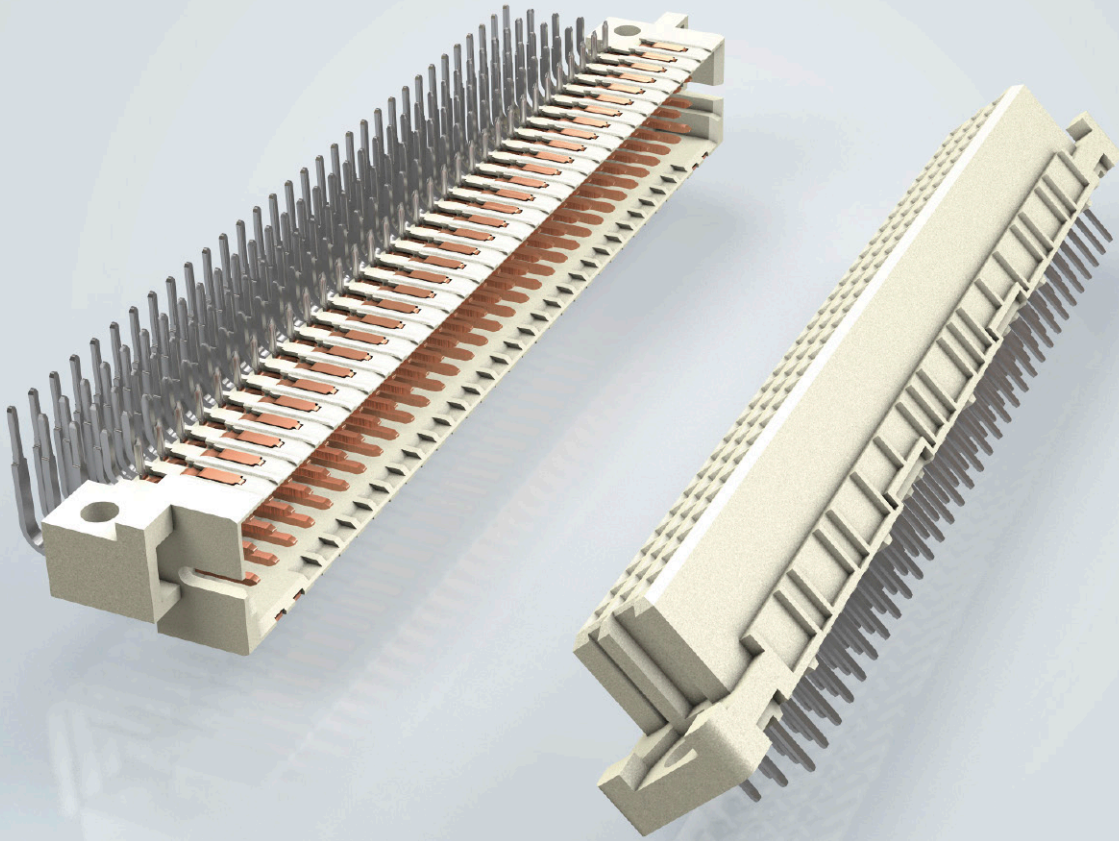




Pushing Performance



People | Power | Partnership

HARTING

Connectors DIN 41 612

	 Type	Termination								
		Solder termination	Reflow soldering (THR)	Solder lug connection	Press-in connection	Crimp connection	Wire wrap connection	IDC connection	Faston connection	Cage clamp connection
DIN Signal	B	Page 01.11	Page 01.11							
		Pages 01.12 f		Pages 01.12 f	Pages 01.12 f	Page 01.15	Pages 01.12 f	Page 01.14		
	2B	Page 01.16	Page 01.16							
		Page 01.17	Page 01.17		Page 01.17					
	3B	Page 01.18	Page 01.18							
		Page 01.19	Page 01.19		Page 01.19					
	C	Pages 01.20 f	Pages 01.20 f							
		Pages 01.22 f		Page 01.26	Pages 01.24 f	Page 01.28	Page 01.26	Page 01.27		
	2C	Pages 01.29 f	Pages 01.29 f							
		Pages 01.31 f	Pages 01.31 f	Pages 01.31 f	Pages 01.32 f	Page 01.32	Pages 01.31 f			
	3C	Pages 01.34 f	Pages 01.34 f							
		Pages 01.36 f	Pages 01.36 f		Pages 01.36 f	Page 01.36				
	M	Page 01.43								
		Pages 01.44 f			Pages 01.44 f					
	M-flat	Pages 01.46 f			Pages 01.46 f					
	M invers	Pages 01.48 f			Pages 01.48 f		Pages 01.48 f			
		Page 01.50								
	R	Pages 01.60 f	Pages 01.60 f		Pages 01.60 f		Pages 01.60 f			
		Page 01.62	Page 01.62							
	R (HE 11), RM	Page 01.63			Page 01.59		Page 01.63			
		Page 01.64								
	Q	Page 01.52			Page 01.52		Page 01.52			
		Page 01.53								
	2Q	Page 01.54			Page 01.54		Page 01.54			
		Page 01.55								
	3Q	Pages 01.56 f	Pages 01.56 f		Pages 01.56 f		Pages 01.56 f			
		Page 01.58	Page 01.58							
	2R	Pages 01.66 f	Pages 01.66 f		Pages 01.66 f		Pages 01.66 f			
		Page 01.65	Page 01.65							
	3R	Pages 01.68 f	Pages 01.68 f		Pages 01.68 f		Pages 01.68 f			
		Page 01.70	Seite 01.70							
	<i>harbus® 64</i>	Page 02.11	Page 02.11							
		Pages 02.12, 02.14			Pages 02.12 f	Page 02.15				
DIN Power	D	Page 03.11	Page 03.11							
		Pages 03.12 f		Page 03.12		Pages 03.14, 03.23	Page 03.12			
	E	Page 03.15	Page 03.15							
		Page 03.18 f		Page 03.18	Page 03.18	Pages 03.17, 03.23	Page 03.18			
	I	Page 03.16								
		Page 03.27	Page 03.27							
	F	Pages 03.30, 03.32, 03.34 f		Page 03.31	Page 03.34	Page 03.33	Page 03.31			
		Page 03.28				Page 03.29	Page 03.28			
	F9					Page 03.41				
						Page 03.41				
	FM	Page 03.42				Page 03.42				
		Page 03.43				Page 03.43	Page 03.43			
	2F					Page 03.45				
						Page 03.44				
	I									
	H15	Page 04.11							Page 04.11	
		Page 04.14			Page 04.15				Page 04.12	Page 04.13
	H16	Page 04.16								
									Page 04.16	
	H 3	Page 04.17								
		Page 04.17								
	MH 24 + 7	Page 04.21							Page 04.21	
		Page 04.22				Page 04.22	Page 04.22			
	MH 21 + 5	Page 04.23								
		Page 04.24								

male

female

Interface connector

The **HARTING eCatalogue** is an electronic catalogue with a part configuration and 3D components library.

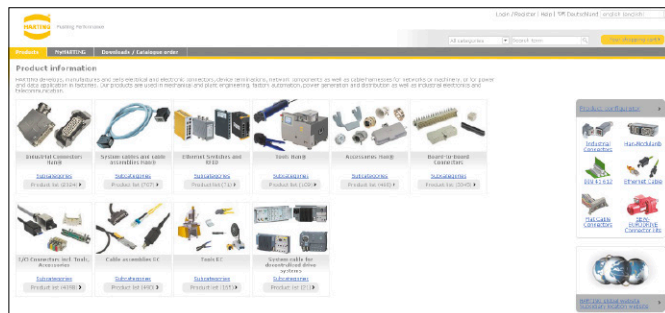
Here you can choose a connector according to your requirements. Afterwards you are able to send your inquiry directly to a HARTING sales partner.

The drawings to every single part are available in PDF-format.

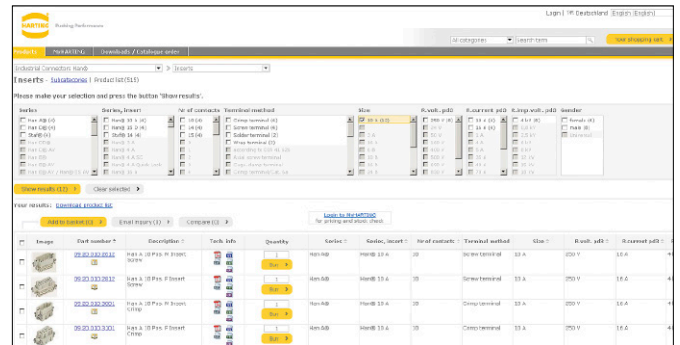
The parts are downloadable in 2D-format (DXF) and 3D-format (IGES, STEP).

The 3D-models can be viewed with a VRML-viewer.

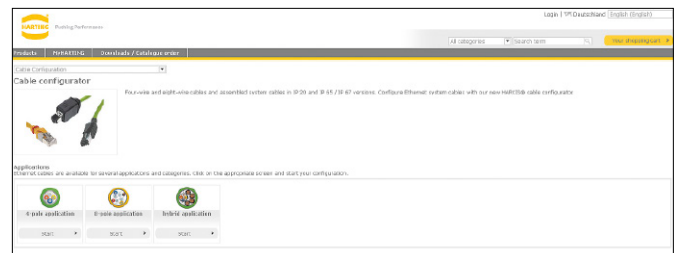
You can find the **HARTING eCatalogue** at **www.HARTING.com**.



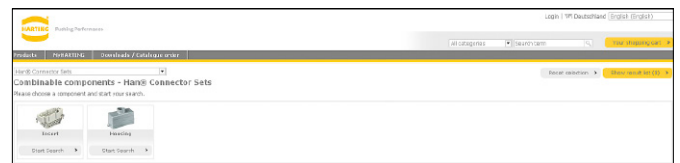
Product overview



Product selection



Product configuration



Product combination

Product samples: Fast-track delivery to your desk, free of charge

The new free express sample service in the HARTING eCatalogue allows customers to order samples immediately, easily and completely free of charge. A broad selection from the device connectivity product portfolio is now available. If a product is unavailable, the system offers alternative products with similar features that can be requested at a mouse click.

The free samples are shipped within 24 hours at no cost to you. This service enables tremendous flexibility, especially in the design phase of projects.

General information

It is the customer's responsibility to check whether the components illustrated in this catalogue also comply with different regulations from those stated in special fields of applications.

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

No part of this catalogue may be reproduced in any form (print, photocopy, microfilm or any other process) or processed, duplicated or distributed by means of electronic systems without the prior written consent of HARTING Electronics GmbH, Espelkamp. We are bound by the German version only.

Transforming customer wishes into concrete solutions



The HARTING Technology Group is skilled in the fields of electrical, electronic and optical connection, transmission and networking technology, as well as in manufacturing, mechatronics and software creation. The Group uses these skills to develop customized solutions and products such as connectors for energy and data-transmission/data-networking applications, including, for example, mechanical engineering, rail technology, wind energy plants, factory automation and the telecommunications sector. In addition, HARTING also produces electro-magnetic components for the automobile industry and offers solutions in the field of housing technology and shop systems.

The HARTING Group currently comprises 53 sales companies and production plants worldwide employing a total of about 4,200 staff.



HARTING Subsidiary



HARTING Representation

We aspire to top performance.

Connectors ensure functionality. As core elements of electrical and optical termination, connection and infrastructure technologies, they are essential in enabling the modular construction of devices, machines and systems across an extremely wide range of industrial applications. Their reliability is a crucial factor guaranteeing smooth functioning in the manufacturing area, telecommunications, applications in medical technology – in short, connectors are at work in virtually every conceivable application area. Thanks to the ongoing development of our technologies, our customers enjoy investment security and benefit from durable, long-term functionality.

Wherever our customers are, we're there.

Increasing industrialization is creating growing markets that are characterized by widely diverging demands and requirements. What these markets all share in common is the quest for perfection, increasingly efficient processes and reliable technologies. **HARTING** is providing these technologies – in Europe, the Americas and Asia. In order to implement customer requirements in the best possible manner, the **HARTING** professionals at our international subsidiaries engage in up-close, partnership-based interaction with our customers, right from the very early product development phase.

Our on-site staff form the interface to the centrally coordinated development and production departments. In this way, our customers can rely on consistently high, superior product quality – worldwide.

Our claim: Pushing Performance.

HARTING provides more than optimally attuned components. In order to offer our customers the best possible solutions, on request **HARTING** contributes a great deal more and is tightly integrated into the value-creation process.

From ready-assembled cables through to control racks or ready-to-go control desks. Our aim is to generate maximum benefit for our customers – with no compromises!

Quality creates reliability – and warrants trust.

The **HARTING** brand stands for superior quality and reliability – worldwide. The standards we set are the result of consistent, stringent quality management that is subject to regular certifications and audits.

EN ISO 9001, the EU Eco-Audit and ISO 14001:2004 are key elements here. We take a proactive stance towards new requirements, which is why **HARTING** is the first company worldwide to have obtained the new IRIS quality certificate for rail vehicles.



HARTING technology creates added value for customers.

Technologies by **HARTING** are at work worldwide. **HARTING's** presence stands for smoothly functioning systems powered by intelligent connectors, smart infrastructure solutions and sophisticated network systems. Over the course of many years of close, trust-based cooperation with its customers, the **HARTING** Technology Group has become one of the leading specialists globally for connector technology. We offer individual customers specific and innovative solutions that go beyond the basic standard functionalities. These tailored solutions deliver sustained results, ensure investment security and enable customers to achieve significant added value.

Opting for HARTING opens up an innovative, complex world of concepts and ideas.

In order to develop and produce connectivity and network solutions serving an exceptionally wide range of connector applications in a professional and cost-effective manner, **HARTING** not only commands the full array of conventional tools and basic technologies. Above and beyond these capabilities, **HARTING** is constantly harnessing and refining its broad base of knowledge and experience to create new solutions that also ensure continuity. To secure its lead in know-how, **HARTING** draws on a wealth of sources from its in-house research and applications.

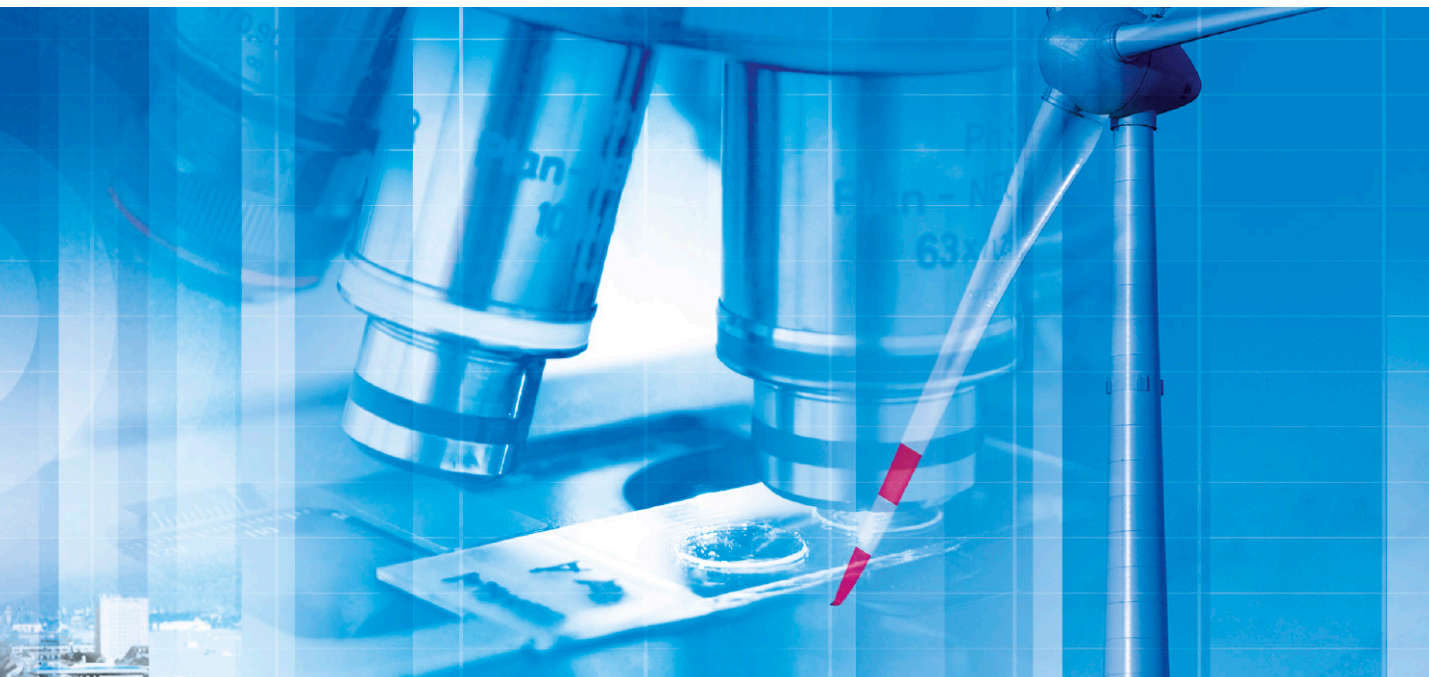
Salient examples of these sources of innovative knowledge include microstructure technologies, 3D design and connection technolo-

gy, high-temperature and ultrahigh-frequency applications that are finding use in telecommunications and automation networks, in the automotive industry, or in industrial sensor and actuator applications, RFID and wireless technologies, in addition to packaging and housing made of plastics, aluminum and stainless steel.

HARTING overcomes technological limitations.

Drawing on the comprehensive resources of the group's technology pool, **HARTING** devises practical solutions for its customers. Whether this involves industrial networks for manufacturing automation, or hybrid interface solutions for wireless telecommunication infrastructures, 3D circuit carriers with microstructures, or cable assemblies for high-temperature applications in the automotive industry – **HARTING** technologies offer not only components, but comprehensive solutions attuned to individual customer requirements and preferences. The range of cost-effective solutions covers ready-to-use cable configurations, completely assembled backplanes and board system carriers, as well as fully wired and tested control panels.

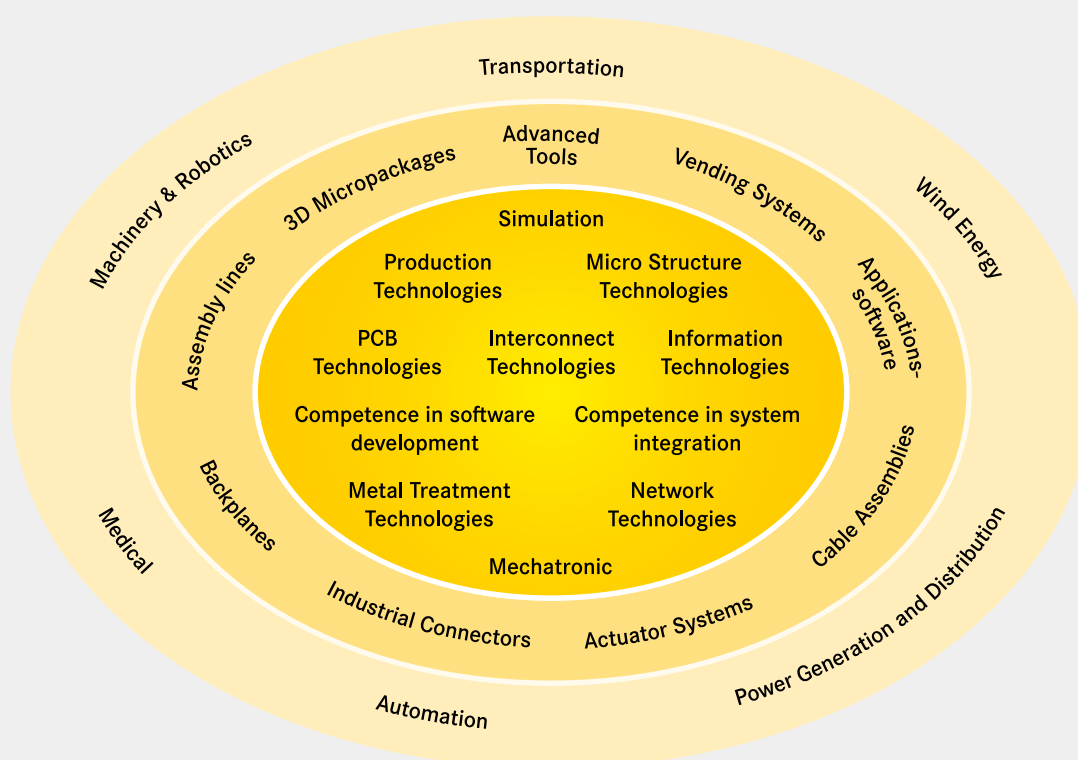
In order to ensure the future-proof design of RF and EMC-compatible interface solutions, the central **HARTING** laboratory (certified to EN 45001) employs simulation tools, as well as experimental, testing and diagnostics facilities all the way to scanning electron microscopes. In addition to product and process suitability considerations, lifecycle and environmental aspects play a key role in the selection of materials and processes.



HARTING's knowledge is practical know-how that generates synergy effects.

HARTING commands decades of experience with regard to the applications conditions involved in connections in telecommunications, computer, network and medical technologies, as well as industrial automation technologies, e.g. in the mechanical engineering and plant engineering areas, in addition to the power generation industry and the transportation sector. **HARTING** is highly

conversant with the specific application areas in all of these technology fields. In every solution approach, the key focus is on the application. In this context, uncompromising, superior quality is our hallmark. Every new solution found invariably flows back into the **HARTING** technology pool, thereby enriching our resources. And every new solution we go on to create will draw on this wealth of resources in order to optimize each and every individual solution. **HARTING** is synergy in action.

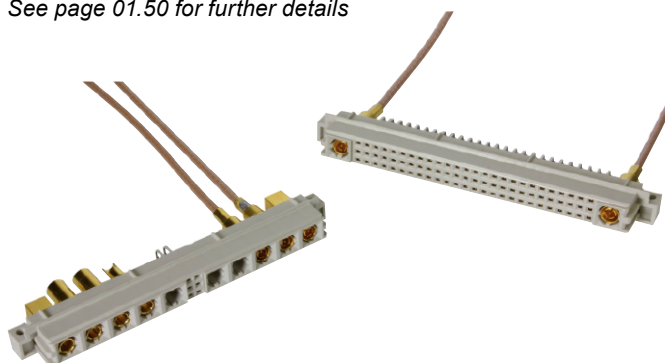


DIN 41612 connectors now also as the M invers type – Suitable for combined connections / Increased flexibility for users

The new M invers type connectors are especially suitable for combined connections between circuit boards. The users profit from an increased flexibility when a mix of signal, coaxial, high current (up to 40 A) or FO contacts in one connector is required.

The new connector types are available with 78+2, 60+4, 42+6, 24+8 and 6+10 poles, where the first figure indicates the number of signal contacts and the second the number of special contacts. The 6+10 connector in particular is completely novel and allows an integration of up to 10 special contacts in one connector.

See page 01.50 for further details



DIN 41612 M invers type

Small cable clamp for the D20 metal housing

The new small cable clamp for the D20 metal housing saves space outside the housing, especially if the top entries are used and the cables have to be bent.

The cable clamp fits in all four cable entries of the D20 metal housing and the clamp opening is adjustable between 1.8 mm and 9.6 mm.

See page 20.31 for further details



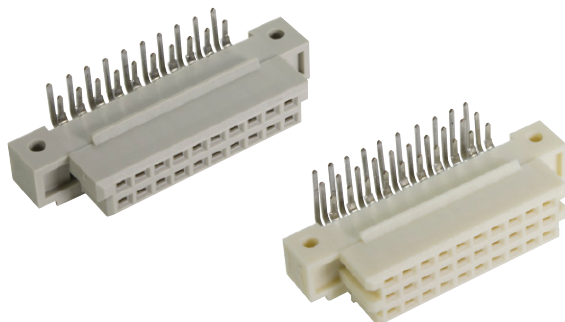
Small cable clamp

DIN 41612 types 3Q / 3R – Even smaller, and just as rugged

The density of electronic components on PCBs is constantly increasing, while the PCBs and components themselves are getting smaller and smaller. Therefore, this trend results in a need for smaller and smaller connectors.

The new 3Q and 3R type female connectors are available with or without fixing clips. The clips make an assembly on the PCBs easier, as connectors with clips do not require a separate fastening with rivets or screws. The connectors are available for solder or THR (Through Hole Reflow) terminations and therefore especially suitable for the connection of two PCBs arranged vertically or side by side. The THR versions are also available in tape & reel packaging.

See pages 01.58 and 01.70 for further details



DIN 41612 types 3Q/3R

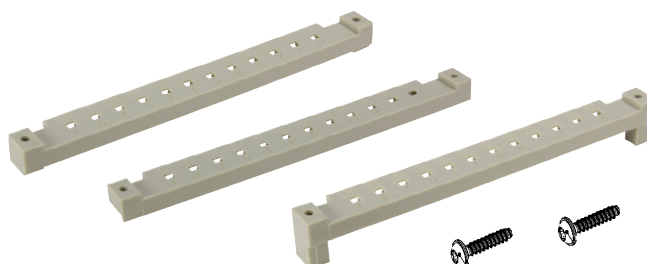
DIN coding bar with a screw fixing

A coding is necessary to make sure that each daughter card can only be inserted into the correct slot in a system with multiple slots. Traditionally, connectors with attached coding bars are used when a coding system without contact loss is required. These coding bars are either moulded or welded to the connectors.

Additionally, we are now offering separate coding bars to be screwed to the connectors. This is recommended in the cases where the required coded connector is not available at all (e. g. for the R or Q female types) or not in the required lot size or contact loading.

This new coding bars are compatible with the welded or moulded coding bars and can be used with the same coding pins (part number 09 02 000 9928). These coding bars can be screwed to the standard angled connectors which have no clips or coding.

See page 00.14 for further details



DIN 41612 coding bar with a screw fixing

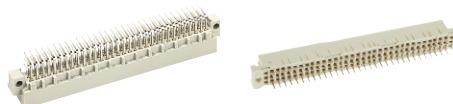
Printed Board Connectors according to DIN 41 612 / IEC 60603-2

Chapter

Printed Board Connectors – general information

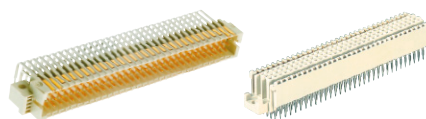
00

DIN Signal (up to 2 A)
Types B, 2B, 3B, C, 2C, 3C, M,
M invers, Q, 2Q, 3Q, R, 2R, 3R



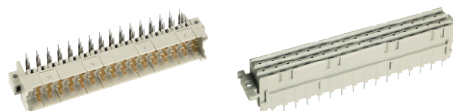
01

harbus® 64



02

DIN Power (up to 6 A)
Types D, E, F, FM, 2F, F9,
interface connectors I



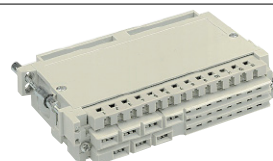
03

DIN Power (up to 15 A)
Types H, H15, H16, H3, MH



04

Shell housings and accessories



20

Tooling



30

List of part numbers

40

Addresses

50

Economic and Reliable Connections

Connector system for use in 19" racks to DIN 41 494 (replaced by DIN EN 60297-3).

Connectors according to

IEC	60603-2
DIN	41 612
(replaced by IEC 60603-2)	
UL-listed	E 102079 (M)
CECC	75101-801
IEC	61076-4-113

Developed for economical assembly of electronic plant and equipment.

HARTING offers the most comprehensive range of highly versatile connectors complemented by many styles of shell housings for a complete interconnection and interface system.



UL-listed E 102079 (M)



The division Printed Board Connectors is certified according to EN ISO 9001



DIN 41 612 connectors are in conformity with the
Directive 2011/65/EU
EC Directive on the Restriction and Use
of Certain Hazardous Substances in Electrical
and Electronic Devices
RoHS

The advantages

- Indirect mating (male/female)
- Automated production processes
- Continuous quality assurance
- 3-160 contacts
- Complete interconnection system
- Numerous interface connectors
- A wide variety of hoods
- Many termination technologies provide for the lowest installed cost
- Contacts selectively gold-plated
- Tinned terminations for increased solderability

The terminations

- Wrap posts for automated wiring
- Straight and angled solder pins for printed circuits
- High temperature connectors for reflow soldering
- Solder lugs for discrete wiring
- Press-in technology for backplanes
- Crimp contacts for selective loading
- Insulation displacement contacts for mass production
- Faston blades for higher power discrete wiring
- Cage-clamp contacts provide low cost connection for solid or stranded wires

For "non standard applications" we can manufacture designs to match your requirements.

Please discuss your requirements with us.

HARTING printed board connectors incorporate the latest design features and provide the assurance of high quality and reliability with economy.

Printed Board Connectors – general information

Page

Creepage and clearance distances, CTI	00.04
Specifications, assembly instructions	00.06
System description	00.08
Male and female connectors with pcb fixings	00.12
Coding systems	00.14
NFF classification	00.17
Terminations	00.18

Extract DIN VDE 0110-04.97*)

This standard is a technical adaptation of IEC Report 664/664A and specifies, in general, the minimum insulation distances for equipment. It can be used by committees to protect persons and property in the best possible way from the effects of electrical voltages or currents (e.g. fire hazard) or from functional failure of the equipment by providing adequate dimensioning of clearances and creepage distances in equipment.

Rated impulse withstand voltage

In allocation of the equipment to an installation category, the following factors shall be taken into account:

- Overvoltages which can enter the equipment from outside across the terminals.
- Overvoltages generated in the equipment itself and occurring at the terminals.

The following parameters apply to:

Installation category I

Equipment is intended for use only in appliances or installation parts, in which no overvoltages can occur.

Equipment in this installation category is normally operated at extra low voltage.

Installation category II

Equipment is intended for use in installations or parts of installations, in which lightning overvoltages need not be considered. Overvoltages caused by switching must be taken into account.

This includes for example domestic appliances.

Installation category III

Equipment is intended for use in installations or parts of installations, in which lightning overvoltages need not be considered, but which are subject to particular requirements with regard to the safety and availability of the equipment and its supply systems.

This includes equipment for fixed installation such as protective devices, relays, switches and sockets.

Installation category IV

Equipment is intended for use in installations or parts of installations, in which lightning overvoltages must be taken into account.

This includes equipment for connection to overhead lines such as omnidirectional control receivers and meters.

For circuits or parts of circuits inside the equipment, clearances may be dimensioned directly for the expected overvoltages. If the expected overvoltages are not impulse voltages but DC or AC voltages, the maximum value of these voltages shall be determined as the rated impulse withstand voltage for clearances both for homogeneous and inhomogeneous field.

Degree of pollution

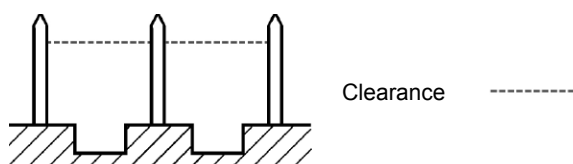
Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

Pollution degree 2: Only non-conductive pollution occurs. A temporary conductive caused by condensation must be expected occasionally.

The degrees of pollution 3 and 4 are in this case not considered, as they are not relevant for the connectors shown in this catalogue.

Clearance

The clearance is defined as shortest distance through the air between two conductive elements.



To identify the clearance distance

- Define the installation category
- Define the degree of pollution expected
- Select the rated impulse withstand voltage from table 00.01
- Select the minimum required clearance from table 00.02

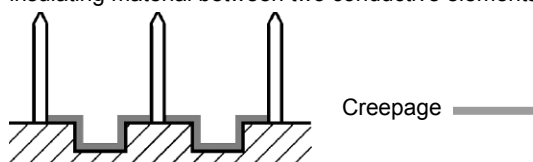
Exemplary calculation

What voltage can be used, if the clearance, the installation category and the degree of pollution are known:

Clearance	Installation category	Degree of pollution	Voltage phase-to-earth
1.2 mm	II	2	150 V
3.0 mm	II	2	600 V
4.5 mm	II	2	600 V

Creepage

The creepage is defined as shortest distance on the surface of an insulating material between two conductive elements.



To identify the creepage distance

- Define the installation category
- Define the degree of pollution expected
- From the nominal voltage and the type of supply system select the rated voltage from table 00.03 a/b
- From the rated voltage and degree of pollution select the minimum creepage and CTI group of the connector required in table 00.04

For the dimensioning of the creepage distance the tracking formation of the insulating material has to be considered. If not indicated contrary, the CTI value of the insulating material is <400 and the isolation group is III a/b.

CTI (Comparative Tracking Index)

This figure gives an indication of the conductivity of insulating materials and affects the specified creepage distances. The influence of the CTI value on the creepage distance is as follows: the higher the index value, the shorter the creepage distance. The CTI is used to divide plastics into insulation groups.

Breakdown of insulation groups:

I	600 ≤ CTI
II	400 ≤ CTI < 600
IIIa	175 ≤ CTI < 400
IIIb	100 ≤ CTI < 175

Exemplary calculation

What voltage can be used, if the creepage, the installation category and the degree of pollution are known:

Creepage	1.2 mm		3.0 mm		8.0 mm	
Installation category	II		II		II	
Degree of pollution	2		2		2	
CTI-Value	< 400	> 400	< 400	> 400	< 400	> 400
Isolation group	III a/b	II	III a/b	II	III a/b	II
Rated voltage	50 V	160 V	250V	400 V	800 V	1,000 V
Nominal voltage of supply system	50 V	150 V	220 V	380 V	720 V	1,000 V

How to identify the maximum voltage

1. Define the installation category
2. Define the degree of pollution expected
3. Select the rated impulse withstand voltage in kV from table 00.02
4. Select the voltage phase to earth derived from rated system voltages from table 00.01
5. Select the rated voltage from table 00.04
6. Define the number of phases and whether table 00.03 a or table 00.03 b is relevant for the application
7. Select the nominal voltage of supply system from table 00.03 a or 00.03 b
8. Select the lower voltage from point 4 and 7

Table 00.01

Voltages phase-to-earth derived from rated system voltages up to $U_{r.m.s.}$ and U_L	Rated impulse withstand voltages in kV for installation category (Voltage form: 1.2/50 μ s according to DIN IEC 60060-1)			
	I	II	III	IV
50	0.33	0.50	0.80	1.5
100	0.50	0.80	1.5	2.5
150	0.80	1.5	2.5	4.0
300	1.5	2.5	4.0	6.0
600	2.5	4.0	6.0	8.0
1000	4.0	6.0	8.0	12.0

Table 00.02

Rated impulse withstand voltage in kV	Minimum clearances in mm up to 2000 m above sea level ¹⁾			
	Case A (Inhomogeneous field ³⁾)		Case B (Homogeneous field ²⁾)	
	Pollution degree		Pollution degree	
	1	2	1	2
0.33	0.01	0.2	0.01	0.2
0.50	0.04		0.04	
0.80	0.1	0.5	0.1	0.3
1.5	0.5		0.3	
2.5	1.5	1.5	0.6	0.6
4.0	3	3	1.2	1.2
6.0	5.5	5.5	2	2
8.0	8	8	3	3

¹⁾ For higher altitudes see table 2b from DIN VDE 0110 for multiplying factors.

²⁾ Verification by an impulse voltage test is required if the clearance is less than the value specified for case A.

³⁾ Point to plane.

Table 00.03 a. Single phase, three or two wire AC or DC systems

Nominal voltage of supply system ¹⁾	Rated voltage in V	
	Phase-to-phase All systems (between conductors of different polarity for U_L)	Phase-to-earth
	$U_{r.m.s.}$ or U_L	$U_{r.m.s.}$ or U_L
12.5	12.5	—
24	25	—
25	—	—
30	32	—
42	—	—
48	50	—
50 ²⁾	—	—
60	63	—
60/30	63	32
100 ²⁾	100	—
110	125	—
120	—	—
150 ²⁾	160	—
220	250	—
220/110	250	125
240/120	—	—
300 ²⁾	320	—
440/220	500	250
600 ²⁾	630	—
480/960	1000	500
1000 ²⁾	1000	—

Table 00.03 b. Three phase, four or three wire AC systems

Nominal voltage of supply system ¹⁾	Rated voltage in V		
	Phase-to-phase All systems	Phase-to-earth	
	$U_{r.m.s.}$	$U_{r.m.s.}$	$U_{r.m.s.}$
60	63	32	63
110	125	80	125
120	—	—	—
127	160	—	160
150 ²⁾	200	125	200
220	250	160	250
230	—	—	—
240	320	—	320
300 ²⁾	400	250	400
380	500	250	500
400	—	—	—
415	500	320	500
440	630	400	630
480	630	—	630
500	—	—	—
575	630	400	630
600 ²⁾	630	—	630
660	630	400	630
690	800	500	800
720	1000	630	1000
830	—	—	—
960	1000	630	1000
1000 ²⁾	1000	—	1000

¹⁾ This voltage can be the same as the rated voltage of the equipment.

²⁾ These values correspond to the values of table 00.01.

In countries where both star and delta, earthed and unearthed supply systems are used the values for delta systems only should be used. Systems earthed across impedances are treated as unearthed systems.

Table 00.04

Rated voltage (V) $U_{r.m.s.}$ or U_L	12.5	25	32	50	63	80	100	125	160	200	250	320	400	500	630	800	1000
Minimum creepage distance (mm)																	
Degree of pollution 1:																	
CTI group II + III a/b	0.09	0.125	0.14	0.18	0.2	0.22	0.25	0.28	0.32	0.42	0.56	0.75	1	1.3	1.8	2.4	3.2
Degree of pollution 2:																	
CTI group III a/b	0.42	0.5	0.53	1.2	1.25	1.3	1.4	1.5	1.6	2	2.5	3.2	4	5	6.3	8	10
CTI group II	0.42	0.5	0.53	0.85	0.9	0.95	1	1.05	1.1	1.4	1.8	2.2	2.8	3.5	4.5	5.6	7.1

Performance level 3 as per IEC 60 603-2

50 mating cycles then visual inspection.
No gas test.
No functional impairment.

Part number explanation 09 7 . . .

Performance level 2 as per IEC 60 603-2

400 mating cycles.
200 mating cycles then 4 days gas test using 10 ppm SO₂.
Measurement of contact resistance.
200 mating cycles then visual inspection. No abrasion of the contact finish through to the base material.
No functional impairment.

Part number explanation 09 6 . . .

Performance level 1 as per IEC 60 603-2

500 mating cycles.
250 mating cycles then 10 days gas test using 10 ppm SO₂.
Measurement of contact resistance.
250 mating cycles then visual inspection. No abrasion of the contact finish through to the base material.
No functional impairment.

Part number explanation 09 2 . . .

Performance level 2 as per IEC 61 076-4-113

250 mating cycles.
125 mating cycles then 4 days gas test using 10 ppm SO₂.
Measurement of contact resistance.
125 mating cycles then visual inspection. No abrasion of the contact finish through to the base material.
No functional impairment.

Part number explanation 02 2 . . .

Performance level 1 as per IEC 61 076-4-113

500 mating cycles.
250 mating cycles then 10 days gas test using 10 ppm SO₂.
Measurement of contact resistance.
250 mating cycles then visual inspection. No abrasion of the contact finish through to the base material.
No functional impairment.

Part number explanation 02 1 . . .

In the industry DIN connectors in performance level 2 are specified most frequently. Connectors in performance level 1 are used for higher requirements, e.g. in railway applications.

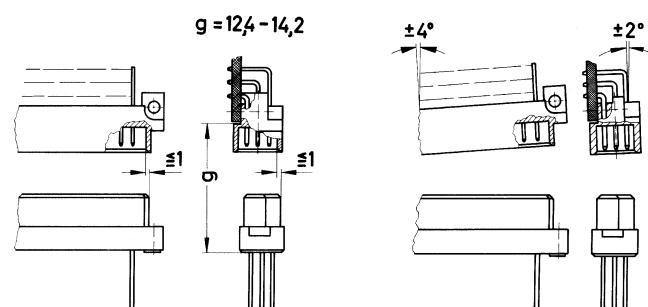
Other plating finishes available on request.

Mating conditions

To ensure reliable connections and prevent unnecessary damage, please refer to the application data diagrams.

These recommendations are set out in IEC 60 603-2.

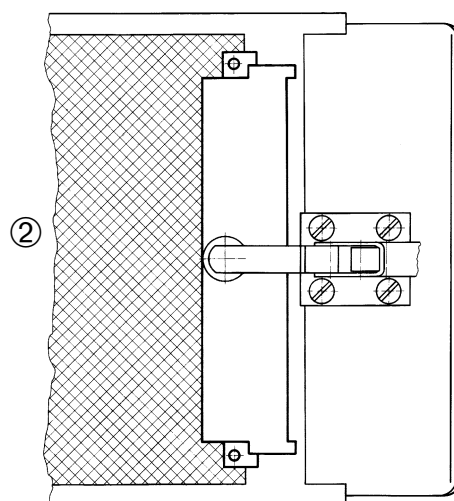
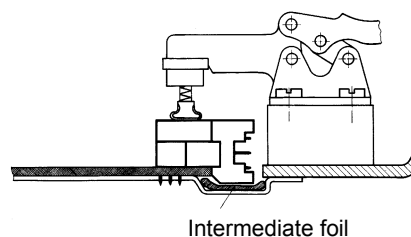
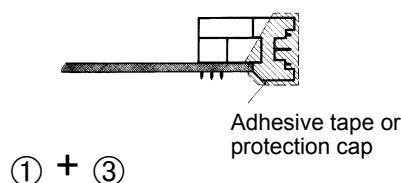
The connectors should not be coupled and decoupled under electrical load.



Soldering the male connectors into pcb's

Male connectors should be protected when being soldered in a dip, flow or film soldering baths. Otherwise, they might become contaminated as a result of soldering operations or deformed as a result of overheating.

- ① For prototypes and short runs protect the connectors with an industrial adhesive tape, e.g. Tesaband 4331 (www.tesa.de). Cover the underside of the connector moulding and the adjacent parts of the pcb as well as the open sides of the connector. This will prevent heat and gases of the soldering apparatus from damaging the connector. About 140 + 5 mm of the tape should suffice.
- ② For large series a jig is recommended. Its protective cover with a fast action mechanical locking device shields the connectors from gas and heat generated by the soldering apparatus. As an additional protection a foil can be used for covering the parts that should not be soldered.
- ③ For prototypes and short runs the protection described under point ① can be replaced by a solder protection cap. This cap can be ordered under the part no. 09 02 000 9935.



Design of connectors

- Standard fixing arrangement
- Standard positions for pcb's and connectors provide a modular system in the card frame and a standard front panel system.
- Standard wiring matrix on the connection side for female connectors built up on a 2.54 mm (0.1" centres) grid. (This facilitates automatic wiring).
- Printed circuit boards with standard dimensions 100 x 160 resp. 233.4 x 160 mm as set out in DIN EN 60 297-3 standard sizes 3 U and 6 U.

Building up card frame systems

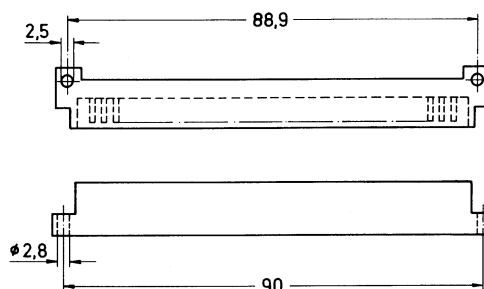
In the basic frame unit according to DIN EN 60 297-3 pcb's are inserted from the front and make contact with the connectors fitted to the back. This basic arrangement gives the following advantages:

- When using conventional connectors on the back of the card frames, space is left above, below and in the middle along the horizontal line of the frame which can be used to fit extra connectors for cross connection or making plug connections by means of flying lead connectors.
- Using the HARTING system one can also connect flying lead connectors onto the front of the frame or even onto the inside of the back of the frame. This means that external equipment can easily be monitored, controlled or tested from the card frame itself.

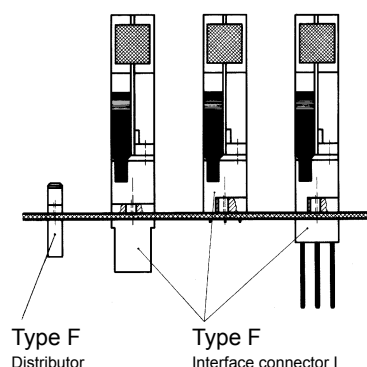
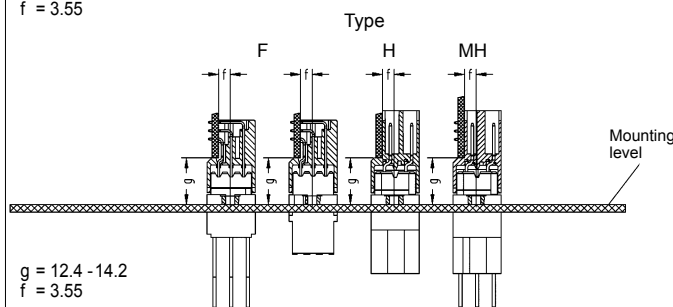
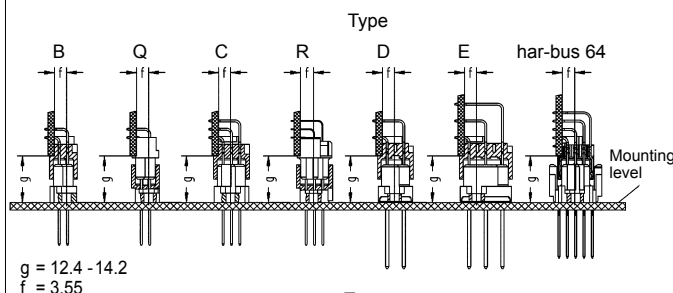
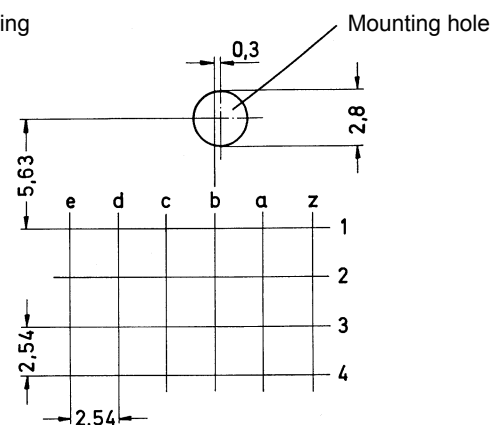
Complementary components

All connectors can be supplied with a complete range of accessories. These can be fitted above or below the wiring plane on the back of the card frame or on the front of the card frame. These connectors and accessories provide a complete connector system suitable for commonly used wiring techniques.

- The flying lead connector consists of a connector with crimp or solder contacts and a shell housing. The flying lead connector is latched or retained in position using screw fixings and is compatible with a corresponding male connector and interface connector I.
- Fixing brackets prohibit the withdrawal of the pcb when a flying lead connector is used on the front side of the card frame.
- The interface connector I has blade contacts on the plug side and solder pins, wrap posts or crimp terminals on the termination side. It replaces the female connector type F fitted into the frame and allows interfacing to the internal wiring with the help of the flying lead connector on the back of the card frame unit.



