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Pushing Performance

HARTING

User‘s Guide Transportation

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Additional information can be found in the catalogues Industrial Connectors Han®, Device Connectivity, Ethernet Network Solutions Automation IT and Connectors DIN 41 612.

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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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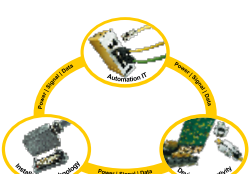
I Foreword

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've 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. We then devote a chapter on the increasingly popular topic of network systems in which solutions and Ethernet products suitable for railway and train use are described. The chapter VI shows a selection of HARTING's customized solutions that are designed to fit individual requirements.



HARTING was founded in 1945. The HARTING Technology Group now employs over 500 engineers to design a variety of products and solutions in the fields of machine construction, railway systems, wind power facilities, factory automation and telecommunications. These solutions cover connectivity, transmissions, network systems, production, mechatronics and software design. The HARTING Group currently employs about 3,000 employees throughout our 32 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). This recognition is a great honour for HARTING but also a challenge for us to meet the future requirements and needs of the railway industry.

I-1 Connections and network systems for railway vehicles

Connections are often implemented using pluggable 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 quite 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 strongly aligned with the requirements of railway customers.

Product 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 61984) but also to the appropriate railway standards (such as EN 50151 and DIN EN 61373).

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.

Chapter 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.

II

Wagon couplings

Sub-systems such as current converter and climate control devices

Electrical cabinet wiring

Passenger information/ data communication

Driver‘s console

Coupling

Measurement and sensor systems

Motor / drive

Network systems

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 HPR series) in order to prevent any such uncontrolled opening. In exterior installations, the advantage of the screw interlock over the locking lever is that it can only be opened using a tool in a controlled fashion.

In addition to the screw interlock, the HPR housings feature IP 68 (IP 69 K) protection when they are locked shut. They are also corrosion resistant and have very good EMC characteristics.

The Han® M series is a rail-compliant option for some applications. It provides the same high level of corrosion protection but has a smaller size compared to the Han® B series and does 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

The motor connection has a pluggable design so that the connection between the traction bogie and the vehicle is versatile and quick to connect. Each connector is designed to connect two drive motors to improve the efficiency level. There are five high-current contacts of the type Han® HC Modular 350 (three power contacts, one return wire and one radial earth) for each motor. This means that there are ten high-current contacts in use for each connector. Housing from the HPR® 48 HPR series is then selected for the enclosure. This housing offers the advantage that it can be pre-assembled and tested before the final assembly of the connector.

Figure II- 3.1
Commuter tram vehicles in Frankfurt

Figure II- 3.2
Entire view of motor connector mounted on vehicle

Figure II- 3.3
Product photo: Han® 48 HPR housing motor connector

Figure II- 3.4
Product photo: contacts integrated in a support frame with cover

II-4. Connector for wagon couplings

Connector modules from the Han-Modular® series are being used in the wagon couplings for the GTW 2/6 series from Bombardier/Stadler. The modules provide a pluggable solution for the following rail vehicle applications:

- Internal train bus (MVB) with the Han-Quintax® module (four poles)
- Low voltage supply and digital signals with the Han DD® module
- Transmission of mid-range power with the Han® EE module
- Transmission of high power (for batteries or climate control system) with the Han® 40-A Axial module
- Video transmission via coax contacts with the Multi-contact module

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. However, for wagon couplings that are mounted within the train and for interior installations, a system with IP 20 protection is sufficient. Modified hoods can be used here from the Han® HPR series for some customer projects. These are open on the sides and screwed directly onto the supporting wall using the riveting nuts. The bulkhead-mounting housing on the bottom side is not needed so an added advantage is the resulting cost and weight savings.

Figure II- 4.1
The SLT train (Nederlandse Spoorwegen)

Figure II- 4.2
Model GTW 2/6 vehicles from the UBB Usedom Resort Railway

Figure II- 4.3
Connectors on the wagon coupling

II-5. Connectors for control data and bus data in the driver's console

For years Siemens Mobility has been delivering the B80D railway vehicles – with their modern design and modular construction – to Bursa in Turkey.

II

Even the control panel has a pluggable design and is constructed from modules. A customized connector was designed to provide a pluggable solution for bus signals and control data in the control panel. The Han-Modular® series with their Han-Quintax® modules (for MVB) and the Han DD® module (for control data) are a good fit for this task. In this case there is no need for housing since the connector is installed within the vehicle. Knurled screws are used to interlock the male and female sides together. A strain-relief clip is mounted to the hinged frame of the connector in order to support the cable.

Figure II- 5.1
The model B80D tram vehicle for Bursa, Turkey

Figure II- 5.2
Driver controls
before final installation

Figure II- 5.3
Connector with knurled screw
for interlock and strain-relief clip

II-6. Rotary encoder

Another typical application is to provide a pluggable solution for rotary encoders and sensors for the purpose of monitoring storage temperatures. An example shown here is from Bombardier Transportation. Bombardier has manufactured multiple “Blue Tiger” diesel-electric locomotives for use in Germany and Europe.

The following illustrations show the connector. Since the connection is installed in a location that is exposed to extreme weather conditions, it is designed to use the Han® HPR series of housings.

This solution allows for parts to be quickly swapped out with minimal effort during servicing.

Figure II- 6.1
The “Blue Tiger” diesel locomotive

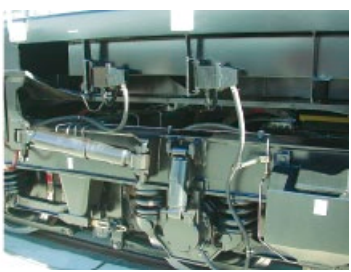

Figure II- 6.2
Connector with connecting cable to the rotary encoder

II-7. Data communication

Video monitoring is an example of data communication within a railway vehicle. In this application, the video monitoring is Ethernet-based. The cameras and recording devices are connected to each other via Ethernet. HARTING provides the system components for the network (the switches, connectors and system cable).

This example shows how the technology is implemented refurbished ICE 1.

Figure II- 7.1
The high-speed ICE 1 train

Figure II- 7.2
The video monitoring layout

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

- *Ethernet Switch Ha-VIS mCon 9080-B*
- *M12 connector*
- *DIN D20 plastic housing*
- *D-Sub full-metal housing*

II-8. Stationary rail equipment

In addition to our applications for moving railway vehicles, HARTING components are often used for stationary railway applications. Figure II- 8.2, for example, shows an axle counter mounted on a DIN rail. Connectors may be used in control centres and heavy-duty connectors may also be used for rail-side electrical cabinets.

These applications are often subject to test requirements similar to those for train applications (such as those for vibration and temperature). 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

II-9. Connectors for use in interiors of railway vehicles

The following application illustrates the use of connectors that are based on HARTING housings from the Han® B series.

Siemens Mobility has delivered a total of 70 Series-2016 (Hercules) diesel-electric locomotives to the Austrian Federal Railway. The connectors shown here enable a pluggable solution for power supplies and control data cables.

Because of the different space requirements, the housings used here were fitted with the Han-Easy Lock® cross lever, the Han-Easy Lock® lengthwise lever and the central locking lever for their interlock mechanisms. These housings have naturally already been tested and verified for usage in railway vehicle applications.

Contact inserts can be chosen – independently from the pluggable connection – from the Han E®, Han® EE, Han DD®, Han-Modular® and Han® K 6/6 series.

Figure II- 9.1
Diesel locomotive for the Austrian Federal Railway (Hercules)

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

Figure II- 9.3
Han® EE and Han® ESS mounting panel

Figure II- 9.4
Han® B with Easy Lock lengthwise lever used on a generator

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.

The following example shows a sub-floor container for a CP 2000 train. The Siemens Mobility -Bombardier Transportation Consortium has delivered a total of 34 such trains to Portugal. The sub-floor container has been manufactured and tested by RWS Railway Service GmbH. 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
The CP 2000 electric train

Figure II- 10.2
Complete view of the sub-floor container

Figure II- 10.3
Sub-floor container, back side with the HARTING Han® connectors

II-11. Connectors in the electrical cabinet

The central parts of the entire vehicle electronics and electrical system are installed within the electrical cabinets located inside of the railway vehicle. Electrical cabinets have a pluggable design so that time and money can be saved during servicing and initial commissioning. The pluggable design covers all areas: from high-current (HARTING's Han-Com® series) to data and signal cables (HARTING's Han E®, Han® EE and Han-Modular® series). HARTING also provides the additional service of offering pre-assembled and tested connector inserts. The customer benefits from the significantly shorter installation time in the electrical cabinets.

The following illustrations show an electrical cabinet from the Desiro train (DB series 642) built by SIEMENS Mobility.

Figure II- 11.1
The Desiro DBAG diesel train from the 642 series

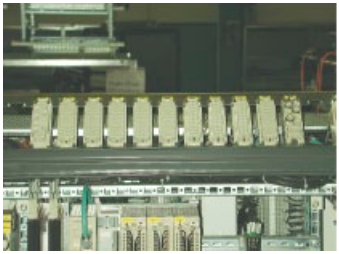

Figure II- 11.2
HARTING connectors used as the interface to the electrical cabinet

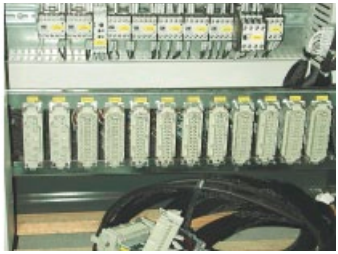

Figure II- 11.3
The Han-Com®, Han E®, Han® EE and Han-Modular® series

II-12. Controlling pantographs

The firm Stemmann Technik manufactures pantographs for overhead wire systems. Pluggable connectors are used for the pantographs and for the devices that control the pantographs so that less time is required during installation and servicing. A 24-pole Han E® contact insert in a Han® B housing is used to provide a pluggable solution for the controlling device. Since the connector is not located outside on the roof but within the vehicle, the Han® B housing is sufficient for this application.

Figure II- 12.1
Rooftop pantograph DSA 200 from the firm Stemman Technik

Figure II- 12.2
Detailed view of the Han® 24E connector that is built into the controlling device for the DSA 200 pantograph

Stemmann Technik also offers side-mount pantographs that can be used to collect current from the third rail. The model Fb 218 contacts the underside of the current rail.

To provide a pluggable design, the Han® Q 5/0 in the Han® 3 A HPR housing were used for the signals that control the pantograph.

Heavy-duty housings from the Han® HPR series were chosen for this application since the connector is positioned directly on the pantograph and is directly exposed to weathering influences.

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

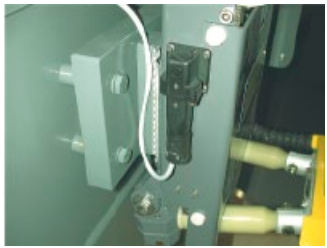

Figure II- 12.4
Han® Q 5/0 in the Han® 3 A HPR housing

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

A classic railway application is the use of connectors in the wagon coupling areas. The vehicle's coupling components have a pluggable design so that they can be more easily connected and disconnected during commissioning and service work. These connectors may also be located outside of the vehicles (under the floor) so the same strict railway-vehicle requirements for safety and reliability are relevant. So here too the connectors of choice use housings from the Han® HPR or Han® M series. Contact inserts for power transmission or for data/bus signals – such as the Han E®, Han® EE, Han-Modular® or Han-Com® – can also be considered for use.

Note here that HARTING delivers the connectors for the junction of the vehicle coupling units.

Figure II- 13.1
Opened front hatch on an ICE3 train The coupling unit is easy to see. The contacts for the electrical connections between the coupling units are covered. The control unit (refer to Figure II- 13.2) for the front hatch (not visible here) is located directly behind the coupling unit.

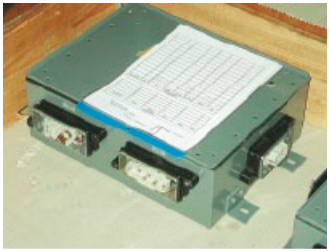

Figure II- 13.2
Control unit for controlling the front hatches (for example, on the ICE 3). Shown here for the Kassel city tram line: using HARTING connectors from the Han-Modular® series (Quintax, DD module for data cables), Han® K 4/0 (for transmission of high currents up to 80 A), and Han® EE (for transmitting mid-range currents up to 16 A). The contact inserts are installed in HPR housings since the control unit is located directly behind the vehicle coupling.

Figure II- 13.3
Rear view of a coupling unit (shown at an exhibit at InnoTrans)

Figure II- 13.4
Han-Modular® contact inserts with Quintax, EE module and Han® 46 EE: mounted in the Han® M hood, size 48 B.

II-14. Monitoring unit for the brake system

The example here uses DIN 41612-series connectors within the interior of a railway vehicle.

Figure II- 14.3 shows a DIN metal housing mounted on a push-in frame and used for controlling and monitoring a brake system. The data (sensor and actuator signals) is controlled by I/O units. The key features are: the connectors take up a minimal amount of space; they have a consistent shielding design with EMC housings in 19-inch metal component carrier; and they have excellent signal quality.

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

Figure II- 14.1
The 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 connectors to the railway. Recently we have also begun delivering active components and Ethernet cable for rail applications. The following list gives some examples of train platforms and railway projects.

- **Tram lines / street cars (LRV)**
  Frankfurt – Germany
  Bochum – Germany
  Dresden – Germany
  Innsbruck – Germany
  Graz – Austria
  Houston – USA
  Hiroshima – Japan

- **Metro / underground railways**
  Bangkok – MRTA
  Shangahi Line 10
  Dubai – Metro Red Line
  Delhi – Metro
  Valencia – Metro
  New York – NYCT
  Madrid – Metro
  Chengdu – Metro
  Berlin – Tram
  Moskau – Metro
  Wien – Metro
  Oslo – Metro

- **Regional commuter trains / express tram lines**
  Malaysia, Kuala Lumpur – Airport Express KLIA
  Norwegen, Oslo – Norwegian State Railway
  Greece, Athens – Greek State Railway (OSE)
  Netherlands, Breda – Viola Transport

- **High-speed trains**
  Helsinki to St. Petersburg – Pendolino
  Deutsche Bahn (DB) – ICE 1, 2, 3
  Shinkansen – E2-1000

Chapter 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)
- Currents and voltages (a criterion for selecting the contact inserts and contacts)
- Wire construction (a criterion for selecting the type of connection)
- EMC and shielding (a criterion for selecting the housing and cable gland)

The modular design of HARTING products allows almost all contact inserts to be combined with all types of hoods and housings. Thus, 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 Industrial Connectors Han®, Device Connectivity and Ethernet Network Solutions Automation IT.

III-2 Hoods and housings overview

III-2.1 Overview of Han® hoods and housings and contact inserts

Product	Features	Area of use	Product photo
Hood and housing Han® HPR	IP 68, (IP 69 K) corrosion resistance, EMC-safe, screw interlock	External use on railway wagons	
Hood and housing Han® M	For harsh environmental requirements; IP 65, stainless steel locking lever	External use on railway wagons	
Hood and housing Han® B	IP 65, Han-Easy Lock® locking lever	Internal use on railway wagons	
Hood and housing Han® EMV/B	IP 65/67, EMC-safe, Han-Easy Lock® locking lever	Internal use on railway wagons	
Hood and housing Han-*Yellock*®	IP 67,Press-button interlock, inner locking mechanism	Internal use on railway wagons	
Hood and housing Han-Eco®	Plastic IP 65, locking lever	Internal use on railway wagons	

Product	Features	Area of use	Product photo
Hood and housing Han-Snap®	Resistant to shock and vibration, in compliance with IEC 60 068 / BN 74 018	Internal use on railway wagons, Electrical cabinet, 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 cabinet, distributor boxes	

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

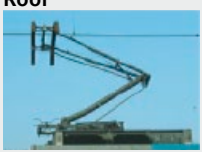
III-2.2 Installation location of the hoods and housings

The overview table below shows which hood and housing types can be used in which locations and for which rail applications.

This is only a general overview. Several different hood and housing types are appropriate for use in some applications and the specific details should be established depending on the particular project.

III-2.2.1 Overview of housings and locations for industrial connectors

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

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

[1)]: Depending on the particular project requirements

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

Location (Interior/inside)	InduCom	InduCom 9	DIN 41 612	DIN D20	MITRAC-housing
Driver's console 	✔	✔	✔	✔	✔
Brake controls 	✔		✔	✔	✔
Train controls 	✔	✔	✔	✔	✔
Interior of passenger wagon 	✔	✔			

Location (Interior/inside)	**InduCom**	**InduCom 9**	**DIN 41 612**	**DIN D20**	**MITRAC-housing**
Air conditioning system 	✔	✔			
Point controls 	✔		✔	✔	
Signalling facilities 	✔		✔	✔	

III-2.3 Han® HPR housing, size 3 A – long version

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

The HPR product line is newly enlarged by large versions of Han® 3 A HPR hoods and housings.
Compared to the previous versions, this hood and housing features a much larger cabling space. It also has a M25-sized thread instead of the previous M20 thread.
It is now possible to design pluggable and compact solutions for data and bus cables (i.e., MVB, WTB) using the Han-Brid® Quintax contact insert with IP 68 protection.
This is the first time that the housing is being offered with either feed-through or threaded M4 tapped holes on the bottom side. The assembly of the housing with the tapped holes is carried out from the connection side. This reduces the chance of leaky seals in the area surrounding the retaining screws.
The dimensions of the flange on the housing are identical to the existing bottom section. It is therefore possible to keep the existing dimensions for the holes and exchange older housing with the longer housing.
These new hoods and housings share the same technical specifications and characteristics that are valid for all HPR hoods and housings.
Please note that the hood and housing is available with either black-chromate passivation or black-powdered (RoHS-compliant) coating.

The following variants are available:

Hood and Housing with black-chromate passivation:

• Hood, M25 straight, screw interlock	19 40 003 0411
• Angled bulkhead-mounting housing with feed-through holes	09 40 003 0951
• Angled bulkhead-mounting housing with M4 threaded tapped holes	09 40 003 0953
• Surface-mounting housing, M25 straight, with feed-through holes	19 40 003 0951
• Surface-mounting housing, M25 with M4 threaded tapped holes	19 40 003 0953

Hood and Housing, black powdered (RoHS-compliant):

• Hood, M25 straight, screw interlock	19 40 703 0411
• Angled bulkhead-mounting housing with feed-through holes	09 40 703 0951
• Angled bulkhead-mounting housing with M4 threaded tapped holes	09 40 703 0953
• Surface-mounting housing, M25 straight, with feed-through holes	19 40 703 0951
• Surface-mounting housing, M25 with M4 threaded tapped holes	19 40 703 0953

III-2.4 Han® B hood with M50 cable entry

HARTING offers a Han® B hood variant with a M50 cable entry. In the past, no cable gland larger than an M40 could be used with this housing series. M50 cable glands can be used with the new hood. This hood is available in a version with a straight cable entry and a side entry for two lever locking 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 hoods.

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 and/or with high-pole contact inserts.
Additional advantages include:

- Quicker installation times
- The wiring is visible within the connection area
- An integrated cable gland
- Strain relief mechanism
- Captive screws
- Cable outlet with optimized angle

The hood is available in sizes 16 B and 24 B. It can fit on all corresponding housing 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 catalogue “Industrial Connectors Han® “).

Several examples of such customized products are described below: the Han® 24 HPR enlarged, the Han® 48 HPR, and the Han® M size 48 series with ratchet on the locking lever.

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, the hood stands 9 mm higher. It has a total height of 120 mm. Bulkhead-mounting and surface-mounting housings are available for mounting horizontally on the bottom section. Special support frames, that only fit in this housing type, are available for holding the high-current contacts.

The following variants of support frames and housings are available:

Support frame	Housing (hood and surface-mounting 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
4 x Han® HC Modular 250	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-mounting housing must be ordered separately from the surface-mounting housing.
- When using Han® HC Modular contacts, consider that the maximum current load of each contact depends on the wire gauge.
- When using four Han® HC Modular 350, a shrink sleeve must be pulled over the cable.

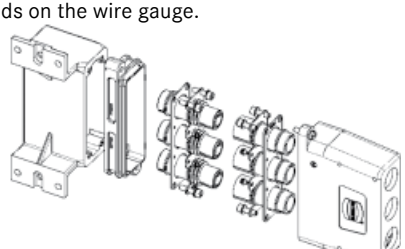


Figure III- 2.5
Assembly principle

III-2.6.2 Han® 48 HPR hood and housing

Figure III- 2.6
Han® 48 HPR

This housing line 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-mounting housing and bulkhead-mounting 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-mounting housing:

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

A protective cover is also available in this series that can be mounted onto bulkhead-mounting housings and surface-mounting 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
- A sample of 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® monobloc and/or Han-Modular®) of 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 housing

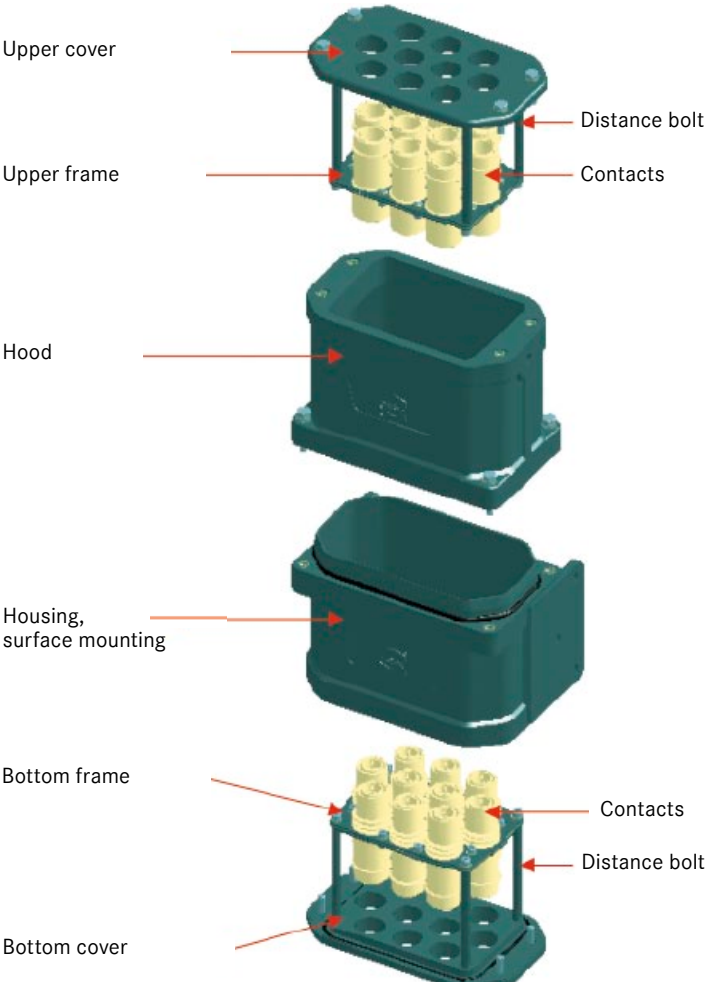


Figure III- 2.7
Han® 48 HPR assembly

III-2.6.3 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-mounting housing and surface-mounting 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:

Article number	Description
09 37 048 0311	Han® 48 M bulkhead-mounting housing, protective cap
19 37 048 0298	Han® 48 M surface-mounting housing 2 x M40, protective cap
19 37 048 0299	Han® 48 M surface-mounting housing 2 x M50, protective cap

The specification sheets for these housings are available on request.

Figure III- 2.8
Han® 48 M assembly locking lever with ratchet on housing

Figure III- 2.9
Han® 48 HPR Locking lever without ratchet on housing

III-2.7 Han-Eco® hood and housing

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

Han-Eco® was designed for modules in the Han-Modular® series. In comparison to the Han® B housing, the new design allows space for an additional module in each of the four sizes. Despite the increased modular density, the installation dimensions are identical to the Han® B series.

The high-performance plastic used in the housing is extremely resistance to environmental influences. The plastic also features excellent mechanical properties. IP 65 protection, in accordance with DIN EN 60 529, is ensured when the housing is mated and locked. This new housing series can be used in protective-insulated facilities and machines according to protection class II. It also meets the flammability classification for V0 material according to UL 94. The Han-Eco® series is available with a straight or side cable entry. The module frame and the cable gland are integrated into the hood, so there is no need to order them separately. The module frame is also integrated into the housing with the bulkhead-mounting housing, which reduces the number of article numbers required.

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 locking levers can stay on the bulkhead-mounting housing or be put on the hood, as required. When mated, the locking levers protect the pegs from contamination.

A recessed area on the neck of the cable gland allows the connector to be labelled in a clear and simple manner.

Figure III- 2.10
Overview of the Han-Eco® hood and housing

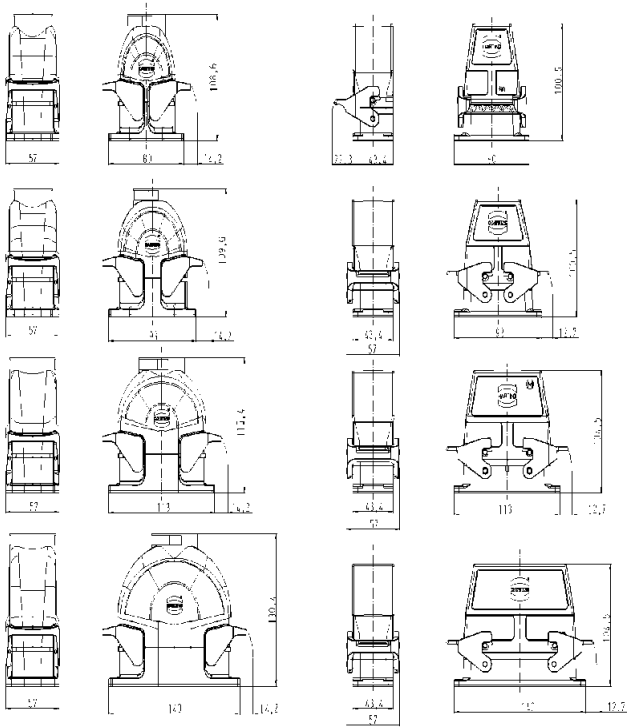


Figure III- 2.11
Sizes and dimensions

III-2.8 Han® B housing locking mechanisms

The locking lever prevents the connector from being accidentally disconnected. 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.

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

Table III- 2.1
Overview of interlock types

III-2.9 Han-Easy Lock® locking lever

The Han® B housing series comes with the Han-Easy Lock® in the default configuration. This clamp brings together a plastic grip and stainless steel spring. It offers the following features:

- Easy to operate
- Minimal operating force required
- Lever position can be set
- High number of usage cycles
- Resistant to corrosion
- Excellent sealing
- Tested against shock and vibration in accordance with EN 50155
- Connector is easy and safe to handle, even from hard-to-access positions

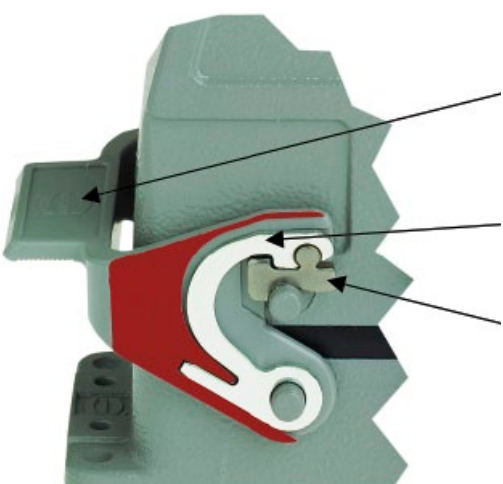


Figure III- 2.12
Han-Easy Lock®

III-2.10 InduCom hood

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.

