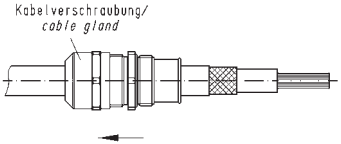
Strip the insulation from the cable as specified in the following table.

Wire cross section [mm²]	Stripping length [mm]		
	a	b	c
35	26	72	126
50	28	72	126
70	28	72	126
95	30	71	126
120	24	64	121



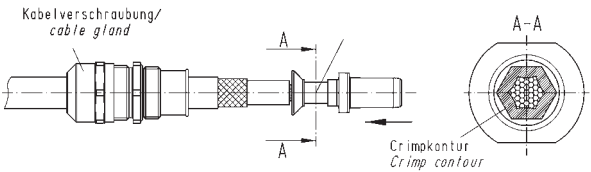
Step 4

Slide the cable clamp onto the cable.



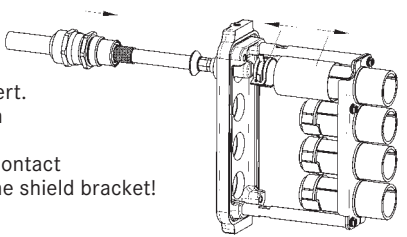
Step 5

Crimp the contacts to the wires.



Step 6

Slide the shrink hose over the insert.
Slide the crimped contact through the assembly cover.
Slide the shield bracket over the contact and the cable. Do not assemble the shield bracket!

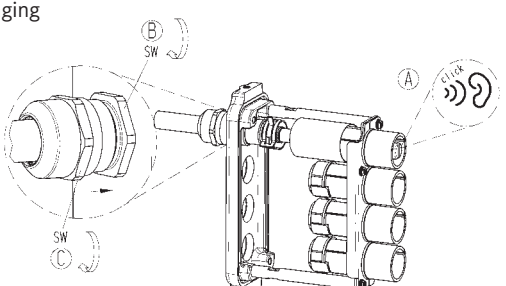


Step 7

(A) Slide the contact into the insert. The contact is correctly assembled when it clicks audibly into the insert!

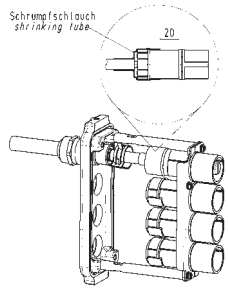
(B) Screw the threaded connection pieces to the assembly cover. Observe the specified tightening torque on the packaging for the screw connections!

(C) Screw the cap nut onto the cable connection. Observe the specified tightening torque on the packaging for the screw connections!



Step 8

Push the shrink hose into position according to the drawing.
Heat the shrink hose over the contact.



Step 9

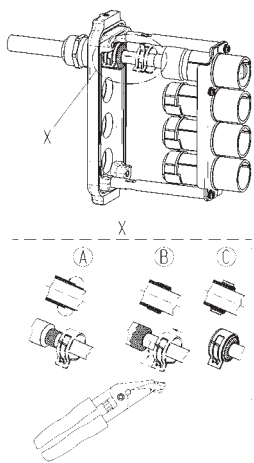
VI

Assemble the shield bracket:

(A) Tap the shield over the threaded connection pieces.

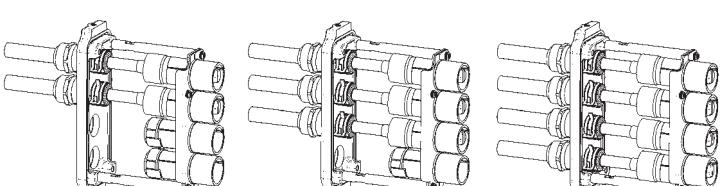
(B) Using pliers, press both fastening tabs on the shield bracket together so that the shield bracket opens.
Push the shield bracket over the shielding.

(C) Release the shield bracket from the pliers.



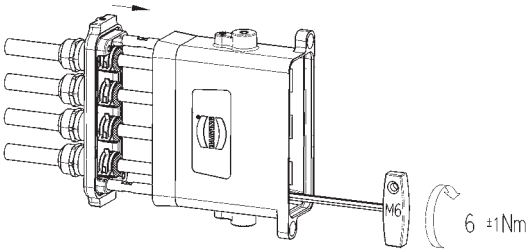
Step 10

Repeat steps 3 to 9 for the other cables.



Step 11

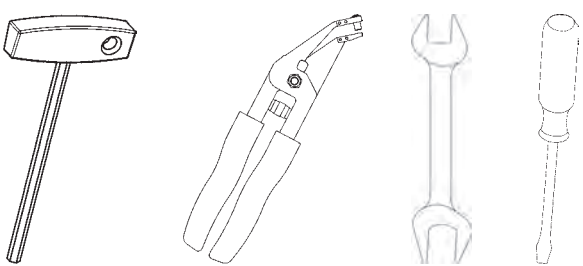
Slide the housing over the inserts. Screw the assembly cover onto the housing. Observe the specified tightening torque!



Note

The assembly steps shown apply for both the surface mounted housing and for the hood.

Tools



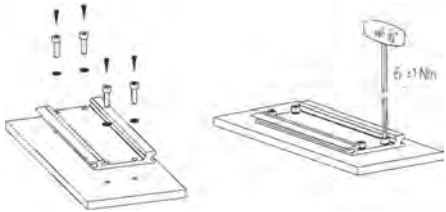
SW 6

Assembly of the Han® HPR EasyCon 3-pole is done in the same way as the Han® EasyCon 4-pole, however you do not need to use a shrink hose due to the larger distance between the contacts, see step 6.

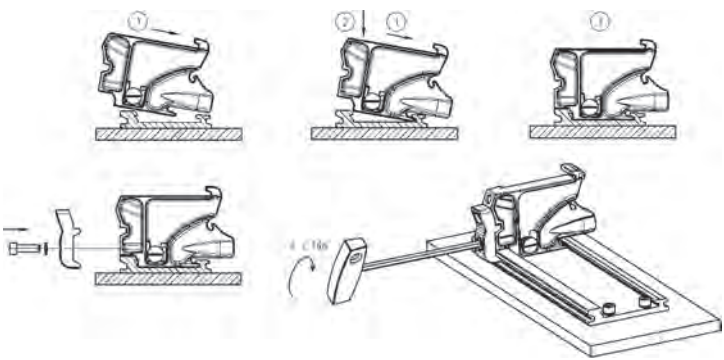
All information presented here is non-binding because it reflects the current state of development at the time of printing. HARTING reserves the right to modify designs without prior notice without giving reasons.

VI-7 Assembly manual: Han® HC Individual

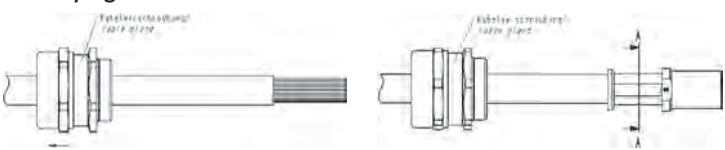
1. Carrier plate assembly



2. Locking module assembly



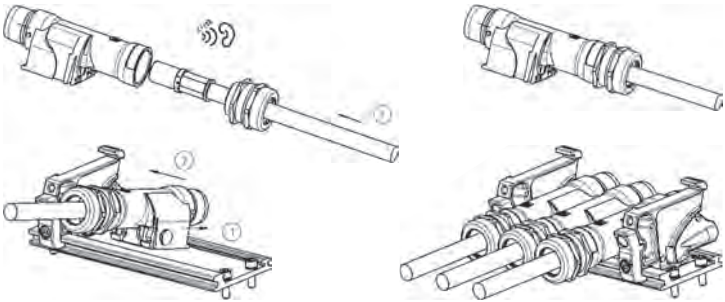
3. Crimping



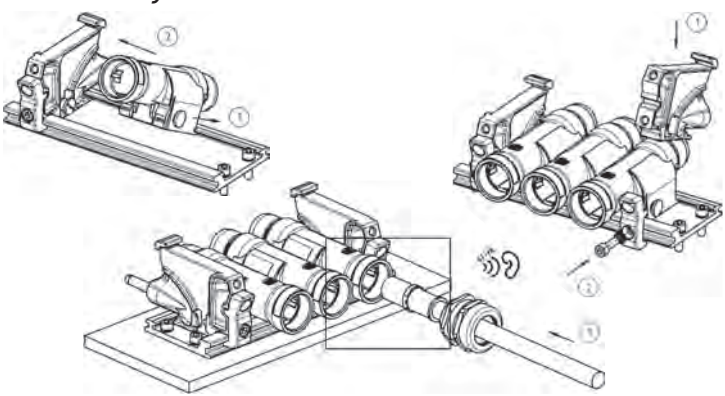
Wire cross section / Wire gauge	Tool ID no.	Stripping length
25 mm²	10	26 mm
35 mm²	12	26 mm
50 mm²	14	28 mm
70 mm²	16	28 mm
95 mm²	18	30 mm
120 mm²	20	24 mm

* for stranded wires in accordance with IEC 60 228 Class 5

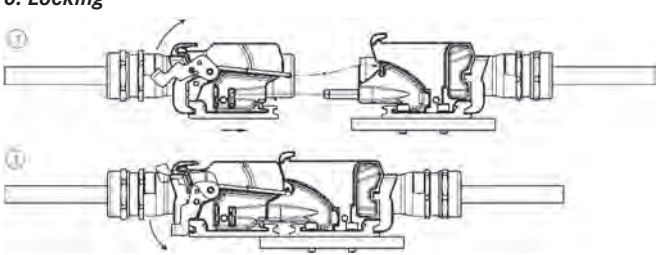
4. Connector layout variant 1



5. Connector layout variant 2



6. Locking



VI-8 Assembly manuals: Han® HC Modular

VI-8.1 Han® HC Modular 250

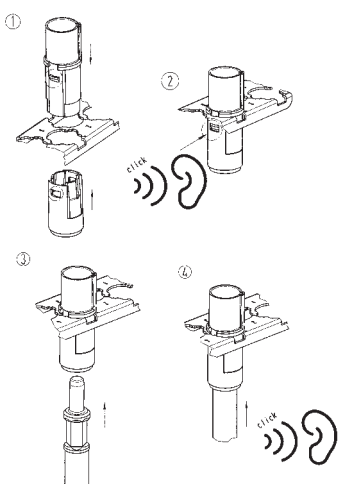
Technical specifications

Crimping jaws in accordance with DIN 46 235

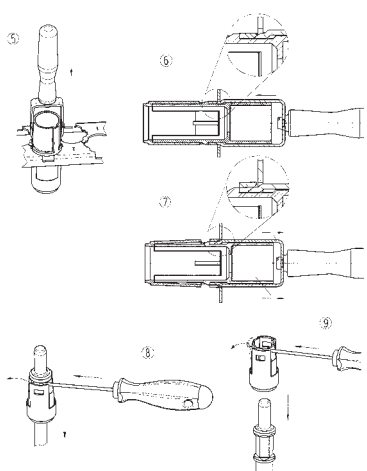
Cross-section	Crimping jaw in accordance with DIN 46 235	Ø	Stripping length
25 mm²	10	7.0 mm	22 mm
35 mm²	12	8.45 mm	22 mm
50 mm²	14	10.25 mm	22 mm
70 mm²	16	11.75 mm	22 mm

Max. insulation diameter 18 mm

Assembly*



Removal*

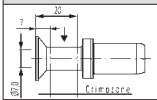
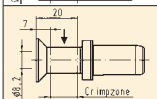
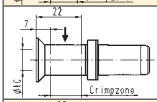
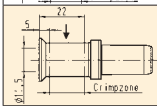
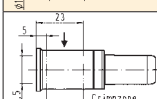
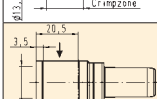


* Applies for male and female contacts

VI-8.2 Han® HC Modular 350

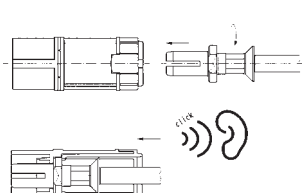
Technical specifications

Max. insulation diameter 22 mm

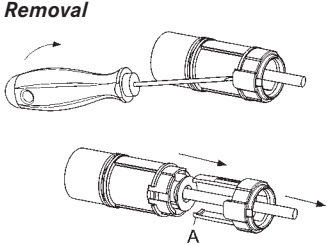
	Wire gauge*	Crimping jaws in accordance with DIN 46 235	Ø	Stripping length
	25 mm²	10	7.0 mm	26 mm
	35 mm²	12	8.2 mm	26 mm
	50 mm²	14	10.0 mm	28 mm
	70 mm²	16	11.5 mm	28 mm
	95 mm²	18	13.5 mm	30 mm
	120 mm²	20	15.5 mm	24 mm

* for stranded wires in accordance with IEC 60 228, Class 5

Assembly



Removal



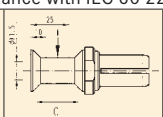
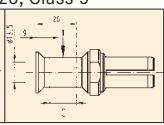
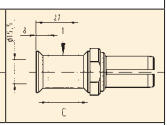
To renew termination “A” use part number 09 11 001 3095.

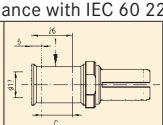
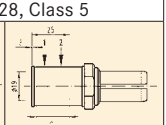
VI-8.3 Han® HC Modular 650

VI-8.3.1 For wire gauges/cross-sections from 70 mm² to 185 mm²

Note! The inserts 09 11 001 3012 and 09 11 001 3112 may not be used with the contacts 09 11 000 6166, 09 11 000 6196, 09 11 000 6266 and 09 11 000 6296.

Technical specifications

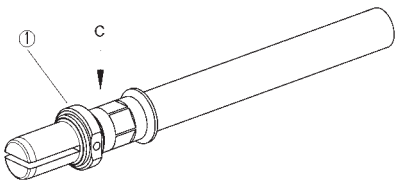
Wire cross section [mm²]	70.0	95.0	120.0
Stripping length [mm]	42.0	42.0	42.0
Max. insulation diameter [mm]	27.0	27.0	27.0
Internal ø crimp contact [mm]	11.5	13.5	15.5
Pressure force crimping tool [t]	13.0	13.0	13.0
for stranded wires in accordance with IEC 60 228, Class 5			
Drawing (C: crimp area)			
	 Crimping sequence		

Wire cross section [mm²]	150	185
Stripping length [mm]	42	42
Max. insulation diameter [mm]	27	27
Internal ø crimp contact [mm]	17	19
Pressure force crimping tool [t]	13	13
for stranded wires in accordance with IEC 60 228, Class 5		
Drawing (C: crimp area)		
	 Crimping sequence	

Installation

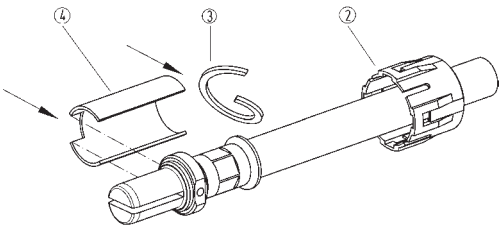
Step 1

①: Contact
C: Crimp area



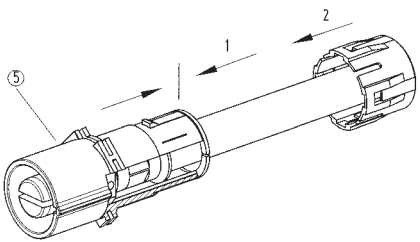
Step 2
Assembly sequence

②: Retaining plate
③: Retaining washer
④: Spacer

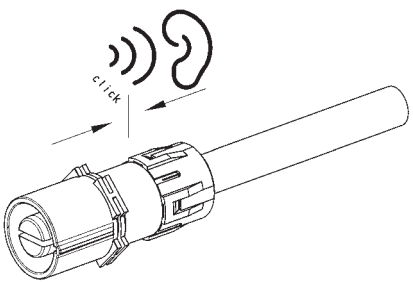


Step 3

⑤: Insert



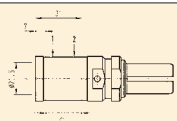
Step 4



VI-8.3.2 For wire cross-section 240 mm²

Note! The inserts 09 11 001 3012 and 09 11 001 3112 may not be used with the contacts 09 11 000 6167 and 09 11 000 6267.

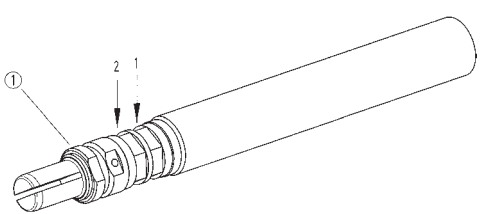
Technical specifications

Wire cross section [mm²]	240.0
Stripping length [mm]	46.0
Max. insulation diameter [mm]	32.0
Internal ø crimp contact [mm]	21.5
Pressure force crimping tool [t]	13.0
for stranded wires in accordance with IEC 60 228, Class 5	
Drawing (C: crimp area)	
	 Crimping sequence

Assembly

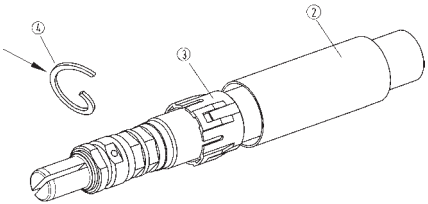
Step 1

①: Contact
1, 2: Crimping sequence
Crimp area
(see above)



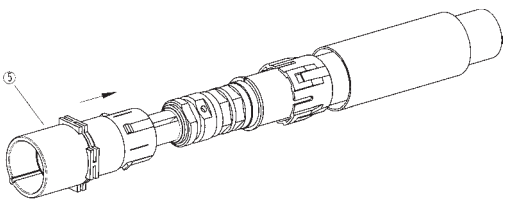
Step 2
Assembly sequence

②: Shrink hose
③: Retaining plate
④: Retaining washer

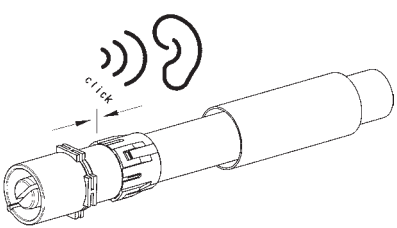


Step 3

⑤: Insert

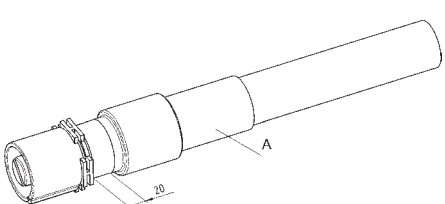


Step 4



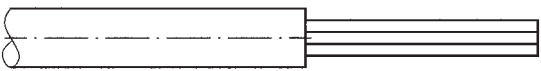
Step 5

Shrink the shrink hose
at 90 °C (A)

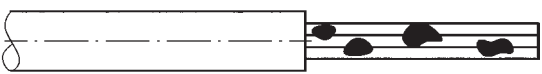


VI-8.4 Cable ends Han® HC Modular 250, 350, 650

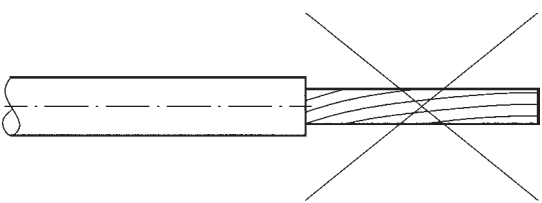
The following instructions should be observed with the cable ends for the Han® HC Modular 250, 350 and 650 contacts.



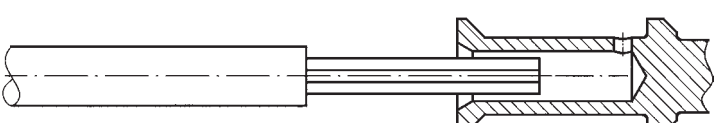
Step 1
Cut off the cable ends perpendicularly and strip the insulation.



Step 2
Remove the contamination or oxide layers from the cable ends.



Step 3
Do not twist the ends of the wires.



Step 4
Insert the cable ends completely into the crimp contact.
Check by inspection hole!

VI-9 Coding options for the Han® HC Modular contacts

The high-current contacts in the Han® HC Modular 250, 350 and 650 series can be coded. This permits multiple connectors of the same type to be installed next to each other without any risk that connectors could be plugged into the wrong sockets. The number of the coding positions differs however. Han® HC Modular 250 offers two, Han® HC Modular 350 six, and Han® HC Modular 650 four coding positions. The actual coding options depends from the number of contacts used in one connector.
The contacts are fitted with corresponding coding pegs and grooves for this purpose (refer to Figure VI-9.1).

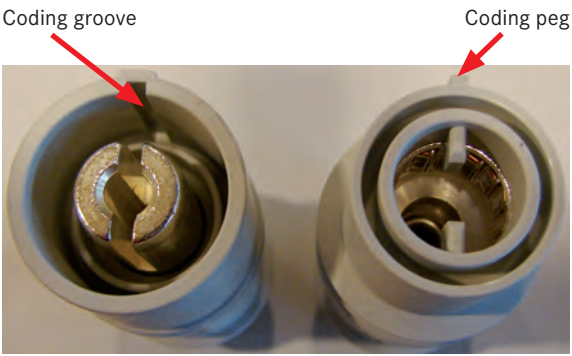


Figure VI-9.1
Coding pegs and grooves on the Han® HC Modular contact

VI-9.1 Coding positions for the Han® HC Modular 250

Figure VI-9.2 shows both possible coding positions.

Figure VI-9.2
Coding positions for the Han® HC Modular 250

VI-9.2 Coding positions for the Han® HC Modular 350 and 650

The contacts have a hexagon-shaped profile (the Han® HC Modular 350) or H-shaped profile (the Han® HC Modular 650) so that they can be installed in different positions in the frame. The details of this can be seen in figures VI-9.3 and VI-9.4.

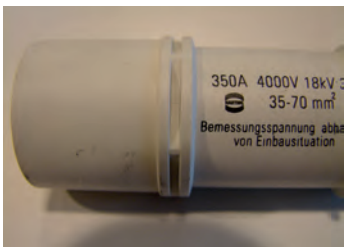


Figure VI-9.3
Hexagon-shaped profile on the Han® HC Modular 350 contact

Figure VI-9.4
H-shaped profile on the Han® HC Modular 650 contact

The frames are put onto the hexagon or H-shaped profile of the contacts. This allows a variety of different coding positions to be configured.

Figure VI-9.5 illustrates the available coding positions for the Han® HC Modular 350 contact. There are six different positions that can be coded.

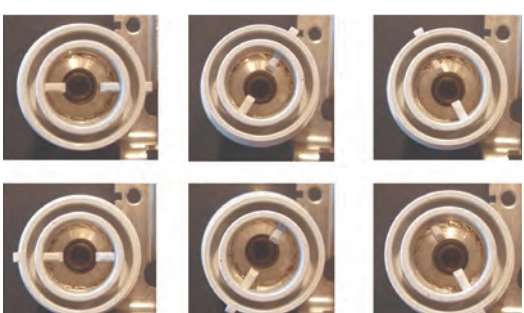


Figure VI-9.5
Coding positions for the Han® HC 350 Modular contacts

The Han® HC Modular 650 contacts offer a maximum of four coding positions (see figure VI-9.6).

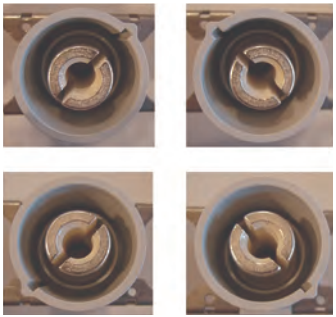


Figure VI-9.6
Coding positions for the Han® HC 650 Modular contacts

Before beginning the assembly, be sure that both mating sides of the coded positions fit to each other and can be plugged in together.

VI-10 Doubled contacting with axial screw contacts

In general, it is possible to connect two cables per axial-screw contact.

In order to eliminate any remaining risks, we recommend consulting with us before this installation. Our laboratory can then check your contact-cable configuration for the appropriate stripping lengths, torques, pull-out forces and temperature characteristics. We can authorize the configuration when it is proper. After our authorization, installation instructions customized to your requirements and application can then be created.

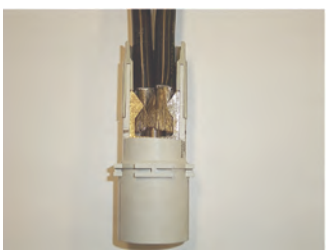


Figure VI-10.1
Doubled contacting on contact
Han® HC Modular 650
of 2 cables, each 35 mm²
wire cross-section

Figure VI-10.2
Doubled contacting on contact
Han® HC Modular 350
of 2 cables each 25 mm²
wire cross-section

VI-11 Han® HC Modular 350 and 650 high-current contacts with screw terminal

In addition to the high-current contacts which use the axial screw termination technique, it is also possible to connect cable lugs to high-current contacts. The cable shoes can be fitted to cables with 120 mm^2 wire cross-sections (for the HC 350) or to cables with 70 to 240 mm^2 wire cross sections (for the HC 650). On the connection side, they consist of a flat washer, a retention clip and a hex screw (M10 for the HC 350 and M12 for the HC 650).

During the installation of the cable shoe, be sure that the components that are placed over the hex screw are placed on in the proper order.

1. Cable shoe
2. Flat washer
3. Retention clip

You must also apply counter pressure to the counter support (as shown in Figure VI-11.1) of the contact using a spanner wrench (Han® HC Modular 350: SW17, Han® HC Modular 650: SW24). This will stop the spread of the torque. If you do not take this step, the insert can be damaged and the interface may malfunction.

The recommended torque is 14 Nm for the Han® HC Modular 350 and 16 – 18 Nm for the Han® HC Modular 650.

These contacts are intended only for installation in **HPR bulkhead mounting housings**!

Figure VI-11.1
Screw terminal

VI-12 Crimp contacts

The following overview shows you which crimping tools are to be used for which crimp contacts. The required stripping lengths are shown in table VI-12.2.