Contact spacing



Type	B, Q	C, R	D
Wiring side (Rear side)	Input access from the front side via a female connector	Input access via a female connector	Input access from the front side via a female connector
		Pin shroud 	Piggyback connector
Soldering technique for a flexible wiring			
Soldering technique for pcb Press-in technique for pcb			
Crimp connections			
Wrapped connections posts 0.6 x 0.6 mm 1 x 1 mm			
Middle section 			
Front side 			
1) Screw fixing (cheesehead screw M 2.5 x 16 + nut) 09 02 000 9909 2) 2 x screw fixing (cylindric screw M 2.5 x 25 DIN EN ISO 1207 + nut M 2.5 DIN EN ISO 4032) 3) Fixing brackets for latching and screw fixing 4) Screw length depends on the pcb thickness f = female connector m = male connector R = right hand L = left hand			

harbus® 64	E			H
Input access from the front side via a female connector	Input access via a female connector			Input access from the front side via a female connector
	Piggyback connector			

Type

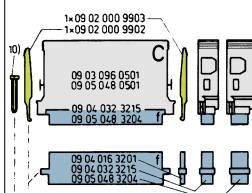
F

Wiring side
(Rear side)

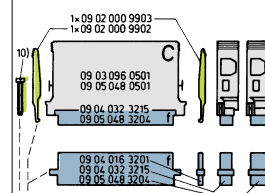
Input access via a female connector

Output from the front side via a male connector

Piggyback connector



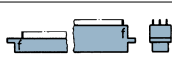
Piggyback connector



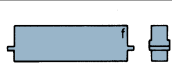
Soldering technique
for a flexible wiring



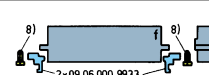
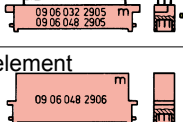
Soldering technique for pcb
Press-in technique for pcb



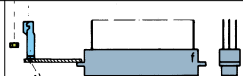
Crimp connections



I element



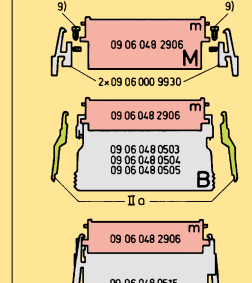
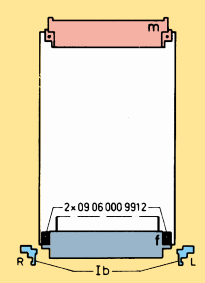
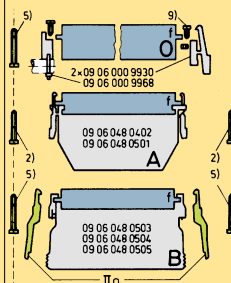
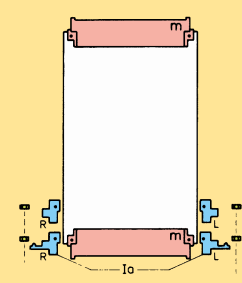
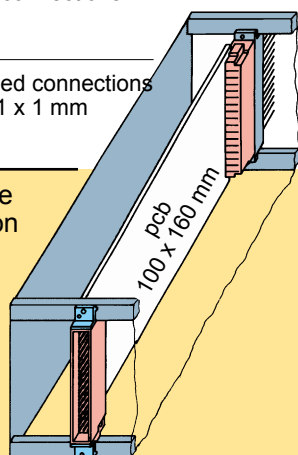
Wrapped connections
posts 1 x 1 mm



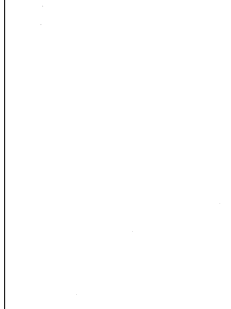
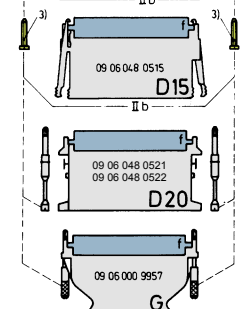
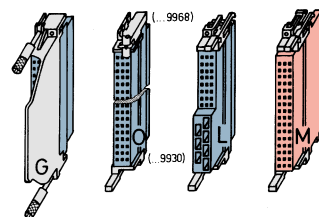
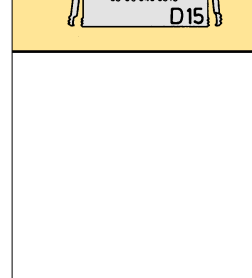
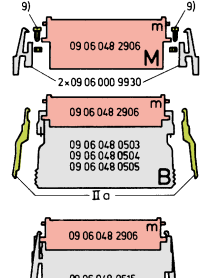
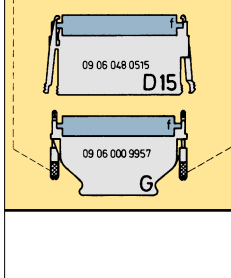
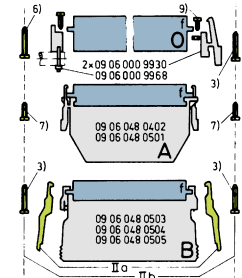
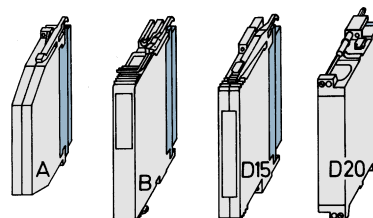
I element



Middle
section



Front side



F	F, H, MH 24 + 7	MH 24 + 7				
Input access from the wiring side via a female connector		Input access from the front side via a female connector	Ia			
			Combinations	Fixing bracket a for male connectors Multiple fixing Single fixing 	Fixing bracket b for male connectors Multiple fixing Single fixing 	
			Housing A	latch (M 2.5 x 12) and screw fixing	latchable	
			Housing B		latch (M 2.5 x 20) and screw fixing	
			Housing D15		latch (M 2.5 x 20) and screw fixing	
			Housing D20		screw fixing	
			Housing G		screw fixing	
			Comb. O (...9930)		latch (M 2.5 x 20) and screw fixing	
			Comb. L (...9968)		screw fixing	
			Comb. O (...9930)		latch (M 2.5 x 20) and screw fixing	
			Comb. L (...9968)		screw fixing	
I element	I element		Ib			
			Combinations	Fixing bracket b for female connectors Multiple fixing 	I element	
			Housing A		(M 2.5x22) latch and (M 2.5x16) screw fixing	
			Housing B	latchable	(M 2.5x26) latch and (M 2.5x20) screw fixing	
			Housing D15	latchable	latchable	
			Housing G		screw fixing	
			Comb. O (...9930)		latchable	
			Comb. L (...9968)		(M 2.5x26) screw fixing (M 2.5x20)	
			Comb. M	latchable		
			II			
			Housing B/D 15	II a	II b	
			09 06 048 0503	2x 09 06 000 9913	and/or 2x 09 06 000 9926	
			09 06 048 0504	1x { 09 06 000 9913 09 06 000 9919	and/or 2x 09 06 000 9926	
			09 06 048 0505	1x { 09 06 000 9913 09 06 000 9919	and/or 2x 09 06 000 9926	
			09 06 048 0515	—	and 2x 09 06 000 9926	
			Comb. O + L	2x 09 06 000 9930 2x 09 06 000 9968	and 2x —	09 06 000 9926
			Comb. M	2x 09 06 000 9930	—	—
			1) Fixing brackets for latch and screw fixing 2) Screw M 2.5 x 22 belongs to supply of I elements, nut M 2.5 DIN EN ISO 4036 does not belong to scope of supply 3) Screw fixing (cheesehead screw M 2.5 x 20 + nut) 09 06 000 9926 4) Screw fixing (cheesehead screw M 2.5 x 16 + nut) 09 02 000 9909 5) Cheesehead screw (M 2.5 x 26) 09 06 000 9955, nut M 2.5 DIN EN ISO 4036 does not belong to scope of supply 6) Screw M 2.5 x 20 belongs to the junction element, hexagonal nut M 2.5 DIN EN ISO 4036 does not belong to scope of supply Following items don't belong to scope of supply 7) Screw M 2.5 x 12 and nut M 2.5 DIN EN ISO 4036 8) Screw M 2.5 x 8 9) Screw M 2.5 x 8 and nut M 2.5 DIN EN 4032 10) Screw M 2.5 x 25 and nut M 2.5 DIN EN 4032 f = female connector m = male connector R = right hand L = left hand			

The automated insertion of components into pcb's is increasing.

To meet this market demand, HARTING has developed connectors which can be assembled and fixed to the pcb in one process.

To fix the connectors HARTING offers snap-in clips as well as kinked pins.

Snap-in clips

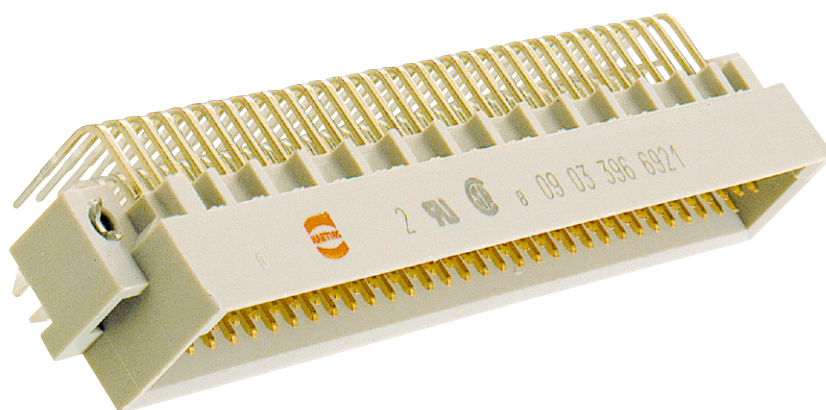
In the soldering process, all component terminations including the snap-in clips are soldered and therefore mechanically secured. This provides mechanical protection for the soldered contacts during mating and unmating of the connector.

Mouldings with snap-in clips offer the following advantages:

- Cost reduction when compared with the screw or rivet assembly methods due to the soldering of the clip along with other components in one process.
- The orientation of the clip **after soldering in the plated through hole** provides mechanical protection against the tensile forces arising from the mating and unmating of the connector.

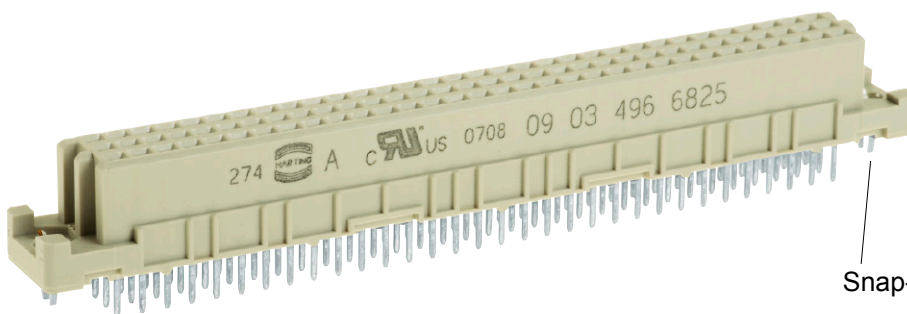
It is possible to supply the majority of male and female connectors with solder termination with snap-in clips (existing articles see product pages).

For pcb thickness
 $1.6 \pm 0.2 \text{ mm}$
 $\varnothing = 2.8^{+0.1} \text{ mm}$



Mounting force
 40 - 60 N

For pcb thickness
 $1.6 - 4.0 \text{ mm}$
 $\varnothing = 2.8^{+0.1} \text{ mm}$



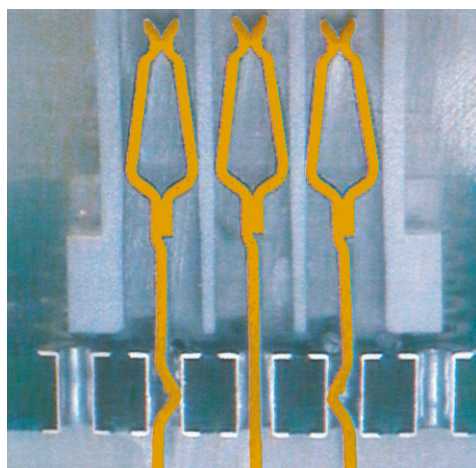
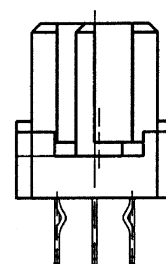
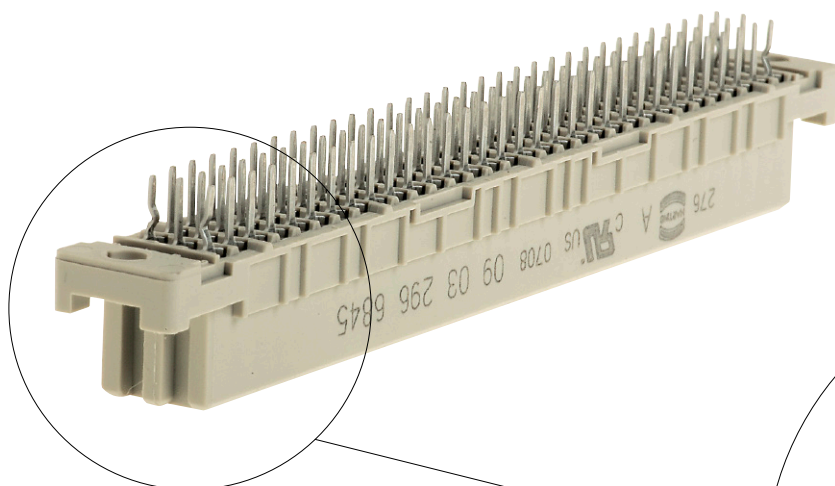
Snap-in clip

Kinked pins

Before and during soldering, the connectors are fixed onto the pcb with four kinked contacts located in the rows a and c, e.g. the positions a1, c1, a32 and c32 for a fully loaded connector.

Connectors with kinked pins are a reliable alternative for female connectors with straight terminations because no additional elements like screws, rivets or clips are necessary.

Connectors see chapter 01, type C.



Cross section of a connector with kinked contacts assembled to a pcb

Dimension of the plated through hole [mm]	Mounting force [N]	Retention force [N] before soldering
0.94	55	35
1.09	11	7

Typical measurements for a pcb of 2.4 mm thickness.

Identification	Part number	Drawing	Dimensions in mm
----------------	-------------	---------	------------------

Coding system
without contact loss –
side coding

Male and
female
connectors

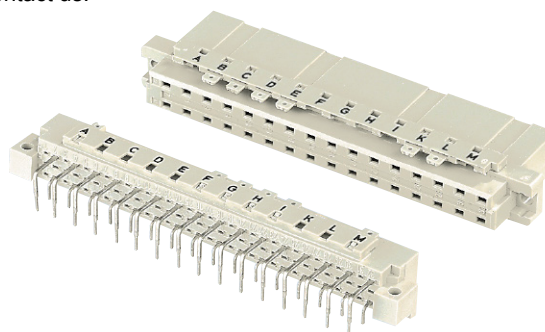
Types
B, C, D, E and R

see product pages
or
on request

To avoid accidental and incorrect mating of adjacent connectors a coding system is required. This coding system is an integral part of both male and female connectors. A comb with 12 coding pins, which is supplied under a single part number, allows over 900 coding variations. The pins are to be locked into the male and female connectors.

The connectors with the integrated coding facility are supplied for types B, C, D, E and R and are available for all variants.

Please contact us.



Coding system
without contact loss –
side coding
Coding bar
for screw fixing

for types C and D
male connectors
for type R
female connectors

09 73 000 9903

for type B
male connectors
for type Q
female connectors

09 72 000 9903

for type E
male connectors

09 05 000 9903

These coding bars can be screwed on the top side of angled male and female connectors. They are alternatives to the male and female connectors with pre-assembled or splashed coding bars. As far as available we recommend the connectors with pre-assembled or splashed coding bar.

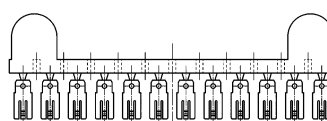


Coding pins

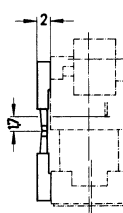
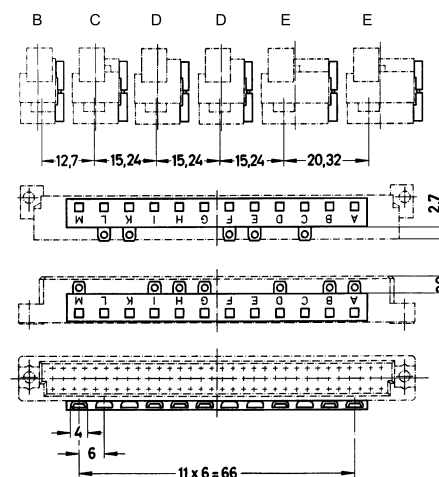
12 pins
on a comb

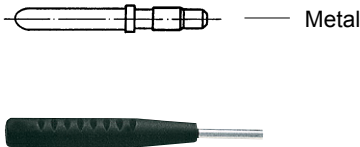
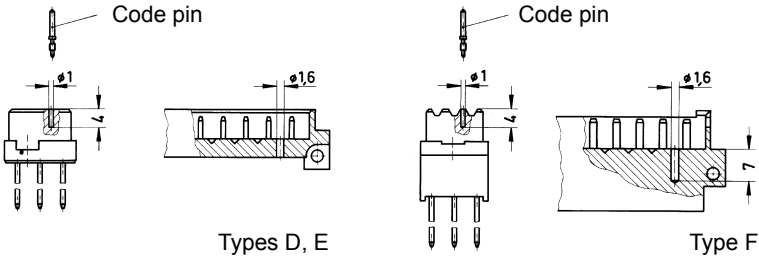
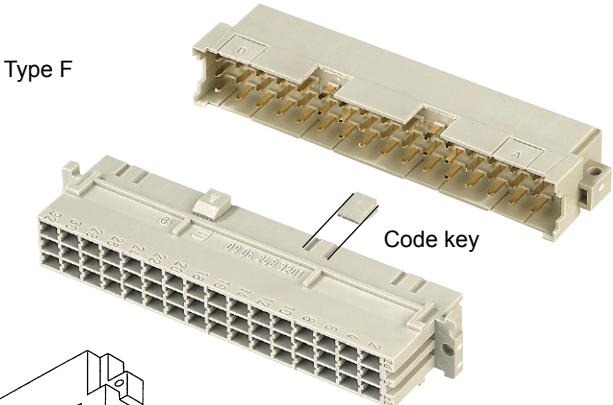
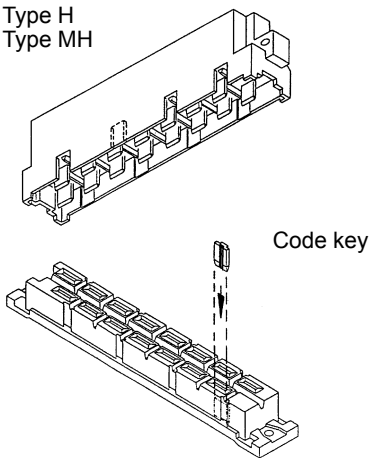
09 02 000 9928

Mounting example



Type



Identification	Part number	Drawing	Dimensions in mm
Coding system <u>without</u> contact loss with code pin Code pin 09 06 000 9950 Insertion tool 09 99 000 0103		With the aid of the marked indents between the contact rows of the male connector a hole has to be drilled at the desired position (also see drawing). The code pin can then be inserted into the corresponding cavity of the female connector by means of the insertion tool. This coding system is available only for the types D, E, F and interface connectors I.  Mounting example 	
shroud coding Type F	Code key 09 06 001 9919	Insert the code key into one of the keyways of the female connector as shown in the drawing. Break out the corresponding area of the male shroud. Connectors coded this way can only be applied in a minimum rack spacing of 20.32 mm. 	
shroud coding Types H, MH 24 + 7	Code key 09 06 001 9918	Type H Type MH 	
Tool for breaking out the coding area of the male shroud	09 99 000 0242		

Identification	Part number	Drawing	Dimensions in mm
----------------	-------------	---------	------------------

Coding system without contact loss

flange coding

Type MH 21 + 5

colour red
blue
green
orange

colour red
blue
green
orange

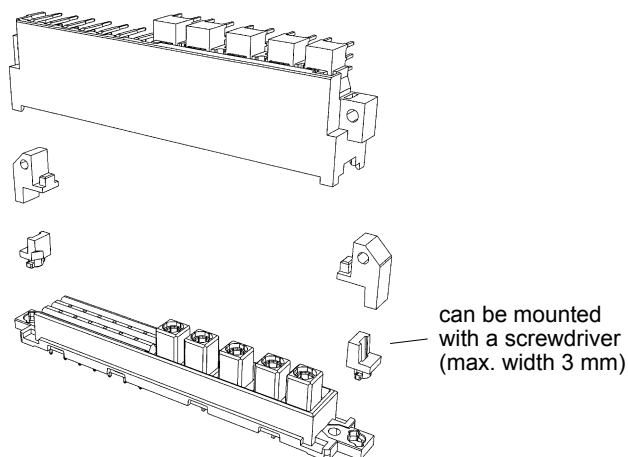
Code keys

for male connectors

09 06 001 9950
09 06 001 9951
09 06 001 9952
09 06 001 9953

for female connectors

09 06 001 9960
09 06 001 9961
09 06 001 9962
09 06 001 9963



Coding system with contact loss

Code pin for types
B, 2B, 3B,
C, 2C, 3C,
M, M-flat,
Q, 2Q,
R, R (HE 11), 2R,
har-bus 64

09 02 000 9901

Removal tool
for
male contacts

09 99 000 0133

Code pin for types
D, E, F, FM, 2F, MH

09 04 000 9908

Removal tool
for
male contacts

09 99 000 0038

To avoid accidental and incorrect mating of adjacent connectors a coding system is required. The coding is achieved by means of a code pin which is inserted into the selected chamber of the female connector (the contact cavity must be filled with a female contact!). The opposite male contact must be removed with the help of the specially designed tool.
It's recommended to use a number of code pins in relation to the total number of contacts per connector: 3 pins for 64 contacts, 7 pins for 160 contacts.



In addition to the standard demands of connectors, as defined in IEC 60 603-2, for example, market and application specific demands and requirements are gaining increasing significance.

In the railway engineering area the demands made on reliability and safety are particularly high, in order to ensure utmost passenger safety in all instances. Especially in the case of routes involving a high share of tunnels that only offer limited escape route possibilities in the event of fire, the technical demands made on the materials employed are very stringent.

In addition to the fire load, and/or the flammability of a material, the so-called smoke gas density is a key characteristic, which is determined based on the opacity and toxicity of the smoke gas emissions. The risk posed by the two characteristics can not be defined in relationship to each other, which means that both minimal inflammability as well as minimal smoke gas density must be fulfilled. Materials that meet both requirements are very rare and in many instances it is only possible to fully meet one of the two criteria.

The French NFF 16-101 railway standard defines these requirements precisely and presents a structure of application groups by way of a matrix.

NFF 16-101 classifies non-metallic materials used in rail vehicles in terms of fire behavior, opacity and toxicity of smoke gas emissions in the event that the materials should burn.

In order to enable the classification with regard to the deployment of connectors, the following values must be applied:

1. Fire behavior class

Classification:

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	

Note: The values are derived from specified test methods determining the oxygen value (I.O.) and testing inflammability by way of a filament.

2. Smoke development classification

Classification:

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

Note: The values of the smoke index (I.F.) are derived from specified test methods by determining opacity (specific optical density, opacity values), toxicity (critical gas concentration of CO, CO₂, HCl, HBr, HCN, HF, SO₂ in smoke).

The matrix from NFF 16-102 shows how the combination of both characteristics results in a classification. This matrix is defined by the contractor in each project put up for bidding. The matrix is geared to the type of train and course of the route, whereby special attention is given to the number of tunnels. By complying with the high classifications I2 and F1, the designated standards supplementing connectors according to IEC 60603-2 can be used in all four defined groups and for all railway applications. According to NFF 16-102 the standard DIN connectors (I3, F4) are only permissible for Group 1.

Group 1							Group 2						
	I0	I1	I2	I3	I4	NC		I0	I1	I2	I3	I4	NC
F0							F0						
F1			X				F1			X			
F2							F2						
F3							F3						
F4							F4						
F5							F5						

Group 3							Group 4						
	I0	I1	I2	I3	I4	NC		I0	I1	I2	I3	I4	NC
F0							F0						
F1			X				F1			X			
F2							F2						
F3							F3						
F4							F4						
F5							F5						

Diagram: Classification from NFF 16-102, April 1992

The HARTING DIN Power and DIN Signal portfolio looks back on a highly successful track record in the railroad engineering industry. Typical application areas include – among many others – control, steering, monitoring components and modules on board trains, as well as signal technology components or the power supply of electronic components.

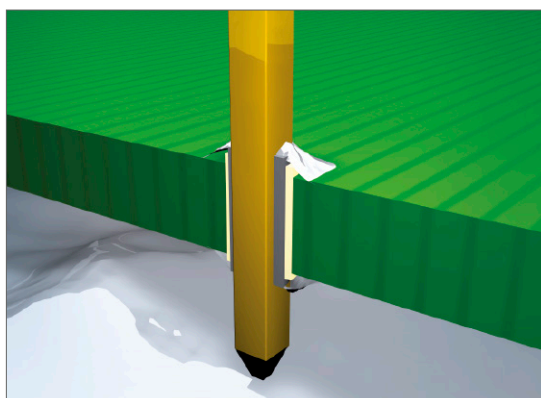
The extended range of connectors complying with the highest classification according to NFF 16-101 and 16-102 considerably reduces our customers' development times: as the selected connectors are suitable for every stipulated hazard or risk class, they are ideal for realizing product platforms, and therefore find use in every conceivable rail vehicle or railroad engineering project. This dispenses with the need for complex, product specific development work, at least in terms of selecting passive PCB interfaces, while the technical approval process is streamlined considerably.

In order to facilitate rapid identification, the additional railway specific articles are designated accordingly on the product pages of this catalogue.

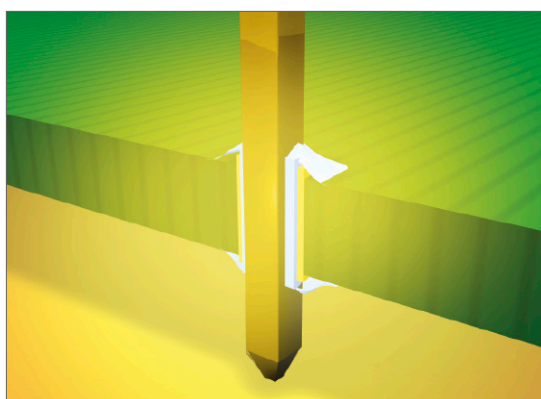
Since 2013 the current European flammability directive is EN 45545:2013. After a transition period, this will replace the national standards, for example NFF 16-101 / 102.

Small electronic components are listed in the standard under "EL10". This includes the DIN 41612 connectors according to IEC 60603-2 shown in this catalogue. For these components it's required to provide evidence that the criterion "V0" in compliance with EN 60695-11-10 or UL 94 has been met to comply with the defined requirement paragraph R26.

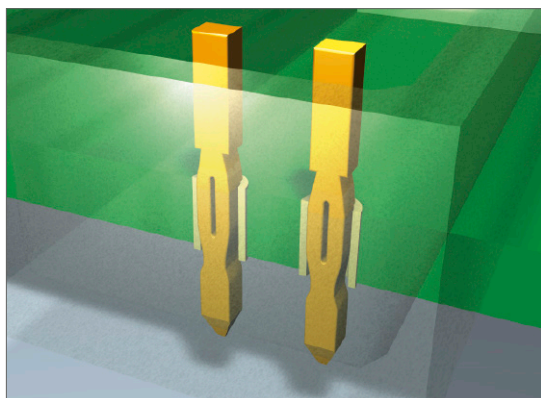
For flammable materials with the mass under 10 g no evidence must be provided. The so-called grouping rule encompasses flammable and non-tested materials which lie closer than 20 mm in the vertical direction and 200 mm in the horizontal direction to each other. Due to this rule, the limit value can be increased to 100 g for the internal area and 400 g for the external area of the vehicle.



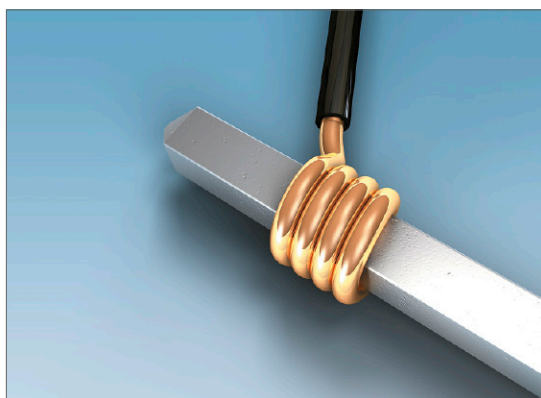
THT soldering technology



THR soldering technology



Press-in technology



Wire wrap terminals

THT soldering technology

Proven over decades, standard soldering technologies deliver maximum stability and process reliability. The soldering pins of the connectors are inserted into the through-plated PCB holes and can then be soldered simultaneously with other components in a wave soldering process.

THR soldering technology

The connector is inserted into through-plated PCB holes similar to standard component assembly for processing with THR (Through Hole Reflow) soldering technology. Insertion of these SMT components can be automated by means of Pick & Place assembly in preparation for a reflow soldering process together with the surface-mounted component.

This connection technology is characterized by high mechanical strength and is facilitated by a design that is specially adapted to the reflow soldering process (high-temperature materials).

Press-in technology

This solder-free connection technology is based on press-in mounting of a pin in a throughplated PCB hole. The implementation of a state-of-the-art, flexible press-fit zone allows for the compensation of tolerances of PCB holes and meets high electrical and mechanical requirements for properties such as low press-in forces and high holding forces.

Press-in technology supports unlimited cost efficient processing, especially of pins with selective gold plating for backplane bus systems.

Wire wrap terminals

This solder-free connection technology is based on a wire, which is wrapped with several turns onto a rectangular post. When wires are correctly wrapped the connection performs with low resistance, mechanical strength and high reliability, unaffected by normal climatic or temperature change.

Crimp terminals

Gas-proof and the miniaturized contact technology are synonymous with crimp technology. The flexible conductor is inserted into the crimp contact and is retained by controlled deformation. This technology is similar to a cold welding process and provides maximum aging resistance and mechanical resistance to shock and vibration. Crimp machines facilitate the efficient, streamlined production of system cable assemblies, and crimp technology can also be deployed for field assemblies using the corresponding hand crimp tools. The technical requirements for crimp technology are standardized in IEC 60 352-2.

IDC insulation displacement terminals

IDC (insulation displacement contact) technology facilitates the simple and safe termination of solid and flexible conductors. With IDC technology, a blade cuts through the wire insulation and produces an elastic termination in a single pass. This gas-proof connection provides maximum safety even for the lowest currents and voltages. Technical requirements for IDC technology are standardized in IEC 60 352-3.

Solder lug terminals

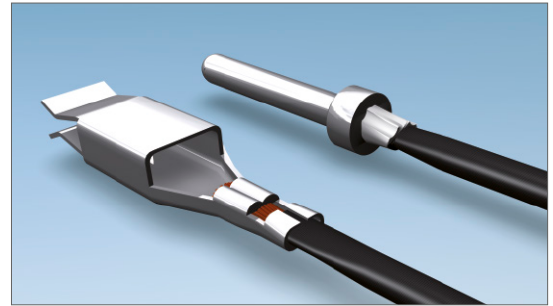
The solder lug termination is the optimized solution for production of small lot sizes and prototypes. Even without any special tooling a big variety of cables can be terminated to the cable connectors. The stripped wire is soldered individually by hand to the solder lug. This termination should however only be manufactured by experienced specialists.

Faston blades terminals

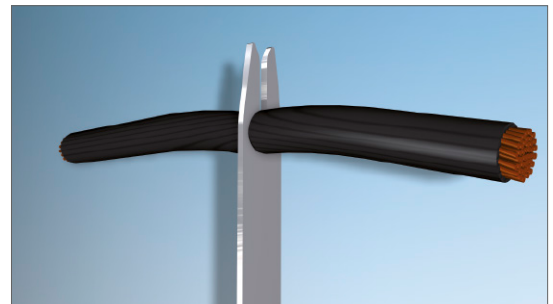
The faston blade termination is used for free wiring. Benefits are the high current carrying capacity (up to 15 A) and the easy possibility for variations.

Cage clamp terminals

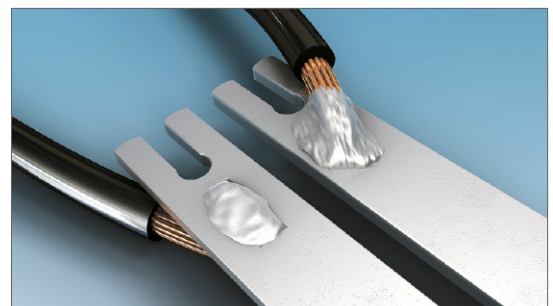
The cage clamp terminal technology is used to terminate flexible and solid conductors by means of spring force. After the spring has been opened by an actuator element, the stripped conductor is simply inserted into the contact chamber. This connection technology requires minimum operating expense and is characterized by its high functional safety. The springloaded connection also allows the termination of more than one wire per contact and excels with high vibration and shock resistance.



Crimp terminal



IDC insulation displacement terminals



Solder lug terminals



Faston blades terminals



Cage clamp terminals

THT soldering technology

The term "soldering" is defined in DIN 8505:

"Soldering is a method of connecting metallic materials using an additional melting metal, if necessary with the assistance of a flux and/or protective gas. The melting temperature of the solder must lie beneath the minimum melting temperature of the base metals being connected. These base metals shall be tinned without melting themselves."

Soft solders commonly used on electronic equipment are to DIN 1707-100. Today's lead free solders have a melting range between 217 °C and 227 °C depending on the composition of the alloy. For soldering metallic materials the flux is defined in DIN EN 29 454-1. Tests are explained in DIN 8526. For soldering male connectors into printed circuit boards, see recommendations for soldering on page 00.06.

THR soldering technology

The continuing trend towards miniaturisation has revolutionised the assembly of electronic components. For the past 15 years, most components have been secured directly to the pcb surface by means of Surface Mount Technology (SMT). By dispensing with drilled holes on the pcb, a space saving of up to 70 percent is achieved.

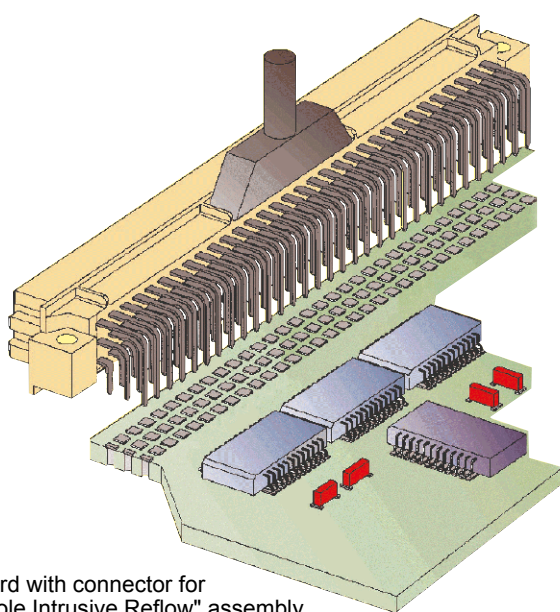


Fig. 1:
SMT board with connector for
"Pin in Hole Intrusive Reflow" assembly

Today, typical components such as resistors, ICs, capacitors, and connectors with straight terminal pins are almost exclusively fitted using SMD (Surface Mount Device) technology in mass production. In contrast, angled SMD connectors at the edge of the board have not been successful because of tolerance problems (co-planarity) and stresses during mating. Modified solder connectors for assembly with "Pin in Hole Intrusive Reflow" process offer a better solution. These can be mounted at low cost, utilising existing SMD production lines.

"Pin in Hole Intrusive Reflow"

In this process, the connector is inserted into plated through holes in a comparable way to conventional component mounting. All other components can be assembled on the pcb surface.

The components are positioned using pick-and-place machines. These automatic assembly machines differ according to whether the components are small, lightweight or bulky. Connectors are considered bulky (odd form) because of their comparatively heavy weight and large volume which makes them more difficult to grip. Furthermore, machines for odd form components must have higher insertion power to fit the components into pcb holes, which are filled with solder paste. As a rule, modern THR production lines are equipped with both types of machine, therefore the "Pin in Hole Intrusive Reflow" process generally entails no extra investment costs for the user.

Conventional assembly process:

1. Application of solder paste
2. Positioning the components
3. Positioning odd form components
4. Reflow soldering
5. Pressing in or partially dip soldering the connector at the board edge
6. Quality inspection

"Pin in Hole Intrusive Reflow" assembly:

1. Application of solder paste
2. Positioning the components
3. Positioning odd form components
4. Reflow soldering
- ~~5. Pressing in or partially dip soldering the connector at the board edge~~
6. Quality inspection

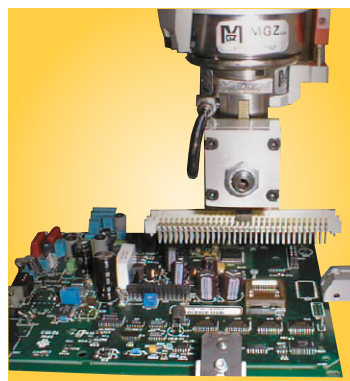


Fig. 2:
Pick-and-place machine for
odd form components
(Courtesy of JOT Automation GmbH)

Solder requirements

Application of solder paste

Before the components are assembled, solder paste must be applied to all the solder pads (for connecting surface-mount components) and the plated through contacts (pcb holes for "Pin in Hole Intrusive Reflow" insertion). Usually a screen printing process is used for this purpose. A squeegee moves across the pcb, which is masked with screens and presses the solder paste into all unmasked areas. To ensure that the plated through holes are completely filled, significantly more solder paste must be applied than traditional solder pads on the pcb surface. The required quantity can be set exactly via several parameters.

As an alternative to screen printing, the solder paste can be applied by means of a dispenser. A high-precision robot moves the dispenser to all required positions on the pcb. The dispensing method is particularly suitable for small pcb's or applications which demand high precision and flexibility in dispensing volumes.

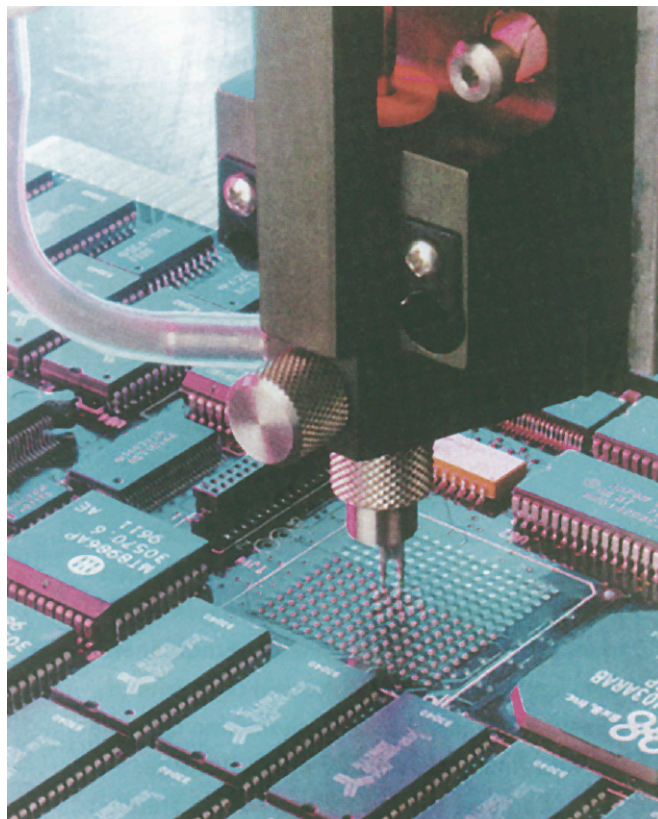


Fig. 3: Dispenser in operation

Requirements for the solder connection

There are numerous scientific studies dealing with calculation of the required quantity of solder paste. These studies use various parameters, e.g. the shrinking factor of the paste during soldering or the thickness of the screens used for masking the pcb. Since such calculation methods are complicated to apply, the following rule of thumb has proved valuable in practice:

$$V_{\text{Paste}} = 2(V_H - V_P)$$

in which:

V_{Paste} = Required volume of solder paste

V_H = Volume of the plated through hole

V_P = Volume of the connector termination in the hole

Comment: the multiplier "2" compensates for solder paste shrinkage during soldering. For this purpose, it was assumed that 50 % of the paste consists of the actual solder, the other 50 % being soldering aids.

At the beginning of a new production batch, the process parameters, such as quantity of solder paste and soldering temperature, can be set by interpreting simple cross-sections of the soldered connection. A reliable measure for achieving optimum parameters is the quantity of solder required to fill the hole. In soldered connections of high quality, the holes are filled to between 75 % and 100 %.

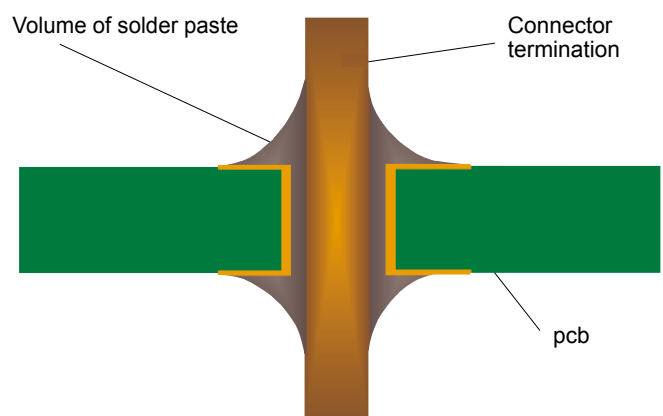


Fig. 4: Plated through hole with connector termination

Requirements for THR connectors

THR (Through Hole Reflow) connectors have to withstand temperatures of up to 240 °C in the reflow oven for 10 to 15 seconds. Therefore, the moulding must be made from a dimensionally stable plastic which expands at the same rate as the pcb material when subjected to heat.

The length of the connector contacts should be such that they protrude by no more than 1.5 millimetres after insertion to the pcb. Each contact collects solder on its tip as it penetrates the solder paste in the hole. So if the contact was too long, this solder would no longer be able to reflow back into the plated through hole by capillary action during the soldering process, therefore the quality of the soldered connection would suffer as a result.

Connector design must permit both automatic assembly with pick-and-place machines and manual positioning for test and pre-production batches. It is also important for the packaging of the connectors to be suitable for automated assembly. Experience shows that deep-drawn film and reel packaging fed into the pick-and-place machines with the aid of a conveyor system is particularly suitable.

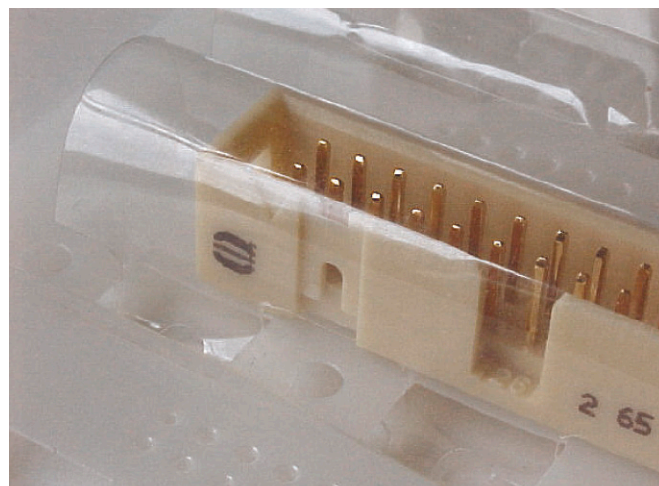


Fig. 5: HARTING connector mounted in a tape ready for placement using an odd form assembly station.

HARTING THR technology

HARTING offers its customers a complete system concept for integrating THR technology into existing production lines. We manufacture a wide range of THR connectors (3 and 5 row) in compliance with IEC 60603-2 and D-Sub connectors in compliance with IEC 60807. In addition, HARTING supports the market with packaging and processing concepts, which have been developed in collaboration with renowned manufacturers of THR soldering and assembly plants.

Advantages of the “Pin in Hole Intrusive Reflow” process:

- Partial dip soldering or press fitting is no longer required
- Complete compatibility with Surface Mount Technology
- Complete integration into the automated assembly process
- Reduced floor space in the production plant
- As a rule, no additional investment costs

har:press Press-in technology

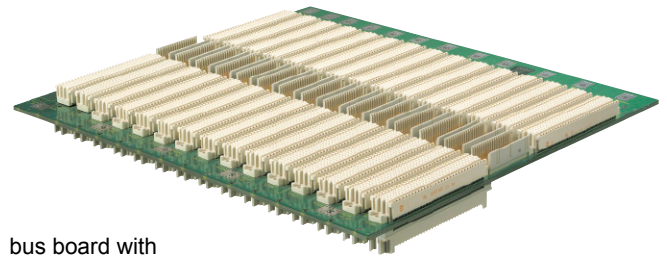
Solderless termination for connectors has proven to be reliable for decades. Today the use of press-in connectors encompasses all fields of electrical and electronical applications.

Pressing of electrical components, mainly connectors, is characterised through the matching of the connector pin and the plated through hole of the pcb. Whereas the desired electrical characteristics can be attained relatively independant from the design of the press-in zone, the mechanical characteristics of the press-in zone are crucial for the reliable assembly of connectors where pcb's have different surfaces.

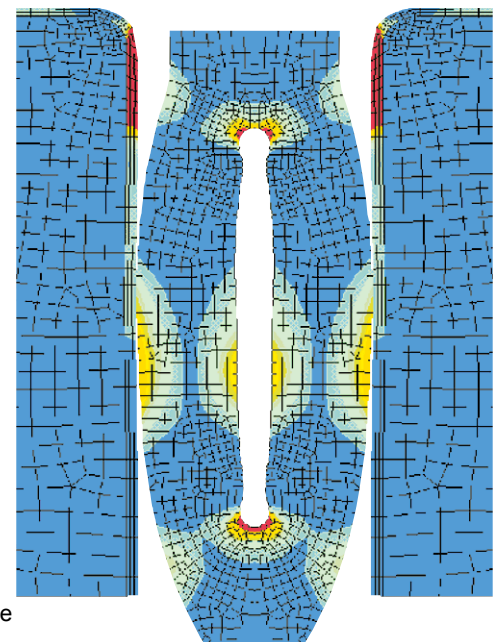
Although the scope of requirements at the press-in process is generally defined in time-tested specifications, the novel press-in zones should offer an optimal handling and a reliable termination. Essentially, this is guaranteed through the design of the press-in zone and the meticulous observance of tolerances. HARTING has been using FEM simulations for the calculation and optimisation of press-in zones for a long period of time. This expertise allows us to simulate various pcb configurations very accurate.

Benefits of the press-in technology

- Thermal shocks associated with the soldering process and the risk of the board malfunction are avoided.
- No need for the subsequent cleaning of the assembled pcb's
- Additional wrap connections are made possible by using connectors with long pins
- Unlimited and efficient processing of partially gold-plated pins for rear I/O – manual soldering is no longer necessary!



bus board with
press-in connectors



FEM simulation
of the needle eye
press-in zone

harpress Press-in technology

The processing of press-in connectors can be divided into 3 phases, containing both mechanical and metallurgical operations:

1. Centering and placing of the termination pins

The centering of connectors before pressing is important in order to prevent damage to the pcb and the termination pins. Centering can be omitted when connectors are pressed using a flat rock die.

HARTING offers insert blocks for male connectors to make the centering of connectors unnecessary.

2. Pressing in the pins

In the press-in process the insertion force is continuously transformed into compression force. The resulting friction frees the contacting bars of insulating films. Superfluous plating (tin) is transferred within the plated through hole. A gas-tight connection of fresh non-oxidised metal surfaces is obtained.

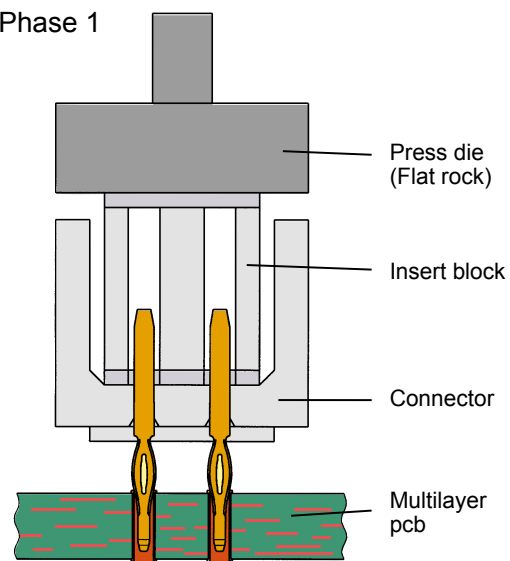
3. Obtaining the final position

The press-in operation should be terminated as soon as the connector obtains its final position on the pcb to avoid unnecessary compressive stress. The press-in machines of HARTING feature automatic termination of the press-in operation independent of pcb thickness and surface properties.

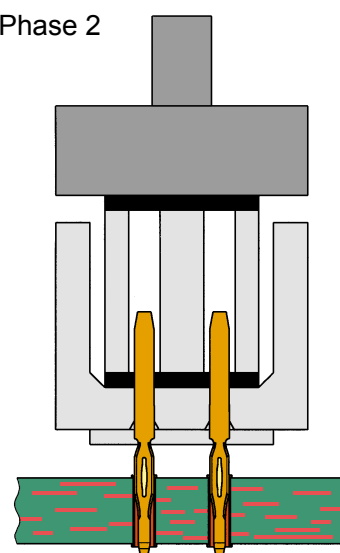
The entire dynamic press-in process is characterised through changes of the press-in force that can be statistically evaluated. HARTING records the changes of force with the help of special software. This is an important step towards permanent process control and documented manufacturing data.

The **harpress**-zone is based on the industry renowned needle eye technology. Its special design allows for compensation of tolerances of pcb surface properties (eg. superfluous tin plating). The excessive material is displaced within the plated through hole, whereby a gas-tight and corrosion resistant electrical connection is assured.

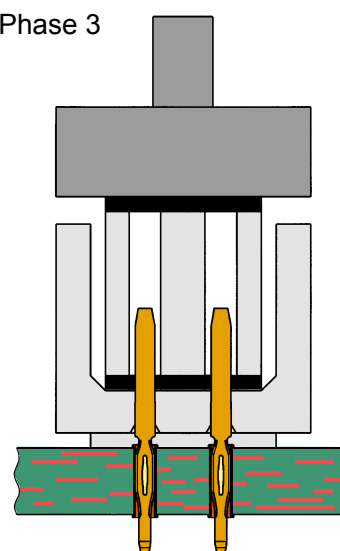
Phase 1



Phase 2



Phase 3



Recommended configuration of plated through holes

Due to the high deformation resistance and resilience of **harpress** contacts, they can be easily and repeatedly removed in case of repairs without impairment to their functioning.

harpress is extremely versatile and offers a reliable electrical contact, therefore it is especially well suited for applications with these surfaces.

Please contact us for detailed test reports.

In addition to the hot-air-level (HAL) other pcb surfaces are getting more important. Due to their different properties, such as mechanical strength and coefficient of friction we recommend the following configuration of pcb through holes.