These full-metal hoods have up to four cable entries. They have become the optimal solution when outstanding shielding attenuation characteristics and mechanical stability are an absolute must. The spacious interior of the InduCom 9 variant allows circuit boards for bus systems or customer-specific applications to be integrated.

The EMC requirements for an interface stipulate that the rated shielding attenuation potential or the degree of interference immunity must be high enough so that the electromagnetic field surrounding the connector cannot interfere with the signal transmission inside the connector.

In the opposite direction, the shielding characteristics also prevent the signal transmission on the interface from emitting interference that could interfere with the surrounding devices and components.

These requirements are all completely met by HARTING's crimp flange and the full-metal InduCom hoods with their labyrinth/double-labyrinth structure.

Figure III- 2.14
Double labyrinth

Figure III- 2.15
Labyrinth

The crimp flange connection also provides a very effective strain relief and anti-twist protection for the cable, even ander extremely harsh industrial conditions. 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.

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.

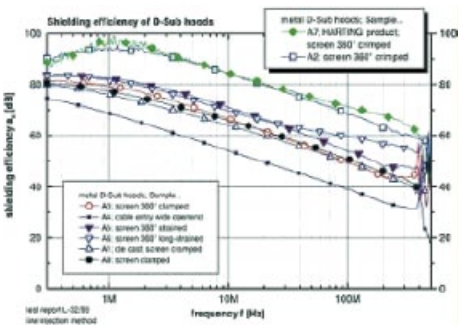


Figure III- 2.16
Attenuation graph for the InduCom

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.

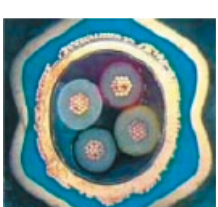
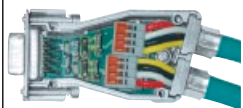


Figure III- 2.17
Crimp flange
with full-surface contact

Figure III- 2.18
InduCom full-metal hoods

Table III- 2.2
Overview of InduCom hood

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.	Interior of railway wagons; Contact for serial and parallel signals in MVB[1)] applications.	
InduCom9 WTB connector set	Cage tension-spring connection with integrated T-functionality. 360° shield connection. Very space saving compact design. Large space for wiring.	Interior of railway wagons; Contact for serial and parallel signals in WTB[2)] applications.	
InduCom9 CAN connector set	Cage tension-spring connection with integrated T-functionality. 360° shield connection Very space saving compact design. Large space for wiring.	Interior of railway wagons; Contact for serial and parallel signals in CAN bus applications.	
InduCom9 Profibus connector set	Cage tension-spring connection with integrated T-functionality. 360° shield connection. Very space saving compact design. Large space for wiring.	Interior of railway wagons; Contact for serial and parallel signals in Profibus applications.	
InduCom9 housing With straight cable outlets	360° shield connection. Very space saving design. Large space for wiring.	Interior of railway wagons; Electrical cabinet, distributor boxes, contact of serial and parallel signals in bus application or interface applications.	

Product	Features	Area of use	Product photo
InduCom housing With cable outlets straight or to the side for screw interlock	360° shield connection. Very space saving compact design. Large space for wiring.	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 outlet for screw interlock	360° shield connection. Very space saving compact design. Large space for wiring.	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	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	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.	

[1] MVB = multi vehicle bus [2] WTB = wire train bus

III-2.11 Housing DIN 41 612 / IEC 60 603-2

Table III- 2.3
Overview of Housing DIN 41 612 / IEC 60 603-2

Product	Features	Area of use	Product photo
Shell housing D20 Plastic	Robust plastic housing with good flammability characteristics	Interior of railway wagons; Mechanical protection for signal lines that do not have special shielding requirements A metallic variant is 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 connection	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 Hoods and Housings for EMC requirements

Many interfaces have demanding EMC requirements for their connectors.

What does EMC mean? **E**lectro-**M**agnetic **C**ompatibility refers to the ability of electrical equipment to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment. (DIN VDE 0870)

Electrical equipment is considered to be compatible if it has sufficient interference immunity and has tolerable emissions or sensitivity.

In order to meet these requirements, HARTING delivers hood and housing with excellent EMC characteristics. Such hood and housing includes the Han® HPR and Han® EMC/B series.

Figure III- 3.1
Han® HPR hood and housing

Figure III- 3.2
Han® EMC/B hood and housing

The EMC requirements for an interface stipulate that the rated shielding attenuation potential or the degree of interference immunity must be high enough so that the electromagnetic field surrounding the connector cannot interfere with the signal transmission inside the connector. The permeability of electromagnetic radiation outwards must also be minimized so that the connector does not interfere with surrounding devices or components.

The following graph shows the shielding attenuation behaviour for HARTING's InduCom connectors as a function of the frequency.

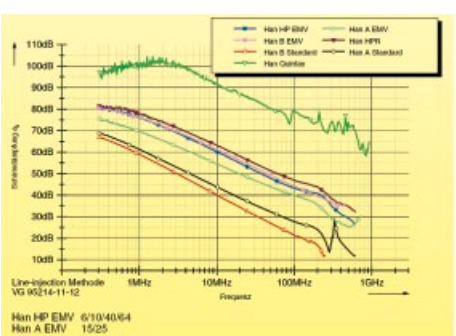


Figure III- 3.3
Han® EMC/B housing

This EMC hood and housing has a distinctive labyrinth structure and a large-surface contact between the bulkhead-mounting housing and the hood; both of these factors help to deliver the high shield attenuation values for the hood.

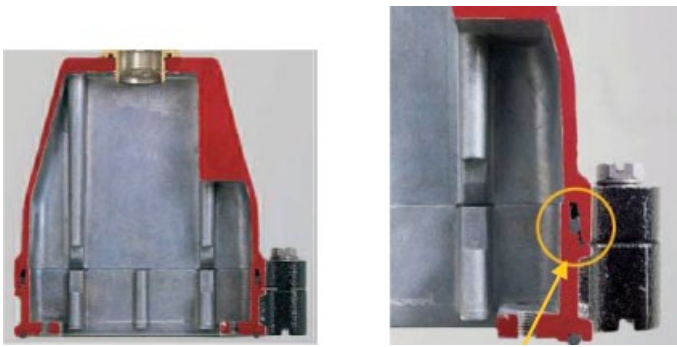


Figure III- 3.4
Labyrinth structure of the Han® HPR series

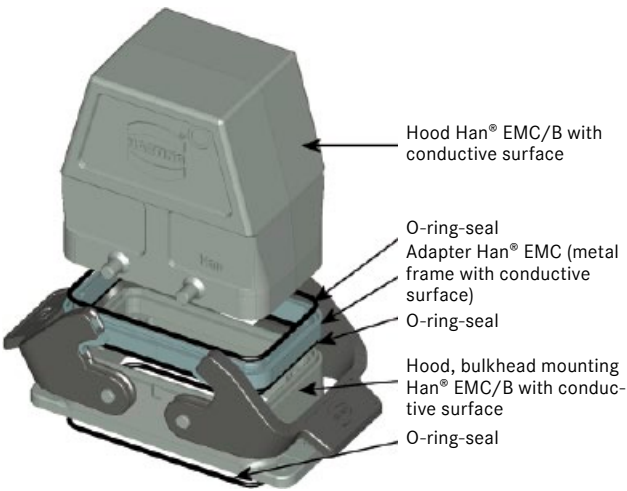


Figure III- 3.5
The electrical contact between the hood and housing sections is established by means of a metallic adapter frame.

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 contacts 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.

All contact inserts and contacts are listed in order of increasing current strength in the tables Table III- 4.1 and Table 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

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

Insulation resistance	≥ 10^{10} Ω
Mating cycles	≥ 500 mating cycles; hazardous gas test; CECC 75 301-802 requirements level 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 contact inserts are designed for rated currents from 10 to 40 A.

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

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

III-4.1 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 of the Han-Modular® is, that customers can combine the modules to suit their needs and thus design their own customized connector. 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® EMC/B, Han® M and Han® HPR series. The tall design should be used whenever possible with the hood and surface-mounting housings (with the exception of the Han® HPR).

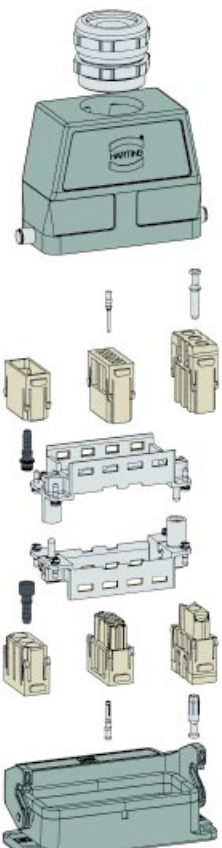


Figure III- 4.1
Han-Modular®

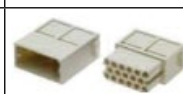
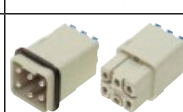
III-4.2 Han® HC Modular

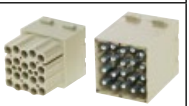
This series features high-current contacts for rated currents from 250 to 650 A. Conductors are connected using the axial screw method or with crimp contacts. A mounting frame must first be inserted before installing the contacts in the housing. The frames are designed only to be used in the Han® HPR and Han® 48 M housing series.

Table III- 4.1
Han® industrial connector – 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®	Retention for hinged frame. Helps during assembly by preventing the accidental opening of the hinged frame when not installed.	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 connection / solder connection	Data transmission	

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	
1	Han-Modular®	Han® USB module USB 2.0 Connection via a patch cable	Data transmission	
5	Han-Modular®	Han® D-Sub module 9-pole, 50 V Crimp connection	Data transmission, including Ethernet	
5	Han-Modular®	Han® GigaBit module 8-pole plus shield, 50 V For Cat.6 Ethernet Crimp connection	Data transmission, including Ethernet	
5	Han-Modular®	Han®-Quintax® high-density contact 8-pole plus shield, 50 V Crimp connection Install in Han-Quintax® module	Data transmission	
10	Han-Modular®	Han D® coax contact 1-pole plus shield For coax cable For Han D® contacts Crimp connection Impedance: 75 Ω Install in Han-Quintax® module	Video signal transmission	
10	Han-Modular®	Han-Quintax® contact 4-pole plus shield 50 V Crimp connection Install in Quintax® module	Data transmission, including Ethernet	
10	Han®	Han D® 7-, 15-, 25-, 40-, 64-pole + PE, 250V Crimp connection	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	

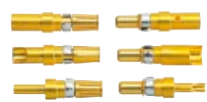
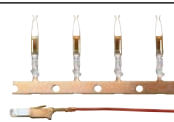
Current [A]	Series	Contact insert / module / contact / accessory	Area of use	Product photo
10	Han®	Han® 8 D 8-pole, 50V AC / 120V DC Crimp connection Han-Easy Lock® connection	Data transmission	
10	Han®	Han® Q 7/0 7-pole plus PE 400 V Crimp connection	Transmission of mid-range power and data	
10	Han®	Han® Q 12/0 12-pole plus PE, 400 V Crimp connection (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 connection Han-Quick Lock® connection	Transmission of mid-range power and data	
10	Han-Modular®	Han® DDD module 17-pole, 160 V Crimp connection	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 tension-spring connections	Transmission of mid-range power and data	
16	Han®	Han® EE 10-, 18-, 32-, 46-pole + PE 500 V Crimp connection	Transmission of mid-range power and data	
16	Han®	Han® EEE 40-pole, 64-pole plus PE 500 V Crimp connection	Transmission of mid-range power and data	
16	Han®	Han® Q 5/0 5-pole plus PE 230 / 400 V Crimp connection 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-Com®	Han® K 8/24 8-/ 24-pole + PE Power usage: 16 A 230 / 400 V Control usage: 10 A 160 V Crimp connection	Combines power and signals in a single connector	
16	Han-Modular®	Han E® module 6-pole 500 V Crimp connection	Transmission of mid-range power and data	
16	Han-Modular®	Han® ES module 5-pole, 400 V Caged tension-spring connection	Transmission of mid-range power and data	
16	Han-Modular®	Han® EE module 8-pole, 400 V Crimp connection Han-Quick Lock® connection	Transmission of mid-range power and data	
16	Han-Modular®	Han® EEE module 20-pole 500 V Crimp connection	Transmission of mid-range power and data	
16	Han-Modular®	Han E® coax contact 1-pole plus shield Impedance: 50 Ω Crimp connection Install in Han-Quintax® module	Transmission of data and ETCS S21 Eurobalise (4 mm²)	
40	Han®	Han® Q 2/0 2-pole plus PE 400 V Axial screw connection	Power transmission	
40	Han®	Han® Q 2/0 2-pole plus PE 830 V (only with shrink sleeve) Axial screw connection	Power transmission	
40	Han-Modular®	Han® 40 A module 2-pole, 1000 V Axial screw connection Crimp connection	Transmission of high power	

Current [A]	Series	Contact insert / module / contact / accessory	Area of use	Product photo
40	Han-Modular®	Han® C module 3-pole, 400 / 690 V Axial screw connection Crimp connection	Transmission of high power	
63	Han-Com®	Han® K 4/4 4-/ 4-pole + PE Power usage: 63 A 690 V Control usage: 16 A 230 V Axial screw connection Caged tension-spring connection	Combines power and signals in a single connector	
70	Han-Modular®	Han® 70 A module 2-pole, 1000 V Axial screw connection Crimp connection	Transmission of high power	
80	Han-Com®	Han® K 4/2 4-/ 2-pole + PE Power usage: 80 A 830 V Control usage: 16 A 400 V Screw connection	Combines power and signals in a single connector	
80	Han-Com®	Han® K 4/8 4-/ 8-pole + PE Power usage: 80 A 400 V Control usage: 16 A 400 V Screw connection	Combines power and signals in a single connector	
100	Han-Com®	Han® K 6/6 6-/ 6-pole + PE Power usage: 100 A 690 V Control usage: 16 A 400 V Axial screw connection (for power) Screw connection (for controls)	Combines power and signals in a single connector	
100	Han-Com®	Han® K 8/0 8-polig + PE 690 V Axial screw connection	Transmission of high power	

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 connection Crimp connection	Transmission of high power	
200	Han-Com®	Han® K 3/0 3-pole 1150 / 2000 V Axial screw connection	Transmission of high power	
200	Han-Modular®	Han® 200 A module 1-pole 1000 V Axial screw connection Crimp connection	Transmission of high power	
250	Han® HC Modular	Insulating base (male / female) for holding the crimp contacts Han® TC250 1-pole, 2000 V Crimp connection	Transmission of high power	
350	Han® HC Modular	Han® HC Modular 350 1-pole 2000 V Axial screw connection Crimp connection	Transmission of high power	
650	Han® HC Modular	Han® HC Modular 650 1-pole 4000 V Axial screw connection Crimp connection	Transmission of high power	

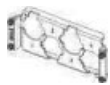
Table III- 4.2
Overview of contacts and high-current contacts

Product	Features	Produktfoto
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 connection or Crimp / crimp connection Surface: - gold plated	
Special contacts for D-Sub. Mixed high-voltage contact 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-voltage contact for cable usage	Rated current: up to 40 A (depending on contact) Surface: – gold plated Wire cross-section: 0.52 – 10.0 mm²	
DIN 41 612[2] contacts FC Signal contacts for cable usage	Rated current: 6 A Surface: – gold plated Wire cross-section: 0.09 – 1.5 mm²	
Han D® (R15) contacts	Rated current: 10 A Cross-section: 0.14 – 2.5 mm² Surface: – gold plated – silver plated – GoldTec®	
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: – 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	
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 Power contact: Cross-section: 20 – 35 mm² 35 – 70 mm² 95 – 120 mm² PE contact: Cross-section: 35 – 70 mm² For Han® HPR and Han® M housings, size 48 Cross-section: 35 mm² 50 mm² 70 mm² 95 mm² 120 mm² For Han® HC Modular 350	Axial screw Screw connection method (for cable lugs up to 120 mm², only install in bulkhead-mounting housing) Crimp	
Han® HC Modular 650	Rated current: 650 A Cross-section: 70 – 120 mm² 150 – 185 mm² For HPR housing Cross-section: 240 mm² For Han® HC Modular 650	Axial screw Screw connection method (for cable lugs from 70 to 240 mm², only install in bulkhead-mounting housing) Crimp	

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

Product	Product illustration	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

Product	Product illustration	Housing Han® HPR size
4 x Han® HC Modular 350 + 1 x PE		48 B
6 x Han® HC Modular 350		48 B
10 x Han® HC Modular 350		48 B
For holding 4 contact inserts and/or 4 hinged frames (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-4.3 Connectors in accordance with DIN 41 612 / IEC 60 603-2

Trains are considered one of the safest modes of transportation throughout the world. One factor that has contributed to this image of safety is the strict requirements restricting flammable materials used on trains.

The French NFF railway standard has established a widely recognized norm that is now used in many other parts of the world as well.

The HARTING connectors set a new benchmark; they comply with DIN 41 612 and IEC 60 603-2 while also meeting the requirements of all hazard classes specified in NFF 16-101 and NFF 16-102. You can eliminate complex steps in the project planning phase when working with HARTING's "DIN Signal" and "DIN Power" connectors. The approval process is also significantly simplified.

Classified in accordance with NF F 16-101

The NF F 16-101 is used to classify the flammability of non-metallic materials used in railway vehicles. The opacity and toxicity of the smoke and gas emitted when the material burns are tested. The following values control the way a connector is classified for usage:

Flammability class

I0	for I.O. ≥ 70	and no inflammation at 960 °C
I1	for I.O. 45 - 69	and no inflammation at 960 °C
I2	for I.O. 32 - 44	and no inflammation at 850 °C
I3	for I.O. 28 - 31	and no afterburning at 850 °C
I4	for I.O. ≥ 20	
NC	not classified	

Smoke factor class

F0	for I.F. ≤ 5
F1	for I.F. 6 - 20
F2	for I.F. 21 - 40
F3	for I.F. 41 - 80
F4	for I.F. 81 - 120
F5	for I.F. > 120

Classified in accordance with NF F 16-102

The tables from the NF F 16-102 show which flammability class and smoke factor class must be met in order to allow a product to be used in an application with that group classification. During the project tender phase, the customer will specify which group must be implemented. The classification scheme considers the type of train, the type of route and the tunnels on the route.

The connectors classified as I2 and F1 (an excellent classification for plastics) can be used for all four groups of railway applications according to DIN 41 612 / IEC 60 603-2.

group1

	I0	I1	I2	I3	I4	NC
F0						
F1			X			
F2						
F3						
F4						
F5						

group2

	I0	I1	I2	I3	I4	NC
F0						
F1			X			
F2						
F3						
F4						
F5						

group3

	I0	I1	I2	I3	I4	NC
F0						
F1			X			
F2						
F3						
F4						
F5						

group4

	I0	I1	I2	I3	I4	NC
F0						
F1			X			
F2						
F3						
F4						
F5						

Classification from NFF 16-102, April 1992

Table III- 4.4
Overview of DIN 41 612 connectors with NFF classification F1, I2

DIN Signal

2B female connector with solder pins 4.5 mm, PL 2  09 22 232 6825 222	**2B male connector** with right angled solder pins, PL 2  09 22 132 6921 222
2C female connector with solder pins 4.5 mm, PL 2  09 23 248 6825 222	**2C male connector** with right angled solder pins, PL 2  09 23 148 6921 222
B female connector with solder pins 4.5 mm, PL 2  09 02 264 6825 222	**B male connector** with right angled solder pins, PL 2  09 02 164 6921 222
C female connector with solder pins 4.5 mm, PL 2  09 03 296 6825 222	**C male connector** with right angled solder pins, PL 2  09 03 196 6921 222
M female connector with solder pins 4.5 mm, PL 2, order special contacts separately  09 03 278 6805 222	**M male connector** with right angled solder pins, PL 2, order special contacts separately  09 03 178 6901 222
R female connector with right angled solder pins, PL 2  09 73 296 6801 222	**R male connector** with solder pins 4.0 mm, PL 2  09 73 196 6903 222

DIN Power

D female connector	D male connector
with solder pins 4.5 mm, PL 2	with right angled solder pins, PL 2
 09 04 232 6831 222	 09 04 132 6921 222
E female connector	**E male connector**
with press-in pins 11.5 mm, PL 2	with right angled solder pins, PL 2
 09 05 248 6851 222	 09 05 148 6921 222
F female connector	**F male connector**
with solder pins 4.5 mm, PL 2	with right angled solder pins, PL 2
 09 06 248 6835 222 low profile 09 06 248 6834 222	 09 06 148 6901 222
F female connector	**F male connector**
for crimp contacts	with right angled solder pins, PL 2, with snap-in clips
 09 06 248 3201 222	 09 06 348 6901 222
H female connector	**H male connector**
for faston 6.3 x 2.5, PL 1	with right angled solder pins, PL 1
 09 06 215 2871 222 low profile with solder pins 4.0 mm 09 06 215 2821 222	 09 06 115 2911 222
Shell housings	
	All shell housings fulfil NFF classification F1, I2. Details see catalogue "Connectors DIN 41 612".

When not otherwise specified, all components shown in Table III- 4.4 are fully equipped with contacts. Other requirement levels (AFS) and assemblies are available on request, or refer to the “HARTING Connector DIN 41 612” Catalogue.

III-5 Power connectors

One of the major keys to saving time and money during the installation of railway motors and drives is taking advantage of a pluggable power connector solution.

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-24B housings from the Han® HPR series. 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 overview tables 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 gland 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 3 x M32	Hood 1 x M50	Hood 1 x M63	Hood 3 x M25, 1 x M20	Hood angled 3 x M25
100A Module U = 1000 V I = 100 A 6 - 10 mm 10 – 25 mm 16 – 35 mm , 38 mm	✓	✓	✓	✓	✓	✓		
200A Module U = 1000 V I = 200 A 25 – 40 mm 40 – 70 mm	✓	✓	✓	✓	✓	✓		
Han K3/0 U = 1150/2000 V I = 200 A 25 – 35 mm 35 – 70 mm		✓		✓	✓	✓		
Han K3/0 angled U = 1150/2000 V I = 200 A 35 – 70 mm								✓
Han K3/2 U = 1150/2000 V I = 200 A 16 – 35 mm (PE) 35 – 70 mm	✓		✓			✓	✓	
Han K3/2 angled U = 1150/2000 V I = 200 A 16 – 35 mm (PE) 35 – 70 mm								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, bulkhead mounting	Housings, surface mounting horizontal 3 x M25	Housings, surface mounting horizontal 3 x M25, 1 x M20	Housings, surface monting 3 x M25
100 A Module U = 1000 V I = 100 A 6 - 10 mm 10 – 25 mm 16 – 35 mm , 38 mm	↘	↘		↘
200 A Module U = 1000 V I = 200 A 25 – 40 mm 40 – 70 mm	↘	↘		↘
Han K3/0 U = 1150/2000 V I = 200 A 25 – 35 mm 35 – 70 mm	↘	↘		↘
Han K3/0 angled U = 1150/2000 V I = 200 A 35 – 70 mm	↘			
Han K3/2 U = 1150/2000 V I = 200 A 16 – 35 mm (PE) 35 – 70 mm	↘		↘	
Han K3/2 angled U = 1150/2000 V I = 200 A 16 – 35 mm (PE) 35 – 70 mm	↘			

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, bulkhead 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 mm Crimp termination	↘		↘			↘		
HC Modular 350 U = 2 kV / 4 kV [5] I = 350 A 20 – 120 mm 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 mm						↘		
HC Modular 650 U = 4 kV I = 650 A 60 – 185 mm Axial screw termination 240 mm Crimp termination					↘	↘		
HC Modular 650 U = 4 kV I = 650 A Screw terminal for cable lug 70 – 240 mm						↘		

-Separate PE-contact
- (16 – 35 mm) 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, bulkhead mounting 3- and 4-pole	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 mm Crimp termination		On request	On request		On request
HC Modular 350 U = 2 kV/ 4 kV [4] I = 350 A 20 – 120 mm 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 mm			↘		
HC Modular 650 U = 4 kV [1] I = 650 A 60 – 185 mm Axial screw termination 240 mm Crimp termination	↘ [1]		↘	↘ [1]	
HC Modular 650 U = 4 kV I = 650 A Screw terminal for cable lug 70 – 240 mm			↘		

- Separate PE-contact
- (16 – 35 mm) available

- Frame necessary
- Hoods appropirate only with frames
- Bulkhead-mounting housing must be additional ordered for surface-mounting housing
- [1] with hexagonal adapter

III-5.2 Power connector with two-part housing

The new power connector is based on sized-24B housings from the Han® HPR series. But in contrast to these housings, it consists mainly of a hood with cover and contact support 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 glands 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 pushed over the assembled connector and fastened.

This robust power connector has a compact design but still provides enough cabling space so that convenient assembly is possible even with large cable cross-sections.

A mounting plate is used to fasten the power connector to the railway vehicle body or pivot mounting.
A custom fastening solution can also be implemented that is tailored to the installation position and space available in the customer application.

Threaded holes are available for connecting cable lugs. These can be used to provide the external PE contact that is often required for railway applications.

The new sectional housing is especially advantageous when using shielded cables. With shielded cable, the structure of the EMC cable gland often does not allow the cable to be pulled through a gland and one-part housing.
The cable gland has been newly designed for this connector; it allows the user to see when the shield is attached so he can create a more secure connection.

The offset cable is inserted into the cable gland. The contacts are then connected and the frame is secured. After the pressure screw is tightened, the shielding braid can then be drawn over the elongated enclosure on the cable gland. Contact is then established using the self-clamping clip.

This provides the user with a quick, safe and convenient method for installing the contact and shielding connections.

The high-current contacts (Han® HC Modular 250, Han® HC Modular 350 and Han® HC Modular 650) with a crimp or axial screw connection can be used for the actual power transmission.
The new cable glands are available in sizes M25 an M32.

If a shield is not required, then standard cable glands in the sized mentioned above can also be used.

The new power connector 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 glands. A four-pole variant is also possible with Han® HC Modular 250 and with Han® HC Modular 350 contacts and M25 cable glands.