Tab. VI-12.1
Crimp contacts overview - tools

Crimp contacts series	mm²	AWG	Crimp tools: 09 99 000 0001	09 99 000 0888	09 99 000 0110	09 99 000 0021	09 99 000 0303	09 99 000 0377	20 99 000 1035	Automatic crimping machines: 09 99 000 0813 3)	09 99 000 0814 3)	09 99 000 6901 1)	09 99 000 6902 1)	09 98 000 8101	09 98 000 8102	09 98 000 8103	09 98 000 8107 5)	09 98 000 9001	09 98 000 9002	09 98 000 9003	Tools: Plug gauge 09 99 000 0379 2)	Removal tools
Han D® signal contacts 09 15 000	0.14-0.25	26-24	x	x								x 6)		x 6)				x			1.00	
	0.37	22			x	x				x												09 99 000 0012
	0.5	20	x	x								x		x				x			1.00	
	0.75	18	x	x	x	x				x		x		x				x			1.30	
	1.0	18	x	x	x	x				x		x		x				x			1.55	
	1.5	16	x	x	x	x				x		x		x				x			1.55	
	2.5	14	x	x	x	x				x		x		x				x			1.55	
Han D® F.O. contacts 20 10 001	1 mm POF								x													09 99 000 0052
Han E® power contacts 09 33 000	0.14-0.37	26-22	x	x									x 6)		x 6)				x		1.00	09 99 000 0319
	0.5	20	x	x	x	x				x			x		x				x		1.55	
	0.75	18	x	x	x	x				x			x		x				x		1.55	
	1.0	18	x	x	x	x				x			x		x				x		1.55	
	1.5	16	x	x	x	x				x			x		x				x		1.80	
	2.5	14	x	x	x	x				x			x		x				x		1.80	
	3.0	12	x	x	x					x			x		x				x		2.00	
	4.0	12	x	x	x					x			x		x				x		2.00	
Han E® F.O. contacts 20 10 001	1 mm POF								x													
Han-*Yellock*® power contacts 11 05 000	0.14-0.37	26-22	x	x													x				1.00	09 99 000 0319
	0.5	20	x	x	x	x				x							x				1.55	
	0.75	18	x	x	x	x				x							x				1.55	
	1.0	18	x	x	x	x				x							x				1.55	
	1.5	16	x	x	x	x				x							x				1.80	
	2.5	14	x	x	x	x				x							x				1.80	
	3.0	12	x	x	x					x											2.00	
	4.0	12	x	x	x					x											2.00	
Han® C power contacts 09 32 000	1.5	16	x	x	x					x						x				x	1.80	09 99 000 0305
	2.5	14	x	x	x					x						x				x	1.80	09 99 000 0381 4)
	4.0	12	x	x	x		x			x						x				x	2.00	
	6.0	10					x	x			x					x				x		
	10.0	8						x			x					x				x		

Tab. VI-12.1 (continued)
Crimp contacts overview - tools

Crimp contacts series	Part number	Crimp tools							Automatic crimping machines									
		09 99 000 0001	09 99 000 0888	09 99 000 0110	09 99 000 0021	09 99 000 0303	09 99 000 0377	20 99 000 1035	09 99 000 0813 [3]	09 99 000 0814 [3]	09 98 000 6901 [1]	09 98 000 6902 [1]	09 98 000 8101	09 98 000 8102	09 98 000 8103	09 98 000 8107 [5]	09 98 000 9001	09 98 000 9002	09 98 000 9003
Locator																			
Han D®	09 99 000 0311	x																	
	09 99 000 0022				x														
Han E®	09 99 000 0310	x																	
	09 99 000 0022				x														
Han-*Yellock*®	09 99 000 0342	x																	
	09 99 000 0341																		
	09 99 000 0343				x														
	09 99 000 0344								x										
Han® C	09 99 000 0308	x																	
	09 99 000 0304					x													
Han D®, Han E® and Han® C	09 99 000 0376																		
Han D®, Han E®, Han® C, Han-*Yellock*®	09 99 000 0887		x																

Footnotes

1) To operate the changeover units 09 98 000 6901 / 6902, the TK-M base device 09 98 000 6900 is required.

2) Plug gauge with ø 1.00 mm; 1.30 mm; 1.55 mm; 1.80 mm; 2.00 mm

3) To operate the tool head, the base device CP 600 (09 99 000 0810) is required.

4) For Han® power contacts, 10 mm^2

5) To operate the changeover units 09 98 000 8101 to 09 98 000 8107, the TC-SC base device 09 98 000 8000 is required.

6) Depending on the stranded wires

Table VI-12.2
Overview - stripping lengths cross-sections 0.14 to 10 mm²

Wire gauge		Stripping length [mm]					
mm²	AWG	Han D® Han DD® Han-Modular® (10 A)	Han E® Han A® Han Hv E® Han-Modular® (16 A)	Han-*Yellock*®	Han® C	DIN 41 612	D-Sub
0.14 to 0.37	26 to 22	8	7.5	6.5		3.5	4
0.50	20	8	7.5	6.5		3.5	4
0.75	18	8	7.5	6.5		3.5	4
1.00	18	8	7.5	6.5		3.5	
1.50	16	8	7.5	6.5	9.5	3.5	
2.50	14	8	7.5	6.5	9.5		
3.00	12		7.5	6.5	9.5		
4.00	12		7.5	6.5	9.5		
6.00	10				9.5		
10.00	8				15.0		

For wire gauges 0.15 and 0.25 mm² only use the male contact (09 15 000 6107 / 6127 / 6307 => Silver/Gold/Han-GoldTec®) or female contact (09 15 000 6207 / 6227 / 6407 => Silver/Gold/Han-GoldTec®). The crimp tool 09 99 000 0110 is delivered in its current design complete with locator. The locator can also be ordered separately under order number 09 99 000 0376.

The following pages contain the operating instructions and notes for the HARTING crimping tools.

VI-13 Crimp contacts for wire cross-sections from 10 to 240 mm²

Figure VI-13.1
Crimp contacts and contact sleeves for Han® HC Modular 350

Crimp contacts are available for wire cross-sections from 10 to 240 mm². They can be processed using the crimping jaws according to DIN EN 46 235. For details, see the following table.

Table VI-13.1.
Crimping jaws

Cross-section [mm²]	Tool		
	Pressure force 60 kN	Pressure force 130 kN	
	Crimping jaw width	Crimping jaw width	Double crimping
10	9 mm*	10 mm**	–
16	9 mm*	10 mm**	–
25	9 mm*	10 mm**	–
35	9 mm*	10 mm**	–
50	9 mm*	13 mm**	–
70	9 mm*	13 mm**	–
95	–	14 mm**	–
120	–	14 mm**	–
150	–	10 mm**	✔
185	–	10 mm**	✔
240	–	10 mm**	✔

* The crimping jaws with 5 mm pressure width cannot be used.
** The crimping jaw widths are based on details from Klauke.

The following table gives an overview of the available crimp contacts. The contacts can be used with stranded wires in accordance with IEC 60 228 Class 5.

Table VI-13.2
Crimp contacts for wire cross-sections > 10 mm²

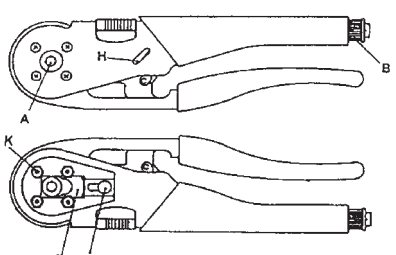
Contact	Product number	Rated current [A]	Cross-section [mm²]	Stripping length [mm]	Max. cable insulation diameter [mm]	Remarks
TC70	09 11 000 6131 / 6231	70	10	15.5	11	Han® 70 A Crimp Module
	09 11 000 6132 / 6232	70	16	15.5	11	
	09 11 000 6133 / 6233	70	25	15.5	11	
TC100	09 11 000 6116 / 6216	100	16	19.0	14	Han® 100 A Crimp Module
	09 11 000 6125 / 6225	100	25	19.0	14	
	09 11 000 6135 / 6235	100	35	16.0	14	
TC200	09 11 000 6120 / 6220	200	25	22.5	18	Han® 200 A Crimp Module
	09 11 000 6121 / 6221	200	35	22.5	18	
	09 11 000 6122 / 6222	200	50	22.5	18	
	09 11 000 6123 / 6223	200	70	22.5	18	
TC250	09 11 000 6127 / 6227	250	35	22.0	18	Han® HC Modular 250
	09 11 000 6128 / 6228	250	50	22.0	18	
	09 11 000 6129 / 6229	250	70	22.0	18	
TC350	09 11 000 6139 / 6239	350	25	26.0	22	Han® HC Modular 350
	09 11 000 6140 / 6240	350	35	26.0	22	
	09 11 000 6141 / 6241	350	50	28.0	22	
	09 11 000 6142 / 6242	350	70	28.0	22	
	09 11 000 6143 / 6243	350	95	30.0	22	
	09 11 000 6144 / 6244	350	120	24.0	22	
TC650	09 11 000 6161 / 6261	650	70	42.0	32	Han® HC Modular 650
	09 11 000 6162 / 6262	650	95	42.0	32	
	09 11 000 6163 / 6263	650	120	42.0	32	
	09 11 000 6164 / 6264	650	150	42.0	32	
	09 11 000 6166 / 6265	650	185	42.0	32	
	09 11 000 6168 / 6268	650	240	46.0	32	

VI-14 Buchanan four-point crimp tool 09 99 000 0001

GENERAL

1. To provide a long life time and optimum performance, this tool should be kept clean and handled with the same care as any other precision device.
2. The tool provides continuously variable crimp depth adjustment to optimum settings over a range of contact and wire combinations. The tool can be adjusted for Han D®, Han E® and Han® C contacts with wire cross-sections from 0.14 to 4.00 mm^2. When processing the wire cross-section 0.14 mm^2, the contact (male: 09 15 000 6107 / 6127 / 6307 – female: 09 15 000 6207 / 6227 / 6407) is to be used.
3. Open and close tool several times and observe precision cycle. Press tool together before opening it. Note that tool cannot be opened or closed without completing its cycle.
4. Do not try to dismantle the tool. Never lose or tighten the ELASTIC STOP nuts on the back of the tool.
5. Identify the following parts:

A	Indenter	**F**	Swappable locator
B	Selector Knob	**G**	Locking Screw
C	Pointer	**H**	Ratchet Release Pin
D	Selector Plate	**K**	Elastic Stop Screws
E	Latch	**L**	Adjustment Window



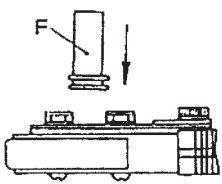
LOCATORS

The tool can be fitted with three different locators.
– Han® C contacts = 09 99 000 0308
– Han D® contacts = 09 99 000 0311
– Han E® contacts = 09 99 000 0310

Locators have to be corresponding to the type of crimp contact.
CAUTION: Do not open tool forcibly.

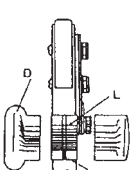
MOUNTING OF LOCATOR

1. Check that right locator (F) for desired contact is chosen.
2. To change or mount locator, loosen locking screw (G). Pull latch (E) into open
3. Install desired locator (F). Push latch (E) into closed position and tighten locking screws.



SELECT CRIMPING DEPTH

1. Open and close tool several times.
2. To adjust crimp depth, bring tool in open position.
3. Set the pointer (C) using the ribbed setting knob (B) to the corresponding adjustment mandrel gauge diameter (D) for the selected wire cross-section, e.g. 1.55 mm^2 for 0.75 mm wires with a Han D® contact.
4. It is necessary to check the setting by using the correct gauge pin. Therefore close the tool and set gauge pin into the indenter opening (A). If this is not possible, open tool again. Turn selector knob (B) to open or close the indenter a little more.
5. Close tool again and insert gauge pin into indenter opening (A).
6. If necessary repeat point 4 + 5, till the gauge pin slides easily into indenter opening without play or sloppiness.
7. Tool is now ready.



DO NOT CRIMP GAUGE PIN
DAMAGE TO TOOL MAY FOLLOW
The following chart shows the settings of gauge pin corresponding to the wire gauge (mm^2).

Wire gauge		Gauge pin		
mm^2	AWG	Han D®	Han E®	Han® C
0.14*	–	1.00	–	–
0.37	22	1.30	–	–
0.50	20	1.55	1.55	–
0.75	18	1.55	1.55	–
1.00	18	1.55	1.55	–
1.50	–	1.80	1.80	1.80
1.38	16	1.60	1.60	–
2.50	–	1.55	1.80	1.80
2.10	14	1.45	1.70	–
3.00	12	–	2.00	–
4.00	–	–	2.00	2.00

* Use contact 09 15 000 6107 / 6207.

CRIMPING

1. Insert contact and prepared wire through the open indenter (A) and into the locator.
2. Squeeze handles together until positive stop is reached. Tool will then release and return to the fully open position.
3. Remove crimped contact and wire and inspect crimping.

GAUGE PIN

Attached chart shows gauge pin diameter and corresponding part number. In one tool various diameters are implemented.

Gauge pin diameter [mm]	Product number
1.00	09 99 000 0379
1.30	09 99 000 0379
1.45	09 99 000 0378
1.55	09 99 000 0379
1.60	09 99 000 0378
1.70	09 99 000 0378
1.80	09 99 000 0379
2.00	09 99 000 0379

Note:

Usage of the adjustment mandrel different to those specified here are not permitted.

VI-15 Four-indent crimp tool 09 99 000 0888

Figure VI-15.1
Four-indent crimp tool

Table VI-15.1
Usage areas: Contacts, part numbers, stripping lengths

Han® C		Han D®		Han E®		Han-*Yellock*®	
Part number*							
09 32 000 6xxx		09 15 000 6xxx		09 33 000 6xxx		11 05 000 6xxx	
Cross-section							
(mm^2)	(AWG)	(mm^2)	(AWG)	(mm^2)	(AWG)	(mm^2)	(AWG)
1.5	16	0.14	26	0.14	26	0.14	26
to	to	to	to	to	to	to	to
4.0	12	2.5	14	4.0	12	4.0	12
Stripping length							
9.5 mm		8.0 mm**		7.5 mm		6.5 mm	

* Part numbers see catalogue HARTING Industrial Connectors Han®
** 2.5 mm^2 = 6.0 mm

Usage/safety

HARTING's four-indent crimp tool 09 99 000 0888 (hereinafter referred to as the crimp tool) creates crimp connections between stranded wires and contacts for various Han® industrial connectors. This crimp tool can be used to process unattached, machined, solid male and female contacts from the Han D®, Han E®, Han® C and Han-*Yellock*® series for wire cross-sections of 0.14 mm^2 to 4 mm^2 (AWG 26 to 12).

The crimp tool features a rotary locator used to properly position the crimping zone between the die jaws. Table VI-15.2 in this document lists the settings parameters for the crimping depths; these can also be found directly on the locator. It is not necessary to check the crimping depth. The go/no-go gauge (09 99 000 0889) can be used to check the crimp tool.

The four-indent crimp tool may only be used when it is in proper technical condition. It may only be operated in a proper and safe manner. The manufacturer is precluded from liability for damages that result from unauthorized alterations or improper use of this tool.

Design of the four-indent crimp tool

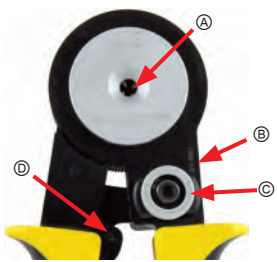
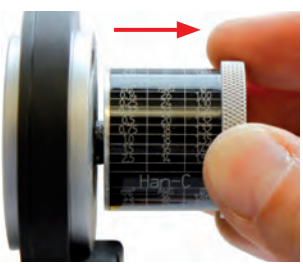


Figure VI-15.2
Front side

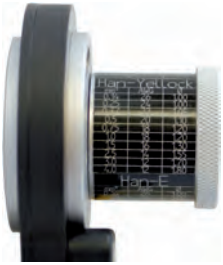
Figure VI-15.3
Rear side

Ⓐ Tool opening
Ⓑ Production code
Ⓒ Settings dial
Ⓓ Release screw
Ⓔ Settings scale
Ⓕ Rotary locator



Locator position
1. Select the series to be processed – Han D®, Han E®, Han® C or Han-*Yellock*®. Pull the locator out of the latch and turn it until the required marking is lined up with the contact position.

2. The arrow will indicate the selected marking. The locator will latch back into position when you release it.



Adjusting the crimping depth

In order to ensure the best error-free crimp connection, the crimping depth (the gap between the crimping dies) must properly correspond to the type of contact and wire diameter in use. The proper setting must be used. The respective setting can be found on the locator (see figure). You can also find it in Table VI-15.2. Han-*Yellock*® 1.5 mm² e.g. corresponds to 1.30 mm diameter.

Table VI-15.2
Settings for the crimping depth

Contacts	mm²	AWG	Crimping depth
Han D®	0.14	26	1.00
	0.25	24	1.10
	0.37	22	1.20
	0.5	20	1.32
	0.75	18	1.32
	1.0	18	1.35
	1.5	16	1.47
	2.5	14	1.50
Han E®	0.14	26	1.00
	0.25	24	1.00
	0.37	22	1.05
	0.5	20	1.36
	0.75	18	1.36
	1.0	18	1.36
	1.5	16	1.50
	2.5	14	1.60
	3.0	12	1.70
	4.0	12	1.80
Han® C	1.5	16	1.40
	2.5	14	1.50
	4.0	12	1.75
Han-*Yellock*®*	0.14	26	1.00
	0.25	24	1.00
	0.37	22	1.05
	0.5	20	1.10
	0.75	18	1.20
	1.0	18	1.20
	1.5	16	1.30
	2.5	14	1.55
	3.0	12	1.70
	4.0	12	1.80

* With the Han-*Yellock*® male and female contacts, different locator settings should be used.

Preparing the crimp tool

NOTE

Protected against unintentional adjustments
This crimp tool features a settings dial Ⓐ which ensures that the crimping depth cannot be re-adjusted unintentionally. There is no need to set the crimping depth with a plug gauge. If necessary, you may use a go/no-go gauge (09 99 000 0889) to check that the crimp tool is functioning properly.

1. Open the crimp tool.

2. Unlatch the settings dial (pull it out) and then turn it until the desired number is visible in the scale on the back of the crimp tool Ⓑ. Release the settings dial; give it a brief turn so that it latches back into place.

The HARTING four-indent crimp tool has now been set and is ready for use with the selected contacts and wires!

Crimp process

1. Insert the crimp contact into the tool opening Ⓐ. The locator ensures that the crimp contact is automatically positioned in the proper crimping position.

2. Insert a properly stripped wire into the crimp contact Ⓑ.

3. Press the crimp tool's handles together in order to crimp the contact. Press the handles closed until they automatically reopen (refer also to sub-chapter ratchet lock on the following page).

4. Remove the crimped contact.

NOTE

Checking that the crimp is safe
You should visually inspect each crimp after it has been completed. Check for the proper stripping length, external damage, cracks, etc.

NOTE

Opening and releasing in the event of an operational error
Never open or close the four-indent crimp tool with force! Otherwise you endanger the functionality of the crimp tool.

Ratchet lock
The HARTING four-indent crimp tool (**09 99 000 0888**) features a ratchet lock for ensuring that each crimp contact is produced with consistent quality.
This ratchet lock prevents the crimp tool from being opened prematurely during the crimping process. This ensures a consistent high-quality crimp!

Early Release

In the event of an operational error, it is possible to release the crimp tool before it has completed the crimp.

Take the pressure off the ratchet by pressing gently on the tool's handles.

Using a screwdriver, turn the unlocking screw counter-clockwise.

Operational errors can happen when the contact is inserted incorrectly or when the wrong contact type is used.

VI-16 Hand crimp tool 09 99 000 0110

Operating Instructions

The crimp tool 09 99 000 0110 is designed for application of various HARTING contacts, cross-section range 0.14 – 4.0 mm^2.

To process these contacts, the tool is fitted with a fixed, turnable locator which enables simple and secure handling.

Ratchet Mechanism

In order to ensure a constant crimp quality for all contacts, the crimping tool is equipped with a releasable safety catch.

- It prevents the crimping tool from closing as long as the crimping jaws are not fully opened.
- It prevents the crimping tool from opening as long as the crimping cycle is not completed. The mechanism guarantees that every single crimping process achieves the required degree of deformation.

Early crimp unclamp

It is possible to effect an early release of the safety device with a screwdriver if the crimp is faulty. The safety device is released by turning right or left. The load must be taken off the jaws by applying slight pressure to the handle. Damage of the crimping stamp will thus be prevented in case the contact does not lie correctly in the profile.

Caution!

Do not use force to open and shut the crimp tool. Lubricate all moving parts weekly.

Locator

The turnable locator must be used exclusively with the specific contact types, the component is labelled for. The locator ensures that the crimp contact is processed in the correct position / crimp zone. Process the Han® contact by turning the locator into the position .

Crimping process

1. Insert the contact into the proper crimp profile for the cross-section range.
2. Secure the contact between the slightly closed crimping jaws.
3. Insert the cable, correctly stripped of insulation, into the contact.
4. Crimp until the tool opens again.
5. Remove the crimped contact.

Table VI-16.1
Tensile strength of crimp connections according to DIN IEC 60352-2, A2

Wire cross section/ Wire gauge		Tensile strength	Han® contacts
mm²	AWG	N	
0.14	26	18	D
0.22	24	28	D
0.25		32	D
0.32	22	40	D
0.50	20	60	D E *Yellock*
0.75		85	D E *Yellock*
0.82	18	90	D E *Yellock*
1.00		108	D E *Yellock*
1.30	16	135	D E *Yellock*
1.50		150	D E *Yellock* C
2.10	14	200	E *Yellock* C
2.50		230	E *Yellock* C
3.30	12	275	E *Yellock* C
4.00		310	E *Yellock* C

Note:

HARTING reserves the right to effect changes in design which may arise from improving the quality of our products, new developments or changes in the manufacturing process.

VI-17 Crimp tool 09 99 000 0377

Using the crimp tool 09 99 000 0377, HARTING Han® C male and female contacts with cross-sections of 6.0 mm² (AWG 10) and 10 mm² (AWG 8) can be processed. To process these contacts, the tool is fitted with a fixed locator.

Ratchet Mechanism

In order to ensure a constant crimp quality for all contacts the crimp tool is equipped with a releasable safety catch

- It prevents the crimp tool from closing before the crimping jaws are fully opened.
- It prevents the crimp tool from opening before the crimp cycle is completed.

Early crimp unclamp

It is possible to effect an early release of the safety device with a screwdriver if the crimp is faulty. The safety device is released by turning right or left.

The load must be taken off the jaws by applying slight pressure to the handle. Damage the crimping stamp will thus be prevented if the contact does not lie correctly in the profile.

Do not use force to open and shut the crimp tool. Lubricate all moving parts weekly.

Locator

The crimp tool is equipped with a locator for all specificities contacts.

Crimping process

1. Insert the contact into the proper crimp profile until it is stopped by the locator.
2. Insert the stripping wire into the contact.
3. Crimp the contact by closing the handles until the controlled cycle mechanism release.
4. Crimp until the tool opens again.
5. Remove the crimped contact.

Table VI-17.1
Tensile strength of crimp connections according to DIN IEC 60352-2, A2

Wire cross section/ Wire gauge		Pullout force	Han® contacts
mm²	AWG	N	
6.0	10	360	C
10.0	8	380	C

HARTING reserves the right to effect changes in design which may arise from improving the quality of our products, new developments or because of changes in the manufacturing process.

VI-18 Crimping tool for coaxial contacts 09 99 000 0503

Crimp tool HX4 (M22520 / 5-01)

Operating instructions for the HX3 and HX4 crimp tools and their inserts

The following operating steps should only be performed when the tool is open!

Installing the insert

1. The groove in the insert must correspond with the guide slot on the tool.
2. Push the holding bolts of both insert halves into the corresponding recesses on the tool (see fig. 1).
3. Carefully close the tool and check if both insert halves correctly come together.
4. Secure both insert halves using the supplied clamping pins (see fig. 4).

The following operating steps should only be performed when the tool is closed!

Removing the insert

1. If present, remove the clamping pins on both insert halves.
2. Insert the removal tool into the opening (groove) at the end of the tool and lightly tap it with a hammer (see fig. 2).
3. This insert half can now be removed by hand.
4. To remove the other insert half, push the removal bracket between the tool and the insert and open the tool with a slight tug (see fig. 3). This insert half can now also be removed by hand.

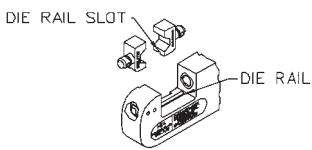


FIG. 1

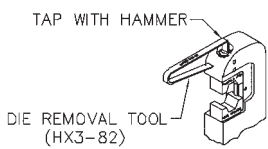


FIG. 2

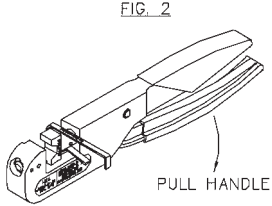


FIG. 3

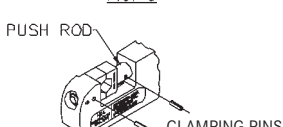


FIG. 4

NOTE: Use only "Y" series dies with HX4 crimp tool.

For the HX4 crimp tool there are three different types of insert:

Crimping die	Contact- Order number	Chamber
09 99 000 0508	09 69 181 x230 09 69 281 x230	B
	09 69 181 x141 09 69 281 x141	C
	09 69 181 x140 09 69 281 x140	B
09 99 000 0518	09 69 181 x143 09 69 281 x143	A
09 99 000 0519	09 69 181 x233 09 69 281 x233	B

Instructions to calibrate the inserts for the HX4 crimp tool

The crimp tools are not checked.

1. “Go test” - completely close the tool. Insert the plug gauge with the “go” side = green. Note: The plug gauge must be able to freely move in the contact chamber.

2. “No-go test” - completely close the tool. Insert the plug gauge with the “no-go” side = red. Note: The test gauge must not be able to be inserted into the contact chamber.

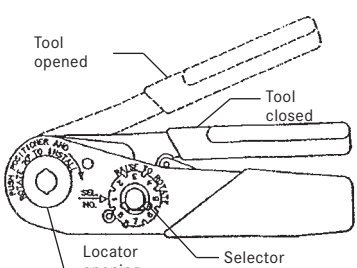
VI-19 Crimp tool for D-Sub contacts 09 99 000 0501

Note

The tool has a safety lock which only allows the crimp tool to release after a crimp has been fully completed.

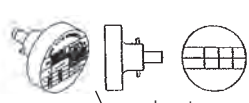
Preparation

1. The tool must be unlocked and fully opened.
2. Pull the securing clip out of the eye of the locator receiver.
3. Select the locator required for the contact.
4. Insert the locator and turn it through 90° - clockwise - until the bayonet lock engages.
5. Secure the locator with the securing clip (optional).
6. The setting data for the selector can be read off the locator.
7. With the tool completely opened, lift up the selector knob and turn it to the corresponding position (arrow points to the selected setting).
8. To replace the locator, remove the securing clip and follow the instructions of step 4 in reverse order (turning the locator anti-clockwise).



Crimp process

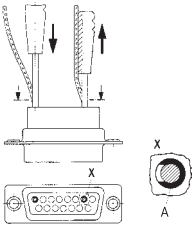
1. Insert the contact and the prepared wire in the opening opposite the locator.
2. Push the handles together. The handles are only released when the crimping process is completed. Remove the wire and the contact.



Assembly of D-Sub contacts:
After crimping the stranded wires to the contact with a hand tool or a automatic crimping device, the contacts are then pushed into the chambers with the tool from the termination side. They click audibly into place. Check that the contact is firmly seated in the chamber by lightly pulling on the stranded wires.

Disassembly of D-Sub contacts:
The tool is oriented to the termination side (see sketch) and inserted into the contact chamber. The contact with the stranded wires is then easily removed with the tool towards the termination side and inserted into another chamber. The tool is designed for maximum insulation diameter of ø 1.7 mm.