<i>Tin-lead plated PCB (HAL) acc. EN 60 352-5</i>	Hole-Ø	1.15±0.025 mm
	Cu	min. 25 µm
	Sn	max. 15 µm
	Plated hole-Ø	0.94-1.09 mm

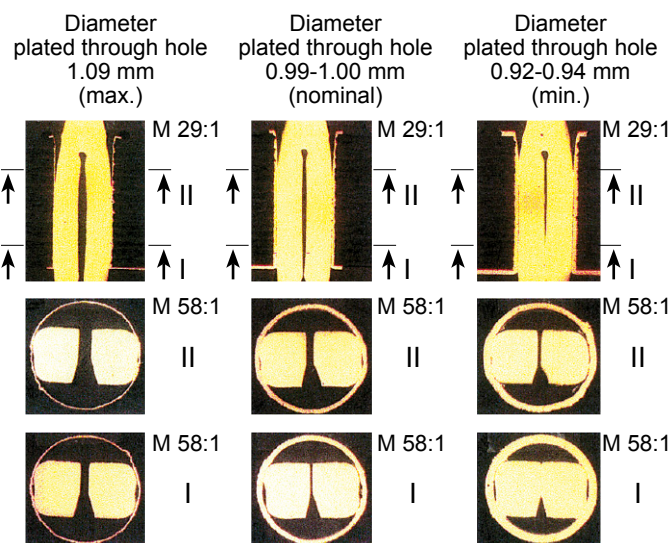
<i>Chemical tin-plated PCB</i>	Hole-Ø	1.15±0.025 mm
	Cu	min. 25 µm
	Sn	min. 0.8 µm
	Plated hole-Ø	1.00-1.10 mm

<i>Au / Ni plated PCB</i>	Hole-Ø	1.15±0.025 mm
	Cu	min. 25 µm
	Ni	3-7 µm
	Au	0.05-0.12 µm
	Plated hole-Ø	1.00-1.10 mm

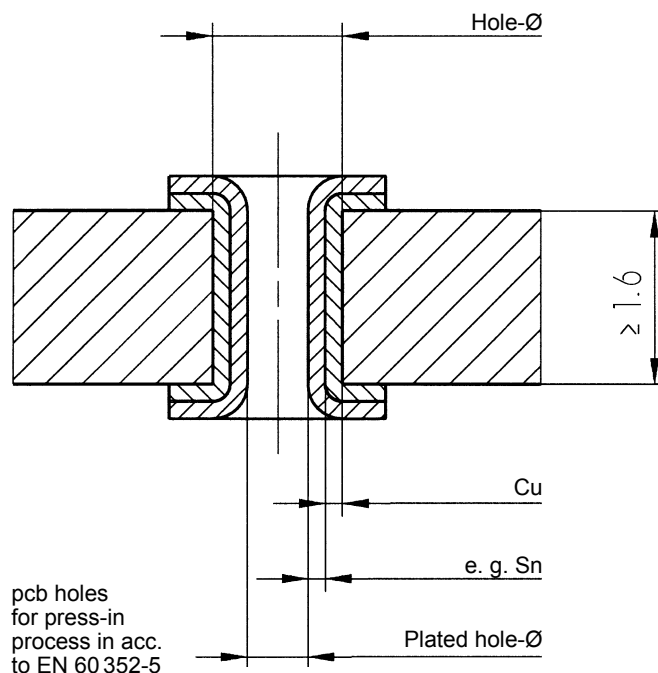
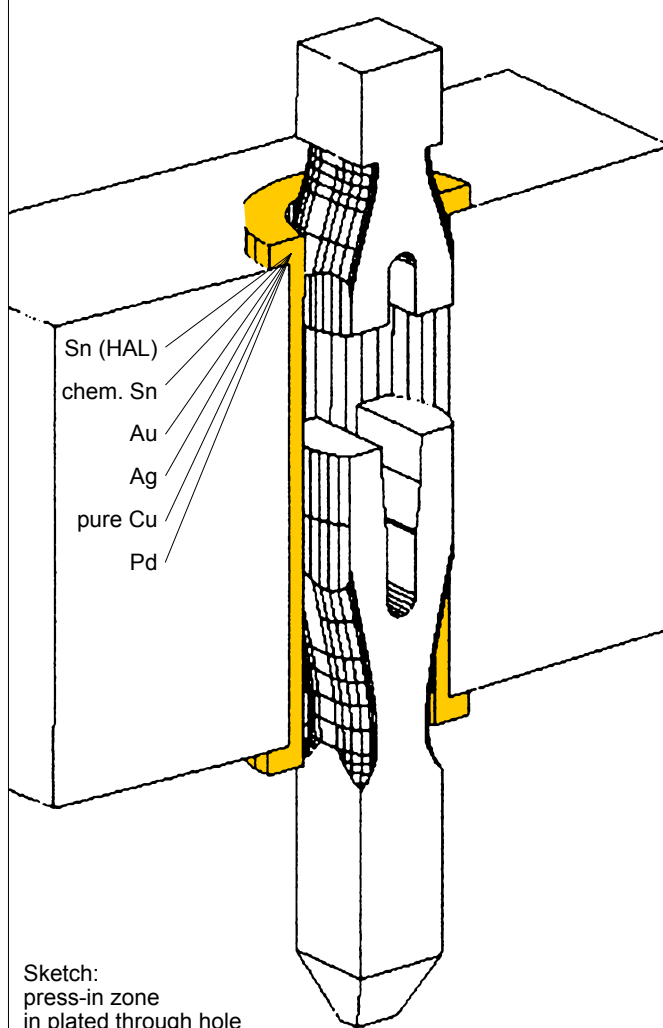
<i>Silver plated PCB</i>	Hole-Ø	1.15±0.025 mm
	Cu	min. 25 µm
	Ag	0.1-0.3 µm
	Plated hole-Ø	1.00-1.10 mm

<i>OSP copper plated PCB</i>	Hole-Ø	1.15±0.025 mm
	Cu	min. 25 µm
	Plated hole-Ø	1.00-1.10 mm

PCB board thickness: ≥ 1.6 mm



Cross section of a pcb 2.4 mm thick with various hole diameters



Crimp terminals

A perfect crimp connection is gastight and therefore corrosion free. It is equivalent to a cold weld of the connected parts. For this reason, major features in achieving high quality crimp connections are the design of the crimping areas of the contact and of course the crimping tool itself. Wires to be connected must be carefully matched to the correct size of crimp contacts. If these basic requirements are met, users will be assured of highly reliable connections with a low contact resistance and a high resistance against corrosion.

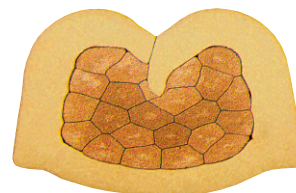
The economical and technical advantages are:

- Constant contact resistance as a result of an unvariable crimp connection quality
- Corrosion free connections as a result of cold weld action
- Preparation of harnessing with crimp contacts already fitted
- More economic cable connection

Requirements for crimp connections are set out in DIN IEC 60 352-2.

Pull out force of stranded wire

The main criterion by which to judge the quality of a crimp connection is the retention force achieved by the wire conductor in the terminal section of the contact. DIN IEC 60 352, part 2, defines the extraction force in relation to the cross-section of the conductor. When fitted using HARTING crimping tools and subject to their utilization in an approved manner, our crimp connectors comply with the required extraction forces.



Crimp cross-section

Tensile strength of crimped connections

Conductor cross-section		Tensile strength
mm ²	AWG	N
0.05	30	6
0.08	28	11
0.12	26	15
0.14		18
0.22	24	28
0.25		32
0.32	22	40
0.5	20	60
0.75		85
0.82	18	90
1.0		108
1.3	16	135
1.5		150
2.1	14	200
2.5		230
3.3	12	275
4.0		310
5.3	10	355
6.0		360
8.4	8	370
10.0		380

Extract from DIN IEC 60 352-2, Amend. 2, table IV

Crimping tools

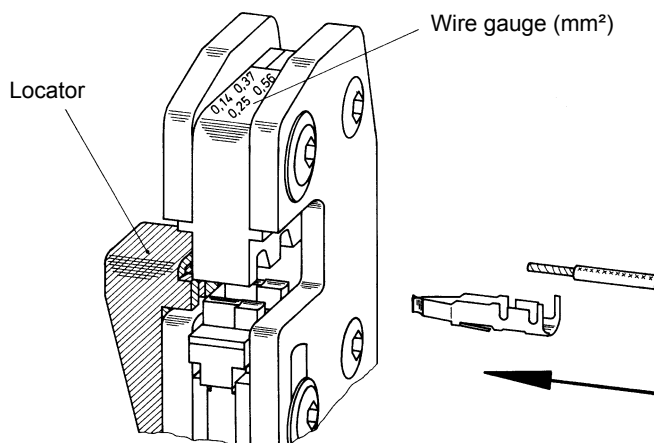
Crimping tools (hand operated or automatic) are carefully designed to guarantee a symmetrical deformation of the crimping area of the contact and the wire through the high pressure forming parts of the tool. The locator automatically engages the crimp contact and the wire at the correct point in the tool. The wire insulation can also be included as a secondary feature of some crimp contacts to care for additional mechanical strength.

The ratchet in the tool performs 2 functions:

- ① It prevents insertion of the crimp into the tool for crimping before the jaws are fully open
- ② It prevents the tool from being opened before the crimping action is completed

A quality crimp connection can be achieved with this crimping system. The adjacent sketches show important features of the HARTING hand crimping tool.

The HARTING automatic crimping tool uses bandoliered contacts. The machine strips insulation from the wire and then crimps the contact. Both the crimping area and the insulation support are independently adjustable to facilitate the use of any wire type with dimensions within the stated crimp capacity.



Wire wrap terminals

This technique permits high wiring density and takes over where other techniques would take up too much real estate. As a result of this process, there is a great time saving factor and cost per connection is relatively low when large numbers of connections are to be made.

When wires are correctly wrapped onto a precision manufactured rectangular post produced to the recommended specifications, one can state the following:

A low resistance, mechanically strong and highly reliable connection is made which is unaffected by normal climatic or temperature changes.

Production of wrapped connections and associated material are defined in DIN EN 60352-1.

Wrapping techniques

Standard wrap

Only the non-insulated part of the wire is wrapped around the post. This means that the size of the wrapped connection is kept to the very minimum.

Modified wrap

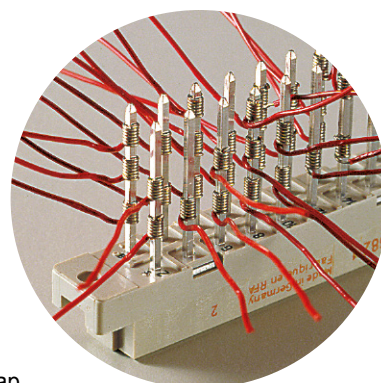
The top part of the wrapped connection is made using the cable conductor as stated above but an extra turn is made at the bottom. For this turn insulation is also wrapped around the post to give a great mechanical strength to the joint and also to provide insulation between adjacent posts.

Wrapping tools

To produce quality wrapped connections one must use a special wrapping tool, which can be pneumatic, electric or hand operated. Such tools have interchangeable wrapping heads and sleeves to suit the particular size of the wrap post being used.

The choice of accessories for these wrapping tools depends from the wrapping technique, the size of the wrap post itself and the conductor and insulation diameters of the wire.

The adjacent tables show the maximum amount of wrapped connections that can be placed on the wire wrap post (in acc. to IEC 60352-1).



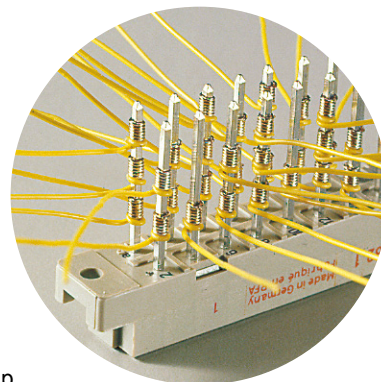
Standard wrap

Wire diameter [mm]							
0.25	0.32	0.4	0.5	0.65	0.8	1.0	
max. allowed wire Ø incl. wire insulation [mm]							
0.7	0.9	1.17	1.27	1.32	1.5	1.78	
min. necessary turns per wrap connection (for non-insulated wire)							
7	7	6	5	4	4	4	4

Valid for
standard wrap

Dimension of wire wrap post [mm]	Length of wire wrap post [mm]	possible wrap connections per wrap post							
0.6 x 0.6	13	6	5	4	4	4	3	2	
0.6 x 0.6	17	8	6	6	5	5	4	3	
1 x 1	20	10	7	7	6	6	5	4	
1 x 1	22	11	8	7	7	6	5	4	

Table 00.05



Modified wrap

Wire diameter [mm]							
0.25	0.32	0.4	0.5	0.65	0.8	1.0	
max. allowed wire Ø incl. wire insulation [mm]							
0.7	0.9	1.17	1.27	1.32	1.5	1.78	
min. necessary turns per wrap connection (for non-insulated wire)							
7	7	6	5	4	4	4	4

Valid for
modified wrap

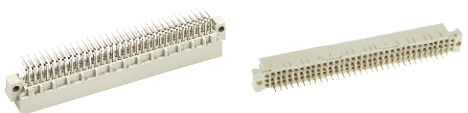
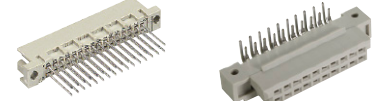
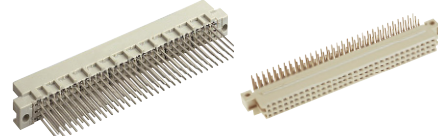
Dimension of wire wrap post [mm]	Length of wire wrap post [mm]	possible wrap connections per wrap post							
0.6 x 0.6	13	4	3	2	2	2	2	1	
0.6 x 0.6	17	5	4	3	3	3	2	2	
1 x 1	20	6	4	4	3	3	3	2	
1 x 1	22	6	5	4	4	4	3	2	

Table 00.06

General
information

Types B, 2B, 3B, C, 2C, 3C, M, M invers, Q, 2Q, 3Q, R, 2R, 3R

Page

Technical characteristics		01.10
Type B connectors		01.11
Type 2B connectors		01.16
Type 3B connectors		01.18
Type C connectors		01.20
Type 2C connectors		01.29
Type 3C connectors		01.34
Special contacts type M		01.38
Type M connectors		01.43
Type M-flat connectors		01.46
Type M invers connectors		01.48
Type Q, 2Q and 3Q connectors		01.52
Type R, RM, R (HE 11), 2R and 3R connectors		01.59
Pin shroud, adapter		01.72
Application examples		01.76

Number of contacts 16-96

Contact spacing (mm) 2.54

Working current
see current carrying capacity chart
Clearance
Creepage
Working voltage
The working voltage also depends on the clearance and creepage dimensions of the pcb itself, and the associated wiring
Test voltage $U_{r.m.s.}$
Contact resistance
Insulation resistance

2 A max.
1 A with insulation displacement
40 A max. type M
 ≥ 1.2 mm
 ≥ 1.2 mm
according to the safety regulations of the equipment
Explanations see chapter 00
1 kV
 ≤ 20 m Ω
 $\geq 10^{12}$ Ω for standard articles
 $\geq 10^{11}$ Ω for special NFF articles (with part-no. ending 222)

Temperature range
The higher temperature limit includes the local ambient and heating effects of the contacts under load
During reflow soldering

-55 °C ... $+125$ °C
 -40 °C ... $+105$ °C for press-in connector
max. $+240$ °C for 15 s for THR connectors

Degree of protection for crimp terminal IP20 according to DIN 40 050

Electrical termination

Male and female connector Solder pins for pcb connections
 $\varnothing 1.0 \pm 0.1$ mm according to IEC 60 326-3
wrap posts 0.6×0.6 mm diagonal $0.79-0.86$ mm
Crimp terminal $0.09-0.5$ mm²
Insulation displacement connection AWG 28/7

Compliant press-in terminations
PCB thickness ≥ 1.6 mm
Recommended PCB holes for press-in technology See recommendation page 00.25 in acc. to EN 60 352-5

Insertion and withdrawal force

16way ≤ 15 N
20way ≤ 20 N
30way ≤ 30 N
32way ≤ 30 N
48way ≤ 45 N
64way ≤ 60 N
96way ≤ 90 N

Materials

Mouldings Thermoplastic resin, glass-fibre filled, UL 94-V0
Contacts Copper alloy

Contact surface

Contact zone Selectively plated according to performance level¹⁾

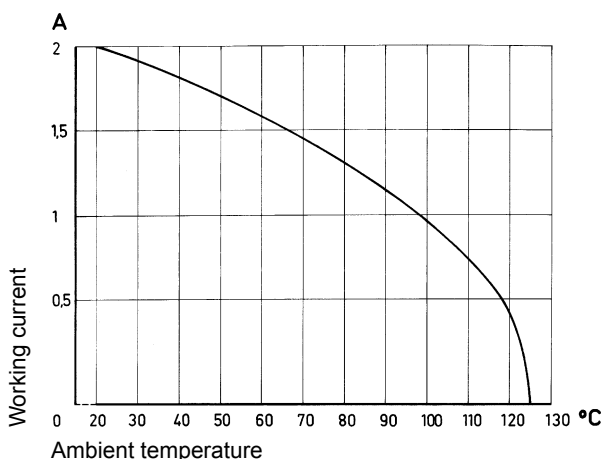
¹⁾ Explanation performance levels see chapter 00

Mating conditions see chapter 00

Current carrying capacity

The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current load-ed contacts of connectors when simultaneous power on all contacts is given, without exceeding the maximum temperature.

Control and test procedures according to DIN IEC 60 512



Pin shroud for male and female connectors with 0.6×0.6 mm pins

A secure interfacing system for signals from the rear of 19" racks to connectors with wrap posts 0.6×0.6 mm is possible with the use of a pin shroud.

The pin shroud protects the wrap posts on the rear side of the rack and can be screwed to the printed circuit board (screw fixing) or can be pressed onto the pins (press-in fixing).

After assembly the rear ends of the wire wrap posts become the mating areas of a type C resp. type 2C male connector.

This system can now accept:

- female connectors type C
- female connectors type 2C
- female connectors type R
- female connectors type 2R

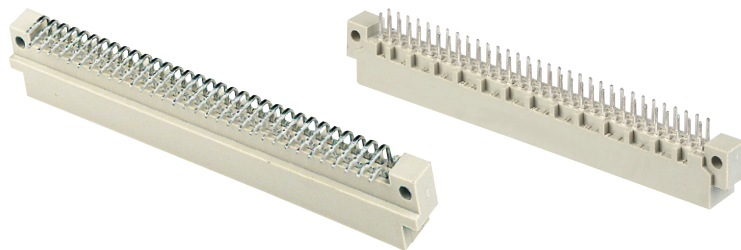
The locking levers provide security for the mated connectors. Fast and simple disconnection is possible (see application examples, pages 01.76 ff).

Fitting and removing crimp contacts

see technical characteristics chapter 03

Number of contacts

64, 32



Male connectors

Identification	No. of contacts	Contact arrangement	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1
Male connector with angled solder pins	64		09 02 164 7921	09 02 164 6921 09 02 164 6921 222 ^{f)} 09 02 364 6921 ^{b)} 09 02 664 6921 ^{c)}	09 02 164 2921
	32		09 02 132 7921	09 02 132 6921 09 02 632 6921 ^{c)}	09 02 132 2921
	32		09 02 132 7931	09 02 132 6931 09 02 332 6931 ^{b)}	09 02 132 2931
	62 + 2▲			09 02 164 6951	09 02 164 2951
	THR 64		09 02 164 7919 ^{d)}	09 02 164 6919 ^{d)}	
Male connector with straight solder pins	64		09 02 164 7922	09 02 164 6922	09 02 164 2922
	32		09 02 132 7922	09 02 132 6922	
	32			09 02 132 6932	
	62 + 2▲			09 02 164 6952	09 02 164 2952
	THR 64			09 02 164 6920 ^{d)}	
Dimensions					
Board drillings Mounting side					

▲ Male connectors with 2 leading contacts [(0.8 mm) pos. a1 and a32]. Lagging pins on request.

Other contact arrangements on request

^{b)} Connectors with snap-in clips see chapter 00

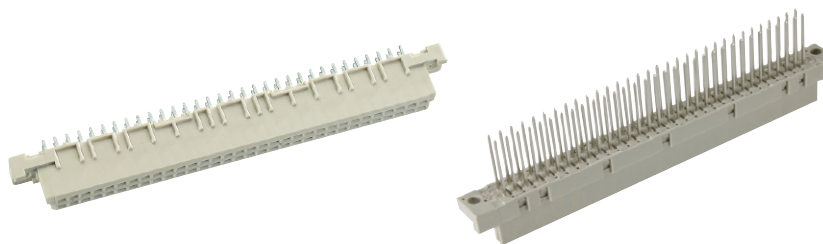
^{c)} Connectors with coding see chapter 00

^{d)} CTI > 400

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

64



Female connectors

Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60603-2. Explanation chapter 00 2	1
Female connector with solder pins 2.9 mm	64		Performance level 3 on request	09 02 264 6824 09 02 464 6824 ^{b)} 09 02 764 6824 ^{c)}	09 02 264 2824
	64			09 02 264 6841 ^{d)}	
Female connector with solder pins 4.5 mm	64			09 02 264 6825 09 02 264 6825 222 ^{f)} 09 02 464 6825 ^{b)} 09 02 764 6825 ^{c)}	09 02 264 2825
	64			09 02 264 6829 ^{d)}	
Female connector with solder pins 13 mm	64			09 02 264 6421	
Female connector with press-in pins 4.5 mm	64			09 02 264 6850 09 02 264 6850 222 ^{f)}	09 02 264 2850
Female connector with press-in pins 13 mm	64			09 02 264 6861 ^{a)}	
Female connector with wrap posts ¹⁾ 13 mm	64			09 02 264 6821	
Female connector with solder lugs 5.5 mm	64			09 02 264 6823	

1) To be used only for wire wrap termination

a) Contacts for rear interfacing selectively gold plated (performance level 3)

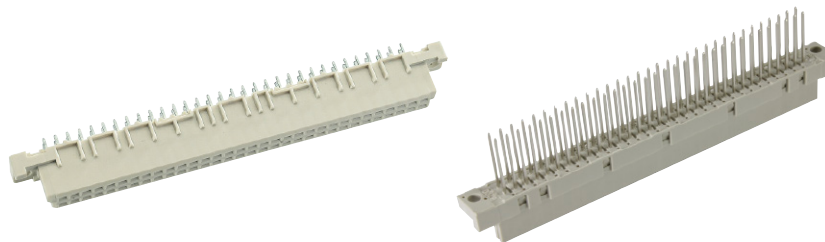
b) Connectors with snap-in clips see chapter 00

c) Connectors with coding see chapter 00

d) CTI > 400

f) Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2
Other contact arrangements on request

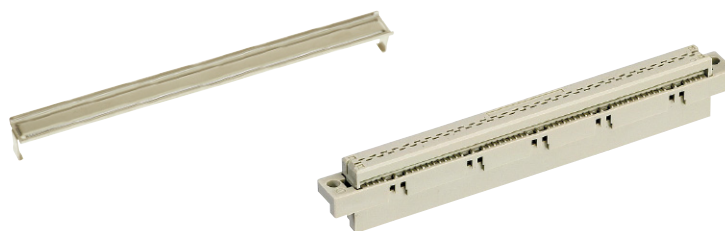
64



**DIN Signal
up to 2 A**

01
13

64



**DIN Signal
up to 2 A**

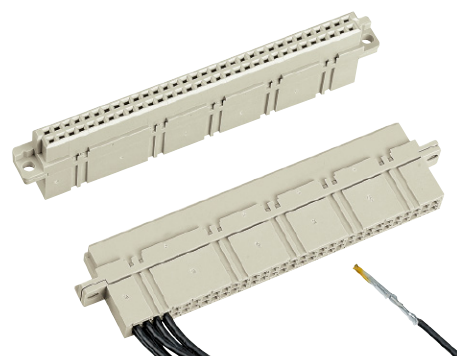
01
14

¹⁾ acc. to IEC 60 603-2

Number of contacts

max. 64

Female connectors

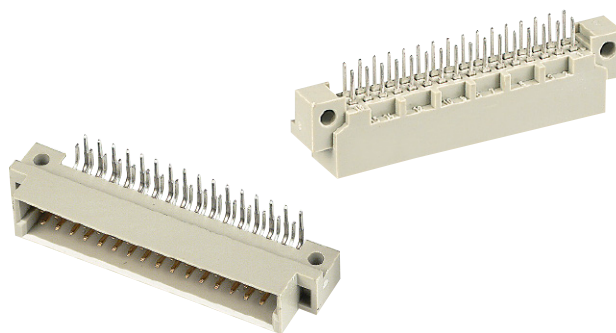
DIN Signal
up to 2 A

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for crimp contacts Order contacts separately	64	09 02 064 3214 ¹⁾	Contact arrangement View from termination side Shell housing 09 02 064 0501 / 09 02 064 0502 see chapter 20	

Identification	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00
Female crimp contacts BC		2 1
Bandoliered contacts (approx. 5,000 pieces)	09 02 000 6484	09 02 000 6474
Bandoliered contacts (approx. 500 pieces)	09 02 000 8434	09 02 000 8444
Individual contacts ¹⁾	09 02 000 8484	09 02 000 8474
	Wire gauge mm ² 0.09 - 0.5 AWG 28 - 20 Insulation ø mm 0.7 - 1.5 3.5 + 0.5 mm of insulation is stripped from the wires to be crimped For the fabrication in line with the specification please use exclusively crimp tools approved by HARTING (see DIN EN 60352-2) Insertion, removal and crimping tools see chapter 30	Bandoliered contacts Individual contacts

¹⁾ Packaging unit 1,000 pieces¹⁾ Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

32, 16



**DIN Signal
up to 2 A**

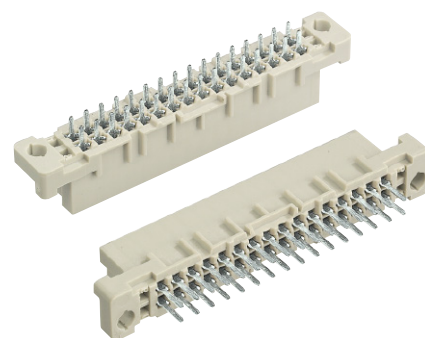
01
16

b) Connectors with snap-in clips see chapter 00
d) CTI > 400

Number of contacts

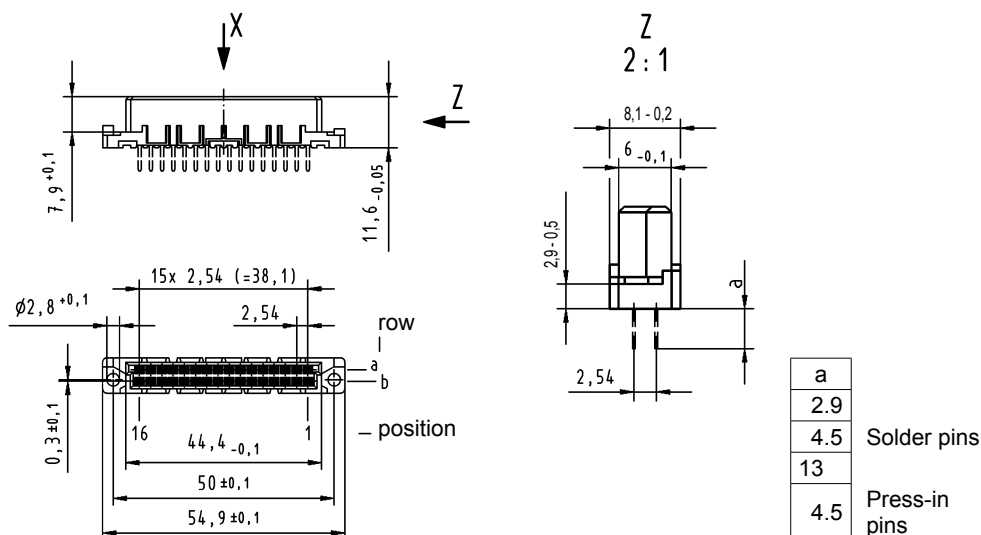
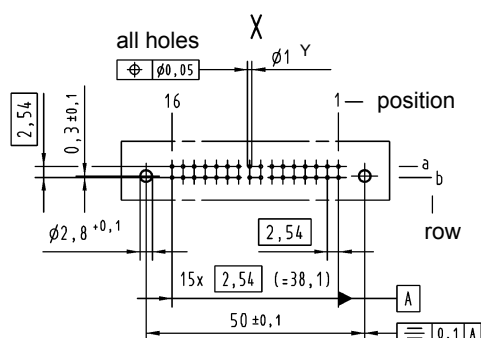
32

Female connectors


DIN Signal
up to 2 A

Identification			No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
					3	2	1
Female connector with solder pins 2.9 mm	THR	32		Performance level 3 on request		09 22 232 6824 09 22 232 6824 222 ^{f)} 09 22 432 6824 ^{b)} 09 22 232 6841 ^{d)}	Performance level 1 on request
		32					
4.5 mm	THR	32					
		32					
13 mm		32					
Female connector with press-in pins 4.5 mm		32					

Dimensions


Board drillings
Mounting side

Cross section
of solder terminations
see page 01.13

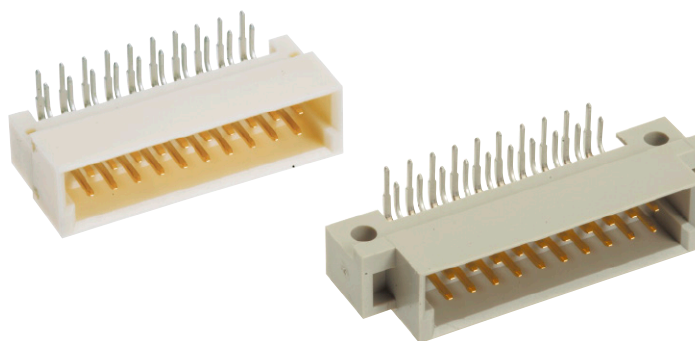
Dimensions in mm

^{b)} Connectors with snap-in clips see chapter 00
^{d)} CTI > 400

^{f)} Railway classification NFF 16-101, Smoke index: F1,
Flammability class: I2
Other contact arrangements on request

Number of contacts

20

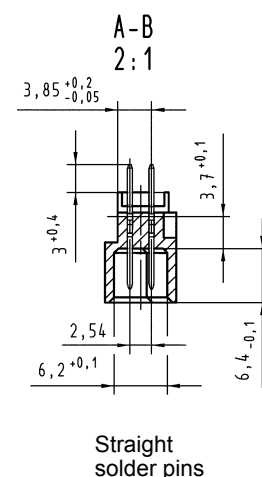
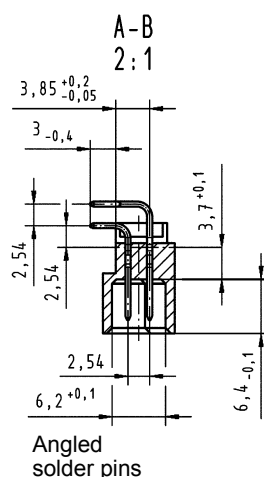
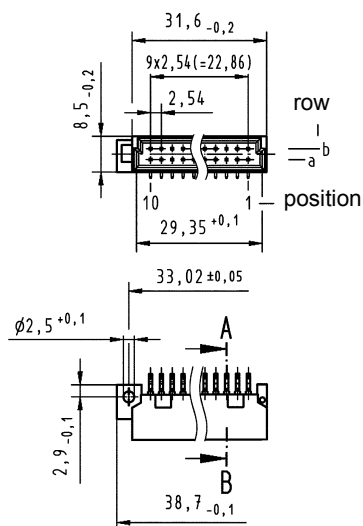


Male connectors

Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60 603-2.	
				2	1
Male connector with angled solder pins with fixing flange	20		Performance level 3 on request	09 24 120 6921 09 24 320 6921 ^{b)}	Performance level 1 on request
with fixing flange, THR	20			09 24 120 6919 ^{d)}	
without fixing flange	20			09 24 120 6571	
without fixing flange, THR	20			09 24 120 6579 ^{d)}	
Male connector with straight solder pins with fixing flange	20			09 24 120 6922	

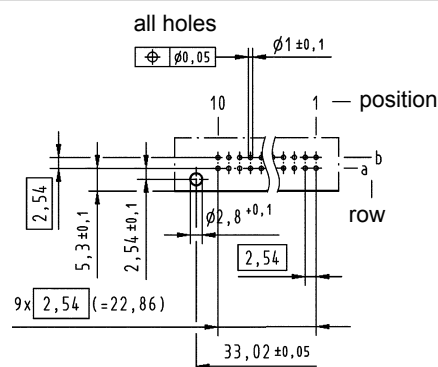
Dimensions

with fixing flange without fixing flange

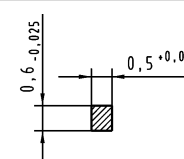


Board drillings

Mounting side



Cross section of solder terminations

Cross area (A) of contacts
row a, b: A = 0.29 - 0.33 mm²

Dimensions in mm

Other contact arrangements as well with lagging/leading pins on request

^{b)} Connectors with snap-in clips see chapter 00^{d)} CTI > 400

Number of contacts

20



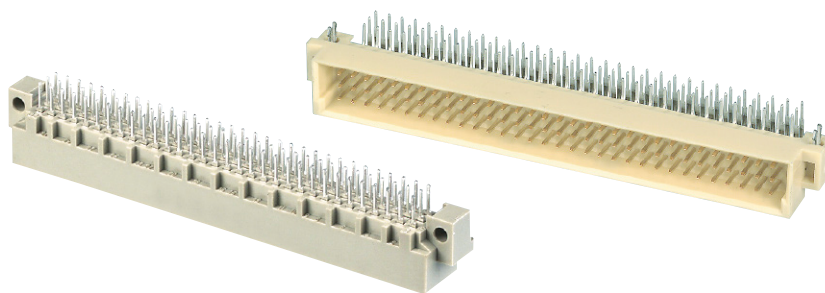
Female connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60 603-2.										
			3	2	1									
Female connector with solder pins 2.9 mm	20		Performance level 3 on request	09 24 220 6824	Performance level 1 on request									
with fixing flange, THR	20			09 24 220 6841 ^{d)}										
without fixing flange, THR	20			09 24 220 6414 ^{d)}										
Female connector with solder pins 4.5 mm	20		Performance level 3 on request	09 24 220 6825	Performance level 1 on request									
with fixing flange	20													
Female connector with press-in pins 4.5 mm	20		Performance level 3 on request	09 24 220 6850	Performance level 1 on request									
with fixing flange	20			09 24 220 6870										
without fixing flange	20													
Dimensions	with fixing flange without fixing flange <table><tr><td>a</td><td></td></tr><tr><td>2.9</td><td>solder pins</td></tr><tr><td>4.5</td><td></td></tr><tr><td>4.5</td><td>press-in pins</td></tr></table>						a		2.9	solder pins	4.5		4.5	press-in pins
a														
2.9	solder pins													
4.5														
4.5	press-in pins													
Board drillings	all holes <table><tr><td></td><td>Y</td></tr><tr><td>Solder</td><td>1 ± 0.1</td></tr><tr><td>Press-in</td><td>see recommendation page 00.25</td></tr></table> Cross section of solder terminations Cross area (A) of contacts row a, b: A = 0.20 - 0.23 mm²							Y	Solder	1 ± 0.1	Press-in	see recommendation page 00.25		
	Y													
Solder	1 ± 0.1													
Press-in	see recommendation page 00.25													
Mounting side	Dimensions in mm													

d) CTI > 400

Number of contacts

96, 64, 32



Male connectors

Identification	No. of contacts	Contact arrangement	Part number						Performance levels according to IEC 60603-2. Explanation chapter 00							
			3		2		1		3		2		1			
Male connector with angled solder pins Length 3 mm	THR	96		09 03 196 7921 09 03 396 7921 ^{b)}		09 03 196 6921 09 03 196 6921 222 ^{f)} 09 03 396 6921 ^{b)} 09 03 696 6921 ^{c)} 09 03 696 6921 222 ^{c)f)} 09 03 896 6921 ^{b)c)}		09 03 196 2921 09 03 196 2921 222 ^{f)} 09 03 396 2921 ^{b)} 09 03 696 2921 ^{c)}								
	THR	96					09 03 196 6919 ^{d)} 09 03 396 6919 ^{b)d)} 09 03 696 6919 ^{c)d)}		09 03 196 2919 ^{d)} 09 03 396 2919 ^{b)d)}							
	THR	64		09 03 164 7921 09 03 364 7921 ^{b)}			09 03 164 6921 09 03 164 6921 222 ^{f)} 09 03 364 6921 ^{b)} 09 03 664 6921 ^{c)} 09 03 864 6921 ^{b)c)}		09 03 164 2921 09 03 164 2921 222 ^{f)} 09 03 364 2921 ^{b)} 09 03 664 2921 ^{c)}							
	THR	64					09 03 164 6919 ^{d)} 09 03 364 6919 ^{b)d)}		09 03 164 2919 ^{d)}							
THR	32		09 03 132 7921 09 03 332 7921 ^{b)}			09 03 132 6921 09 03 332 6921 ^{b)} 09 03 632 6921 ^{c)}		09 03 132 2921 09 03 332 2921 ^{b)}								
	THR	94 + 2▲		09 03 196 7951			09 03 196 6951 09 03 396 6951 ^{b)} 09 03 696 6951 ^{c)}		09 03 196 2951							
THR	94 + 2▲					09 03 396 6918 ^{b)d)}										
THR	62 + 2▲		09 03 164 7951 09 03 364 7951 ^{b)}			09 03 164 6951 09 03 364 6951 ^{b)} 09 03 664 6951 ^{c)}		09 03 164 2951								
Length 4.4 mm	96					09 03 196 6569 09 03 396 6569 ^{b)}										

Male connector with straight solder pins	THR	96		09 03 196 7922		09 03 196 6922		09 03 196 2922
		96				09 03 196 6920 ^{d)}		
		64		09 03 164 7922		09 03 164 6922		09 03 164 2922

▲ Male connectors with 2 leading contacts [(0.8 mm) pos. a1 and a32]. Lagging pins on request.

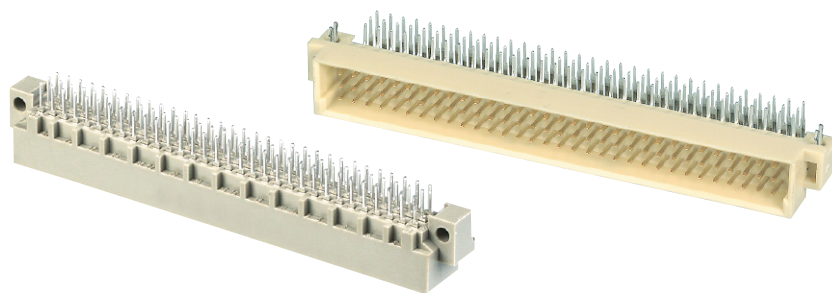
^{b)} Connectors with snap-in clips see chapter 00

^{c)} Connectors with coding see chapter 00

^{d)} CTI > 400

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

96, 64, 32



Dimensions in mm

[illegible]

x
3
4.4

A - A

all holes

$\phi 1 \pm 0,1$

position

32

1

$\phi 2,8 \pm 0,1$

2,54

31 x 2,54 (= 78,74)

88,9 $\pm 0,1$

2,54 $\pm 0,1$

5,3 $\pm 0,1$

2,54

2,54 (= 5,08)

2 x 2,54

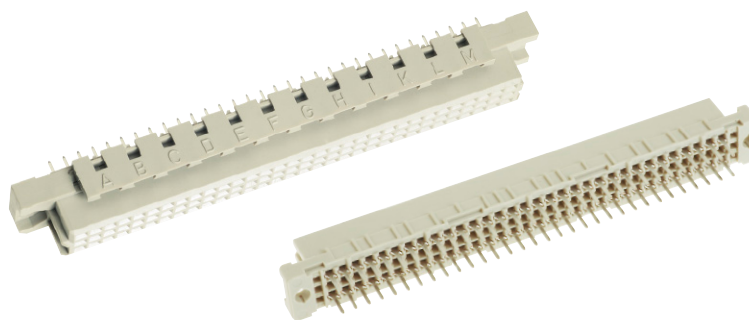
row

Technical drawing of a part showing dimensions $0,6 \pm 0,025$ and $0,49 \pm 0,06$. The drawing includes a hatched rectangular area.

Dimensions in mm

Number of contacts

96, 64, 32



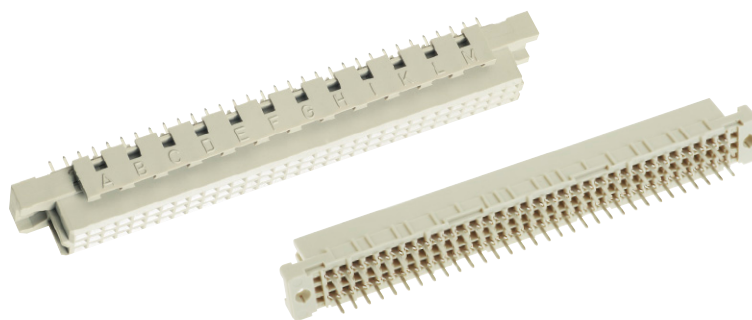
Female connectors

Identification	No. of contacts	Contact arrangement	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1
Female connector with solder pins 2.9 mm	96		09 03 296 7824	09 03 296 6824 09 03 296 6824 222 ^{f)} 09 03 496 6824 ^{b)} 09 03 796 6824 ^{c)}	09 03 296 2824 09 03 296 2824 222 ^{f)} 09 03 496 2824 ^{b)}
	96			09 03 296 6841 ^{d)}	
	64		09 03 264 7824 09 03 464 7824 ^{b)}	09 03 264 6824 09 03 264 6824 222 ^{f)} 09 03 464 6824 ^{b)} 09 03 764 6824 ^{c)}	09 03 264 2824 09 03 264 2824 222 ^{f)} 09 03 464 2824 ^{b)}
	64			09 03 264 6841 ^{d)}	
	32		09 03 232 7824	09 03 232 6824 09 03 432 6824 ^{b)}	09 03 232 2824 09 03 432 2824 ^{b)}
Female connector with kinked solder pins ¹⁾ 2.9 mm	96		09 03 296 7855	09 03 296 6855	09 03 296 2855
	64		09 03 264 7855	09 03 264 6855	
	32		09 03 232 7855	09 03 232 6855	09 03 232 2855
Female connector with solder pins 4.5 mm	96		09 03 296 7825 09 03 496 7825 ^{b)}	09 03 296 6825 09 03 296 6825 222 ^{f)} 09 03 496 6825 ^{b)} 09 03 796 6825 ^{c)} 09 03 796 6825 222 ^{c)f)}	09 03 296 2825 09 03 296 2825 222 ^{f)} 09 03 496 2825 ^{b)} 09 03 796 2825 ^{c)}
	96			09 03 296 6829 ^{d)}	
	64		09 03 264 7825 09 03 464 7825 ^{b)}	09 03 264 6825 09 03 464 6825 ^{b)} 09 03 764 6825 ^{c)}	09 03 264 2825 09 03 464 2825 ^{b)} 09 03 764 2825 ^{c)}
	64			09 03 264 6829 ^{d)}	
	32		09 03 232 7825	09 03 232 6825 09 03 432 6825 ^{b)}	09 03 232 2825
Female connector with kinked solder pins ¹⁾ 4.5 mm	96		09 03 296 7845	09 03 296 6845 09 03 296 6845 222 ^{f)}	09 03 296 2845
	64		09 03 264 7845	09 03 264 6845	09 03 264 2845
	32		09 03 232 7845	09 03 232 6845	09 03 232 2845
Female connector with solder pins 13 mm	96			09 03 296 6421 09 03 796 6421 ^{c)}	
	64			09 03 264 6421 09 03 764 6421 ^{c)}	
	32			09 03 232 6421 09 03 732 6421 ^{c)}	

¹⁾ Kinked pins for fixing the connector onto the pcb see chapter 00^{b)} Connectors with snap-in clips see chapter 00^{c)} Connectors with coding see chapter 00^{d)} CTI > 400^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

96, 64, 32



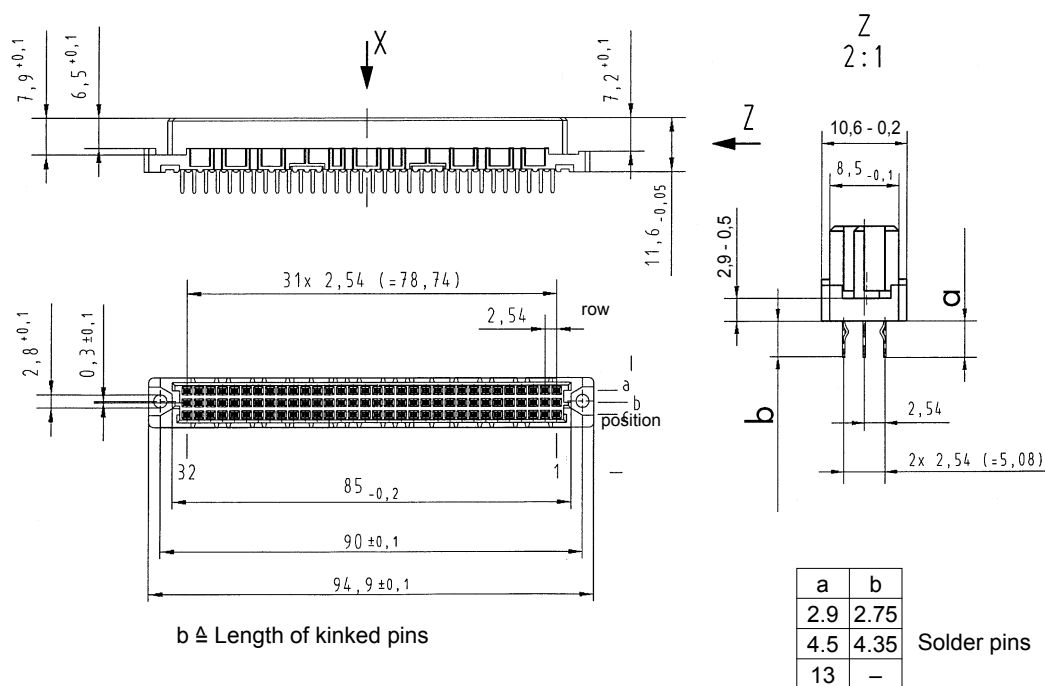
Female connectors

Identification

Drawing

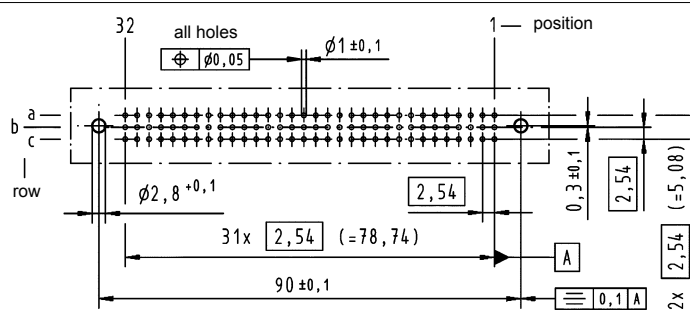
Dimensions in mm

Dimensions

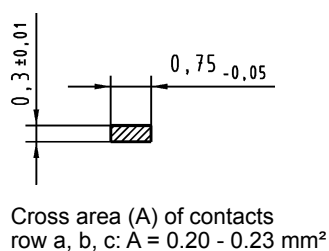


Board drillings

Mounting side



Cross section of solder terminations

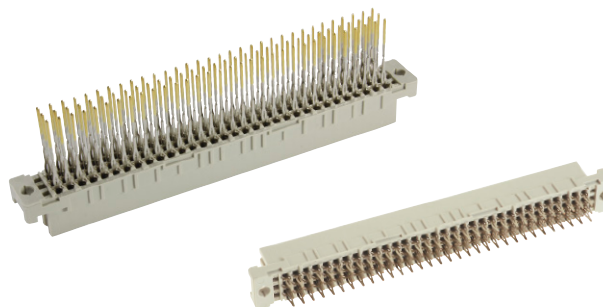


Dimensions in mm

DIN Signal
up to 2 A

Number of contacts

96, 64, 32



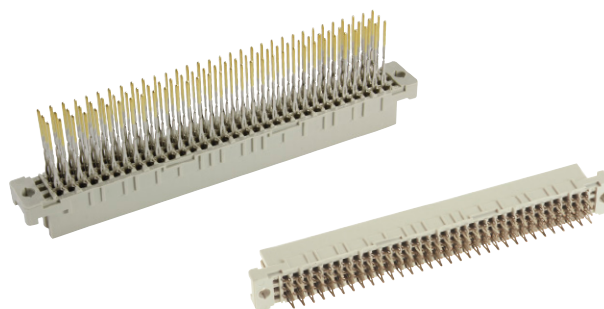
Female connectors

Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60 603-2. 2	Explanation chapter 00 1
Female connector Type C with press-in terminations 4.5 mm	96		09 03 296 7850	09 03 296 6850 09 03 296 6850 222 ^{f)} 09 03 796 6850 ^{c)} 09 03 796 6850 222 ^{c)f)}	09 03 296 2850 09 03 296 2850 222 ^{f)}
	64		09 03 264 7850	09 03 264 6850 09 03 264 6850 222 ^{f)} 09 03 764 6850 ^{c)}	09 03 264 2850
	32			09 03 232 6850	09 03 232 2850
with press-in terminations for rear interfacing Usage of HARTING shroud recommended: contacts for rear interfacing selectively gold plated (performance level 3)	96			09 03 296 6861 09 03 796 6861 ^{c)}	
	64			09 03 264 6861	
	96			09 03 296 6411 09 03 296 6416 ²⁾	
	64			09 03 264 6411	
	32			09 03 232 6411	
	96			09 03 296 6862 09 03 796 6862 ^{c)}	
	64			09 03 264 6862	
with press-in terminations for wire wrapping (wrap posts not for interfacing, no performance level)	96			09 03 296 6851 252	
	64			09 03 264 6851 252	
	96				09 03 296 2852 252

²⁾ Contacts for rear interfacing gold plated (performance level 2)^{c)} Connectors with coding see chapter 00^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