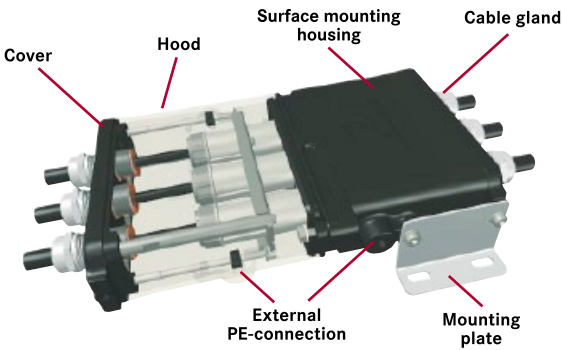


Figure III- 5.1
External construction

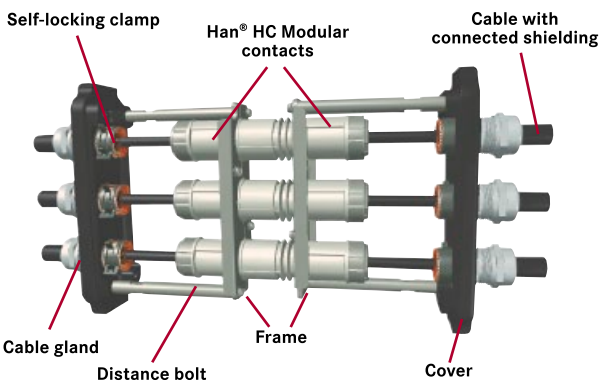


Figure III- 5.2
Internal construction

Table III- 5.5
Technical details

Housing type	Han® 24 HPR EasyCon
IP protection degree	IP 68
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
Support frame for holding contacts	Stainless steel 3 or 4 contacts: Han® HC Modular 250 and Han® HC Modular 350 3 contacts: Han® HC Modular 650
Cable gland	Special cable gland with self-clamping clip for contact with shield, M25 or M32 Alternative: Standard cable gland, M25 or M32

III-6 Han-*Yellock*® housing and contact inserts

Han-*Yellock*® is ideal for use in electrical cabinets and driver's console inside of railway wagons. The totally 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 structure of the Han-*Yellock*® interface consists of a device-side bulkhead-mounting housing and cable-side support housing with hood. The interior interlock (which can optionally protect against accidental opening) securely holds both housings together after they are plugged in.

The Han-*Yellock*® also features two newly designed modules with "Quick Lock" and "Crimp" connection 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.

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

The crimp-connect modules can only be assembled with pin contacts. A socket sleeve establishes the contact. This sleeve comes integrated into the socket support by default. The socket support can be inserted onto the touch-protected pin contacts on either the cable side or on the device side. This significantly simplifies the assembly process and results in less required product article numbers.

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 non-directional installation of the insulating base requires no tools and makes the assembly even simpler. Just snap in the module and you're ready to go.

Han-*Yellock*® is available in the following sizes: Han-*Yellock*® 30 for 3 modules and Han-*Yellock*® 60 for 6 modules. The flange seal around the circumference also covers the retaining covers and screws. It ensures IP 67 protection in accordance with DIN EN 60 529. The wide range of coding possibilities also 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.

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

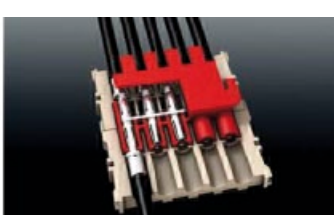


Figure III- 6.3
Han-*Yellock*® *multiplying the potentials inside of the connector*

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 and type
- Availability of tools
- Installation location
- Location where connector will be used

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

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

Table III- 7.1
Overview of contact inserts and wire connection types

Wire connection method	HARTING series
Screw terminal	Han E® Han® HsB Han Hv E® Han® K 6/12 Han® K4/x Han A®
Cage clamp connection	Han® ES Han® ESS Han® ES module Han® K 4/4 (control contacts) InduCom9 MVB InduCom9 WTB InduCom9 CAN InduCom9 Profibus DIN 41 612 shape H15
Han-Quick Lock® connection	Han® 3 A Han® 4 A Han® 7 D Han® 8 D Han® Q 5/0 Han® Q 12/0 (PE contact)
Crimp connection	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 (only 240 mm^2) 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 Bauform F
Axial screw connection	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

These connection methods are described in the text below.

III-7.1 Screw terminal

The screw terminals are designed in accordance with 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.

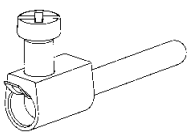


Figure III- 7.1
Screw terminal
with wire protection

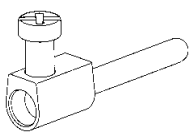


Figure III- 7.2
Screw terminal
without wire protection

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 gauge (mm^2)	1.5	2.5	4	6	10	16
Screw thread	M3	M3	M3.5	M4	M4	M6
Test moment of torque(Nm)	0.5	0.5	0.8	1.2	1.2	1.2*
min. pull-out for stranded wire (N)	40	50	60	80	90	100

* with screws without heads

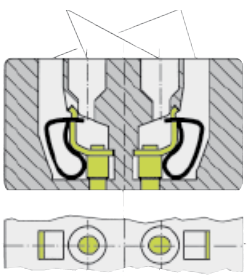
III-7.2 Cage-clamp terminal

This connection method 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

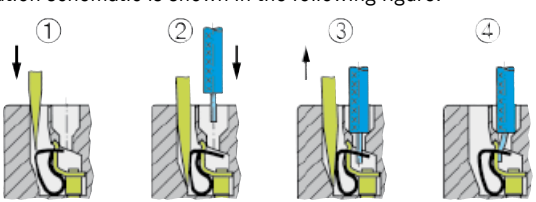
One conductor per termination

Slot for screwdriver



Installation:
- 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

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

This connection method 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 connection
- 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.

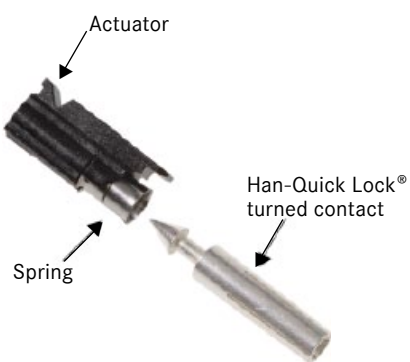
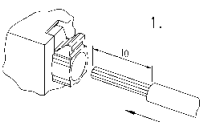


Figure III- 7.3
Han-Quick Lock® termination technique

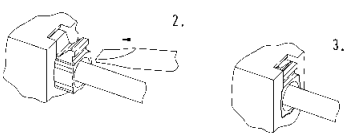
Figure III- 7.4 illustrates this connection technology.

Figure III- 7.4
Han-Quick Lock® termination technique

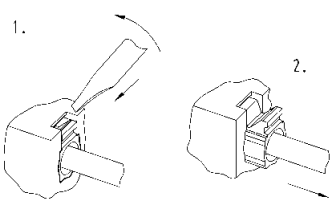
Assembly Manual Han-Quick Lock®
Remove cable jacket and strip the fine stranded wires.



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



Removal Manual Han-Quick Lock®
Please insert the screw driver at an angle of 45° into the opening and lever the slide out.



Technical characteristics

Terminal cross-section	0.34 – 1.5 mm²	0.5 – 2.5 mm²
	AWG 22 – 16	AWG 20 – 14
Slide	black	blue

Further information and a video presentation you will find on our Homepage: www.HARTING.com

III-7.4 Crimp wire connection

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 crimping 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 connection method are:

- Can be processed with crimping machines or with manual crimping tools
- Connection 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 wires with cross-sections up to 10 mm². 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 mm².

Table III- 7.3
Pull-out forces for crimp connections in accordance with DIN IEC 60 352-2, A2

Wire cross-section		Pull-out force	HARTING contacts
mm²	AWG	N	
0.14	26	18	Han D®; Han E®; D-Sub; DIN 41 612
0.22	24	28	Han D®; Han E®; D-Sub; DIN 41 612
0.25		32	Han D®; Han E®; D-Sub; DIN 41 612
0.32	22	40	Han D®; Han E®; D-Sub; DIN 41 612
0.50	20	60	Han D®; Han E®; D-Sub; DIN 41 612
0.75		85	Han D®; Han E®; D-Sub; DIN 41 612
0.82	18	90	Han D®; Han E®; DIN 41 612
1.00		108	Han D®; Han E®; DIN 41 612
1.30	16	135	Han D®; Han E®; DIN 41 612
1.50		150	Han D®; Han E®; DIN 41 612
2.10	14	200	Han D®; Han E®; Han C®
2.50		230	Han D®; Han E®; Han C®
3.30	12	275	Han E®; Han C®
4.00		310	Han E®;Han C®
6.00	10	360	Han C®
10.00	8	380	Han C®

Table III- 7.4
Overview of the stripping lengths for cross-sections 0.14 – 10 mm²:

Wire cross-section		Stripping length [mm]				
mm²	AWG	Han D® Han DD® Han-Modular® (10A)	Han E® Han A® Han Hv E® Han-Modular® (16A)	Han® C	DIN 41 612	D-Sub
0.14 ...0.37	26 – 22	8	7.5		3.5	4
0.50	20	8	7.5		3.5	4
0.75	18	8	7.5		3.5	4
1.00	18	8	7.5		3.5	
1.50	16	8	7.5		3.5	
2.50	14	8	7.5	9		
3.00	12		7.5	9		
4.00	12		7.5	9.6		
6.00	10			9.6		
10.00	8			15		

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 with crimp dies according to DIN EN 46 235. Thus, crimping can be carried by tools which:

- Can exert a pressing force of 130 kN (or 13 tons)
- Can be fitted with crimping dies according to DIN 46 235.

Additional tools are not required.

Table III- 7.5
Stripping lengths 10 – 240 mm²

Contact	Product article 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	
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 6167 / 6267	240	46	Han® HC Modular 650

III-7.4.2 Connecting multiple 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 connection

An axial screw wire connection 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. Wires with cross-sections ranging 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.

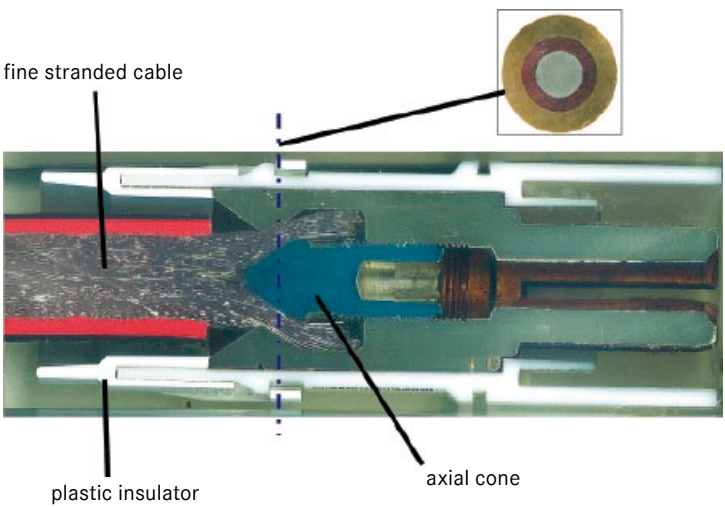


Figure III- 7.5
A schematic of the axial screw connection

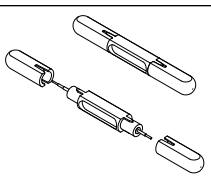
Figure III- 7.5 shows a cut-out view of a contact with an axial screw connection.

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

III-8 Overview of tools and accessories

Table III- 8.1
Crimping tools

Product	Features	Product photo
Crimping tool		
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: 6 mm² AWG 10	
Crimping tool 09 99 000 0377	Wire cross-section: Han® C: 6 – 10 mm² AWG 10 – 8	
Wire-end 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-end ferrules to the existing Han-Modular® hinged frame.	

Product	Features	Product photo
Crimping tool		
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 crimping 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 die 09 99 000 0508	For crimping tool 09 99 000 0503	
Crimping tool 61 03 600 0022	For D-Sub contacts Wire cross-section 0.08 – 0.82 mm² AWG 28 – 18 Attention: Locator must be ordered separately!	
Locator 61 03 600 0023 61 03 600 0024	For crimping tool 61 03 600 0022 AWG 28 - 20 AWG 20 - 18	
TK crimping machine 09 98 000 6000	Han D®, Han E® contacts Wire cross-section 0.34 – 4.0 mm² AWG 22 – 12 Performs both stripping and crimping processes (Refer to the Han® Industrial Connectors Catalogue)	
Crimpautomat TC Han D®: 09 98 000 9001 Han E®: 09 98 000 9002 Han C®: 09 98 000 9003	contacts Han D®. Han E® and Han C® Wire cross-section 0.14 – 6.0 mm² AWG 26 – 10 Performs crimping (Refer to the Han® Industrial Connectors Catalogue)	
HARTING pneumatic crimping tool 09 99 000 0810 Tool heads (Refer to the Han® Industrial Connectors Catalogue)	Wire cross-section: Han®: 0.14 – 1.5 mm² AWG 26 – AWG 16 Han E®: 0.14 – 4.0 mm² AWG 26 – AWG 12 Han ®C: 1.5 – 10.0 mm² AWG 16 – AWG 8	

Product	Features	Product photo
Crimping tool		
Crimping tool 09 99 000 0620	For individual contacts BC and FC	
Crimp die set 09 99 000 0621 09 99 000 0622 09 99 000 0623	For individual contacts BC / FC1 FC2 FC3	
Locator 09 99 000 0630 09 99 000 0631	For individual contacts BC FC	
Service case 09 99 000 0632	Crimp tool with 5 crimp die sets and screwdriver for changing the inserts, without contents	
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 reel with 500 contacts BC for reel with 500 contacts FC1 FC2 FC3	
Crimping tool for individual contacts (Servicing tool) 09 99 000 0191	for contacts FC1, FC2 and FC3 A locator is included in the delivery.	
Manual crimping tool 61 03 600 0020	For crimp flange and crimp sleeve	

Table III- 8.2
Tool inserts

Product	Features	Product photo
Tool inserts	For manual crimping tools 09 99 000 0501 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
Removal/disassembly tools		
Han D® 09 99 000 0012	Opens the contact cavity on the plug side. Pulls out the wire strands with the contact on the connection side.	
Han E® 09 99 000 0319	Opens the contact cavity and pulls out the wire strands with the crimped-on contact on the connection side.	
Han C® 09 99 000 0305	Opens the contact cavity and pulls out the wire strands with the crimped-on contact on the connection side.	
Han Quintax® 09 99 000 0323	Removal tool for removing the Quintax® contacts from the Quintax® module	
D-Sub contacts 09 99 000 0511	Assembly and removal tool	
Coaxial contacts 09 99 000 0512	Removal/disassembly tool	
BC contacts 09 99 000 0101	Removal/disassembly tool	
FC1, FC2 and FC3 contacts 09 99 000 0087	Removal/disassembly tool	

Table III- 8.4
Assembly tools

Product	Features	Product photo
Assembly tools		
Assembly tool for crimp contacts 09 99 000 0059	Recommended for wire cross-sections less than 0.75 mm² (AWG 18). For Han D® and Han E® contacts	
Stripping tool 09 99 000 0159	For stranded and solid wires 0.08 – 10 mm² AWG 28 – AWG 6	
Allen hex wrench for axial terminal screw 09 99 000 0313 09 99 000 0363 09 99 000 0364 09 99 000 0364 09 99 000 0365	For 40 A contacts: SW[1] 2 100 A contacts: SW[1] 4 200 A contacts: SW[1] 5 350 A contacts: SW[1] 5 650 A contacts: SW[1] 8	
1/4“ bit 09 99 000 0369	40 A contacts: SW[1] 2	
3/8“ adapter 09 99 000 0370 09 99 000 0371 09 99 000 0371 09 99 000 0372	100 A contacts: SW[1] 4 200 A contacts: SW[1] 5 350 A contacts: SW[1] 5 650 A contacts: SW[1] 8	
Assembly tool 09 99 000 0367	For contact inserts with caged tension-spring 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 installation D-Sub housing 9 – 37 poles D-Sub housing 50 poles	

[1] SW = spanner width

III-8.1 Mounting frame for Han® housing

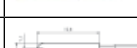
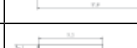
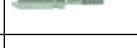
Table III- 8.5
Mounting frames for Han® housing

Product	Features	Product photo
Mounting frame For housing Han® B Sizes 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 Han® HPR housing Sizes 6 B: 09 40 000 9901 10 B: 09 40 000 9902 16 B: 09 40 000 9903 24 B: 09 40 000 9904	For strengthening the mounting surfaces; Intended for use with Han® B housings and Han® HPR housings Sizes 6 B – 24 B, on thin-walled panels. We recommend using the mounting frame when installing multiple housings in a row.	

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		
Locking stud (for Han® mono-block contact inserts) 09 30 000 9901 1)	6 coding options 3) for housings with one contact insert / two contact inserts	
Locking stud (for Han-Modular®) 09 14 000 9901 1)	6 coding options 3) for housings with one contact insert / two contact inserts	
Guide pin (for Han® mono-block contact inserts) 09 33 000 9908 2)	16 coding options 3) for housings with one contact insert (15 coding options with two contact inserts)	
Guide socket (for Han® mono-block contact inserts) 09 33 000 9909 2)	16 coding options 3) for housings with one contact insert (15 coding options with two contact inserts)	
Guide pin (for Han® mono-block contact inserts) 09 33 000 9937 2)	With extended thread	
Guide socket (for Han® mono-block contact inserts) 09 33 000 9938 2)	With extended thread	
Guide pin (Han-Modular®) 09 14 000 9908 2)	16 coding options 3) for housings with one hinged frame (15 coding options with two hinged frames)	
Guide socket (Han-Modular®) 09 14 000 9909 2)	16 coding options 3) for housings with one hinged frame (15 coding options with two hinged frames)	

1): 4 pieces / connector (top section and bottom section)
2): 4 pieces / connector
3): Refer to Chapter IV Installation Instructions, Coding Elements
Please contact us for more information if these coding options are not adequate for your requirements.

Coding elements		
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.

III

Dimensioning examples:

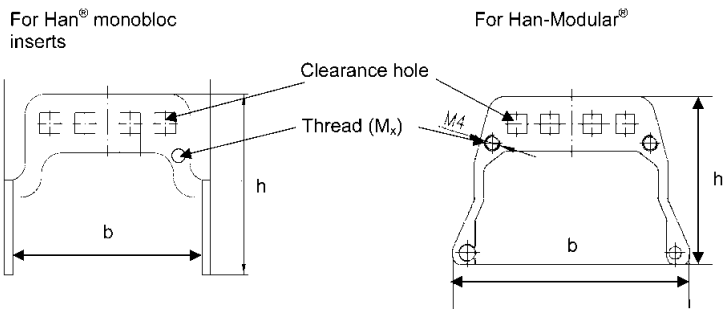
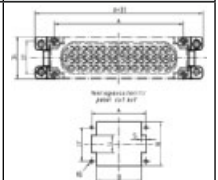
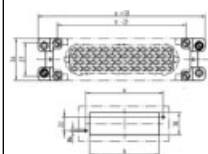
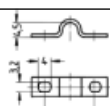
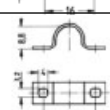


Table III- 8.7
Shield frame, grip panel, screw adapter, clamps

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

Product article number	Description	Size	Series usage	Technical specifications Height h (mm) / total width w (mm)	Material	Sample illustration
09 00 000 5211	Shield frame	24 B	For Han-Modular® in bulkhead-mounting housing	63.7 / 108.5	Galva-nized steel	
09 00 000 5298	Shield frame	24 B	For Han-Modular® in bulkhead-mounting housing or hood housing, Tall height	42.2 / 108.5	Galva-nized steel	
09 00 000 5235	Shield frame	24 B	For Han-Quintax® in bulkhead-mounting housing	42.2 / 108.5	Galva-nized steel	
09 00 000 5209	PE frame	24 B	For Han-Modular® in bulkhead-mounting housing or hood housing, Tall height	38.2 / 108.5	Galva-nized 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	Galva-nized 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	Galva-nized steel	

Product article number	Description	Size	Series usage	Technical specifications Height h (mm) / total width w (mm)	Material	Sample illustration
09 00 000 5602*	Screw adapter bulkhead-mounting 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			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	Die-cast zinc	
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 inside railway vehicles.

Figure III- 8.1
Han® EE multiplier

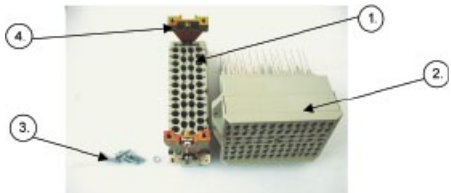


Figure III- 8.2
Han® EE multiplier variants

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

Table III- 8.8
Han® 46 EE multiplier

Variants	Product article number	Consisting of	Position in Figure III- 8.2
Male version	09 32 046 5651	One Han® 46 EE contact insert (M), unpopulated	1
		One Han® 46EE multiplier populated with 46 long contact pins	2
		4 M3 retaining screws	3
		2 PE panels (pre-mounted to contact insert)	4
Female version	09 32 046 5751	One Han® 46 EE contact insert (F) populated with 46 contact sockets	1
		One Han® 46 EE multiplier populated with 46 short contact pins	2
		4 M3 retaining screws	3
		2 PE panels (pre-mounted to contact 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-24B bulkhead-mounting housing. Figure III- 8.3 illustrates the layout.

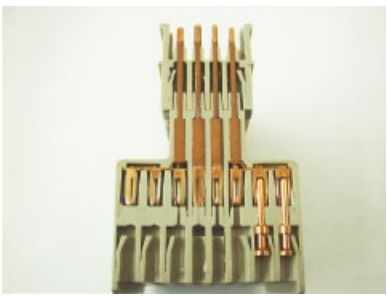


Figure III- 8.3
Han® 46 EE sectional view

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

III-8.5 Cable glands

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

	Part number	thread M	cable diameter 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
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

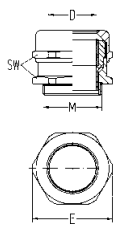
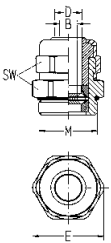


Table III- 8.10
EMC cable glands for metric cable entries (IP 68)

Part number	thread M	cable-Ø D		shield-Ø B		SW	E
		min.	max.	min.	max.		
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
Blanking piece for metric cable entries, metal

Part 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

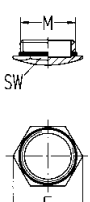


Table III- 8.12
Reducers for metric cable entries, metal

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

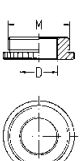
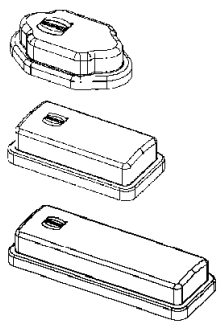
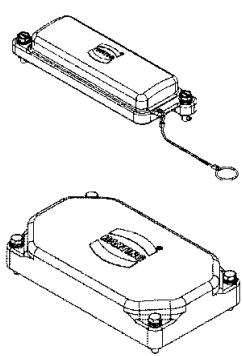


Table III- 8.13
Covers for Han® HPR bottom housing section

Covers		
Transport protective cover HPR 09 40 003 5406 09 40 006 5406 09 40 010 5406 09 40 016 5406 09 40 024 5406	For bulkhead-mounting and surface-mounting housings IP 20 protection To snap on Size HPR 3 A Size HPR 6 B Size HPR 10 B Size HPR 16 B Size HPR 24 B	
Covers HPR 09 40 006 5411 09 40 010 5411 09 40 016 5411 09 40 024 5411 09 40 048 5401	For bulkhead-mounting and surface-mounting housings IP 68 protection Screw lock Size HPR 6 B Size HPR 10 B Size HPR 16 B Size HPR 24 B Size HPR 48 B	

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 housings and HPR housings. Additional information is included about interlock mechanisms that are also available as spare parts.

Table III- 9.1
Screws, interlock 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	
Retaining screw 09 16 000 9903	For all Han® monobloc contact inserts	
Contact screw 09 30 000 9997	For Staf®, Han® 3 A, 4 A	
Han® 3 A retaining screw 09 20 000 9995	Without sealing ring	
Han® 3 A retaining screw 09 20 000 9918	With seal (for IP 65 protection)	
Han® HPR interlock screw 09 40 000 9932	M6 For HPR hood housing Sizes 6 B, 10 B, 16 B and 24 B with screw interlock 09 40 0xx 0x**1**x 19 40 0xx 0x**1**x	
Han® HPR interlock screw 09 40 000 9929	M3 For HPR hood Size 3 A with screw interlock 19 40 x03 041x	

III

Product Locking lever	Features	Product photo
Han Easy-Lock® 1 lever locking system 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® 2 lever locking system 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 1 lever locking system[1)] 09 00 000 5401 09 00 000 5264 09 00 000 5288	Sizes 6 B 10 B 24 B	
Han Easy-Lock® X 2 lever locking system[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 retaining material
Interlock roll 09 30 000 9998	Size 48 B (two per housing)	
Locking panel[2)] (for Han Easy-Lock® cross lever) 09 30 000 9986	For Han® B bulkhead-mounting housings, sizes 10 B/16 B/24 B	
Locking panel[2)] (for metal cross levers) 09 30 000 9987	For Han® B bulkhead-mounting housings, sizes 10 B/16 B/24 B	No illustration
Locking panel[2)] (for Han-Easy Lock® lengthwise lever). On request	For Han® B bulkhead-mounting housings, sizes 6 B/10 B/16 B/24 B	No illustration

[1)]: Han-Easy Lock® X: Locking clamp 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 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-mounting housings with retaining surface of flange
[4)] For Han® HPR housing

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

Gasket: Required for all housings (bulkhead-mounting, surface-mounting and coupling housing types). It ensures the proper seal between the top and bottom housing sections.

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

Notes

Chapter IV – Installation Instructions

Table of Contents

IV-1 Installation Instructions

This chapter contain instructions for the on-site installation and assembly of the connectors that are most commonly used in the railway industry. Some of the files are found in the catalogues Industrial Connectors Han® and others are available separately upon request in PDF format.

General Notes:

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. HARTING reserves the right to make construction changes in response to manufacturing requirements, improved quality or advances in the design. This information describes the components but should not be considered as a guarantee of certain properties.

Additional information can be found in the catalogues Industrial Connectors Han®, Device Connectivity and Ethernet Network Solutions Automation IT.

IV-2 Contact inserts with axial screw wire connection

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 IV- 2.2 gives an overview of wire cross-sections, stripping lengths, and required torques for the listed contact inserts using the axial screw connection method. The illustration Figure IV- 2.1 shows the designations used for the dimensions. The specified cross-sections of the wires refer to the geometric cross-sectional area of the cable being used. The specifications given here come from the catalogue Industrial Connectors Han®.

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 minimum wire diameter is not specified! (For example: a rated cross-section of 95 mm^2 is greater than a real, geometric cross-section of 89 mm^2.)

Before beginning installation, you can check the connection options for the cable you are using at our accredited HARTING laboratory.

Additional information about the axial screw wire connection 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 IV- 2.1
Retention gap for easily accessible cables, DIN VDE 0100-520: 2003-06

Outer diameter of the cable [mm]	**Maximum gap for the retention 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 lines according to DIN EN 60 228 / VDE 0295 Class 5. Cable constructions that deviate should be checked separately.