Removal sketch
D-Sub contacts:



*A = Tool positioning

VI

Maintenance

The tool is maintenance-free. You should ensure that the crimp opening is free from residues and dirt.

You should ensure that

- the tool is not dipped into cleaning baths,
- no oil is used for lubrication, and
- the tool is not disassembled.

VI-20 Crimp tool for individual DIN contacts BC and FC 09 99 000 0620

The basic tool 09 99 000 0620 can be used with the following crimping insert sets:

Crimping die Set no.		For individual contacts		Cross-section range [mm]	Insulation Ø [mm]
	09 99 000 0621	0902 000	BC	0.09 – 0.50	0.7 – 1.5
	09 99 000 0621	0906 000 ...4	FC 1	0.09 – 0.25	0.7 – 1.5
	09 99 000 0622	0906 000 ...1	FC 2	0.14 – 0.56	0.8 – 2.0
	09 99 000 0623	0906 000 ...2	FC 3	0.50 – 1.50	1.6 – 2.8

VI

Marking of the FC-contacts is stamped on their rear side.

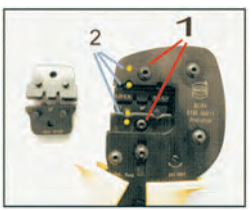
Locators are supplied with the crimping sets.

To order them separately use the following part-no.

	09 99 000 0630	locator **BC**
	09 99 000 0631	locator **FC1**

Assembly of crimping inserts

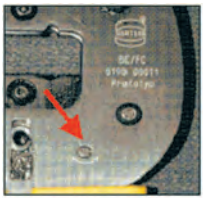
- Unscrew the fixing screw (1) – pliers closed.
- Close tool until it releases (now open the tool).
- Remove inserts (first upper part).
- Now assembly the new inserts. The markings (2) must have the same colour (install the bottom insert first).
- Secure the inserts with the fixing screws:
  - SKA M4x18 (above)
  - ISKA M4x9 (below)
- Plug the locator from the top in a 90° position as shown in the picture.



Safety ratchet

Each crimp process has to be done fully, before the tool can be opened again.

- The hand crimp tool can only be used after it has been opened completely.
- This prevents the tool being opened prematurely once the crimping process has started.



Early crimp unclamp

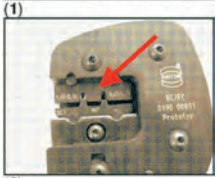
The crimp tool can be unlocked by pressing the tool together slightly and then turning the screw as shown in the direction of the arrow.

Then the crimp tool can be completely opened.

Crimp process

1. Fold out the locator.
2. Assembly the individual contact into the locator (1) - select the right chamber!
3. Fold the locator back.
4. Now partially close the tool until the contact is securely held - (2).
5. Insert the wire into the contact.
6. Crimp the contact until the tool is unlocked.
7. Remove the crimped contact.

(1)



(2)

Maintenance

- The crimp tool should be cleaned from dust and oil when needed.
- Protect the crimp tool from dust and moisture!

Only HARTING crimp contacts can be processed!

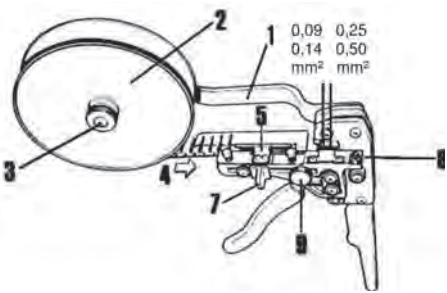
Protect tool against high humidity and dust!

VI-21 Crimp tool 09 99 000 0248

The following are the operating instructions for this crimp tool as well as an overview (see table 21.1) for the respective crimp contacts DIN 41 612 and the suitable tools for them. These are the standard contacts (also refer to the DIN 41 612 Connectors Catalogue).

Application field
The crimp tool is designed for crimping of DIN 41 612 crimp contacts 09020008434, -8444, 02050001512 and -2512. These are supplied in carrier strips of approximately 500 contacts per roll (2). The Roll Holder (1) caters for two wire crimp profiles, thus guaranteeing easy handling with the best crimp result.

a) Crimp profile 0.09 to 0.25 mm²
b) Crimp profile 0.14 to 0.50 mm²

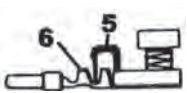


Each crimp profile crimps the contacts onto the conductors of the wire and the insulation in one step. After the crimping process, the contact is automatically cut from the carrier strip. The wire then is easily removed from the tool with a successful crimp installed onto the wire.

VI

Indexing Unit
With aid of the Indexing Unit the contact strip moves into the correct position and is terminated as follows:

1. Assemble the contact roll (2) onto the roll holder (1) holding it in place with the knurled nut (3). The contacts point towards the roll holder!
2. Close the tool, until the lock releases and it can be opened.
3. Insert the contact strips (6) in the direction of the arrow, into the Indexing Unit. Ensure the contact and the retaining plate of the Indexing Unit (5) is positioned fully over the contact and wire insulation as shown in the detail below.
4. Index the contact strip forward by pushing trigger (7) fully towards the crimping head.



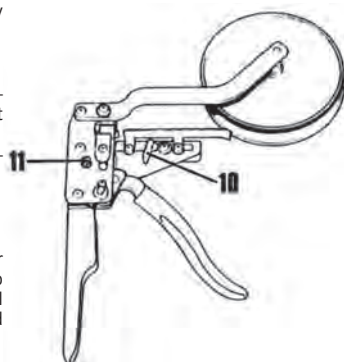
Adjustment of Indexing Unit
To produce a crimp contact within the Crimp / Wire profiles as a) and b), it is necessary to adjust the Indexing Unit as follows:

1. Undo the knurled nut (9).
2. Move the Indexing Unit to the left or to the right.
3. Tighten up the knurled nut (9) again!
4. Check to see if the contact is in the middle of the respective crimp profile.

Crimping process

1. Ensure that the contact is in the middle of the crimp profile after the indexing.
2. Close the tool to the first detent.
3. Insert the wire into the contact.
4. Close the hand tool completely until the safety ratchet allows the tool to be opened.
5. Take out the crimped contact.

Note: The empty carrier strip can be easily broken off behind the bending plate (8).



Changing contacts

1. Release the Indexing Unit Red Release lever (10) in direction “Release” and hold it there.
2. Pull out the contact roll away from the indexing unit towards the roll (2).
3. Remove the contact roll.

Safety ratchet

The hand crimp tool can only be used after it has been opened completely. Each crimp process has to be done fully, before the tool can be opened again. This guaranties a good quality crimp each time.

Early Release

It is possible to open the tool during crimping if necessary:

1. Push the tool handles slightly together.
2. Release the safety lock (11) on the rear of the tool by turning it anticlockwise.
3. Open the tool handles.

Maintenance

Remove any existing material and dirt and clean the crimp zone regularly. Check the tool to ensure that the profile closes correctly, clean moving parts and oil them lightly (machine oil SAE 20).

In case of any identified damage only let authorised personal attempt any repairs.

Only use the crimp tool for crimping!
Only HARTING crimp contacts can be processed with the tool!
Protect tool against high humidity and dust!

Table VI-21.1
Overview of wire cross-sections for DIN 41 612 crimp contacts and the corresponding crimp tool

Wire cross section [mm²]	Insulation diameter of cable [mm]	Contact designation	HARTING Order number	Number of contacts per roll	Crimp tool	Possible profile settings on the crimp tool [mm²]	AWG
0.09 – 0.50	0.7 – 1.5	BC	09 02 000 8444	500	09 99 000 0248	0.09 – 0.14 0.25 – 0.50	28 – 20
0.09 – 0.25	0.7 – 1.5	FC1	09 06 000 7474	250	09 99 000 0247	0.14 – 0.25 0.14 – 0.25	28 – 24
0.14 – 0.56	0.8 – 2.0	FC2	09 06 000 7471	250	09 99 000 0119	0.37 – 0.56 0.50 – 1.30	26 – 20
0.50 – 1.50	1.6 – 2.8	FC3	09 06 000 7472	250	09 99 000 0120	1.00 – 1.50	20 – 16

VI-22 Hand crimp tool 09 99 000 0191

Crimping process

- Insert the contact into the locator.
- Hold the contact between the slightly closed crimping jaws (first detent).
- Insert the stripped stranded wire into the contact.
- Crimp until the tool opens again.
- Remove the crimped contact.

Adjusting the crimping depth

If after prolonged use the crimp tensile strength in the connection between the stranded wire and the barrel of the contact is no longer sufficient, the pressure of the jaws can be increased by adjusting the eccentric ratchet plate. Undo the fixing screw by two turns using a screwdriver. Lift the toothed spring washer and turn it by hand counter clockwise, in direction “9”. Tighten the fixing screw.

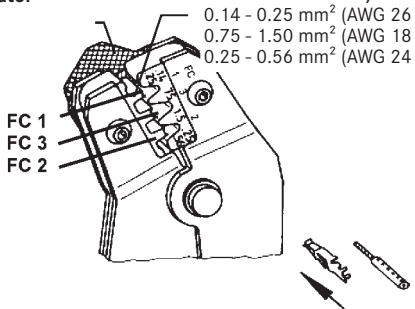
Pull-out force and crimp quality has to be checked again now!

Pull-out force of the crimped wire in the connection is in accordance with IEC 60352, Part 2.

Wire cross section/ Wire gauge mm²	AWG	Pull-out force
0.14	26	≥ 18 N
0.25	24	≥ 32 N
0.50	20	≥ 60 N
0.75	18	≥ 85 N
1.50	16	≥ 150 N

Locator

Wire cross section/ Wire gauge
0.14 - 0.25 mm² (AWG 26 - 24) FC1
0.75 - 1.50 mm² (AWG 18 - 16) FC3
0.25 - 0.56 mm² (AWG 24 - 20) FC2



Caution: only limited cross-sectional ranges for FC contacts!

HARTING reserves the right to modify designs in order to improve quality, keep pace with technical advancement or meet particular requirements in production.

Safety ratchet

The crimping tool is fitted with a safety ratchet to ensure that all contacts are crimped to a constant quality.

- The hand crimp tool can only be used after it has been opened completely.
- This prevents the tool being opened prematurely once the crimping process has started.

Early crimp unclamp

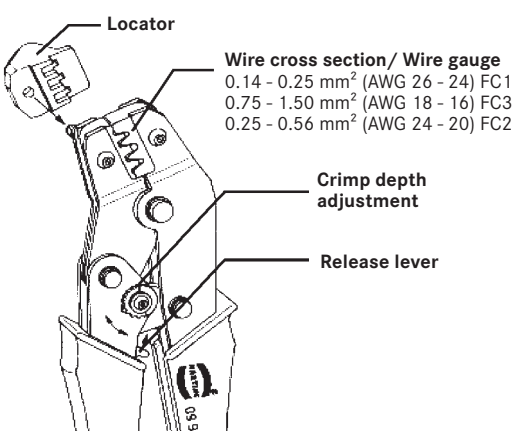
It is possible to perform an early release of the safety ratchet in case of a faulty crimping. The tool must be released by pressing together slightly. Operate the release lever (see sketch) in the direction of the tool head. Damage to the crimping die will thereby be prevented when the contact does not lie correctly in the crimp profile.

DO NOT OPEN OR CLOSE THE TOOL WITH FORCE!

LUBRICATE MOVING PARTS WEEKLY!

Fastening the locator

The supplied locator must be fastened on the upper part of the tool head (see sketch). The screw and the nut must be tightened firmly.



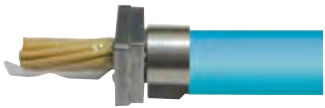
VI-23 Installing the crimp flange and crimp sleeve for the InduCom housings

1. Strip the cable to a length of 35 to 40 mm (depending on the connector used). Release the screen and expose the screen foil.

2. First push the crimp barrel onto the cable. Fold the screen to the rear, and cut off. Leave approximately 2 mm of the screening braid. Push the flange over the cable and the screen foil.

3. Push the flange between the screening braid and the insulation (if necessary, turn it slightly). Slide the flange so far until the cable insulation is on the flange.

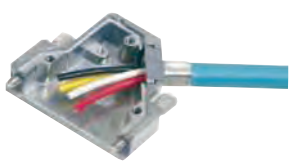
4. HARTING has a special tool which can help pushing the flange in.



5. The barrel can now be pushed back over the cable. The barrel should be positioned as near as possible to the flange for the best crimping process.

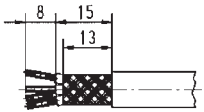
6. The barrel and the flange can now be crimped using the crimp tool. Push the tool together until it can be opened again.

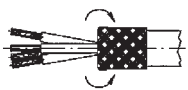
7. Finally the screen foil is removed and the cable can be put into the housing opening.



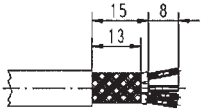
8. The wire connection can now be further processed.

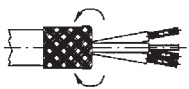
VI-24 Han-Quintax® 4-pole



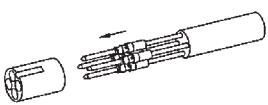


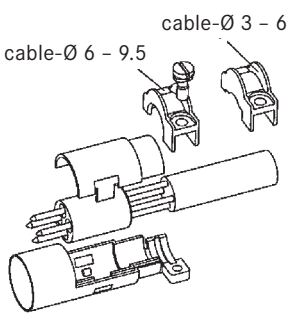
Pull back the shielding braid

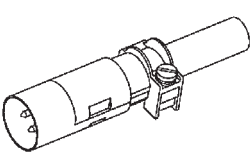




Pull back the shielding braid







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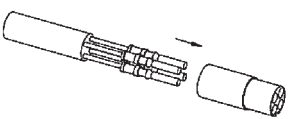
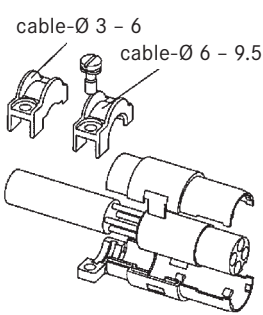
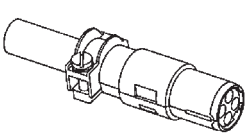




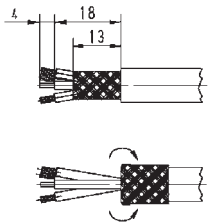


09 15 004 3113

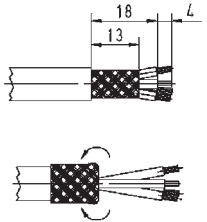
The pair must be aligned opposite each other in order to implement a reliable Ethernet connection in accordance with ISO/IEC 11801 Category 5.

Dimensions in mm

VI-25 Han-Quintax® 8-pole

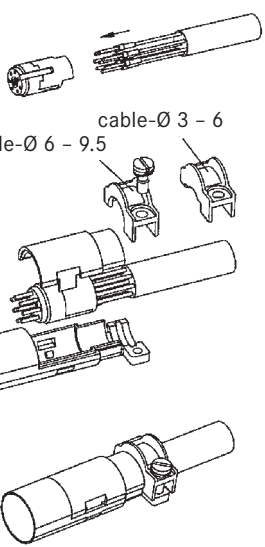


Pull back the shielding braid

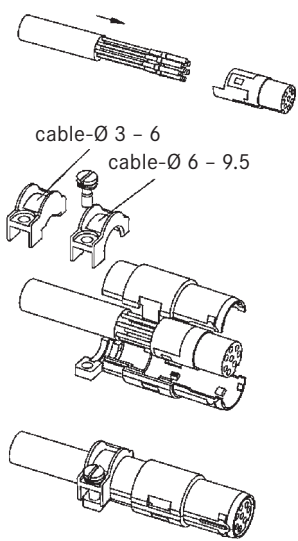


Pull back the shielding braid

VI



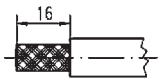
09 15 008 3013

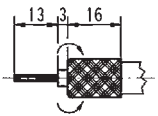


09 15 008 3113

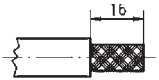
Dimensions in mm

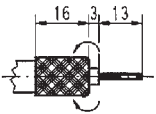
VI-26 Han D® Coax





Pull back the shielding braid





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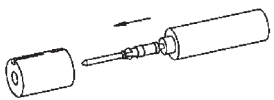
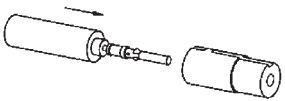
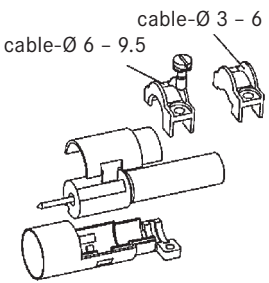
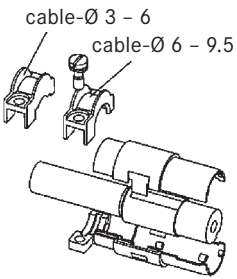
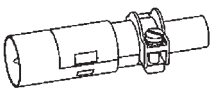


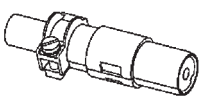








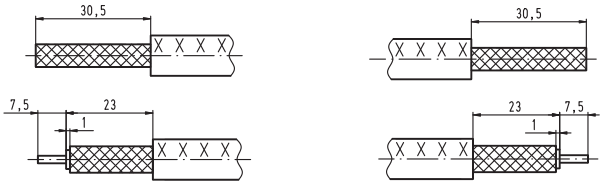
09 15 001 3013



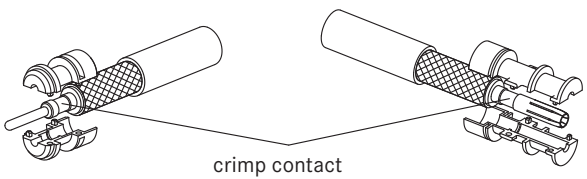
09 15 001 3113

Dimensions in mm

VI-27 Han E® Coax

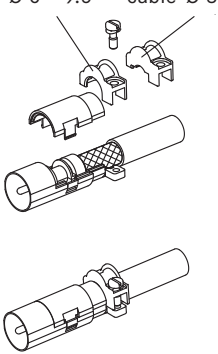


If there is a plastic foil between the shielding, the foil has to be removed



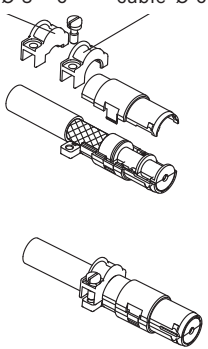
crimp contact

cable-Ø 6 – 9.5 cable-Ø 3 – 6



09 15 001 3023

cable-Ø 3 – 6 cable-Ø 6 – 9.5



09 15 001 3123

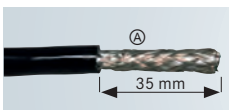
Dimensions in mm

VI-28 Han® Gigabit module

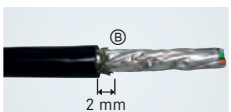
There are two ways to connect the shielding of the cable to the connector:
- Using the crimp flange
- Using the cable clamp

The following describes the required steps for both types of assembly.

Assembly with crimp flange

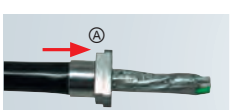


1. Strip the cable over 35 mm, release the screening braid Ⓐ and expose the screen foil Ⓑ.

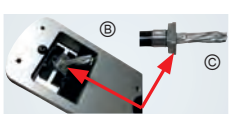


2. Push the crimp barrel Ⓒ over the outer jacket of the cable. Fold the screen backwards and cut it off, leave approx. 2 mm of the screening braid.

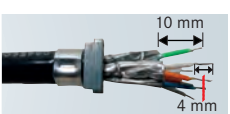
3. Push the crimping flange Ⓓ over the cable and screen foil and press it between the screening braid and foil. Slide the crimping flange so that the cable insulation lies on the flange.*



4. Now slide the barrel back over the cable. The barrel should be positioned as near as possible to the flange for the best crimping process.

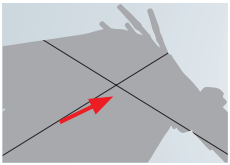


5. Crimp the barrel with the crimp tool Ⓑ **61 03 600 0020**. Hold the tool closed until it opens by itself. Remove the crimped cable Ⓒ.

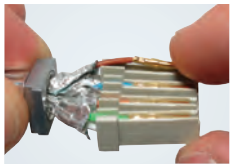


6. Shorten the screen foil to 10 mm. Strip all individual wires to 4 mm.

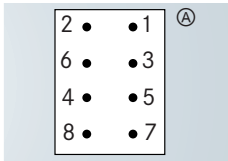
* Insert the support of the flange as far as possible under the cable shield. Tip: The assembly tool 61 03 600 0017 makes it easier to insert the flange.



7. Guide the stripped wires into the contact and crimp them in accordance with the tool's instructions (red arrow). Recommended tool: **09 99 000 0501**

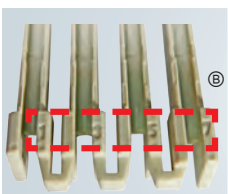


8. Place the contacts sideways into the Han® Gigabit insert. The contact chambers 1, 3, 5 and 7 are on one level, the chambers 2, 4, 6 and 8 are on the other.



Ⓐ Contact assignment acc. to EIA / TIA 568A (view from termination side):

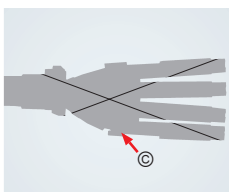
2 = green	1 = white / green
6 = orange	3 = white / orange
4 = blue	5 = white / blue
8 = brown	7 = white / brown



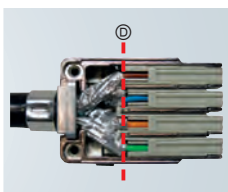
Ⓐ Contact assignment acc. to EIA / TIA 568B (view from termination side):

2 = orange	1 = white / orange
6 = green	3 = white / green
4 = blue	5 = white / blue
8 = brown	7 = white / brown

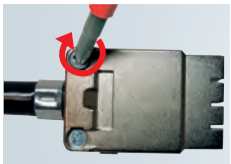
Ⓑ Contact chamber marking: Female insert (F), Male side (M) assigned similarly.



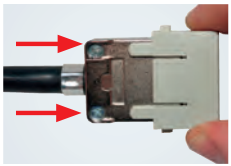
9. Insert the crimped contacts until they lock securely with an audible click. To achieve optimal transmission characteristics, the screen foil must reach to the insert. Push the insert upper part onto the insert Ⓒ.



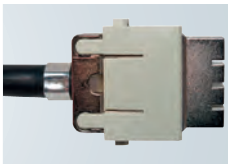
10. Lay the assembled insert into the chamber of the housing bottom part.
To achieve optimal transmission characteristics, the screen foil must reach to the metal ribs of the housing bottom part – red line Ⓓ.



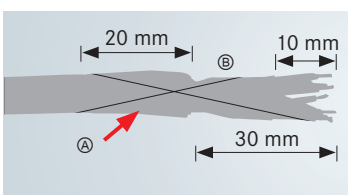
11. Screw the housing cover onto the housing bottom part (0.5 Nm).



12. Insert the assembled insert into the Han® module adapter (in the direction of the arrow). The module is now assembled.

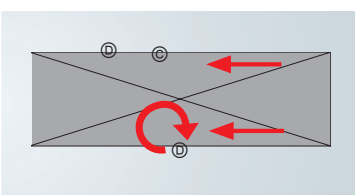


Assembly with cable clamp



1. Strip the jacket of the cable and lay the screening braid Ⓐ according to the requirements (20 mm).

2. Strip all individual wires to 4 mm. Shorten the shield foil Ⓑ of the wires to 10 mm.



3. Push the cable clamp Ⓒ over the wires until the foil is completely enclosed by the cable clamp.

4. Close the cover of the cable clamp and tighten up the M3 screws Ⓓ (recommended: PH 1 screwdriver, 0.5 Nm).

The wires can now be further processed (see **Assembly with crimp flange**, step 7).

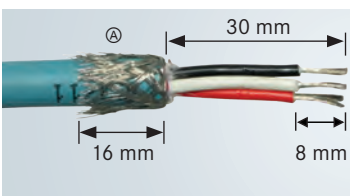
VI-29 Han® Megabit module

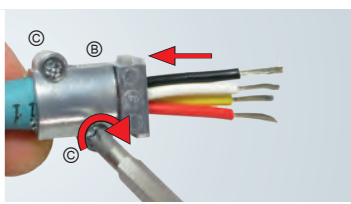
There are two ways to connect the shielding of the cable to the connector:
- Using the cable clamp
- Using the crimp flange

The following describes the required steps for both types of assembly.

These instructions are limited to the assembly of the male contacts. The female contacts are assembled in the same way.

Assembly with cable clamp

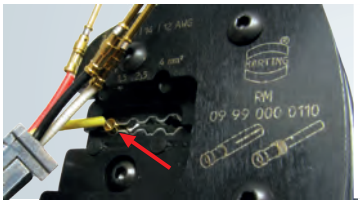


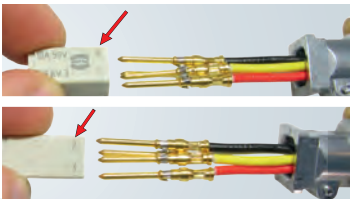


1. Strip the jacket of the cable and lay the screening braid Ⓐ according to the requirements. Strip all the individual wires to 8 mm (6 mm with Han D® 2.5 mm^2 contacts).

2. Push the cable clamp Ⓒ over the wires until the foil is completely enclosed by the cable clamp.

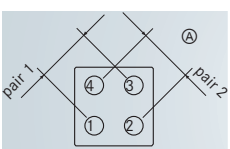
3. Close the cover of the cable clamp and tighten up the M3 screws Ⓓ. (Recommended: PH 1 screwdriver, 0.5 Nm).

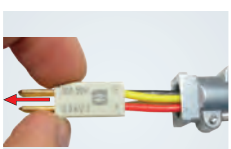


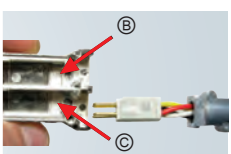


4. Guide the stripped wires into the contact and crimp them in accordance with the respective crimp tool's instructions (red arrow). (Recommended tools: **09 99 000 0110**, **09 99 000 0001**, **09 999 000 0021**)

5. Before inserting the contacts, check the contact chamber marking. The contact chambers 1 and 4 are on one side (with the HARTING logo), chambers 2 and 3 on the other side.





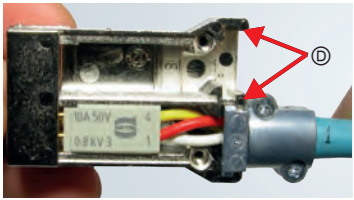


6. Insert the contacts into the Han® Megabit insert (assignment acc. to the sketch Ⓐ). Insert the crimped contacts until it locks securely with an audible click.