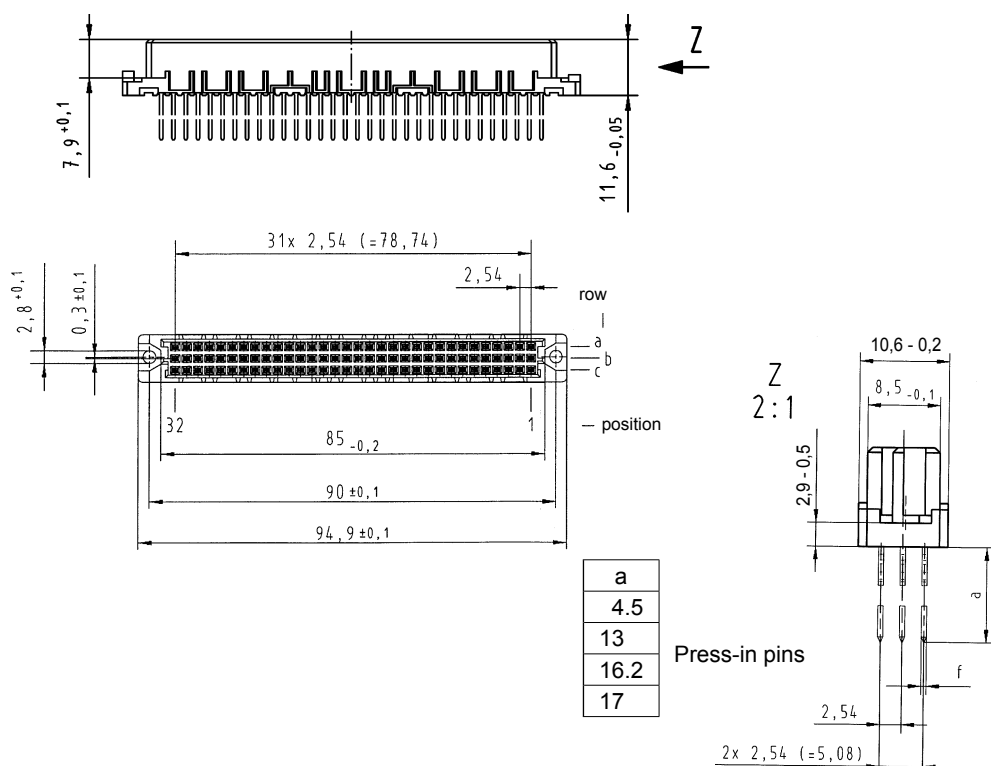
96, 64, 32



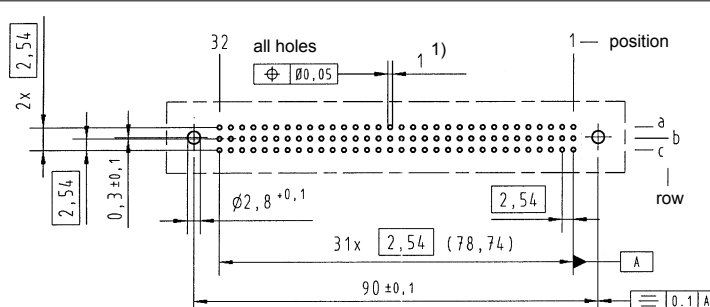
Female connectors

Identification Drawing Dimensions in mm

Dimensions



Board drillings
Mounting side

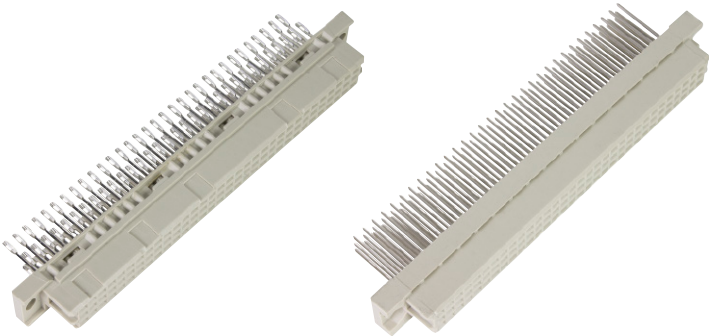


Dimensions in mm

¹⁾ refer to recommended configuration of pcb holes, see page 00.25

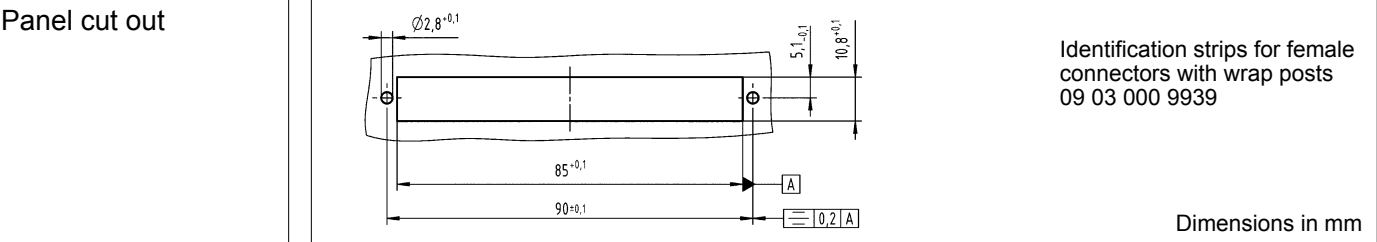
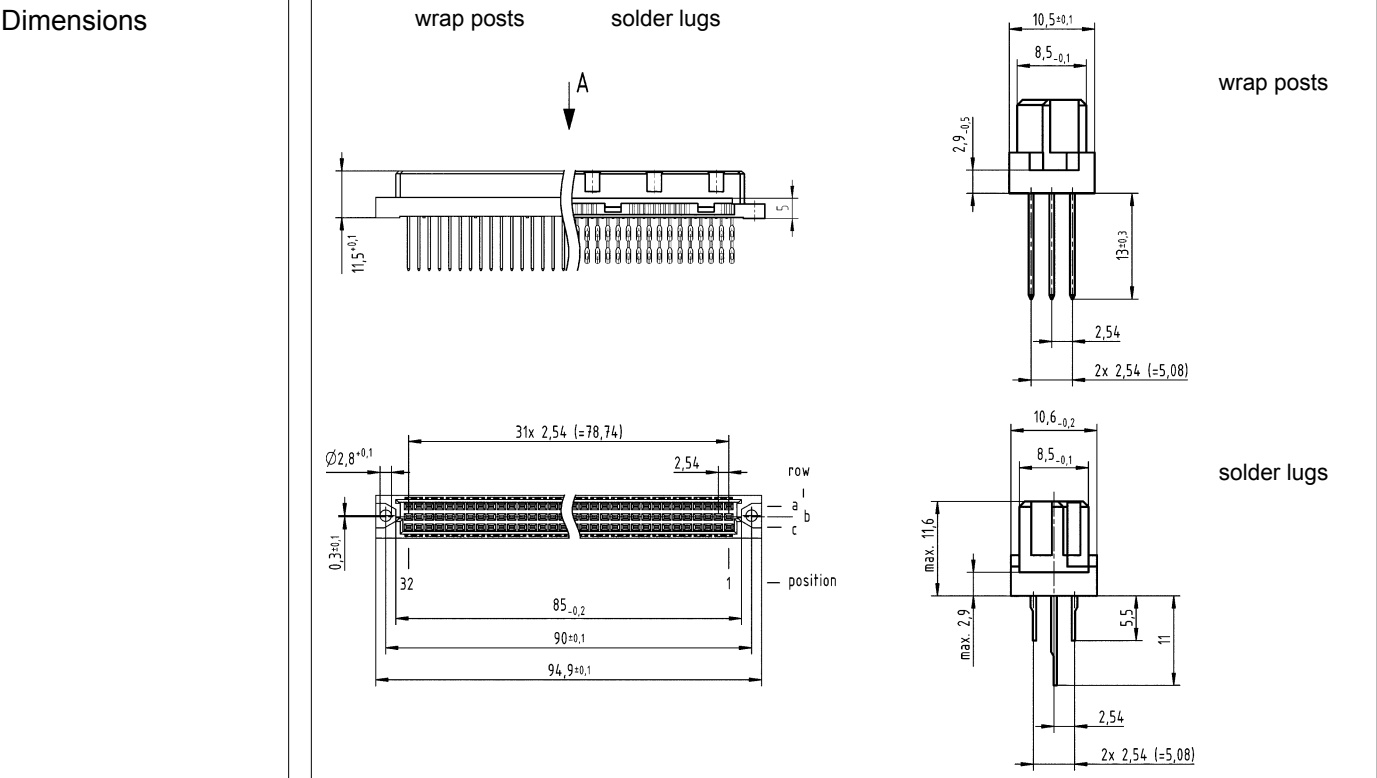
Number of contacts

96, 64



Female connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00 2
Female connector with wrap posts ²⁾ 13 mm	96			09 03 296 6821 09 03 296 6878 ¹⁾
	64			09 03 264 6821 09 03 264 6878 ¹⁾
Female connector with solder lugs a + c 5.5 mm b 11 mm	96			09 03 296 6823
	64			09 03 264 6823

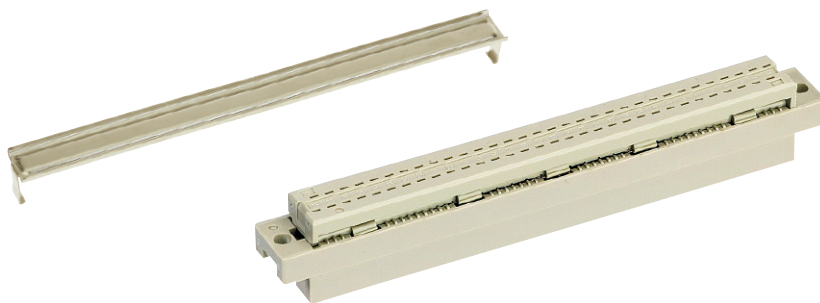


¹⁾ Wrap posts for interfacing, selectively gold-plated (performance level 3)
²⁾ To be used only for wire wrap termination. Solder versions see page 01.22

Number of contacts

64

Female connectors

DIN Signal
up to 2 A

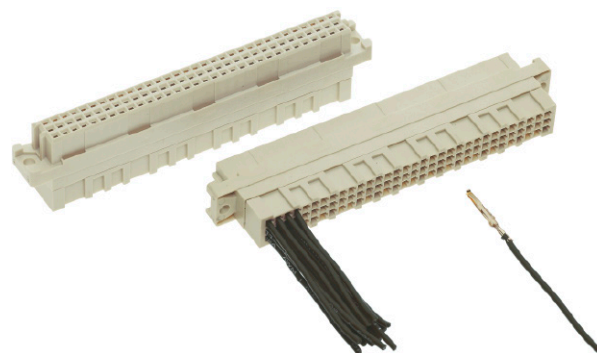
Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for insulation displacement	64	Performance level 2 ¹⁾ 09 03 264 6828 Performance level 3 ¹⁾ 09 03 264 7828	Cable 1 to contact 1 c Contact arrangement View from termination side	
Strain relief (metal)		09 03 000 9940		
Panel cut out			Mateable with 3 row male connector type C, no female contacts in the middle row	
Flat cable AWG 28/7 grey 30.48 m grey 100.00 m colour coded 30.48 m twisted pair ²⁾ 30.48 m	64 64 64 64	09 18 064 7001 09 18 064 7004 09 18 064 7005 09 18 064 7006	Wire (tinned) Gauge Insulation material as per UL style ²⁾ Termination area spacing = 508 mm Important: always store reels vertically Cu AWG 28/7 0.089 mm² PVC	
Round flat cable³⁾ with screening 30.48 m screening 100.00 m without screening 30.48 m	64 64 64	09 18 064 7007 09 18 064 7010 09 18 064 7008	³⁾ Termination area spacing = 100 mm	
Bench press		09 99 000 0114		
Base plate		09 99 000 0150		
Cable cutter		09 99 000 0116		
Spare parts				
Blade		09 99 000 0179		
Cutting plate		09 99 000 0180		

Further components and accessories for insulation displacement see interface catalogue, chapter 32

¹⁾ acc. to IEC 60 603-2

Number of contacts

max. 96, 48



Female connectors

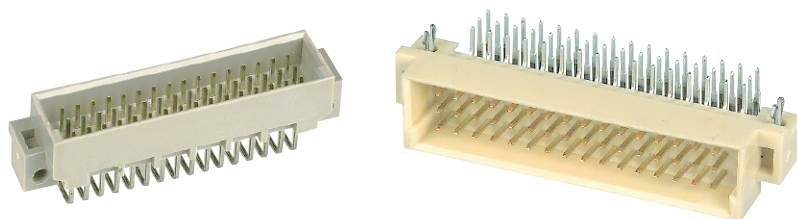
Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for crimp contacts Order contacts separately				(2:1)
Type C	96	09 03 096 3214 ^{f)} 09 03 596 3214 ^{c)f)}		
Type C Position marking turned for mating type R male	96	09 03 096 3217 ^{f)}		

Identification	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00
	2	1
Female crimp contacts BC		
Bandoliered contacts (approx. 5,000 pieces)	09 02 000 6484	09 02 000 6474
Bandoliered contacts (approx. 500 pieces)	09 02 000 8434	09 02 000 8444
Individual contacts ¹⁾	09 02 000 8484	09 02 000 8474
	Wire gauge mm ² AWG Insulation ø mm 0.09 - 0.5 28 - 20 0.7 - 1.5	 Bandoliered contacts
	3.5 + 0.5 mm of insulation is stripped from the wires to be crimped For the fabrication in line with the specification please use exclusively crimp tools approved by HARTING (see DIN EN 60352-2) Insertion, removal and crimping tools see chapter 30	 Individual contacts

^{c)} Connectors with coding see chapter 00¹⁾ Packaging unit 1,000 pieces^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

48, 32, 16



Male connectors

Identification	No. of contacts	Contact arrangement	Part number			Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1		
Male connector with angled solder pins	48		09 23 148 7921	09 23 148 6921	09 23 148 2921		
			09 23 348 7921 ^{b)}	09 23 148 6921 222 ^{f)} 09 23 348 6921 ^{b)}	09 23 348 2921 ^{b)}		
	48		09 23 148 7919	09 23 148 6919 ^{d)} 09 23 348 6919 ^{b)d)} 09 23 148 6919 791 ^{d)}			
	32		09 23 132 7921 09 23 332 7921 ^{b)}	09 23 132 6921 09 23 332 6921 ^{b)}	09 23 132 2921 09 23 332 2921 ^{b)}		
				09 23 132 6919 ^{d)} 09 23 332 6919 ^{b)d)}			
Male connector with straight solder pins	48		09 23 148 7922	09 23 148 6922	09 23 148 2922		
				09 23 148 6920 ^{d)}			
	32		09 23 132 7922	09 23 132 6922	09 23 132 2922		
				09 23 132 6920 ^{d)}			
	16			09 23 116 6931 09 23 316 6931 ^{b)}	09 23 116 2931		
Male connector with angled solder pins	46 + 2 [▲]		09 23 148 7951	09 23 148 6951 09 23 348 6951 ^{b)}			

DIN Signal
up to 2 A

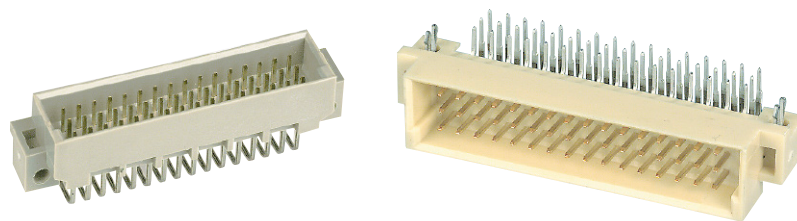
▲ Male connectors with 2 leading contacts [(0.8 mm) pos. a1 and a16]. Lagging pins on request. Other contact arrangements on request

^{b)} Connectors with snap-in clips see chapter 70

^{d)} CTI > 400

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

48, 32, 16

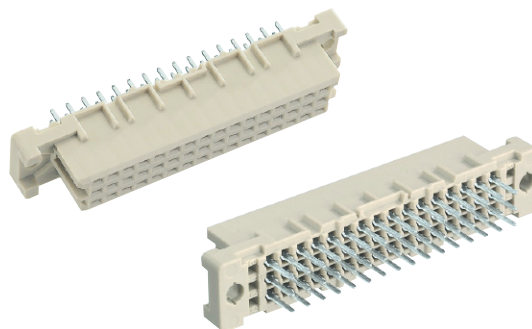


**DIN Signal
up to 2 A**

¹⁾ Recommendation for variants with clip: Drillings can be enlarged up to 3.1 mm Ø to reduce standard mounting force

Number of contacts

48, 32



Female connectors

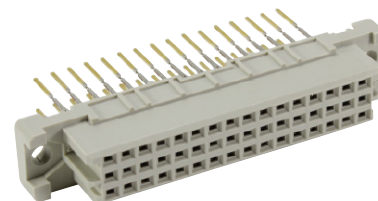
Identification	No. of contacts	Contact arrangement	Performance levels according to IEC 60603-2. Explanation chapter 00		
			Part number 3	2	1
Female connector with solder pins 2.9 mm	48			09 23 248 6824 09 23 448 6824 ^{b)}	09 23 248 2824
	48			09 23 248 6841 ^{d)}	
	32			09 23 232 6824 09 23 432 6824 ^{b)}	
	32			09 23 232 6841 ^{d)}	
Female connector with solder pins 4.5 mm	48			09 23 248 6825 09 23 248 6825 222 ^{f)} 09 23 448 6825 ^{b)}	09 23 248 2825
	48			09 23 248 6829 ^{d)}	
	32		09 23 232 7825	09 23 232 6825	
	32			09 23 232 6829 ^{d)}	
Female connector with solder pins 13 mm	48			09 23 248 6421	
Female connector with wrap posts ¹⁾ 13 mm	48			09 23 248 6821	
Female connector with solder lugs 5.5/11 mm	48			09 23 248 6823	
	32			09 23 232 6823	

Other contact arrangements on request

¹⁾ To be used only for wire wrap termination^{b)} Connectors with snap-in clips see chapter 00^{d)} CTI > 400^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

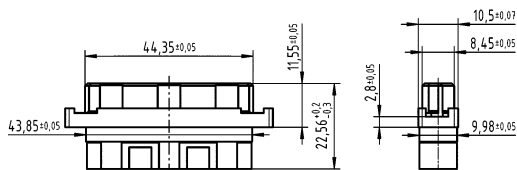
Number of contacts

48, 32



Female connectors

Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60603-2. 2	Explanation chapter 00 1
Female connector with press-in pins 3.7 mm	48			09 23 248 6866	
Female connector with press-in pins 4.5 mm	48 32	 		09 23 248 6850 09 23 248 6850 222 ^{f)} 09 23 232 6850	09 23 248 2850
Female connector with press-in pins 13 mm	48 32	 		09 23 248 6861 09 23 232 6861	
Female connector with press-in pins 17 mm	48			09 23 248 6862	
with press-in terminations for rear interfacing Usage of HARTING shroud recommended: contacts for rear interfacing selectively gold plated (performance level 3)					

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for crimp contacts Order contacts separately see page 01.28				
Type 2C	48	09 23 048 3214 ^{f)}		
Type 2C	48	09 23 048 3217 ^{f)}		
Position marking turned for mating type 2R male				

Other contact arrangements on request

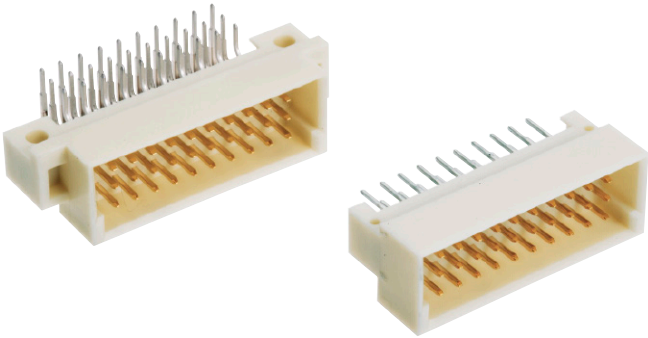
^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

48, 32

**DIN Signal
up to 2 A**

Number of contacts

30, 20



Male connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60 603-2.	
			3	2	1
Male connector with angled solder pins			Performance level 3 on request		Performance level 1 on request
	with fixing flange			09 25 130 6921 09 25 330 6921 ^{b)}	
	20			09 25 120 6921	
	with fixing flange, THR			09 25 130 6919 ^{d)}	
	without fixing flange			09 25 130 6571	
	without fixing flange, THR			09 25 130 6579 ^{d)}	
Male connector with straight solder pins					
	with fixing flange			09 25 130 6922	
	20			09 25 120 6922	
	without fixing flange			09 25 130 6572	
	without fixing flange, THR			09 25 130 6590 ^{d)}	

Other contact arrangements as well with lagging/leading pins on request

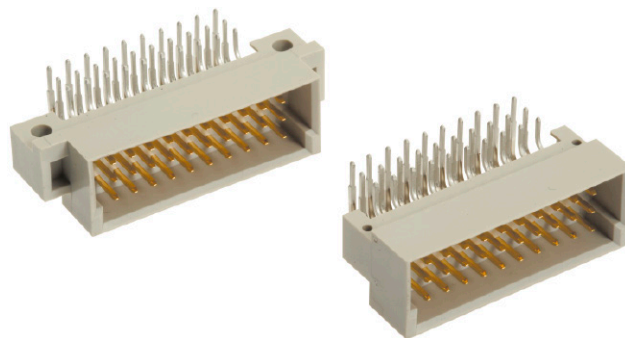
^{b)} Connectors with snap-in clips see chapter 00

^{d)} CTI > 400

Number of contacts

30, 20

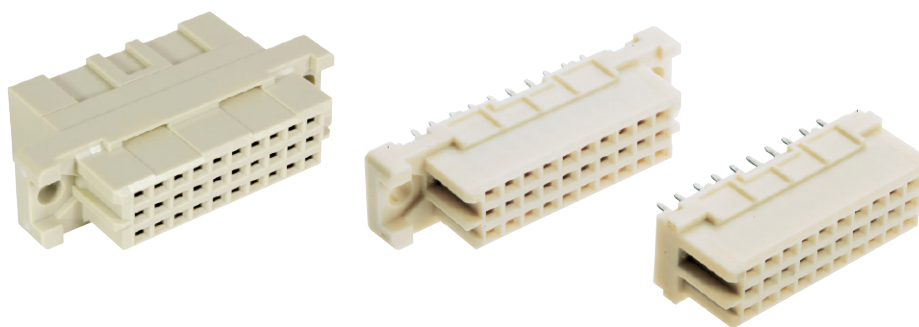
Male connectors



Identification	Drawing	Dimensions in mm
Dimensions	with fixing flange without fixing flange angled solder pins straight solder pins	
Board drillings Mounting side	all holes	
Cross section of solder terminations	Cross area (A) of contacts row a, b, c: A = 0.29 - 0.33 mm²	

Number of contacts

30, 20



Female connectors

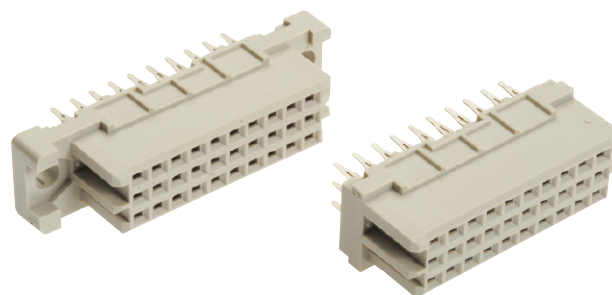
Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60 603-2.	
				2	1
Female connector with solder pins 2.9 mm			Performance level 3 on request		
with fixing flange	30			09 25 230 6824	
	20			09 25 220 6824	
with fixing flange, THR	30			09 25 230 6841 ^{d)}	
without fixing flange, THR	30			09 25 230 6414 ^{d)}	
Female connector with solder pins 4.5 mm					
with fixing flange	30			09 25 230 6825	Performance level 1 on request
	20			09 25 220 6825	
Female connector with solder pins 13 mm					
with fixing flange	30			09 25 230 6421	
Female connector with press-in pins 4.5 mm					
with fixing flange	30			09 25 230 6850	
without fixing flange	30			09 25 230 6870	

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for crimp contacts				
Order contacts separately see page 01.28				
Type 3C	30	09 25 030 3214 ^{f)}		
Type 3C	30	09 25 030 3217 ^{f)}		
Position marking turned for mating type 3R male				

^{d)} CTI > 400^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

30, 20



Female connectors

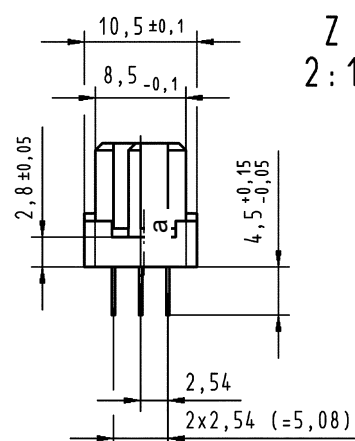
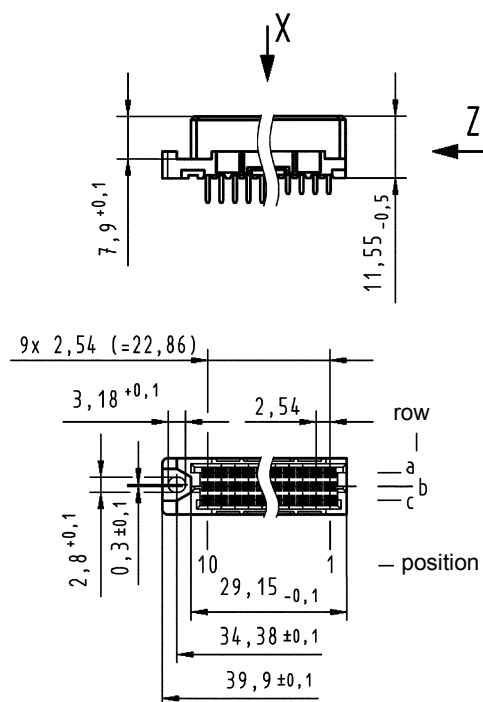
Identification

Drawing

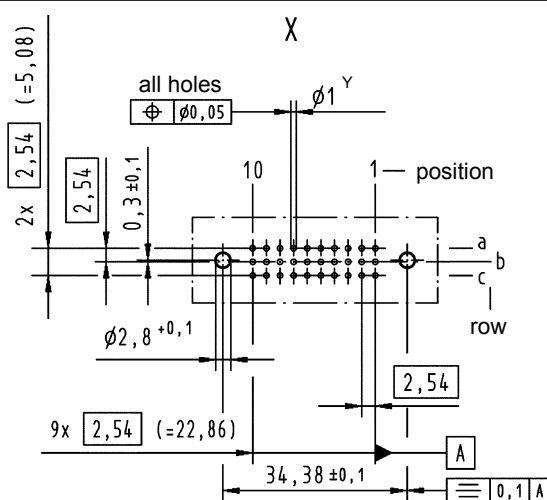
Dimensions in mm

Dimensions

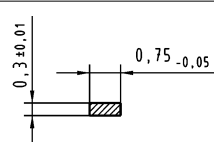
with fixing flange without fixing flange



a	
2.9	solder pins
4.5	solder pins
13	
4.5	press-in pins

Board drillings
Mounting side


	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

Cross section of
solder terminations


Cross area (A) of contacts row a, b, c: A = 0.20 - 0.23 mm²

Application matrix

- Coax Contacts
- High Voltage Contacts
- High Power Contacts
- FOC- Contacts

Application				Connector	
Male				Male connector type M angled	
Female				Male connector type M invers	
Part number				Female connector type M straight	
09 03 1XX X901				Female connector type M flat	
09 73 1XX 6902 / 6903 / 6904 / 6907 / 6974 / 6991				Female connector type M invers	
09 03 2XX 6804 / 6805 / 6850				Female connector type M crimp	
09 03 2XX 6864 / 6865 / 6830				Male connector type MH 21+5	
09 73 2XX 6801				Female connector type MH 21+5	
09 03 2XX 3214				Male connector type M0+2	
09 06 X21 6883				Female connector type M0+2	
09 06 121 6981					
09 29 002 3201					
09 29 002 3401					

Board to Backplane				Part number	Impedance	Termination	
1.	M	M				solder/crimp	cable
2.	M	M flat		09 03 000 6160	50 Ω	solder/crimp	s
3.	M invers	M invers		09 03 000 6161	50 Ω	solder/crimp	a
4.	MH 21+ 5	MH 21+ 5		09 03 000 6165	50 Ω	solder	s
5.	M0+2	M0+2		09 03 000 6162	50 Ω	solder	a
				09 03 000 6182	50 Ω	solder	s
				09 03 000 6260	50 Ω	solder/crimp	s
				09 03 000 6261	50 Ω	solder/crimp	a
				09 03 000 6262	50 Ω	solder	a
				09 03 000 6263	50 Ω	solder	a
				09 03 000 6265	50 Ω	solder	s
				09 03 000 6274	50 Ω	solder/crimp	s

Mezzanine				Part number	Impedance	Termination	
6.	M invers	M				solder/crimp	cable
7.	M invers	M flat		09 03 000 6181	75 Ω	solder/crimp	s
				09 03 000 6269	75 Ω	solder	a
				09 03 000 6281	75 Ω	solder/crimp	s

pcb to pcb				Part number	Impedance	Termination	
8.	M	M invers				solder/crimp	cable
				09 03 000 6140	High voltage 2.8 kV		
				09 03 000 6240			

● = can be used in ○ male connector
○ = male connector for ● contacts

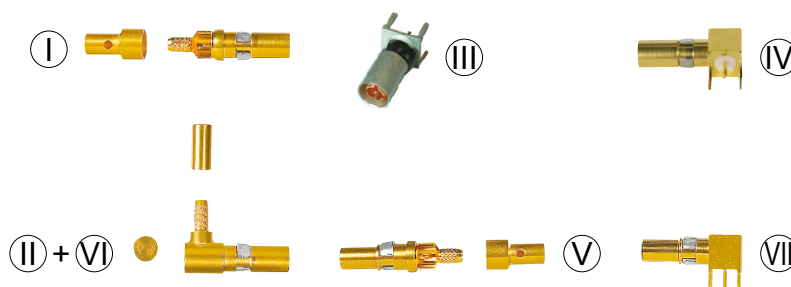
◆ = can be used in ◇ female connector
◇ = female connector for ◆ contacts

* details see catalogue Industrial Connectors Han®

	Part number	Currency	Termination		Preleading
			solder	cable	
●	09 03 000 6101	10 A	solder	cable	—
●	09 03 000 6102	20 A	solder	cable	—
●	09 03 000 6103	40 A	solder	cable	—
●	09 03 000 6104	40 A	solder	pcb	—
●	09 03 000 6110	40 A	solder	pcb	—
●	09 03 000 6113	10 A	crimp	cable	—
●	09 03 000 6114	20 A	crimp	cable	—
●	09 03 000 6115	40 A	crimp	cable	—
●	09 03 000 6127	40 A	solder	pcb	—
●	09 03 000 6128	40 A	solder	pcb	1.8
●	09 03 000 6133	40 A	solder	cable	0.8
●	09 03 000 6134	40 A	solder	pcb	0.6
●	09 03 000 6135	40 A	solder	pcb	—
●	09 03 000 6201	10 A	solder	cable	—
●	09 03 000 6202	20 A	solder	cable	—
●	09 03 000 6203	40 A	solder	cable	—
●	09 03 000 6207	40 A	solder	pcb	—
●	09 03 000 6213	10 A	crimp	cable	—
●	09 03 000 6214	20 A	crimp	cable	—
●	09 03 000 6215	40 A	crimp	cable	—
●	09 03 000 6220	20 A	crimp	cable	—
●	09 03 000 6225	40 A	solder	pcb	—
●	09 03 000 6245	40 A	screw	busbar	—
●	09 03 000 6250	40 A	press-in	pcb	—
FOC ceramic ferrule*					
●	20 10 125 4212				
◆	20 10 125 4222				
FOC for SI-fibre (HCS)*					
●	20 10 230 4211				
◆	20 10 230 4221				
FOC for 1 mm (POF)*					
●	20 10 001 4211				
◆	20 10 001 4221				

● = can be used in ○ male connector
○ = male connector for ● contacts
* see also chapter 04

◆ = can be used in ◇ female connector
◇ = female connector for ◆ contacts

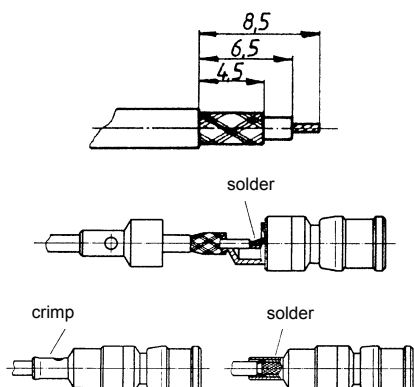


Coaxial contacts

Identification	Part number Performance level 1	Drawing	Dimensions in mm						
Male coaxial contacts for female connectors	acc. to DIN 41626		<table><tr><td></td><td>x</td></tr><tr><td>6165</td><td>16.05</td></tr><tr><td>6182</td><td>14.2</td></tr></table>		x	6165	16.05	6182	14.2
	x								
6165	16.05								
6182	14.2								
I for straight solder and/or crimp termination	09 03 000 6160 09 03 000 6181 ¹⁾								
II for angled solder and/or crimp termination	09 03 000 6161								
III for straight pcb termination for type M-flat	09 03 000 6182								
for type M	09 03 000 6165								
IV for angled pcb termination for type M invers	09 03 000 6162								
Female coaxial contacts for male connectors									
V for straight solder and/or crimp termination	09 03 000 6260 09 03 000 6281 ¹⁾ 09 03 000 6274 ²⁾								
VI for angled solder and/or crimp termination	09 03 000 6261								
VII angled for pcb termination	09 03 000 6262 09 03 000 6269 ¹⁾ 09 03 000 6263 ²⁾								
straight for pcb termination for type M invers	09 03 000 6265								

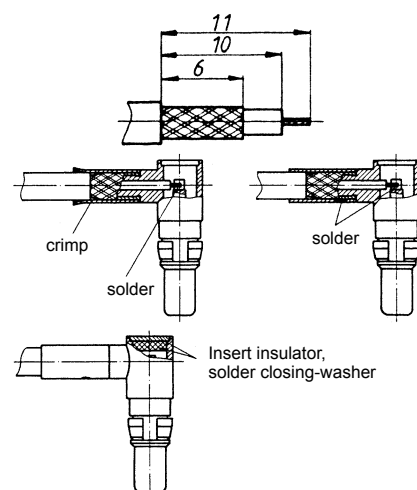
Assembly instruction for contacts

I and **V**



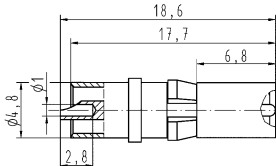
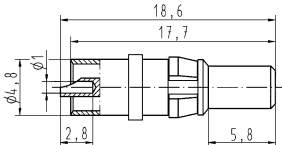
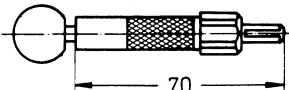
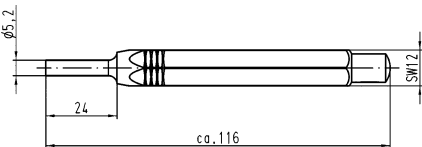
for contacts

II and **VI**

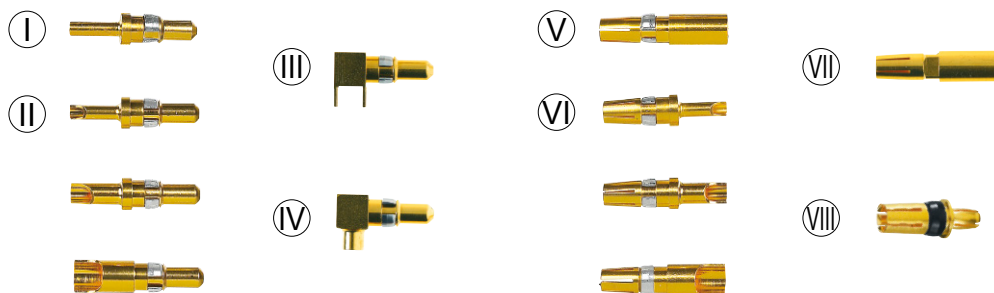




High voltage contacts

Identification		Part number	Drawing	Dimensions in mm		
Performance level 1						
High voltage male contact for male connectors ¹⁾		acc. to DIN 41 626				
I for straight solder termination	2.8 kV	09 03 000 6140				
High voltage female contact for female connectors ¹⁾						
II for straight solder termination	2.8 kV	09 03 000 6240				
Crimping tool for coaxial contacts		09 99 000 0194				
Crimping tool for high current contacts		09 99 000 0196				
Removal tool						
III incl. removal jacket for contact replacement in male and female connectors		09 99 000 0174				
Replacement removal jacket		09 99 000 0243				
Removal tool						
IV for contact replacement in male connectors		09 99 000 0328				
Electrical characteristics of coaxial contacts and wires		Impedance		50 Ω	75 Ω	
		Max. working frequency		0 up to 10 GHz		
		Return loss		0 up to 1.5 GHz		
		RF-leakage		≥ 20 dB up to 6 GHz		
		Test voltage		≥ 20 dB		
		Working voltage		≥ 80 dB up to 0.5 GHz		
		Insulation resistance		≥ 68 dB up to 1.5 GHz		
		Contacts resistance – Center contact		750 V _{rms}		
		– Outer contact		250 V _{max.}		
		Contact current max.		≥ 1 GΩ		
		Admissible power (depends on: frequency, application, return loss, environmental characteristics)		≥ 200 MΩ		
				≤ 10 mΩ		
				≤ 3 mΩ		
				1.5 A		
		Data on request				
Cable group 2 flexible wires	Impedance	Shell ø	Screening ø	Dielectric ø	Internal wire ø	Hexagonal crimp Spanner width
RG 174 A/U	50 Ω	2.5	2.0	1.5	0.48	3.25
RG 188 A/U	50 Ω	2.6	2.0	1.5	0.54	3.25
RG 316 U	50 Ω	2.5	2.0	1.5	0.54	3.25
RG 179 B/U	75 Ω	2.54	2.0	1.6	0.3	3.25

¹⁾ Contact resistance internal wire max. 3 mΩ



1) Contact resistance max. 1.5 mΩ
2) Contact resistance internal wire max. 3 mΩ

78+2, 60+4,
42+6, 24+8

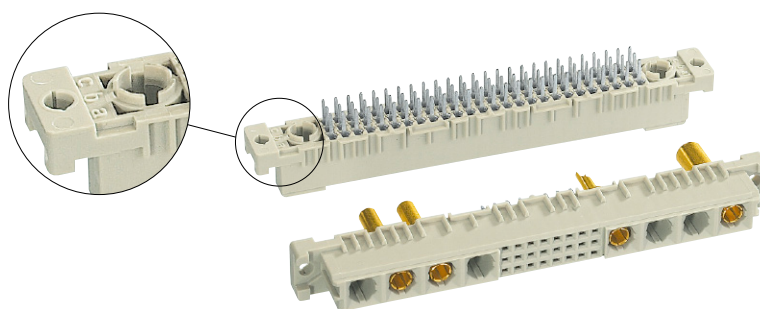
**DIN Signal
up to 2 A**

Order high current, high voltage, coaxial and fibre optic contacts separately, see pages 01.40 ff

Dimensions in mm

Number of contacts

78+2, 60+4, 42+6, 24+8



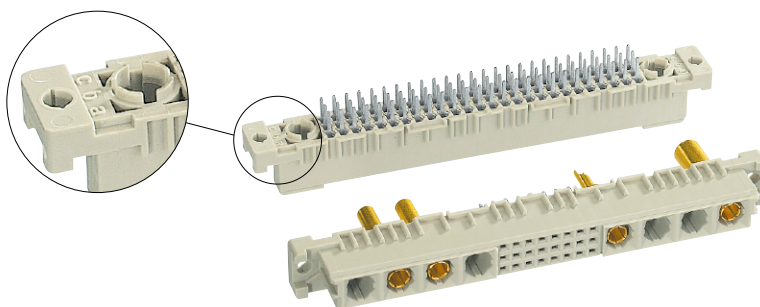
Female connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1
Female connector with solder pins 2.9 mm (without special contacts)	78 + 2		Performance level 3 on request	09 03 278 6804	
	60 + 4			09 03 260 6804	
	42 + 6			09 03 242 6804	
	24 + 8			09 03 224 6804	
Female connector with solder pins 4.5 mm (without special contacts)	78 + 2			09 03 278 6805	
	60 + 4			09 03 260 6805	
	42 + 6			09 03 242 6805	
	24 + 8			09 03 224 6805	
Female connector with solder pins 13 mm (without special contacts)	78 + 2			09 03 278 6401	
	60 + 4			09 03 260 6401	
	42 + 6			09 03 242 6401	
	24 + 8			09 03 224 6401	
Female connector with press-in pins 4.5 mm (without special contacts)	78 + 2			09 03 278 6850	09 03 278 2850
	60 + 4			09 03 260 6850	
	42 + 6			09 03 242 6850	
	24 + 8			09 03 224 6850	

Other contact arrangements as well with lagging/leading pins on request

Number of contacts

78+2, 60+4, 42+6, 24+8



Female connectors

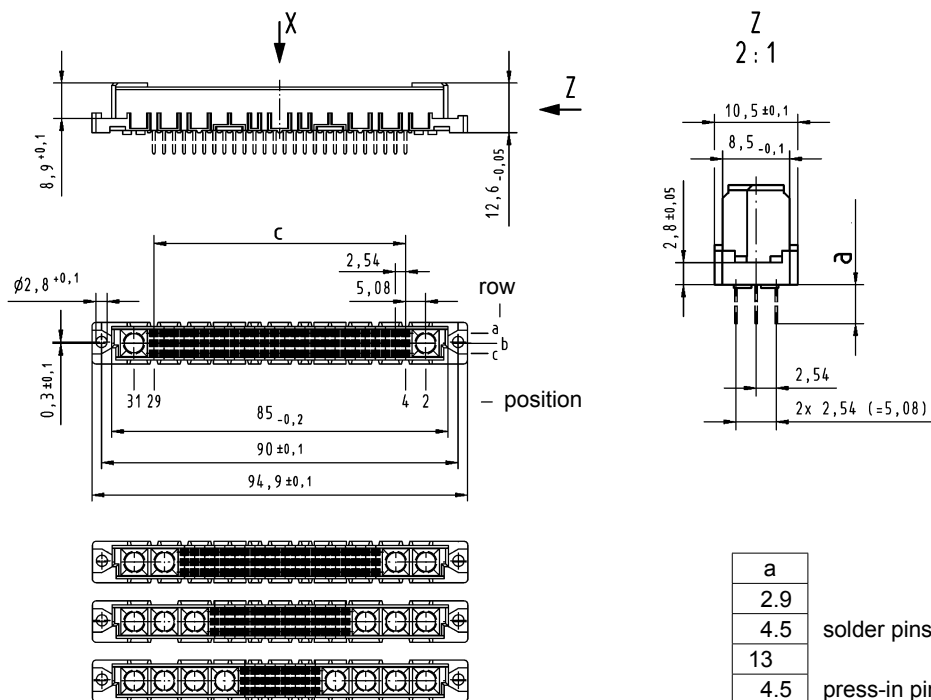
Identification

Drawing

Dimensions in mm

Dimensions

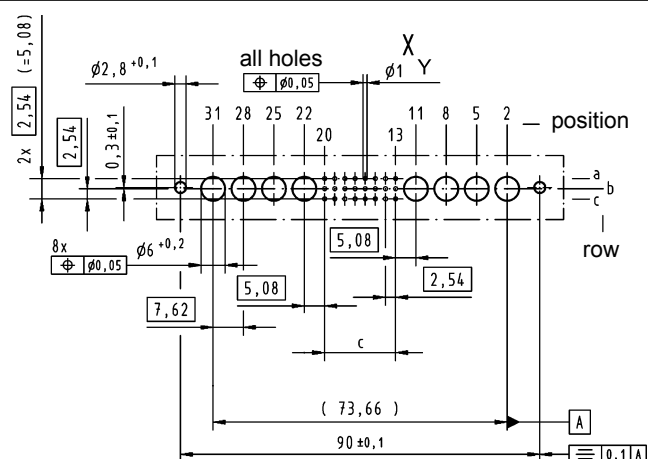
Order high current, high voltage, coaxial and fibre optic contacts separately, see pages 01.40 ff



Board drillings

Mounting side

Board drillings depend on type and special contact loading



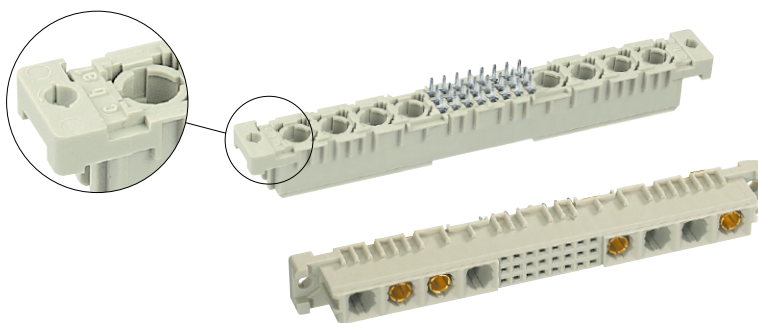
Type	c
78 + 2	25 x 2.54 = 63.5
60 + 4	19 x 2.54 = 48.26
42 + 6	13 x 2.54 = 33.02
24 + 8	7 x 2.54 = 17.78

Dimensions in mm

DIN Signal
up to 2 A

Number of contacts

78+2, 60+4, 42+6, 24+8



Female connectors

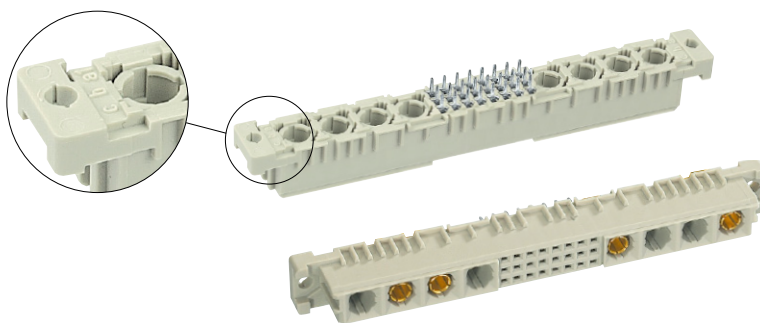
Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60 603-2. Explanation chapter 00 2	1
Female connector with solder pins 2.9 mm (without special contacts)*	78 + 2 60 + 4 42 + 6 24 + 8	   	Performance level 3 on request	09 03 278 6864 09 03 478 6864 ^{b)} 09 03 260 6864 09 03 242 6864 09 03 224 6864	
Female connector with solder pins 4.5 mm (without special contacts)*	78 + 2 60 + 4 42 + 6 24 + 8	   		09 03 278 6865 09 03 260 6865 09 03 242 6865 09 03 224 6865	
Female connector with press-in pins 4.5 mm (without special contacts)*	78 + 2 60 + 4 42 + 6 24 + 8	   		09 03 278 6830 09 03 260 6830 09 03 242 6830 09 03 224 6830	09 03 224 2830
Female connector with press-in pins 13 mm (without special contacts)*	78 + 2 60 + 4 42 + 6 24 + 8	   		09 03 278 6840 09 03 260 6840 09 03 242 6840 09 03 224 6840	09 03 260 2840
with press-in terminations for rear interfacing Usage of HARTING shroud recommended: contacts for rear interfacing selectively gold plated (performance level 3)					

* Pre-loaded with special contacts on request

^{b)} Connectors with snap-in clips see chapter 00

Number of contacts

78+2, 60+4, 42+6, 24+8



Female connectors

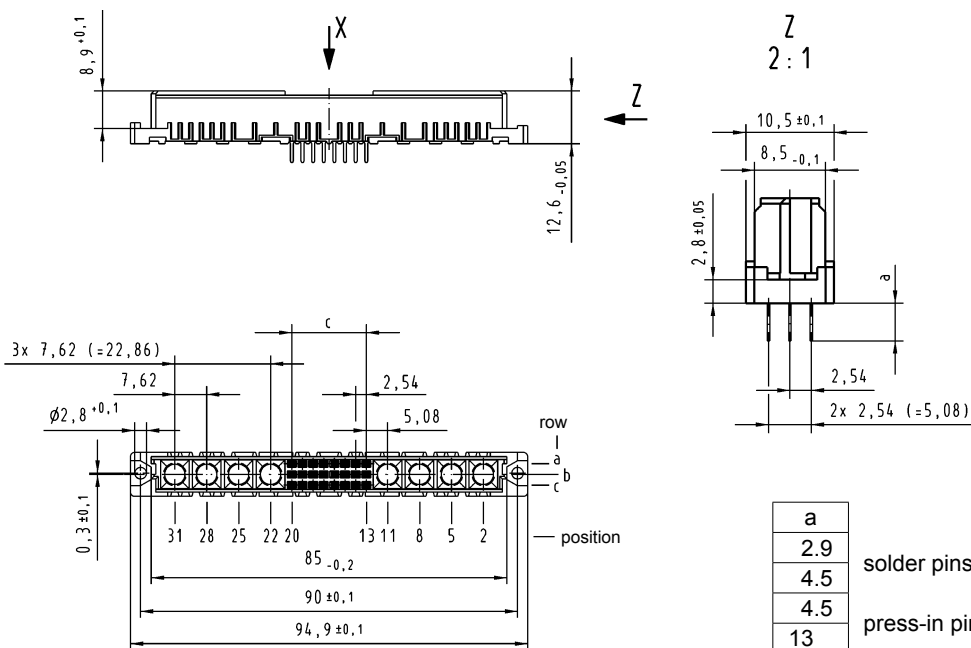
Identification

Drawing

Dimensions in mm

Dimensions

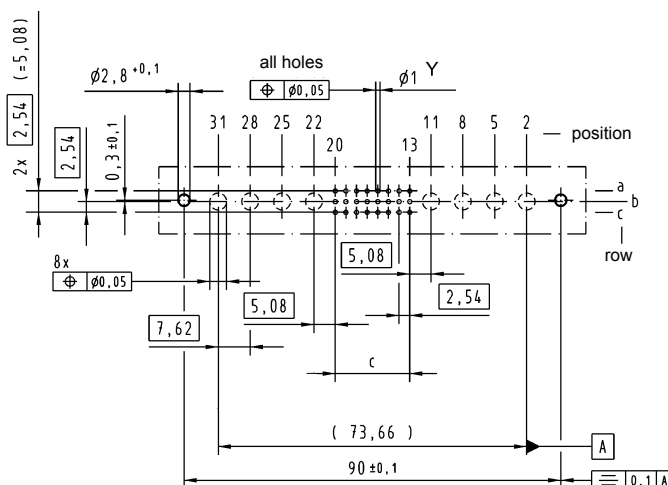
Order high current, high voltage, coaxial and fibre optic contacts separately, see pages 01.40 ff



Board drillings

Mounting side

Board drillings depend on type and special contact loading



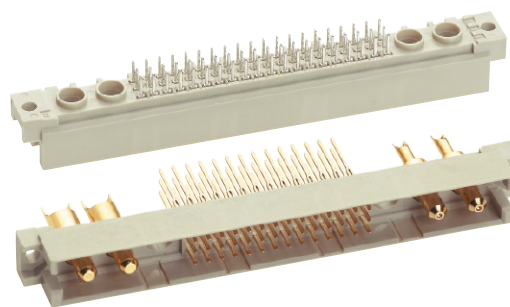
Type	c
78 + 2	25 x 2.54 = 63.5
60 + 4	19 x 2.54 = 48.26
42 + 6	13 x 2.54 = 33.02
24 + 8	7 x 2.54 = 17.78

Dimensions in mm

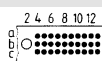
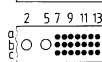
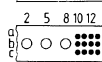
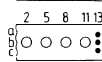
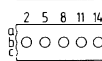
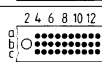
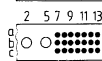
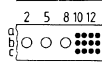
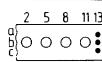
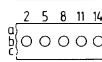
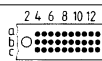
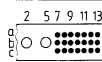
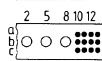
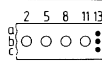
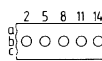
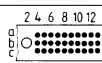
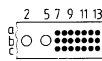
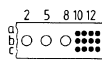
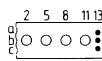
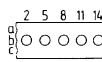
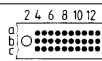
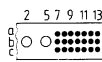
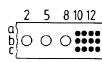
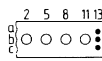
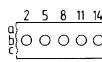
Other contact arrangements as well with lagging/leading pins on request

Number of contacts

78+2, 60+4, 42+6, 24+8, 6+10



Male connectors

Identification			No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00		
					3	2	1	
Male connector with solder pins 2.5 mm	78 + 2		Performance level 3 on request	09 73 178 6902	Performance level 1 on request			
	60 + 4			09 73 160 6902				
	42 + 6			09 73 142 6902				
	24 + 8			09 73 124 6902				
	6 + 10			09 73 106 6902				
Male connector with solder pins 4.0 mm	78 + 2			09 73 178 6903				
	60 + 4			09 73 160 6903				
	42 + 6			09 73 142 6903				
	24 + 8			09 73 124 6903				
	6 + 10			09 73 106 6903				
Male connector with solder pins 6.0 mm	78 + 2			09 73 178 6991				
	60 + 4			09 73 160 6991				
	42 + 6			09 73 142 6991				
	24 + 8			09 73 124 6991				
	6 + 10			09 73 106 6991				
Male connector with wrap posts 13 mm	78 + 2			09 73 178 6907				
	60 + 4			09 73 160 6907				
	42 + 6			09 73 142 6907				
	24 + 8			09 73 124 6907				
	6 + 10			09 73 106 6907				
Male connector with press-in pins 13 mm (5.0 mm on request)	78 + 2			09 73 178 6974●				
	60 + 4			09 73 160 6974●				
	42 + 6			09 73 142 6974●				
	24 + 8			09 73 124 6974●				
	6 + 10			09 73 106 6974●				