Table IV- 2.2
Overview of contact inserts and axial wire connection

Insert	Wire gauge	Stripping length	Tightening torque	Max. cable insulation diameter	Size hexagon recess	ISK dimension for cable indication
	(mm²)	(mm)	(Nm)	(mm)	(SW)	(mm)
Han® K 4/4 finger protected	6 – 16	6 mm²: 11+1 10 mm²: 11+1 16 mm²: 11+1	6 mm²: 2 10 mm²: 3 16 mm²: 4	8.9	2.5	7.4 PE +1.5
	10 – 22	10 mm²: 11+1 16 mm²: 11+1 22 mm² 13+1	10 mm²: 3 16 mm²: 4 22 mm² 5	8.9 8.9 11	2.5	7.4 7.4 5.4 PE +1.5
Han® K 4/4	6 – 16	6 mm²: 11+1 10 mm²: 11+1 16 mm²: 11+1	6 mm²: 2 10 mm²: 3 16 mm²: 4	8.9	2.5	7.4 PE +1.5
	10 – 22	10 mm²: 11+1 16 mm²: 11+1 22 mm² 13+1	10 mm²: 3 16 mm²: 4 22 mm² 5	8.9 8.9 11	2.5	7.4 7.4 5.4 PE +1.5
Han® K 6/12	2.5 – 8	2.5 mm²: 5+1 4 mm²: 5+1 6 mm²: 8+1 8 mm²: 8+1	2.5 mm² 1.5 4 mm²: 1.5 6 mm²: 2 8 mm²: 2	6.1	2	4.7
	6 - 10	6 mm²: 8+1 8 mm²: 8+1 10 mm²: 8+1	6 mm²: 2 6 mm²: 2 10 mm²: 2	6.1	2	4.7
Han® K 6/6	16 – 35	13+/-1	16 mm²: 6 25 mm²: 7 35 mm²: 8	11.4	4	4.9
	10 – 25	13+/-1	10 mm²: 6 16 mm²: 6 25 mm²: 7	11.4	4	4.9
Han® K 8/0	10 – 25	13+/-1	10 mm²: 6 16 mm²: 6 25 mm²: 7	11.4	4	4.75

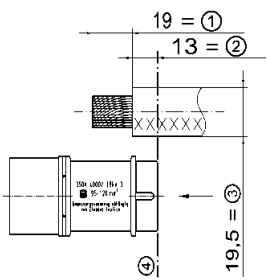
Insert	Wire gauge	Stripping length	Tightening torque	Max. cable insulation diameter	Size hexagon recess	ISK dimension for cable indication
	(mm²)	(mm)	(Nm)	(mm)	(SW)	(mm)
Han® Q 2/0 Han® Q 2/0 High Voltage	2.5 – 10	8+1	1.8	7.3	2	5.6
Han® 200 A module Han® 200 A module with PE	25 – 40	16	25 mm²: 8 35 mm²: 8	12 16	5	3 -
Han® 200 A module Han® 200 A module with PE	40 –70	16	50 mm²: 9 70 mm²: 10	12 16	5	3 -
Han® 100 A module	38	13+/-1	8	11.4	4	4.9
	16 – 35	13+/-1	16 mm²: 6 25 mm²: 7 35 mm²: 8	11.4	4	4.9
	10 – 25	13+/-1	10 mm²: 6 16 mm²: 6 25 mm²: 7	11.4	4	4.9
	6 – 10	13+/-1	6 mm²: 4 10 mm²: 4	11.4	2.5	4.9
Han® 70 A module	6 - 16	6 mm²: 11+1 10 mm²: 11+1 16 mm²: 11+1	6 mm²: 2 10 mm²: 3 16 mm²: 4	8.9	2.5	7.4
	14 - 22	: 12.5+1	14 mm²: 4 16 mm²: 4 22 mm²: 5	10	2.5	5.9
Han® 40 A module	2.5 – 8	2.5 mm²: 5+1 4 mm²: 5+1 6 mm²: 8+1 8 mm²: 11+1	2.5 mm²: 1.5 4 mm²: 1.5 6 mm²: 2 10 mm²: 2	4 4 6 10.5	2	4.7
	6 – 10	6 mm²: 8+1 10 mm²: 11+1	6 mm²: 2 10 mm²: 2	6 10.5	2	4.7
Han® C module with axial screw terminal	2.5 – 8 6 – 10	2.5 mm²: 5+1 4 mm²: 5+1 6 mm²: 8+1 10 mm²: 11+1	2.5 mm²: 1.5 4 mm²: 1.5 6 mm²: 2 10 mm²: 2	4 4 6 8.2	2	5.2

Insert	Wire gauge	Stripping length	Tightening torque	Max. cable insulation diameter	Size hexagon recess	ISK dimension for cable indication
	(mm²)	(mm)	(Nm)	(mm)	(SW)	(mm)
Han® K3/0 straight	35 – 70	22	35 mm²: 8 50 mm²: 9 70 mm²: 10	15	5	8.2
Han® K3/0 angled	35 – 70	22	35 mm²: 8 50 mm²: 9 70 mm²: 10	15	5	9.0
Han® K3/2 straight	35 – 70	22	35 mm²: 8 50 mm²: 9 70 mm²: 10	Power: 15 PE: 10	5	Power: 8.2 PE: 7.2
Han® K3/2 angled	35 – 70	22	35 mm²: 8 50 mm²: 9 70 mm²: 10	Power: 15 PE: 10	5	9.0
Han® HC Modular 350	35 – 70	19 + 1	35 mm²: 8 50 mm²: 10 70 mm²: 12	19.5	5	13
	95 – 120	19 + 1	95 mm² 14 120 mm² 16	19.5	5	13
Ground contact for Han® HC Modular	35 – 70	19 + 1	35 mm²: 8 50 mm²: 10 70 mm²: 12	-	5	-
Han® HC Modular 650	70 – 120	23 + 2	70 mm²: 12 95 mm²: 14 120 mm²: 16	26.5	8	28
	150 – 185	23 + 2	150 mm²: 17 185 mm²: 18	26.5	8	28

The insulating base dimension (ISK) for the cable marking:

Marking the proper cable position for the axial screw connection contact point:

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 IV- 2.1 illustrates this process when using the Han® HC Modular 350 contact. The marker and the upper edge of the insulating base are at the same level (as indicated by the dashed line).



1: Insulation stripping length
2: Insulating base dimension (ISK dimension)
3: Max. cable insulation diameter
4: Inlet line

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

IV-3 General installation information for contacts in the axial screw connection

Observe the following when connecting cables to contacts with the axial screw connection method:

- Strip the wire strands according to the preceding table. (The stripping length depends on the type of contact and contact insert that are being used.)
- Insert the wires strands in the contact chamber until the insulation is flush with the contact.
- 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 driver and the torque value depend on the type of contact and contact insert being used. These values can be found in the preceding table.

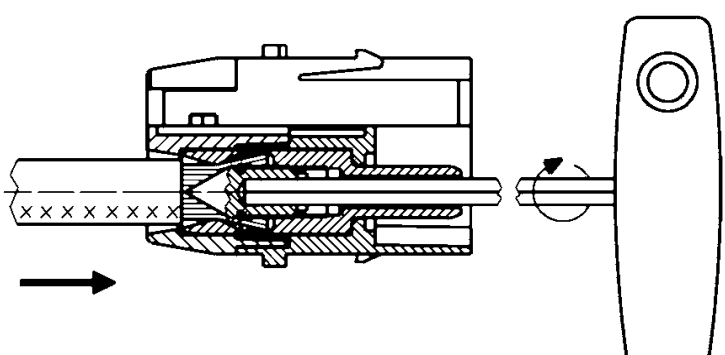
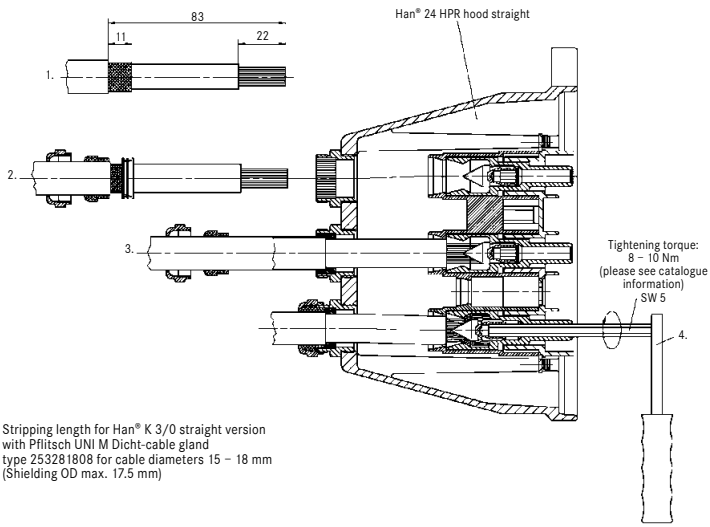


Figure IV- 3.1
A schematic of the axial screw connection

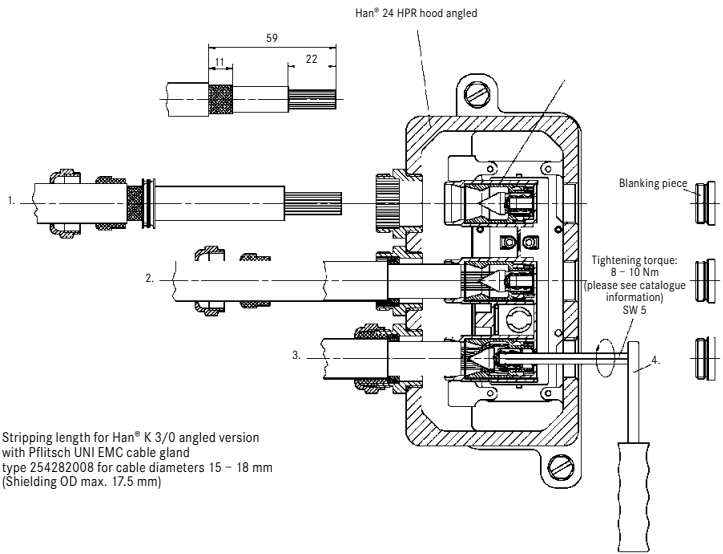
The installation instructions for the Han® K 3/0 and Han® K 3/2 contact inserts, both straight and angled, are detailed in this section.
These instructions vary according to the installation; the contact inserts are intended only for installation in Han® HPR housings.

Installation in straight hoods
19 40 024 0461 (3 x M25 for Han® K 3/0)
19 40 024 0471 (3 x M25, 1 x M20 for Han® K 3/2)



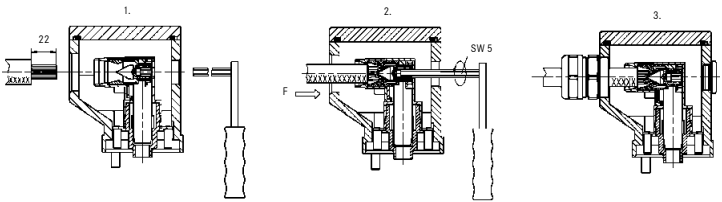
Stripping length for Han® K 3/0 straight version
with Pflitsch UNI M Dicht-cable gland
type 253281808 for cable diameters 15 – 18 mm
(Shielding OD max. 17.5 mm)

Installation in angled hood
19 40 024 0631 (3 x M25 for Han® K 3/0)
Sheet 1

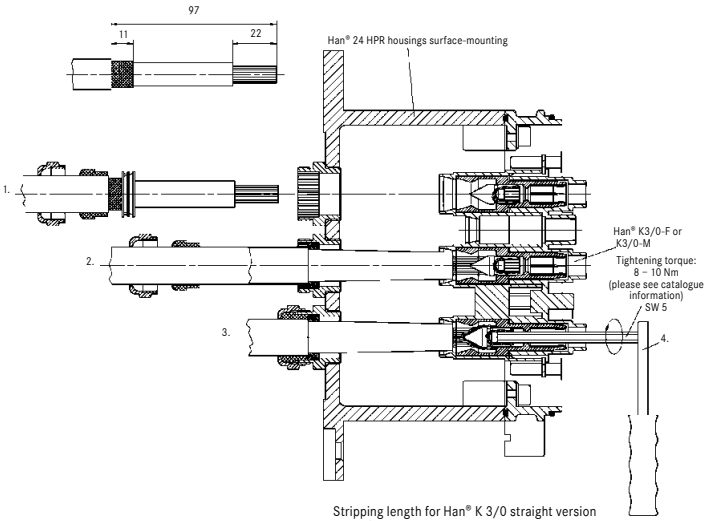


Stripping length for Han® K 3/0 angled version
with Pflitsch UNI EMC cable gland
type 254282008 for cable diameters 15 – 18 mm
(Shielding OD max. 17.5 mm)

Installation in angled hood
19 40 024 0631 (3 x M25 for Han® K 3/0)
Sheet 2



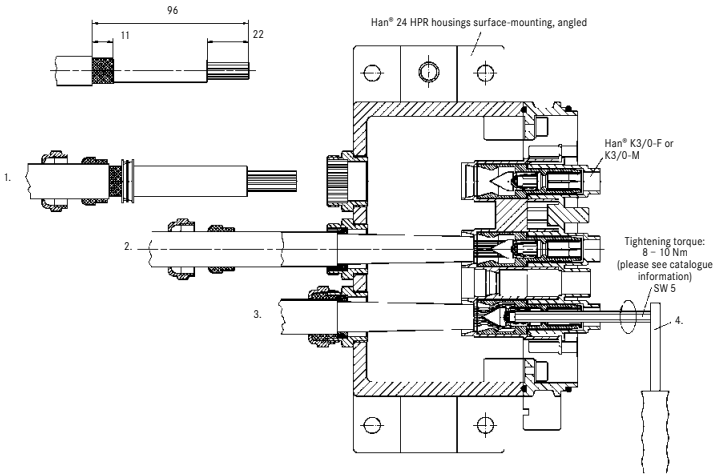
Installation in straight surface-mounting housing
19 40 024 1231 (3 x M25 for Han® K 3/0)
19 40 024 1271 (3 x M25, 1 x M20 for Han® K 3/2)



Stripping length for Han® K 3/0 straight version
with Pflitsch UNI EMC cable gland
type 254282008 for cable diameters 17 – 20 mm
(Shielding OD max. 19.5 mm)

IV

Installation in horizontal surface-mounting housing
19 40 024 0931 (3 x M25 for Han® K 3/0)
19 40 024 0971 (3 x M25, 1 x M20 for Han® K 3/2)

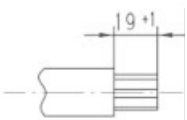


Stripping length for Han® K 3/0 straight version
with Pflitsch UNI EMC cable gland
type 254282008 for cable diameters 17 – 20 mm
(Shielding OD max. 19.5 mm)

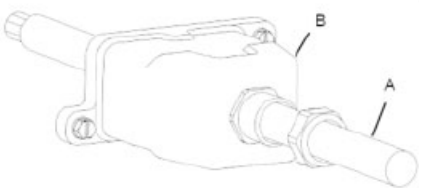
IV-4 Han® HC Modular 350

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

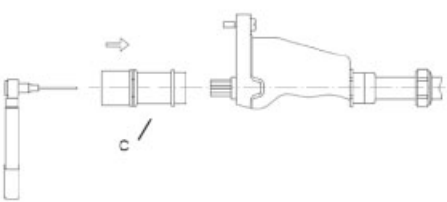
Step 1:
The diameter of the cable's outer insulation may not be greater than 19.5 mm. Strip the cable to the length of 19 mm.



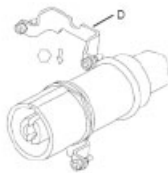
Step 2:
Guide the cable (A) through the hood (B).



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 IV- 2.2. All cable strands must be inserted completely into the contact chamber.

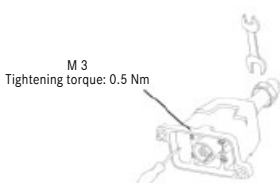


Step 4:
Put the support frame (D) into the hexagon-shaped HC contact. The required coding for the HC contact can be made in 60° steps. The figure below shows an example of a one-pole variant. These steps are also valid for the multi-pole variants of the connector.



Step 5:
Push the contact with the support frame into the hood.

Step 6:
Tighten the four M3 retaining screws and attach the pressure screw on the cable gland according to the manufacturer‘s specifications.



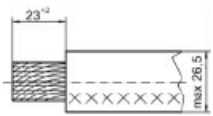
Tools:

0.5 x 3.5 SW 5 (09 99 000 0371)

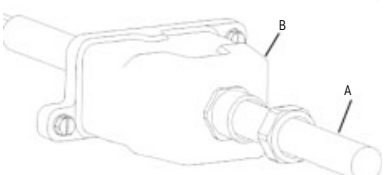
IV-5 Han® HC Modular 650:

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

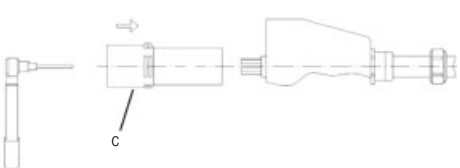
Step 1:
The diameter of the cable‘s outer insulation may not be greater than 26.5 mm. Strip the cable to a length of 23 mm.



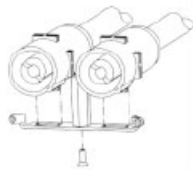
Step 2:
Guide the cable (A) through the hood (B).



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 IV- 2.2. All cable strands must be inserted completely into the contact chamber.

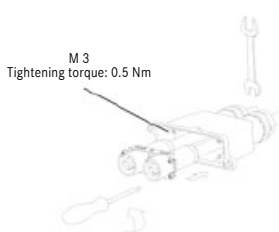


Step 4:
Put the support frame into the H structure of the HC contact. The required coding for the HC contact can be made in 90° steps.

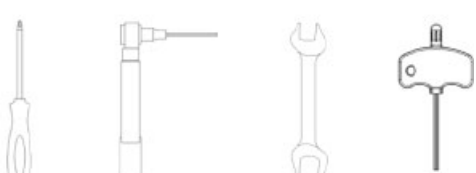


Step 5:
Screw on the support frame on both sides with the hex bolts and using hexagonal screws (SW 2,5).

Step 6:
Insert the contact packet into the hood. Tighten the four M3 retaining 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

IV-6 Installation instructions for the Han® 24 HPR enlarged holder

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:

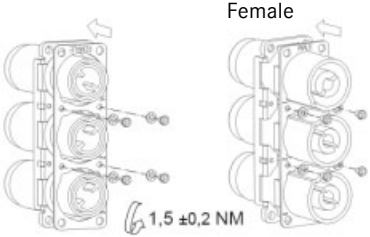
Male

Female

Step 2:

Male

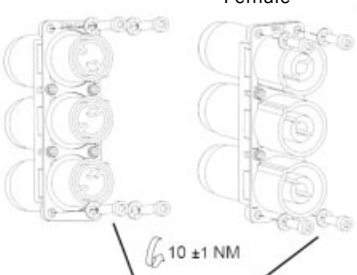
Female



Step 3:

Male

Female



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

IV-7 Coding options for the Han® HC Modular contacts

The high-current contacts in the Han® HC Modular 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 contacts are fitted with corresponding coding pegs and grooves for this purpose (refer to Figure IV- 7.1).

Figure IV- 7.1
Coding pegs and grooves on the Han® HC Modular 350 contact

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 support frame. Refer to Figure IV- 7.2 and Figure IV- 7.3 for additional details.

Figure IV- 7.2
Hexagon-shaped profile of the Han® HC Modular 350 contact

Figure IV- 7.3
H-shaped profile of the Han® HC Modular 650 contact

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

Figure IV- 7.4 illustrates the available coding positions for the Han® HC Modular 350 contact. There are six different positions that can be coded.

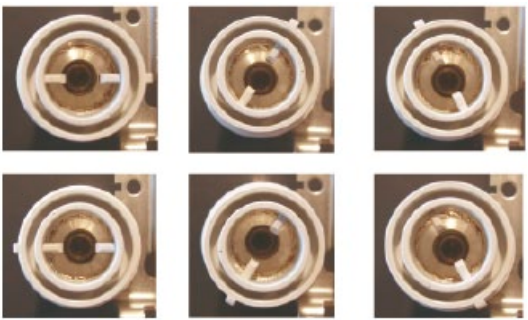


Figure IV- 7.4
Coding options for the Han® HC 350 Modular contacts

The Han® HC Modular 650 contacts have up to four coding positions available (refer to Figure IV- 7.5).

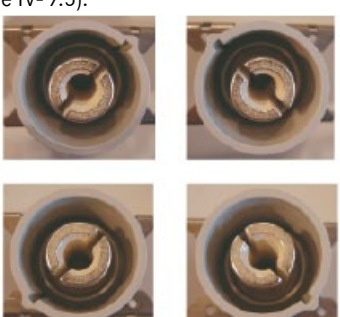


Figure IV- 7.5
Coding positions for the Han® HC 650 Modular contacts

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

IV-8 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.

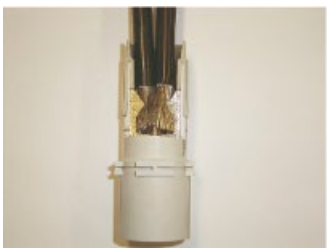


Figure IV- 8.1
Double connection for the Han® HC Modular 650 contacts with two cables, each with a 35-mm² wire cross-section

Figure IV- 8.2
Double connection for the Han® HC Modular 350 contacts with two cables, each with a 25-mm² wire cross-section

IV-9 Han® HC Modular 350 and 650 high-current contacts with screw connection

In addition to the high-current contacts which use the axial screw connection method, it is also possible to connect cable lugs to high-current contacts. The cable lugs 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 spring washer and a hex screw (M10 for the HC 350 and M12 for the HC 650).

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

- Cable lug
- Flat washer
- Spring washer

You must also apply counter pressure to the counter support (as shown in Figure IV- 9.1) 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 insulating base 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**!

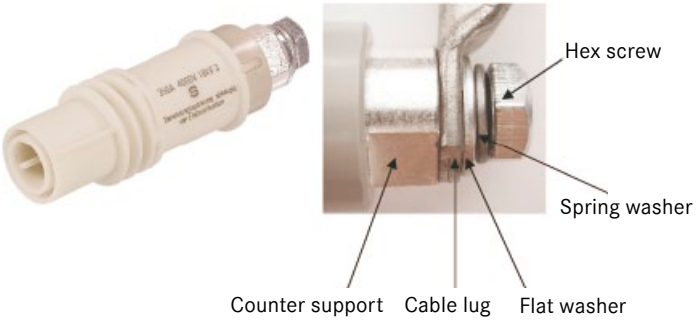


Figure IV- 9.1
Screw terminal connection

IV-10 Installing the high-current contacts in the Han® 48 HPR housing series

Figure IV- 10.1
Han® 48 HPR

Figure IV- 10.1 shows the installation sequence for high-current contacts in 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 connectors 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 IV of the Installation Instructions.

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 (hooded or surface-mounting housing) from the connection side. The four screws for retaining the cover should be tightened with the specified torque.

IV-11 Crimp contacts

The following overview shows which crimping tools should be used for different crimp contacts.

Table IV- 11.1
Overview of crimping contacts and crimping tools

Crimp contact series	mm²	AWG	Crimping tool							Crimping machine				Pneumatic crimper CP 600	Tools		
			09 99 000 0001	09 99 000 0110	09 99 000 0021	09 99 000 0303	09 99 000 0377	09 99 000 0501	09 99 000 0503	09 98 000 6001 [1]	09 98 000 6002 [1]	09 98 000 9001	09 98 000 9002	09 98 000 9003	09 99 000 0813 [3] 09 99 000 0814 [3]	Plug gauge 09 99 000 0379 [2]	Removal 0999 000 0305	Removal 0999 000 0381
Han C® Power contacts 09 32 000	1.5	16	x	x									x	x		1.80		
	2.5	14	x	x									x	x		1.80		
	4.0	12	x	x		x							x	x		2.00		
	6.0	10				x	x						x		x			
	10.0	8					x						x		x			
Han D® Control contacts 09 15 000	0.14 - 0.25	26 - 24	x									x				1.00	09 99 000 0012	09 99 000 0052
				x	x										x			
	0.37	22	x									x				1.00		
			x	x	x					x		x				1.30		
	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	1.55		

Han E® Power contacts 09 33 000	0.14 - 0.37	26 - 22	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		x	2.00	
	4.0	12	x	x						x		x		x	2.00	
D-Sub	0.08 - 0.82	28 - 18						x								
Coaxial DIN 41 652 T1								x	x							
Designation																
Locator Han C®	09 99 000 0308		x													
	09 99 000 0304					x										
Locator Han D®	09 99 000 0311		x													
	09 99 000 0022				x											
Locator Han E®	09 99 000 0310		x													
	09 99 000 0022				x											

1) The crimping machine TK (base) 09 99 000 6000 is required when operating the changeover units 09 99 000 6001 / 6002.
2) Plug gauge with Ø 1.00 mm; 1.30 mm; 1.55 mm; 1.80 mm; 2.00 mm
3) The base device 09 99 000 0810 is required when operating the tool heads 09 99 000 0813 / 0814.

Only the male contact (09 15 000 6107/ 6127/ 6307 => Silver/ Gold/ Han-GoldTec®) or the female contact (09 15 000 6207/ 6227/ 6407 => Silver/ Gold/ Han-GoldTec®) should be used for wire cross-sections 0.14 and 0.25 mm^2. In the current version, the crimping tool 09 99 000 0110 is delivered 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.

IV-12 Crimp contacts for wire cross-sections from 10 to 240 mm²

Figure IV- 12.1
Crimp contact and contact sleeves for Han® HC Modular 350

For wire cross-sections in the 10–240 mm² range, HARTING offers crimp contacts with a crimp zone in compliance with DIN EN 46 235. So for these contacts, you can use tools equipped with DIN crimping jaws in order to meet the requirement for a pressing force of 13 tons (130 kN). The contacts can be used with stranded wires in accordance with IEC 60 228 Class 5.

The following table contains an overview of the available crimp contacts.