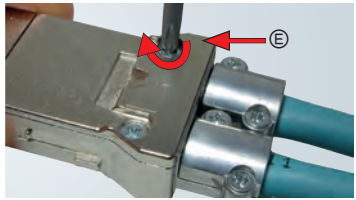
7. Then check the crimp contact for firm seating by pulling in the direction of the arrow.

8. Place the assembled insert into the respective chamber of the housing bottom part. So that the allocation is clear, the letters B and A are formed in the housing chambers (Ⓑ, Ⓒ).

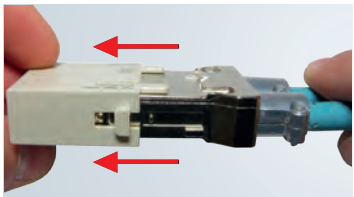
- ▶ The insert is placed so that the HARTING logo is visible from above. The insert fits exactly into the insertion area provided.



9. Place the clamping piece for the shield connection exactly in the guides of the housing bottom part Ⓓ.



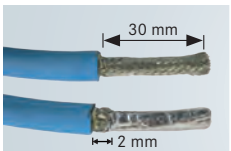
10. Assembly and mount the second insert in accordance with the instructions for the first and place it in the empty contact chamber. Screw on the housing cover Ⓔ.
(Recommended: PH 1 screwdriver, 0.5 Nm).



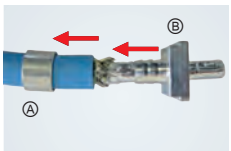
11. Insert the assembled housing into the Han® Module adapter (in the direction of the arrows).

12. The module is now assembled.

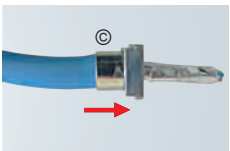
Assembly with crimp flange



1. Strip the cable to 30 mm, release the shielding and expose the shield foil.
2. Fold the screen to the rear, and cut off. Leave approximately 2 mm of the screening braid.

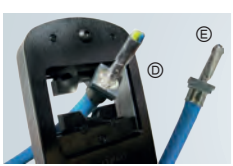


3. Push the crimp barrel Ⓐ over the outer jacket of the cable. Push the flange Ⓑ over the cable and the screen foil. Press it between the screening braid and the insulation (if necessary, turn it slightly).
Insert the support of the flange as far as possible under the cable shield.*

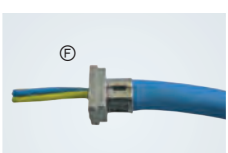


Slide the crimping flange so that it lies on the cable insulation.

4. Push the crimp barrel Ⓒ back over the cable. The barrel should be positioned as near as possible to the flange for the best crimping process.



5. Crimp the barrel and flange, e.g. using the crimp tool **61 03 600 0020** Ⓓ. Keep pressing the crimp tool until the die opens itself again.
Remove the crimped cable Ⓔ.



6. Remove the shield foil and insert the crimp flange Ⓕ in the housing opening Ⓖ.

7. The wires are now ready for further processing - as described in the instructions for assembly with the cable clamp, steps 4 to 11.

* The assembly tool 61 03 600 0017 makes it easier to insert the flange.

VI-30 Han® 46 EE Multiplier

The insert is inserted into the bulkhead mounted housing from the mating side (figure VI-30.2). Be sure that you have mounted both PE panels already (figure VI-30.1).

Note: The PE panel is already attached to the contact insert.

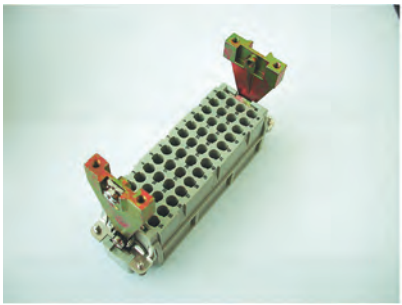


Figure VI-30.1
Han® 46 EE Multiplier top view

Figure VI-30.2
Han® 46 EE-Multiplier side view

The distributor is plugged with the contacts from the termination side here into insert fitted to the bulkhead mounted housing (see figure VI-30.3).

Figure VI-30.3
Han® 46 EE Multiplier

Four M3 retaining screws (Figure VI-30.4) are used to fasten the multiplier to the insert.

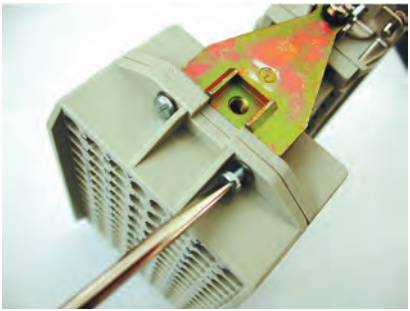


Figure VI-30.4
Han® 46 EE Multiplier – fixing

The completely assembled Han® 46 EE Multiplier

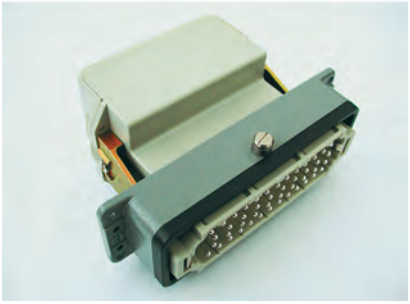


Figure VI-30.5
Han® 46 EE Multiplier – assembled

VI-31 Assembly notes for the Han® B standard housing

Several issues must be kept in mind while assembling the bulkhead mounted housing:

In order to reach the IP65 degree of protection, the bulkhead mounted housings are delivered with a rubber flange seal. This seal is the same size as the bulkhead mounted housing (refer to Figure VI-31.1). The flange gasket grips the housing and also prevents the fixing screws from coming out. This helps to speed up the attachment and assembly procedures. The holes for the fixing screws are located in the sealing area. In order to create a reliable seal, be sure to follow these points:

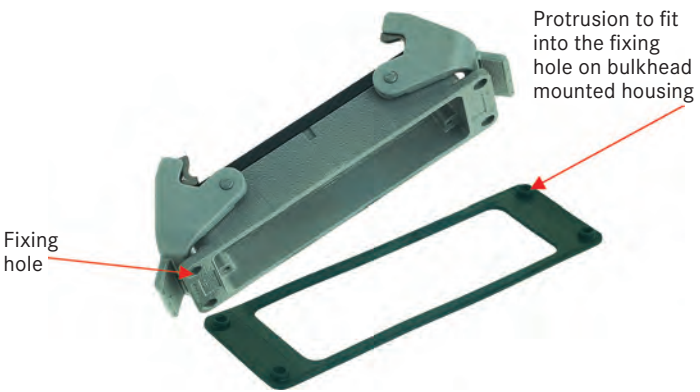


Figure VI-31.1
Bulkhead mounted housing with flange gasket

- In order to prevent moisture penetrating through the fixing screws (M4) into the housing, it must be ensured that the customer takes the appropriate steps to seal this area.
- If you are assembling on metal plate walls, there is a possibility of fitting a mounting frame on the other side. This frame functions as an abutment and provides for a more secure fixation to the assembly wall. The mounting frame is available for sizes 6 B, 10 B, 16 B and 24 B. It is fitted with M4 threaded holes for the screws that attach it to the bulkhead mounting housing.

When working with bulkhead mounted housings that do not have a flange gasket directly on the housing (delivery status up to 2005), you must be sure that the flange gasket is positioned precisely under the bulkhead mounted housing (see figure VI-31.3).

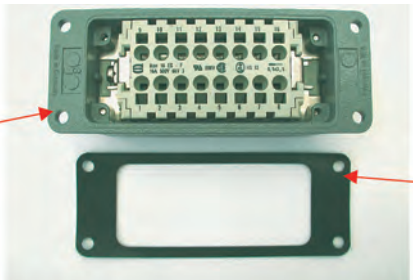


Figure VI-31.2
Bulkhead mounted housing up to 2005 and flange gasket

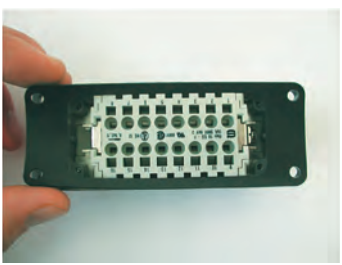


Figure VI-31.3
Bulkhead mounted housing up to 2005 with flange gasket fitted

The flange gasket (both the self-adhesive and loose versions) are available as replacement parts. If desired, the loose seal can be used with bulkhead mounted housings that are delivered with the self-adhesive seal. However, in this case be sure that both flange gaskets are not used at the same time.

VI-32 HPR housing sizes HPR 6 B to 24 B

The bulkhead mounted housings from this series have an O-ring seal on the bulkhead mounted side. When the housing is properly installed, with this seal IP68 or IP69K protection can be achieved. These housings have through holes for the M6 retaining screws located within the sealed area of the housing (see figure VI-32.1). This allows you to use through holes or continuous threads on the mounting surface. Such holes and threads will not affect the sealing.

If you installing on metal panel walls, then a proper mounting frame should be used (such as with the Han® B standard housings) to ensure the stability of the mount and the proper housing seal. Mounting frames with M6 threads are available for the HPR housings. Just as with the standard housings, the installation is carried out from the rear side on the mounting wall.

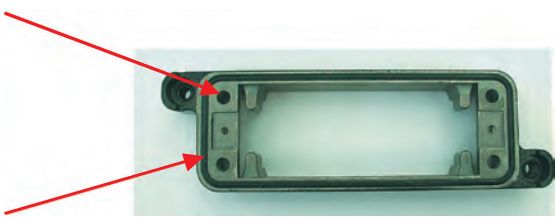


Figure VI-32.1
Han® HPR bulkhead mounted housing with O-ring seal

VI-33 HPR housing, size Han® HPR 3A

Two versions of bulkhead mounting housings are available for this size:

- Straight bulkhead mounted housing
- Angled bulkhead mounted housing

The straight bulkhead mounted housing of the Han® 3A series has an O-ring seal on the installation side and the through holes for the M4 fixing screws are found inside the sealed area. This housing is installed in a similar fashion as the HPR housings in sizes HPR 6 B – 24 B. A mounting frame for the HPR 3A housing is not required because of its small dimensions.

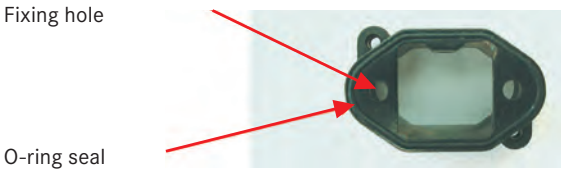


Figure VI-33.1
Han® 3 A HPR

A further seal is found in the plugging area. Since the inserts of the plastic inserts in size 3A are fitted with their own seal too, due to the fact that they can be used in different ways in housings of the Han® A, Han® M or Han® EMV series, these must be removed before use with Han® HPR housings.

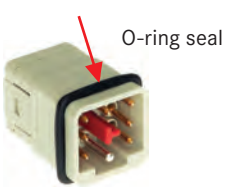


Figure VI-33.2
Han® 3 A with O-ring seal

In order to achieve IP68 protection for inserts, you should use the M3 sealed screw instead of the M3 fixing screw that is included with the delivery. The sealed screw is included in the delivery of the Han® 3 HPR housing, it can also be ordered separately under article number 09 20 000 9918. If, during the installation, you determine that the upper and lower sections of the plug-in connector do not interlock properly, make sure that the O-ring seal has already been removed from the male insert.

Table VI-33.1
Overview of male inserts, size Han® 3 A

Insert	Part number
Han® 3 A	09 20 003 2611
	09 20 003 2633
Han® 4 A	09 20 004 2611
	09 20 004 2633
Han® 7 D (for plastic housings)	09 21 007 3001
Han® 8 D	09 36 008 3001
	09 36 008 2632
Han® Q 2 / 0	09 12 002 2651 (4 to 6 mm^2)
	09 12 002 2653 (2.5 to 6 mm^2)
Han® Q 2 / 0 High Voltage	09 12 002 2652 (4 to 6 mm^2)
	09 12 002 2654 (2.5 to 6 mm^2)
Han ® Q 3 / 0	09 12 003 3051
	09 12 003 3151
Han ® Q 4 / 0 (for plastic housings)	09 12 003 3051
	09 12 004 3151
Han® Q 5 / 0	09 12 005 3001
	09 12 005 2633
Han® Q 7 / 0	09 12 007 3001
Han® Q 12 / 0	09 12 012 3001

The angled bulkhead mounted housing Han® 3 HPR is delivered with a flange gasket. The seal has through holes that are positioned for the fixing screws. The customer must therefore ensure that the fixing screws are appropriately sealed from the inside of the housing.

Figure VI-33.3
Han® 3 A HPR
flange gasket

Figure VI-33.4
Han® 3 A HPR
flange gasket, detailed view

VI-34 Han-Brid® inserts

Figure VI-34.1
Han® 3 A with Han-Brid®

HARTING also offers contact inserts in size 3 A that have male inserts with no O-ring seal. This includes the inserts from the Han-Brid® series. The Han-Brid® Quintax 3 A insert can be used with this product series in railway applications.
In order to ensure that the connector is sealed properly, be sure to select a hood variant with an adhesive-attached seal. The order numbers are listed in the following tables.

Table VI-34.1
Han® hood, size Han® 3 A with adhesive-attached seal

Housings	Part number	Remarks
Han® A	19 20 003 1443	Cable entry, M20, straight
Han® A	19 20 003 1643	Cable entry, M20, side
Han® M	19 37 003 1443	Cable entry, M20, straight
Han® M	19 37 003 1643	Cable entry, M20, side
Han® EMV	19 62 003 1443	Cable entry, M20, straight
Han® EMV	19 62 003 1643	Cable entry, M20, side

No special housings (bulkhead mounted, surface mounted, coupling or screw-in housings) are needed when using this insert. It can be used with the standard housing types.
The housing types listed below can be used with housings from the Han® 3 A HPR series.

Table VI-34.2
Han® 3 A HPR black-chrome housings

Housings	Product number	Remarks
Hood	19 40 003 0411	Cable entry, M25, straight
Bulkhead mounting housing	09 40 003 0311	
Bulkhead mounting housing, angled	09 40 003 0951	Through holes
Bulkhead mounting housing, angled	09 40 003 0953	M4 threaded tapped holes
Surface mounting housing, angled	19 40 003 0951	Cable entry, M25, through holes
Surface mounting housing, angled	19 40 003 0953	Cable entry M25; M4 threaded tapped holes

VI-35 Inserts with screw adapters

Connectors are often used to provide a pluggable solution for power and signals in the electrical cabinet.Such connectors require no housing but do need a strain relief mechanism. For these applications, HARTING offers a secure connection via the grip panel and screw adapter (refer to Figure VI-35.1). Knurled screws are used to interlock with the connector so that the plug cannot be accidentally pulled out. The grip panel is used for the strain relief.

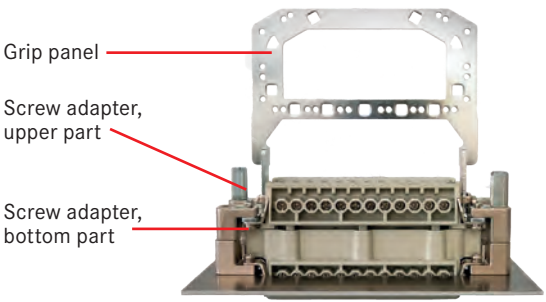


Figure VI-35.1
Grip panel and screw adapter

Therefore, HARTING offers complete sets for the cable side (upper part) consisting of a grip panel and a screw adapter upper part. These are available for sizes 6 B, 10 B, 16 B and 24 B and, depending on the type, are compatible with standard and modular inserts (see table VI-35.1). The screw adapter upper parts and certain grip panels are also available individually.

For each screw adapter upper part, there is a suitable bottom part. These are available, independently of the upper part set, in two different variants.

To make assembly easier, and for better differentiation of the different components, these are described in detail in the following sub-chapter.

VI-35.1 Upper part

Part number: **09 00 000 5601**

Description: Screw adapter with retaining screw (top section)

Included in delivery: Two screw adapters
Two knurled screws

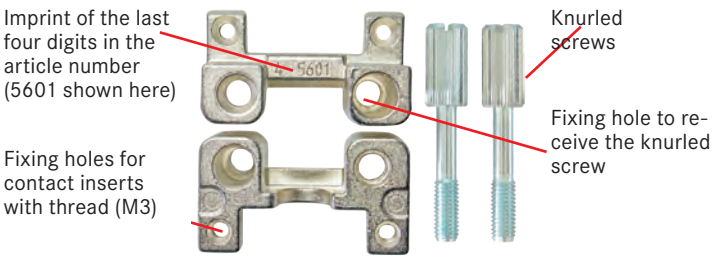


Figure VI-35.2
Screw adapter with fixing screw (upper part)

VI-35.2 Bottom part

Part number: **09 00 000 5602**

Description: Screw adapter, bulkhead mounting side (bottom part)

Included in delivery: Two screw adapters

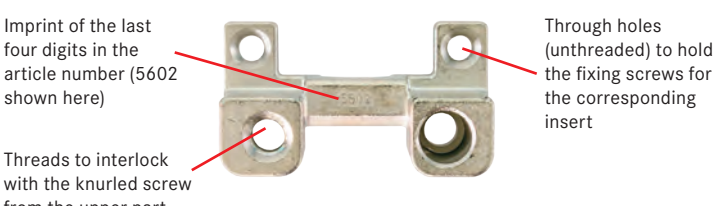


Figure VI-35.8
Screw adapter, bulkhead mounted side (bottom part)

Remarks: The contact inserts should be mounted directly to the mounting wall since the corresponding through holes are unthreaded. The adapter is not secured by the contact insert. Thus during disassembly, it is important that you do not lose the adapter. The version 09 00 000 5603 should be used for current projects.

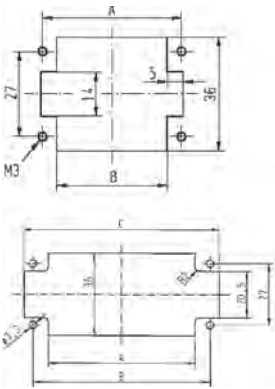


Figure VI-35.4
Panel cut-out

Standard contact inserts		
Size	**A**	**B**
6 B	44. mm	35 mm
10 B	57. mm	48. mm
16 B	77.5 mm	68.5 mm
24 B	104. mm	95. mm

Han-Modular® inserts			
Size	**A**	**B**	**C**
6 B	35 mm	44. mm	52 mm
10 B	49 mm	57. mm	66. mm
16 B	64 mm	77.5 mm	85.5 mm
24 B	94 mm	104. mm	112 mm

Part number: **09 00 000 5603**

Description: Screw adapter, bulkhead mounting side (bottom section)

Included in delivery: 2 screw adapters
2 M4 self-captive retaining screws
4 M3 fixing screws for the insert

Remark: This adapter has a simplified assembly compared with the screw adapter version 09 00 000 5602.

One of the advantages is the type of retention used. Both of the M4 fixing screws included in the delivery (see figure VI-35.5) are used to mount to the metal panel wall. These screws are self-captive and can be re-used several times. Thus the adapter can remain on-site even when the contact insert has been removed. This is not possible with the version 09 00 000 5602. Another ad-

vantage is that a rectangular cut-out is sufficient for installation (see figure VI-35.6) and so it is not necessary to cut out any special shape. The inserts are fastened in the adapter. The M3 fixing screws supplied must be exchanged with the screws fitted in the insert as they are too long for assembly in the adapter. The coding elements 09 14 000 9908/9909 or 09 33 000 9908/9909 can be used to code the connectors when you are using multiple connectors of the same type.

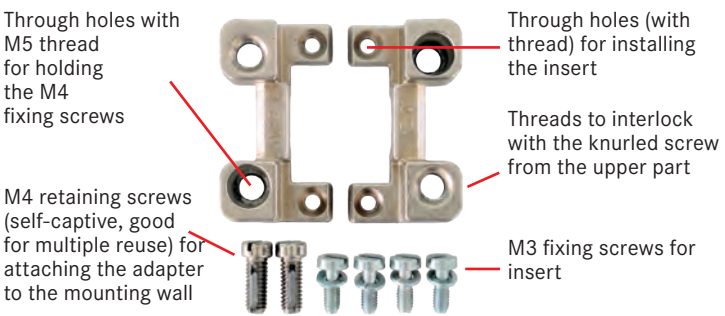
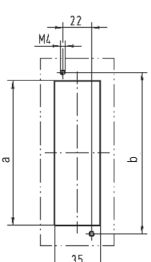


Figure VI-35.5
Screw adapter, installation side (bottom part)



Size	a*	b**
6 B	52. mm	65. mm
10 B	65. mm	78. mm
16 B	85.5 mm	98.5 mm
24 B	112. mm	125. mm

* Panel cut out length (a)
** Centre-spacing fixing holes (b)

Figure VI-35.6
Panel cut-out

VI-35.3 Notes about a secure contact presentation

The screw adapters for the upper and bottom parts are designed so that, when used together with the grip panel, the proper distance between the male and female inserts is achieved. The contacts are thereby securely placed over each other. When assembling in housings, the distance therefore also occurs automatically. The gap, as measured between the contact support surfaces of the inserts, must be between 19.5 mm and 21 mm.

When maintaining these safe contact dimensions (19.5 – 21.0 mm) while using screw adapters without a grip panel, galvanized steel spacer washers (4 x 8 x 0.8, according to DIN EN 28378, previously DIN 1440) should be used on the cable side.When plugged in, these ensure that the proper gap is maintained between the upper and bottom parts (refer to figure VI-35.9).

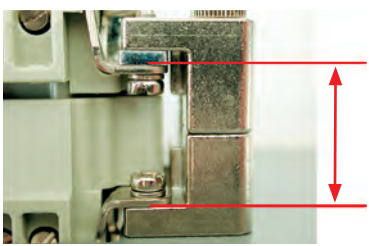


Figure VI-35.7
Screw adapter with grip panel

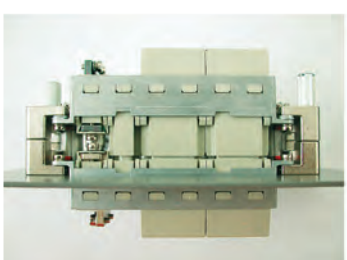


Figure VI-35.8
Screw adapter without grip panel

Figure VI-35.9
Spacer washers for creating the required distance for a secure contact presentation without a grip panel

The following overview describes the possible combinations for connections with grip panels and screw adapters.

Screw adapter (upper part) with grip panel (part no.)	Size	Screw adapter bottom part		Inserts	
		09 00 000 5602	09 00 000 5603	Standard	modular
09 00 006 5605	6 B	✓	✓	x*	✓
09 00 010 5605	10 B	✓	✓	x*	✓
09 00 016 5605	16 B	✓	✓	x*	✓
09 00 016 5612	16 B	✓	✓	✓	x
09 00 024 5605	24 B	✓	✓	x*	✓
09 00 024 5611	24 B	✓	✓	✓	x
*On request					

Table VI-35.1
Combinations of grip panels with screw adapters

VI-36 Han-Snap®

In addition to the screw adapters, the Han-Snap® system also permits connectors to be used without housings for interior railway applications (such as in the electrical cabinet or in the driver's console).

The following table gives an overview of the components that may be used.

Table VI-36.1
Han-Snap® components suitable for use inside railway wagons

Location	Han® Snap Components	Product number	Remarks
Installation side	Panel feed-through, metal	09 33 000 9984	Specially designed for use in railway wagons
Cable side	Coupling with the strain relief mechanism	09 33 000 9991	
Cable side	Shell housings	09 33 006 0401 09 33 010 0401 09 33 016 0401 09 33 024 0401	Size 6 B Size 10 B Size 16 B Size 24 B

The following is valid for all listed components:

- Suitable for standard inserts and Han-Modular®, sizes 6 B – 24 B (not including 09 33 000 9991 with Han-Modular®, size 10 B)
- Can be used with the Han® coding elements (male and female guide pin)
- Fixing mechanism with high level of functional safety, not damaged when the recommended torque is slightly exceeded
- Protection degree for coupled connector according to DIN EN 60 529: IP20

Additional information concerning these components can be found in the Han® Industrial Connectors Catalogue.

VI-37 Coding elements

There are two variants of coding elements that can be used to code plug-in connectors.

- Coding with coding pins
- Coding with guide pins and female sockets

VI-37.1 Coding with coding pins

When coding with the coding pins, two retaining screws per contact insert are replaced with coding pins.

The coding pins are arranged so that two will hit each other when an attempt is made to insert a connector into the wrong mate.

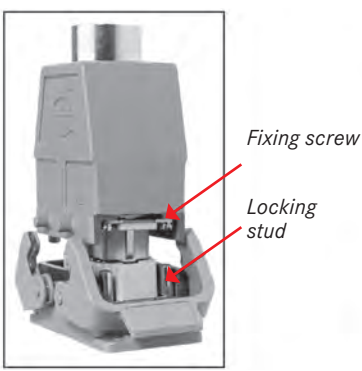


Figure VI-37.1
Proper combination

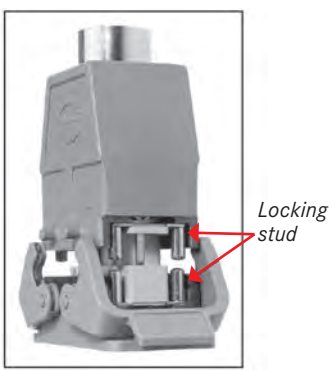
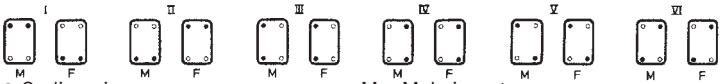


Figure VI-37.2
Wrong combination

Figure VI-37.3
Coding pins

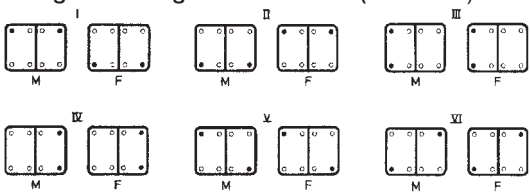
Coding for housing with an insert (sizes 10 A + 16 A, and 6 B to 24 B)



● Coding pins
○ Fixing screws

M = Male insert
F = Female insert

Coding for housing with two inserts (sizes 32 A, and 32 B + 48 B)



VI-37.2 Coding with male and female guide pins

The male and female guide pins actually fulfil two tasks:

1. Improved guiding of the plug-in process
2. Coding made possible by targeted insertion of the guide pieces

Insertion is only possible with male-female pairs.