Male connectors with 17 mm wrap posts on request

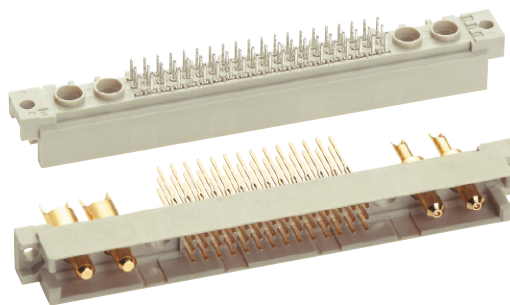
● Wrap posts for interfacing selectively gold plated (performance level 3)

Other contact arrangements on request

Number of contacts

78+2, 60+4, 42+6, 24+8, 6+10

Male connectors

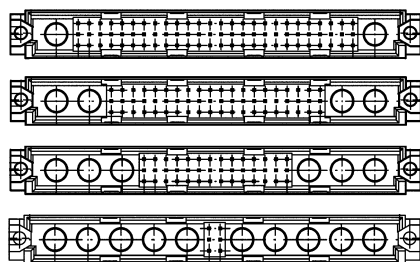


Identification

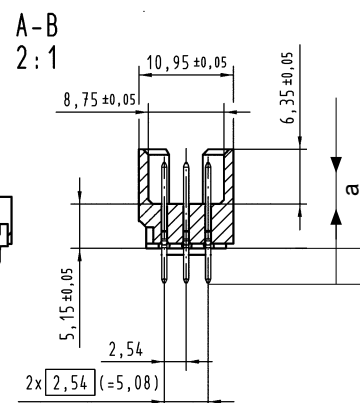
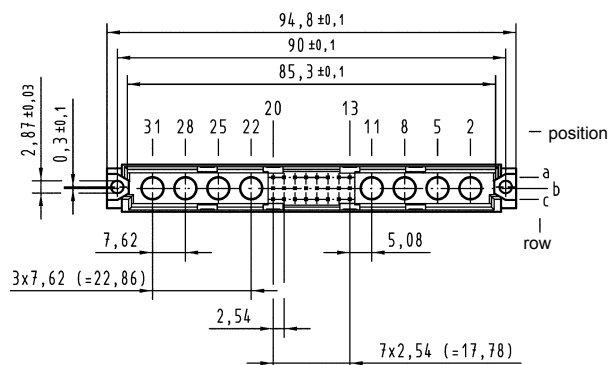
Drawing

Dimensions in mm

Dimensions



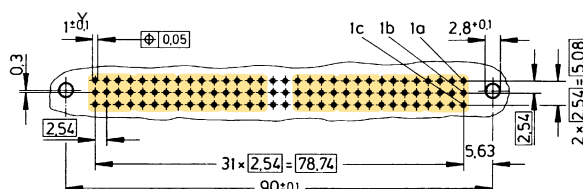
a	b	
2.5	ø 0.7	Solder pins
4.0		
6.0		
13	□ 0.6	Wrap posts
5.0	–	Press-in pins
13	–	



Order high current, high voltage, coaxial and fibre optic contacts separately, see pages 01.40 ff

Board drillings

Mounting side

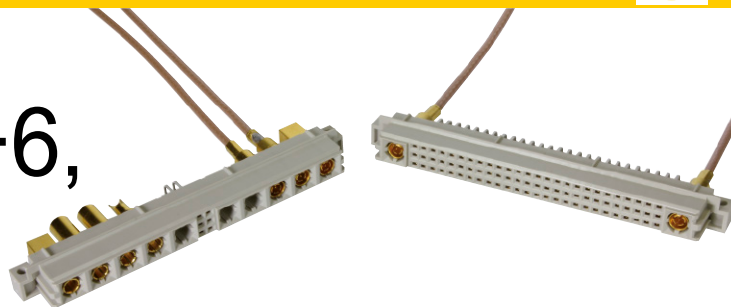


	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

Board drillings depend on type and special contact loading

Number of contacts

78+2, 60+4, 42+6, 24+8, 6+10

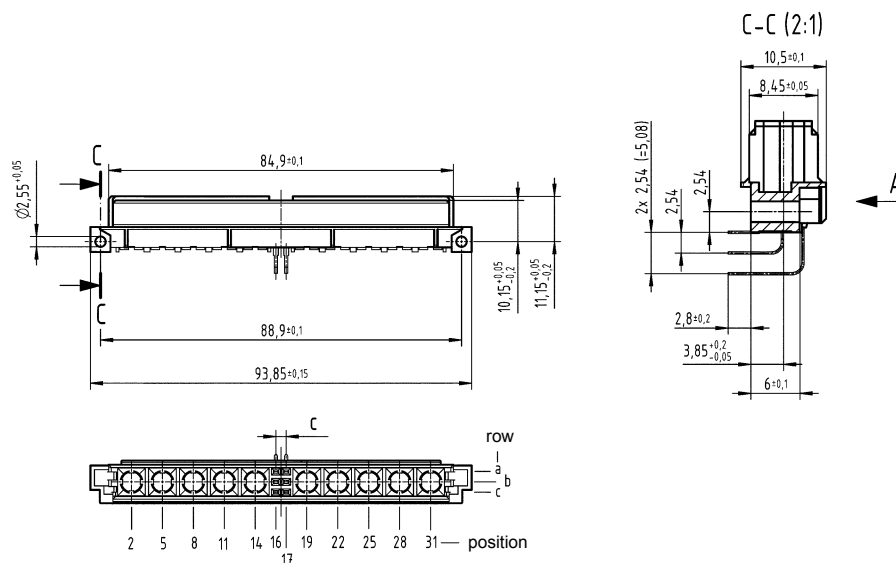


Female connectors

Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60 603-2. Explanation chapter 00 2	1
Female connector with angled solder pins (without special contacts)*	78 + 2		Performance level 3 on request	09 73 278 6801	Performance level 1 on request
	60 + 4			09 73 260 6801	
	42 + 6			09 73 242 6801	
	24 + 8			09 73 224 6801	
	6 + 10			09 73 206 6801	

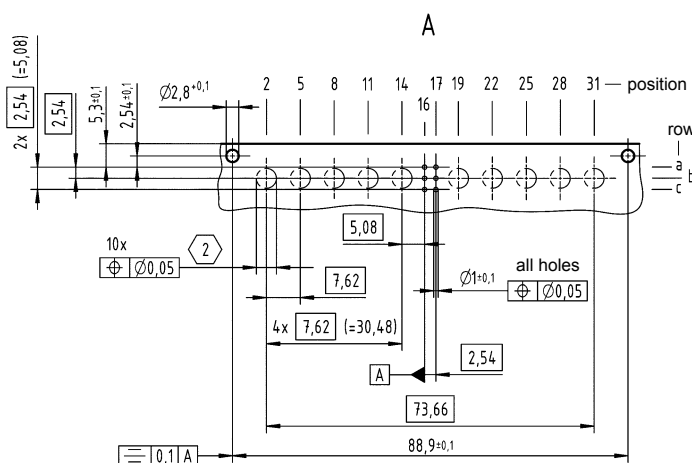
Dimensions

Order high current, high voltage, coaxial and fibre optic contacts separately



Board drillings

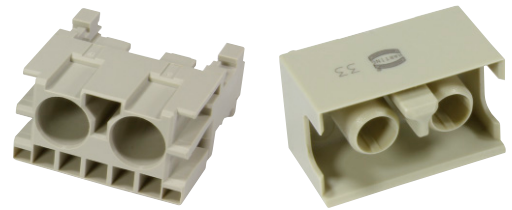
Mounting side



Type	c
78 + 2	25 x 2.54 = 63.5
60 + 4	19 x 2.54 = 48.26
42 + 6	13 x 2.54 = 33.02
24 + 8	7 x 2.54 = 17.78
6 + 10	1 x 2.54 = 2.54

Dimensions in mm

0+2



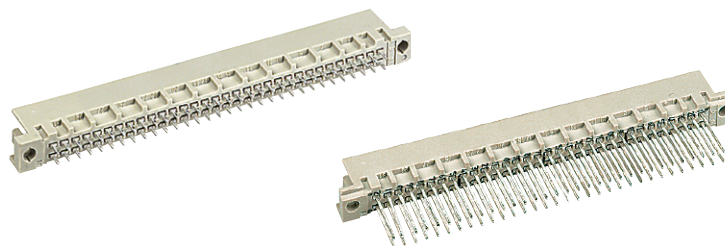
**DIN Signal
up to 2 A**

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Male connector, angled (without special contacts)	0 + 2	09 29 002 3201	The drawing includes three main views: - Top view: Shows a rectangular component with dimensions 20mm width and max 23mm height. - Side view: A cross-section labeled A-A at 90 degrees, showing a depth of 13mm and various internal features with dimensions like 3.75, 3.5, 2.5, 10, 12.5, and 23.7. - Board layout: Two versions are shown. Version B for straight contacts has dimensions 26mm, 18mm, 2x Ø2.15^{+0.05}, 2.5±0.1, 6mm, and 15.5mm. Version B for angled contacts has dimensions 5.08, 2.54, 3.75, 2.54, 2.46, 5.08, and Ø1.01 for all holes.	
Order high current, high voltage, coaxial and fibre optic contacts separately, see pages 01.40 ff				
Female connector, straight (without special contacts)	0 + 2	09 29 002 3401	The drawing includes three main views: - Top view: Shows a rectangular component with dimensions 24.8mm width and 13.65mm height. - Side view: A cross-section showing a depth of 14.85mm and 16.6mm, with a 2.5mm feature at the bottom. - Board layout: Shows two circular contact areas with a diameter of 10mm and a center-to-center distance of 10mm. It also shows mounting holes with dimensions 3.75, 10, 2x Ø2.15^{+0.05}, and 2x Ø1.01. A note indicates 'board drillings not metalised'.	
Order high current, high voltage, coaxial and fibre optic contacts separately, see pages 01.40 ff				

Dimensions in mm

Number of contacts

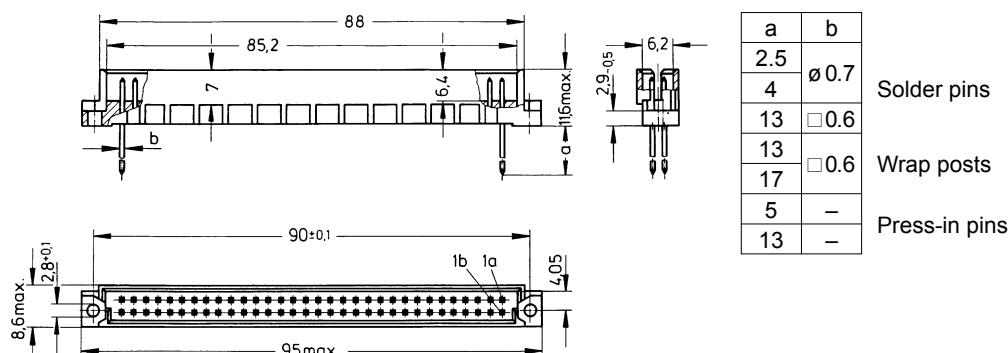
64



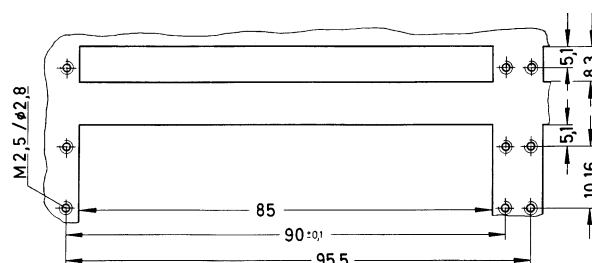
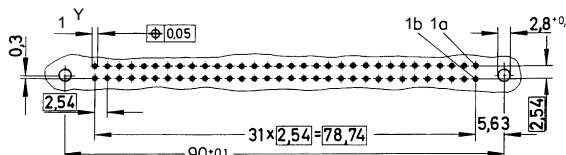
Male connectors

Identification		No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
				3	2	1
Male connector with solder pins	2.5 mm	64		09 72 164 7902	09 72 164 6902 09 72 364 6902 ^{b)}	Performance level 1 on request
	4.0 mm	64		09 72 164 7903	09 72 164 6903	
	13 mm	64			09 72 164 6577	
Male connector with wrap posts ¹⁾	13 mm	64		09 72 164 7907	09 72 164 6907	
	17 mm	64			09 72 164 6909	
Male connector with press-in pins	5.0 mm	64			09 72 164 6904	
	13 mm	62 + 2 [▲]			09 72 164 6954	
		64			09 72 164 6985 ^{w)} 09 72 164 6974 [*] 09 72 164 6995 ^{w)}	

Dimensions



Panel cut out

Board drillings
Mounting side

	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

Dimensions in mm

Other contact arrangements as well with lagging/leading pins on request

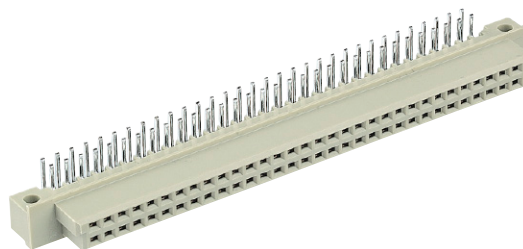
▲ Male connectors with 2 leading contacts (0.8 mm) pos. a1 and a32/a16

• Wrap posts for interfacing selectively gold plated (performance level 3)

¹⁾ To be used only for wire wrap termination^{b)} Connectors with snap-in clips see chapter 00^{w)} Wrap posts not for interfacing, no performance level

Number of contacts

64



Female connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1
Female connector with angled solder pins	64		Performance level 3 on request	09 72 264 6801 09 72 464 6801 ^{b)}	Performance level 1 on request
THR	64			09 72 264 6804 ^{d)}	
Dimensions					
Board drillings Mounting side					
Dimensions in mm					

Dimensions in mm

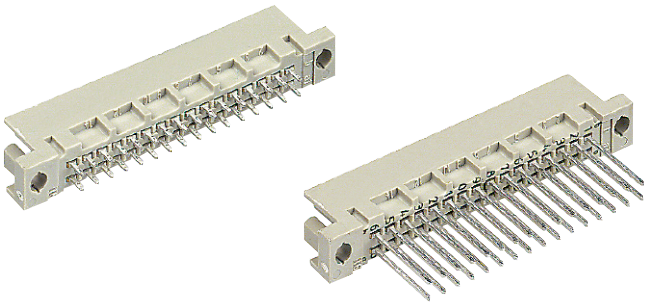
Other contact arrangements as well with lagging/leading pins on request

^{b)} Connectors with snap-in clips see chapter 00

^{d)} CTI > 400

Number of contacts

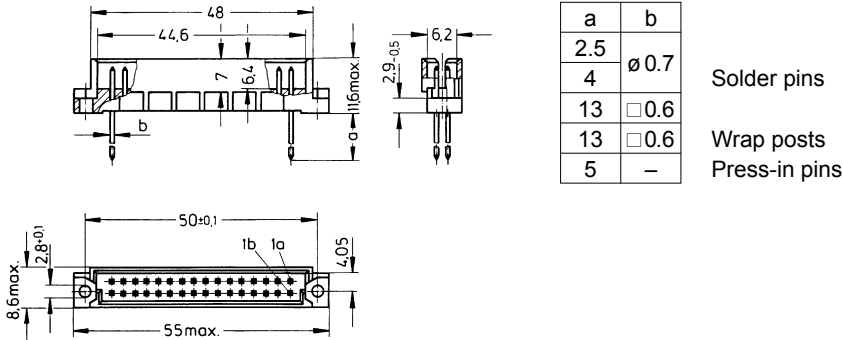
32



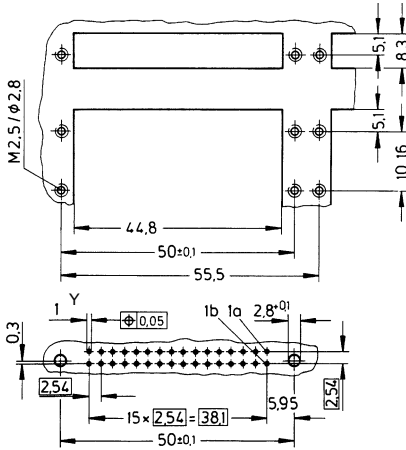
Male connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1	
Male connector with solder pins 2.5 mm 4.0 mm 13 mm	32		09 27 132 7902 09 27 332 7902	09 27 132 6902	09 27 132 2903	
	32		09 27 132 7903	09 27 132 6903		
	32			09 27 132 6577		
Male connector with wrap posts ¹⁾ 13 mm	32		09 27 132 7907	09 27 132 6907		
Male connector with press-in pins 5.0 mm	32 30 + 2▲			09 27 132 6904 09 27 132 6954		

Dimensions



Panel cut out



Board drillings
Mounting side

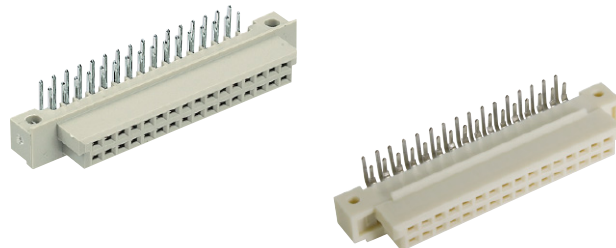
	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

Dimensions in mm

Other contact arrangements as well with lagging/leading pins on request
▲ Male connectors with 2 leading contacts (0.8 mm) pos. a1 and a32/a16
¹⁾ To be used only for wire wrap termination

Number of contacts

32



Female connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1
Female connector with angled solder pins	32		Performance level 3 on request	09 27 232 6801	Performance level 1 on request
THR	32			09 27 232 6804 ^{d)}	
THR, 150 pieces on a reel				09 27 232 6804 791 ^{d)}	
Dimensions					
Board drillings Mounting side	Cross section of solder terminations Cross area (A) of contacts row a, b: A = 0.20 - 0.23 mm² Dimensions in mm				

Other contact arrangements as well with lagging/leading pins on request

^{d)} CTI > 400

Number of contacts

20



Male connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1
Male connector with solder pins 2.5 mm			Performance level 3 on request		Performance level 1 on request
with fixing flange	20			09 75 120 6902	
with fixing flange, THR	20			09 75 120 6519 ^{d)}	
with fixing flange, THR, 240 pieces on a reel				09 75 120 6519 792 ^{d)}	
without fixing flange	20			09 75 120 6592	
without fixing flange, THR	20			09 75 120 6569 ^{d)}	
without fixing flange, THR, 240 pieces on a reel				09 75 120 6569 792 ^{d)}	
Male connector with solder pins 4.0 mm					
with fixing flange	20			09 75 120 6903	
with fixing flange, THR	20			09 75 120 6520 ^{d)}	
without fixing flange	20			09 75 120 6593	
without fixing flange, THR	20			09 75 120 6570 ^{d)}	
Male connector with solder pins 13 mm					
with fixing flange	20			09 75 120 6577	
with fixing flange, THR	20			09 75 120 6521 ^{d)}	
Male connector with wrap posts ¹⁾ 13 mm					
with fixing flange	20			09 75 120 6907	
Male connector with press-in pins 5.0 mm					
with fixing flange	20			09 75 120 6904	
without fixing flange	20		09 75 120 6504		

¹⁾ To be used only for wire wrap termination^{d)} CTI > 400

Number of contacts

20



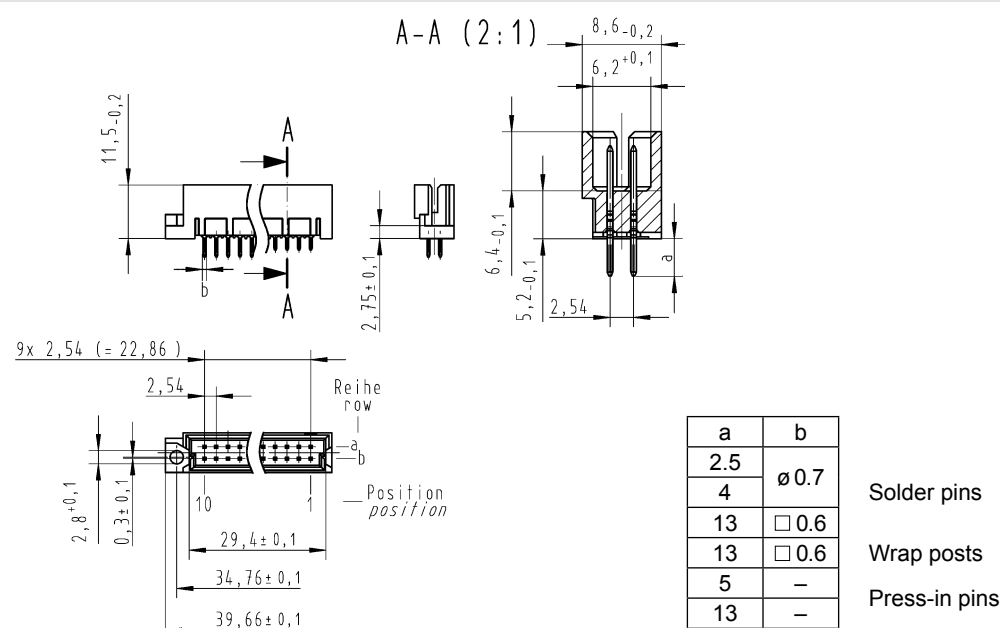
Male connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1
Male connector with press-in pins 13 mm	20		Performance level 3 on request	09 75 120 6985 ^{w)} 09 75 120 6974 [•]	Performance level 1 on request
with fixing flange					
without fixing flange	20			09 75 120 6574 [•]	

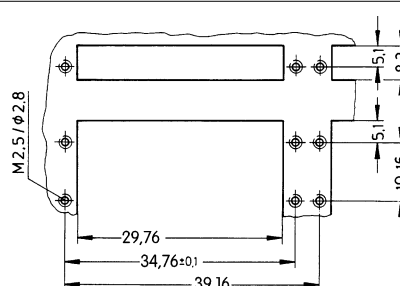
DIN Signal up to 2 A

Identification Drawing Dimensions in mm

Dimensions

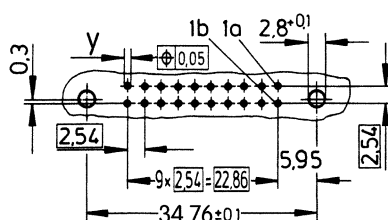


Panel cut out

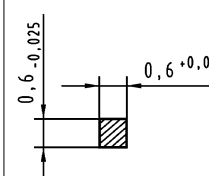


	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

Board drillings
Mounting side



Cross section of solder terminations



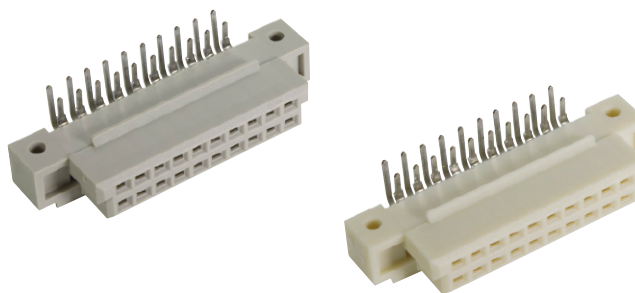
Cross area (A) of contacts row a, b: A = 0.35 - 0.39 mm²

Other contact arrangements as well with lagging/leading pins on request

• Wrap posts for interfacing selectively gold plated (performance level 3)

^{w)} Wrap posts not for interfacing, no performance level

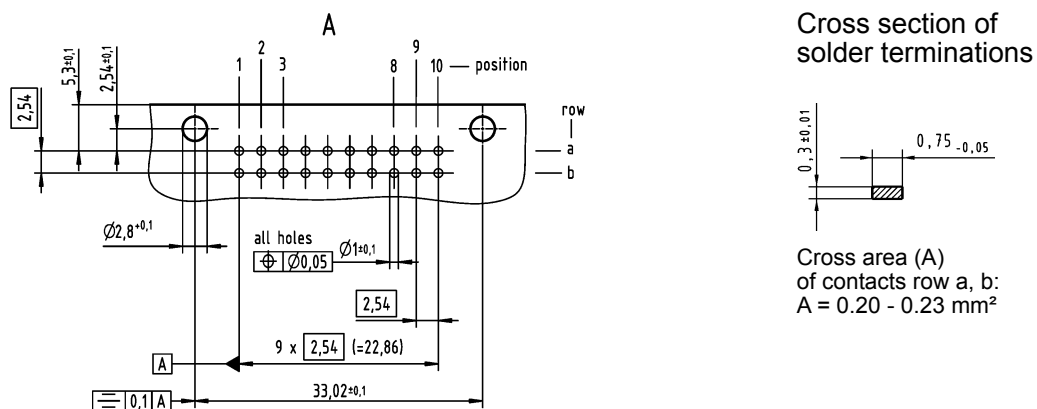
32



**DIN Signal
up to 2 A**

Identification	No. of contacts	Contact arrangement	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1
Female connector with angled solder pins	20		Performance level 3 on request	09 75 220 6801 09 75 420 6801 ^{b)}	Performance level 1 on request
THR	20			09 75 220 6804 ^{d)} 09 75 420 6804 ^{b)d)}	
THR on a reel				09 75 220 6804 791 ^{d)}	

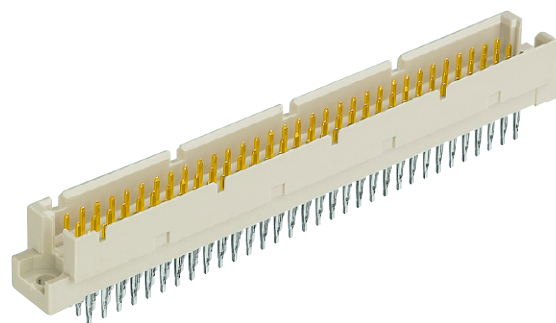
Mounting side



Dimensions in mm

Number of contacts

96, 64

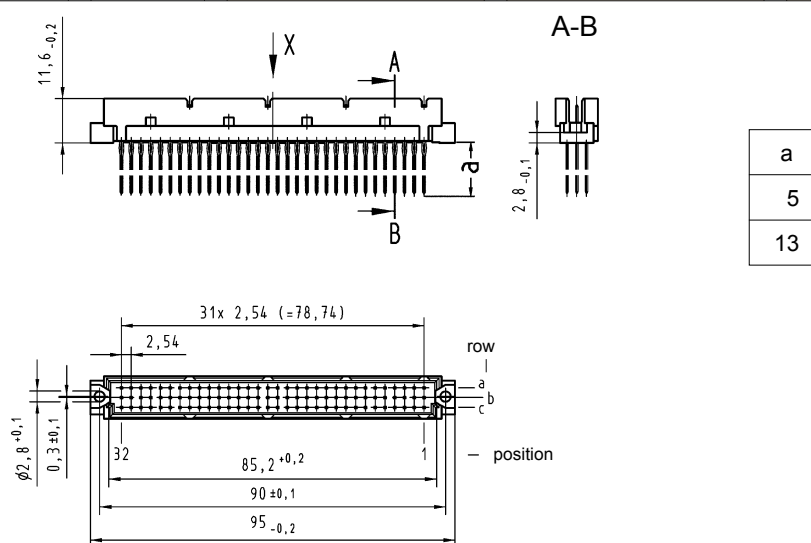


Male connectors

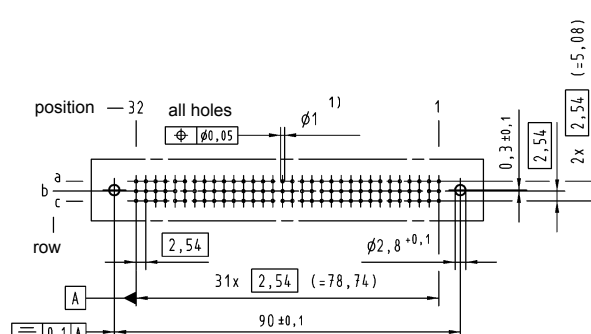
DIN Signal
up to 2 A

Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60 603-2. 2	Explanation chapter 00 1
Male connector with press-in terminations	5.0 mm		Performance level 3 on request	Performance level 2 on request	09 79 196 2950
					09 79 164 2950
	13 mm				09 79 196 2961*

Dimensions



Board drillings
Mounting side



Dimensions in mm

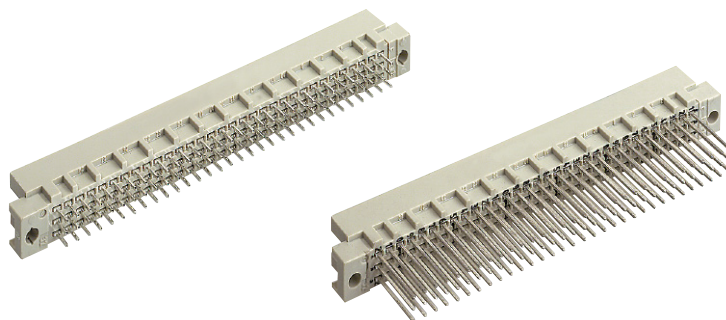
* Wrap posts for interfacing selectively gold plated (performance level 1)

¹⁾ refer to recommended configuration of pcb holes, see page 00.25

Other contact arrangements as well
with lagging/leading pins on request

Number of contacts

96, 64



Male connectors

Identification	No. of contacts	Contact arrangement	Performance levels according to IEC 60603-2. Explanation chapter 00		
			Part number 3	2	1
Male connector with solder pins 2.5 mm THR	96		09 73 196 7902	09 73 196 6902 09 73 396 6902 ^{b)} 09 73 696 6902 ^{c)}	09 73 196 2902
	96			09 73 196 6519 ^{d)}	
	64		09 73 164 7902	09 73 164 6902 09 73 364 6902 ^{b)}	09 73 164 2902 09 73 364 2902 ^{b)}
Male connector with solder pins 4.0 mm THR	96		09 73 196 7903	09 73 196 6903 09 73 196 6903 222 ^{f)} 09 73 396 6903 ^{b)} 09 73 196 6953	09 73 196 2903
	96			09 73 196 6520 ^{d)}	
	64		09 73 164 7903	09 73 164 6903 09 73 364 6903 ^{b)}	09 73 164 2903
	64			09 73 164 6520 ^{d)}	
Male connector with solder pins 13 mm THR	96			09 73 196 6577	09 73 196 2577
	96			09 73 196 6521 ^{d)}	
	64			09 73 164 6577	
Male connector with wrap posts ¹⁾ 13 mm	96		09 73 196 7907	09 73 196 6907 09 73 696 6947 ^{●c)}	09 73 196 2907
	64		09 73 164 7907	09 73 164 6907 09 73 164 6947 [●] 09 73 664 6947 ^{●c)}	09 73 164 2907
Male connector with press-in pins 5.0 mm	96		09 73 196 7904	09 73 196 6904 09 73 696 6904 ^{c)} 09 73 196 6954	09 73 196 2904
	64		09 73 164 7904	09 73 164 6904	09 73 164 2904
Male connector with press-in pins 13 mm	96		09 73 196 7974 [●]	09 73 196 6985 ^{w)} 09 73 196 6974 [●] 09 73 196 6995 ^{w)}	Performance level 1 on request
	96 + 2 [▲]				
	64			09 73 164 6985 ^{w)} 09 73 164 6974 [●]	

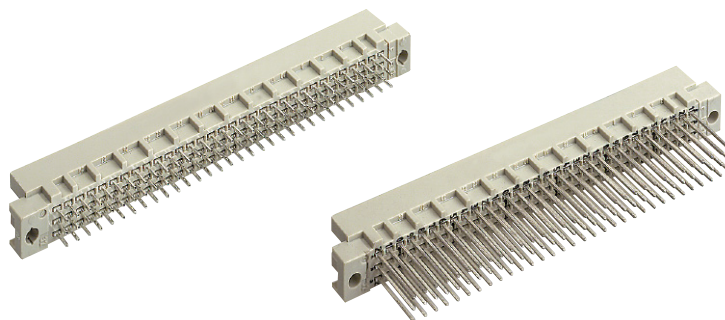
▲ Male connectors with 2 leading contacts [(0.8 mm) pos. a1 and a32]
 ● Wrap posts for interfacing selectively gold plated (performance level 3)
 ● Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2
 1) To be used only for wire wrap termination

b) Connectors with snap-in clips see chapter 00
 c) Connectors with coding see chapter 00
 d) CTI > 400
 w) Wrap posts not for interfacing, no performance level

Number of contacts

96, 64

Male connectors

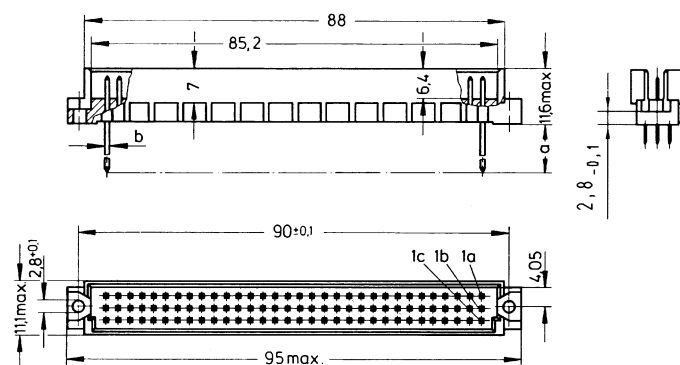


Identification

Drawing

Dimensions in mm

Dimensions



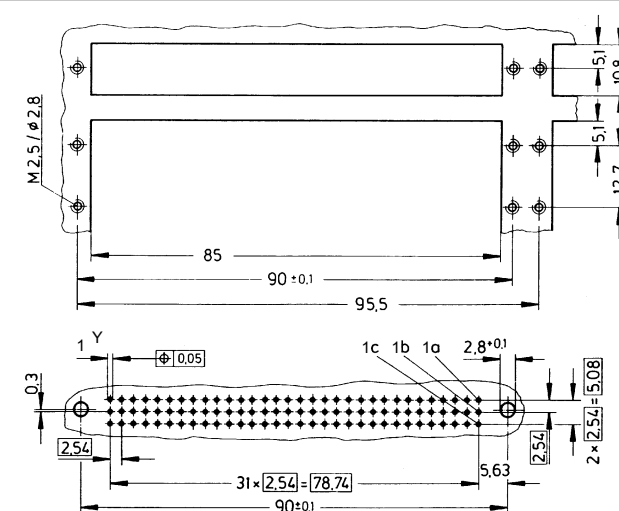
a	b
2.5	ø 0.7
4	□ 0.6
13	□ 0.6
5	—
13	—

Solder pins

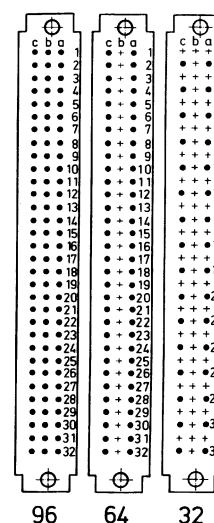
Wrap posts

Press-in pins

Panel cut out



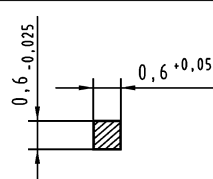
Board drillings
Mounting side



Contact arrangement
View from termination side

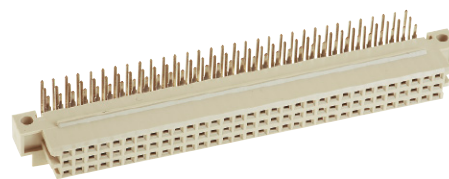
	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

Cross section of
solder terminations



Cross area (A) of contacts row a, b, c: A = 0.35 - 0.39 mm²

96, 64, 32



**DIN Signal
up to 2 A**

**DIN Signal
up to 2 A**

**DIN Signal
up to 2 A**



**DIN Signal
up to 2 A**



**DIN Signal
up to 2 A**

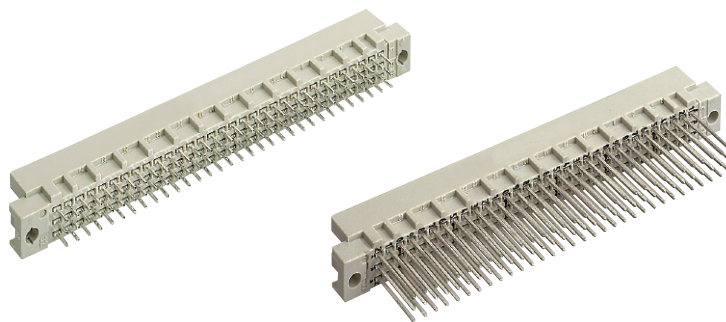


**DIN Signal
up to 2 A**

**DIN Signal
up to 2 A**

Number of contacts

96, 64



Male connectors

Identification		No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00											
				3	2	1										
Male connector with solder pins 2.5 mm		96		Performance level 3 on request	09 79 196 6902	Performance level 1 on request										
Male connector with solder pins 4.0 mm		96			09 79 196 6903 09 79 396 6903 ^{b)}											
		64			09 79 164 6903 09 79 364 6903 ^{b)}											
Male connector with wrap posts ¹⁾ 13 mm		96		Performance level 3 on request	09 79 196 6907	Performance level 1 on request										
		64			09 79 164 6907											
Dimensions	<table><tr><td>a</td><td>b</td></tr><tr><td>2.5</td><td>ø 0.7</td></tr><tr><td>4</td><td></td></tr></table>Solder pins<table><tr><td>a</td><td>b</td></tr><tr><td>13</td><td>□ 0.6</td></tr></table>Wrap posts						a	b	2.5	ø 0.7	4		a	b	13	□ 0.6
a	b															
2.5	ø 0.7															
4																
a	b															
13	□ 0.6															
Panel cut out																
Board drillings Mounting side	96 64 32															

Dimensions in mm

Other contact arrangements on request

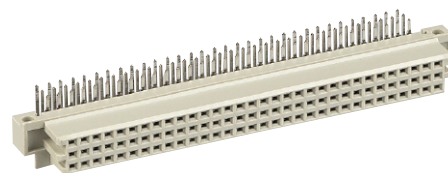
= deviating dimensions from standard male connectors (see page 01.60f)

^{b)} Connectors with snap-in clips see chapter 00

¹⁾ To be used only for wire wrap termination

Dimensions in mm

96, 64



**DIN Signal
up to 2 A**

Identification	No. of contacts	Contact arrangement	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1
Female connector with angled solder pins	96		09 79 296 7801	09 79 296 6801 09 79 496 6801 ^{b)}	Performance level 1 on request
	64		09 79 264 7801	09 79 264 6801 09 79 464 6801 ^{b)}	

Technical drawing of a perforated plate (Fig. 10.10). The drawing shows a rectangular plate with a grid of holes. Key dimensions include: overall width $2 \times 2,54 (\pm 0,08)$, overall height $5,3 \pm 0,1$, hole diameter $\varnothing 2,8 \pm 0,1$, hole pitch $2,54$, and total length $88,9 \pm 0,1$. A detail 'X' shows a hole with a diameter of $\varnothing 0,05$ and a position tolerance of $1 \pm 0,1$. The plate is labeled 'all holes' and 'position'. A table at the bottom right shows a tolerance of $0,1$.

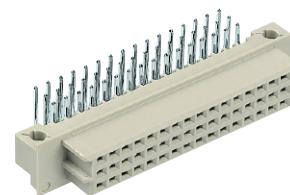
Other contact arrangements on request

b) Connectors with snap-in clips see chapter 00

= deviating dimensions from standard female connectors
(see page 01.62)

Number of contacts

48, 32



Female connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1	
Female connector with angled solder pins THR THR on a reel	48		Performance level 3 on request	09 28 248 6801 09 28 448 6801 ^{b)}	Performance level 1 on request	
	48			09 28 248 6804 ^{d)} 09 28 248 6804 791 ^{d)}		
	32			09 28 232 6801 09 28 432 6801 ^{b)}		
Dimensions						
Board drillings Mounting side					Cross section of solder terminations Cross area (A) of contacts row a, b, c: A = 0.20 - 0.23 mm²	
Dimensions in mm						

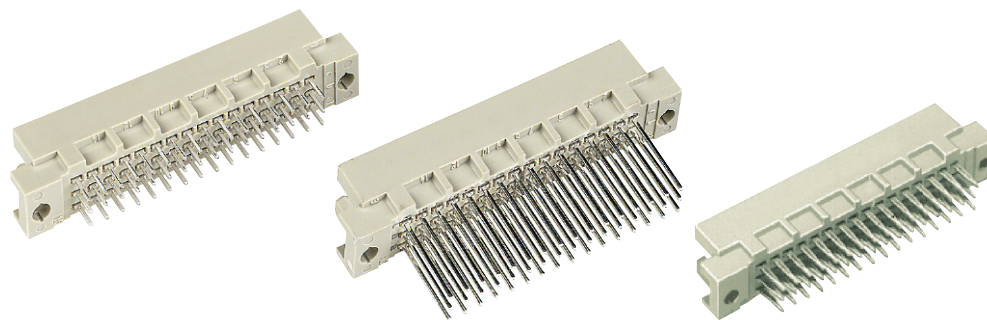
Other contact arrangements as well with lagging/leading pins on request

^{b)} Connectors with snap-in clips see chapter 00

^{d)} CTI > 400

Number of contacts

48, 32



Male connectors

Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60603-2. 2	Explanation chapter 00 1
Male connector with solder pins 2.5 mm	48		09 28 148 7902 09 28 348 7902 ^{b)}	09 28 148 6902 09 28 348 6902 ^{b)}	09 28 148 2902
	48			09 28 148 6519 ^{d)}	
	32		09 28 132 7902	09 28 132 6902	09 28 132 2902
	32			09 28 132 6519 ^{d)}	
Male connector with solder pins 4.0 mm	48		09 28 148 7903	09 28 148 6903 09 28 148 6903 222 ^{f)} 09 28 348 6903 ^{b)}	09 28 148 2903
	48			09 28 148 6520 ^{d)}	
	32		09 28 132 7903	09 28 132 6903	
	32			09 28 132 6520 ^{d)}	
Male connector with solder pins 13 mm	48			09 28 148 6577	
	48			09 28 148 6521 ^{d)}	
Male connector with wrap posts ¹⁾ 13 mm	48		09 28 148 7907	09 28 148 6907	09 28 148 2907
	32		09 28 132 7907	09 28 132 6907	09 28 132 2907
Male connector with press-in pins 5.0 mm	48		09 28 148 7904	09 28 148 6904	
	32			09 28 132 6904	
Male connector with press-in pins 13 mm	48		09 28 148 7985	09 28 148 6985 ^{w)} 09 28 148 6974 [*]	
	32			09 28 132 6985 ^{w)}	

* Wrap posts for interfacing selectively gold plated (performance level 3)

¹⁾ To be used only for wire wrap termination

^{b)} Connectors with snap-in clips see chapter 00

^{d)} CTI > 400

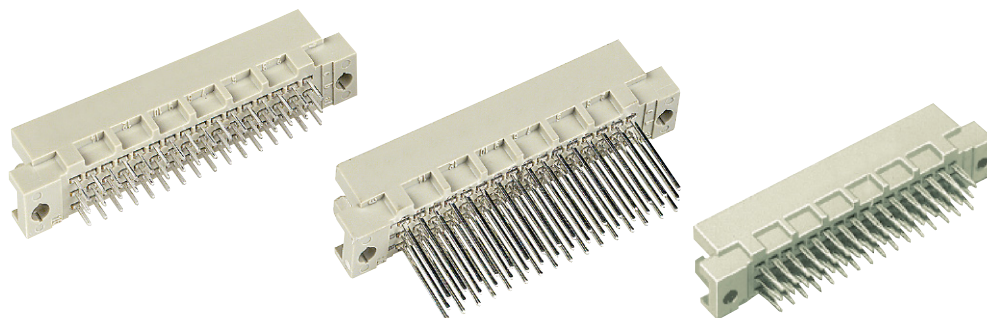
^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

^{w)} Wrap posts not for interfacing, no performance level

Number of contacts

48, 32

Male connectors

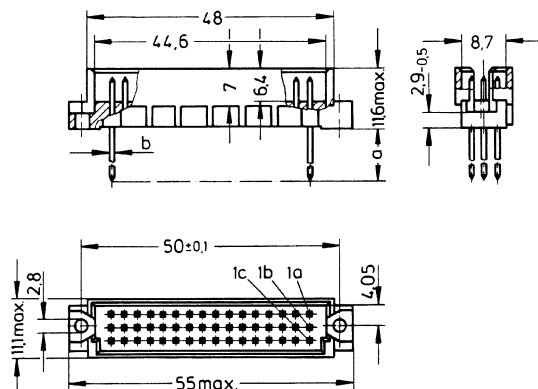


Identification

Drawing

Dimensions in mm

Dimensions



a	b
2.5	4
13	13
5	13

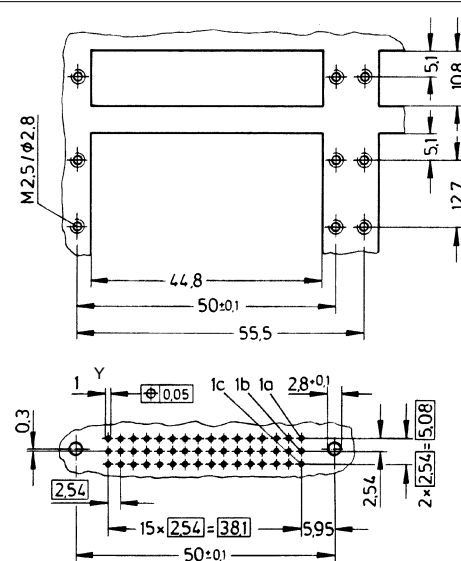
Solder pins

Wrap posts

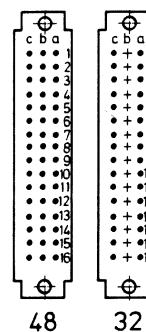
Press-in pins

Panel cut out

Board drillings
Mounting side

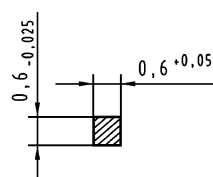


Contact arrangement
View from termination side



	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

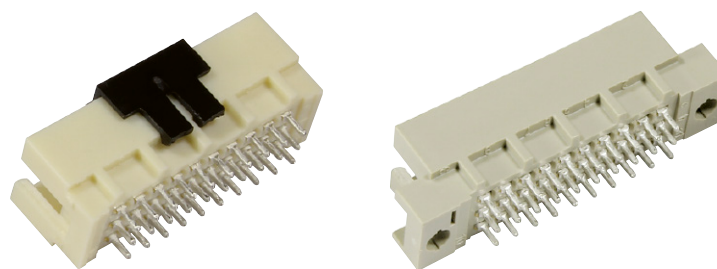
Cross section of
solder terminations



Cross area (A) of contacts row a, b, c: A = 0.35 - 0.39 mm²

Number of contacts

30, 20



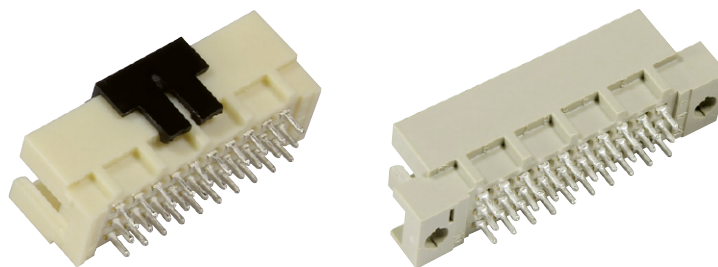
Male connectors

Identification	No. of contacts	Contact arrangement	Performance levels according to IEC 60603-2. Explanation chapter 00		
			Part number 3	2	1
Male connector with solder pins 2.5 mm	30		Performance level 3 on request	09 29 130 6902	Performance level 1 on request
	20			09 29 120 6902	
	30			09 29 130 6519 ^{d)}	
	30			09 29 130 6519 792 ^{d)}	
	30			09 29 130 6592	
	30			09 29 130 6569 ^{d)}	
Male connector with solder pins 4.0 mm	30			09 29 130 6903	
	20			09 29 120 6903	
	30			09 29 130 6520 ^{d)}	
	30			09 29 130 6593	
	30			09 29 130 6570 ^{d)}	
	30				
Male connector with solder pins 13 mm	30			09 29 130 6577	
	20			09 29 120 6577	
	30			09 29 130 6521 ^{d)}	
Male connector with wrap posts ¹⁾ 13 mm	30			09 29 130 6907	
Male connector with press-in pins 5.0 mm	30			09 29 130 6904	
	20			09 29 120 6904	
	30			09 29 130 6504	

¹⁾ To be used only for wire wrap termination^{d)} CTI > 400

Number of contacts

30, 20

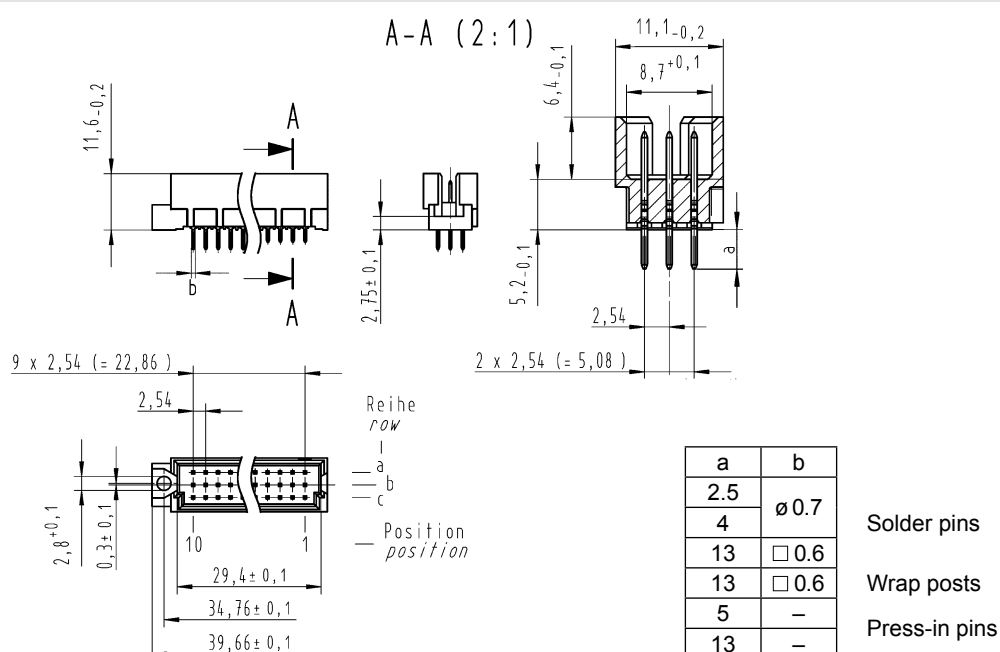


Male connectors

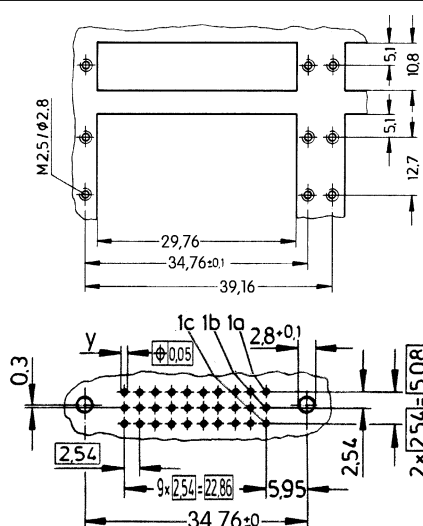
Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1
Male connector with press-in pins 13 mm	30		Performance level 3 on request	09 29 130 6985 ^{w)} 09 29 130 6974•	Performance level 1 on request
with fixing flange	20			09 29 120 6974•	
without fixing flange	30			09 29 130 6574•	