Table IV- 12.1
Crimp contacts for wire cross-sections greater than 10 mm²

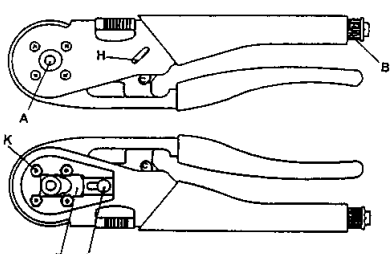
Contact	Product article number	Rated current [A]	Cross-section [mm²]	Stripping length [mm]	Max. insulation diameter [mm]	Remarks
TC70	09 11 000 6131 / 6231	70	10	15.5	11	Han® 70 A Crimp Module
	09 11 000 6132 / 6232	70	16	15.5	11	
	09 11 000 6133 / 6233	70	25	15.5	11	
TC100	09 11 000 6116 / 6216	100	16	19	14	Han® 100 A Crimp Module
	09 11 000 6125 / 6225	100	25	19	14	
	09 11 000 6135 / 6235	100	35	16	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	18	Han® HC Modular 250
	09 11 000 6128 / 6228	250	50	22	18	
	09 11 000 6129 / 6229	250	70	22	18	
TC350	09 11 000 6139 / 6239	350	25	26	22	Han® HC Modular 350
	09 11 000 6140 / 6240	350	35	26	22	
	09 11 000 6141 / 6241	350	50	28	22	
	09 11 000 6142 / 6242	350	70	28	22	
	09 11 000 6143 / 6243	350	95	30	22	
	09 11 000 6144 / 6244	350	120	24	22	
TC650	09 11 000 6167 / 6267	650	240	46	33	Han® HC Modular 650

IV-13 Buchanan four-point crimping 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. Its micrometer type adjusting knob (B) lets you select the precise crimp depth suited to your needs. The tool can be used for Han D®, Han E®, and Han® C contacts and set crimp depth values varying from 0.14 - 4.0 mm². For wire gauge 0.14 mm² a special contact has to be used (male: 09 15 000 6107/ 6127/ 6307 – female: 09 15 000 6207/ 6227/ 6407).
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. If for any reason the crimp cycle is to be aborted, move the ratchet release pin to the left and the tool will release (see depiction)
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**	Locator
B	Selector Knob	**G**	Locking Screw
C	Pointer	**H**	Ratchet Release Pin
D	Selector Plate	**K**	Elastic Stop Nuts
E	Latch	**L**	Adjustment Window



LOCATORS

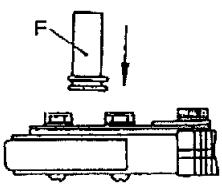
Three different locators can be selected for the tool:
– Han® C contacts = 09 99 000 0308
– Han D® contacts = 09 99 000 0311
– Han E® contacts = 09 99 000 0310

Locators have to be corresponding to the type of crimp contact.

CAUTION: Do not open tool forcibly.

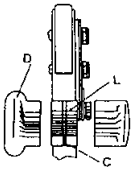
MOUNTING OF LOCATOR

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) on the corresponding wire gauge diameter (D).
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	1.60	1.60
2.10	14	1.45	1.70	–
3.00	12	–	2.00	–
4.00	–	–	2.00	2.00

* Usage of 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 few diameters are implemented.

Gauge pin diameter [mm]	Part 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

REMARK

We prohibit the use of this tool for every other application.

IV-14 Hand crimping tool 09 99 000 0110

Operating Instructions

The Service Crimp Tool 09 99 000 0110 is designed for allpication of twisted HARTING contacts, cross section range 0.14 – 4.0 mm².

For application of these contacts, the crimp tool is equipped with a fixed turn able 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 release

It is possible to effect an early relase 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 specificifies contacts.

Crimping Procedure

- Insert the contact into the proper crimp profile until it is stopped by the locator.
- Insert the stripping wire into the contact.
- Crimp the contact by closing the hanles until the controlled cycle mechanism release.
- Upon, release the handles will open automatically and the crimped contact can be removed.

Pullout forces according to DIN IEC 60 352-2, A2

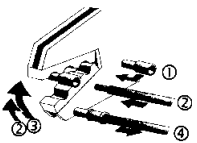
Wire gauge		Tightening torque	Han® contacts
mm²	AWG	N	
0.12	26	15	D
0.14		18	D
0.22	24	28	D
0.25		32	D
0.32	22	40	D
0.50	20	60	D E
0.75		85	D E
0.82	18	90	D E
1.00		108	D E
1.30	16	135	D E
1.50		150	D E C
2.10	14	200	E C
2.50		230	E C
3.30	12	275	E C
4.00		310	E C

We reserve 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.

IV-15 Crimping tool 09 99 000 0303

CRIMPING INSTRUCTIONS

Risk of
ELECTRIC SHOCK
Do not use this tool on live wire.



IV

- Open the tool. Place the terminal into the correct die nest (1).
- Particularly close the tool until the terminal is held in place. Insert the wire into the terminal (2).
- Close the tool until the **RATCHET RELEASES** (3).
- Remove the crimped terminal (4)

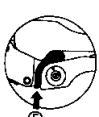
ATTENTION!

- To release the ratchet mechanism, push the trigger in the direction indicated by the arrow (5).

HOW TO ADJUST

It is sometimes necessary to adjust the crimp force:

1. Remove the cover washer.
2. Note the setting wheel position, the remove it.
3. Adjust the eccentric axle with a screw driver. Turn the axle counterclockwise to tighten the preload.
4. Place the setting wheel so the pin in the handle locks die setting wheel. Replace the cover washer.
5. Check preload against factory specification.



MAINTENANCE

It is recommended that each operator of the tool be made aware of – and responsible for – following these maintenance steps.

- Remove dust, moisture and other contaminants with a clean brush, or a soft, lint-free cloth. Do NOT use objects that could damage the tool.
- Make certain all pins, pivot pionts, and bearing surfaces are protected with a THIN cost of any good SAE No. 20 motor oil. Do NOT oil excessively.
- When the tool is not in use, keep the handles closed to prevent objects from becoming lodged in the crimping dies and store the tool in a clean, dry area.

IV-16 Crimping tool 09 99 000 0374

The crimping tool 09 99 000 0374 can be used to process wire-end ferrules with round and trapezoidal-shaped cross-sections for 10 mm^2 cross-sections.

The wire-end ferrules are processed as round crimps and are pressed down very hard. Because of their small size, the ferrules processed as round crimps can be used in even the smallest of housing receptacles.

Interlock

The tool comes with a locking mechanism which ensures that all crimp contacts have a uniform crimping quality.

- It prevents the tool from closing before the crimping jaws are opened.
- It prevents the tool from being opened prematurely during the crimping process.

Premature unlock mechanism

The tool can be unlocked prematurely by using the ratchet lever. The lever is spring-loaded between the hand grips. Press the grips gently together in order to take the load off the tool. Then use a screwdriver to move the ratchet lever against the spring tension to the right. This can be done to prevent the crimp profile from being damaged when the contact is not seated properly in the crimp profile.

Do not open or close the tool using excessive force! Be sure to oil the movable parts regularly.

The crimping process

- Insert the wire-end ferrule in the crimp profile that is appropriate for that size.
- Secure the ferrule between the slightly closed crimping jaws.
- Insert the cable, correctly stripped of insulation, into the contact.
- Crimp until the tool opens again.
- Remove the wire-end ferrule; it is crimped and ready.

IV-17 Crimping tool 09 99 000 0377

Operating Instructions

The Service Crimp Tool 09 99 000 0377 is designed for application of twisted HARTING contacts, cross section range 0,6 and 10 mm^2. For application of these contacts, the crimp tool is equipped with a fixed, turnable 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 release

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 Procedure

- Insert the contact into the proper crimpprofil until it is stopped by the locator.
- Insert the stripping wire into the contact.
- Crimp the contact by closing the handles untol the controlled cycle mechanism release.
- Upon, release the handles will open automatically and the crimped contact can be removed.

Table IV- 17.1
Pullout forces, according to DIN IEC 60352-2, A2

Conductor cross-section		Extraction force	Han® contacts
mm^2	AWG	N	
6,0	10	360	C
10,0	8	380	C

We reserve 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 manufactoring process.

IV-18 Crimping tool for Coax contacts 09 99 000 0503

HOW TO USE THE DANIELS HX4 (M22520/5-01) CRIMP TOOL AND DIES

GENERAL INFORMATION

The DANIELS HX4 crimp tool is designed to crimp various sizes and types of ferrules, coaxial connectors, contacts, splices and terminal lugs to cables and wires. Interchangeable dies may be installed and locked in place with pins.

CAUTION: BEFORE ATTEMPTING TO REMOVE DIES FROM TOOL, ASSURE THAT ALL LOCK PINS HAVE BEEN REMOVED (SEE FIGURE 4). FAILURE TO DO SO MAY RESULT IN SERIOUS DAMAGE TO THE TOOL.

DIE INSTALLATION

1. Align die rail slots in die halves with the rail in the crimp tool and push shank of dies into holes. Dies will snap into place. (See Figure 1)
2. Close tool handle to make sure dies are properly seated. The tool is now ready for use.

DIE REMOVAL

1. With the crimp tool handle open, place die removal tool against end of knockout pin and tap gently with small hammer (See Figure 2) The die will be released from the front die holder It can now be removed by hand.
2. Close the crimp tool handle and slide the die removal tool between the die and tool body (See Figure 3). Pull handle open with a snap action. The die will be released and can then be removed by hand.

PERMANENT DIE ASSEMBLY

1. Install dies in crimp tool.
2. Drive lock pins, supplied with dies, through holes and flush with outside surfaces. Long pin through tool body and short pin through push rod. (see Figure 4)

NOTE: Die removal tool part number HX3-82 is furnished with crimp tool. (If die removal tool is not available, a rod approximately 3/16" diameter X 1 3/4" long may be used)

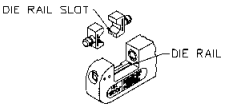


FIG. 1

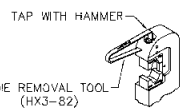


FIG. 2

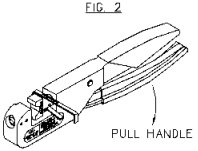


FIG. 3

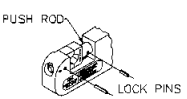


FIG. 4

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

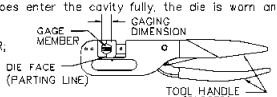
HEX DIE GAGING

1. Hold the tool handles firmly closed.

2. Insert the GO gage (green) member as shown; gaging only those hex flats parallel to the die face (parting line). The GO gage member should freely enter the die cavity.

3. Attempt to insert the NO-GO gage (red) member in the same manner. The NO-GO gage member may enter slightly into the die cavity, but shall not pass fully through the cavity. If the NO-GO gage member does enter the cavity fully, the die is worn and should be replaced.

CAUTION: DO NOT CRIMP THE GAGE MEMBER, TO DO SO MAY SERIOUSLY DAMAGE THE DIE SET.



GENERAL INFORMATION

The DANIELS HX4 crimp tool features a system of interchangeable dies. There are already a wide variety of these dies, available at DANIELS, for the HX4 tool frame. As new requirements evolve, the ongoing process of developing new die sets continues.

CARE OF TOOL

We strongly recommend that you:

1. DO NOT immerse tools in cleaning solution.
2. DO NOT spray oil into tool to lubricate.
3. DO NOT attempt to disassemble tool or make repairs.

This is a precision crimp tool and should be handled as such.

DMC offers complete refurbishing and recalibration services.

DMC specially engineers and manufactures complete tool kits to satisfy individual customer requirements, such as total aircraft support, general shop maintenance or production, on board ship and vehicle service, etc.

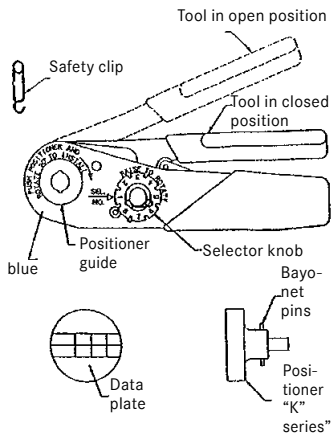
IV-19 Crimping tools for D-Sub contacts 09 99 000 0501

General information:

1. Designation AFMB (M 22520/2-01) refers to basic hand tool without positioners. Wire crimp range 20 AWG to 32 AWG.
2. The tool has a double action ratchet. Note that the tool cannot be opened without completing the cycle.

Tool preparation:

1. Tool must be in open position.
2. Remove safety clip from positioner guide.
3. Select positioner for contact to be crimped.
4. Insert positioner into positioner guide and turn 90 degrees until bayonet pins lock.
5. Install safety clip unto positioner guide (optional).
6. Wire size and corresponding selector number are shown in data plate.
7. With tool still in open position, raise and rotate selector knob until number indicated on data plate for wire size to be crimped is in line with Sel. No. arrow.



(All dimensions in Inch)

Crimping instructions

1. Insert contact and prepared wire into indenter opening from side opposite the positioner.
2. Squeeze handles together until ratchet releases. Handle will return to the open position. Remove crimped contact and wire.

Removing Positioner

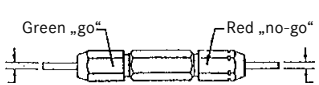
1. Remove safety clip and reverse procedure described in step four (4) above.

Gauge	A	B	SEL
Part No.	go Ø	no-go Ø	Nr.
G125	0.0390	0.0440	8

Table IV- 19.1
Caging limits:

Selector No.	A ± 0.0001 Go Ø	B ± 0.0001 No-Go Ø
1	0.0130	0.0180
2	0.0160	0.0210
3	0.0190	0.0240
4	0.0220	0.0270
5	0.0260	0.0310
6	0.0300	0.0350
7	0.0340	0.0390
8	0.0390	0.0440

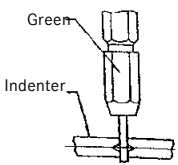
Caution!
Do not crimp gauge!



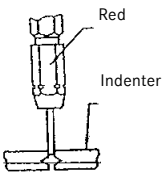
G125
(M22520/3-1)

Gauging instructions

„Go“ gauging
Operate tool to fully closed position. Maintain firm hand pressure on the tool handles. Insert „go“ gauge end as shown. Gauge must pass freely between indenter tips.



„No-Go“ gauging
Operate tool to fully closed position. Maintain firm hand pressure on the tool handles. Insert „No-Go“ gauge end as shown. The „No-Go“ gauge may partially enter the indenter opening, but must not pass completely through the opening.



Note: The gauge will be delivered only on request

Care of tool

It is a good practice to keep indenter tips free of residual color band deposits and other debris. A small wire brush may be used for this purpose.

We strongly recommend that you:

1. Do not immerse tools in cleaning solution.

2. Do not spray oil into tool to lubricate.

3. Do not attempt to disassemble tool or make repairs.

This is a precision crimp tool and should be handled as such.

DMC offers complete refurbishing and recalibration services.

DMC specially engineers and manufactures complete tool kits to satisfy individual customer requirements, such as total aircraft support, general shop maintenance or production, on board ship and vehicle service, etc.

IV-20 Crimping 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 insert set-no.		For individual contacts		Wire gauge [mm²]	Isolation-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

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.

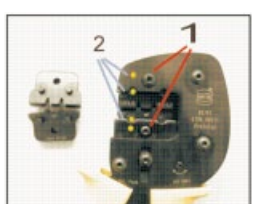
	09 99 000 0630	locator **BC**
	09 99 000 0631	locator **FC1**

Set up Crimping inserts

- Screw-off the fixing screw (1) – pliers closed
- Close tool until it releases (now open the tool)
- Remove inserts (first upper part)
- Install new inserts – marking (2) has to have same colour – first insert lower part
- Fix the screws again with:

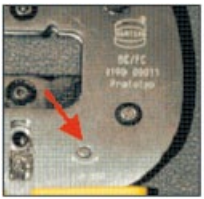
  ISKA M4x18 (upper)

  ISKA M4x9 (lower)
- Plug the locator from the top in a 90° position as shown in the picture



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 guarantees a good quality crimp each time.

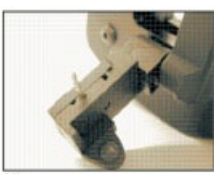


Do not open or close the tool by force!

Early crimp unclamp

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

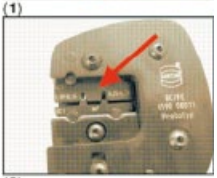
- Slightly hold together the grips of the tool
- Open the safety barrier on the rear side of the tool by turning left or right
- Open the grips of the tool to release the partially crimped contact.



(1)

Crimp process

- Fold up locator
- Assemble the contact into the locator (– select the right chamber!
- Fold back the locator
- Close the tool until the contact is held
- Put the wire into the crimp opening
- Crimp the contact until the tool can be released
- Take out the crimped contact.



(2)

Maintenance

Remove any existing material and dirt and clean the crimp zone regularly. Check the crimp zone of the tool for correct closing, clean all moving parts. These should move smoothly in operation. Lubricate regularly. (Use: machine oil SAE 20).

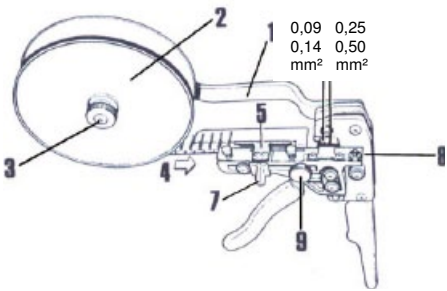
Use with HARTING crimp contacts only!

Protect tool against high humidity and dust!

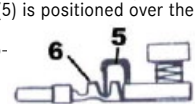
IV-21 Crimping tool 09 99 000 0248

This section includes the operation instructions for this crimping tools as well as an overview (refer to Tab. IV- 20.1) listing the tools appropriate for the different types of DIN 41 612 crimp contacts. 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 41612 crimp contacts 09020008434, -8444, 02050001512 and -2512. These are supplied in strips of appr. 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 – 0.25 mm²
b) Crimp profile 0.14 – 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.



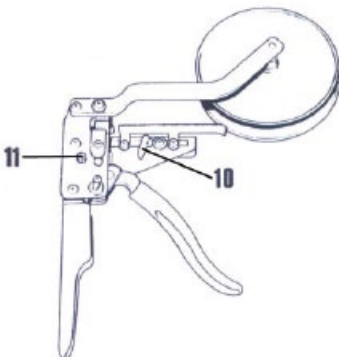
Indexing Unit
With aid of the Indexing Unit the contact strip moves into the correct position and is terminated as follows:
- Assemble the contact roll (2) onto the roll holder (1) holding it in place with the knurled nut (3). **ENSURE THE CONTACTS POINT INWARDS TOWARDS THE ROLL HOLDER.**
- Ensure the crimp tool is fully open.
- Insert the contact strip (6+4) in the direction of the arrow shown, into the Indexing Unit.
- Ensure the contact and the retaining plate of the Indexing Unit (5) is positioned over the contact and wire insulation as shown in the detail below.
- 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:
- Open knurled nut (9).
- Move the Indexing Unit to the left or right.
- Tighten the knurled nut (9).
- Check whether the contact is positioned in the middle of the required Crimp / Wire profile as indicated on the tool.

Crimp process
- Care about the set up in 3. will produce a good crimp.
- Index the contact strip with trigger (7)
- Insert the wire into the contact.
- Close the hand tool completely until the safety ratchet clicks off to open.
- Take out the crimped contact.

Tip: the empty carrier strip that feed out of the tool can easily be broken off at (8).



Changing contacts
- Release the Indexing Unit Red Release lever (10) in direction “Release” and hold it there.
- Pull out the contact strip (6+4) from the Indexing Unit towards the contact roll (2).
- Remove the contact roll (2) by undoing the knurled nut (3)

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 crimp unclamp
It is possible to open the tool during crimping if necessary:
- Slightly hold together the grips of the tool
- Open the safety barrier (11) on the rear side of the tool by turning left
- Open the grips of the tool to release the partially crimped contact.

Maintenance
Remove any existing material and dirt and clean the crimp zone regularly.
Check the crimp zone of the tool for correct closing, clean all moving parts. These should move smoothly in operation and lubricate them. (Use: machine oil SAE 20).
In case of any identified damages let only authorised personal attempt any repairs.

Tool is for crimping purpose only!
Use with HARTING crimp contacts only!
Protect tool against high humidity and dust!

Tab. IV-21.1
Overview of wire cross-sections for DIN 41 612 crimp contacts and the corresponding crimping tool

Wire cross-section [mm²]	Insulation diameter of cable [mm]	Contact designation	HARTING Order number	Number of contacts per role	Crimping tool	Profile setting options on the crimping 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

IV-22 Hand crimping tool 09 99 000 0191

Crimping process

- Insert the contact into the locator
- Close the jaws slightly to lock the contact in place
- Insert the stripped stranded wire into the contact
- Complete the crimping operation
- Remove the crimped contact

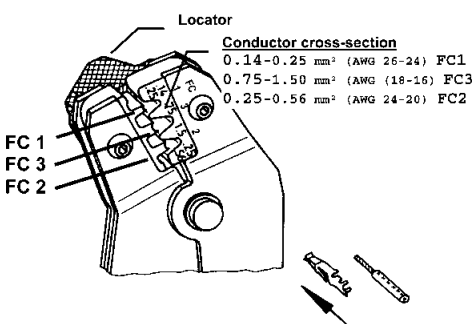
Adjustment of the eccentric ratchet plate

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 two turns of the Phillips screw by means of a screw driver (SW 2 mm). Lift the toothed spring washer and turn it by hand counter clockwise, in direction "9". Tighten the screw.

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

Pull out force of the crimped wire at the connection is according to IEC 60352, part 2

Conductor cross-section		Pull out force
mm²	*AWG*	
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



Only limited conductor cross-sections for FC-contacts can be used!

Modifications due to quality improvements, advancements or manufacturing requirements we reserve ourselves.

Ratchet

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

- It prevents the jaws from being re-opened until they have been completely closed.

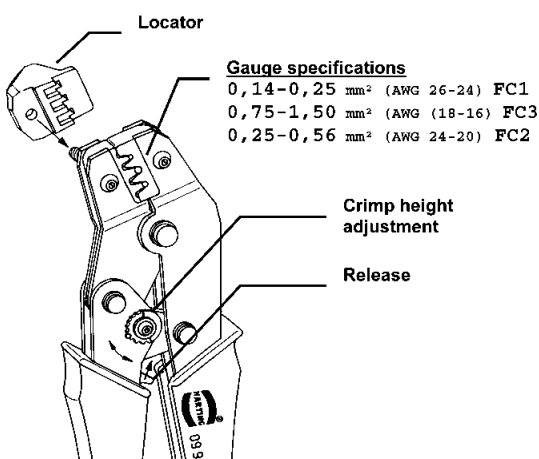
Early release

It is possible to perform an early release of the safety ratchet if a crimp is faulty. Relieve the pressure from the jaws by slight pressure on the handles and move the release lever (see diagram) in the direction of the crimping tool head. Damage to the crimping die will thus be prevented if the contact does not lie correctly in the die profile.

DO NOT USE EXCESSIVE FORCE TO OPEN OR SHUT THE TOOL!
LUBRICATE ALL MOVING PARTS WEEKLY!

Fixing the locator

The locator supplied must be fixed to the head of the tool (see fig. below). Tide the screw carefully.



IV-23 Installing the crimp flange and crimp sleeve for the InduCom housing

1. Strip off the cable sheath on the bus cable (strip about 35 to 40 mm, depending on the type of interface).

2. Put the crimp sleeve over the cable sheath. Bend the braided shielding over the cable sheath. Cut off so that it overlaps the cable sheath by about 2 mm.

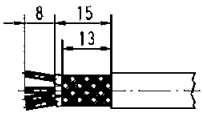
3. Guide the cable wires through the crimp flange. Rotate the crimp flange gently under the braid until it reaches the cable sheath. We recommend the special installation tool 61 03 600 0017 for this purpose.

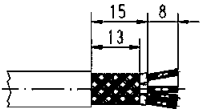
4. Position the crimp sleeve and then crimp using the hand crimper 61 03 600 0020. Apply the crimping jaws so they are as close as possible to the crimp flange.

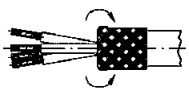
5. Twist off the foil shield up to the crimp flange and then cut it off where it meets the flange. Press the crimp flange into the housing.

6. The wires should be stripped for 4 mm so they can be connected to the contacts in the connector. Additional processing tips are described in the Device Connectivity Catalogue.