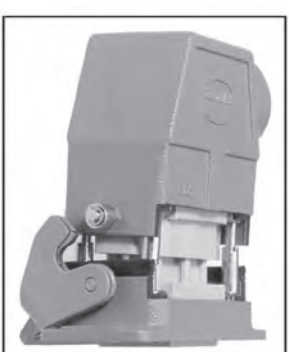
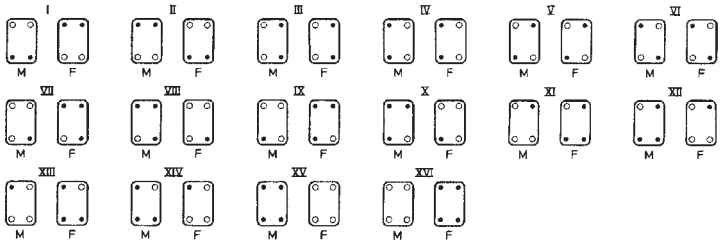


Figure VI-37.4
Guiding pin

Figure VI-37.5
Female guiding pin

Figure VI-37.6
Coding with male and female guide pins

Coding for housing with an insert (sizes 10 A, 16 A, and 6 B to 24 B)

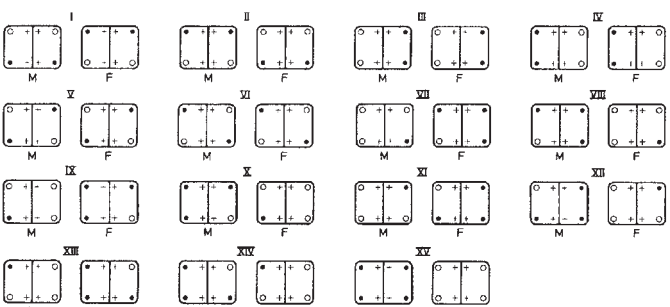


● Guide pin
○ Guide socket
\+ fixing screw

M = Male pin insert
F = Female insert

VI

Coding for housing with two inserts (sizes 32 A, and 32 B + 48 B)



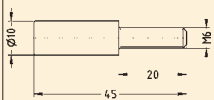
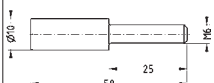
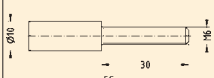
Note: According to DIN 43652, connectors must be constructed so that it is possible to plug them in at a lengthwise skew of +/- 5 degrees and a perpendicular skew of +/- 2 degrees. The use of guide pins and guide sockets prevents a larger skew or slant from taking place during the plugging. Male and female guide pins are required for all high-pole connectors.

HARTING provides other coding options on request.

VI-37.3 Male and female guiding pins and coding pins

The following tables show the male and female guiding pins and coding pins for the various Han® product series.

Table VI-37.1
Male and female guiding pins for Han® HPR

Designation	Part no.	Drawing	Application
Coding pin M6 (45 mm)	09 40 000 9981		• Coding for Han®HC Modular inserts in Han®HPR enlarged housings (order 4 pieces for each interface) • Use in the Han®24 HPR enlarged hood in connection with Han®HC Modular 350 or HAN HC Modular 650 contacts and correspondingly enlarged contact frames
Coding pins M6 (50 mm)	09 40 000 9982		• Coding for Han®HC Modular inserts in Han®HPR enlarged housings (order 4 pieces for each interface) • Use in the Han®24 HPR enlarged bulkhead mounted or surface mounted housing in connection with Han®HC Modular 350 or Han®HC Modular 650 contacts and correspondingly enlarged contact frames
Coding pins M6 (55 mm)	09 40 000 9983		• Coding for Han®HC Modular inserts in Han®HPR enlarged housings (order 4 pieces for each interface) • Use in the Han®24 HPR enlarged bulkhead mounted or surface mounted housing in connection with Han®HC Modular 650 contacts and correspondingly enlarged contact frames

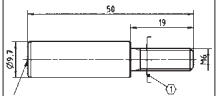
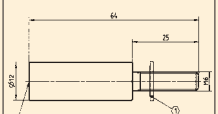
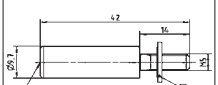
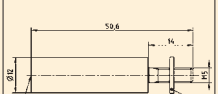
Designation	Part no.	Drawing	Application
Han® HPR enlarged guiding pin	09 11 000 9918		• Use in the Han®24 HPR enlarged hood in connection with Han®HC Modular 350 or HAN HC Modular 650 contacts and correspondingly enlarged contact frames • Prevents skewed mating/ unmating • Coding system possibility • Particularly suited for rough handling of the connector
Han® HPR enlarged female guiding pin	09 11 000 9919		• Use in the Han®24 HPR enlarged bulkhead mounted or surface mounted housing in connection with Han®HC Modular 350 or HAN HC Modular 650 contacts and correspondingly enlarged contact frames • Prevents skewed mating/unmating • Coding system possibility • Particularly suited for rough handling of the connector
Han® 48 HPR male guiding pin	09 11 000 9933		• Use in the Han®48 HPR housing in combination with Han®HC Modular 350 or Han®HC Modular 650 contacts and the corresponding frames • Prevents skewed mating/ unmating • Coding system possible • Particularly suited for rough handling of the connector
Han® 48 HPR female guiding pin	09 11 000 9934		• Use in Han®48 HPR bulkhead or surface mounted housings in combination with Han®HC Modular 350 or Han®HC Modular 650 contacts and the corresponding frames • Prevents skewed mating/ unmating • Coding system possible • Particularly suited for rough handling of the connector

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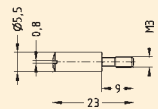
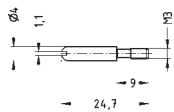
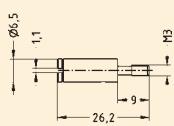
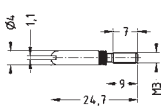
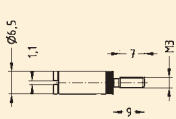
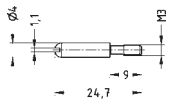
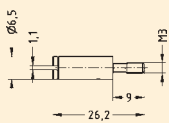
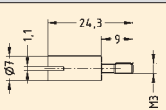
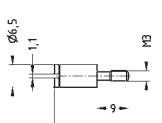
Table VI-37.2
Male/female guiding pins for standard inserts

Designation	Part no.	Drawing	Application
Han® B coding pins	09 30 000 9901		• Coding for inserts in the housing (order 4 pieces for each interface)
Han E® / Han D® guiding pin	09 33 000 9908		• Use in housings • Prevents skewed insertion/pulling • Coding system possibility
Female guiding pin Han E® / Han D®	09 33 000 9909		• Use in housings • Prevents skewed insertion/pulling • Coding system possibility
Guiding pin, thread length 7 mm	09 33 000 9808		• When using the screw adapter with/without grip panel • Prevents skewed insertion/pulling • Coding system possibility • 3 machined grooves for improved differentiation from standard guide pins
Female guiding pin, thread length 7 mm	09 33 000 9809		• When using the screw adapter with/without grip panel • Prevents skewed insertion/pulling • Coding system possibility • 3 machined grooves for improved differentiation from standard guide pins

Designation	Part no.	Drawing	Application
Han E® / Han D® guiding pin, stainless steel	09 33 000 9927		• Use in housings • Prevents skewed insertion/pulling • Coding system possibility • For particularly harsh environmental conditions
Han E® / Han D® female guiding pin, stainless steel	09 33 000 9970		• Use in housings • Prevents skewed insertion/pulling • Coding system possibility • For particularly harsh environmental conditions

VI

Table VI-37.3
Male and female guiding pins for Han® Modular

Designation	Part no.	Drawing	Application
Han-Modular® coding pins	09 14 000 9901		• Coding for inserts in the housing (order 4 pieces for each interface)
Han-Modular® Coding Pin, short version	09 14 000 9955		• Use in housings • Prevents skewed insertion/pulling • Coding system possibility • Particularly suited for rough handling of the connector • Lower bending risk due to shorter overall length

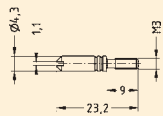
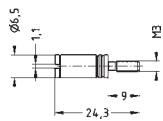
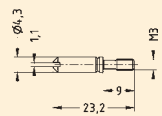
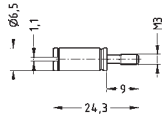
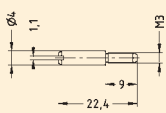
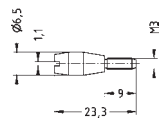
Designation	Part no.	Drawing	Application
Han-Modular® guiding pin (L= 6.5 mm)	09 14 000 9981		• When using the screw adapter with/without grip panel • Prevents skewed insertion/pulling • Coding system possibility
Han-Modular® female guiding pin (L= 6.5 mm)	09 14 000 9982		• When using the screw adapter with/without grip panel • Prevents skewed insertion/pulling • Coding system possibility
Han-Modular® guiding pin	09 14 000 9908		• Use in housings • Prevents skewed insertion/pulling • Coding system possibility
Han-Modular® female guiding pin	09 14 000 9909		• Use in housings • Prevents skewed insertion/pulling • Coding system possibility

Table VI-37.4
Male and female guiding pins for Han® Snap

Designation	Part no.	Drawing	Application
Guiding pin Han-Snap®	09 33 000 9956		• Compatible with all Han-Snap® products • Prevents skewed insertion/pulling • Coding system possibility
Female guiding pin Han-Snap®	09 33 000 9957		• Compatible with all Han-Snap® products • Prevents skewed insertion/pulling • Coding system possibility

VI-38 Locking panel for locking lever

HARTING offers a locking panel (refer to Figure VI-38.1) that prevents the lever locking mechanism on the connector from being opened or tampered with. This locking panel can be used with bulkhead mounting housings of sizes 10 B, 16 B and 24 B with two locking levers (cross lever).

Two versions are available:

09 30 000 9986	for the Han-Easy Lock® locking lever
09 30 000 9987	for the metal lever

A locking panel for bulkhead mounting housings in 6 B – 24 B with 1 Han-Easy Lock® locking lever (lengthwise lever) is available on request from HARTING.

Figure VI-38.1
Locking panel

The locking panel is designed so that once it is installed the interlock lever cannot be opened by hand. The locking panel can only be installed when the connecter is interlocked. A cord attached to the housing flange is used to ensure that the locking panel stays in place (refer to the following images).

1. The panel is inserted from the top down behind the locking lever.

2. The panel is pushed through until the metal tongue is sitting completely under the grip of the locking lever.

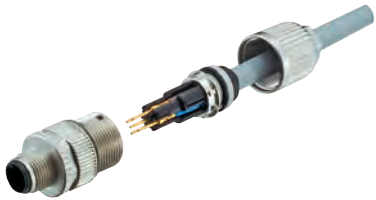
3. The metal tongue is now pressing under the grip and thus preventing the lever from opening.

4. In order to release the connection, you must press on the metal tongue with a screwdriver. This allows the locking clamp to glide over the metal tongue and release the connection.

VI-39 M12 Crimp

Part numbers:

21 03 882 1415 (D-coded)
21 03 812 1505 (A-coded)



Technical details

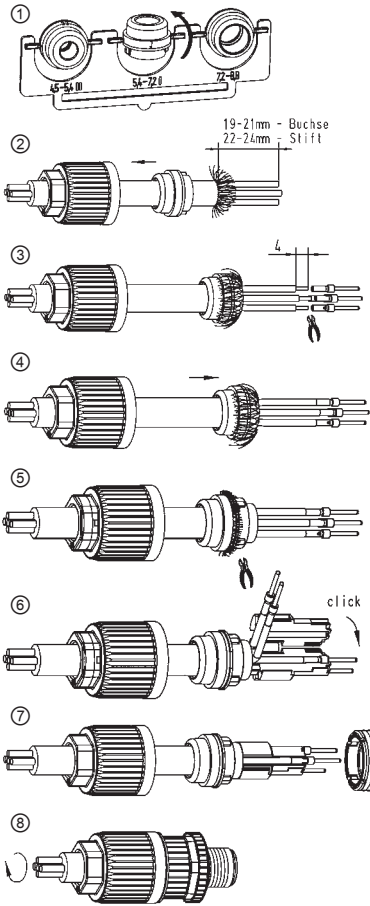
Recommended crimping tool	09 99 000 0501
Locator	09 99 000 0531
Wire diameter	1.5 to 2.3 mm
Cable diameter	4.5 – 8.8 mm
Degree of protection	IP65 / IP67
Rated voltage	50 V
Rated current	4 A
Working temperature	–40 °C ... +85 °C
Temperature during connection[1)]	–5 °C ... +50 °C
Mating cycles	≥ 500 x
Recommended tightening torque mating side	0.6 Nm

[1)] Please respect the manufacturer's recommendations.

The A-coded variant can also be used for 110-V DC power supplies.

Table VI-39.1
D-Sub contacts

Male contact	Female contact	Wire cross section / Wire gauge	
09 67 000 3576	09 67 000 3476	0.33 - 0.82 mm	AWG 22 - 18
09 67 000 8576	09 67 000 8476	0.25 - 0.52 mm	AWG 24 - 20
09 67 000 5576	09 67 000 5476	0.13 - 0.33 mm	AWG 26 - 22



1. Break out the required seal.
2. Push nut and seal onto the cable. Remove outer cable sleeve.
3. Form braid as shown. Remove foils and cross cables if necessary. Finally strip cable ends and crimp contacts.
4. Slide seal onto the cable until it stops and form as shown.
5. Slide shielding ring over cable ends onto the braid and seal. Cut off excess shielding braid.
6. Place middle contact in the contact element. Push contact elements together until it snaps.
7. Place all other contacts into side cavities. Push preassembled unit of contact element, shielding ring and seal into the connector. Respect the coding!
8. Assemble connector. Screw nut down until it stops.

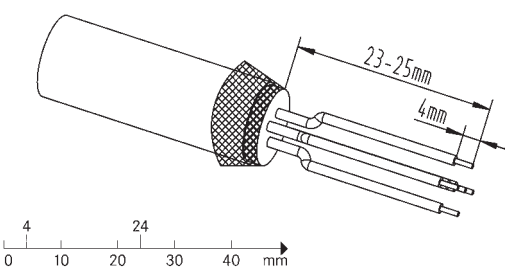
	1	2	3	4
Profinet	Yellow	White	Orange	Blue

The seal has to be replaced when worn.

VI-40 M12 Crimp Slim Design A-coded and D-coded

Part number:	D-coded	21 03 881 1405
	A-coded	21 03 821 1505
Wire cross section / male contact		
AWG 22 – 18 / 0.33 – 0.82 mm²		09 67 000 3576
AWG 24 – 20 / 0.25 – 0.52 mm²		09 67 000 8576
AWG 26 – 22 / 0.13 – 0.33 mm²		09 67 000 5576
Recommended crimp tool:		09 99 000 0501
Locator:		09 99 000 0531
Wire diameter:		2.0 – 2.3 mm
Cable diameter:		5.7 – 8.8 mm
Degree of protection		IP65 / IP67
Rated voltage:		250 V
Rated current		4 A
Working temperature		-40 °C to +85 °C
Temperature during connection:		–5 °C to +50 °C
Mating cycles		≥ 500
Recommended tightening torque, cable side:		0.6 Nm
D-coded:		Fast Ethernet / 100 Mb /Cat 5

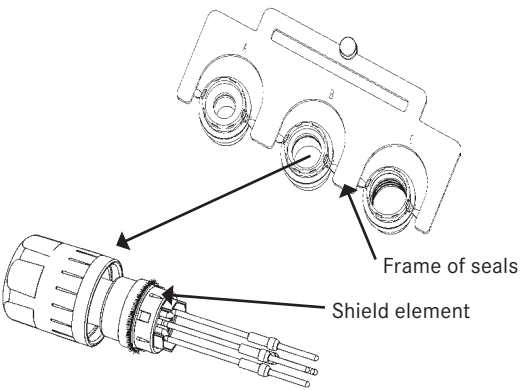
Assembly manual



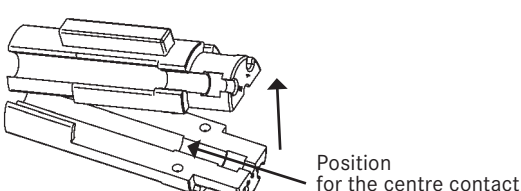
1. Remove 23 – 25 mm of the cable jacket.
2. Pull the screening braid back. If there is foil over the wires, please cut it off.
3. Remove 4 mm of the wire insulation.

4. Crimp the contacts.

Part number	AWG	Tool setting
09 67 000 3576	18	6
	20	6
	22	5
09 67 000 8576	20, 22, 24	6
09 67 000 5576	22, 24, 26	6



5. Slide the lock nut over the cable.
6. Select a suitable seal from the seal comb. Observe the clamping area.
7. Slide the selected seal onto the cable.
8. Pull the screening braid apart.
9. Put the screening element on. The cable screen must be located between the seal and the screening element. With 4-pole connections, go to point 12. With 5-pole connections, go to point 10.

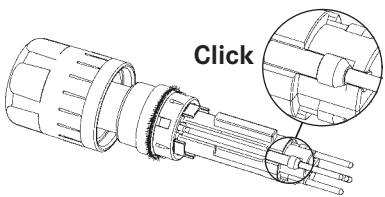


For 5-pole variants:

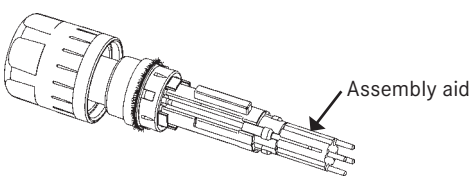
10. Pull the insert apart.

11. Place the contact in the centre contact chamber of the insert. Assemble the insert.

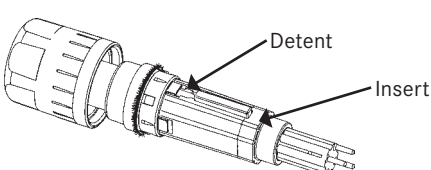
12. Place the contacts. When using a four-wire cable, observe the coloured identification. When using a five-wire cable, use the numbering on the insert for the pin assignment.



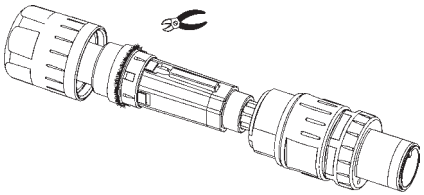
13. Attach the assembly aid.



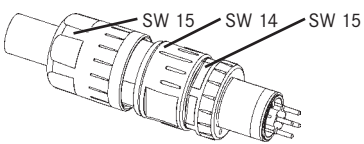
14. Push on the insert and lock in place.



15. Cut off excess screening braid.



16. Slide the sub-assembly into the housing (observe the coding).



17. Screw the lock nut to the stop, then remove the assembly aid.

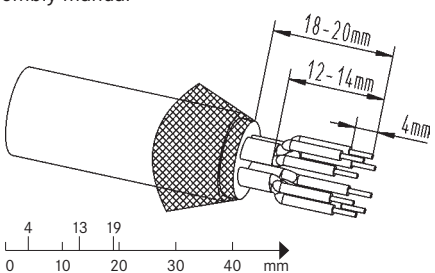
18.

Manufacturer	Description	Seal required
Helukabel	TRONIC-CY (LIY-CY) 5 x 0,50 QMM / 16005 500V 01560080314 CE RoHS 12/15	small seal (A)
Leoni/Studer	HARTING Ha-VIS EtherRail® CAT5 LSZH 4xAWG22/7	small seal (A)
Leoni/Studer	BETATRANS DATA C-Flex 100 OHM CAT5 FOAM 1x4xAWG	small seal (A)
H+S	H+S 12568935-725780 DATABUS 100 OHM CAT5 COM 4X22AWG	middle seal (B)
Leoni/Studer	HARTING Ha-VIS EtherRail® CAT5 LSZH 4xAWG22/19	middle seal (B)
Nexans	DTREN150002 - 300V - 4x0,5mm^2 CS - Qadrax 100 Ohms - 239 - Filotex P EDE 2PK211	big seal (C)

VI-41 M12 Crimp Slim Design X-coded

Part number:	X-coded	21 03 881 1805
Wire cross section / male contact:		
AWG 28 – 24 / 0.08 – 0.22 mm²		21 01 100 9014
AWG 26 – 23 / 0.13 – 0.25 mm²		21 01 100 9019
Recommended crimp tool:		09 99 000 0501
Locator:		09 99 000 0525
Wire diameter:		2.00 – 2.3 mm
Cable diameter:		5.7 – 8.8 mm
Degree of protection		IP65 / IP67
Rated voltage:		48 V
Rated current		0.5 A
Working temperature		-40 °C to +85 °C
Temperature during connection:		–5 °C to 50 °C
Mating cycles		≥ 500
Recommended tightening torque, cable side:		0.6 Nm
X-coded:		Gigabit Ethernet / 10 Gb / Cat 6_A

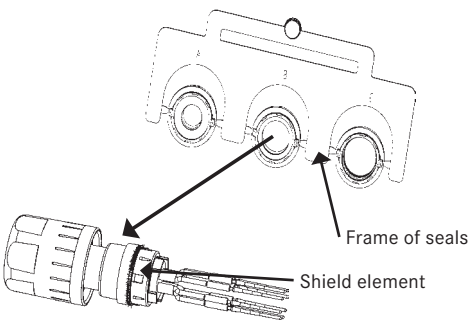
Assembly manual



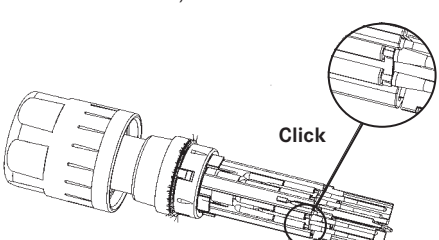
1. Remove 18 – 20 mm of the cable jacket.
2. Pull the screening braid back. If there is foil over the wires, cut it off.
3. Remove 12 – 14 mm of the pair screening.

4. Remove 4 mm of the wire insulation.

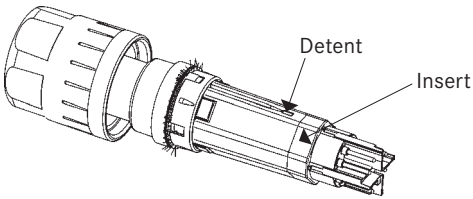
Part number	AWG	Tool setting
21 01 100 9014	28	3
	26	4
	24	5
21 01 100 9019	26	4
	24	5
	23	5



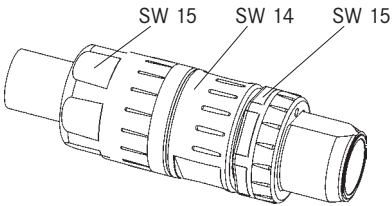
5. Crimp the contacts.
6. Slide the lock nut over the cable.
7. Select a suitable seal from the seal comb. Observe the clamping area.
8. Slide the selected seal onto the cable.
9. Pull the screening braid apart.
10. Put the screening element on. The cable screen must be located between the seal and the screening element.
11. Insert the contacts, observe the coloured markings.



12. Push on the insert and lock in place.

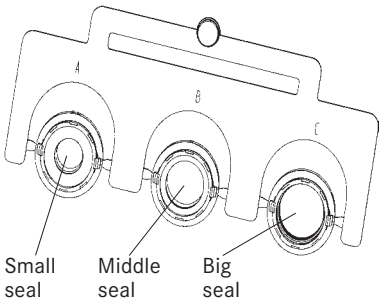


13. Cut off excess screening braid.
14. Slide the sub-assembly into the housing (observe the coding).



15. Tighten screw cap until it stops.

Manufacturer	Description	Seal required
Leoni	MegaLine® F10-120 S / F 11Y flex Cat. 7_A, 4 x 2 x AWG 26 / 7 PIMF	middle seal (B)



VI-42 *HARAX*® M12-L shielded

The *HARAX*® M12 connectors have been designed and tested according to the IEC 60352-4 and IEC 61076-2-101 standards.
Part numbers:

21 03 241 1300/2300 Male/female 3-pole, B-coded, Profibus version
21 03 281 1405/2405 Male/female 4-pole, D-coded, AWG 26-22
21 03 282 1405/2405 Male/female 4-pole, D-coded, AWG 22-20
21 03 221 1405/2405 Male/female 4-pole, A-coded

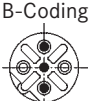
Figure VI-42.1
HARAX® M12-L shielded

Table VI-42.1
Technical characteristics

	M12-L	M12-L Ethernet	M12-L Profibus
Wire cross section/ Wire gauge	0.14 – 0.34 mm² AWG 24 – 22	0.25 – 0.5 mm² AWG 24 – 20	0.34 mm² AWG 22
Wire strand diameter	≥ 0.1 mm	≥ 0.1 mm	≥ 0.1 mm
Wire insulation material	PVC	PVC, PE	PVC, Zell-PE
Wire diameter	1.2 – 2.0 mm	1.2 – 2.0 mm	2.0 – 2.6 mm
Cable diameter	7.0 – 8.8 mm	5.4 – 7.2 mm	7.0 – 8.8 mm
Coding	A	D	B

View mating side, male: *HARAX*® M12-L shielded

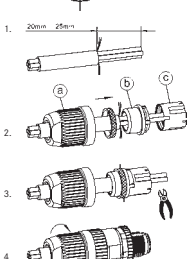
3-pole
PROFIBUS
B-Coding



4-pole
Ethernet
D-Coding

4-pole

A-Coding



Mounting:

1. Strip cable
2. Assemble HARAX® elements, twist screening braid and push it into the sealing slot
3. Slide ring over the sealing cut off cable ends and the screening braid
4. Screw the connector
   - ⓐ Screw nut
   - ⓑ Strain relief
   - ⓒ Splice ring

Note! For reconnection cut off the used cable ends and repeat steps 1 to 4.