Identification Drawing Dimensions in mm

Dimensions

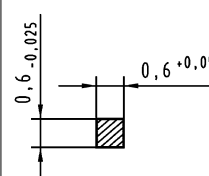


Panel cut out

Board drillings
Mounting side


	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

Cross section of solder terminations


Cross area (A) of contacts row a, b, c: A = 0.35 - 0.39 mm²

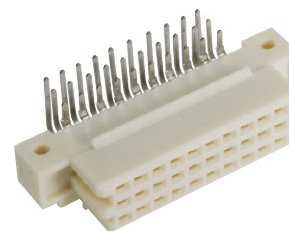
Other contact arrangements as well with lagging/leading pins on request

• Wrap posts for interfacing selectively gold plated (performance level 3)

^{w)} Wrap posts not for interfacing, no performance level

Number of contacts

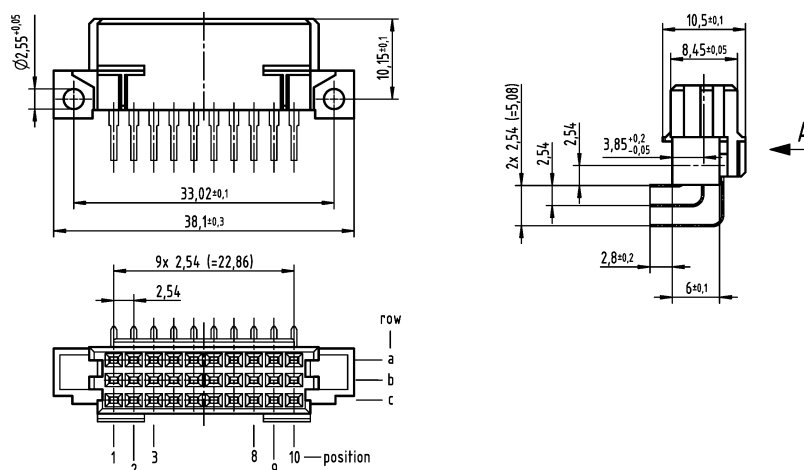
30



Female connectors

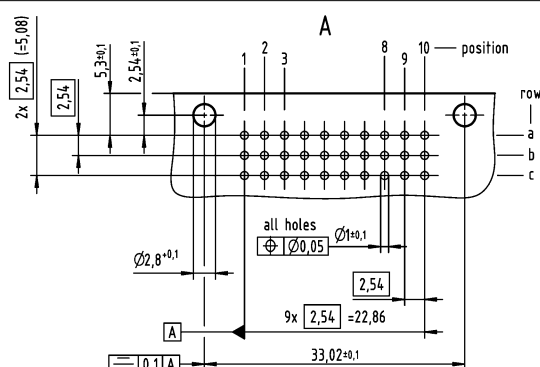
Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1
Female connector with angled solder pins	30		Performance level 3 on request	09 29 230 6801 09 29 430 6801 ^{b)}	Performance level 1 on request
THR THR on a reel	30			09 29 230 6804 ^{d)} 09 29 430 6804 ^{b)d)} 09 29 230 6804 791 ^{d)}	

Dimensions

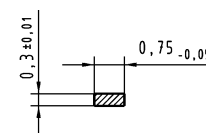


Board drillings

Mounting side



Cross section of solder terminations



Cross area (A) of contacts row a, b, c:
A = 0.20 - 0.23 mm²

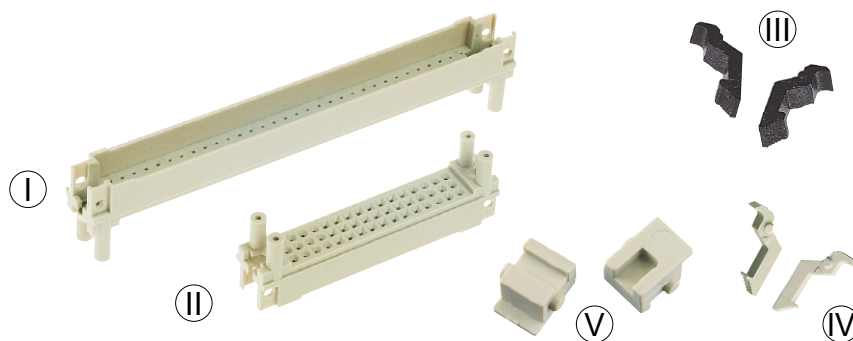
Dimensions in mm

Other contact arrangements as well with lagging/leading pins on request

^{b)} Connectors with snap-in clips see chapter 00^{d)} CTI > 400

Number of contacts

96, 48

Pin shrouds
for types C, 2C, R, 2R

Identification	Termination length ± 0.3	pcb-thick- ness ± 0.4	Dimension a ± 0.1	Part number – Pin shrouds with	
				press-in fixing ¹⁾	screw fixing
Pin shrouds for female connectors type C and for male connectors type R I	13.0/ 13.2	1.6	6.7	09 03 000 9956	09 03 000 9966
		2.4	5.9	09 03 000 9957	09 03 000 9967
		3.2	5.1	09 03 000 9958	09 03 000 9968
		4.0	4.3	09 03 000 9959	09 03 000 9969
	17.0	1,6	10,7	09 03 000 9951	09 03 000 9961
		2,4	9,9	09 03 000 9952	09 03 000 9962
		3,2	9,1	09 03 000 9953	09 03 000 9963
		4,0	8,3	09 03 000 9954	09 03 000 9964
		4,8	7,5	09 03 000 9955	09 03 000 9965
		5,6	6,7	09 03 000 9956	09 03 000 9966
		6,4	5,9	09 03 000 9957	09 03 000 9967
	20.0	4,0	11,75	09 03 000 9950	09 03 000 9960
		4,8	10,7	09 03 000 9951	09 03 000 9961
		5,6	9,9	09 03 000 9952	09 03 000 9962
		6,4	9,1	09 03 000 9953	09 03 000 9963
		7,2	8,3	09 03 000 9954	09 03 000 9964
Pin shrouds for female connectors type 2C and for male connectors type 2R II	13.0/ 13.2	1.6	6.7	09 23 000 9956	09 23 000 9966
		2.4	5.9	09 23 000 9957	09 23 000 9967
		3.2	5.1	09 23 000 9958	09 23 000 9968
		4.0	4.3	09 23 000 9959	09 23 000 9969
	17.0	1,6	10,7	09 23 000 9951	09 23 000 9961
		2,4	9,9	09 23 000 9952	09 23 000 9962
		3,2	9,1	09 23 000 9953	09 23 000 9963
		4,0	8,3	09 23 000 9954	09 23 000 9964
		4,8	7,5	09 23 000 9955	09 23 000 9965
		5,6	6,7	09 23 000 9956	09 23 000 9966
		6,4	5,9	09 23 000 9957	09 23 000 9967
	20.0	4,0	11,75	09 23 000 9950	09 23 000 9960
		4,8	10,7	09 23 000 9951	09 23 000 9961
		5,6	9,9	09 23 000 9952	09 23 000 9962
		6,4	9,1	09 23 000 9953	09 23 000 9963
		7,2	8,3	09 23 000 9954	09 23 000 9964

Identification

Part number

Locking lever for female connectors
type C, 2C*

III

09 03 000 9914

Locking lever for female connectors
type R, 2R*

IV

09 03 000 9913

Fixing bracket for shell housing C*

V

09 03 000 9921

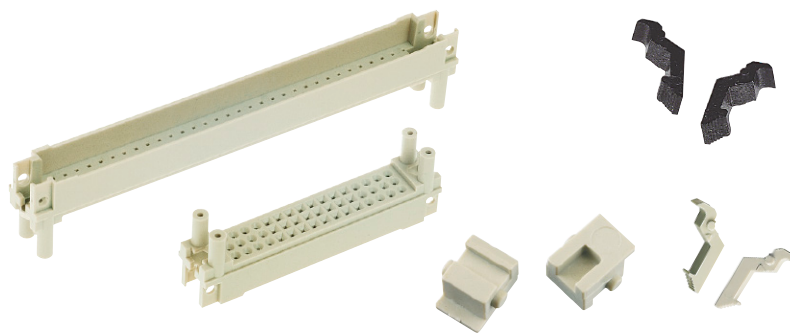
* order 2 pieces per connector

¹⁾ Processing only with press-in tools, see chapter 30

Number of contacts

96, 48

Pin shrouds
for types C, 2C, R, 2R

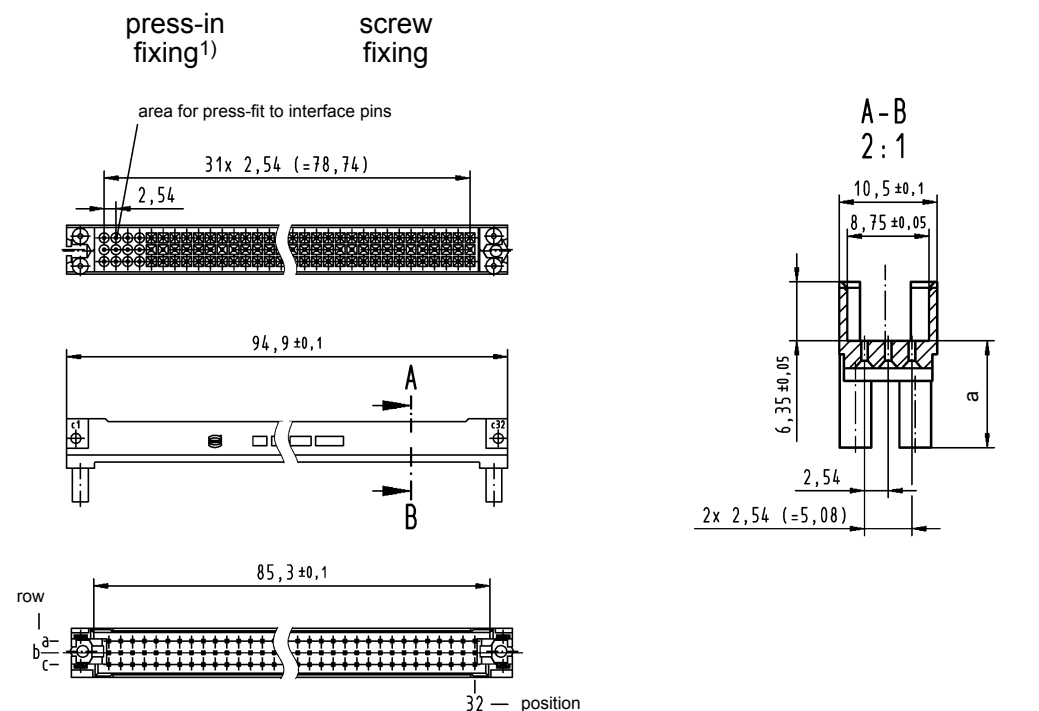


Identification

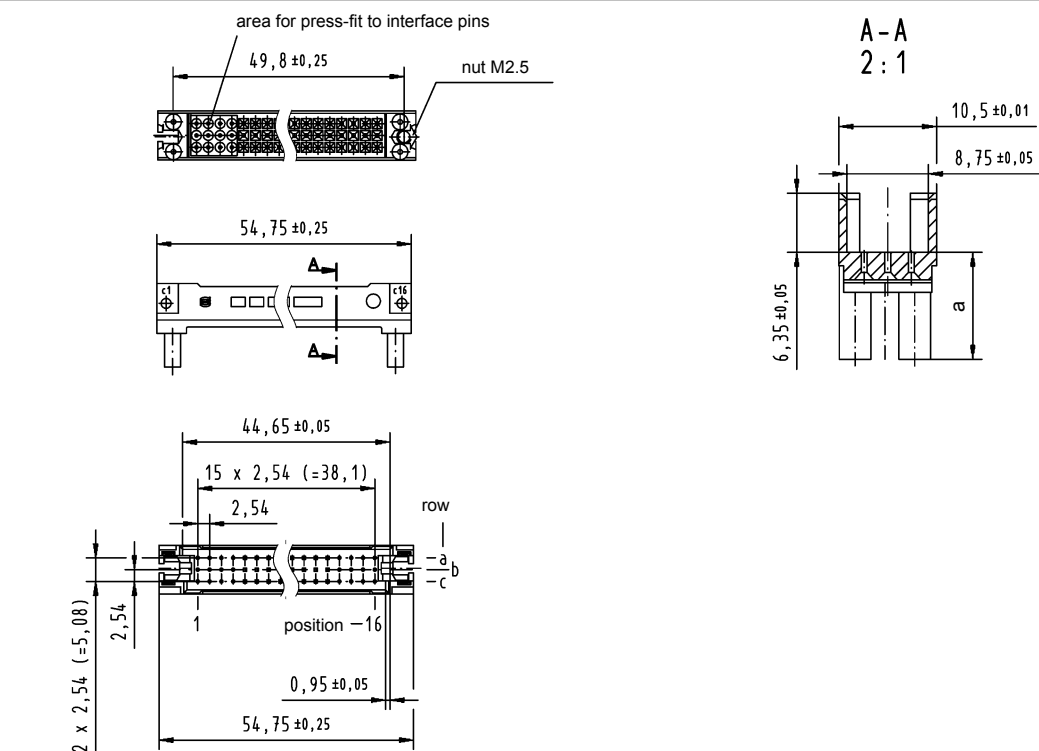
Drawing

Dimensions in mm

Pin shrouds
for female connectors
type C, R



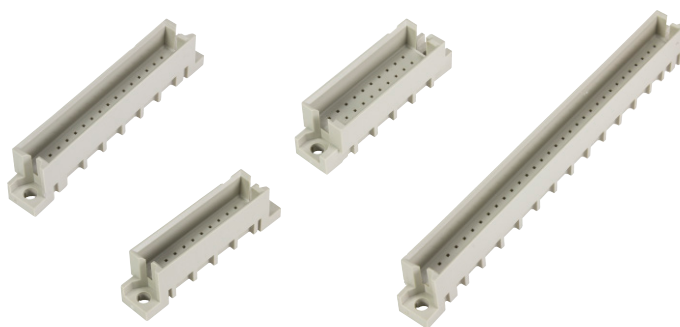
Pin shrouds
for female connectors
type 2C, 2R



¹⁾ Tooling see chapter 30

Number of contacts

64, 32, 30, 20



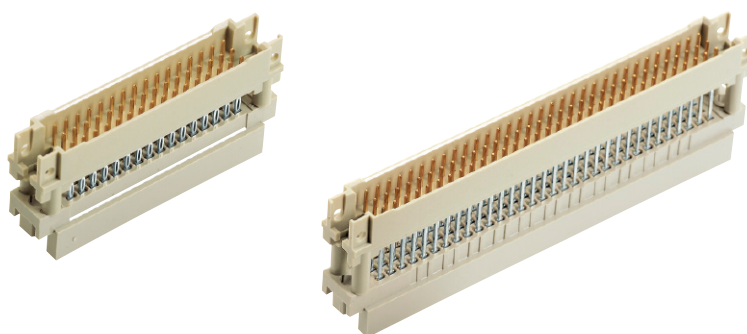
Pin shrouds

for types B, 2B, 3B, 3C, Q, 2Q, 3Q and 3R

Identification	No. of contacts	Part number	Drawing	Dimensions in mm																				
Pin shrouds for female connectors type B for male connectors type Q	64	09 72 164 3101																						
Pin shrouds for female connectors type 2B for male connectors type 2Q	32	09 27 132 3101																						
Pin shrouds for female connectors type 3B for male connectors type 3Q	20	09 75 120 3101	A-A (2:1) <table border="1"> <thead> <tr> <th></th><th>a</th><th>b</th><th>c</th><th>d</th></tr> </thead> <tbody> <tr> <td>B / Q</td><td>78.74</td><td>85.2</td><td>90.00</td><td>95.00</td></tr> <tr> <td>2B / 2Q</td><td>38.10</td><td>44.1</td><td>50.00</td><td>55.00</td></tr> <tr> <td>3B / 3Q</td><td>22.86</td><td>29.4</td><td>34.76</td><td>39.66</td></tr> </tbody> </table>		a	b	c	d	B / Q	78.74	85.2	90.00	95.00	2B / 2Q	38.10	44.1	50.00	55.00	3B / 3Q	22.86	29.4	34.76	39.66	
	a	b	c	d																				
B / Q	78.74	85.2	90.00	95.00																				
2B / 2Q	38.10	44.1	50.00	55.00																				
3B / 3Q	22.86	29.4	34.76	39.66																				
Pin shrouds for female connectors type 3C for male connectors type 3R	30	09 29 130 3101																						
These pin shrouds must be pressed on the interfacing contacts. After the assembly the interfacing contacts should have a contact length of appr. 4.8 mm.																								

Number of contacts

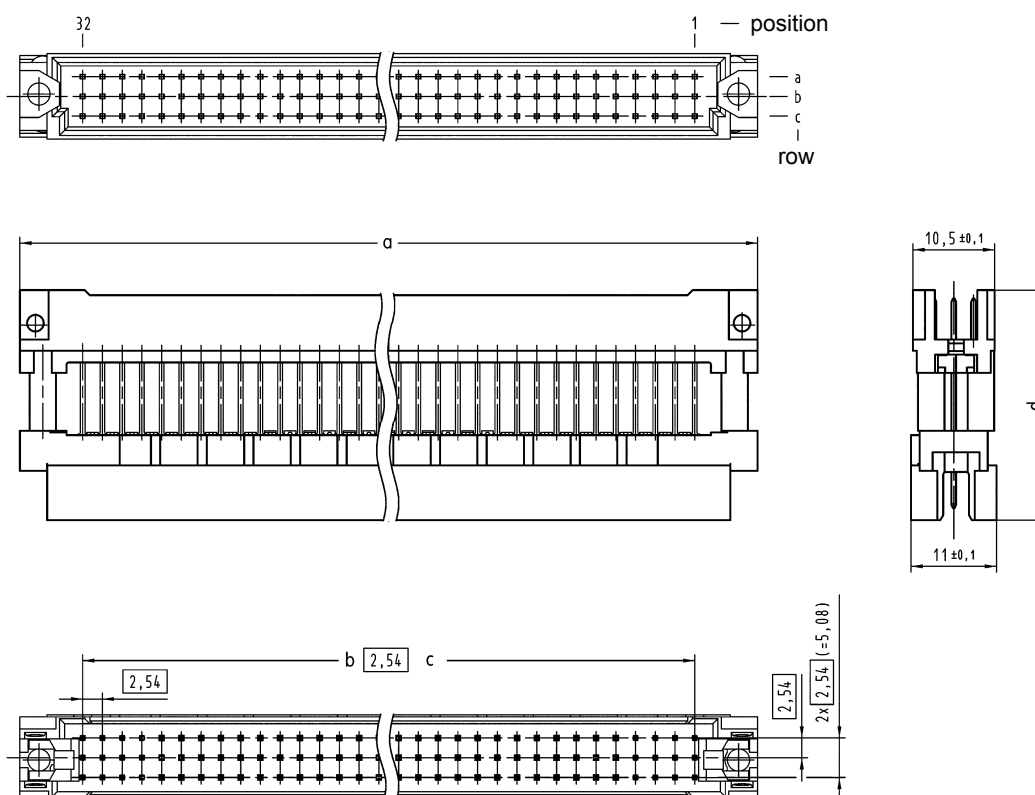
96, 48



Mezzanine Adapter

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60 603-2.		
				3	2	1
Male connector type R with pin shroud for pcb distance 41 mm	96		Performance level 3 on request			09 73 196 5531
Male connector type 2R with pin shroud for pcb distance 41 mm 37.5 mm	48				09 28 148 6532	09 28 148 5531

Dimensions



	a	b	c	d
09 73 196 5531	94.9 ± 0.1	31	78.74	29.6 ± 0.3
09 28 148 5531	54.9 ± 0.1	15	38.1	29.6 ± 0.3
09 28 148 6532	54.9 ± 0.1	15	38.1	26.15 ± 0.3

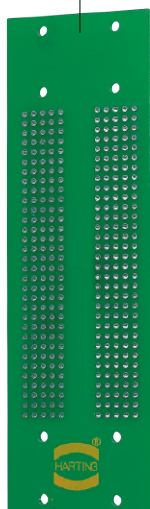
Dimensions in mm

Application 1

Female connector
09 03 296 6861



Backplane



Pin shroud
09 03 000 9957



Locking lever
09 03 000 9914



Female connector
09 03 264 6828



Female connector
09 03 096 3214

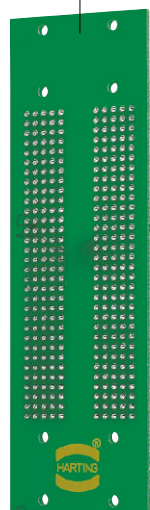


Application 2

Female connector
09 03 296 6862



Backplane



Pin shroud
09 03 000 9953



Locking lever
09 03 000 9913



Female connector
09 73 296 6801



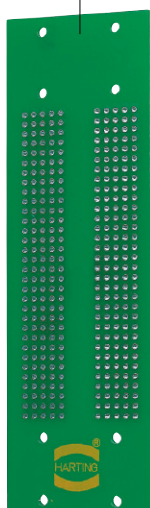
Daughtercard

Application 3

Female connector
09 03 296 6861



Backplane



Pin shroud
09 03 000 9957



Fixing brackets
09 03 000 9921



Female connector
09 03 096 3214

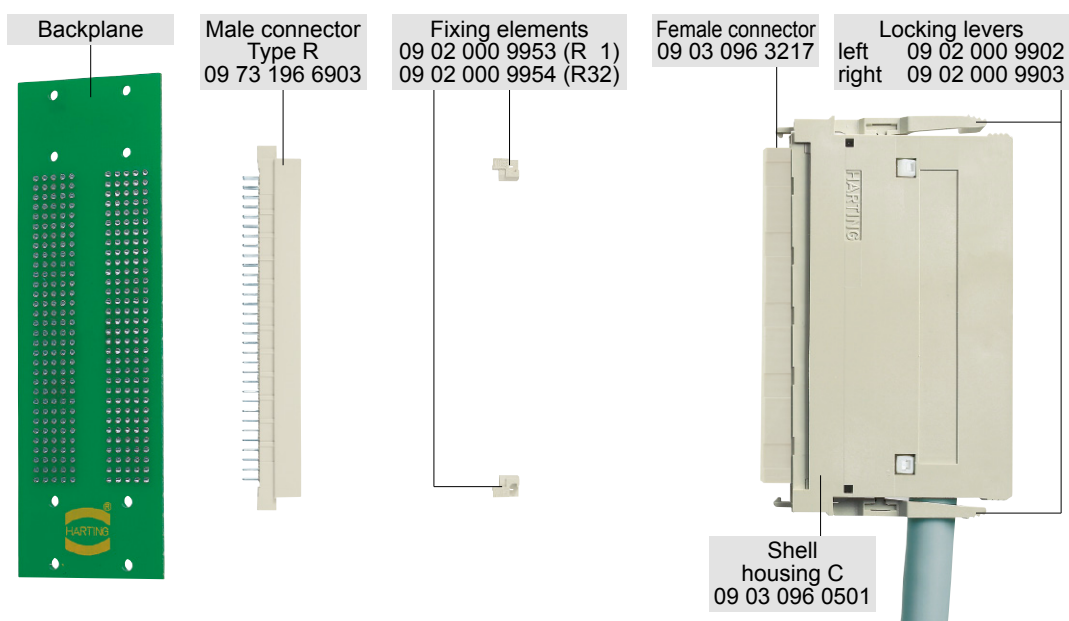


Locking levers
left 09 02 000 9902
right 09 02 000 9903

Shell housing C
09 03 096 0501

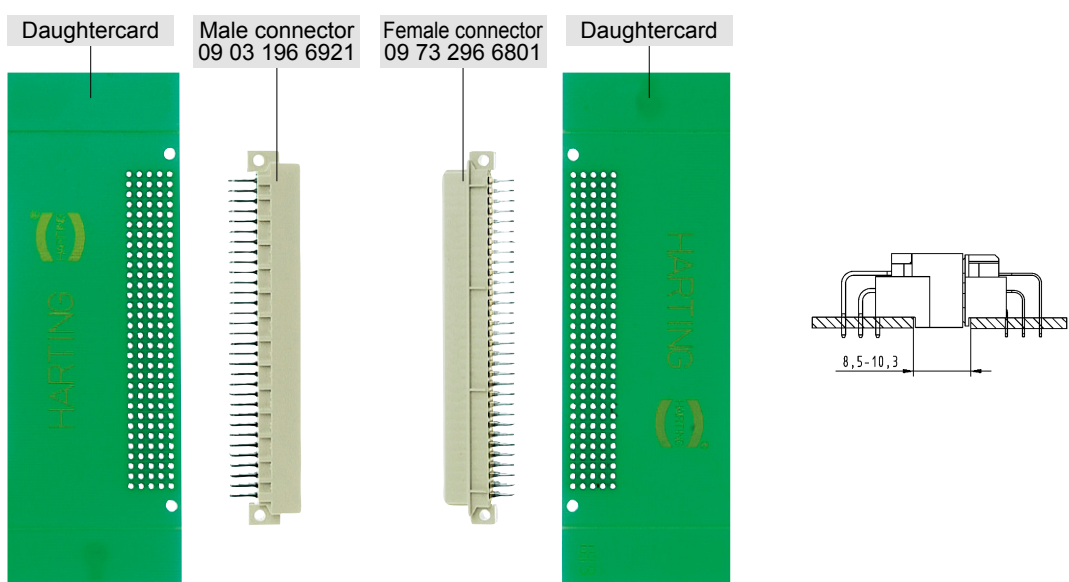


Application 4

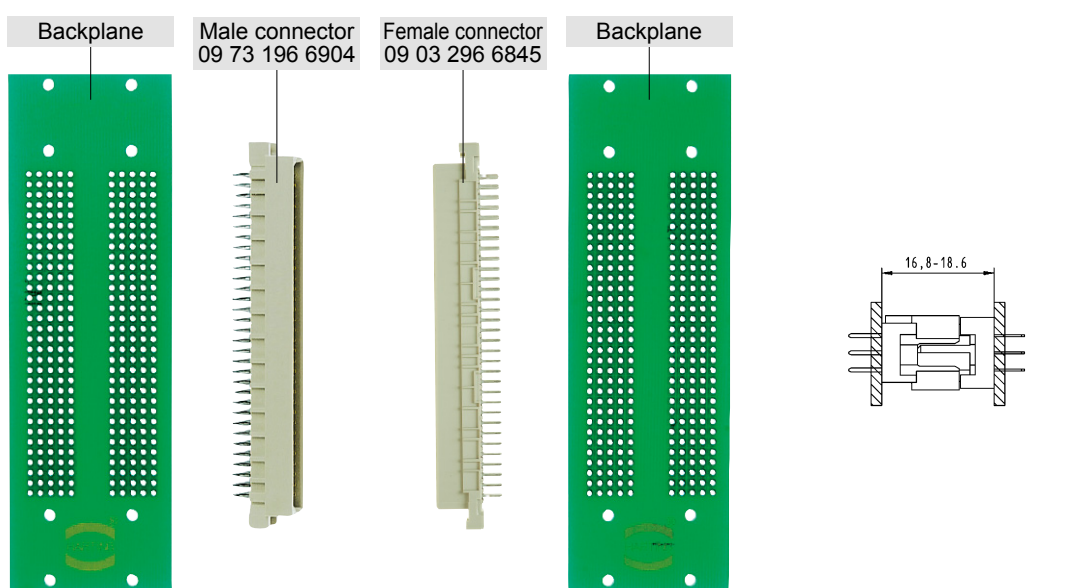


DIN Signal
up to 2 A

Application 5*

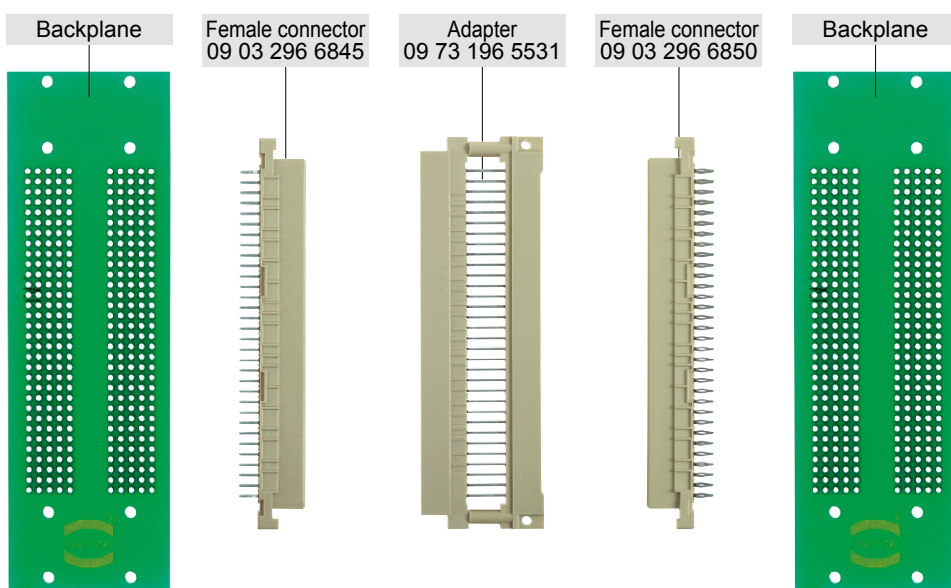
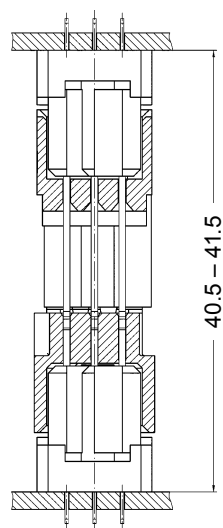


Application 6*

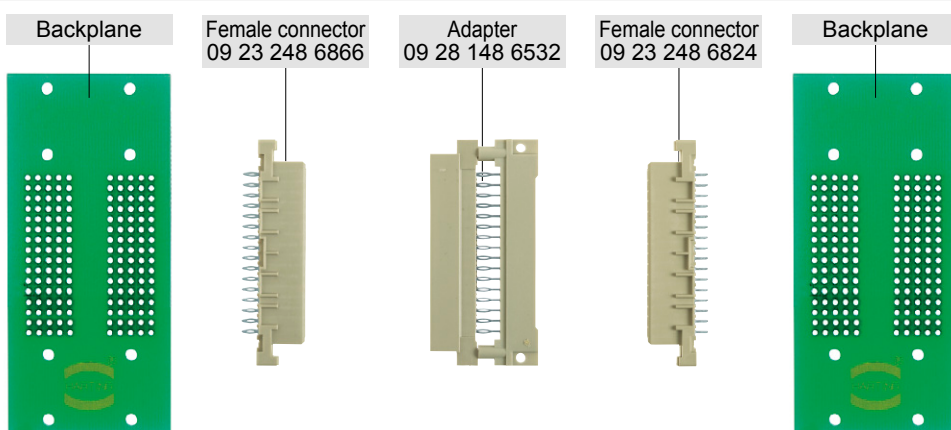
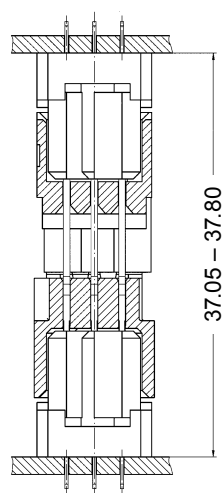


* Position marking turned: a1 contacts a32, a2 contacts a31, ...

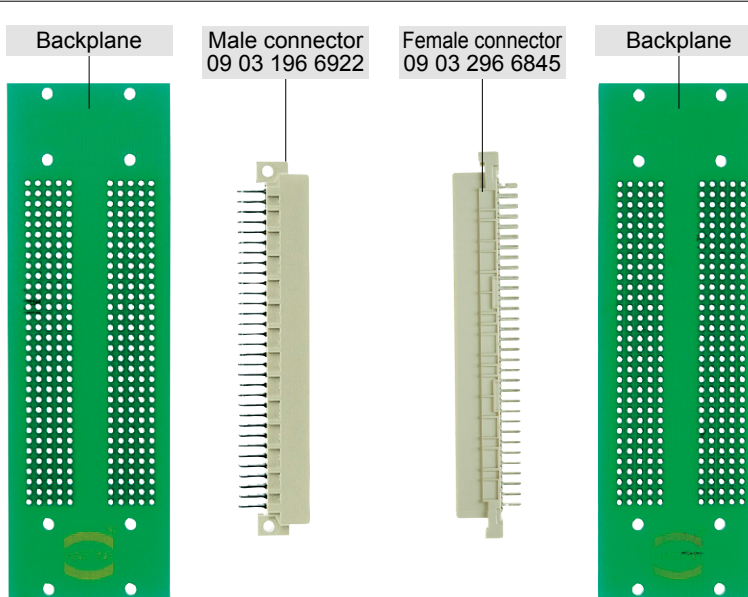
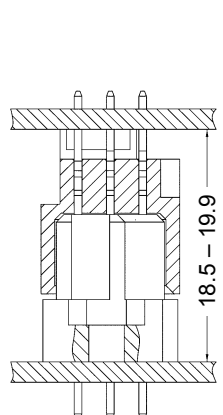
Application 7



Application 8



Application 9



harbus® 64

Page

VMEbus systems **02.02**

harbus® 64

System description **02.03**

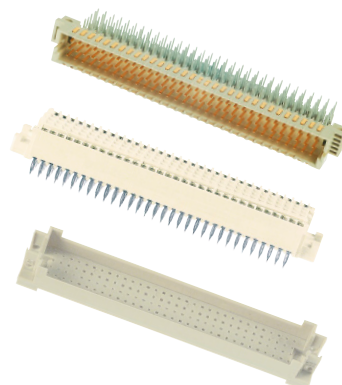
Technical characteristics **02.10**

Male connectors **02.11**

Female connectors **02.12**

Pin shrouds **02.16**

Application examples **02.17**



The past 20 years the VMEbus has reached a dominant position for industrial busses with a number of suppliers.

Despite numerous new bus systems based on the rapid changes in chip technology, VMEbus systems offer significant advantages such as their robustness, reliability and increased availability of processor, memory and I/O cards.

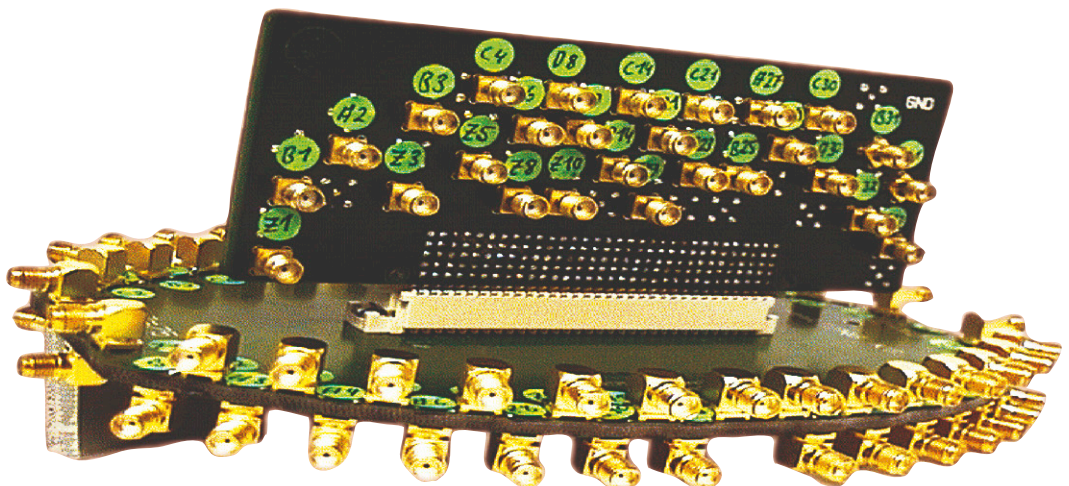
Additional advantages appear under real-time conditions, where unforeseen events have to be managed. This is realised with the program interrupt concept and variable control that closely monitors the bus system.



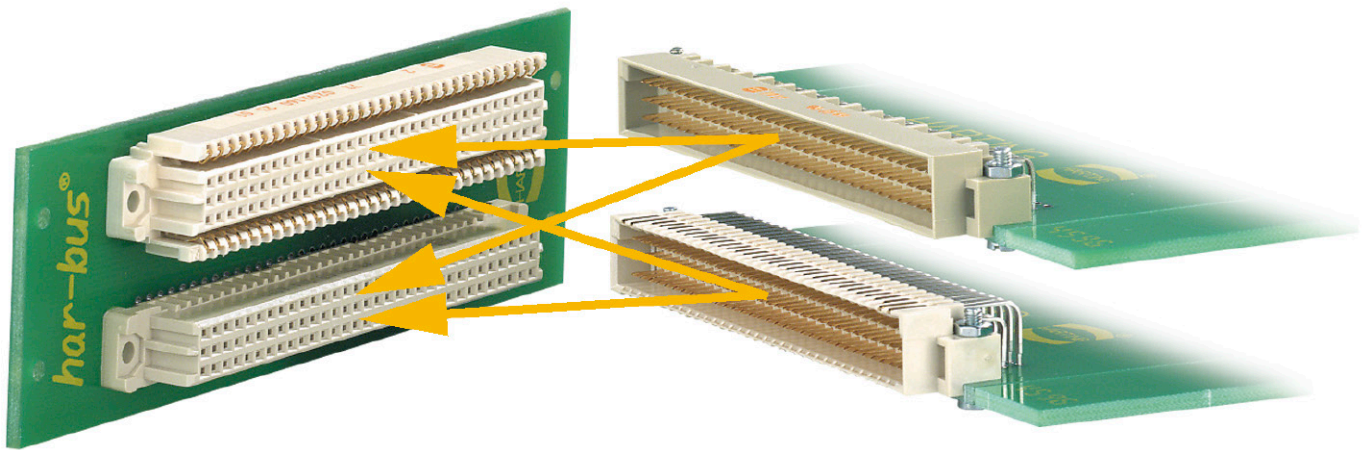
With the increase in processing speeds and data transmission rates, 3 row DIN 41612 connectors have reached their limit, so the VME standard needs to be enhanced further.

When VME architecture was increased from 8-bit to 64-bit and data transmission rates up to 160 Mbyte/s (VME 64x), HARTING introduced **harbus® 64** with 160 pins. This Eurocard connector is 100 % backwards compatible to existing 3 row connectors with 96 contacts, therefore old can plug into new.

To offer the best design possible from the start, HARTING developed spice models that were later certified via signal integrity measurements of the connector.



High precision slot structure with VME pinning for connector characterisation.

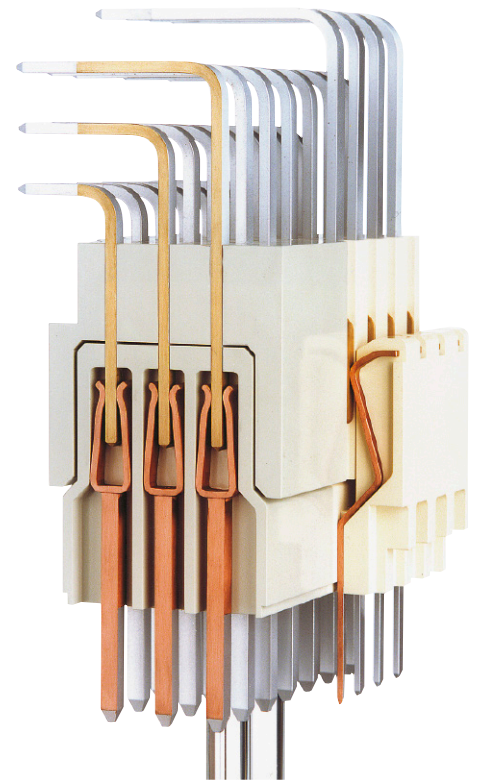


Backward compatibility

The design of **harbus® 64** female connectors allows mating of any combinations of the 5 or 3 row versions without mechanical interference, thus making it possible for users to upgrade and maintain existing systems at lower costs. It is also possible to mate 5 row male connectors with 3 row female connectors.

The feature of backward compatibility allows a gradual upgrade of existing Eurocard based systems without the additional cost of a complete system redesign. It is not necessary to replace conventional 96 pin based boards as they remain pluggable into the 160 pin based systems.

Not only VMEbus, but also existing proprietary bus systems for which 3 row 96 pin connectors are no longer performance sufficient, **harbus® 64** provides the opportunity to adapt the system economically without a complete redesign to a new bus architecture.



harbus® 64 – five rows – 160 poles

Two additional rows of contacts in the **harbus® 64** connector offer new system features:

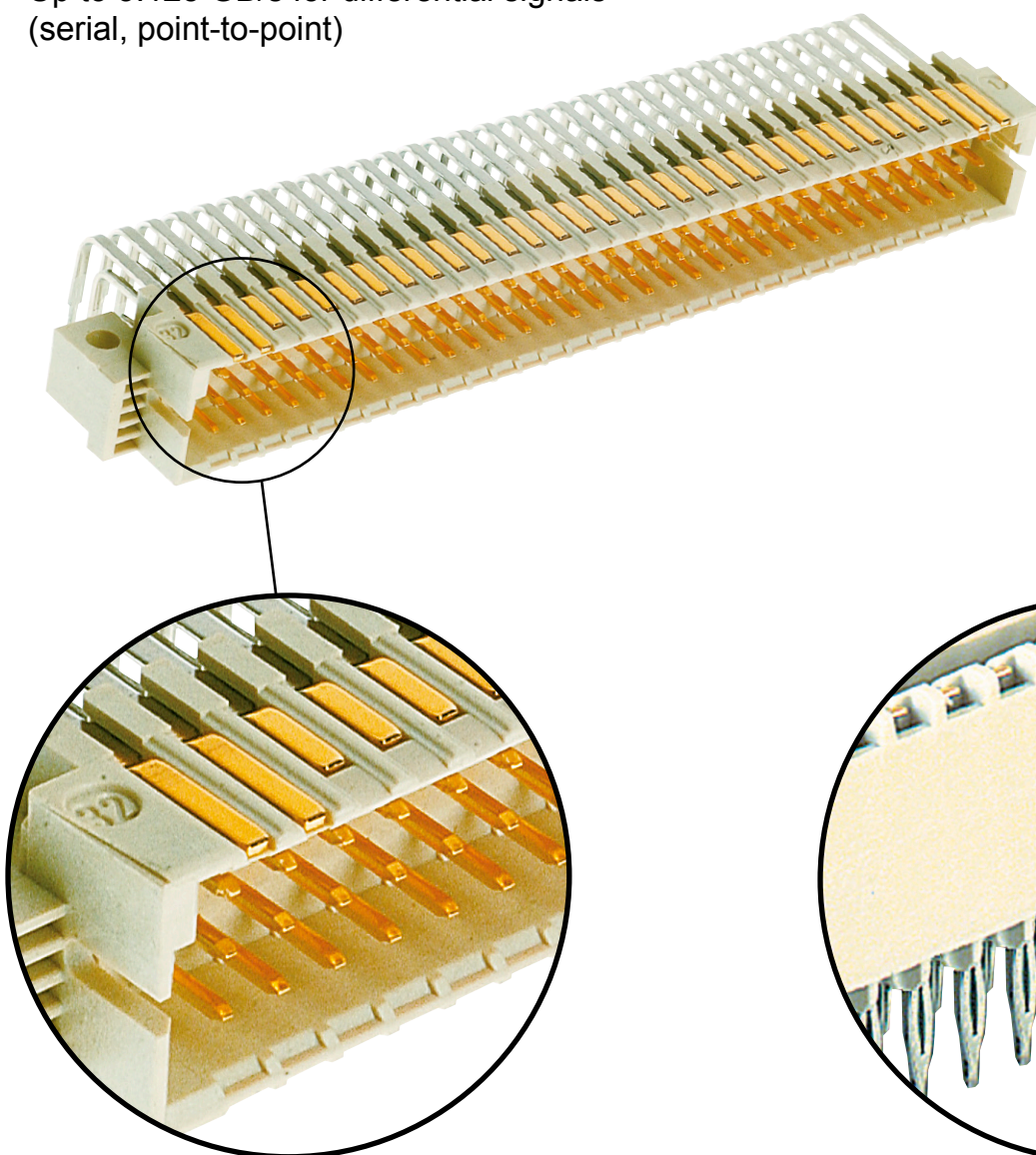
- Additional contacts for I/O and system upgrade
- New voltage supplies for 3.3 V and 48 V system components
- Identifying locations of system components and the bus length. “Plug & Play”
- Improved signal/ground ratio for reliable signal data transfer at rates up to 320 MByte/s (VMEbus) resp. 1.25 Gb/s (Gigabit Ethernet) or 3.125 Gb/s (serial point-to-point)
- Live Insertion for replacing processor or memory cards without closing down the system
- User defined pins for test and maintenance bus lines

The advantages of **harbus® 64** in detail

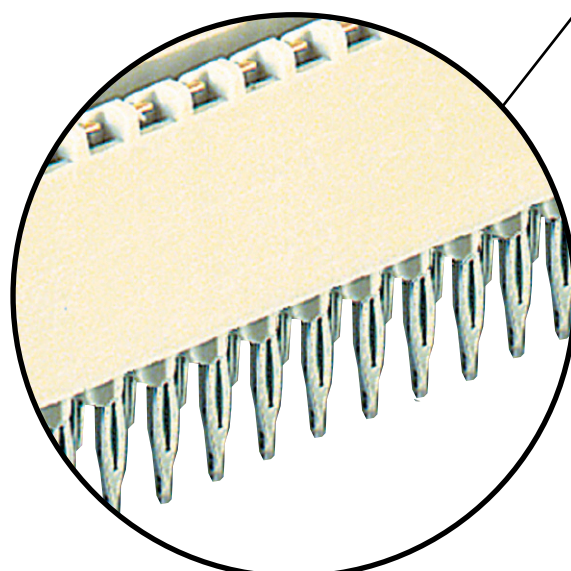
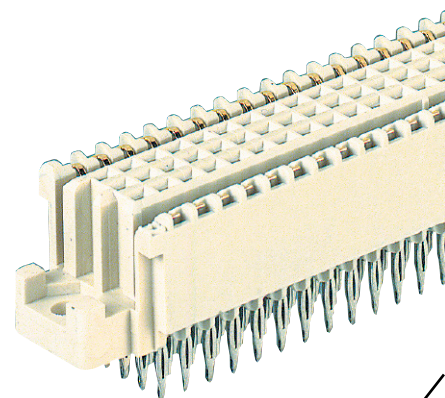
User-defined pins in the outer rows can be used for application specific functions such as **additional I/O**. Configured as a shield to provide larger ground return paths, they assure for higher **data transfer rates**:

- Up to 320 MByte/s for asynchronous signals (VMEbus)
- Up to 1.25 GB/s for Gigabit Ethernet
- Up to 3.125 GB/s for differential signals (serial, point-to-point)

Proprietary bus systems can utilise the new contact rows to optimise signal-to-ground ratios and improve system speed.



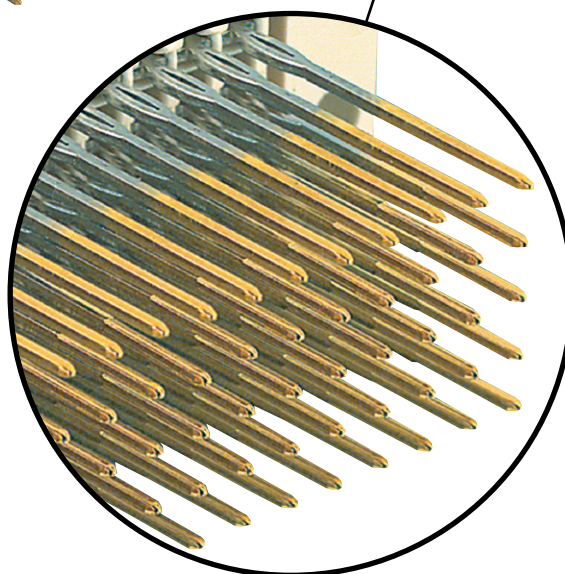
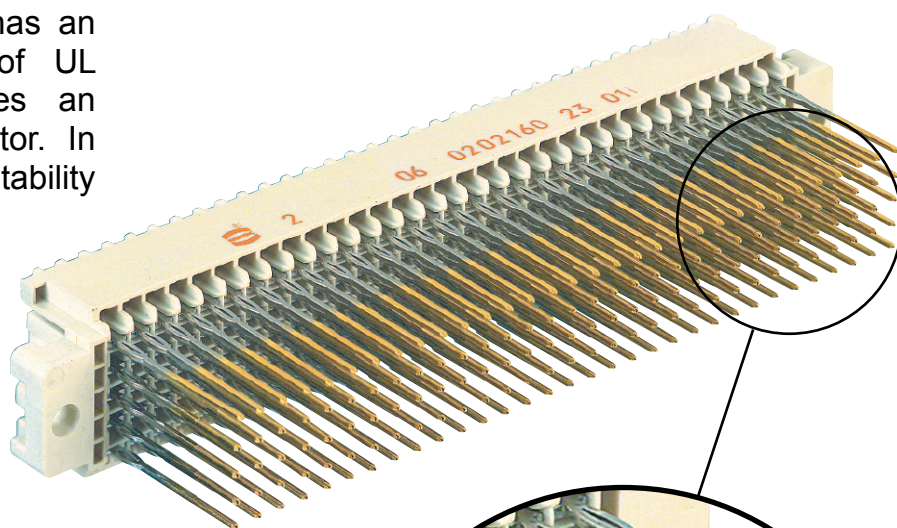
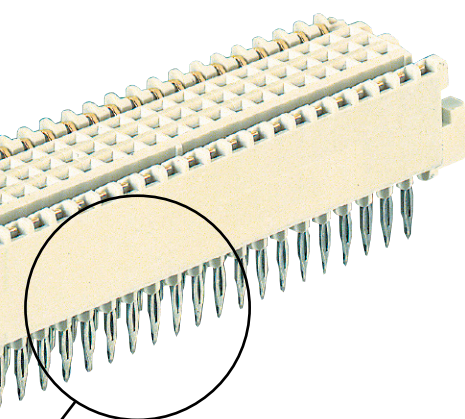
Four preleading contacts (1.5 mm) serve to pre-load the transmit and receive logic so that the bus will not experience glitches during **live insertion** of new cards into the backplane.