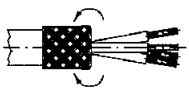
IV-24 Han Quintax® 4-pole



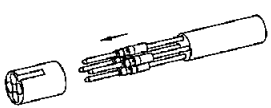


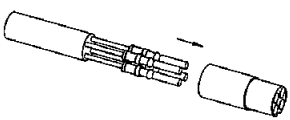


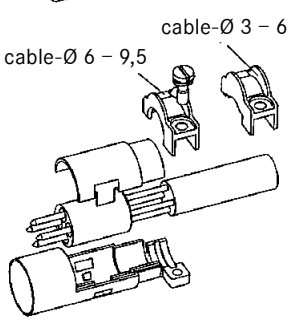
pull back the shielding braid

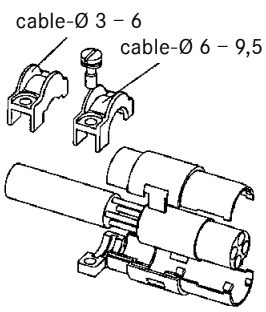


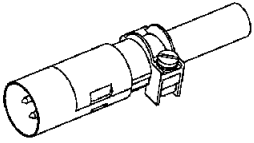
pull back the shielding braid



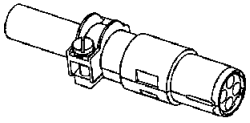








09 15 006 3013

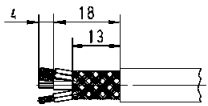


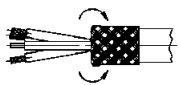
09 15 004 3113

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

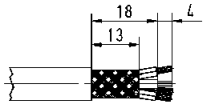
Dimensions in mm

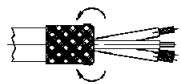
IV-25 Han Quintax® 8-pole



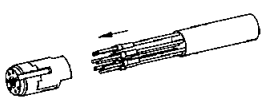


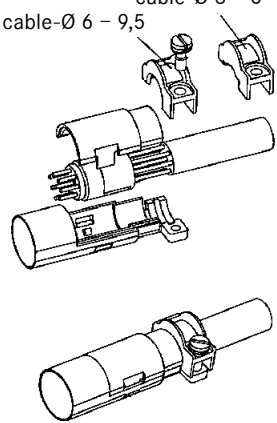
pull back the shielding braid



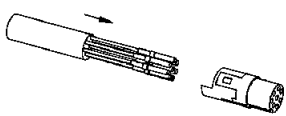


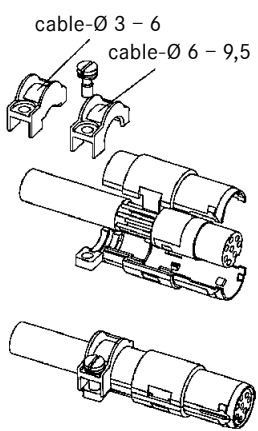
pull back the shielding braid





09 15 008 3013

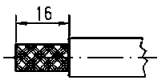


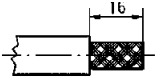


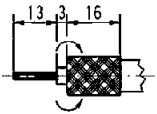
09 15 008 3113

Dimensions in mm

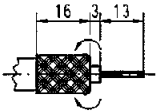
IV-26 Han D®-Coax



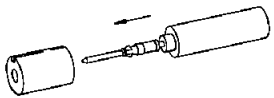


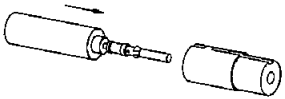


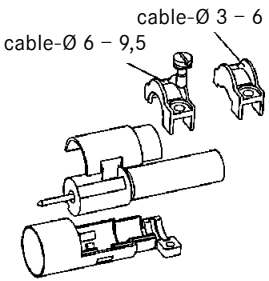
pull back the shielding braid

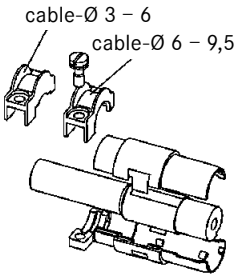


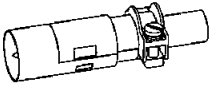
pull back the shielding braid



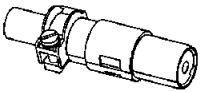








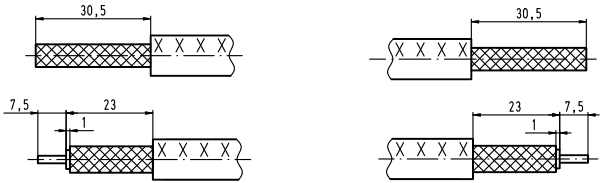
09 15 001 3013



09 15 001 3113

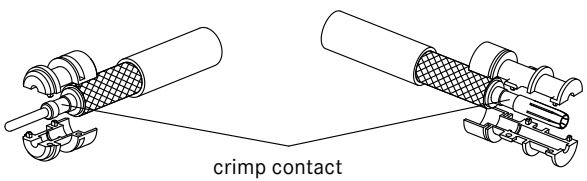
Dimensions in mm

IV-27 Han E®-Coax



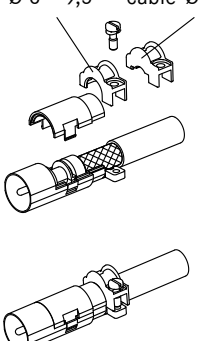
IV

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



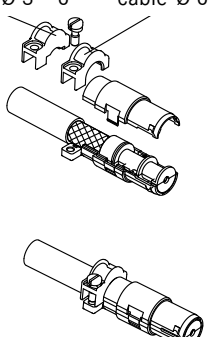
crimp contact

cable-Ø 6 – 9,5 cable-Ø 3 – 6



09 15 001 3023

cable-Ø 3 – 6 cable-Ø 6 – 9,5

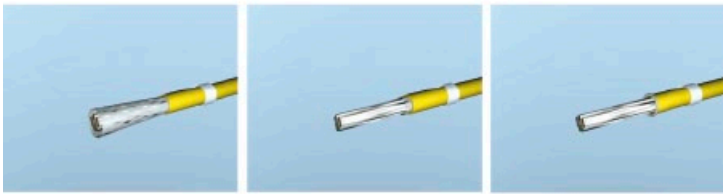


09 15 001 3123

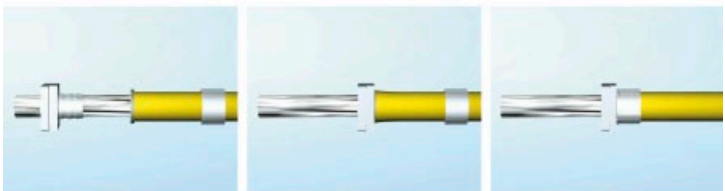
Dimensions in mm

IV-28 Han® GigaBit Module

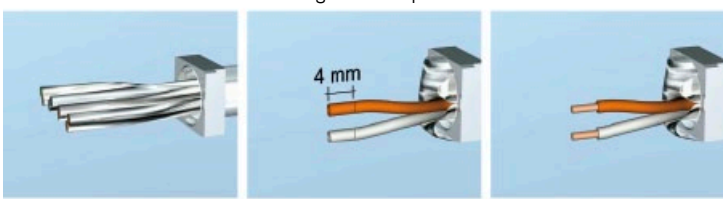
Strip wire to the correct length and move crimp ferrule over the cable sheath



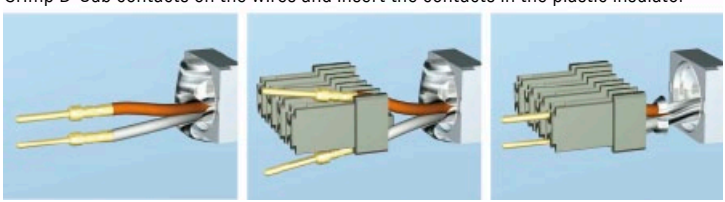
Put crimp flange over the wires and push it under the shield, move ferrule over the flange, crimp it



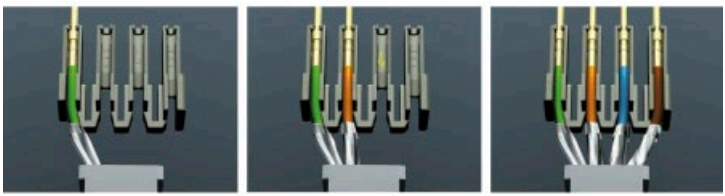
Pull back the shield to the correct length and strip the wire.



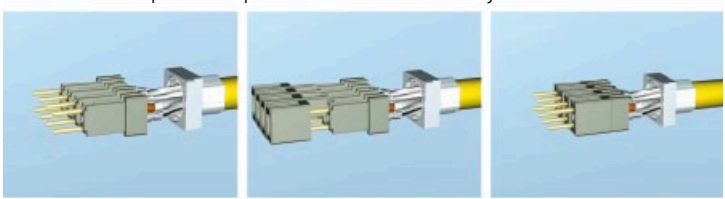
Crimp D-Sub contacts on the wires and insert the contacts in the plastic insulator



Check the contact positions and take care that the shield ends right behind the plastic insulator



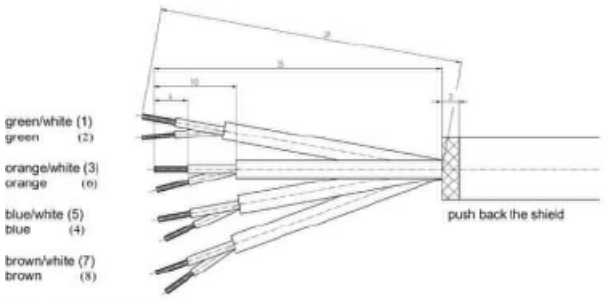
Move the second part of the plastic insulator over the body



Put the assembly in the metal hood and fix the cover by a screw driver

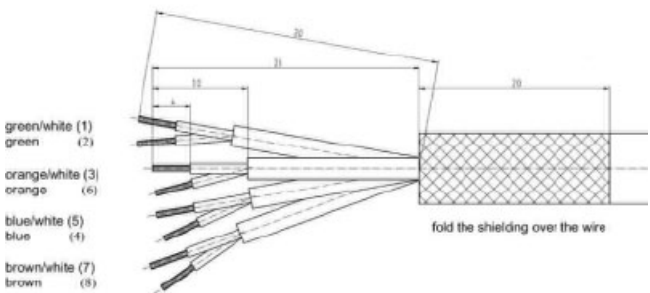
Push the metal hood onto the plastic module

Stripping length with crimp flange



(wiring acc. EIA/TIA 568A)

Stripping length with cable clamp



(wiring acc. EIA/TIA 568A)

IV-29 Han® 46 EE Multiplier

The contact insert should be inserted into the bulkhead-mounting housing from the plug-in side (Figure IV- 29.2). Be sure that you have already mounted both PE panels (Figure IV- 29.1).

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

Figure IV- 29.1
Han® 46 EE multiplier, top view

Figure IV- 29.2
Han® 46 EE-multiplier, side view

The multiplier is plugged with the contacts from the connection side into the contact insert that is mounted into the bulkhead-mounting housing (refer to Figure IV- 29.3).

Figure IV- 29.3
Han® 46 EE multiplier

Four M3 retaining screws (Figure IV- 29.4) are used to fasten the multiplier to the contact insert.

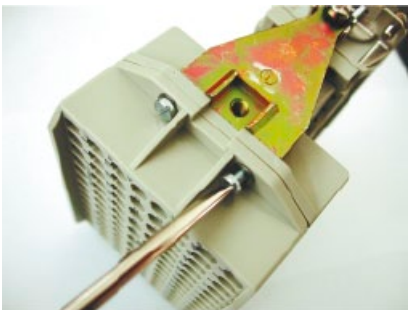


Figure IV- 29.4
Han® 46 EE multiplier – retention

The completely assembled Han® 46 EE multiplier

Figure IV- 29.5
Han® 46 EE multiplier, assembled

IV-30 Assembly notes for the Han® B housing

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

In order to reach the IP 65 degree of protection, the bulkhead-mounting housings are delivered with a rubber flange seal. This seal is the same size as the bulkhead-mounting housing (refer to Figure IV- 30.1). The rubber flange seal grips the housing and also prevents the retaining screws from coming out. This helps to speed up the add-on and installation procedures. The holes for the retaining screws are located in the sealing area. In order to create a reliable seal, be sure to follow these points:

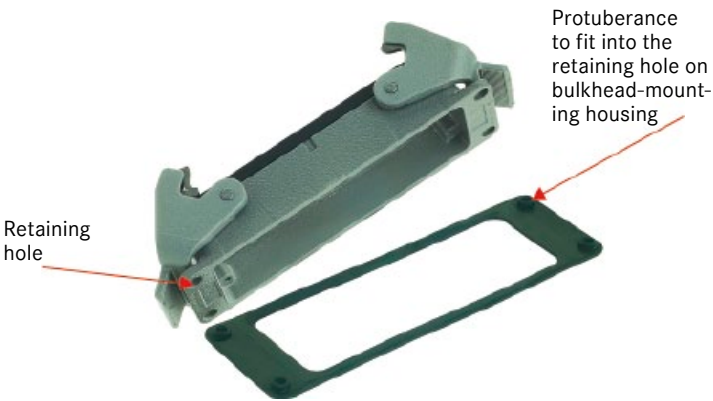


Figure IV- 30.1
Bulkhead-mounting housing with rubber flange seal

- In order to prevent humidity from penetrating through the M4 retaining screws into the housing, the customer must take steps to seal this area.
- If you are installing on metal panel walls, you can install a mounting frame on the opposite side of the wall. This frame functions as an abutment and provides for a more secure mount to the 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-mounting housings that do not have a rubber flange seal directly on the housing (delivery status up to 2005), you must be sure that the flange seal is positioned precisely under the bulkhead-mounting housing (refer to Figure IV- 30.3).

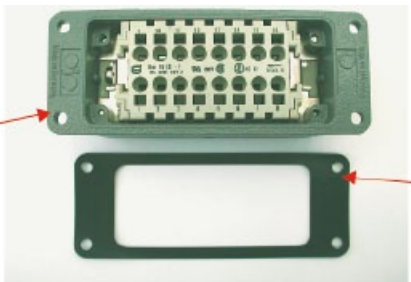


Figure IV- 30.2
Bulkhead-mounting housing until 2005 and rubber flange seal

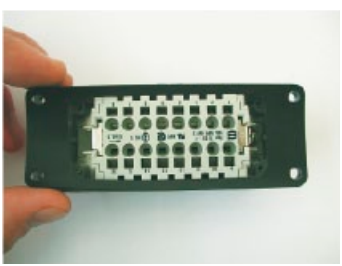


Figure IV- 30.3
Bulkhead-mounting housing,
until 2005 with mounted rubber flange seal

The rubber flange seals (both the self-retaining and unattached versions) are available as replacement parts. If desired, the unattached seal can be used with bulkhead-mounting housings that are delivered with the self-retaining seal. However in this case be sure that both rubber flange seals are not used at the same time.

IV-31 Han® HPR housing, sizes 6 B – 24 B

The bulkhead-mounting housings from this series have an O-ring seal on the bulkhead-mounting side. When the housing is properly installed, with this seal IP 68 or IP 69 K protection can be achieved. These housings have through holes for the M6 retaining screws located within the sealed area of the housing (refer to Figure IV- 31.1). 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 (just 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 IV- 31.1
Han® HPR bulkhead-mounting housing with O-ring seal

IV-32 Han® HPR housing, size 3 A

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

- Straight bulkhead-mounting housing
- Angled bulkhead-mounting housing

The straight bulkhead-mounting housing from the 3A series – just like the HPR bulkhead-mounting housings in sizes HPR 6 B, 10 B, 16 B and 24 B – should be fitted with an O-ring seal on the bulkhead-mounting side. Here too, the through holes for the M4 retaining screws are located within 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 housing is not required because of the small dimensions.

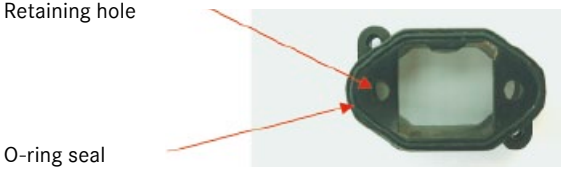


Figure IV- 32.1
Han® 3 A HPR

The bulkhead-mounting housing is delivered with an additional seal in the plug-in area. Since the insulating bases of the sized-3A plastic inserts also have their own seal, these seals must be removed before assembly!

The angled bulkhead-mounting housing is delivered with a rubber flange seal. The seal has through holes that are positioned for the retaining screws. This poses a risk that moisture can penetrate into the housing through these retaining screws. Thus the customer must provide an appropriate seal for the retaining screws.

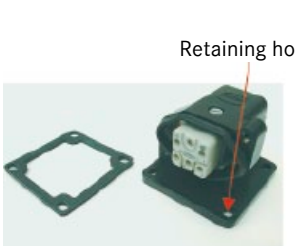


Figure IV- 32.2
Han® 3 A HPR
rubber flange seal

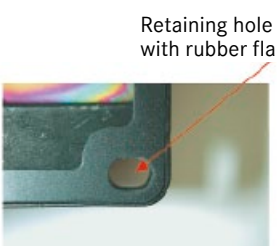


Figure IV- 32.3
Han® 3 A HPR
rubber flange seal, detailed view

IV-33 Achieving IP 65 or IP 68 protection degree for bulkhead-mounting housings

The following requirements are necessary for ensuring that IP 65 or IP 68 protection is maintained when installing the bulkhead-mounting housing (in accordance with DIN 4766):

- Coarseness of the mounting surface: Ra ≤ 16 µm
- Undulation ≤ 0,2 mm over 200 mm distance

The following torque is recommended when installing the housings.

Table IV- 33.1
Bulkhead-mounting housing, screw size, torque

Series	Number of retaining screws	Screw size	Recommended tightening torque [Nm]	Remarks
Han® 3 A	2	M3	0.8 – 1.0	Seal
Han® 10 A/16 A	4	M3	0.8 – 1.0	Seal
Han® 15 EMC/25 EMC	4	M3	Min. 1.0	O-ring
Han® 32 A	4	M4	0.8 – 1.0	Seal
Han® 6 B/10 B/16 B/24 B	4	M4	0.8 – 1.0	Seal
Han® 32 B	4	M5	Min. 2.5	O-ring
Han® 48 B	4	M6	Min. 3.0	O-ring
Han® 3 HPR	2	M4	0.8 – 1.0	O-ring
Han® 6/10/16/24 HPR	4	M6	Min. 3.0	O-ring
Han® 48 HPR	4	M8	Min. 4.0	O-ring

We recommend using the HARTING mounting frame when working with surfaces that have values which exceed the values specified above.

IV-34 Contact inserts with O-ring seal

A gasket is used to seal the plug-in connector in the area between the top and bottom sections for almost all housing sizes. The gasket is mounted to the housing (seal on the top section of housing for sizes 10 A and 16 A; seal on the bottom section of housing for sizes 32 A, 6 B, 10 B, 16 B, 24 B, 32 B and 48 B). The only exception is for housing size 3 A. Most of the contact inserts for this size have a seal on the male pin insert. The following tables lists the details for the individual inserts.

Table IV- 34.1
Overview of male contact inserts, size Han® 3 A

Contact insert	Order 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	09 21 007 3001
Han® 8 D	09 36 008 3001 09 36 008 2632
Han® Q 2/0	09 12 002 2651 (4...6 mm²) 09 12 002 2653 (2.5...6 mm²)
Han® Q 2/0 High Voltage	09 12 002 2652 (4...6 mm²) 09 12 002 2654 (2.5...6 mm²)
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

Figure IV- 34.1
Han® 3 A with O-Ring seal

When installing these inserts in housing from the Han® A, Han® M or Han® EMC series, the O-ring remains on the contact inserts in order to ensure a proper seal on the connector. If these contact inserts are installed in size 3 A **Han® HPR** housings, be sure to always remove the O-ring seal! (Refer to Figure IV- 33.1). You must remove the O-ring because the HPR housing comes with its own O-ring seal. In order to achieve IP 68 protection, you should use the M3 sealed screw instead of the M3 retaining 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 order 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 pin insert.

IV-35 Han-Brid® contact inserts

Figure IV- 35.1
Han® 3 A with Han-Brid®

HARTING also offers contact inserts in size 3 A that have male pin inserts with no O-ring seal. The contact inserts from the Han-Brid® series fall under this category. 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 select a hood variant with an adhesive-attached seal. The order numbers are listed in the following tables.

Table IV- 35.1
Han® hood, size 3 A with adhesive-attached seal

Housing	Order number	Remarks
Han® A	19 20 003 1443	Cable outlet, M20, straight
Han® A	19 20 003 1643	Cable outlet, M20, side
Han® M	19 37 003 1443	Cable outlet, M20, straight
Han® M	19 37 003 1643	Cable outlet, M20, side
Han® EMV	19 62 003 1443	Cable outlet, M20, straight
Han® EMV	19 62 003 1643	Cable outlet, M20, side

Cable outlet, M20, sideNo special bottom housing sections (bulkhead-mounting, surface-mounting, coupling or screw-in housings) are needed when using this contact 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 IV- 35.2
Han® 3 A HPR black-chromate housing

Housing	Order number	Remarks
Hood	19 40 003 0411	Cable outlet, 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 outlet, M25, through holes
Surface-mounting housing, angled	19 40 003 0953	Cable outlet M25; M4 threaded tapped holes

IV-36 Contact inserts with screw adapters

Plug-in 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 IV-36.1). 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. Grip panels are available in sizes 16 B and 24 B.

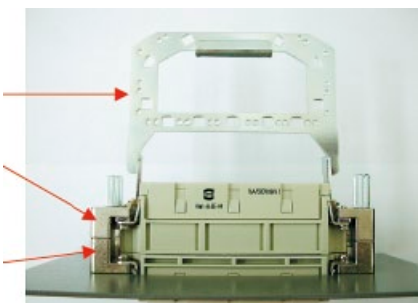


Figure IV- 36.1
Grip panel and screw adapter

As shown in the preceding figure, the top and bottom sections of the screw adapter are similar in appearance. In order to simplify installation and to tell them apart better, the differences between the two screw adapter sections are described below:

IV-36.1 Top section

Product article number: 09 00 000 5601
Description: Screw adapter with retaining screw (top section)
Included in delivery: Two screw adapters
Two knurled screws

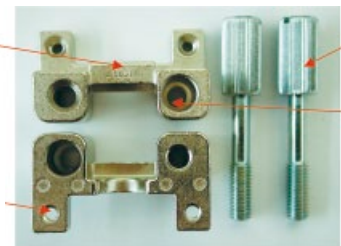


Figure IV- 36.2
Screw adapter with retaining screw (top section)

Product article number: 09 00 016 5612
Description: Screw adapter (top section) with grip panel
Included in delivery: Two screw adapters (top section)
Two knurled screws
One grip panel (size 16 B)
One PE combi-screw

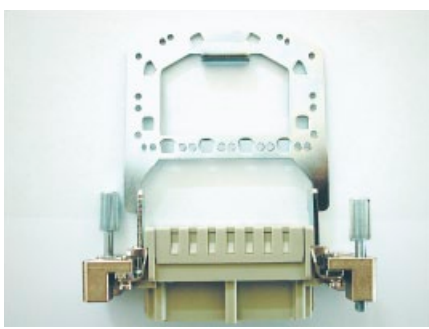


Figure IV- 36.3
The contact insert is only an example (male and female also possible)

Product article number: 09 00 024 5601
Description: Grip panel
Included in delivery: One grip panel (size 24 B)
One PE screw

Figure IV- 36.4
Grip panel

Product article number: 09 00 024 5611
Description: Screw adapter (top section) with grip panel 09 00 000 5601 and 09 00 024 5601
Included in delivery: Two screw adapters (top section)
Two knurled screws
One grip panel (size 24 B)
One PE combi-screw

Figure IV- 36.5
Contact insert only an example (Male and female possible)

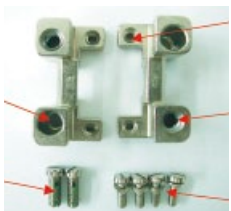
IV-36.2 Bottom section:

Product article number: 09 00 000 5603
Description: Screw adapter, bulkhead-mounting side (bottom section)
Included in delivery: Two screw adapters
Two M4 self-captive retaining screws
Four M3 retaining screws for contact insert

Remarks: This adapter is easier to install when compared to the screw adapter version 09 00 000 5602.
One of the advantages is the type of retention used. Both of the M4 retaining screws included in the delivery (refer to Figure IV-36.6) 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 version 09 00 000 5602. Another advantage is that a rectangular cut-out is sufficient for installation (refer to Figure IV- 36.7) and so it is not necessary to cut out any special shape.
The contact inserts are attached in the adapter. Thus the screws attached to the contact inserts should be replaced by the M3 retaining screws included. The original screws are too long to install in an adapter.
The coding elements 09 14 000 9908/9909 or 09 33 000 9908/9909 can be used to code the plug-in connectors when you are using multiple connectors with the same mating profile.

Through holes with M5 thread for holding the M4 retaining screws

M4 retaining screws (self-captive, good for multiple reuse) for attaching the adapter to the mounting wall



Through holes (with thread) for installing the contact insert

Threads for interlock with the knurled screw from the top section

M3 retaining screws for contact insert

Figure IV- 36.6
Screw adapter, bulkhead-mounting side (bottom section)

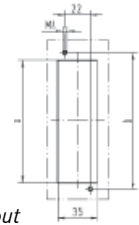


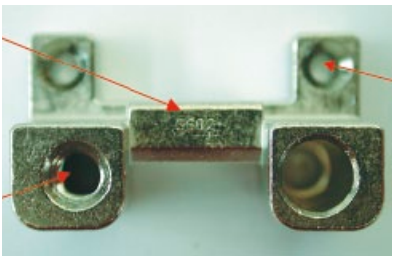
Figure IV- 36.7
Mounting cut-out

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

Product article number: 09 00 000 5602
Description: Screw adapter, bulkhead-mounting side (bottom section)
Included in delivery: Two screw adapters

Imprint of the last four digits in the article number (5602 shown here)

Threads for interlock with the knurled screw from the top section



Through holes (unthreaded) to hold the retaining screws for the corresponding contact insert

Figure IV- 36.8
Screw adapter, bulkhead-mounting side (bottom section)

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.

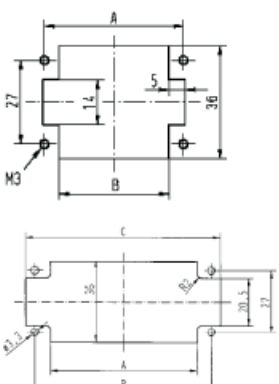


Figure IV- 36.9:
Mounting cut-out

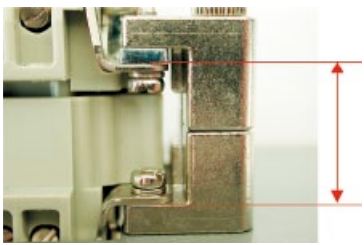
Standard contact inserts		
Size	A	B
6 B	44 mm	35 mm
10 B	57 mm	48 mm
16 B	77.5 mm	68.5 mm
24 B	104 mm	95 mm

Contact inserts Han-Modular®			
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

The screw adapters for the top and bottom section are designed so that, when used together with the grip panel, the proper gap between the male and female inserts is automatically maintained which ensures that the contacts are properly inserted.

The gap is also automatically set during the installation of the housings.

The gap, as measured between the contact support surfaces of the contact inserts, must be between 19.5 mm and 21 mm.



Gap for reliable electrical contacts:
19.5 – 21.0 mm

Figure IV- 36.10
Screw adapter with grip panel

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 top and bottom sections (refer to Figure IV- 36.11).

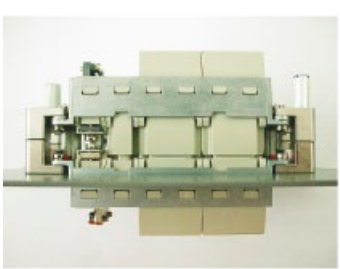
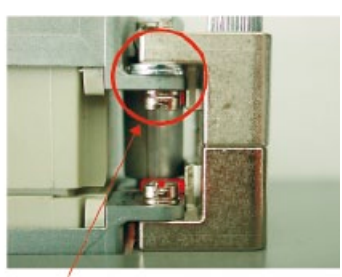


Figure IV- 36.11
Screw adapter without grip panel



Spacer washers for creating the required gap to ensure a safe contact without the use of a grip panel

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

Table IV- 36.1
Combinations of grip panel with screw adapter

Description	Article number, top section	Article number, bottom section	Remarks
Grip panel and screw adapter	09 00 016 5612	09 00 000 5602	for standard contact inserts, size 16 B
Grip panel and screw adapter	09 00 016 5612	09 00 000 5603	for standard contact inserts, size 16 B
Grip panel and screw adapter	09 00 024 5611	09 00 000 5602	for standard contact inserts, size 24 B
Grip panel and screw adapter	09 00 024 5611	09 00 000 5603	for standard contact inserts, size 24 B
Grip panel and screw adapter	09 00 000 5601 + 09 00 024 5601	09 00 000 5602	for standard contact inserts, size 24 B
Grip panel and screw adapter	09 00 000 5601 + 09 00 024 5601	09 00 000 5603	for standard contact inserts, size 24 B

IV-37 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 IV- 37.1
Han-Snap® components suitable for use inside railway wagons

Location	Han® Snap components	Product article number	Remarks
Installation side	Wall 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	Plastic housing	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 contact inserts and Han-Modular® sizes 6 B – 24 B (not including 09 33 000 9991 with Han-Modular® size10 B)
- Vibration resistance in compliance with IEC 60 068 Part 2-6
- Shock and impact resistance in compliance with IEC 60 068 Part 2–27
- Can be used with the Han® coding elements (male guide pin and female guide socket)
- Retaining mechanism has high level of functional safety. Not damaged when the recommended torque is slightly exceeded.
- Protection degree while plugged-in, according to DIN EN 60 529: IP 20

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

Installation side:

Product article number: 09 33 000 9984

Description: Wall feed-through, metal

Included in delivery: Two Han-Snap® adapters (die-cast zinc)

We recommend always having a metal wall feed-though when using the Han-Snap® components in railway vehicles. This part was designed especially for railway applications and has excellent stability. It can be used with standard contact inserts and Han-Modular®.

The schematic diagram included in this document details the proper mounting cut-out.