VI-42.1 *HARAX*® M12 L shielded, D-coded

Part number:	21 03 281 1405 21 03 282 1405
Wire cross section / male contact: Contacts are assembled AWG 26 – 22 / 0.14 – 0.34 mm^2 AWG 22 – 20 / 0.34 – 0.50 mm^2	 21 03 281 1405 21 03 282 1405
Recommended Crimp tool:	./.
Locator:	./.
Wire diameter:	1.2 – 2.0 mm
Cable diameter:	4.5 – 8.8 mm
Degree of protection	IP65 / IP67
Rated voltage:	50 V
Rated current	4 A
Working temperature	-40 °C to +85 °C
Temperature during connection:	–5 °C to 50 °C
Mating cycles	≥ 100
Recommended tightening torque, cable side:	0.6 Nm
D-coded:	Fast Ethernet / 100 Mb /Cat 5

VI-42.2 *HARAX*® M12 L shielded, B-coded

Part number:	Male	21 03 241 1301
	Female	21 03 241 2301
Wire cross section / male contact:		
Contacts are assembled		
AWG 24 – 22 / 0.25 – 0.34 mm²		21 03 224 1301
AWG 24 – 22 / 0.25 – 0.34 mm²		21 03 224 2301
Recommended Crimp tool:		./.
Locator:		./.
Wire diameter:		2.0 – 2.6 mm
Cable diameter:		7.0 – 8.8 mm
Degree of protection		IP65 / IP67
Rated voltage:		32 V
Rated current		4 A
Working temperature		-40 °C to +85 °C
Temperature during connection:		–5 °C to 50 °C
Mating cycles		≥ 100
Recommended tightening torque, cable side:		0.6 Nm
B-coded:		Profibus

VI-43 HARTING RJ Industrial® / Han® 3 A RJ45 4-pole

Part numbers:

IP20	09 45 151 1100
IP65 (metal)	09 45 115 1100 (Standard) 09 45 115 1102 (Han® M version)

Technical characteristics IP20

Connector type	RJ45 plug acc. to IEC 60 603-7
No. of contacts	4
Transmission characteristics	Category 5 / class D up to 100 MHZ acc. to ISO / IEC 11 801:2002, EN 50 173-1
Transmission rate	10 / 100 Mbit/s
Shielding	fully shielded, 360° shielding contact
Mounting	Field-assembly
Cable termination	with IDC contacts
Wire cross section	
flexible	AWG 24 / 7 – AWG 22 / 7
solid	AWG 23 / 1 – AWG 22 / 1
Wire diameter	1.6 mm
Cable outer diameter	6.1 mm – 6.9 mm
Mating cycles	min. 750
Degree of protection	IP20
Temperature range	– 40 °C to + 70 °C
Housing material	Polycarbonate, UL 94-V0
Colour	black
	UL approval (E 102079)

Technical characteristics IP65/IP67

Connector type	Han® 3 A connector RJ45 acc. to IEC 61 076-3-106 Variant 5
No. of contacts	4
Transmission characteristics	Category 5 / class D up to 100 MHZ acc. to ISO / IEC 11 801:2002, EN 50 173-1
Transmission rate	10 / 100 Mbit/s
Shielding	fully shielded, 360° shielding contact
Cable termination	with IDC contacts
Wire cross section	
flexible	AWG 24 / 7 – AWG 22 / 7
solid	AWG 23 / 1 – AWG 22 / 1
Wire diameter	1.6 mm
Cable diameter	6,0 mm – 9,0 mm
Degree of protection	IP65 / IP67
Temperature range	– 40 °C to + 70 °C
Housing material	
Plastic version	Polycarbonate, UL 94-V0, black
Metal version	
Standard	Zinc die-cast, powder coating grey
M version	Zinc die-cast, powder coating black

The assembly of the data module is identical for all variants.

Table VI-43.1
Contact assignments according to PROFINET® guideline

Signal	Function	Wire colour	Contact no. RJ45
TD +	Transmission Data +	Yellow	1
TD –	Transmission Data –	Orange	2
RD +	Receiver Data +	White	3
RD –	Receiver Data –	Blue	6

Figure VI-43.1
Rear view of data module

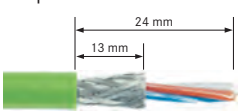
Installation Instructions:

1. Push the cable gland and housing over the cable insulating sheath.

IP20 housing

IP65 / IP67 Han® 3 A housing

2. Strip 24 mm from the cable sheath and 13 mm from the shielding braid.



3. Prepare the wires for insertion into the splice element according to the colour coding.

4. Fully insert the wires into the splice element until flush with the end.

5. Engage the splice element with the RJ 45 data module.

6. Insert the data module and the splice element into the IDC assembly tool provided.

7. Squeeze together the data module and IDC assembly tool to create the IDC connection.

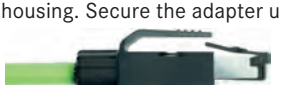
8. Remove the assembled data module from the IDC assembly tool.

9. Put on the upper shielding shell and press it over the cable screen.

10. Add the lower shielding panel; snap it together with the upper metal shield until it engages with an audible click.

11. IP20 Data: Push the housing over the assembled data module until is snaps in with an audible click.

12. IP67 Data 3 A: Place the data module in the adapter and insert into the housing. Secure the adapter using the sealing screw.



13. Tighten the cable gland.

VI-44 HARTING RJ Industrial® IP20 EtherRail®

Part number:

IP20 09 45 151 1122

Technical specifications for IP20	
Connector type RJ 45	acc. to IEC 60 603-7
Number of contacts	4
Transmission properties	Category 5 / Class D up to 100 MHz acc. to ISO / IEC 11 801:2002, EN 50 173-1
Transmission rate	10 / 100 Mbit / s
Shielding	fully shielded, 360° shielding contact
Mounting	Field-assembly
Cable termination	with IDC contacts
Wire cross section flexible / solid	 AWG 24 AWG 22
Wire diameter	1.6 – 2 mm
Cable outer diameter	4.5 mm - 9 mm
Mating cycles	min. 750
Degree of protection	IP20
Operating temperature range	- 40 °C to + 70 °C
Housing material	Polycarbonate, UL 94-V0
Colour	black UL approval (E 102079)

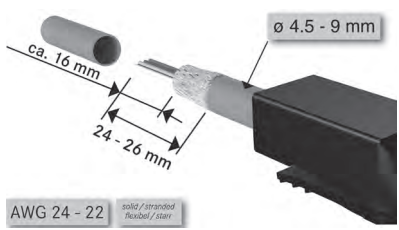
Table VI-44.1
Contact assignment for Fast Ethernet 10 / 100 Mbit / s

Function / Signal	Wire colour			Contact no.
	Industrial Ethernet[1)]	EIA / TIA 568 A	EIA / TIA 568 B	
Transmission Data+ / TD+	YE	WH / GN	WH / OR	1
Transmission Data– / TD–	OR	GN	OR	2
Receiver Data / RD+	WH	WSH / OR	WH / GN	3
Receiver Data / RD–	BL	OR	GN	6

[1)] For Ethernet profiles such as PROFINET, EtherNet / IP, Ethernet POWERLINK, EtherCAT, SERCOS III, VARAN etc.

Installation Instructions:

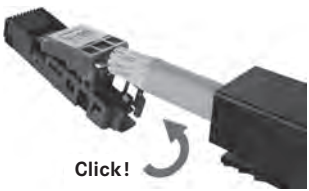
1. Push the housing over the cable jacket and remove the cable jacket over a length of 24 - 26 mm and the screening braid over 14-16 mm.



2. To guarantee simple assembly, check the stripping lengths from the following drawing at a 1:1 scale and pre-sort the cables into the correct position before placing them in the cable manager in accordance with the selected colour coding.

3. Push the bottom four cables in accordance with the selected colour coding into the cable manager.

4. Close and lock the cable manager.



5. Lock the shielding panel with an audible click.

11. Connector housing: Push the housing over the assembled data module until is snaps in with an audible click.

7. Then tighten the cable clamp.

VI-45 Han® 3 A RJ45 and HARTING RJ Industrial® Gigalink, 8-pole, Cat. 6_A

Part numbers:

IP20	09 45 151 1520
IP65 (metal)	09 45 115 1520 (Han® A) 09 45 115 1522 (Han® M version)

Technical characteristics IP20

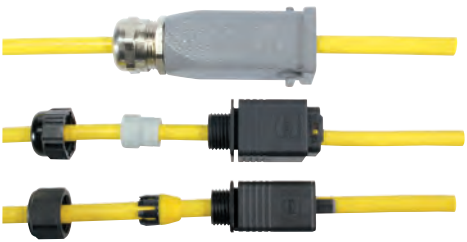
Connector type	RJ45 acc. to IEC 60 603-7
Number of contacts	8
Transmission characteristics	Category 6_A /Class E_A up to 500 MHZ acc. to ISO / IEC 11 801:2002, EN 50 173-1
Transmission rate	10 / 100 Mbit / s and 1 / 10 Gbit / s
Shielding	fully shielded, 360° shielding contact
Mounting	Field assembly
Cable termination	with piercing contacts
Wire cross section flexible	AWG 28 / 7 – AWG 24 / 7
Wire diameter:	1.05 mm
Cable outer diameter	6.1 mm – 6.9 mm
Mating cycles	min. 750
Degree of protection	IP20
Temperature range	– 40 °C up to + 70 °C
Housing material	Polycarbonate, UL 94-V0
Colour	black
	UL approval (E 102079)

Technical characteristics IP65

Connector type	Han® 3 A connector RJ45
Number of contacts	8
Transmission characteristics	Category 6_A /Class E_A up to 500 MHZ acc. to ISO / IEC 11 801:2002, EN 50 173-1
Transmission rate	10 / 100Mbit / s and 1 / 10Gbit / s
Shielding	fully shielded, 360° shielding contact
Cable termination	with piercing contacts
Wire cross section flexible	AWG 28 / 7 – AWG 24 / 7
Wire diameter:	1.05 mm
Cable outer diameter	6,0 mm – 8,0 mm
Degree of protection	IP65 / IP67
Temperature range	– 40 °C up to + 70 °C
Housing material Plastic version	Polycarbonate, UL 94-V0, black
Metal versions Standard	Cast zinc, powder coated, grey
M version	Cast zinc, powder coated, black

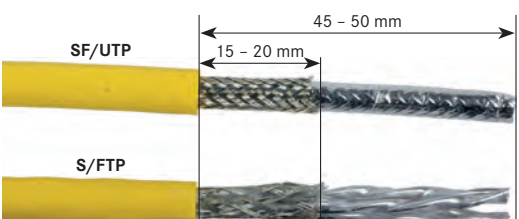
The assembly of the data module is identical for all variants.

1. Push the cable clamp and housing over the cable.



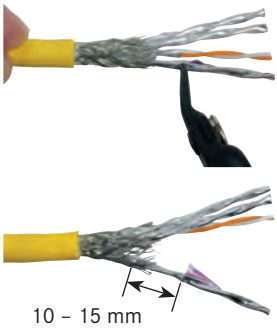
2. Strip the cable jacket and screening braid.

(Tool 0945 800 0002)

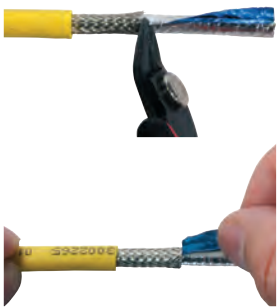


3. Cut into and remove the screen foil.

S/FTP



SF/UTP



VI

4. Unwind the cable pairs and bend to the correct position.

SF/UTP

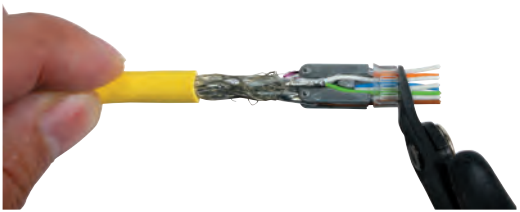
S/FTP

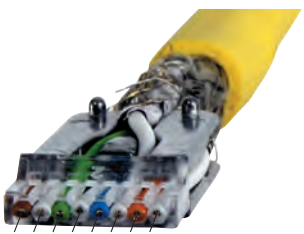
5. Bend the wires and insert up to the shielding into the cable manager. The shielding foil for the wire pairs of S/FTP cables must reach to the zinc pressed wire manager.

SF/UTP

S/FTP

6. Cut off the protruding ends of the wires so that no short circuits are possible. Excess end max. 0.3 mm.



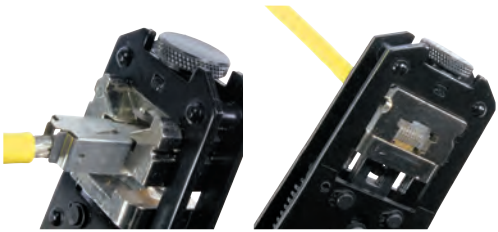


EIA / TIA 568B

7. Insert the cable with the cable manager to the stop in the RJ45 data module.

8. Put on the upper shielding sheet and press it over the cable screen.

9. Press the contacts into the RJ45 data module with the HARTING RJ Industrial® assembly tool (part no. 09 45 800 0520). Ensure that the data module is pushed into the tool until it stops.



10. Add the lower shielding panel; snap it together with the upper metal shield until it engages with an audible click.

11. Push the connector housing over the assembled data module (here place the data module in the RJ 45 holder, if required) until it snaps in with an audible click, or fix it with the sealing screw. When pulling back, observe the symbols on the connector if required. Then tighten the cable clamp.

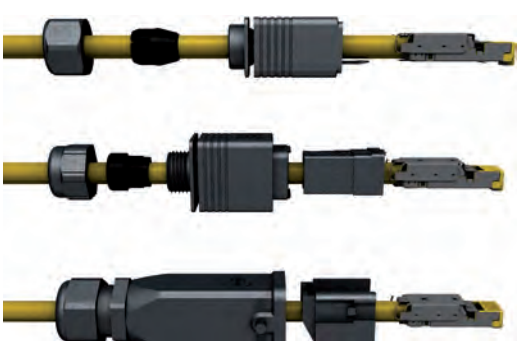


Table VI-45.1
Contact assignment

Contact	EIA / TIA 568 A	EIA / TIA 568 B
1	green / white	orange / white
2	green	orange
3	orange / white	green / white
4	blue	blue
5	blue / white	blue / white
6	orange	green
7	brown / white	brown / white
8	brown	brown

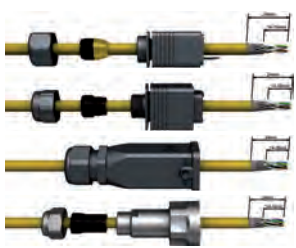
VI-46 HARTING RJ Industrial 10G protection class IP65 / IP67

Table VI-46.1
Contact assignment for Fast Ethernet 1 / 10 Gbit / s

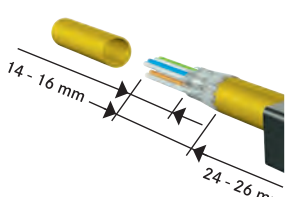
Contact no.	Function/ Signal	Wire colour		
		TIA / EIA 568 A	TIA / EIA 568 B	Industrial 1)
1	T3	green / white	orange / white	yellow
2	R3	green	orange	orange
3	T2	orange / white	green / white	white
4	R1	blue	blue	–
5	T1	blue / white	blue / white	–
6	R2	orange	green	blue
7	T4	brown / white	brown / white	–
8	R4	brown	brown	–

1) For Ethernet profiles such as PROFINET, SERCOS III, Varan etc.

1. Push the cable gland and housing over the cable insulating sheath.



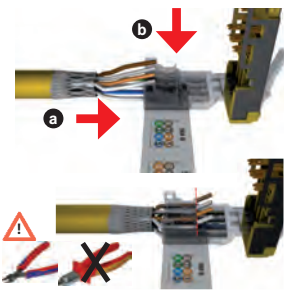
2. Remove the cable jacket over a length of 24 - 26 mm and the screening braid over 14-16 mm.



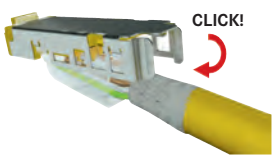
3. To guarantee simple assembly, check the stripping lengths from the following drawing at a 1:1 scale.

4. Pre-sort the cables into the correct position according to the selected colour coding before placing them into the cable manager.

5. Place the lower four cables according to the selected colour coding into the cable manager, then place the upper four cables into the cable manager and press them in gently with the thumb. Use a small side cutter to cut the upper four cables to the correct length.

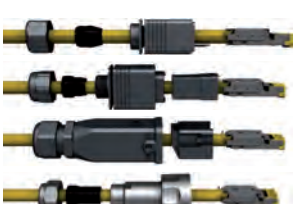


6. Close and lock the cable manager with an audible click.



7. Lock the shielding panel with an audible click.

8. Push the connector housing over the assembled data module (here place the data module in the RJ 45 holder, if required) until it snaps in with an audible click, or fix it with the sealing screw. When pulling back, observe the symbols on the connector if required. Then tighten the cable clamp.



Notes

VII – Ethernet Network Systems

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VII-1 Network systems

Ethernet is a global standard which is being increasingly employed to handle train communication tasks. Ethernet provides an excellent solution for applications requiring high-speed data transmission such as video monitoring. Modern rail vehicles offer many state-of-the-art services including information, entertainment and internet access. HARTING is your ideal partner because we can provide an Ethernet-based network – consisting of rail-compliant components – throughout the entire train. We have designed reliable and complete solutions for wagon couplings and Ethernet switching to supplement the standard M12 or RJ45 interfaces.

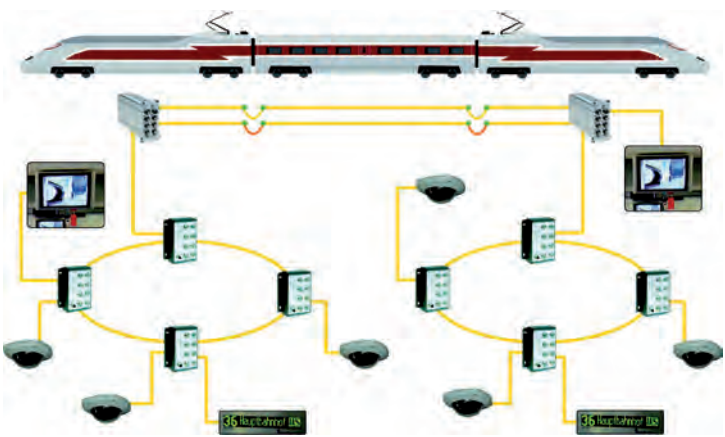

Figure VII-1.1
Redundant Ethernet topology with HARTING managed switches

Figure VII-1.1 shows the logical design of an Ethernet network consisting of active components (such as switches) and passive components (such as data cables and connectors). This also includes the plugable interfaces for the peripheral devices, cameras and end terminals.

Further Ethernet applications in the train are standardized by the IEC standard series IEC 61375. The new topologies and requirements for the part standards IEC 61375-3-4 (Ethernet Consist Network) and 61375-2-5 (Ethernet Train Backbone) are taken into consideration in HARTING's product range and are being systematically developed further.

The following pages describe the components necessary for setting up a network in rail vehicles: active Ethernet components (switches); plug-in connectors for the wagon interior and for critical wagon couplings; and pre-assembled system cable. We would be happy to talk with you if you have any special requirements or if you are looking for a switch that is not shown here.

VII-2 Ethernet switches for transportation

Switches are exposed to vibrations, electrical fields and other external influences in locomotives, drive and control carriages. This field of application demands extraordinary reliability and longevity from all electrical components. The EN 50155 standard stipulates these requirements.

The Ha-VIS eCon, Ha-VIS sCon and Ha-VIS mCon families of switches meet the requirements of rail systems and are also suitable for the use in electric sub-assemblies in buses.

VII-2.1 The Ha-VIS eCon unmanaged switch

Ethernet Switches in the Ha-VIS eCon series can be used for Fast Ethernet (100 Mbit/s) and are plug & play. Both line and star topologies as well as combinations of both are supported.

Depending on the type, between 6 and 10 Ethernet devices can be connected to the Ethernet Switch via RJ45 (twisted-pair) or M12 ports. Depending on the type used, modules are also available to connect two further Ethernet devices by means of fibre-optic ports (100BASE-FX; Full Duplex with SC connection technology).

The Ethernet Switch operates as an unmanaged switch in the “store & forward” switching mode supporting auto-crossing, auto-negotiation and auto-polarity.

VII-2.2 The Ha-VIS sCon configurable switch

Ethernet Switches from the Ha-VIS sCon line feature a wide selection of configuration options based on an unmanaged switch, among other things. The Ha-VIS sCon switches support per-port configuration options and a variety of different network topologies. Parallel-redundant and ring-redundant topologies can be implemented.

The Ha-VIS sCon ring-redundant topology allows you to implement a ring topology using HARTING’s unmanaged sCon switches.

With the parallel redundancy, two physical links are coupled together to form an active and passive link. In the event of a link failure, the connection is re-established on the previously passive link within a few milliseconds. The redundancy mechanisms provided by the HA-VIS sCon switch give a network an increased level of security and reliability.

VII-2.3 The Ha-VIS mCon managed switch

In addition to the standard functions that are already well-known from the Ha-VIS eCon and Ha-VIS sCon series of switches, the Ha-VIS mCon switches feature additional management functions.These functions help to implement a convergent network that can be administered from one central location.

Ha-VIS mCon switches support the use of VLAN for creating virtual network segments. This allows you to better control the flow of communication and to avoid unnecessary network overload. IGMP snooping ensures that multicast data packets only go to the intended recipients and are not broadcast and flooded throughout the network.

One key requirement for many applications is that the network is continually available and is resistant to outages. HARTING's management software supports the rapid spanning tree protocol for creating loop-free and outage-resistant networks.

The actual configuration and management for the Ha-VIS mCon switch is not difficult at all; the switch can be configured using SNMP tools, network management software or simply using an internet browser via the web interface.

The HARTING Ha-VIS mCon switches are versatile, provide professional solutions for operating Ethernet networks, and are easy to install and administer. Besides the Fast Ethernet interface, the Ha-VIS mCon also provides Gigabit and fibre-optic ports.

Table VII-2.1
Management functions

Basic Functions		
	Store and Forward Switching Mode	IEEE 802.3
	Manual and Dynamic IP Address Assignment	
Port Settings	Auto-Negotiation on / off	IEEE 802.3
	Port Speed 10 MBit / s / 100 MBit / s	
	Half- / Full duplex	
	Port disable / enable	
	Link Up / Down Trap disable / enable	
	Flow Control disable / enable	
Network Discovery	Link Layer Discovery Protocol (LLDP)	802.1AB, 2005

Rate control	Rate Control per port (Broadcast, Multicast, Unicast)	
File Transfer	Firmware import and export via TFTP and HTTP	
	Configuration import and export via TFTP and HTTP	
Time settings	Manual time setting	
	Simple Network Time Protocol (SNTP)	RFC 1305, RFC 4330
User management	Admin, Guest and Service Level	
Service	Service Mode via Port 1	
PROFINET		
	PROFINET IO Device Stack [1) 2)]	
Time Synchronization		
	Precision Time Protocol [1)]	IEEE 1588, 2008
QoS		
	Quality of Service (QoS)	IEEE 802.1p
	Differentiated services (DiffServ)	RFC 2474, 2475
VLAN		
	Port protocol based VLANs VLAN ID Range: 1 – 4094 Max. active VLANs: 256	IEEE 802.1Q Rev D5.0, 2005
Redundancy		
	Spanning Tree (STP)	IEEE 802.1D (2004)
	Rapid Spanning Tree (RSTP)	IEEE 802.1D (2004)
	Media redundancy protocol (MRP) [1) 2)]	DIN EN 62 439-2
Security		
	Port-Based Network Access Control Port-Based Authentication with EAP	802.1x (2004)
	RADIUS Client	RFC 2138
	IP authorized manager	

Link Aggregation		
	Link Aggregation (LACP)	IEEE 802.3ad (2005)
Multicast		
	IGMP Snooping (v1, v2, v3) with support for querier	RFC 1112, 2236, 3376
DHCP Client		
	DHCP relay agent	RFC 2131
	DHCP Option 82	RFC 2131
	DHCP Option 82	RFC 3046
Alarm		
	Alarms via E-Mail (SMTP) and SNMP Traps	
	Signalling contact for low voltage detection or Link break	
Diagnostic		
	Port Mirroring	
	Switch History	
	MAC Address Table RMON (1,2,3 & 9 groups)	RFC 2819
Management		
	Password protected Web-Management interface SNMP (v1, v2c, v3) agent & MIB support	RFC 1155, 1157, 1212, 1213, 1215, 2089, 2578, 3411, 3412, 3413, 3414, 3415, 3416, 3417, 3584
	Command Line Interface (CLI)	
	Pluggable SD card for saving of configuration [1)]	
	Multifunction button [1)]	

[1)] Available for Ha-VIS mCon 3000 Next Generation

[2)] Licensing via separately available SD card

VII-2.4 Switches

HARTING offers switches with different functional classes as derived from their corresponding area of use.

Table VII-2.2
Overview of Ethernet Switches

Functional classification / Switch series	Features
Ha-VIS eCon Basic functions (unmanaged)	• Ethernet Switch per IEEE 802.3 • Fast Ethernet (100 Mbit/s), Gigabit Ethernet (1000 Mbit/s) • Store-and-forward switching mode • Auto-Negotiation / Auto-Crossing / Auto-Polarity • Up to 10 ports (copper and fibre-optic), M12 and RJ45
Ha-VIS sCon Conconfigurable functions (configurable)	• Port characteristics and functions can easily be configured via the USB port • For example, redundancy (parallel or ring) • Up to 10 ports (copper and fibre-optic)
Ha-VIS mCon Management functions (managed)	• Management Services (IGMP Snooping, QoS, VLAN, RSTP, 802.1x, Link Aggregation, DHCP Option 82) • Web Management • SNMP Management • Up to 10 ports (copper and fibre-optic)

The switch is specially designed for use in rolling stock applications. It complies with the requirements of EN 50 155 regarding EMC, temperature range and mechanical stability.

Table VII-2.3
Overview of active network components

Function class	Series	Features	Product photo
Un-managed	Ha-VIS eCon 2000	• 3x / 4x / 5x / 8x 10 /100Base-T(X) RJ45 • PoE variants • Robust metal housing, IP30 • Mounting on top-hat rail • Low profile • E1 certificate for use in buses	
	Ha-VIS eCon 3000	• 8x 10 /100Base-T(X) RJ45 • PoE variants • Robust metal housing, IP30 • Mounting on top-hat rail • Compact and thin design • E1 certificate for use in buses	
	Ha-VIS eCon 4000	• 8x 10 /100Base-T(X) Ports (M12 D-coded) • Gigabit uplink Ports (X-coded) • 110 V DC and PoE variants • Robust metal housing, IP30 / IP40 • E1 certificate for use in buses	
	Ha-VIS eCon 7000	• 5x / 10x ports (M12 D-coded) • Robust metal (die-cast zinc) housing, IP65 / IP67	
	Ha-VIS eCon 9000	• 7x/ 8x 10/100Base-T(X) ports (M12 D-coded) • Robust metal housing, IP30 • 19-inch mounting • Compact and thin design • E1 certificate for use in buses	

Function class	Series	Features	Product photo
Un-managed, can be configured via USB port	Ha-VIS sCon 3000	• 6x/ 8x/ 10x 10/100Base-T(X) RJ 45 ports • Variants with 2x 10/100/1000Base-T(X) or 2x/ 3x 100Base-FX ports • Robust metal housing, IP30 • Mounting on top-hat rail • Ring redundancy and / or parallel redundancy	
Managed	Ha-VIS mCon 3000	• 6x/ 8x/ 10x 10/100Base-T(X) RJ 45 ports • Variants with 2x 10/100/1000Base-T(X) or 2x/ 3x 100Base-FX ports • Robust metal housing, IP30 • Mounting on top-hat rail	
	Ha-VIS mCon 3000 NG	• 8x/ 10x 10/100Base-T(X) RJ 45 ports • Gigabit uplink ports RJ45 and SFP modules • Robust metal housing, IP30 • Mounting on top-hat rail	
	Ha-VIS mCon 4000	• 8x 10 /100Base-T(X) Ports (M12 D-coded) • Gigabit uplink Ports (X-coded) • 110 V DC and PoE variants • Robust metal housing, IP30 / IP40	
	Ha-VIS mCon 7000	• 5x/ 10x 10/100Base-T(X) ports (M12 D-coded) • Robust metal (die-cast zinc) housing, IP65 / IP67	
	Ha-VIS mCon 9000	• 7x/ 8x 10/100Base-T(X) ports (M12 D-coded) • Robust metal housing, IP30 • 19-inch mounting • Compact and thin design	

Table VII-2.4
Overview of connectors for the cable side

Product	Features	Product photo
M12- circular connector	Male, D-coded Crimp termination Clamping range: 7 – 8.8 mm Use with D-Sub contacts	
HARAX® M12-L, screened	Male, D-coded 0.14 – 0.34 mm² (AWG 26 – 22) 0.34 – 0.5 mm² (AWG 22 – 20) IDC termination	
Han® 3 A RJ45	Can be fabricated on site by using IDC technology Wire gauge: AWG 27 / 7 – 22 / 1 Outer diameter of cable: 6.0 – 9.0 mm Degree of protection: IP65 / IP67	
HARTING RJ Industrial	Can be fabricated on site by using IDC technology Wire gauge: AWG 27 / 7 – 22 / 1 Outer diameter of cable: 4.5 – 9.0 mm Degree of protection: IP20	

VII

Table VII-2.5
Overview of panel feed-through and device interfaces

Product	Features	Product photo
M12 panel feed- through for installati- on outdoors	Female, D-coded, shielded, 360 mm cable[1)], AWG 26, 4-pole	
M12 panel feed- through for installati- on indoors	Female, D-coded, shielded, 700 mm cable[1)], AWG 20, 4-pole	
HARAX® panel feed- through	Female, D-coded	
D-Sub	Male multi-point connector, crimp contacts, 9-pole	
M12 PCB adapter	Female, D-coded, angled, 4-pole	

[1)] Additional lengths available on request.