Backplane connector terminations are designed in solderless **press-in technology**.

The connector can be installed without any special tooling using economical **flat dies** for high speed insertion.

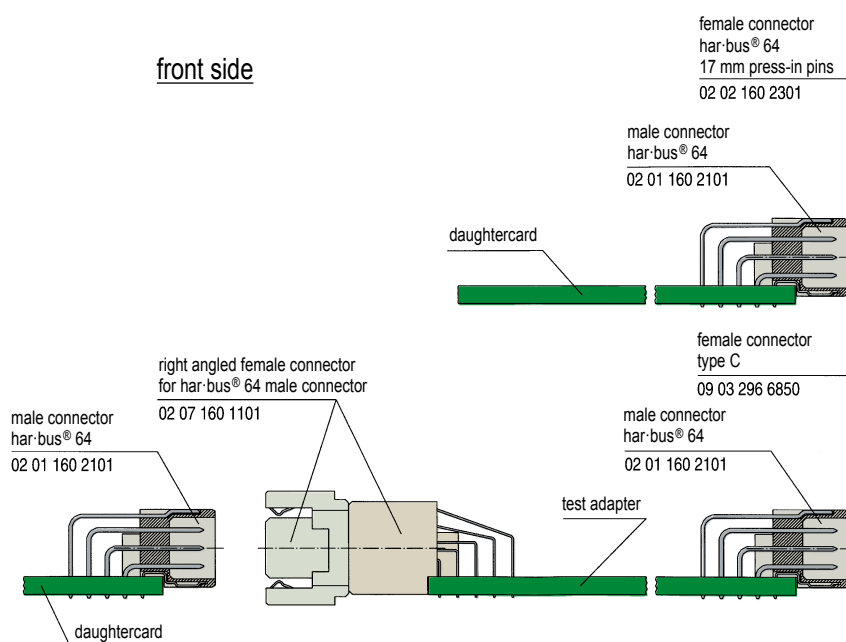
The insulator, made of LCP, has an inherent flammability rating of UL 94-V0 and therefore provides an **environment friendly** connector. In addition, the heat deformation stability of LCP makes the connector **surface-mount compatible** (see chapter 00).



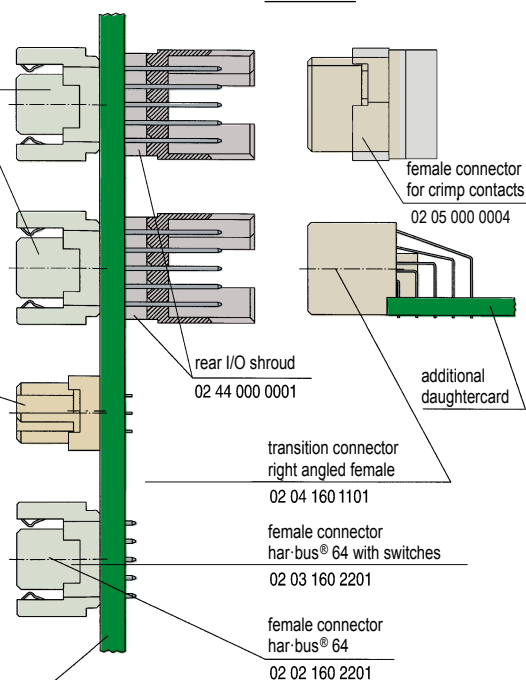
Partially gold plated terminations with precisely formed tips serve as contact area for **rear transition boards**.

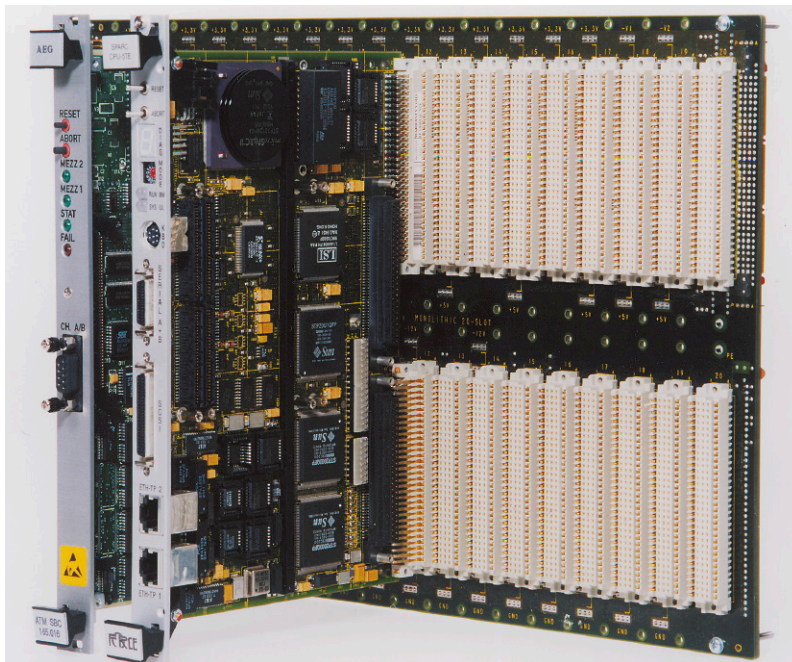
system description

front side



rear side





As a typical multiprocessor bus, VME has to distribute processor information continuously according to the right priorities.

This is done through the well known daisy-chain lines.

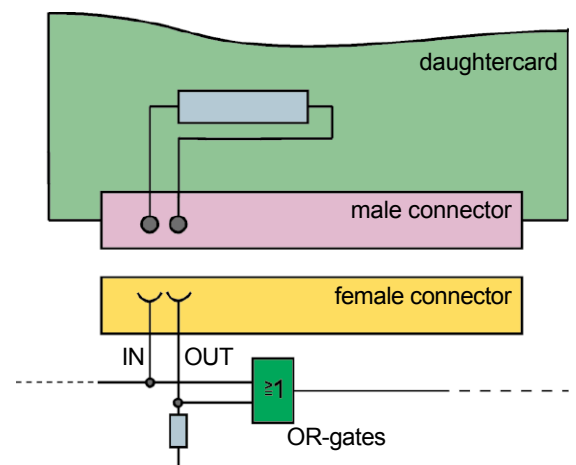
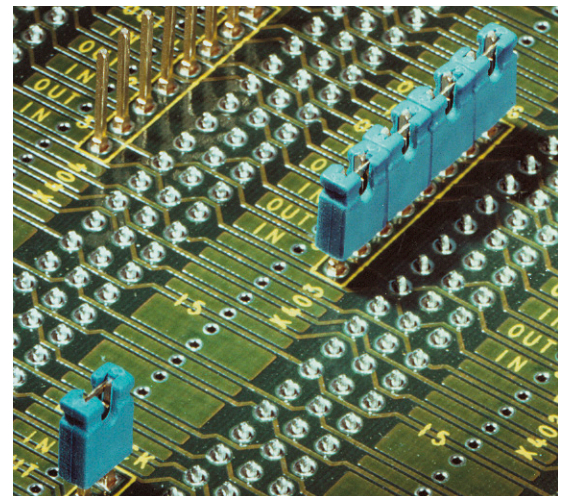
The VME protocol requests 5 daisy-chains on position 1 of every backplane.

These lines are defined to go through every daughter card.

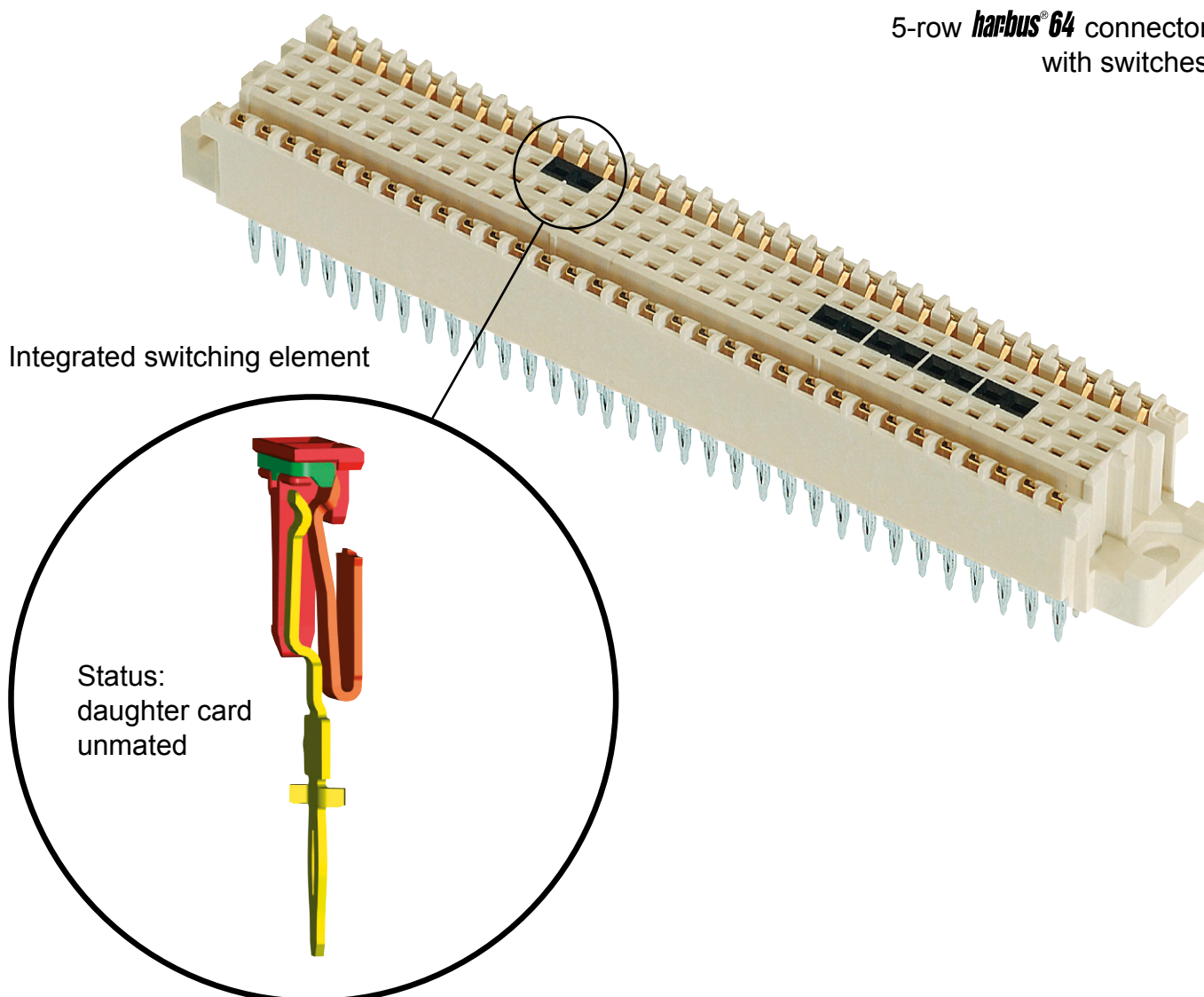
Therefore, in case of unloaded card slots the signal have to be bridged across the connector.

Bridging variants:

1. The empty card slots may be assembled with dummy cards, that bridge the daisy-chain lines.
2. Bridging can be achieved by inserting 5 jumpers on the backplane manually.
3. Bridging by using IC's with internal integration OR the function may accept automatic daisy-chaining.
4. The 5-row *har-bus*[®] 64 connector with switches allows an automatic switching. In the case of an unmated daughter card the connector bridges the signals at positions a21-22, b4-5, b6-7, b8-9 and b10-11. The switch elements open automatically when the daughter card is mated, so that the daughter card accepts the ongoing signal daisy-chain.



5-row **harbus® 64** connector
with switches



Advantages:

- Passive backplane; no active components assembled
- No additional space required, due to integrated switching function inside the connector
- No jumpers on the backplane
- User friendly regarding maintenance and repairing
- Automatically daisy-chaining through mating/unmating the daughter card
- High MTBF value
- No additional, manual bridging necessary
- Less assembly cost, no special tooling required

MEMBER
VITA
Open Standards, Open Markets

VMEbus
Technology™

Number of contacts 160

Contact spacing (mm) 2.54

Working current 1 A at 70 °C
and all contacts
are loaded

see current carrying capacity chart

Clearance and creepage distances

minimal clearance and creepage distance		distance in mm		
		rows a, b, c	rows z, d	female angled
between two rows	clearance	1.2	1.2	0.6
	creepage	1.2	1.2	0.6
between two contacts (in a row)	clearance	1.2	1.0	0.8
	creepage	1.2	1.0	0.8

Working voltage

The working voltage also depends
on the clearance and creepage
dimensions of the pcb itself and
the associated wiring

according to the safety
regulations of the equipment
Explanations see chapter 00

Test voltage $U_{r.m.s.}$ 1 kV

Contact resistance

rows a, b, c $\leq 20 \text{ m}\Omega$
rows z, d $\leq 30 \text{ m}\Omega$

Insulation resistance $\geq 10^{10} \Omega$ acc. to IEC 60512-2

Temperature range – 55 °C ... + 125 °C

for press-in termination – 40 °C ... + 105 °C

acc. to IEC 60512-11

During reflow soldering max. + 240 °C for 20 s
for THR connectors

The higher temperature limit
includes the local ambient and
heating effects of the contacts
under load

Electrical termination

Solder pins for pcb
termination $\varnothing 1.0 \pm 0.1 \text{ mm}$
according to IEC 60326-3

Crimp terminal
0.09 - 0.50 mm²

Compliant press-in
terminations

pcb thickness $\geq 1.6 \text{ mm}$
Recommended pcb holes
for press-in technology See recommendation page 00.25
in acc. to EN 60352-5

Insertion and withdrawal force $\leq 160 \text{ N}$

Materials

Mouldings

- Liquid Cristal Polymer (LCP),
for male connectors, straight
female connectors, UL 94-V0

- Thermoplastic resin
glass-fibre filled, UL 94-V0

Copper alloy

Contacts

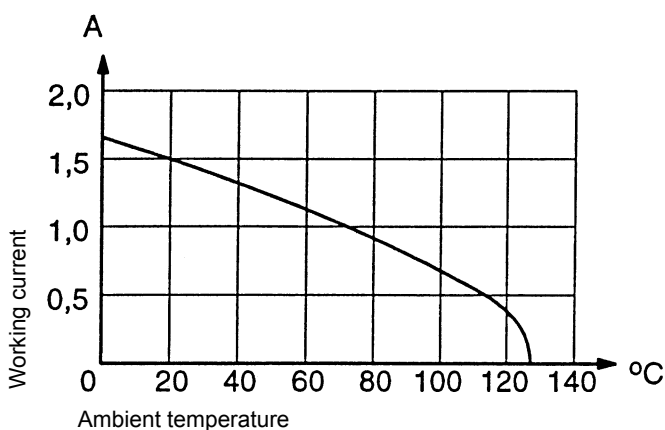
Contact surface

Contact zone Plated acc. to performance
level¹⁾

Current carrying capacity chart

The current carrying capacity is limited by maximum temperature of
materials for inserts and contacts including terminals. The current
capacity curve is valid for continuous, non interrupted current load-
ed contacts of connectors when simultaneous power on all contacts
is given, without exceeding the maximum temperature.

Control and test procedures according to DIN IEC 60512



With selective loading higher currents can be transmitted. The
requirements according to VITA 1.7 are fulfilled.

harbus® 64 with switches

Deviating technical characteristics for the switching elements.

minimal clearance and creepage distance		distance in mm
		switching positions
between two rows	clearance	0.5
	creepage	0.7
between two contacts (in a row)	clearance	0.5
	creepage	0.7

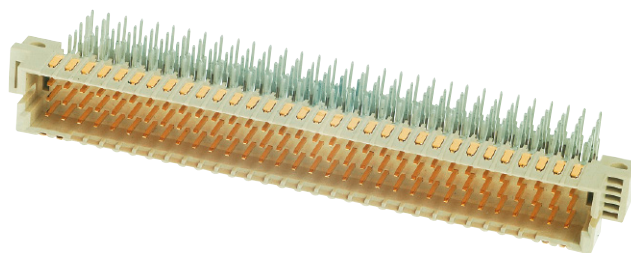
Contact resistance

Switching elements $\leq 60 \text{ m}\Omega$

Insertion and withdrawal force

Complete connector $\leq 180 \text{ N}$

160

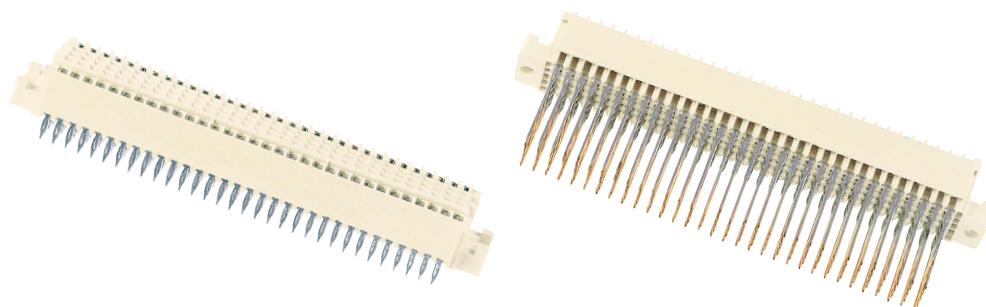


har-bus 64

02
11

²⁾ Special variant with min. 1.27 μm (50 μinch) Au and SnPb on termination

160



Identification			No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 61 076-4-113	
					2	Explanation chapter 00	
						1	
Female connectors, straight ²⁾							
with press-in terminations							
with	3.7 mm		160	z, a, b, c, d		02 02 160 1601	
fixing flange	4.5/5 mm		160	z, a, b, c, d	02 02 160 2201	02 02 160 1201	
	17 mm*		160	z, a, b, c, d	02 02 160 2301	02 02 160 1301	
without	5 mm		160	z, a, b, c, d	02 02 160 2202	02 02 160 1202	
fixing flange	17 mm*		160	z, a, b, c, d	02 02 160 2302	02 02 160 1302	
with solder pins							
	2.9 mm		160	z, a, b, c, d	02 02 160 2804		

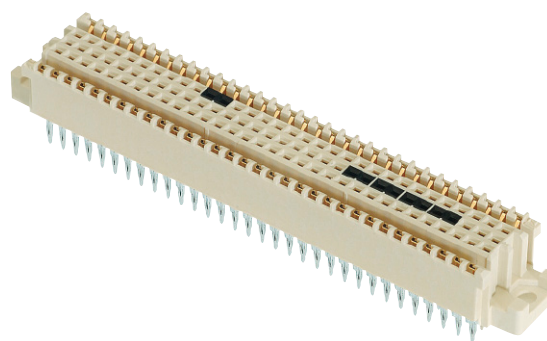
Part number	Dimension "X" for row				
	z	a	b	c	d
02 02 160 1601	3.7	3.7	3.7	3.7	3.7
02 02 160 2201 / 02 02 160 1201	5.0	4.5	4.5	4.5	5.0
02 02 160 2301 / 02 02 160 1301	17.0	17.0	17.0	17.0	17.0
02 02 160 2202 / 02 02 160 1202	5.0	5.0	5.0	5.0	5.0
02 02 160 2302 / 02 02 160 1302	17.0	17.0	17.0	17.0	17.0
02 02 160 2804	2.9	2.9	2.9	2.9	2.9

Technical drawing of a rectangular plate with a grid of holes. The drawing includes dimensions for hole diameter ($\phi 1$, $\phi 2.8$), hole spacing ($31 \times$, 90), and plate dimensions ($4 \times$, 2.54 , 32 , 1). It also shows a grid of holes with a pitch of 0.3 and a total width of 2.54 . The drawing is labeled "position" and "row".

Dimensions in mm

Number of contacts

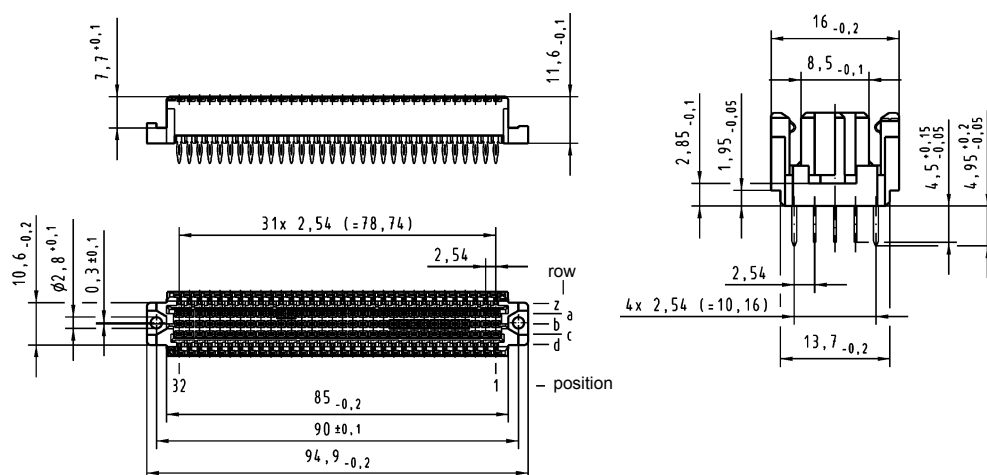
160



Female connectors

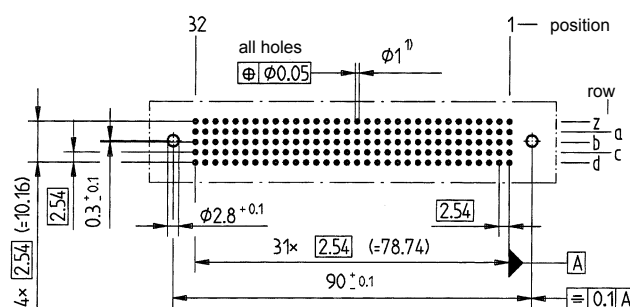
Identification	No. of contacts	Contact arrangement	Part number
Female connectors, straight with switches ²⁾			Performance level 2 according to IEC 61076-4-113 Explanation chapter 00
with press-in terminations			
with flange 4.5/5 mm	160	z, a, b, c, d	02 03 160 2201

Dimensions



Board drillings

Mounting side



Dimensions in mm

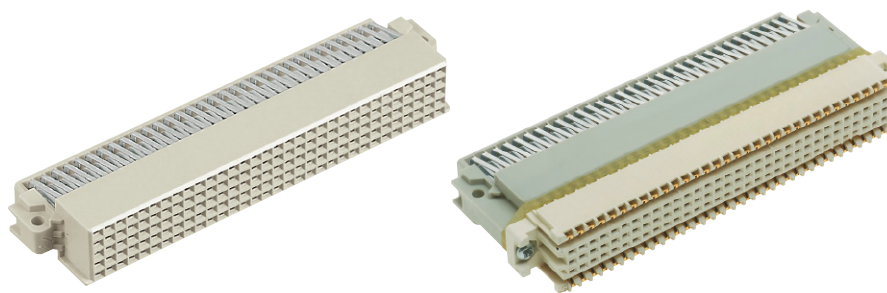
Tooling see chapter 30

¹⁾ Press-in technology see page 00.25

²⁾ Switching elements at positions a21-22, b4-5, b6-7, b8-9 and b10-11

Number of contacts

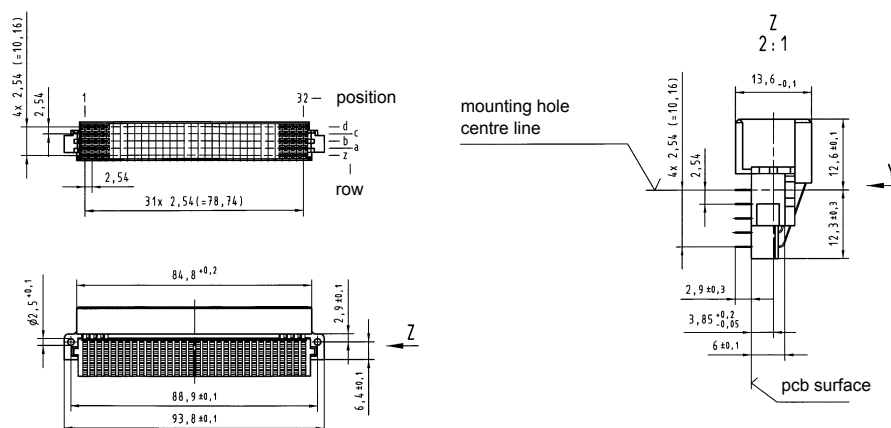
160



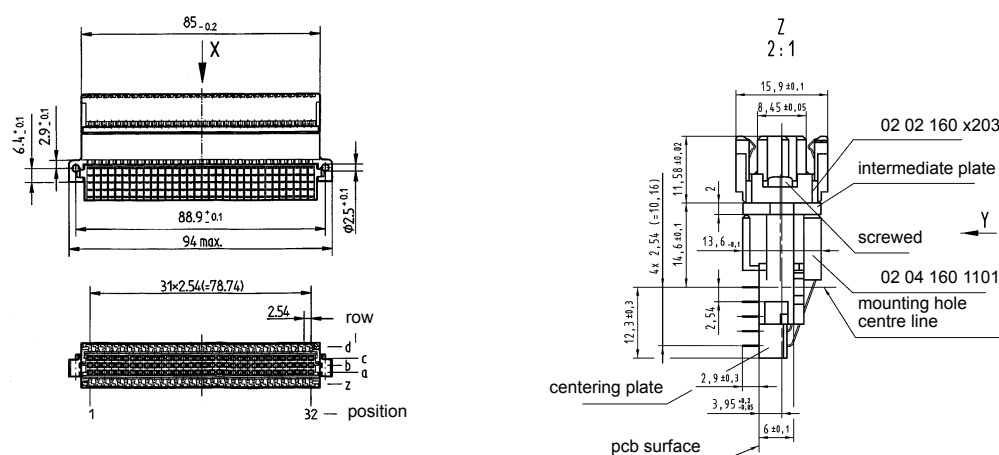
Female connectors

Identification	No. of contacts	Contact arrangement	Part number
Female connectors, angled with solder pins			Performance level 1 according to IEC 61076-4-113 Explanation chapter 00
for rear access	160	z, a, b, c, d	02 04 160 1101
for har-bus® 64 male connector	160	z, a, b, c, d	02 07 160 1101

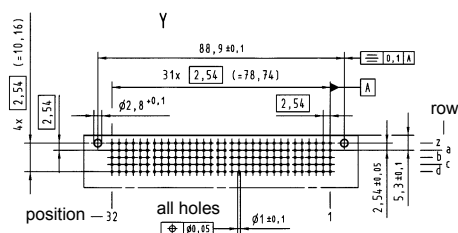
Dimensions
02 04 160 1101



Dimensions
02 07 160 1101

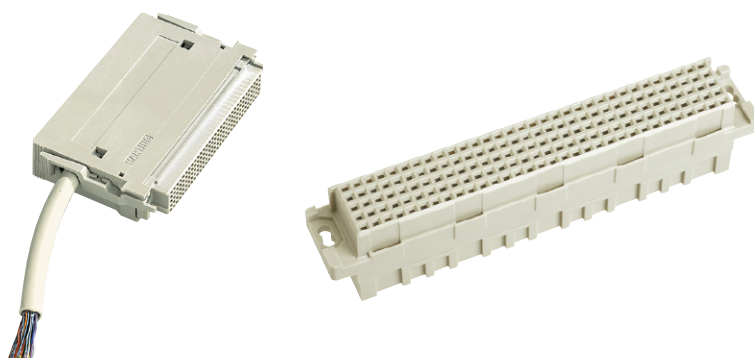


Board drillings
Mounting side



Dimensions in mm

max. 160



Identification	No. of contacts	Contact-arrangement	Suitable for	Part number
Female connector for crimp contacts order contacts separately fits into shell housing C see chapter 20	160		har-bus® 64 shroud	02 05 000 0004
	160		Male connector type R with 5 rows	02 05 000 0005
	160		Male connector type C with 5 rows	02 05 000 0003

Technical drawing of a 31x2.54mm connector. The drawing includes three views: a top view, a side view, and a cross-sectional view.

Top View Dimensions:

- Overall width: $94,9 \pm 0,1$ mm
- Internal width: $83,55 \pm 0,05$ mm
- Length: $84,94 \pm 0,05$ mm
- Pin pitch: $2,54$ mm
- Pin diameter: $\varnothing 2,85 \pm 0,05$ mm
- Pin spacing (31 pins): $31 \times 2,54 (=78,74)$ mm
- Pin diameter (4 pins): $4 \times 2,54 (=10,16)$ mm
- Pin diameter (2 pins): $2 \times 2,54 (=5,08)$ mm
- Pin diameter (1 pin): $1 \times 2,54 (=2,54)$ mm
- Pin diameter (0.3 pins): $0,3 \pm 0,1$ mm
- Pin diameter (2 pins): $2,54$ mm
- Pin diameter (4 pins): $4 \times 2,54 (=10,16)$ mm
- Pin diameter (2 pins): $2,54$ mm
- Pin diameter (1 pin): $1 \times 2,54 (=2,54)$ mm
- Pin diameter (0.3 pins): $0,3 \pm 0,1$ mm
- Pin diameter (2 pins): $2,54$ mm
- Pin diameter (4 pins): $4 \times 2,54 (=10,16)$ mm
- Pin diameter (2 pins): $2,54$ mm
- Pin diameter (1 pin): $1 \times 2,54 (=2,54)$ mm
- Pin diameter (0.3 pins): $0,3 \pm 0,1$ mm

Side View Dimensions:

- Overall height: $11,55 \pm 0,05$ mm
- Internal height: $8,94 \pm 0,05$ mm
- Pin height: $2,54$ mm
- Pin spacing (31 pins): $31 \times 2,54 (=78,74)$ mm
- Pin diameter: $\varnothing 2,85 \pm 0,05$ mm
- Pin spacing (4 pins): $4 \times 2,54 (=10,16)$ mm
- Pin diameter (2 pins): $2 \times 2,54 (=5,08)$ mm
- Pin diameter (1 pin): $1 \times 2,54 (=2,54)$ mm
- Pin diameter (0.3 pins): $0,3 \pm 0,1$ mm
- Pin diameter (2 pins): $2,54$ mm
- Pin diameter (4 pins): $4 \times 2,54 (=10,16)$ mm
- Pin diameter (2 pins): $2,54$ mm
- Pin diameter (1 pin): $1 \times 2,54 (=2,54)$ mm
- Pin diameter (0.3 pins): $0,3 \pm 0,1$ mm

Cross-sectional View Dimensions:

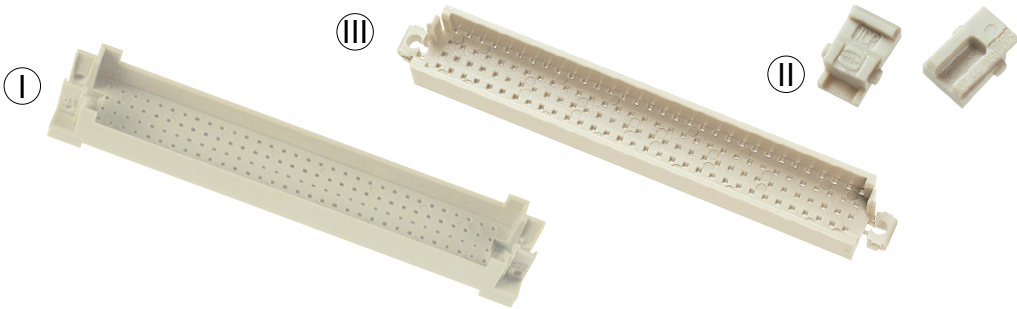
- Overall width: $15,65 \pm 0,05$ mm
- Internal width: $13,55 \pm 0,05$ mm
- Pin height: $15,05 \pm 0,1$ mm

Identification		Part number	Performance levels according to IEC 61076-4-113.	Explanation chapter 00
		2	1	
Female crimp contacts har-bus® 64				
Bandoliered contacts (approx. 5,000 pieces)		02 05 000 2511	02 05 000 1511	
Bandoliered contacts (approx. 500 pieces)		02 05 000 2512	02 05 000 1512	
Individual contacts ¹⁾		02 05 000 2513	02 05 000 1513	

		Wire gauge mm² AWG Insulation ø mm 0.09 - 0.5 28 - 20 0.7 - 1.5 3.5 + 0.5 mm of insulation is stripped For the fabrication in line with the specification please use exclusively crimp tools approved by HARTING (see DIN EN 60352-2) Insertion, removal and crimping tools see chapter 30	Bandoliered contacts  Individual contacts 
--	--	--	--

Number of contacts

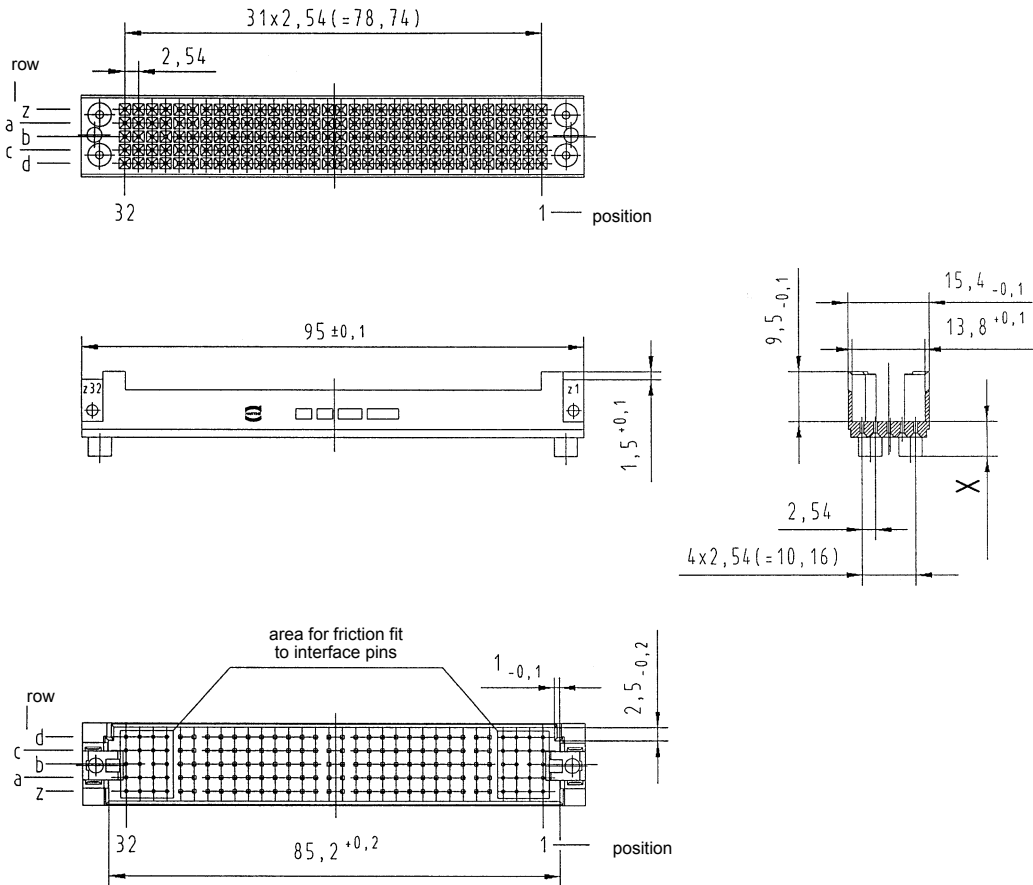
160



Pin shrouds

Identification	pcb-thickness ± 0.3	Dimension X - 0.1	Part number
Pin shrouds ¹⁾			
Ⓘ	1.6	7.8	02 44 000 0012
	2.2	7.2	02 44 000 0011
	2.8	6.6	02 44 000 0007
	3.4	6.0	02 44 000 0001
	4.0	5.4	02 44 000 0002
	4.6	4.8	02 44 000 0003
	5.2	4.2	02 44 000 0004
	5.8	3.6	02 44 000 0005
	6.4	3.0	02 44 000 0006
Ⓜ Fixing brackets for shell housing C ²⁾			02 44 000 0009
Ⓜ Shroud insert for 3 row female connectors			02 44 000 0008

Dimensions



Dimensions in mm

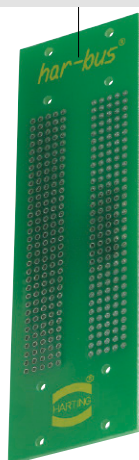
¹⁾ Insert block (02 09 000 0012) for assembly see chapter 30
²⁾ order 2 pieces per connector

Application 1*

Female connector
02 02 160 2301



Backplane



Pin shroud
02 44 000 0007



Fixing brackets
02 44 000 0009



Shell housing C
09 05 048 0501



Female connector
with crimp contacts
02 05 000 0004

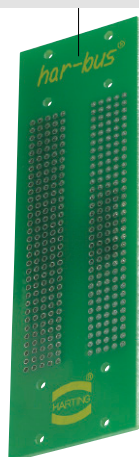
Locking lever
left 09 02 000 9902
right 09 02 000 9903

Application 2*

Female connector
02 02 160 2301



Backplane



Pin shroud
02 44 000 0007



Locking lever
09 03 000 9913



Female connector
for crimp contacts
02 05 000 0004

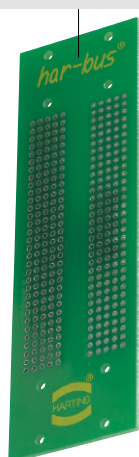


Application 3

Female connector
02 02 160 2301



Backplane



Pin shroud
02 44 000 0007



Shroud insert
02 44 000 0008



Female connector
09 73 296 6801

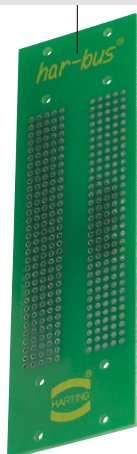


Application 4

Female connector
02 02 160 2301



Backplane



Pin shroud
02 44 000 0007



Screw
M 2.5 x 30



Female connector
for crimp contacts
02 05 000 0004



Types D, E, F, FM, 2F, F9, interface connectors I

Page

Technical characteristics types D and E **03.10**

Type D connectors **03.11**



Type E connectors **03.15**



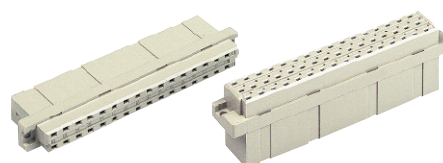
Pin shrouds for type E **03.20**



Application examples type E **03.21**

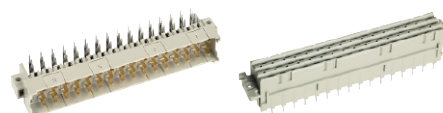
Technical characteristics piggyback connectors **03.22**

Piggyback connectors **03.23**



Technical characteristics types F, F9, FM and 2F **03.26**

Type F connectors **03.27**



Pin shrouds for type F **03.36**

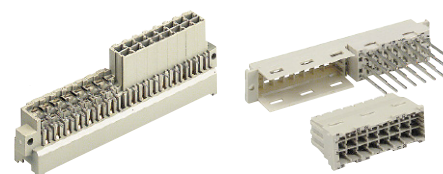


Application examples type F **03.38**

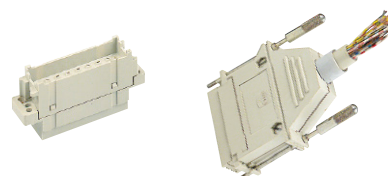
Type F9 connectors **03.41**



Type FM connectors **03.42**



Type 2F connectors **03.44**



Number of contacts

Type D	32
Type E	48

Contact spacing (mm)

Type D	5,08	
Type E	male connector	5.08 x 5.08
	male connector	2.54 x 5.08
	female connector	5.08 x 5.08

Working current

see current carrying capacity chart
6 A max.
1 A max. for female connector type E angled

Clearance

Types D and E
Type E male connector
row separation 2.54 mm
≥ 3.0 mm
≥ 1.6 mm

Creepage

≥ 3.0 mm

Working voltage

The working voltage also depends on the clearance and creepage dimensions of the pcb itself and the associated wiring
according to the safety regulations of the equipment
Explanations see chapter 00

Test voltage $U_{r.m.s.}$

1.55 kV

Contact resistance

≤ 15 mΩ
≤ 20 mΩ for female connector type E angled

Insulation resistance

≥ 10¹² Ω for standard articles
≥ 10¹¹ Ω for special NFF articles (with part-no. ending 222)

Temperature range

The higher temperature limit includes the local ambient and heating effects of the contacts under load
– 55 °C ... + 125 °C
– 40 °C ... + 105 °C for press-in connectors

Degree of protection for crimp terminal according to DIN 40 050

IP20

Electrical termination

Solder pins for pcb connections Ø 1.0 ± 0.1 mm according to IEC 60 326-3
Wrap posts 1 x 1 mm diagonal 1.34-1.45 mm
Angled solder pins 1 x 1 mm for pcb connections Ø 1.6 ± 0.1 mm
Solder lugs
Crimp terminal 0.09-1.5 mm²
Compliant press-in terminations
PCB thickness
Recommended PCB holes for press-in technology
≥ 1.6 mm
see recommendation page 00.25 in acc. to EN 60 352-5

Insertion and withdrawal force

32 way ≤ 40 N
48 way ≤ 75 N

Materials

Mouldings

Thermoplastic resin, glass-fibre filled, UL 94-V0
Copper alloy

Contact surface

Contact zone

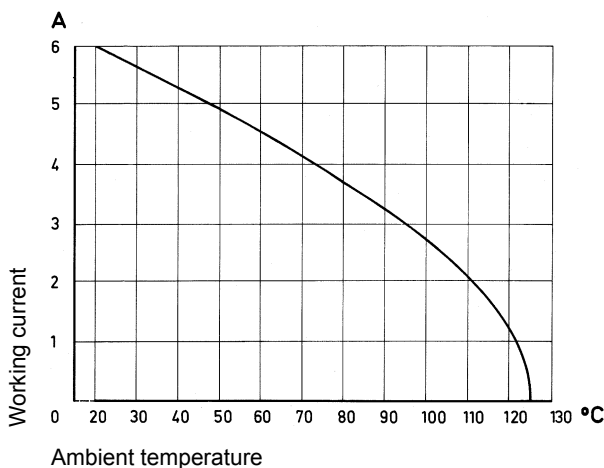
Selectively gold plated according to performance level¹⁾

¹⁾ Explanation of performance levels see chapter 00

Current carrying capacity

The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current load-ed contacts of connectors when simultaneous power on all contacts is given, without exceeding the maximum temperature.

Control and test procedures according to DIN IEC 60 512

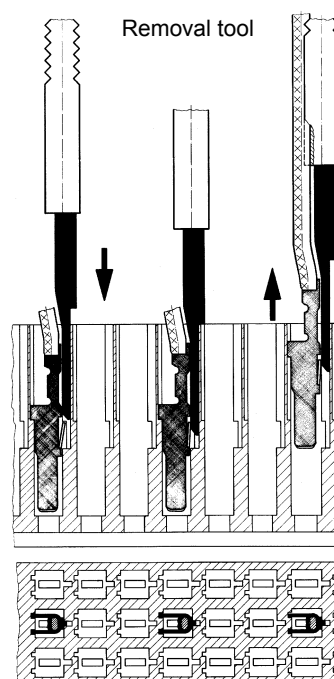


Fitting the crimp contacts

After crimping the wires onto the contacts with the help of a crimping tool or an automatic crimping machine the contacts should be correctly oriented and inserted into the cavities of the connector moulding in the required configuration. They snap into position and are firmly held in place. A light pull on the wire assures the correct tensile strength of the contact. When using stranded wires with a gauge below 0.37 mm² an insertion tool is necessary.

Removing the crimp contacts

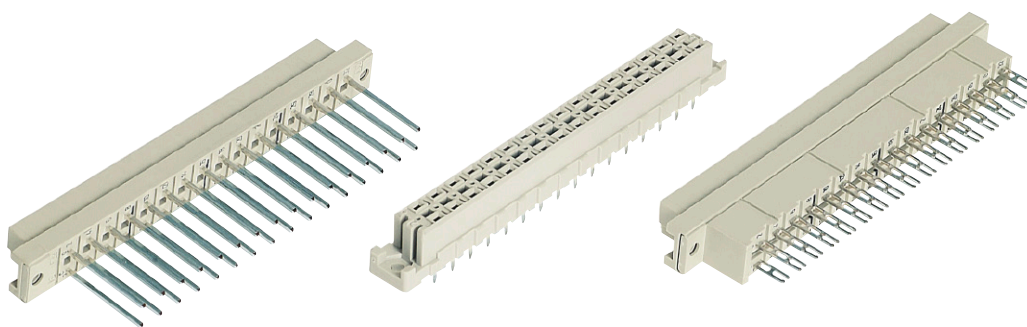
The removal tool is inserted into a slot on the termination side of the respective crimp cavity. This action compresses the contact retaining spring therefore the contact can then be easily withdrawn using a light pull on the wire. This action will cause no damage to the contact/wire which can be repositioned/refitted as necessary. The drawing demonstrates the crimp removal procedure (max. 5x).