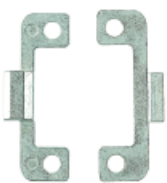


Figure IV- 37.1
Wall feed-through, metal

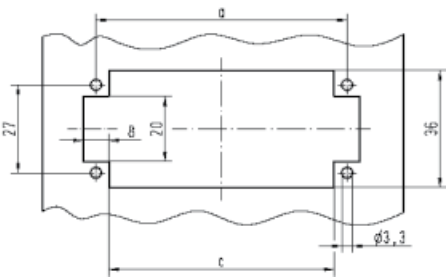


Figure IV- 37.2
Schematic diagram of the mounting cut-out

Size	a	c
6 B	44 mm	36 mm
10 B	57 mm	49 mm
16 B	77.5 mm	69.5 mm
24 B	104 mm	96 mm

Cable side:

Two variants are available for mounting the contact inserts to the cable side:

- Coupling with strain relief mechanism
- Plastic housing

Product article number: 09 33 000 9991

Description: Coupling with strain relief mechanism

Included in delivery: One coupling element with strain relief
One coupling element

Figure IV- 37.3
Coupling with strain relief mechanism

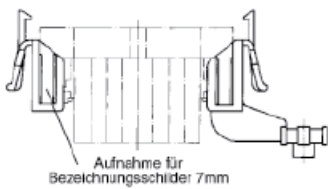


Figure IV- 37.4
Illustration of receptacle for the labelling tag

Tags (9 x 20 mm) can be attached to the cavities on both sides of the coupling elements. The tags measuring 7 x 20 mm also fit onto the two drill holes in the plug-in direction (refer to Figure IV- 37.3).

One or two cable ties (with max. width of 5 mm) can be used for strain relief.

Note: Always attach the strain relief mechanism on the side of the contact insert that is opposite the PE terminal.

Product article number:	09 33 006 0401 size 6 B 09 33 010 0401 size 10 B 09 33 016 0401 size 24 B 09 33 024 0401 size 24 B
Description:	Plastic housing
Included in delivery:	2 half shells with dummy plugs

Figure IV- 37.5
Plastic housing

Each housing has three cable outlets: one on each face side and one facing up.
Two cable outlets can be closed with the dummy plugs that are included in the delivery. These housings can be used with standard contact inserts and Han-Modular®.

Rectangular break-out holes are located near the cable outlets. These can be used for cable connectors of up to 5 mm width.

Both housing shells are held together in the plug-in area by the mounting screws from the contact insert.

The two housing shells can be disconnected from each other using a screwdriver (3.5 x 0.5).

Labelling tags (7 x 20 mm or 9 x 20 mm) can be attached using the support receptacles for the dummy plugs.

IV-38 Coding elements

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

- Coding with locking studs
- Coding with guide pins and guide sockets

IV-38.1 Coding with locking studs

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

The locking studs are arranged so that they will hit when an attempt is made to insert a connector into the wrong mate.

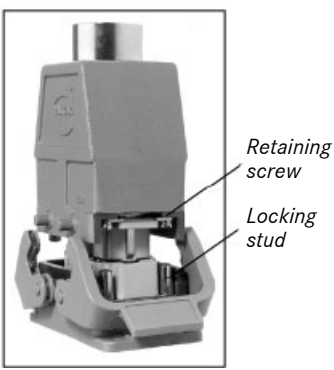


Figure IV- 38.1
Proper combination

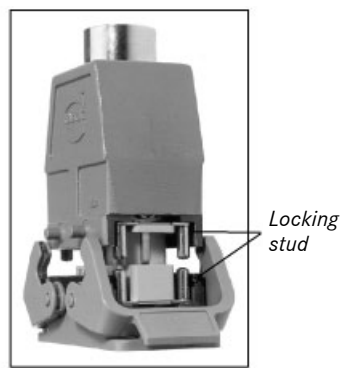
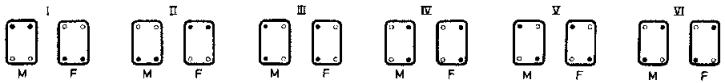


Figure IV- 38.2
Wrong combination

Figure IV- 38.3
Proper combination

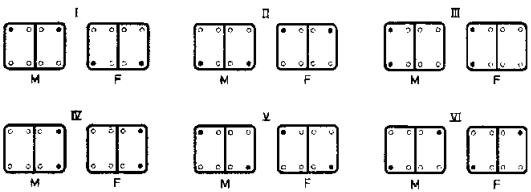
Coding for housing with a contact insert (sizes 10 A + 16 A, and 6 B to 24 B)



● Locking stud
○ Retaining screws

M = Male pin insert
F = Female insert

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



IV-38.2 Coding with guide pins and guide sockets

The guide pins and guide sockets 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.

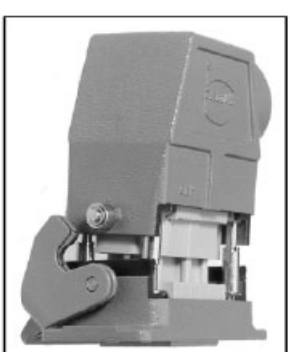
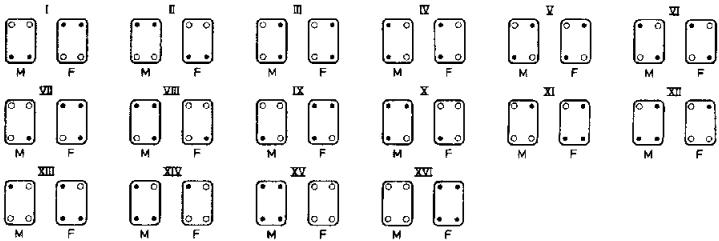


Figure IV- 38.4
Guide pin

Figure IV- 38.4
Guide socket

Figure IV- 38.6
Coding with guide pins and guide sockets

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

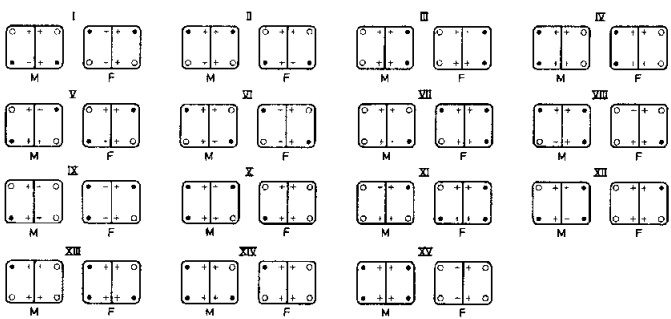


IV

● Guide pin
○ Guide socket
\+ Retaining screw

M = Male pin insert
F = Female insert

Coding for housing with two contact 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. Guide pins and guide sockets are required for all high-pole connectors.

Please contact us if you require other coding options than those described here.

IV-39 Locking panel for locking lever

HARTING offers a locking panel (refer to Figure IV- 39.1) that prevents the lever interlock 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 IV- 39.1
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.

IV-40 Han® M12 Crimp

Order number: 21 03 882 1405

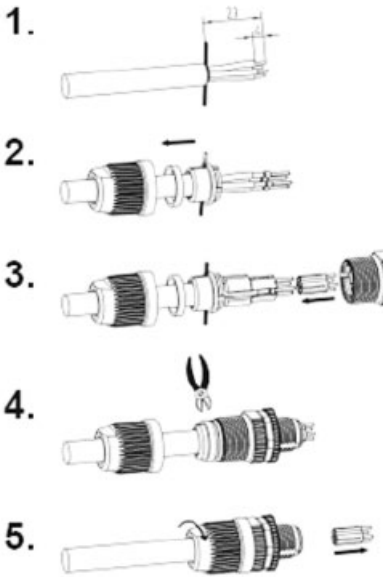
Technical details

Male contact	Female contact	Conductor cross section	
61 03 000 0073	61 03 000 0074	0.34 – 0.5 mm²	AWG 22 – 20

Recommended crimping tool	61 03 600 0022
Locator	61 03 600 0023
Wire diameter	2.0 – 2.3 mm
Cable outside diameter	
Seal transparent	4.5 – 5.4 mm
Seal light grey	7.0 – 8.8 mm
Degree of protection	IP 67
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	0,5 Nm
Coding	D, A
Cable stripping length female[1)]	17 – 20 mm
Cable stripping length male[1)]	20 – 23 mm

[1)] Please respect the manufacturer‘s recommendations.
[2)] It is the user‘s responsibility to determine the correct outer jacket stripping length for each cable and connector combination used. Ideally this should be in the range of 17 to 20 mm for female and 20 to 23 mm for male connectors.

The A-coded variant can also be used for 110-VDC power supplies. Other D-Sub contacts may be used in addition to the specified D-Sub contacts. The following are typical for railway applications:
61 03 000 0112 male; AWG 18-22; 0.34 ... 0.75mm²
61 03 000 0113 female; AWG 18-22; 0.34 ... 0.75mm²
09 67 000 8672 female; AWG 18-22, extra robust D-Sub female contact
09 67 000 3476 female; AWG 18-22; 0.34 ... 0.75mm²
09 67 000 3576 male; AWG 18-22; 0.34 ... 0.75mm²



1. Remove cable jacket and strip cores. Twist screening braid as shown and crimp contacts.

2. Slide screw cap, ring and seal onto the cable. Push screening braid into the seal slot.

3. Insert contacts into locator from the side. Fix contacts with the aid of assembly aid. Slide locator into connector, pay attention to the coding.

4. Seal has to be flush with connector. Slide ring over the seal and cut off screening braid.

5. Tighten screw cap. Remove assembly aid.

	1	2	3	4
Profinet	Yellow	White	Orange	Blue

The seal has to be replaced when worn.

IV-41 *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.
Order 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 24-22
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

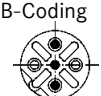
Figure IV- 41.1
HARAX® M12-L shielded

Table IV- 41.1
Technical specifications

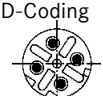
	M12-L	M12-L Ethernet	M12-L Profibus
Wire cross-section	0,14 – 0,34 mm² AWG 24 – 22	0,25 – 0,5 mm² AWG 24 – 20	0,34 mm² AWG 22
Wire strand diameter	≥ 0,1 mm	≥ 0,1 mm	≥ 0,1 mm
Wire insulation material	PVC	PVC, PE	PVC, Zell-PE
Wire diameter	1,2 – 2,0 mm	1,2 – 2,0 mm	2,0 – 2,6 mm
Cable diameter	7,0 – 8,8 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

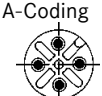


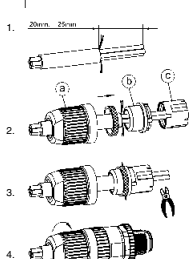
4-pole
Ethernet
D-Coding



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

ⓐ Nut
ⓑ Strain relief
ⓒ Insert

Note! For reconnection cut off the used cable ends and repeat steps 1 to 4.

IV-42 Han® 3 A RJ 45 4-pole

Order numbers:
IP 20: 09 45 151 1100
IP 65 (metal): 09 45 115 1100 (Standard)
09 45 115 1102 (Han® M version)

Technical specifications for IP 20	
Connector type	RJ 45 connector acc. to IEC 60 603-7
Number of contacts	4
Transmission performance	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 piercing contacts
Cable diameter	
stranded	AWG 24/7 – AWG 22/7
solid	AWG 23/1 – AWG 22/1
Cable outer diameter	6.1 mm – 6.9 mm
Mating cycles	min. 750
Degree of protection	IP 20
Temperature range	– 40 °C bis + 70 °C
Housing material	Polycarbonate, UL 94-V0
Colour	black
	UL approval (E 102079)

Technical specifications for IP 65	
Connector type	Han® 3A connector RJ 45 acc. to IEC 61 076-3-106 variant 5
Number of contacts	4
Transmission performance	Category 5/Class D bis 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 piercing contacts
Cable diameter	
stranded	AWG 24/7 – AWG 22/7
solid	AWG 23/1 – AWG 22/1
Cable outer diameter	6,0 mm – 9,0 mm
Degree of protection	IP 65 / IP 67
Temperature range	– 40 °C bis + 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

Die Konfektionierung des Datenmoduls ist bei allen Varianten identisch.

Table IV- 42.1
Contact assignments according to PROFINET® Guideline

Signal	Function	Adernfarbe	Contact-Nr. RJ 45
TD +	Transmission Data +	Yellow	1
TD –	Transmission Data –	Orange	2
RD +	Receiver Data +	White	3
RD –	Receiver Data –	Blue	6

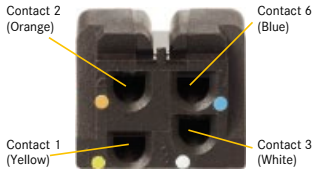


Figure IV- 42.1
Rear view of data module

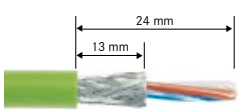
Installation Instructions:

1. Push the cable gland and housing over the cable insulating sheath.

IP 20 housing

IP 67 Data 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.

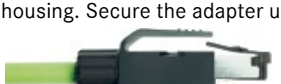
8. Remove the assembled data module from the IDC assembly tool.

9. Add the upper metal shielding panel and press it over the cable shielding braid.

10. Add the lower shielding panel; snap it together with the upper metal shield until it engages with an audible click.

11. IP 20 Data: Push the housing over the assembled data module until is snaps in with an audible click.

12. IP 67 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.

IV-43 Han® 3 A RJ45 8-pole and RJ Industrial RJ45

Order numbers:

IP 20	09 45 151 15x0	x:
IP 65 (metal)	09 45 115 15x0 (Han® A)	0 = cable manager white
	09 45 115 15x2 (Han® M version)	1 = cable manager blue

Technical specifications for IP 20	
Connector type	RJ 45 connector acc. to IEC 60 603-7
Number of contacts	8
Transmission performance	Category 6/Class E up to 250 MHZ acc. to ISO/IEC 11 801:2002, EN 50 173-1
Transmission rate	10/100/1000 Mbit/s
Shielding	fully shielded, 360° shielding contact
Mounting	Field-assembly
Cable termination	with piercing contacts
Cable diameter stranded	AWG 24/7 – AWG 22/7
Cable outer diameter	6.1 mm – 6.9 mm
Mating cycles	min. 750
Degree of protection	IP 20
Temperature range	– 40 °C up to + 70 °C
Housing material	Polycarbonate, UL 94-V0
Colour	black
	UL approval (E 102079)

Technical specifications for IP 65	
Connector type	Han® 3A connector RJ 45
Number of contacts	8
Transmission performance	Category 6/Class E up to 250 MHZ acc. to ISO/IEC 11 801:2002, EN 50 173-1
Transmission rate	10/100/1000 Mbit/s
Shielding	fully shielded, 360° shielding contact
Cable termination	with piercing contacts
Cable diameter stranded	AWG 27/7 – AWG 24/7
Cable outer diameter	6,0 mm – 8,0 mm
Degree of protection	IP 65 / IP 67
Temperature range	– 40 °C up 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 IV- 43.1
Contact assignments for the cable manager

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

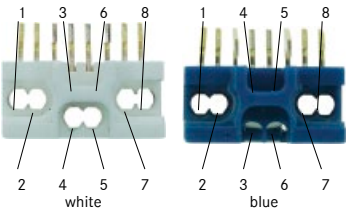


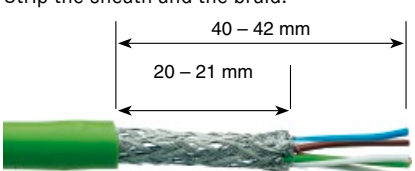
Figure IV- 43.1
Rear view of cable manager

1. IP 20 Data and Han® 3 A: Push the cable gland and housing over the cable insulating sheath. HARTING Push Pull Gigalink IP 67: Adjust the all-purpose seal so that it fits the diameter of the cable sheath in use. Push the cable gland, thrust washer, all-purpose seal and housing over the cable sheath.

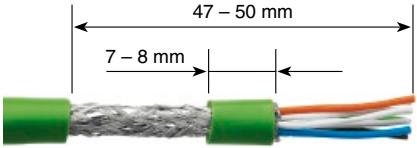
RJ Industrial RJ 45 IP 20

Han® 3 A RJ45

2. Strip the sheath and the braid.



3. Cut 7 - 8 mm of the sheath and push it up to the end of the braid.



4. Insert the wires pair wise up to braid into the cable manager.

5. Crimp the cable manager.

Attention: Use only the HARTING RJ Industrial® crimp tool (part no.09 45 800 0500)! Be aware to insert the cable manager up to the end into the tool.

6. Cut the over standing ends of the wires in the way that no electrical short-cuts are possible. Excess end max. 0.3 mm.

7. Insert the cable manager into the data module adaptor and lock it with an audible „click“.

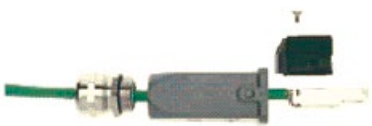
8. Press down the cable fixing and lock it with an audible „click“.

9. Put on the upper shielding shell and press it over the cable screen. Afterwards put on the lower shielding shell and lock it with the upper shell with an audible „click“.

10. IP 20 Data: Push the housing over the assembled data module until is snaps in with an audible click.

    Han® 3 A: Place the data module in the housing adapter and insert into the plug housing. Secure the housing adapter using the sealing screw.

RJ Industrial RJ 45 IP 20



Han® 3 A

11. IP 20 Data: Tighten the cable gland.

    Push Pull: Tighten the cable gland. We recommend using an open-ring spanner wrench with a spanner width of SW 19.

    Han® 3 A: Tighten the cable gland. Do not pull on the cable in the process. We recommend using an open-ring spanner wrench with a spanner width of SW 22.

Notes

Chapter V – Ethernet Networking Systems

Table of Contents

V-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.

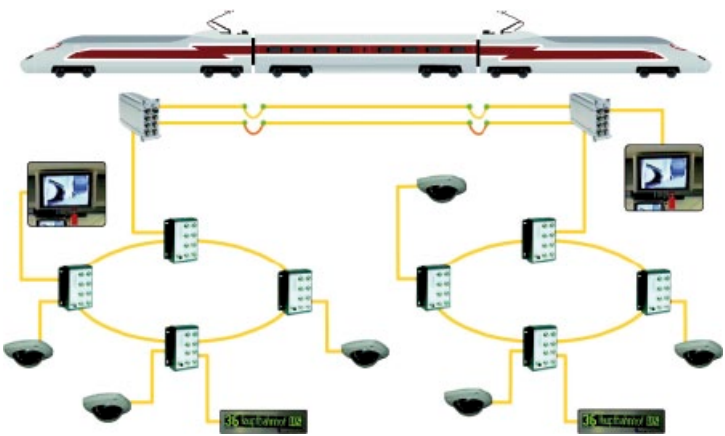


Figure V- 1.1
Redundant Ethernet topology with HARTING managed switches

Figure V- 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 pluggable interfaces for the peripheral devices, cameras and end terminals.

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.

V-2 Ethernet Switches for transportation

Switches for locomotives, passenger wagons and control wagons are exposed to vibrations, electrical fields and other external influences. This field of application demands extraordinary reliability and longevity from all electrical components. The EN 50 155 standard stipulates these requirements.

The Ha-VIS eCon, Ha-VIS sCon and Ha-VIS mCon lines of switches support the railway and bus industry requirements.

V-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. 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 and forward” switching mode supporting auto-crossing, auto-negotiation and auto-polarity.

V-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. 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.

V-2.3 The Ha-VIS mCon managed switch

In addition to the standard functions 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. The HARTING 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 V- 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 Port Speed 10MBit/s / 100MBit/s Half- / Fullduplex Port disable / enable Link Up/Down Trap disable / enable Flow Control disable / enable	
Network Discovery	Link Layer Discovery Protocol (LLDP)	802.1AB, 2005
Protocols	IPv4	RFC 791, 903, 951, 1293, 1519
	TCP	RFC 793, 896
	UDP	RFC 768
	Ethernet ARP	RFC 826
	ICMP	RFC 2521, 1191, 1788, 792
File Transfer	Firmware-Import und –Export Via TFTP Configuration-Import und –Export Via TFTP	
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	
QoS		
	Quality of Service (QoS)	IEEE 802.1p
VLAN		
	Port protocol based VLANs	IEEE 802.1Q Rev D5.0, 2005
Redundancy		
	Spanning Tree (STP)	IEEE 802.1D (2004)
	Rapid Spanning Tree (RSTP)	IEEE 802.1D (2004)

Security		
	Port-Based Network Access Control Port Based Authentication with EAP	802.1x (2004)
	RADIUS Client	RFC 2138
	IP authorized managers	
Link Aggregation		
	Link Aggregation (LACP)	ISO/IEC 8802-3:2005 (E), IEEE 802.3-2005 Edition Clause 43 (IEEE 802.3ad)
Multicast		
	IGMP Snooping (v1, v2, v3) with support for querier	RFC 1112, 2236, 3376
DHCP		
	DHCP Client	RFC 2131
	DHCP relay agent	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 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

V-2.4 Switches

HARTING offers Ethernet Switches classified according to their function as derived from their corresponding area of use.

Table V- 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 (1000Mbit/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 configurable 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 V- 2.3
Overview of active network components

Functional classification	Series	Features	Product photo
Un-managed	Ha-VIS eCon 3000	• 6x/ 8x/ 10x 10/100Base-T(X) RJ45 Ports and optional 1x / 2x 100Base-FX fibre-optic ports • Robust metal housing, IP30 • Mounting on top-hat rail • Compact and thin design	
	Ha-VIS eCon 4000	• 8x 10/100Base-T(X) ports (M12 D-coded); • 110 V DC and PoE variants • Robust metal housing, IP30 / IP40	
	Ha-VIS eCon 7000	• 5x/ 10x ports (M12 D-coded) • Robust metal (die-cast zinc) housing, IP 65/ IP 67	
	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	
Unman-aged with con-figuration options 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 1x/ 2x/ 3x 100Base-FX ports • Robust metal housing, IP30 • Mounting on top-hat rail • Ring redundancy and/or parallel redundancy	

Functional classification	Series	Features	Product photo
Managed	Ha-VIS mCon 3000	• 6x/ 8x/ 10x 10/100Base-T(X) RJ 45 ports • Variants with 2x 10/100/1000Base-T(X) or 1x/ 2x/ 3x 100Base-FX ports • Robust metal housing, IP30 • Mounting on top-hat rail	
	Ha-VIS mCon 4000	• 8x 10/100Base-T(X) ports (M12 D-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, IP 65 / IP 67	
	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 V- 2.4
Overview of connectors for the cable side

Product	Features	Product photo
Han® M12 circular connector	Male, D-coded Crimp wire connection Clamping range: 7 – 8.8 mm Use with D-Sub contacts	
HARAX® M12-L shielded	Male, D-coded 0.14 - 0.34 mm2 (AWG 26 - 22) 0.34 - 0.5 mm2 (AWG 22 - 20) Insulation-displacement connection	
Han® 3 A RJ45	Can be assembled on-site Connection with piercing contact to wire Wire diameter: AWG 42/7 – 22/7 Outer diameter of cable: 6.5 – 6.9 mm Degree of protection: IP 65 / IP 67	
HARTING RJ Industrial	Can be assembled on-site Connection with piercing contact to wire Wire diameter: AWG 42/7 – 22/7 Outer diameter of cable: 6.5 – 6.9 mm Degree of protection: IP 20	

Table V- 2.5
Overview of panel feed-throughs and device interfaces

Product	Features	Product photo
Han® M12 panel feed-through for installation outdoors	Female, D-coded, shielded, 360 mm cable[1], AWG 26, 4-pole	
Han® M12 panel feed-through for installation indoors	Female, D-coded, shielded, 700 mm cable[1], AWG 20, 4-pole	
HARAX® panel feed-though	Female, D-coded	
D-Sub	Male multi-point connector, crimp contacts, 9-pole	
Han® M12 PCB adapter	Female, D-coded, angled, 4-pole	

[1)] Additional lengths available on request.

Table V- 2.6
Overview of connectors for wagon couplings

Product	Features	Product photo
Han® HPR hood	Housing suitable for stricter climatic requirements (IP 69 K). Available in different sizes, with straight or angled cable outlets.	
Han® HPR bulkhead-mounting housing	Housing suitable for stricter climatic requirements (IP 69 K). Available in different sizes.	
Han-Quintax® module	Module for two shielded Quintax contacts, 4- or 8-pole. Only the 4-pole contacts are suitable for Ethernet Cat. 5e and the transmission of CAN-Bus, MVB, PROFIBUS, etc.	
Han® GigaBit module	8-pole module, 360° shielding, Ethernet Cat. 6A – standard turned D-Sub contacts. Mechanically robust module. Captive screws.	

V-3 System cable

Figure V- 3.1
M12 system cable

The customer can choose from one of two options when using system cable. Customers can order railway-certified cable from HARTING in lengths from 20 to 500 metres. The customer is then responsible for connector assembly.
For customers who prefer completely assembled and tested cable, HARTING also offers system cable in a variety of lengths. Customer-specific lengths can also be provided on request. The following variants with pre-assembled connectors are available from HARTING:

- M12 on both sides
- M12 – Han® 3 A RJ45
- M12 – HARTING RJ Industrial
- HARTING RJ Industrial – HARTING RJ Industrial

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 co-operation 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 produce locally and shorten the supply path.

Figure V- 3.2
Wagon-coupling cable, HPR version

Chapter VI – Customer-Specific Solutions

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VI-1 Customer-Specific Solutions

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.

VI-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 de-

livery. 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 IP 20 protection can be used for the wagon couplings used in wagon interiors, but by keeping mechanical robustness of a IP 68 solution. For exterior systems, up to IP 68 protection is typically used.

Figure VI- 2.1
Total Inter Car Jumper Assembly

Figure VI- 2.2
Open HPR hoods with support panel

Figure VI- 2.3
Coupling between the wagons

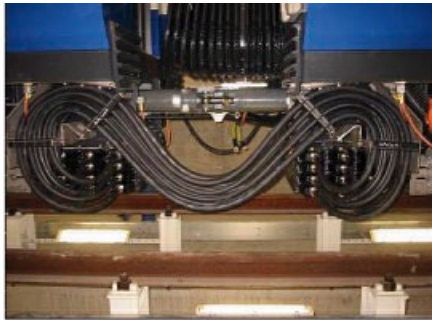

Figure VI- 2.4
Wagon coupling mounted from the side / below

Figure VI- 2.5
Wagon coupling installed on roof

VI-3 Special housings

Despite the wide variety of products in our catalogue, 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 VI- 3.1
Open housing in IP 20

Figure VI- 3.2
Housing with custom-drilled holes

Figure VI- 3.3
Housing with riveted PE earthing stud

Figure VI- 3.4
Housing with custom modification

Figure VI- 3.5
Multi-distributor housing in IP 65

VI-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 VI- 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.

VI-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 and Play installation is thus significantly simplified and accelerated.