Table VII-2.6
Overview of connectors for wagon couplings

Product	Features	Product photo
Han® HPR hood	Housing suitable for harsher climatic requirements (IP69K). Available in different sizes, with straight or angled cable outlets.	
Han® 10 A bulkhead mounted housing	Housing suitable for harsher climatic requirements (IP69K). Available in different sizes.	
Han-Quintax® module	Module for two shielded Quintax contacts, 4- or 8-poles. Only the 4-pole contacts are suitable for Ethernet Cat.5e and the transmission of CAN-Bus, MVB, PROFIBUS, etc.	
Han® Megabit module	2x 4-pole module for 2x Ethernet cat. 5e and MVB transfer in a single module. 360° shielding. Gold-plated standard Han® D crimp contacts	
Han® Gigabit module	8-pole module, 360° shielding, Ethernet Cat. 6A – standard turned D-Sub contacts. Mechanically robust module. Captive screws.	

VII-3 System cables

Figure VII-3.1
M12 system cable

The user has the following options to use HARTING's system cables: They can order the approved cable for the rail industry from HARTING in lengths from 20 to 500 metres and do the fabrication themselves.

For users who prefer to have completely fabricated and tested cables, HARTING offers system cables in different lengths. Customer-specific lengths can also be provided. The following variants with pre-assembled connectors are available from HARTING:

- M12 both ends
- M12 – Han® 3 A RJ45
- M12 – HARTING RJ Industrial
- HARTING RJ Industrial both ends

Additional variants are available on request.

Special cable assemblies intended for use in wagon couplings are also part of the HARTING product portfolio. Such assemblies are produced in close cooperation with the customer and in accordance with customer diagrams and any required testing. HARTING is well positioned globally with ten different production sites. This permits us to offer locally produced items and to shorten the supply path.

Figure VII-3.2
Wagon-coupling cable, HPR version

VIII – Customer-Specific Solutions

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VIII-1 Introduction

Modern railway vehicles have a more modular design and so are often manufactured in separate component assemblies at different locations. Modern railway vehicles must also be outfitted and equipped for global use. Vehicular solutions for customers must often be customized so that they comply with the growing number of requirements.

It is not always sufficient to rely only on the line of standardized products. Instead there is an increasing demand for “problem solvers”: tailored components or systems that can fulfil custom requirements in a quick and reliable manner.

These systems are put together from standard components, modifications and completely new innovations.

The customer-specific solutions from HARTING can deliver simplified handling with initial commissioning tailored to customer needs. They can also provide complex products and systems with integrated custom-tailored design. A wide range of engineering tasks are also taken into account during the product design phases.

We take advantage of our team of engineers, professional graphic designers and our own high-quality accredited laboratory so that we can deliver the best solutions for our customers. Materials are also procured independently and in accordance with customer requirements. This provides our customers with a level of flexibility that is extraordinary.

The most important requirement is to achieve outstanding quality and reliability.

VIII-2 Wagon-to-wagon cable assembly

A variety of different data, signal and power lines run through railway vehicles. The wagon couplings between rail vehicles are a vital component of this “central nervous system”.

A large number of components – such as the internal MVB rail bus, the low-voltage power supply, the power transmission for the battery or air conditioning, and the video signal transmission – must be properly connected.

The connectivity solution must be pluggable, because service technicians need to disconnect the cables during maintenance.

HARTING has designed and implemented a wagon-to-wagon cable assembly in cooperation with several of our railway customers. We are a single-source provider – starting with CAD-based design all the way to quality-certified delivery. The complete pre-assembled and tested wagon-to-wagon cable solution includes the following:

- Connectors
- Cable glands
- System cable
- Protective cable tubes
- Mechanical hanger and strain relief, in part with special lever systems
- Stainless-steel connector plate with strain relief mechanism
- Complete assembly
- Electrical inspection
- Suitable packaging for transport

The wagon couplings on the interior and exterior of a train are subject to different requirements. The requirements concerning water and dust protection for an interior installation are not as strict as for an exterior application. Systems with IP20 protection can be used for the wagon couplings used in wagon interiors, but by keeping mechanical robustness of an IP68 solution. For exterior systems, up to IP68 protection is typically used.

Figure VIII-2.1
Total Inter Car Jumper Assembly

Figure VIII-2.2
Open HPR hoods with support panel

Figure VIII-2.3
Coupling between the wagons

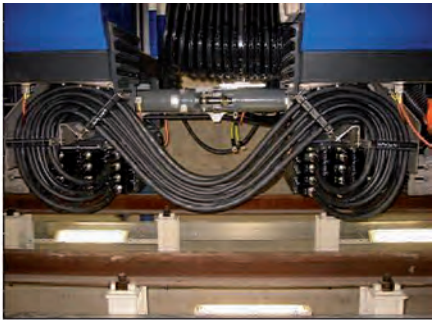

Figure VIII-2.4
Wagon coupling mounted from the side / below

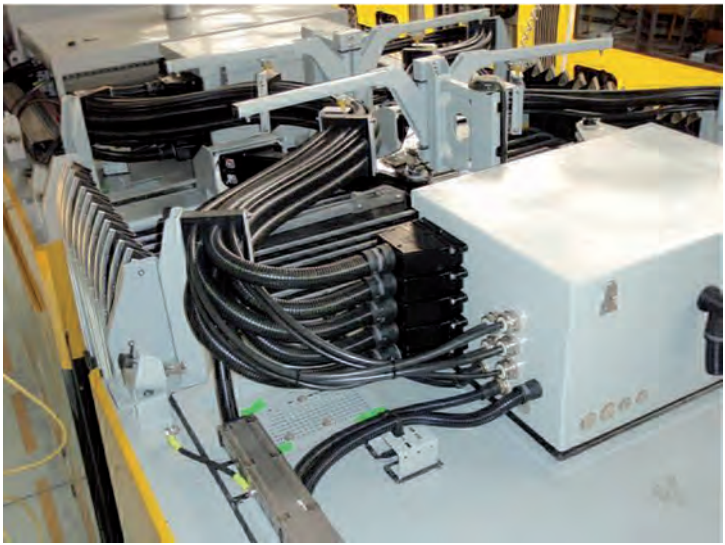

Figure VIII-2.5
Wagon coupling installed on roof

VIII-3 Special housings

Special housing solutions are often required to satisfy technical requirements or unusual installation situations. These solutions include such modifications as additional drilled holes in existing housing, special surface handling or new housing shapes.

Figure VIII-3.1
Open housing in IP20

Figure VIII-3.2
Housing with custom-drilled holes

Figure VIII-3.3
Housing with riveted PE earthing stud

Figure VIII-3.4
Housing with custom modification

Figure VIII-3.5
Multi-distributor housing in IP65

VIII-4 MVB / WTB Service Box

The Multifunction Vehicle Bus (MVB) is used as a Fieldbus for data exchange within a railway vehicle. It is often used in conjunction with the Wire Train Bus (WTB) for data exchange throughout the entire train. HARTING has developed the MVB / WTB Service Box as a quick and easy solution for testing these communication networks and for switching them off during maintenance. The Service Box is shown in the network topology as a T-junction pick-off. The corresponding assembled cables can also be ordered for the box.

Figure VIII-4.1
MVB / WTB Service Box

Since the mid-nineties, the MVB has been used for the Fieldbus in vehicles manufactured by ABB, Adtranz, AEG, Bombardier and Siemens. The MVB connects all key control mechanisms in the vehicle including: drive controllers, inputs/outputs, the driver's control displays, decentralized door controls, auxiliary inverters, climate control systems, centralized control devices and the train safety system.

VIII-5 Junction and distributor box

The junction and distributor box shown below is offered by HARTING as a unit which is completely assembled, wired and tested. On the bulkhead mounting side, this unit is already fitted with connectors for the different interfaces. The junction and distributor box is completely wired up inside based on the project requirements. Completely assembled cables can be used to plug into the unit.
The plug & play installation is thus significantly simplified and accelerated.

Figure VIII-5.1
Stainless-steel distributor box, Heavy Duty Connectors and pre-assembled D-Sub cables

VIII-6 Customized metal panel processing and electronic fittings

The space for electronics on-board a train is quite limited. The best use of this limited space must be determined in the planning and implementation phases of a project. Sometimes, electrical cabinets and distributors must be custom designed to fit the environmental surroundings.
A good example of such a system solution is the complete electrical cabinet integrated into the front of a locomotive which HARTING provided for the Vossloh MaK 1000 BB. HARTING was the single source for all the panel work, assembly, professional testing and also procured the third-party materials for the electrical installation.
The modern and precise manufacturing facilities at HARTING are well suited for sheet metal processing and customized production of electrical cabinets, boxes and consoles.

Figure VIII-6.1
Vossloh Locomotive MaK 1000 BB

Figure VIII-6.2
Front of the vehicle
MaK 1000 BB

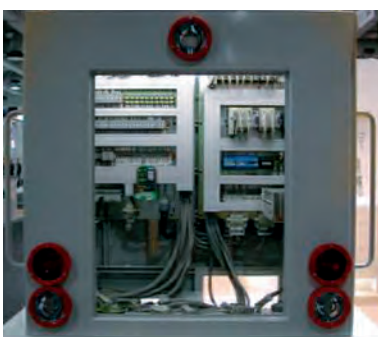

Figure VIII-6.3
Front of vehicle with opened electrical cabinet

VIII-7 Interior Cabling for rail vehicles

HARTING service does not end after we have delivered the connectors – it also includes a wide range of engineering and assembly services which take individual customer requirements into account. Complete cable assemblies for vehicles can also be made.

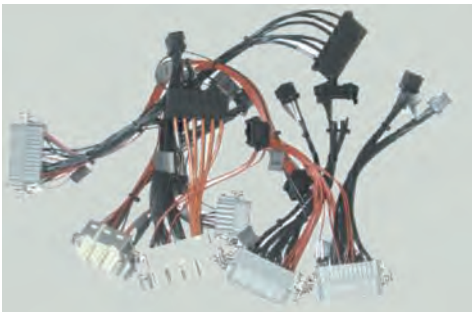

Figure VIII-7.1
Sample cable harness

Figure VIII-7.2
Assembled connectors

VIII-8 Connector sets and accessories

Electrical junctions are typically made up of many components which all have to be ordered separately. HARTING offer custom sets which include all components necessary for creating an electrical connection. The actual grouping of components is tailored to the corresponding project and is optimized for on-site installation. Customer-specific labelling of packaging is also an option. Such tailored sets provide a simplified ordering mechanism and eliminate the risk of errors. They also help to save time when using the products.

Figure VIII-8.1
Packaging in sets for the Han® connector

Figure VIII-8.2
Example of package sets for the System Box

VIII-9 Customized printed circuit boards

VIII-9.1 Introduction

HARTING Integrated Solutions (HIS) is the Global Business Unit for custom designed PCB applications. The spectrum covers:

- Backplane design
- High-speed backplanes
- Signal integrity testing
- Mechanical design
- Sub-Rack manufacture
- Han® on the backplane and distribution board
- Box design and build

Figure VIII 9.1
Customized Rack for Signaling

VIII-9.2 HARTING Integrated Solutions in the Railway Industry

HIS covers many applications in the Railway Industry, both on-board trains and stationary, including the supply of assemblies using EN 45545-2 compatible connectors.

The specialisation in reducing space, weight as well as increasing the reliability of products by using PCB-based solutions, both for signal and power, is a user benefit.

Typical Railway applications are:

- Interlocking
- Relay control
- Passenger information systems
- Rail Control Systems (CBTC/ ERMTS)
- Bogie control

VIII-9.3 Example Applications

VIII-9.3.1 Large backplane assembly for on-board relay control

Confusing and complex wiring could be structured through backplane solutions, this saves space and weight.
Thus, the installation time is significantly reduced for initial fitting as well as servicing.

Short re-design time

less:
- time
- wiring
- weight
- space requirements
- service time

enhanced:
- availability

Figure VIII-9.2
PCB for cabinets

VIII-9.3.2 3U relay subrack

HARTING converted this assembly from individually rack-mounted connectors which were hard wired to rear I/O connectors, to a backplane that includes the I/O connectors directly on the rear face, thereby removing all of the wiring.

Figure VIII-9.3
3U relay Sub-Rack

VIII-9.3.3 Backplane for Bogie management

Small, simple backplane for Bogie management, using DIN 41612 and har-bus® HM 2mm connectors. Conformally coated for protection against pollution, as are many backplanes in the Railway industry.

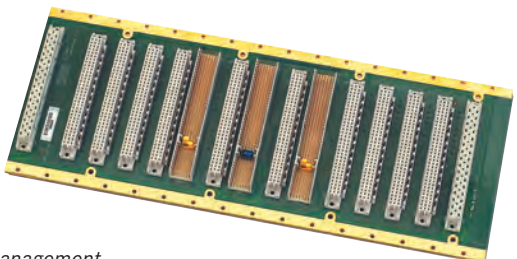

Figure VIII-9.4
Backplane for Bogie management

VIII-9.3.4 6U backplane assembly

Busy, 6U backplane assembly equipped with I/O cable connectors that are directly mounted on the rear of the board.

These backplane assembly provides the same functionality as hard-wired interfaces, but adds the option to use bench made and tested cable assemblies thus reducing installation time.

Complex and unreliable hard-wiring has been converted into reliable, repeatable and pre-tested components.

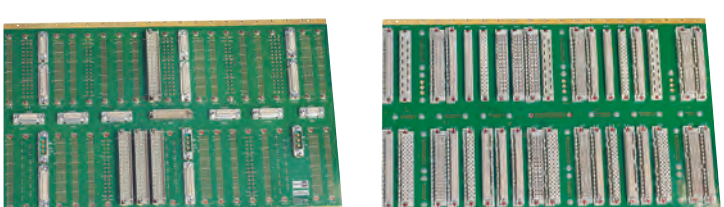

Figure VIII-9.5
6U backplane assembly

VIII-9.3.5 Distribution boxes for Pullman carriages

These boxes distribute all electrical functions, such as illumination and loudspeaker, via HARTING Han® connectors, to the sleeper cars.

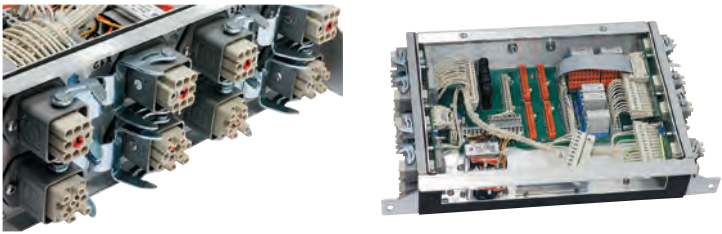

Figure VIII-9.6
Distribution box with Han® 3A connectors

VIII-9.4 Relevant Approvals

- ISO 9002 – 2008
- IRIS – Railway approval
- IPC 610 – all assemblies to level III (highest)

IX – Selected Standards Relevant to Railway Applications

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IX-1 Introduction

Often generally applicable standards are just as important for railway applications as the standards which are only applicable in the railway environment. The following are selected standards, regulations and requirements which are relevant in practice and in accordance with which HARTING connectors are developed, designed, manufactured and tested.

IX-2 General standards for connectors

The design of connectors and their termination techniques is based on international standards.

Interface / DIN connector:

D-Sub:

• DIN 41 652	Connectors for plug-in boards
• CECC 75 301-802	Harmonized system of quality assessment for electronic components
• IEC 60 807	Rectangular connectors for frequencies below 3 MHz

DIN 41 612:

• IEC 60 603-2	Connectors for printed circuits for frequencies below 3 MHz

Industrial connectors:

• IEC 61 984	Connectors – Safety requirements and tests
• IEC 60 664-1	Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests
• DIN EN 175 301-801	Detailed specification – high-pole rectangular connectors with round replaceable crimp contacts (for contact inserts from the Han® D series (except for Han® 7 D) and standard housings sized 10 A, 16 A, 16 B and 24 B).
• DIN EN 60 529	Degrees of protection provided by enclosures (IP code)
• NF F 61 030	Matériel roulant ferroviaire – Connecteurs électriques – Généralités (Avril 1992)

Termination technique:

- DIN IEC 60 352-2 — Solder-free connections – Part 2: Crimp connections; general requirements, testing methods and usage notes (crimp wire connection)
- DIN IEC 60 352- 3 — Solder-free electrical connections – Part 3: Solder-free accessible insulation displacement connections
- DIN EN 60 999 — Connection material (torque, screw connection)
- DIN 46 235 — Cable lugs for compression connections; cover plate type for copper conductors

IX-3 Railway-related standards

When considering the rail compatibility of components, the technical compliance with the requirements of many different standards is what is meant. In Europe, these are brought together in the overall standard, EN 50 155. Even though this is a European standard, this standard is also often used outside Europe in tender processes.
As far as connectors are concerned, the standard itself, however, is not fully comprehensive. Due to this, improvements were made and EN 50 467 “Railway applications – Vehicles – Electrical connectors, requirements and test procedures” was created and published in 2012. This is now the applicable standard. In relation to termination techniques, EN 50 467 encompasses many more variants (IDC technique, cage clamp terminal, press-in technology) than EN 50 155, which applies for electronic systems in rail vehicles. Although EN 50 155 refers to test procedures, in relation to electromagnetic compatibility (EMC), environment (cold, humidity, warmth), protective classes, shock and vibration, EN 50 467 has much more detail in the form of the differences for the test requirements on connectors depending on their installation location.

Selected excerpts from EN 50 467:

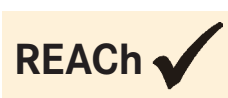
- Protection against incorrect mating — EN 60 512
- Protection against electric shock — EN 61 984:2001; EN 50 153
- Earthing devices
- Locking
- IP degree of protection — EN 60 529
- Service life
- Shock and vibration — EN 61 373
- Corrosion protection
- Behaviour in a fire

Selected standards referenced from EN 50 155:

- Shock and vibration: EN 61 373, Category 1 b by default, Category 2 on request
- Environmental testing: IEC 60 068
- Electromagnetic compatibility (EMC): EN 50 121, EN 61 000-4-4

IX-4 HARTING Product Compliance

Even though the “Restrictions of the Use of Certain Hazardous Substances” (RoHS) do not apply for means of transportation for passengers or goods, all HARTING products meet the full requirements of this directive.



All HARTING products meet the requirements of REACH and are SVHC free (Substances of Very High Concern). The advantage for our customers is that the requirement to provide information to third parties, which is very time-consuming, is not necessary!

HARTING KGaA is aligned with the use of conflict materials and has been successfully audited by DQS in accordance with section 1052 of the Dodd-Frank Act. The EICC-GeSI format declaration, with details of the smelters used, can be provided on request.

IX-5 Business-related certificates

- Quality management system in compliance with ISO 9001:2008
- Environmental management in compliance with ISO 14 001
- IRIS certification (International Railway Industry Standard)

These certifications are updated in rotation. A copy can be issued on request.

IRIS Certification

C E R T I F I C A T E

awarded to

HARTING Electric GmbH & Co KG
Wilhelm-Harting-Strasse 1
32339 Espelkamp
Germany

confirms, as an IRIS approved certification body, that the Management System of the above organization has been assessed and found to be in accordance with the

International Railway Industry Standard (IRIS) Revision 02, May 2009

for the activity of Design and development & Manufacturing
for the scopes of certification 12 (Cabling and cabinets)
for the products of industrial connectors, Interface- and PCB connectors, cable assemblies, Fibreoptics systems and components

Certificate valid from: 05/04/2014

Certificate valid until: 04/04/2017 *

G. Blechschmidt

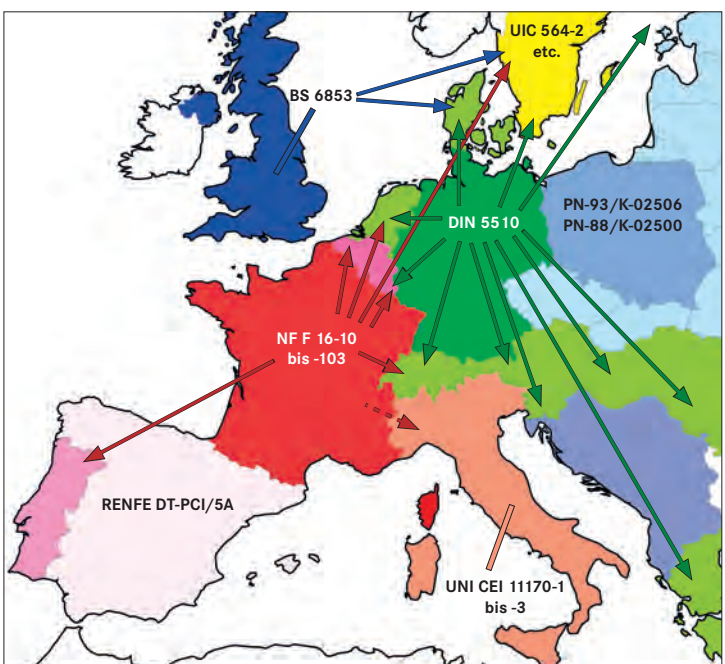
Current date: 07/04/2014
Certificate-Register-No.: 241244 IRIS

* Providing that the subsequent surveillance audits are successful before the anniversary of this validity date.

IX-6 Flammability directives

Trains are considered one of the safest modes of transportation throughout the world. Standards governing flammability protection are a significant contribution to this safety record. To avoid, or at least minimise, harmful effects on people, the following properties of flammable materials must be met in particular.

1. The materials must be inflammable so that a fire does not spread easily.
2. The smoke produced by a fire must be as non-toxic as possible and transparent to reduce the risk of suffocation and to keep the escape routes visible.
3. In special areas, the products must be fire resistant, this is also to prevent a fire spreading in the train.



Since 2013, the current European flammability directive is EN 45545:2013. After a transition period, this will replace the national standards, for example: NFF 16-101 / 102, UNI CEI 11 170-1 to 3, BS 6853 or DIN 5510-2.

To take the different series and operating classes of rail vehicles into account, EN 45 545 defines three hazard levels (HL). The requirements are lowest at HL 1, and highest at HL 3. HARTING complies with the highest level in almost all of its rail products. For connectors, the requirement paragraphs R22, R23 and R24 define the tests which are to be performed. The limit values contained in the requirement paragraph R22 are the most strict since they apply to installation inside the train. It calls for proof of the oxygen index, the smoke density and the smoke toxicity. For installations between two fire compartments, a resistance against fire for 10 minutes (E 10) is required for technical spaces up to 2 m^3 in volume, and for 15 minutes (E 15) for technical spaces over 2 m^3. Han® housings meet the maximum requirement of 15 minutes and offer an enormous safety buffer above this in addition.

For small electrical components, listed in the standard under “EL 10”, such as electronic connectors (M12, D-Sub, SEK, etc.), rail-mounted terminals or fuses, evidence must be provided that the criterion “V0” in compliance with EN 60 695-11-10 or UL 94 has been met to comply with the defined requirement paragraph R26.

For flammable materials whose mass is under 10 g, no evidence must be provided. The so-called grouping rule encompasses flammable and non-tested materials which lie closer than 20 mm in the vertical direction and 200 mm in the horizontal direction to each other. Due to this rule, the limit value can be increased to 100 g for the internal area and 400 g for the external area of the vehicle.

Test	Para-meter	Unit	Limit value (R 22)			HARTING (polycarbonate)
Oxygen index	OI	%	HL1: 28	HL2: 28	HL3: 32	R 22, R 24 = HL3
Smoke density	D_s max.	non-dimensional	HL1: 600	HL2: 300	HL3: 150	R 22 = HL3
Smoke toxicity	CIT_{HLP}	non-dimensional	HL1: 1.2	HL2: 0.9	HL3: 0.75	R 22 = HL3

Table IX-1
Tests and limit values i.a.w. EN 45545-2

If surfaces of non-flammable components (e.g. made of metal or glass surfaces) are coated in organic materials (i.e. flammable materials), these components must also be tested in compliance with ISO 5658-2 or EN ISO 9239-1. The heat released and the smoke generated or toxicity of the smoke must only be certified when the nominal coating thickness is larger than 0.15 mm for components in the internal area or larger than 0.3 mm for components on the outside. The coatings on HARTING connectors also meet these requirements with a large safety factor.

IX-6.1 Standards for the North American market

Conformity with further specialised standards is often required for the North American rail market. Connectors are often not directly considered in these standards, so there is not compatibility in every point. In principle, there are also material requirements in connection with the smoke density, the smoke toxicity, the heat released and flame propagation.

The main standards are:

- ASTM E 662 – Smoke density
- ASTM E 162 – Flame propagation
- ASTM E 1354 – Heat release
- BSS 7239 – Smoke toxicity
- SMP 800 – Smoke toxicity

NFPA 130 brings all the requirements together. Here too, HARTING offers its customers comprehensive certification and evidence.

IX-6.2 Fire loads

A further safety element in the train is that the vehicle manufacturer must determine and specify the total fire load, that is to say the total weight of all flammable materials. HARTING provides tables (also in MS Excel format, for example) to support the respective project-related fire load calculation. The fire loads for the most popular products are listed in the following table. These details can be provided for all other products on request.