Figure VI- 5.1
Stainless-steel distributor box, Heavy Duty Connectors and pre-assembled D-Sub cables

VI-6 Customized metal panel processing and electronic fittings

The space for electronics onboard 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 VI- 6.1
Vossloh Locomotive MaK 1000 BB

Figure VI- 6.2
Front of the vehicle MaK 1000 BB

Figure VI- 6.3
Front of vehicle with opened electrical cabinet

VI-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 VI- 7.1
Sample cable harness

Figure VI- 7.2
Assembled connectors

VI-8 Connector sets and accessories

Electrical junctions are typically made up of many components which all have to be ordered separately. HARTING offers 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 VI- 8.1
Packaging in sets for the Han® connector

Figure VI- 8.2
Example of package sets for the System Box

VI-9 Customized printed circuit boards

HARTING designs and manufactures circuit boards and backplanes for all customer-specific applications including completely integrated systems. Our wide range of services and deliverables also includes simulations, solution analyses, as well as a variety of signal and system tests. We can professionally process both individual and larger batch orders.

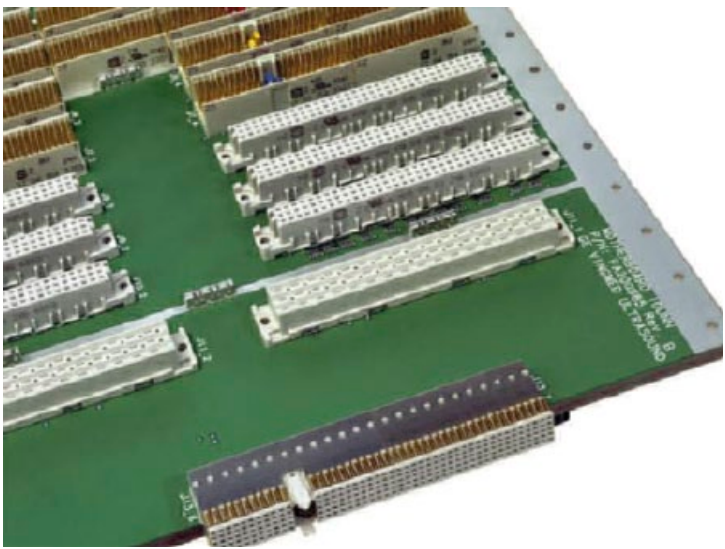

Figure VI- 9.1
Example of a customized backplane

Notes

Chapter VII – Selected Standards Relevant to Railway Applications

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VII-1 Selected Standards Relevant to Railway Applications

The standards and directives that HARTING uses to develop, design, manufacture and test its connectors are listed below.

Particular attention has been given to all flammability directives that relate to HARTING contact inserts.

VII-1.1 Connector standards

The following international standards cover the general design of the connector and the termination method.

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 41612:

• 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)
• NFF 61 030	On request

Connection method:

- DIN IEC 60 352-2 — Solder-free connections – Part 2: Crimp connections; general requirements, testing methods and usage notes (crimp wire connection)
- DIN IEC 60352- 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

VII-1.2 The railway standard EN 50155

It is common to ask if a component is suitable for railway use. Technically, however, the question is whether the component fulfils the requirements of EN 50155. Although this is a European standard, there are jobs and requests for bids outside of Europe which also call for compliance with EN 50155.

EN 50155 is valid for electronic facilities on railway vehicles. This is a type of umbrella standard which describes testing processes including procedures to test for electromagnetic compatibility (EMC), environmental factors (cold, heat and humidity), degrees of protection, shock and vibration. Regarding wire connection methods, the current (2004) edition of the standard describes only the solder-free wrapped connection (IEC 60351-1) and the crimp connection (IEC 60352-2). Special specifications are given for solder connections. If other wire connection methods are in use (for example, IDC), these methods must first be clarified with the user.

A European standard specifically for railway vehicle connectors is in the draft approval stage. It is entitled prEN 50467:2009 ”Railway applications – vehicles – electrical connectors, provisions and testing processes”. This draft standard covers many more wire connection method variants than the EN 50155. For example, these extensions are included: IDC (insulation displacement connection), cage clamp, and press-in. Compared to EN 50155, there are more details distinguishing the testing requirements for connectors depending on the installation location.

VII-1.3 Additional standards

Selected standards referenced from the EN 50155:

Shock and vibration:	EN 61373, Category 1b by default; Category 2 on request
Environmental testing:	IEC 60068
Electromagnetic compatibility (EMC):	EN 50121, EN 61000-4-4

Country-specific certificates:

CCC (China Compulsory Product Certification)

GOST certification (Russia)

RoHS compliance
(EU directive for restricting the use of certain hazardous materials in electrical and electronic devices)

REACH compliance
(EU chemical regulation (EC) No. 1907/2006)

Business-related certificates:

- Quality management system in compliance with ISO 9001:2008
- Environmental management in compliance with ISO 14001
- IRIS certification (International Railway Industry Standard)

These certifications are updated in rotation. A copy can be issued on request.

CERTIFICATE

DQS GmbH
Deutsche Gesellschaft zur Zertifizierung von Managementsystemen

hereby certifies that the company

HARTING Electronics GmbH & Co. KG

Marienwerderstraße 3
D-32339 Espelkamp

for the scope

Cabling and Cabinets (IRIS Scope 12)

Design, manufacturing and sales of industrial connectors, Interface- and PCB connectors, cable assemblies, Fibreoptic systems and components

has implemented and maintains a Quality Management System.
An audit, documented in a report, has verified that this quality management system fulfills the requirements of the following standard:

International Railway Industry Standard (IRIS)
Revision 01, November 2007

Certification audit	2009-03-21
Certification decision	2009-04-26
This certificate is valid until	2012-04-25
Certificate Registration No.	241243 IRIS
Issued in Frankfurt am Main, Germany	2009-04-26

Ass. iur. M. Drechsel

Dipl.-Ev. J. Böge

MANAGING DIRECTORS

D-60433 Frankfurt am Main, August-Schanz-Straße 21

IRIS Certification

CERTIFICATE

The

DQS GmbH

Deutsche Gesellschaft zur Zertifizierung von Managementsystemen

hereby certifies that the company

HARTING Electric GmbH & Co. KG

Wilhelm-Harting-Straße 1
D-32339 Espelkamp

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An audit, documented in a report, has verified that this quality management system fulfills the requirements of the following standard:

International Railway Industry Standard (IRIS)
Revision 01, November 2007

Certification audit	2009-02-27
Certification decision	2009-04-26
This certificate is valid until	2012-04-25
Certificate Registration No.	241244 IRIS
Issued in Frankfurt am Main, Germany	2009-04-26

Ass. iur. N. Drechsel

Dipl.-Ing. J. Boge

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IRIS Certification

VII-1.4 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. Two characteristics of flammable materials are very important in order to avoid personal injury.

1. The materials must not be easily flammable so that it is not possible for fire to spread.

2. The smoke from the burning material should as transparent as possible and contain as little poison as possible. In the event of a fire, this minimizes the danger of asphyxiation and allows evacuation routes to remain visible.

Standards primarily in Europe, but also in the USA, have established themselves and are now referenced throughout the world. The standards with the strictest material requirements include BS 6853, DIN 5510-2, NF F 16-101 and NF F 16-102. The CEN/TS 45545-2:2009 attempts to harmonize European fire protection standards. Although the status until now has only been pre-standard, HARTING can already provide the first certifications for polycarbonate, the most commonly used material. According to CEN/TS 45545-2, connectors are classified as non-listed products and must comply at most with requirements class R23.

• UL 94	Classification: V-0 for polycarbonate and polyamide(partially)
• NF F 16-101/ NF F 16-102	Classification: F1; I2 for polycarbonate (Han® and DIN D20). Plastic housing and special DIN rails
• ASTM E 662-01	Smoke density: D1.5 & D4 passed
• Bombardier SMP 800-C	The material complies with the requirements relating to toxic gas formation.
• DIN 5510-2	Flammability class: S3 Smoke development class: SR 2 Dripping characteristic class: ST 2
• BS 6853	Smoke toxicity: Classification Ib and II Oxygen index: Classification Ia, Ib and II
• CEN/TS 45545-2	R23 for polycarbonate

In regards to the connectors and network components provided by HARTING, the flammable materials and the type of plastic used are the decisive factors in determining the reaction to fire. The HARTING contact inserts and PCB connectors are mainly made from both polycarbonate and polyamide. The total thermal fire load is based on the material-dependent heating values together with the weight.

The most widely recognized fire protection standards, as listed above, specify so-called small-part formulas for such weight limits as 10 g or 50 g. No special testing proof is needed for materials which only occur in minimal quantities and which do not exceed these quantities even when grouped together. Since the precise formula and limit depends on the specific standard, be sure to first speak with your sales representative in order to clarify the specifics.

In order to support the determination of the thermal fire load for individual projects, a table has been compiled containing the high-demand products. This table contains the following information:

- Part number
- Short description
- Material
- Total weight
- Weight of flammable portion
- Heating value
- Thermal fire load
- Selected fire protection standards that cover the contact inserts

The specifications in the table refer to the contact inserts for industrial connectors. Flammability data for interface connectors, DIN connectors and M12 connectors are available on request.

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 (350A,20-35mm²)	polyamide	0.164	0.032	16	0.512	UL94 V0
09 11 001 2651	Han 1HC-sti-AX (350A,35-70mm²)	polyamide	0.160	0.032	16	0.512	UL94 V0
09 11 001 2652	Han 1HC-sti-AX (350A,95-120mm²)	polyamide	0.152	0.032	16	0.512	UL94 V0
09 11 001 2655	Han 1HC-sti-s-M10 350A	polyamide	0.268	0.032	16	0.512	UL94 V0
09 11 001 2670	Han 1HC-Sti-Ax 650A, 60-70mm²	polyamide	0.356	0.052	16	0.832	UL94 V0
09 11 001 2671	Han 1HC-Sti-Ax 650A, 70-120mm²	polyamide	0.356	0.052	16	0.832	UL94 V0
09 11 001 2672	Han 1HC-Sti-Ax 650A, 150-180mm²	polyamide	0.340	0.052	16	0.832	UL94 V0
09 11 001 2675	Han 1HC-Sti-S-M12, 650A	polyamide	0.533	0.052	16	0.832	UL94 V0
09 11 001 2750	Han 1HC-bu-AX (350A,20-35mm²)	polyamide	0.173	0.034	16	0.544	UL94 V0
09 11 001 2751	Han 1HC-bu-AX (350A,35-70mm²)	polyamide	0.172	0.034	16	0.544	UL94 V0
09 11 001 2752	Han 1HC-bu-AX (350A,95-120mm²)	polyamide	0.165	0.034	16	0.544	UL94 V0
09 11 001 2755	Han 1HC-bu-s-M10 350A	polyamide	0.229	0.034	16	0.544	UL94 V0
09 11 001 2770	Han 1HC-Bu-Ax 650A, 60-70mm²	polyamide	0.315	0.053	16	0.848	UL94 V0
09 11 001 2771	Han 1HC-Bu-Ax 650A, 70-120mm²	polyamide	0.315	0.053	16	0.848	UL94 V0
09 11 001 2772	Han 1HC-Bu-Ax 650A, 150-185mm²	polyamide	0.298	0.053	16	0.848	UL94 V0
09 11 001 2775	Han 1HC-Bu-S-M12, 650A	polyamide	0.483	0.053	16	0.848	UL94 V0
09 11 001 3001	Han HC Modular 350 crimp, male	polyamide polycarbonate	0.033	0.030 0.004	16 23.9	0.480 0.096	UL94 V0 UL94 V0, DIN5510, 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	UL94 V0 UL94 V0, DIN5510, 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	UL94 V0 UL94 V0, DIN5510, NFF16101
09 11 001 3111	Han HC Modular 650 crimp, female	polyamide polycarbonate	0.050	0.042 0.008	16 23.9	0.672 0.191	UL94 V0 UL94 V0, DIN5510, NFF16101
09 11 001 3021	Han HC Modular 250 crimp, female	polycarbonate	0.014	0.014	23.9	0.335	UL94 V0, DIN5510, 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 11 001 3121	Han HC Modular 250 crimp, male	polycarbonate	0.014	0.014	23.9	0.335	UL94 V0, DIN5510, NFF16101
09 12 002 2651	Han Q 2/0-sti	polycarbonate	0.029	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 12 002 2652	Han Q 2/0-m High Voltage	polycarbonate	0.031	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 12 002 2751	Han Q 2/0-bu	polycarbonate	0.024	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 12 002 2752	Han Q 2/0-f High Voltage	polycarbonate	0.026	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 12 005 3001	HAN Q 5/0-M-C	polycarbonate	0.013	0.008	23.9	0.191	UL94 V0, DIN5510, NFF16101
09 12 005 3101	HAN Q 5/0-F	polycarbonate	0.014	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 12 007 3001	Han Q 7/0-M	polycarbonate	0.014	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 12 007 3101	Han Q 7/0-F	polycarbonate	0.014	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 12 012 3001	Han Q12-M-QL	polycarbonate	0.015	0.013	23.9	0.311	UL94 V0, DIN5510, NFF16101
09 12 012 3101	Han Q12-F-QL	polycarbonate	0.018	0.016	23.9	0.382	UL94 V0, DIN5510, NFF16101
09 14 001 3001	Han MOD 200A,crimp, female	polycarbonate	0.019	0.019	23.9	0.454	UL94 V0, DIN5510, NFF16101
09 14 001 3101	Han MOD 200A,crimp, male	polycarbonate	0.019	0.019	23.9	0.454	UL94 V0, DIN5510, NFF16101
09 14 001 0421	Han-Modular ECO, Hood, IP 65	polycarbonate	0.045	0.032	23.9	0.765	UL94 V0, DIN5510, NFF16101
09 14 001 0423	Han-Modular ECO, Hood, IP 20	polycarbonate	0.031	0.03	23.9	0.717	UL94 V0, DIN5510, NFF16101
09 14 001 0321	Han-Modular ECO, Housing	polycarbonate	0.013	0.013	23.9	0.311	UL94 V0, DIN5510, NFF16101
09 14 000 9950	HAN MOD DUMMY	polycarbonate	0.005	0.005	23.9	0.120	UL94 V0, DIN5510, NFF16101
09 14 002 2601	HAN 2 MOD STI-S 40 A	polycarbonate	0.027	0.012	23.9	0.287	UL94 V0, DIN5510, NFF16101
09 14 002 3002	Han 2 MOD 40A, crimp, male	polycarbonate	0.012	0.012	23.9	0.287	UL94 V0, DIN5510, NFF16101
09 14 002 3102	Han 2 MOD 40A, crimp, female	polycarbonate	0.011	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 002 2641	Han 2 MOD-M-AX 70A, 6-16mm^2	polycarbonate	0.032	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 002 2651	HAN 2 MOD STI-S 100A/16-35mm^2	polycarbonate	0.069	0.023	23.9	0.550	UL94 V0, DIN5510, NFF16101
09 14 002 2653	HAN 2 MOD STI-S 100A/10-25mm^2	polycarbonate	0.07	0.023	23.9	0.550	UL94 V0, DIN5510, NFF16101
09 14 002 2701	HAN 2 MOD BU-S 40 A	polycarbonate	0.025	0.011	23.9	0.263	UL94 V0, DIN5510, 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 2741	Han 2Mod-F-AX 70A, 6-16 mm²	polycarbonate	0.03	0.01	23.9	0.239	UL94 V0, DIN5510, NFF16101
09 14 002 2751	HAN 2 MOD BU-S 100A/16-35mm²	polycarbonate	0.072	0.027	23.9	0.645	UL94 V0, DIN5510, NFF16101
09 14 002 2753	HAN 2 MOD BU-S 100A/10-25mm²	polycarbonate	0.074	0.027	23.9	0.645	UL94 V0, DIN5510, NFF16101
09 14 002 3051	Han 2 MOD 100A, crimp, male	polycarbonate	0.018	0.018	23.9	0.430	UL94 V0, DIN5510, NFF16101
09 14 002 3151	Han 2 MOD 100A, crimp, female	polycarbonate	0.021	0.021	23.9	0.502	UL94 V0, DIN5510, NFF16101
09 14 002 3001	HAN 2/4 MOD STI-C QUINTAX	polycarbonate	0.014	0.014	23.9	0.335	UL94 V0, DIN5510, NFF16101
09 14 002 3101	HAN 2/4 MOD BU-C QUINTAX	polycarbonate	0.015	0.015	23.9	0.359	UL94 V0, DIN5510, NFF16101
09 14 003 2601	Han 3 Mod-M-s 40A	polycarbonate	0.033	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 003 2602	Han 3 Mod-M-s 40A 10qmm	polycarbonate	0.032	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 003 2701	Han 3 Mod-F-s 40A	polycarbonate	0.031	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 003 2702	Han 3 Mod-F-s 40A 10qmm	polycarbonate	0.03	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 003 3001	HAN 3 MOD STI-C 40A	polycarbonate	0.014	0.014	23.9	0.335	UL94 V0, DIN5510, NFF16101
09 14 003 3002	HAN 3 MOD STI-C 40A	polycarbonate	0.015	0.015	23.9	0.359	UL94 V0, DIN5510, NFF16101
09 14 003 3101	HAN 3 MOD BU-C 40A	polycarbonate	0.013	0.013	23.9	0.311	UL94 V0, DIN5510, NFF16101
09 14 003 3102	HAN 3 MOD BU-C 40A	polycarbonate	0.015	0.015	23.9	0.359	UL94 V0, DIN5510, NFF16101
09 14 001 3011	Han GigaBit MOD, male	polycarbonate	0.006	0.006	23.9	0.143	UL94 V0, DIN5510, NFF16101
09 14 001 3111	Han GigaBit MOD, female	polycarbonate	0.004	0.004	23.9	0.096	UL94 V0, DIN5510, NFF16101
09 14 004 4501	HAN 4 MOD STI-C KOAX	polycarbonate	0.008	0.008	23.9	0.191	UL94 V0, DIN5510, NFF16101
09 14 004 4512	HAN 4 MOD BU-C KOAX 2-TEILIG	polycarbonate	0.008	0.008	23.9	0.191	UL94 V0, DIN5510, NFF16101
09 14 004 4513	HAN 4 MOD BU-C KOAX 2TEILIG (f.RG58)	polycarbonate	0.009	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 14 005 2616	Han 5 Mod sti-ES 16A	polycarbonate	0.018	0.008	23.9	0.191	UL94 V0, DIN5510, NFF16101
09 14 005 2716	Han 5 Mod bu-ES 16A	polycarbonate	0.017	0.007	23.9	0.167	UL94 V0, DIN5510, NFF16101
09 14 006 3001	Han 6 Mod Sti-c 16A	polycarbonate	0.01	0.01	23.9	0.239	UL94 V0, DIN5510, 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 14 006 3041	Han 6 Mod Sti-C, berührungssicher	polycarbonate	0.012	0.012	23.9	0.287	UL94 V0, DIN5510, NFF16101
09 14 006 3101	Han 6 Mod Bu-c 16A	polycarbonate	0.011	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 006 3141	Han 6 Mod Bu-C, berührungssicher	polycarbonate	0.011	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 008 3001	Han 8 Mod sti-c 16A	polycarbonate	0.011	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 008 3101	Han 8 Mod bu-c 16A	polycarbonate	0.011	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 012 3001	HAN 12 MOD STI-C 10A	polycarbonate	0.011	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 012 3101	HAN 12 MOD BU-C 10A	polycarbonate	0.011	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 017 3001	Han 17 Mod Sti-c 10A	polycarbonate	0.009	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 14 017 3101	Han 17 Mod Bu-c 10A	polycarbonate	0.011	0.011	23.9	0.263	UL94 V0, DIN5510, NFF16101
09 14 020 3001	Han 20 Mod-M	polycarbonate	0.02	0.02	23.9	0.478	UL94 V0, DIN5510, NFF16101
09 14 020 3101	Han 20 Mod-F	polycarbonate	0.025	0.025	23.9	0.598	UL94 V0, DIN5510, NFF16101
09 15 004 3013	Han 4 Quintax sti-c	polycarbonate	0.028	0.008	23.9	0.191	UL94 V0, DIN5510, NFF16101
09 15 004 3113	Han 4 Quintax bu-c	polycarbonate	0.027	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 15 008 3013	Han 8 Quintax-M-c	polycarbonate	0.029	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 15 008 3113	Han 8 Quintax-F-c	polycarbonate	0.027	0.009	23.9	0.215	UL94 V0, DIN5510, NFF16101
09 16 024 3001	HAN 24DD-STI-C	polycarbonate	0.040	0.025	23.9	0.598	UL94 V0, DIN5510, NFF16101
09 16 024 3101	HAN 24DD-F-C	polycarbonate	0.043	0.028	23.9	0.669	UL94 V0, DIN5510, NFF16101
09 16 042 3001	HAN 42DD-STI-C	polycarbonate	0.045	0.030	23.9	0.717	UL94 V0, DIN5510, NFF16101
09 16 042 3101	HAN 42DD-BU-C	polycarbonate	0.053	0.038	23.9	0.908	UL94 V0, DIN5510, NFF16101
09 16 072 3001	HAN 72 DD-Sti-C	polycarbonate	0.056	0.041	23.9	0.980	UL94 V0, DIN5510, NFF16101
09 16 072 3101	HAN 72 DD-BU-C	polycarbonate	0.067	0.052	23.9	1.243	UL94 V0, DIN5510, NFF16101
09 16 108 3001	HAN 108 DD-STI-C	polycarbonate	0.069	0.054	23.9	1.291	UL94 V0, DIN5510, NFF16101
09 16 108 3101	HAN 108 DD-BU-C	polycarbonate	0.087	0.072	23.9	1.721	UL94 V0, DIN5510, NFF16101
09 21 007 3031	HAN 7D-STI-C	polyamide	0.008	0.008	19	0.152	UL94 HB

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 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	UL94 V0, DIN5510, NFF16101
09 21 040 3101	HAN-D40F-C	polycarbonate	0.066	0.050	23.9	1.195	UL94 V0, DIN5510, NFF16101
09 21 064 3001	HAN-D64M-C	polycarbonate	0.065	0.047	23.9	1.123	UL94 V0, DIN5510, NFF16101
09 21 064 3101	HAN-D64F-C	polycarbonate	0.091	0.075	23.9	1.793	UL94 V0, DIN5510, NFF16101
09 32 010 3001	HAN 10 EE-M-C	polycarbonate	0.043	0.028	23.9	0.669	UL94 V0, DIN5510, NFF16101
09 32 010 3101	HAN 10 EE-F-C	polycarbonate	0.046	0.031	23.9	0.741	UL94 V0, DIN5510, NFF16101
09 32 018 3001	HAN 18 EE-M-C	polycarbonate	0.051	0.036	23.9	0.860	UL94 V0, DIN5510, NFF16101
09 32 018 3101	HAN 18 EE-F-C	polycarbonate	0.056	0.041	23.9	0.980	UL94 V0, DIN5510, NFF16101
09 32 032 3001	HAN 32 EE-M-C	polycarbonate	0.062	0.047	23.9	1.123	UL94 V0, DIN5510, NFF16101
09 32 032 3101	HAN 32 EE-F-C	polycarbonate	0.070	0.055	23.9	1.315	UL94 V0, DIN5510, NFF16101
09 32 046 3001	HAN 46 EE-M-C	polycarbonate	0.079	0.064	23.9	1.530	UL94 V0, DIN5510, NFF16101
09 32 046 3101	HAN 46 EE-F-C	polycarbonate	0.093	0.078	23.9	1.864	UL94 V0, DIN5510, NFF16101
09 32 040 3001	Han 40 EEE-M-C	polycarbonate	0.063	0.041	23.9	0.980	UL94 V0, DIN5510, NFF16101
09 32 040 3101	Han 40 EEE-F-C	polycarbonate	0.075	0.053	23.9	1.267	UL94 V0, DIN5510, NFF16101
09 32 064 3001	Han 64 EEE-M-C	polycarbonate	0.073	0.056	23.9	1.338	UL94 V0, DIN5510, NFF16101
09 32 064 3101	Han 64 EEE-F-C	polycarbonate	0.092	0.075	23.9	1.793	UL94 V0, DIN5510, NFF16101
09 33 006 2602	Han 6 E-sti-c	polycarbonate	0.041	0.026	23.9	0.621	UL94 V0, DIN5510, NFF16101
09 33 006 2616	Han 6 ES-M	polycarbonate	0.05	0.023	23.9	0.550	UL94 V0, DIN5510, NFF16101
09 33 006 2702	Han 6 E-bu-c	polycarbonate	0.041	0.026	23.9	0.621	UL94 V0, DIN5510, 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 33 006 2716	Han 6 ES-F	polycarbonate	0.052	0.025	23.9	0.598	UL94 V0, DIN5510, NFF16101
09 33 010 2602	Han 10 E-sti-c	polycarbonate	0.049	0.034	23.9	0.813	UL94 V0, DIN5510, NFF16101
09 33 010 2616	Han 10 ES-M	polycarbonate	0.063	0.028	23.9	0.669	UL94 V0, DIN5510, NFF16101
09 33 010 2702	Han 10 E-bu-c	polycarbonate	0.051	0.036	23.9	0.860	UL94 V0, DIN5510, NFF16101
09 33 010 2716	Han 10 ES-F	polycarbonate	0.068	0.033	23.9	0.789	UL94 V0, DIN5510, NFF16101
09 33 016 2602	Han 16 E-sti-c	polycarbonate	0.059	0.044	23.9	1.052	UL94 V0, DIN5510, NFF16101
09 33 016 2616	Han 16 ES-M	polycarbonate	0.084	0.037	23.9	0.884	UL94 V0, DIN5510, NFF16101
09 33 016 2702	Han 16 E-bu-c	polycarbonate	0.064	0.049	23.9	1.171	UL94 V0, DIN5510, NFF16101
09 33 016 2716	Han 16 ES-F	polycarbonate	0.091	0.044	23.9	1.052	UL94 V0, DIN5510, NFF16101
09 33 024 2602	Han 24 E-sti-c	polycarbonate	0.075	0.06	23.9	1.434	UL94 V0, DIN5510, NFF16101
09 33 024 2616	Han 24 ES-M	polycarbonate	0.111	0.048	23.9	1.147	UL94 V0, DIN5510, NFF16101
09 33 024 2702	Han 24 E-bu-c	polycarbonate	0.082	0.067	23.9	1.601	UL94 V0, DIN5510, NFF16101
09 33 024 2716	Han 24 ES-F	polycarbonate	0.123	0.06	23.9	1.434	UL94 V0, DIN5510, NFF16101
09 36 008 3001	HAN-U 08 M-C	polyamide	0.008	0.008	19	0.152	UL94 HB
09 36 008 3101	HAN-U 08 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	UL94 V0, DIN5510, NFF16101
09 38 005 2721	HAN K 3/0 BU-S	polycarbonate	0.25	0.061	23.9	1.458	UL94 V0, DIN5510, NFF16101
09 38 012 2651	HAN K 6/6-M 100 AMP/16-35QMM	polycarbonate	0.284	0.077	23.9	1.840	UL94 V0, DIN5510, NFF16101
09 38 012 2751	HAN K 6/6-F 100 AMP/16-35QMM	polycarbonate	0.03	0.095	23.9	2.271	UL94 V0, DIN5510, NFF16101

Notes

Notes

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