Table IX-2
Han® industrial connectors

Part number	Short description	Material	Total weight [kg]	Weight of flammable portion [kg]	Heating value [MJ/kg]	Thermal fire load heating value * weight (flammable portion) [MJ]	Standards met
09 11 001 2650	Han 1HC-sti-AX (350 A, 20-35 mm²)	polyamide	0.164	0.032	16	0.512	EN 45545, UL94 V0
09 11 001 2651	Han 1HC-sti-AX (350 A, 35-70 mm²)	polyamide	0.16	0.032	16	0.512	EN 45545, UL94 V0
09 11 001 2652	Han 1HC-sti-AX (350 A, 95-120 mm²)	polyamide	0.152	0.032	16	0.512	EN 45545, UL94 V0
09 11 001 2655	Han 1HC-sti-s-M10 350 A	polyamide	0.268	0.032	16	0.512	EN 45545, UL94 V0
09 11 001 2670	Han 1HC-Sti-Ax 650 A, 60-70 mm²	polyamide	0.356	0.052	16	0.832	EN 45545, UL94 V0
09 11 001 2671	Han 1HC-Sti-Ax 650 A, 70-120 mm²	polyamide	0.356	0.052	16	0.832	EN 45545, UL94 V0
09 11 001 2672	Han 1HC-Sti-Ax 650 A, 150-185 mm²	polyamide	0.34	0.052	16	0.832	EN 45545, UL94 V0
09 11 001 2675	Han 1HC-Sti-S-M12, 650 A	polyamide	0.533	0.052	16	0.832	EN 45545, UL94 V0
09 11 001 2750	Han 1HC-bu-AX (350 A, 20-35 mm²)	polyamide	0.173	0.034	16	0.544	EN 45545, UL94 V0
09 11 001 2751	Han 1HC-bu-AX (350 A, 35-70 mm²)	polyamide	0.172	0.034	16	0.544	EN 45545, UL94 V0
09 11 001 2752	Han 1HC-bu-AX (350 A, 95-120 mm²)	polyamide	0.165	0.034	16	0.544	EN 45545, UL94 V0
09 11 001 2755	Han 1HC-bu-s-M10 350 A	polyamide	0.229	0.034	16	0.544	EN 45545, UL94 V0
09 11 001 2770	Han 1HC-Bu-Ax 650 A, 60-70 mm²	polyamide	0.315	0.053	16	0.848	EN 45545, UL94 V0

Part number	Short description	Material	Total weight [kg]	Weight of flammable portion [kg]	Heating value [MJ/kg]	Thermal fire load heating value * weight (flammable portion) [MJ]	Standards met
09 11 001 2771	Han 1HC-Bu-Ax 650 A, 70-120 mm^2	polyamide	0.315	0.053	16	0.848	EN 45545, UL94 V0
09 11 001 2772	Han 1HC-Bu-Ax 650 A, 150-185 mm^2	polyamide	0.298	0.053	16	0.848	EN 45545, UL94 V0
09 11 001 2775	Han 1HC-Bu-S-M12, 650 A	polyamide	0.483	0.053	16	0.848	EN 45545, UL94 V0
09 11 001 3001	Han HC Modular 350 crimp, male	polyamide polycarbonate	0.033	0.03 0.004	16 23.9	0.48 0.096	EN 45545, UL94 V0 EN 45545, UL94 V0, NFF16101
09 11 001 3101	Han HC Modular 350 crimp, female	polyamide polycarbonate	0.035	0.031 0.004	16 23.9	0.496 0.096	EN 45545, UL94 V0 EN 45545, UL94 V0, NFF16101
09 11 001 3011	Han HC Modular 650 crimp, male	polyamide polycarbonate	0.052	0.044 0.008	16 23.9	0.704 0.191	EN 45545, UL94 V0 EN 45545, UL94 V0, NFF16101
09 11 001 3111	Han HC Modular 650 crimp, female	polyamide polycarbonate	0.05	0.042 0.008	16 23.9	0.672 0.191	EN 45545, UL94 V0 EN 45545, UL94 V0, NFF16101
09 11 001 3021	Han HC Modular 250 crimp, male	polycarbonate	0.014	0.014	23.9	0.335	EN 45545, UL94 V0, NFF16101
09 11 001 3121	Han HC Modular 250 crimp, female	polycarbonate	0.014	0.014	23.9	0.335	EN 45545, UL94 V0, NFF16101
09 12 002 2651	Han Q 2 / 0-sti	polycarbonate	0.029	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 12 002 2652	Han Q 2 / 0-m High Voltage	polycarbonate	0.031	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 12 002 2751	Han Q 2 / 0-bu	polycarbonate	0.024	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 12 002 2752	Han Q 2 / 0-f High Voltage	polycarbonate	0.026	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 12 005 3001	Han Q 5 / 0-M-C	polycarbonate	0.013	0.008	23.9	0.191	EN 45545, UL94 V0, NFF16101
09 12 005 3101	Han Q 5 / 0-F	polycarbonate	0.014	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 12 007 3001	Han Q 7 / 0-M	polycarbonate	0.014	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 12 007 3101	Han Q 7 / 0-F	polycarbonate	0.014	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 12 012 3001	Han Q12-M-QL	polycarbonate	0.015	0.013	23.9	0.311	EN 45545, UL94 V0, NFF16101
09 12 012 3101	Han Q12-F-QL	polycarbonate	0.018	0.016	23.9	0.382	EN 45545, UL94 V0, NFF16101
09 14 001 3001	Han 200 A Crimp module, male	polycarbonate	0.019	0.019	23.9	0.454	EN 45545, UL94 V0, NFF16101

Part number	Short description	Material	Total weight [kg]	Weight of flammable portion [kg]	Heating value [MJ/kg]	Thermal fire load heating value * weight (flammable portion) [MJ]	Standards met
09 14 001 3101	Han 200 A crimp module, female	polycarbonate	0.019	0.019	23.9	0.454	UL94 V0, DIN5510, NFF16101
09 14 001 3011	Han module adapter, male	polycarbonate	0.007	0.007	23.9	0.171	EN 45545, UL94 V0
09 14 001 3111	Han module adapter, female	polycarbonate	0.005	0.005	23.9	0.112	EN 45545, UL94 V0
09 14 001 3031	Han 100 A Single module, male	polycarbonate	0.01	0.01	23.9	0.246	EN 45545, UL 94 V0
09 14 001 3131	Han 100 A Single module, female	polycarbonate	0.01	0.01	23.9	0.228	EN 45545, UL 94 V0
09 14 001 0421	Han-Modular ECO, Hood, IP65	polycarbonate	0.045	0.032	23.9	0.765	EN 45545, UL94 V0, NFF16101
09 14 001 0423	Han-Modular ECO, Hood, IP20	polycarbonate	0.031	0.03	23.9	0.717	EN 45545, UL94 V0, NFF16101
09 14 001 0321	Han-Modular ECO, Housing	polycarbonate	0.013	0.013	23.9	0.311	EN 45545, UL94 V0, NFF16101
09 14 000 9950	Han MOD DUMMY	polycarbonate	0.005	0.005	23.9	0.12	EN 45545, UL94 V0, NFF16101
09 14 002 2601	Han 2 MOD STI-S 40 A	polycarbonate	0.027	0.012	23.9	0.287	EN 45545, UL94 V0, NFF16101
09 14 002 3002	Han 2 MOD 40 A, crimp, male	polycarbonate	0.012	0.012	23.9	0.287	EN 45545, UL94 V0, NFF16101
09 14 002 3102	Han 2 MOD 40 A, crimp, female	polycarbonate	0.011	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 002 2641	Han 2 MOD-M-AX 70 A, 6-16 mm^2	polycarbonate	0.032	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 002 2651	Han 2 MOD STI-S 100 A / 16-35 mm^2	polycarbonate	0.069	0.023	23.9	0.55	EN 45545, UL94 V0, NFF16101
09 14 002 2653	Han 2 MOD STI-S 100 A / 10-25 mm^2	polycarbonate	0.07	0.023	23.9	0.55	EN 45545, UL94 V0, NFF16101
09 14 002 2701	Han 2 MOD BU-S 40 A	polycarbonate	0.025	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 002 2741	Han 2 Mod-F-AX 70 A, 6-16 mm^2	polycarbonate	0.03	0.01	23.9	0.239	EN 45545, UL94 V0, NFF16101
09 14 002 2751	Han 2 MOD BU-S 100 A / 16-35 mm^2	polycarbonate	0.072	0.027	23.9	0.645	EN 45545, UL94 V0, NFF16101
09 14 002 2753	Han 2 MOD BU-S 100 A / 10-25 mm^2	polycarbonate	0.074	0.027	23.9	0.645	EN 45545, UL94 V0, NFF16101
09 14 002 3051	Han 2 MOD 100 A, crimp, male	polycarbonate	0.018	0.018	23.9	0.43	EN 45545, UL94 V0, NFF16101
09 14 002 3151	Han 2 MOD 100 A, crimp, female	polycarbonate	0.021	0.021	23.9	0.502	EN 45545, UL94 V0, NFF16101
09 14 002 3001	Han 2 / 4 MOD STI-C QUINTAX	polycarbonate	0.014	0.014	23.9	0.335	EN 45545, UL94 V0, NFF16101

Part number	Short description	Material	Total weight [kg]	Weight of flammable portion [kg]	Heating value [MJ/kg]	Thermal fire load heating value * weight (flammable portion) [MJ]	Standards met
09 14 002 3101	Han 2 / 4 MOD BU-C QUINTAX	polycarbonate	0.015	0.015	23.9	0.359	EN 45545, UL94 V0, NFF16101
09 14 003 2601	Han 3 Mod-M-s 40 A	polycarbonate	0.033	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 003 2602	Han 3 Mod-M-s 40 A 10 mm²	polycarbonate	0.032	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 003 2701	Han 3 Mod-F-s 40 A	polycarbonate	0.031	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 003 2702	Han 3 Mod-F-s 40 A 10 mm²	polycarbonate	0.03	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 003 3001	Han 3 MOD STI-C 40 A	polycarbonate	0.014	0.014	23.9	0.335	EN 45545, UL94 V0, NFF16101
09 14 003 3002	Han 3 MOD STI-C 40 A	polycarbonate	0.015	0.015	23.9	0.359	EN 45545, UL94 V0, NFF16101
09 14 003 3101	Han 3 MOD BU-C 40 A	polycarbonate	0.013	0.013	23.9	0.311	EN 45545, UL94 V0, NFF16101
09 14 003 3102	Han 3 MOD BU-C 40 A	polycarbonate	0.015	0.015	23.9	0.359	EN 45545, UL94 V0, NFF16101
09 14 004 4501	Han 4 MOD STI-C KOAX	polycarbonate	0.008	0.008	23.9	0.191	EN 45545, UL94 V0, NFF16101
09 14 004 4512	Han 4 MOD BU-C KOAX 2-part	polycarbonate	0.008	0.008	23.9	0.191	EN 45545, UL94 V0, NFF16101
09 14 004 4513	Han 4 MOD BU-C KOAX 2-part (f.RG58)	polycarbonate	0.009	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 14 004 4701	Han SC module, male	polycarbonate	0.009	0.007	23.9	0.166	EN 45545, UL 94 V0
09 14 004 4711	Han SC module, female with 4 ferrules	polycarbonate	0.011	0.007	23.9	0.17	EN 45545, UL 94 V0
09 14 005 2616	Han 5 Mod M-ES 16A	polycarbonate	0.018	0.008	23.9	0.191	EN 45545, UL94 V0, NFF16101
09 14 005 2716	Han 5 Mod F-ES 16A	polycarbonate	0.017	0.007	23.9	0.167	EN 45545, UL94 V0, NFF16101
09 14 006 3001	Han 6 Mod M-c 16A	polycarbonate	0.01	0.01	23.9	0.239	EN 45545, UL94 V0, NFF16101
09 14 006 3041	Han 6 Mod M-C, finger safe	polycarbonate	0.012	0.012	23.9	0.287	EN 45545, UL94 V0, NFF16101
09 14 006 3101	Han 6 Mod F-c 16A	polycarbonate	0.011	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 006 3141	Han 6 Mod F-C, finger safe	polycarbonate	0.011	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 008 3001	Han 8 Mod sti-c 16A	polycarbonate	0.011	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 008 3011	Han GigaBit MOD, male	polycarbonate	0.006	0.006	23.9	0.143	EN 45545, UL94 V0, NFF16101

Part number	Short description	Material	Total weight [kg]	Weight of flammable portion [kg]	Heating value [MJ/kg]	Thermal fire load heating value * weight (flammable portion) [MJ]	Standards met
09 14 008 3016	Han Megabit contact-M	polycarbonate	0.044	0.003	23.9	0.067	EN 45545, UL 94 V0
09 14 008 3101	Han 8 Mod f-c 16A	polycarbonate	0.011	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 008 3111	Han Gigabit MOD, female	polycarbonate	0.004	0.004	23.9	0.096	EN 45545, UL94 V0, NFF16101
09 14 008 3116	Han Megabit contact-F	polycarbonate	0.044	0.004	23.9	0.091	EN 45545, UL 94 V0
09 14 012 3001	Han 12 MOD STI-C 10 A	polycarbonate	0.011	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 012 3101	Han 12 MOD BU-C 10 A	polycarbonate	0.011	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 017 3001	Han 17 Mod Sti-c 10 A	polycarbonate	0.009	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 14 017 3101	Han 17 Mod Bu-c 10 A	polycarbonate	0.011	0.011	23.9	0.263	EN 45545, UL94 V0, NFF16101
09 14 020 3001	Han 20 Mod-M	polycarbonate	0.02	0.02	23.9	0.478	EN 45545, UL94 V0, NFF16101
09 14 020 3013	Han Shielded Module male	LCP	0.036	0.002	27	0.061	EN 45545, UL 94 V0
09 14 020 3101	Han 20 Mod-F	polycarbonate	0.025	0.025	23.9	0.598	EN 45545, UL94 V0, NFF16101
09 14 020 3113	Han Shielded module female	LCP	0.035	0.003	27	0.094	EN 45545, UL 94 V0
09 14 042 3001	Han DD Quad module, male	LCP	0.021	0.018	27	0.489	EN 45545, UL 94 V0
09 14 042 3101	Han DD Quad module, female	LCP	0.028	0.026	27	0.691	EN 45545, UL 94 V0
09 15 004 3013	Han 4 Quintax m-c	polycarbonate	0.028	0.008	23.9	0.191	EN 45545, UL94 V0, NFF16101
09 15 004 3113	Han 4 Quintax f-c	polycarbonate	0.027	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 15 008 3013	Han 8 Quintax-M-c	polycarbonate	0.029	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 15 001 6101	Han Coax ETCS-contact-male, D = 7.5 mm	polycarbonate	0.021	0.001	23.9	0.014	EN 45545, UL 94 V0
09 15 001 6201	Han Coax ETCS-contact-female, D = 7.5 mm	polycarbonate	0.02	0.001	23.9	0.014	EN 45545, UL 94 V0
09 15 008 3113	Han 8 Quintax-F-c	polycarbonate	0.027	0.009	23.9	0.215	EN 45545, UL94 V0, NFF16101
09 16 024 3001	Han 24DD-STI-C	polycarbonate	0.04	0.025	23.9	0.598	EN 45545, UL94 V0, NFF16101
09 16 024 3101	Han 24DD-F-C	polycarbonate	0.043	0.028	23.9	0.669	EN 45545, UL94 V0, NFF16101

Part number	Short description	Material	Total weight [kg]	Weight of flammable portion [kg]	Heating value [MJ/kg]	Thermal fire load heating value * weight (flammable portion) [MJ]	Standards met
09 16 042 3001	Han 42DD-STI-C	polycarbonate	0.045	0.03	23.9	0.717	EN 45545, UL94 V0, NFF16101
09 16 042 3101	Han 42DD-BU-C	polycarbonate	0.053	0.038	23.9	0.908	EN 45545, UL94 V0, NFF16101
09 16 072 3001	Han 72 DD-Sti-C	polycarbonate	0.056	0.041	23.9	0.98	EN 45545, UL94 V0, NFF16101
09 16 072 3101	Han 72 DD-BU-C	polycarbonate	0.067	0.052	23.9	1.243	EN 45545, UL94 V0, NFF16101
09 16 108 3001	Han 108 DD-STI-C	polycarbonate	0.069	0.054	23.9	1.291	EN 45545, UL94 V0, NFF16101
09 16 108 3101	Han 108 DD-BU-C	polycarbonate	0.087	0.072	23.9	1.721	EN 45545, UL94 V0, NFF16101
09 21 007 3031	Han 7D-STI-C	polyamide	0.008	0.008	19	0.152	UL94 HB
09 21 007 3131	Han 7D-BU-C	polyamide	0.008	0.008	19	0.152	UL94 HB
09 21 015 3001	Han 15D-STI-C	polyamide	0.029	0.014	19	0.266	UL94 HB
09 21 015 3101	Han 15D-BU-C	polyamide	0.031	0.016	19	0.304	UL94 HB
09 21 025 3001	Han 25D-STI-C	polyamide	0.034	0.019	19	0.361	UL94 HB
09 21 025 3101	Han 25D-BU-C	polyamide	0.038	0.023	19	0.437	UL94 HB
09 21 040 3001	Han-D40M-C	polycarbonate	0.052	0.035	23.9	0.837	EN 45545, UL94 V0, NFF16101
09 21 040 3101	Han-D40F-C	polycarbonate	0.066	0.05	23.9	1.195	EN 45545, UL94 V0, NFF16101
09 21 064 3001	Han-D64M-C	polycarbonate	0.065	0.047	23.9	1.123	EN 45545, UL94 V0, NFF16101
09 21 064 3101	Han-D64F-C	polycarbonate	0.091	0.075	23.9	1.793	EN 45545, UL94 V0, NFF16101
09 32 010 3001	Han 10 EE-M-C	polycarbonate	0.043	0.028	23.9	0.669	EN 45545, UL94 V0, NFF16101
09 32 010 3101	Han 10 EE-F-C	polycarbonate	0.046	0.031	23.9	0.741	EN 45545, UL94 V0, NFF16101
09 32 018 3001	Han 18 EE-M-C	polycarbonate	0.051	0.036	23.9	0.86	EN 45545, UL94 V0, NFF16101
09 32 018 3101	Han 18 EE-F-C	polycarbonate	0.056	0.041	23.9	0.98	EN 45545, UL94 V0, NFF16101
09 32 032 3001	Han 32 EE-M-C	polycarbonate	0.062	0.047	23.9	1.123	EN 45545, UL94 V0, NFF16101
09 32 032 3101	Han 32 EE-F-C	polycarbonate	0.07	0.055	23.9	1.315	EN 45545, UL94 V0, NFF16101

Part number	Short description	Material	Total weight [kg]	Weight of flammable portion [kg]	Heating value [MJ/kg]	Thermal fire load heating value * weight (flammable portion) [MJ]	Standards met
09 32 046 3001	Han 46 EE-M-C	polycarbonate	0.079	0.064	23.9	1.53	EN 45545, UL94 V0, NFF16101
09 32 046 3101	Han 46 EE-F-C	polycarbonate	0.093	0.078	23.9	1.864	EN 45545, UL94 V0, NFF16101
09 32 040 3001	Han 40 EEE-M-C	polycarbonate	0.063	0.041	23.9	0.98	EN 45545, UL94 V0, NFF16101
09 32 040 3101	Han 40 EEE-F-C	polycarbonate	0.075	0.053	23.9	1.267	EN 45545, UL94 V0, NFF16101
09 32 064 3001	Han 64 EEE-M-C	polycarbonate	0.073	0.056	23.9	1.338	EN 45545, UL94 V0, NFF16101
09 32 064 3101	Han 64 EEE-F-C	polycarbonate	0.092	0.075	23.9	1.793	EN 45545, UL94 V0, NFF16101
09 33 006 2602	Han 6 E-m-c	polycarbonate	0.041	0.026	23.9	0.621	EN 45545, UL94 V0, NFF16101
09 33 006 2616	Han 6 ES-M	polycarbonate	0.05	0.023	23.9	0.55	EN 45545, UL94 V0, NFF16101
09 33 006 2702	Han 6 E-f-c	polycarbonate	0.041	0.026	23.9	0.621	EN 45545, UL94 V0, NFF16101
09 33 006 2716	Han 6 ES-F	polycarbonate	0.052	0.025	23.9	0.598	EN 45545, UL94 V0, NFF16101
09 33 010 2602	Han 10 E-m-c	polycarbonate	0.049	0.034	23.9	0.813	EN 45545, UL94 V0, NFF16101
09 33 010 2616	Han 10 ES-M	polycarbonate	0.063	0.028	23.9	0.669	EN 45545, UL94 V0, NFF16101
09 33 010 2702	Han 10 E-f-c	polycarbonate	0.051	0.036	23.9	0.86	EN 45545, UL94 V0, NFF16101
09 33 010 2716	Han 10 ES-F	polycarbonate	0.068	0.033	23.9	0.789	EN 45545, UL94 V0, NFF16101
09 33 016 2602	Han 16 E-m-c	polycarbonate	0.059	0.044	23.9	1.052	EN 45545, UL94 V0, NFF16101
09 33 016 2616	Han 16 ES-M	polycarbonate	0.084	0.037	23.9	0.884	EN 45545, UL94 V0, NFF16101
09 33 016 2702	Han 16 E-f-c	polycarbonate	0.064	0.049	23.9	1.171	EN 45545, UL94 V0, NFF16101
09 33 016 2716	Han 16 ES-F	polycarbonate	0.091	0.044	23.9	1.052	EN 45545, UL94 V0, NFF16101
09 33 024 2602	Han 24 E-m-c	polycarbonate	0.075	0.06	23.9	1.434	EN 45545, UL94 V0, NFF16101
09 33 024 2616	Han 24 ES-M	polycarbonate	0.111	0.048	23.9	1.147	EN 45545, UL94 V0, NFF16101
09 33 024 2702	Han 24 E-f-c	polycarbonate	0.082	0.067	23.9	1.601	EN 45545, UL94 V0, NFF16101
09 33 024 2716	Han 24 ES-F	polycarbonate	0.123	0.06	23.9	1.434	EN 45545, UL94 V0, NFF16101

Part number	Short description	Material	Total weight [kg]	Weight of flammable portion [kg]	Heating value [MJ/kg]	Thermal fire load heating value * weight (flammable portion) [MJ]	Standards met
09 36 008 3001	Han 8 D M-C	polyamide	0.008	0.008	19	0.152	UL94 HB
09 36 008 3101	Han 8 D F-C	polyamide	0.008	0.008	19	0.152	UL94 HB
09 38 005 2621	Han K 3/0 STI-S	polycarbonate	0.263	0.06	23.9	1.434	EN 45545, UL94 V0, NFF16101
09 38 005 2721	Han K 3/0 BU-S	polycarbonate	0.25	0.061	23.9	1.458	EN 45545, UL94 V0, NFF16101
09 38 012 2651	Han K 6/6-M 100 A/16-35 mm^2	polycarbonate	0.284	0.077	23.9	1.84	EN 45545, UL94 V0, NFF16101
09 38 012 2751	Han K 6/6-F 100 A/16-35 mm^2	polycarbonate	0.03	0.095	23.9	2.271	EN 45545, UL94 V0, NFF16101

Table IX-3
Connectors DIN 41612

Part number	Short description	Material	Total weight [kg]	Weight of flammable portion [kg]	Heating value [MJ/kg]	Thermal fire load heating value * weight (flammable portion) [MJ]	Standards met
09 02 164 6921 222	DIN 41612 type B male	polyamide	0.012	0.005	18.6	0.093	EN 45545, UL94 V0, NFF16101
09 02 264 6825 222	DIN 41612 type B female	polyamide	0.013	0.006	18.6	0.1116	EN 45545, UL94 V0, NFF16101
09 03 196 6921 222	DIN 41612 type C male	polyamide	0.017	0.007	18.6	0.1302	EN 45545, UL94 V0, NFF16101
09 03 296 6825 222	DIN 41612 type C female	polyamide	0.017	0.008	18.6	0.1488	EN 45545, UL94 V0, NFF16101
09 03 296 6850 222	DIN 41612 type C female	polyamide	0.017	0.008	18.6	0.1488	EN 45545, UL94 V0, NFF16101
09 03 696 6921 222	DIN 41612 type C male	polyamide	0.018	0.008	18.6	0.1488	EN 45545, UL94 V0, NFF16101
09 03 796 6825 222	DIN 41612 type C female	polyamide	0.018	0.009	18.6	0.1674	EN 45545, UL94 V0, NFF16101
09 04 132 2921 222	DIN 41612 type D male	polyamide	0.012	0.007	18.6	0.1302	EN 45545, UL94 V0, NFF16101
09 04 232 2831 222	DIN 41612 type D female	polyamide	0.013	0.008	18.6	0.1488	EN 45545, UL94 V0, NFF16101

Part number	Short description	Material	Total weight [kg]	Weight of flammable portion [kg]	Heating value [MJ/kg]	Thermal fire load heating value * weight (flammable portion) [MJ]	Standards met
09 05 148 2921 222	DIN 41 612 type E male	polyamide	0.018	0.011	18.6	0.2046	EN 45545, UL94 V0, NFF16101
09 05 248 2831 222	DIN 41 612 type E female	polyamide	0.02	0.01	18.6	0.186	EN 45545, UL94 V0, NFF16101
09 06 115 2911 222	DIN 41 612 type H male	polyamide	0.034	0.018	18.6	0.3348	EN 45545, UL94 V0, NFF16101
09 06 148 6901 222	DIN 41 612 type F male	polyamide	0.027	0.015	18.6	0.279	EN 45545, UL94 V0, NFF16101
09 06 215 2821 222	DIN 41 612 type H female	polyamide	0.018	0.011	18.6	0.2046	EN 45545, UL94 V0, NFF16101
09 06 215 2854 222	DIN 41 612 type H female	polyamide	0.018	0.01	18.6	0.186	EN 45545, UL94 V0, NFF16101
09 06 215 2871 222	DIN 41 612 type H female	polyamide	0.047	0.03	18.6	0.558	EN 45545, UL94 V0, NFF16101
09 06 248 2821 222	DIN 41 612 type F female	polyamide	0.044	0.019	18.6	0.3534	EN 45545, UL94 V0, NFF16101
09 06 248 3201 222	DIN 41 612 type F female	polyamide	0.019	0.019	18.6	0.3534	EN 45545, UL94 V0, NFF16101
09 06 248 6834 222	DIN 41 612 type F female	polycarbonate	0.017	0.011	24.8	0.2728	EN 45545, UL94 V0, NFF16101
09 22 132 6921 222	DIN 41 612 type 2B male	polyamide	0.007	0.004	18.6	0.0744	EN 45545, UL94 V0, NFF16101
09 22 232 6825 222	DIN 41 612 type 2B female	polyamide	0.007	0.004	18.6	0.0744	EN 45545, UL94 V0, NFF16101
09 23 148 6921 222	DIN 41 612 type 2C male	polyamide	0.01	0.004	18.6	0.0744	EN 45545, UL94 V0, NFF16101
09 23 248 6825 222	DIN 41 612 type 2C female	polyamide	0.01	0.004	18.6	0.0744	EN 45545, UL94 V0, NFF16101
09 06 048 0521	DIN 41 612 shell housing D20	polycarbonate	0.037	0.024	24.8	0.5952	EN 45545, UL94 V0, NFF16101

Notes

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