Number of contacts

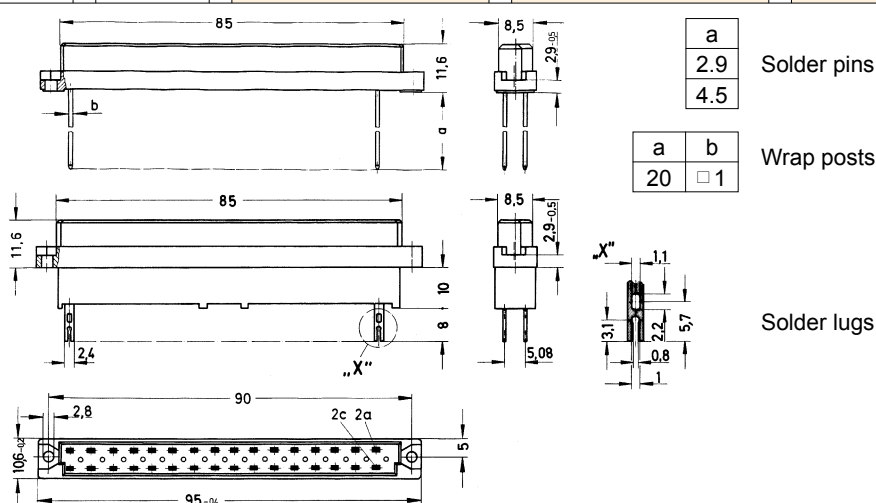
32

Female connectors

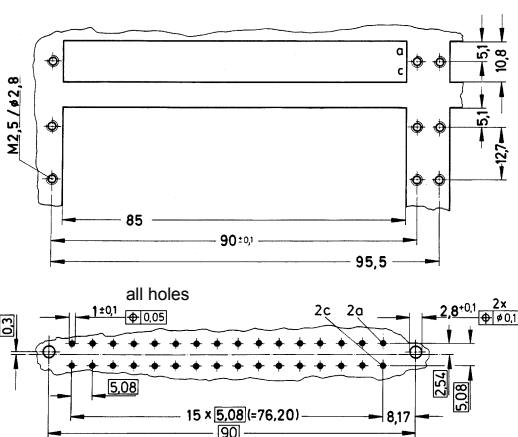
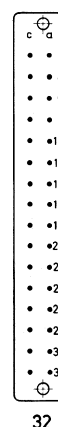


Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1	
Female connector with solder pins 2.9 mm	32		09 04 232 7832	09 04 232 6832 09 04 732 6832 ^{c)}	09 04 232 2832	
Female connector with solder pins 4.5 mm	32		09 04 232 7831	09 04 232 6831 09 04 332 6831 ^{b)} 09 04 732 6831 ^{c)}	09 04 232 2831	
Female connector with wrap posts 20 mm	32		09 04 232 7821	09 04 232 6821 09 04 732 6821 ^{c)}	09 04 232 2821	
Female connector with solder lugs	32		09 04 232 7823	09 04 232 6823	09 04 232 2823	

Dimensions



Panel cut out

Contact arrangement
View from termination side

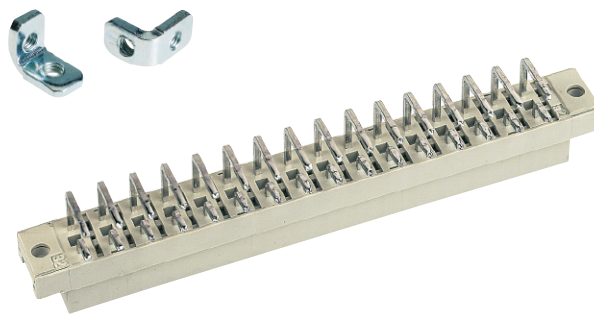
Dimensions in mm

b) Connectors with snap-in clips see chapter 00

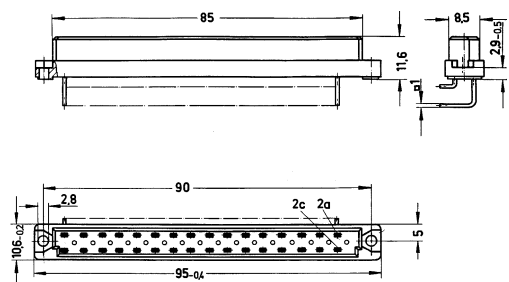
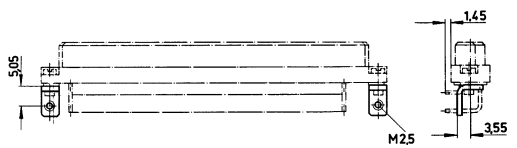
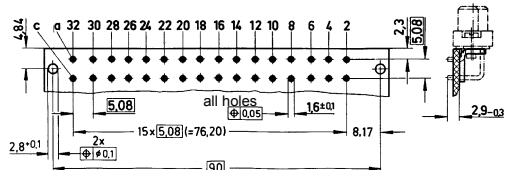
c) Connectors with coding see chapter 00

Number of contacts

32



Female connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
				2	1
Female connector with angled solder pins 1 x 1 mm	32			09 04 232 6826	09 04 232 2826
Dimensions					
Fixing bracket Metal			09 06 000 9912 ¹⁾		
Board drillings Mounting side					

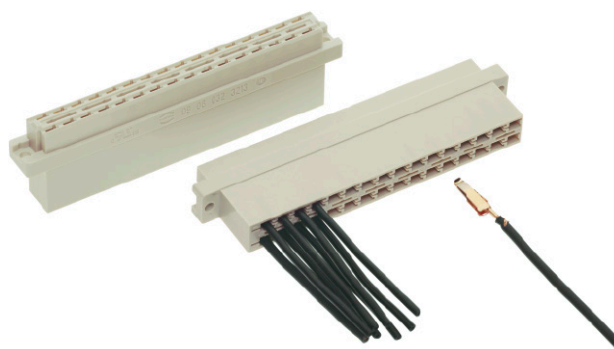
¹⁾ order 2 pieces for one connector

Dimensions in mm

DIN Power
up to 6 A

Number of contacts

max. 32

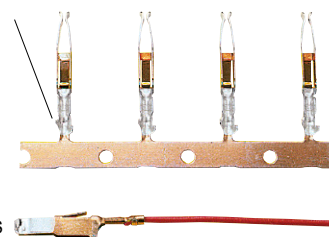


Female connectors

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for crimp contacts Order contacts separately	32	09 04 032 3213 ^{f)}		
	32	09 04 532 3213 ^{c)} f)		
Shell housing 09 03 096 0501 see chapter 20				

Identification	Identification Wire gauge	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00
Female crimp FC contacts			2
Bandoliered contacts (approx. 2,500 pieces)	1	09 06 000 6484	09 06 000 6474
	2	09 06 000 6481	09 06 000 6471
	3	09 06 000 6482	09 06 000 6472
Bandoliered contacts (approx. 250 pieces)	1	09 06 000 7484	09 06 000 7474
	2	09 06 000 7481	09 06 000 7471
	3	09 06 000 7482	09 06 000 7472
Individual contacts ¹⁾	1	09 06 000 8484	09 06 000 8474
	2	09 06 000 8481	09 06 000 8471
	3	09 06 000 8482	09 06 000 8472
Female contacts with solder lugs ²⁾ (lockable)			09 06 000 6420

FC 1	FC 2	FC 3	Wire gauge mm ²	AWG	Insulation ø mm	Identification
			0.09 - 0.25	28 - 24	0.7 - 1.5	
			0.14 - 0.56	26 - 20	0.8 - 2.0	
			0.5 - 1.5	20 - 16	1.6 - 2.8	
			3.5 + 0.5 mm of insulation is stripped from the wires to be crimped			Bandoliered contacts
			For the fabrication in line with the specification please use exclusively crimp tools approved by HARTING (see DIN EN 60352-2)			Individual contacts
			Insertion, removal and crimping tools see chapter 30			



1) Packaging unit 1,000 pieces

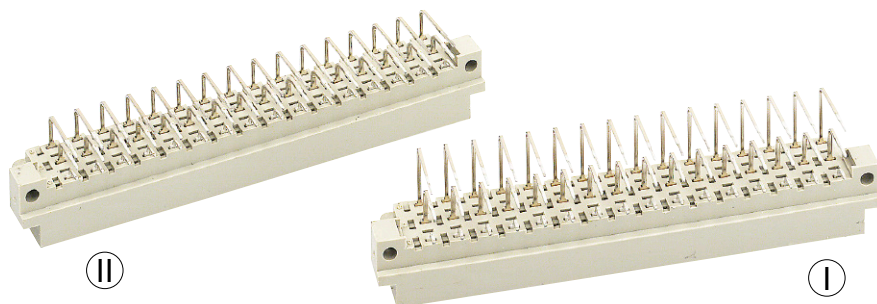
2) Solder contacts must not be used together with shell housing A. Special contact surface: 2 µm gold.

c) Connectors with coding see chapter 00

f) Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

48



Male connectors

Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1	
Male connector with angled solder pins Row separation termination side 5.08 mm Ⅰ Row separation termination side 2.54 mm Ⅱ THR	48		09 05 148 7921	09 05 148 6921 09 05 348 6921 ^{b)} 09 05 648 6921 ^{c)} 09 05 848 6921 ^{b)c)}	09 05 148 2921 09 05 648 2921 ^{c)}	
	46 + 2▲			09 05 148 6951		
	48		09 05 148 7931	09 05 148 6931 09 05 348 6931 ^{b)} 09 05 648 6931 ^{c)}	09 05 148 2931	
	48			09 05 148 6920 ^{d)} 09 05 348 6920 ^{b)d)}		
	46 + 2▲			09 05 148 6961		
Dimensions						
Board drillings Mounting side						

Dimensions in mm

Dimensions in mm

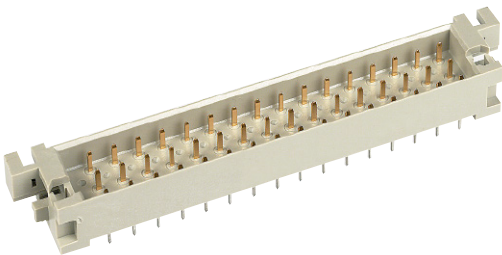
▲ Male connectors with 2 leading contacts [(0.8 mm) pos. a2 and a32]
Other contact arrangements on request

^{b)} Connectors with snap-in clips see chapter 00
^{c)} Connectors with coding see chapter 00
^{d)} CTI > 400

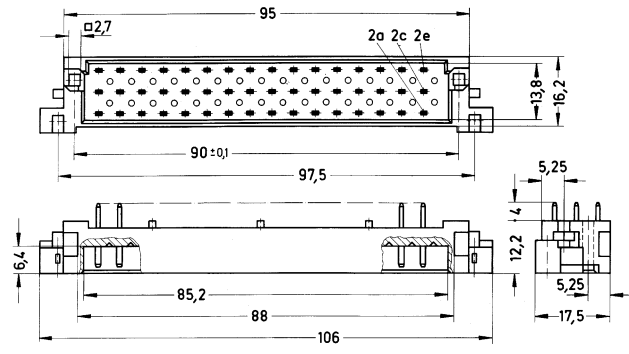
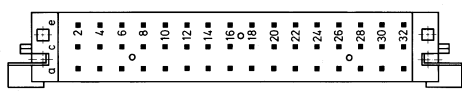
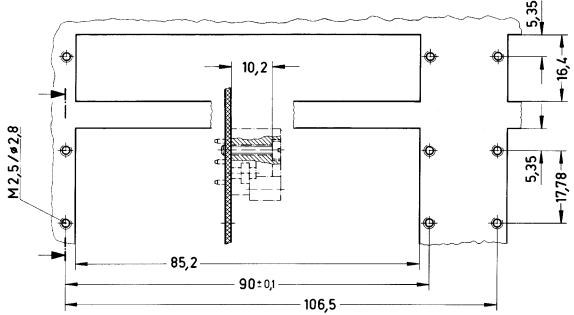
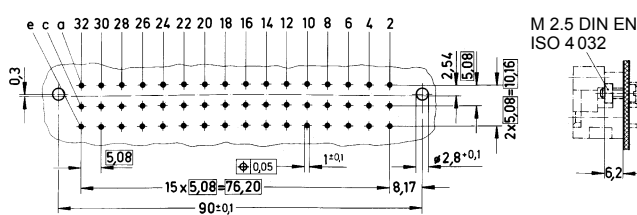
DIN Power
up to 6 A

Number of contacts

48



Interface connector I

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Interface connector I with solder pins 0.6 x 0.6 mm	48	Performance level 2 acc. to IEC 60 603-2 09 05 048 6924 ^{f)}	 Contact arrangement View from termination side 	
Panel cut out				
Board drillings Mounting side				

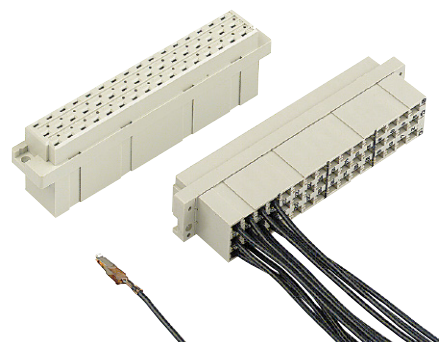
^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

DIN Power
up to 6 A

Number of contacts

max. 48

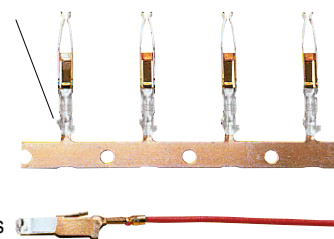
Female connectors



Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for crimp contacts Order contacts separately	48	09 05 048 3202 ¹⁾ 09 05 548 3202 ^{c)}	Contact arrangement View from termination side Shell housing 09 05 048 0501 see chapter 20	

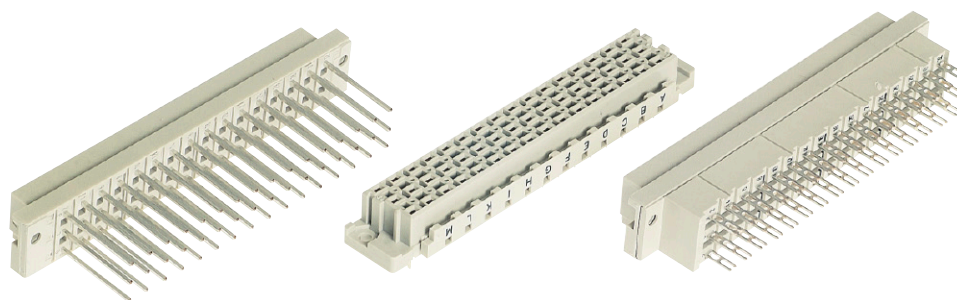
Identification	Identification Wire gauge	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00
Female crimp FC contacts			1
Bandoliered contacts (approx. 2,500 pieces)	1 2 3	09 06 000 6484 09 06 000 6481 09 06 000 6482	09 06 000 6474 09 06 000 6471 09 06 000 6472
Bandoliered contacts (approx. 250 pieces)	1 2 3	09 06 000 7484 09 06 000 7481 09 06 000 7482	09 06 000 7474 09 06 000 7471 09 06 000 7472
Individual contacts ¹⁾	1 2 3	09 06 000 8484 09 06 000 8481 09 06 000 8482	09 06 000 8474 09 06 000 8471 09 06 000 8472
Female contacts with solder lugs ²⁾ (lockable)			09 06 000 6420

		Wire gauge mm ²	AWG	Insulation ø mm	Identification
FC 1	1	0.09 - 0.25	28 - 24	0.7 - 1.5	
FC 2	2	0.14 - 0.56	26 - 20	0.8 - 2.0	
FC 3	3	0.5 - 1.5	20 - 16	1.6 - 2.8	
3.5 + 0.5 mm of insulation is stripped from the wires to be crimped					Bandoliered contacts
For the fabrication in line with the specification please use exclusively crimp tools approved by HARTING (see DIN EN 60352-2)					Individual contacts
Insertion, removal and crimping tools see chapter 30					

^{c)} Connectors with coding see chapter 00^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2¹⁾ Packaging unit 1,000 pieces²⁾ Solder contacts must not be used together with shell housing A. Special contact surface: 2 µm gold.

Number of contacts

48



Female connectors

Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60603-2. 2	Explanation chapter 00 1												
Female connector with solder pins 2.9 mm	48		09 05 248 7832	09 05 248 6832	09 05 248 2832												
4.5 mm	48			09 05 248 6831 09 05 348 6831 ^{b)} 09 05 748 6831 ^{c)} 09 05 848 6831 ^{b)c)}	09 05 248 2831 09 05 748 2831 ^{c)}												
Female connector with wrap posts 20 mm	48		09 05 248 7821	09 05 248 6821	09 05 248 2821												
Female connector with solder lugs	48		09 05 248 7823	09 05 248 6823	09 05 248 2823												
Female connector with press-in pins 4.5 mm	48				09 05 248 2854												
11.5 mm	48			09 05 248 6851●	09 05 248 2851●												
Dimensions	<table><tr><th>a</th><th>b</th></tr><tr><td>2.9</td><td>0.8 x 0.53</td></tr><tr><td>4.5</td><td>0.8 x 0.53</td></tr><tr><td>20</td><td>□ 1</td></tr><tr><td>4.5</td><td>0.6 x 0.6</td></tr><tr><td>11.5</td><td>0.6 x 0.6</td></tr></table> Solder pins Wrap posts Press-in pins Solder lugs					a	b	2.9	0.8 x 0.53	4.5	0.8 x 0.53	20	□ 1	4.5	0.6 x 0.6	11.5	0.6 x 0.6
a	b																
2.9	0.8 x 0.53																
4.5	0.8 x 0.53																
20	□ 1																
4.5	0.6 x 0.6																
11.5	0.6 x 0.6																
Board drillings Mounting side	<table><tr><th></th><th>Y</th></tr><tr><td>Solder</td><td>1 ± 0.1</td></tr><tr><td>Press-in</td><td>see recommendation page 00.25</td></tr></table> Dimensions in mm						Y	Solder	1 ± 0.1	Press-in	see recommendation page 00.25						
	Y																
Solder	1 ± 0.1																
Press-in	see recommendation page 00.25																

• Wrap posts for interfacing selectively gold plated (performance level 2)

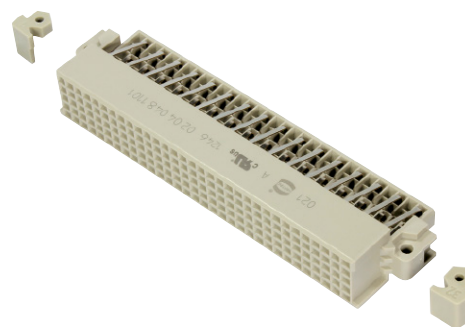
b) Connectors with snap-in clips see chapter 00

c) Connectors with coding see chapter 00

Number of contacts

48

Female connectors



Identification	Part number	Drawing	Dimensions in mm
Female connector with angled solder pins	Performance level 1 02 04 048 1101	X Kontaktanordnung contact arrangement	
Board drillings Mounting side		Y Lochbild board drillings	
Fixing bracket Position 1 Position 32	02 09 000 0018 02 09 000 0017		

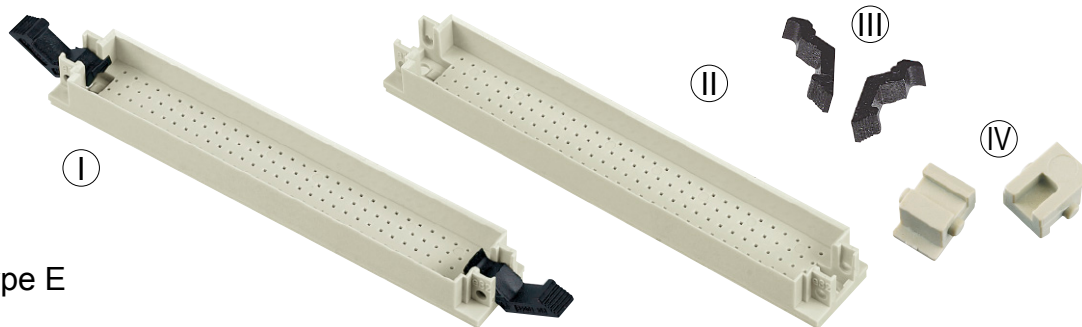
DIN Power
up to 6 A

Dimensions in mm

Number of contacts

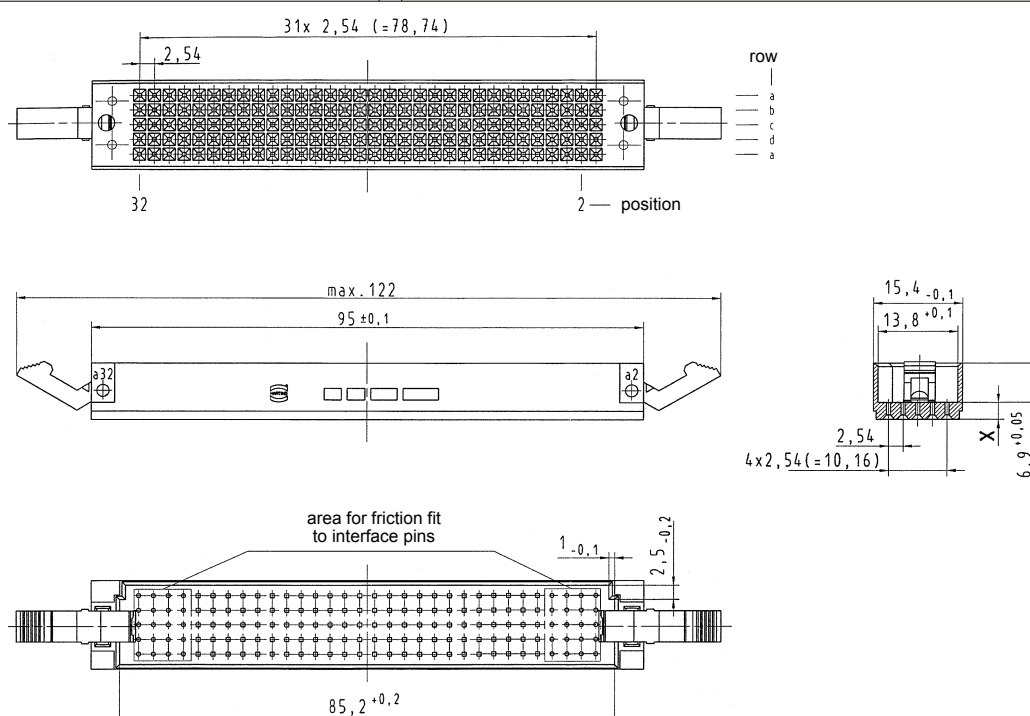
48

Pin shrouds for type E
with press-in pins



Identification	pcb-thickness + 0.2 / - 0.3	Dimension X - 0.1	Part number
Pin shrouds			
Ⓘ with locking levers	2.8	3.6	09 05 000 9924
Ⓜ without locking levers	2.8	3.6	09 05 000 9914 ¹⁾
Ⓘ with locking levers	3.4	3.0	09 05 000 9922
Ⓜ without locking levers	3.4	3.0	09 05 000 9912 ¹⁾
Ⓜ Locking lever for female connector type E ¹⁾			09 03 000 9914
Ⓜ Fixing brackets for shell housing C ¹⁾			09 03 000 9921 ¹⁾

Dimensions



Dimensions in mm

¹⁾ order 2 pieces per connector

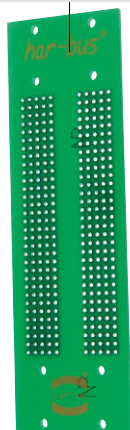
²⁾ Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Application 1

Female connector
09 05 248 6851



Backplane



Pin shroud
09 05 000 9912



Fixing brackets
09 03 000 9921



Shell housing C
09 05 048 0501



Female connector
with crimp contacts
09 05 048 3202



Locking lever
left 09 02 000 9902
right 09 02 000 9903

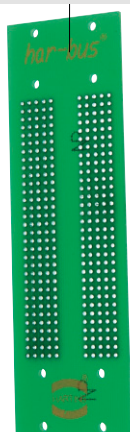


Application 2

Female connector
09 05 248 6851



Backplane



Pin shroud
09 05 000 9912



Locking lever
09 03 000 9914



Female connector
for crimp contacts
09 05 048 3202

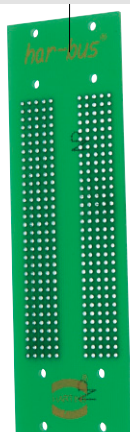


Application 3

Female connector
09 05 248 6851



Backplane



Pin shroud
09 05 000 9912



Locking lever
09 03 000 9914



Female connector
02 04 048 1101



Fixing brackets
Pos. 32 02 09 000 0017
Pos. 1 02 09 000 0018



DIN Power
up to 6 A

Number of contacts 16, 32, 48

Working current 6 A max.

see current carrying capacity chart

Clearance

16 ways ≥ 1.6 mm

32, 48 ways ≥ 1.6 mm

Creepage

16 ways ≥ 1.6 mm

32, 48 ways ≥ 3.0 mm

Working voltage

The working voltage also depends on the clearance and creepage dimensions of the pcb itself and the associated wiring according to the safety regulations of the equipment
Explanations see chapter 00

Contact resistance ≤ 20 m Ω

Insulation resistance $\geq 10^{12}$ Ω for standard articles

Termination Crimp terminal
0.09-1.5 mm²

Materials

Mouldings and hoods Thermoplastic resin,
glass-fibre filled

Contacts Copper alloy

Piggyback connectors for interfacing with female connectors with wrap posts 1 x 1 mm

The problem of interfacing systems designed for the distribution or collection of electronic signals can be overcome by the use of piggyback connectors. Designed to be mounted on the rear of DIN 41 612 type wire wrap female connectors (1 x 1 mm posts) these piggyback elements can be used to terminate input and output cables.

Distance fixing brackets are fitted to provide either a latching or screw fixing facility over the two level wire wrap plane.

The female crimp contacts used in these versions are designed for 1 x 1 mm posts.

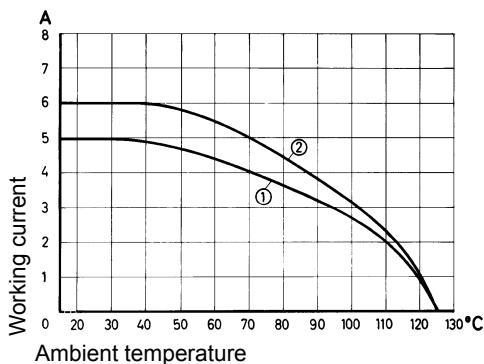
After crimping they can be easily inserted into the chambers of the connector body with the aid of an insertion tool. Insertion errors can be simply rectified with the use of a removal tool.

2 and 3 row piggyback connectors can be mounted in shell housings C and open hood G. Security is provided by either latches or screws to the distance fixing brackets.

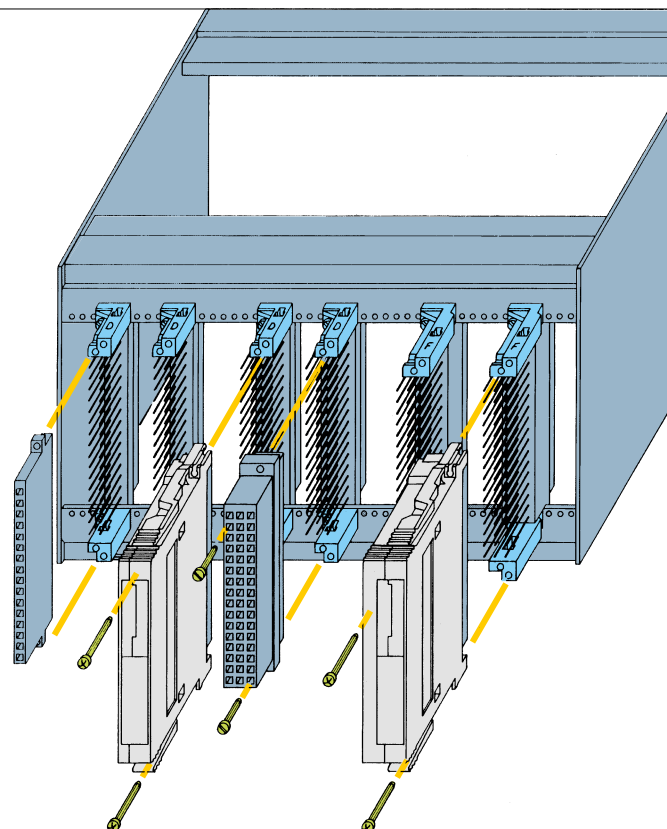
Current carrying capacity

The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current loaded contacts of connectors when simultaneous power on all contacts is given, without exceeding the maximum temperature.

Control and test procedures according to DIN IEC 60 512

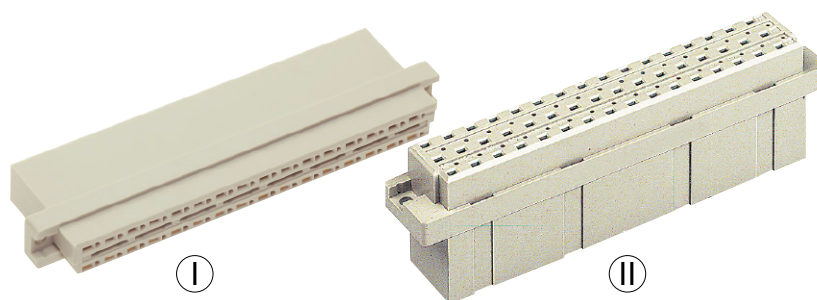


① with shell housing ② without shell housing



Number of contacts

max. 48



Piggyback connectors for 1 x 1 mm wrap posts

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Piggyback connector for crimp contacts Order contacts separately I	16	09 04 016 3201 ^{f)}		
	32	09 04 032 3215 ^{f)}		
	48	09 05 048 3204 ^{f)}		

DIN Power
up to 6 A

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

max. 48



Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female FC crimp contacts individual contacts ¹⁾ FC1 FC2 FC3 Bandoliered contacts (approx. 2,500 pcs.) FC1 FC2 FC3		09 06 000 6464 09 06 000 6461 09 06 000 6462 09 06 000 6454 09 06 000 6451 09 06 000 6452	Identi- fication 1 2 3 1 2 3 Wire gauge mm² 0.09-0.25 0.14-0.56 0.50-1.50 0.09-0.25 0.14-0.56 0.50-1.50 AWG 28-24 26-20 20-16 28-34 26-20 20-16 Insulations ø mm 0.7-1.5 0.8-2.0 1.6-2.8 0.7-1.5 0.8-2.0 1.6-2.8 3.5 + 0.5 mm of insulation is stripped from the wires to be crimped. For the fabrication in line with the specification please use exclusively crimp tools approved by HARTING (see DIN EN 60352-2) Crimping tools see chapter 30	
Mateable with 1 x 1 mm wrap posts				
Distance fixing brackets for female connectors Type D Type E		top (pos. 2) 09 04 000 9907 ^{f)} bottom (pos. 32) 09 04 000 9906 ^{f)}		
Type F I II		top (pos. 2) 09 06 000 9936 ^{f)} bottom (pos. 32) 09 06 000 9937 ^{f)}		

DIN Power
up to 6 A

1) Packaging unit 1,000 pieces

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Identification

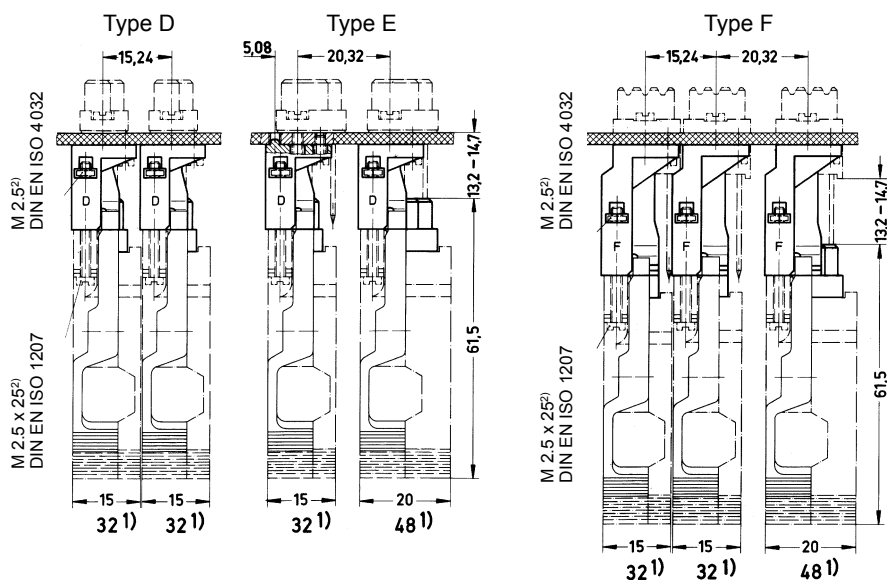
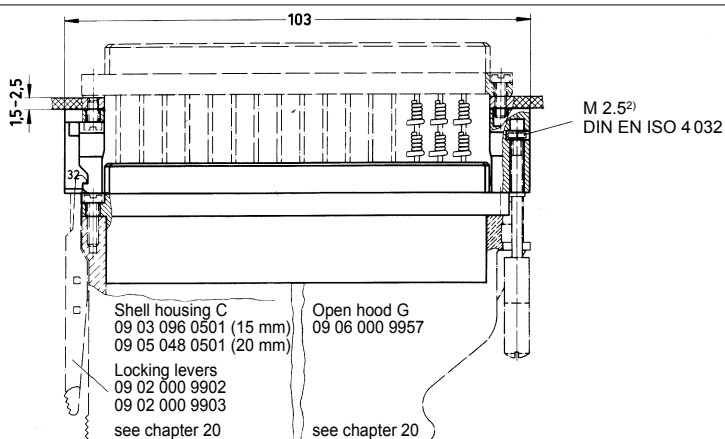
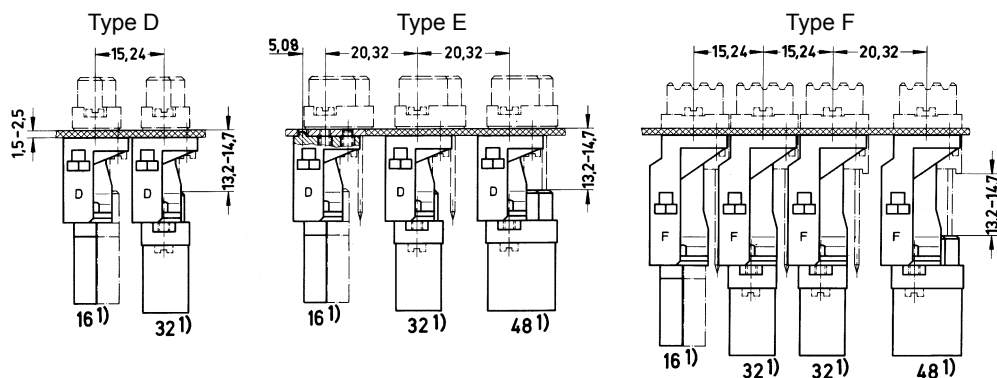
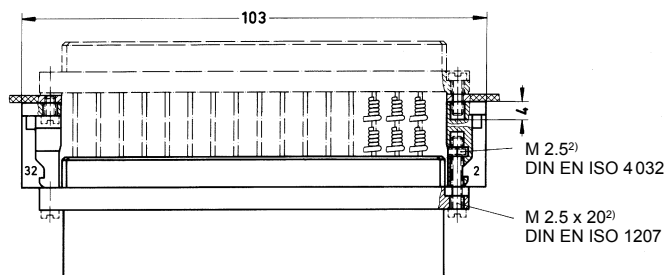
Drawing

Dimensions in mm

Mounting examples
of piggyback
connectors

without housings

with housings



DIN Power
up to 6 A

¹) Number of contacts piggyback connector
²) Doesn't belong to the scope of supply

Number of contacts

Type F	48, 32
Type FM	45
Type 2F	max. 24
Type F9	max. 9

Contact spacing (mm)

5.08

Working current

see current carrying capacity chart

6 A max.

Clearance

≥ 1.6 mm

Creepage

≥ 3.0 mm

Working voltage

The working voltage also depends on the clearance and creepage dimensions on the pcb itself and the associated wiring

according to the safety regulations of the equipment
Explanations see chapter 00

Test voltage $U_{r.m.s.}$

1.55 kV (contact-contact)
2.5 kV (contact-ground)

Contact resistance

≤ 15 mΩ

Insulation resistance

≥ 10¹² Ω for standard articles
≥ 10¹¹ Ω for special NFF articles
(with part-no. ending 222)

Temperature range

The higher temperature limit includes the local ambient and heating effects of the contacts under load
During reflow soldering

– 55 °C ... + 125 °C
– 40 °C ... + 105 °C for press-in connector

max. + 240 °C for 15 s for THR connectors

Electrical termination

Solder pins for pcb connections Ø 1 ± 0.1 mm according to IEC 60 326-3
Wrap posts 1 x 1 mm diagonal 1.34-1.45 mm
Crimp terminal 0.09-1.5 mm²
Angled solder pins 1 x 1 mm for pcb connections Ø 1.6 ± 0.1 mm
Solder lugs
Compliant press-in terminations
pcb thickness ≥ 1.6 mm
Recommended pcb holes for press-in technology See recommendation page 00.25 in acc. to EN 60 352-5

Insertion and withdrawal force

48 way ≤ 75 N
45 way ≤ 70 N
32 way ≤ 50 N
24 way ≤ 37 N

Materials

Mouldings

Thermoplastic resin, glass-fibre filled, UL 94-V0
Copper alloy

Contacts

Contact surface

Contact zone

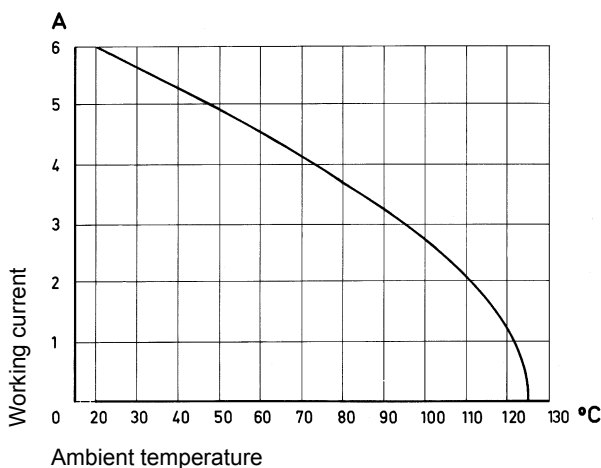
Selectively plated according to performance level¹⁾

¹⁾ Explanation of performance levels see chapter 00

Current carrying capacity

The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current load-ed contacts of connectors when simultaneous power on all contacts is given, without exceeding the maximum temperature.

Control and test procedures according to DIN IEC 60 512

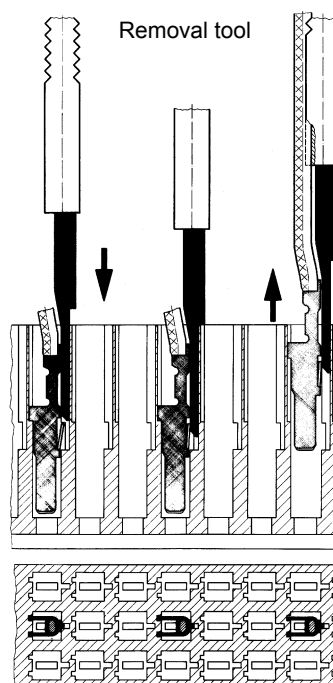


Fitting the crimp contacts

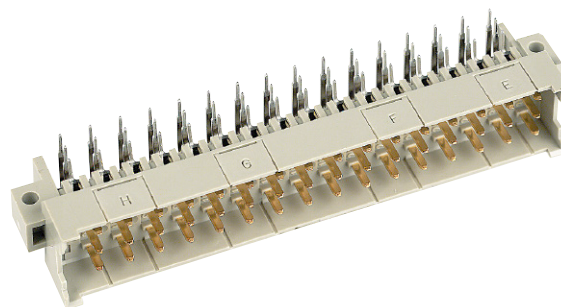
After crimping the wires onto the contacts with the help of a crimping tool or an automatic crimping machine the contacts should be correctly oriented and inserted into the cavities of the connector moulding in the required configuration. They snap into position and are firmly held in place. A light pull on the wire assures the correct tensile strength of the contact. When using stranded wires with a gauge below 0.37 mm² an insertion tool is necessary.

Removing the crimp contacts

The removal tool is inserted into a slot on the termination side of the respective crimp cavity. This action compresses the contact retaining spring therefore the contact can then be easily withdrawn using a light pull on the wire. This action will cause no damage to the contact/wire which can be repositioned/refitted as necessary. The drawing demonstrates the crimp removal procedure (max. 5x).



48, 32

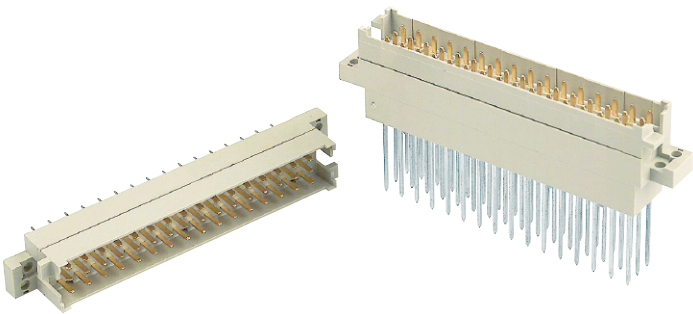


Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1
Male connector with angled solder pins ¹⁾	THR		09 06 148 7901	09 06 148 6901 09 06 148 6901 222 ^{f)} 09 06 348 6901 ^{b)} 09 06 348 6901 222 ^{b)f)}	09 06 148 2901 09 06 148 2901 222 ^{f)}
				09 06 148 6951 ^{d)} 09 06 348 6951 ^{b)d)}	09 06 348 2951 ^{b)d)}
			09 06 132 7901 09 06 332 7901 ^{b)}	09 06 132 6901 09 06 132 6901 222 ^{f)}	09 06 132 2901
			09 06 132 7931	09 06 132 6931 09 06 132 6931 222 ^{f)} 09 06 332 6931 ^{b)}	09 06 132 2931 09 06 332 2931 ^{b)}
				09 06 148 6921 09 06 348 6921 ^{b)}	09 06 148 2921
			09 06 132 7921	09 06 132 6921	09 06 132 2921
1 leading contact (position z 32)	47 + 1				
2 leading contacts (positions b 2 + b 32)	31 + 1				
	46 + 2			09 06 148 6925 09 06 148 6925 222 ^{f)}	09 06 148 2925
Dimensions					
Board drillings Mounting side					
Cross section of solder terminations	Cross area (A) of contacts row z, b, d: A = 0.29 - 0.34 mm² Dimensions in mm				

DIN Power
up to 6 A

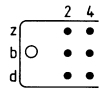
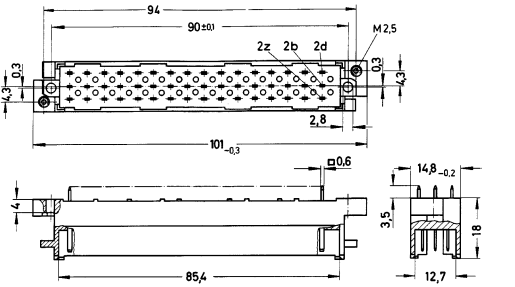
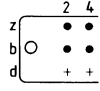
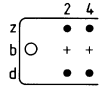
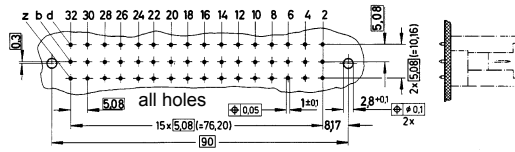
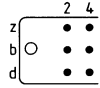
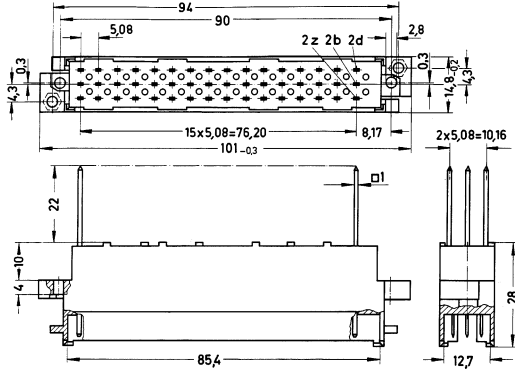
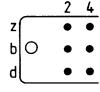
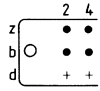
Number of contacts

48, 32



Interface connectors I

DIN Power
up to 6 A

Identification	No. of contacts	Contact arrangement	Part number	Drawing	Dimensions in mm
Interface connector I with solder pins ¹⁾ 0.6 x 0.6 mm	48		09 06 048 2905 ^{f)}		
	32		09 06 032 2905 ^{f)}		
	32		09 06 032 2941 ^{f)}		
Board drillings Mounting side					
Interface connector I with wrap posts ¹⁾ 1 x 1 mm	48		09 06 048 2903 ^{f)}		
	48		09 06 048 2963 ^{f)}		
	32		09 06 032 2903 ^{f)}		
Panel cut out					

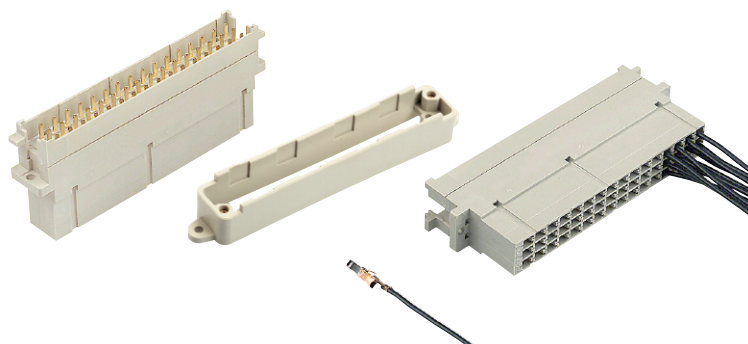
* Acc. to IEC 60 603-2, performance level 2 on request

¹⁾ With shroud coding, see also chapter 00

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

48



Interface connector I

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Interface connector I utilising female crimp contacts¹⁾ Order crimp contacts separately see page 03.33	48	Performance level 1 acc. to IEC 60 603-2 09 06 048 2906²⁾	Contact arrangement View from termination side	
Shell housing see chapter 20				
Panel cut out				
Shroud¹⁾ for screw-fixing of shell housing D20 plastic or D20 metallised . The shroud is assembled onto the Interface connector I and is screwfixed onto the pcb or to the rack.		09 06 001 9964	Inkl. Einpressmutter M2,5 incl. insert nut M2,5	

DIN Power up to 6 A

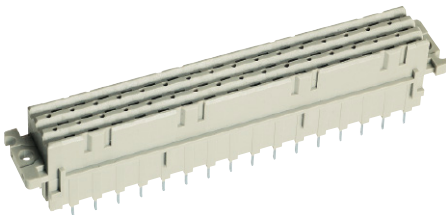
03
29

¹⁾ With shroud coding, see also chapter 00

²⁾ Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

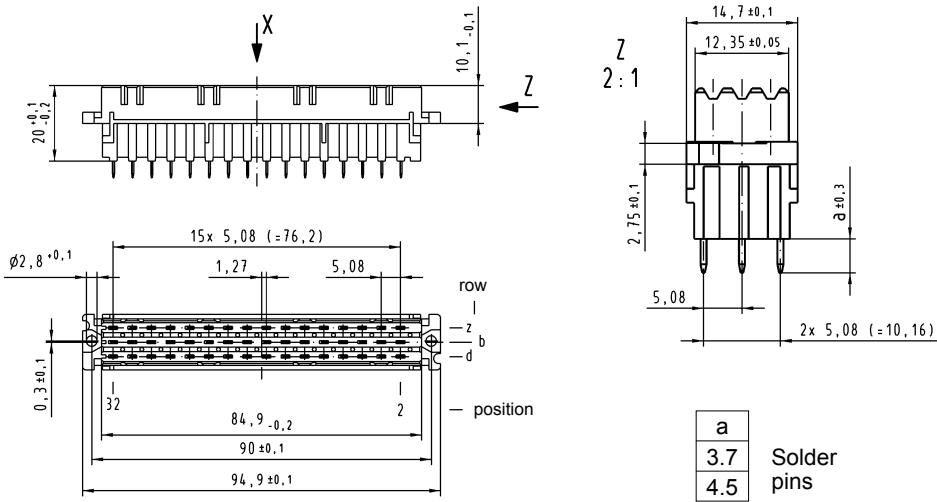
48, 32



Female connectors

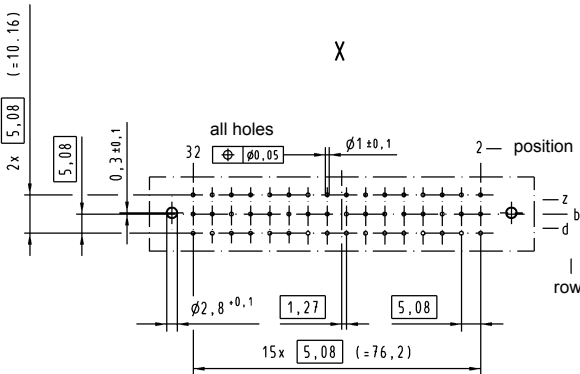
Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60 603-2. 2	Explanation chapter 00 1
Female connector with solder pins 3.7 mm ¹⁾	48			09 06 248 6848	09 06 248 2848
	32			09 06 232 6848	09 06 232 2848
	32			09 06 232 6858	
Female connector with solder pins 4.5 mm ¹⁾	48		09 06 248 7835	09 06 248 6835	09 06 248 2835
	32			09 06 232 6835	09 06 232 2835
	32			09 06 232 6845	09 06 232 2845

Dimensions



Board drillings

Mounting side



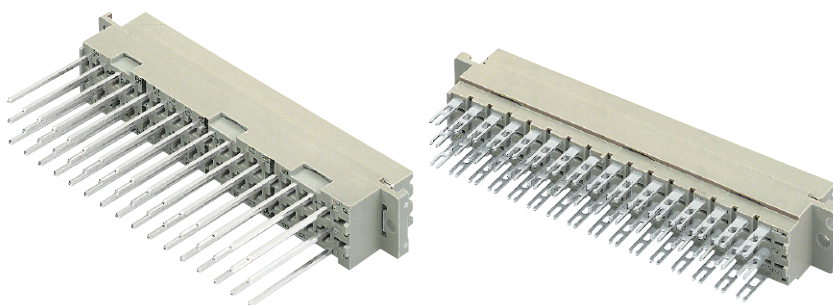
Dimensions in mm

¹⁾ With shroud coding, see also chapter 00

DIN Power
up to 6 A

Number of contacts

48, 32



Female connectors

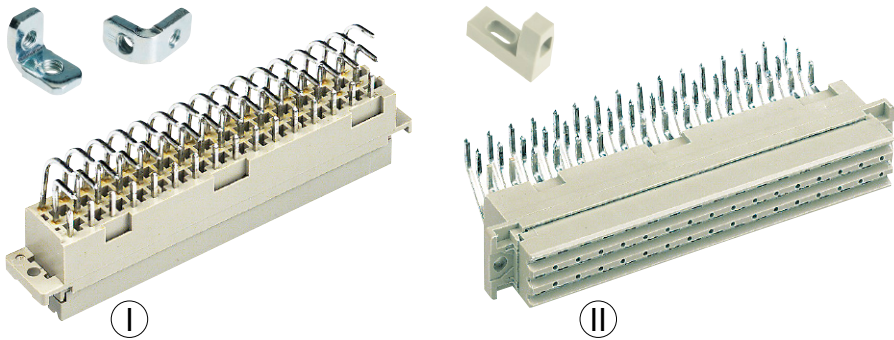
Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60 603-2. Explanation chapter 00										
			3	2	1									
Female connector with wrap posts 22 mm	48		09 06 248 7821	09 06 248 6821	09 06 248 2821 09 06 248 2821 222 ^{f)}									
	32		09 06 232 7821	09 06 232 6821	09 06 232 2821									
	32		09 06 232 7831	09 06 232 6831	09 06 232 2831									
Female connector with solder lugs open solder lug 	48		09 06 248 7823	09 06 248 6823	09 06 248 2823									
	32		09 06 232 7823	09 06 232 6823	09 06 232 2823									
	32		09 06 232 7843	09 06 232 6843	09 06 232 2843									
Dimensions														
Panel cut out	Contact arrangement View from termination side <table><tr><th>d + b + z</th><th>b + z</th><th>d + z</th></tr><tr><td></td><td></td><td></td></tr><tr><td>48</td><td>32</td><td>32</td></tr></table>					d + b + z	b + z	d + z				48	32	32
d + b + z	b + z	d + z												
48	32	32												

Dimensions in mm

DIN Power
up to 6 A

Number of contacts

48, 32



Female connectors

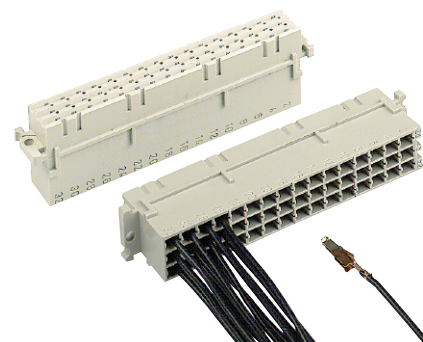
Identification	No. of contacts	Contact arrangement	Part number	Performance levels according to IEC 60 603-2. Explanation chapter 00	
			3	2	1
Female connector with angled solder pins 1 x 1 mm	48		Performance level 3 on request	09 06 248 6826	Performance level 1 on request
	32			09 06 232 6826	
	48			09 06 248 6836	
	32			09 06 232 6846	
	32			09 06 232 6836	
Dimensions					
Fixing bracket		Metal	09 06 000 9912 ¹⁾	for version	
		Plastic	09 06 000 9975 ¹⁾	for version	
Board drillings Mounting side				 Dimensions in mm	

DIN Power
up to 6 A

Number of contacts

max. 48

Female connectors



Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for crimp contacts ¹⁾ Order contacts separately	48	09 06 248 3201 09 06 248 3201 222 ^{f)}	Contact arrangement View from termination side Shell housing see chapter 20	

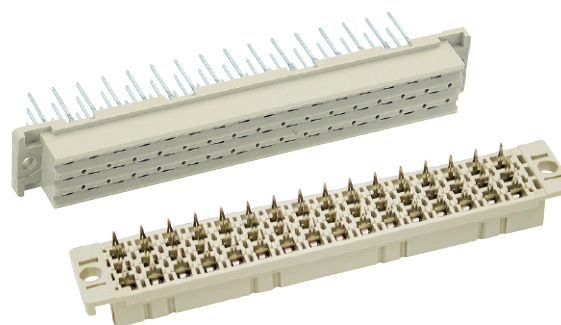
DIN Power
up to 6 A

Identification	Identification Wire gauge	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
			2	1
Female crimp FC contacts				
Bandoliered contacts (approx. 2,500 pieces)	1	09 06 000 6484		09 06 000 6474
	2	09 06 000 6481		09 06 000 6471
	3	09 06 000 6482		09 06 000 6472
Bandoliered contacts (approx. 250 pieces)	1	09 06 000 7484		09 06 000 7474
	2	09 06 000 7481		09 06 000 7471
	3	09 06 000 7482		09 06 000 7472
Individual contacts ²⁾	1	09 06 000 8484		09 06 000 8474
	2	09 06 000 8481		09 06 000 8471
	3	09 06 000 8482		09 06 000 8472
Female contacts with solder lugs ³⁾ (lockable)				09 06 000 6420
FC 1	1	Wire gauge mm ²	AWG	Insulation ø mm
FC 2	2	0.09 - 0.25	28 - 24	0.7 - 1.5
FC 3	3	0.14 - 0.56	26 - 20	0.8 - 2.0
		0.5 - 1.5	20 - 16	1.6 - 2.8
		3.5 + 0.5 mm of insulation is stripped from the wires to be crimped		
		For the fabrication in line with the specification please use exclusively crimp tools approved by HARTING (see DIN EN 60352-2)		
		Insertion, removal and crimping tools see chapter 30		
		Identification	Bandoliered contacts Individual contacts	

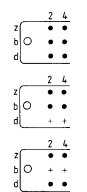
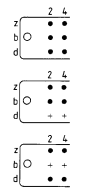
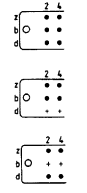
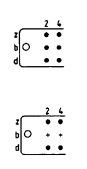
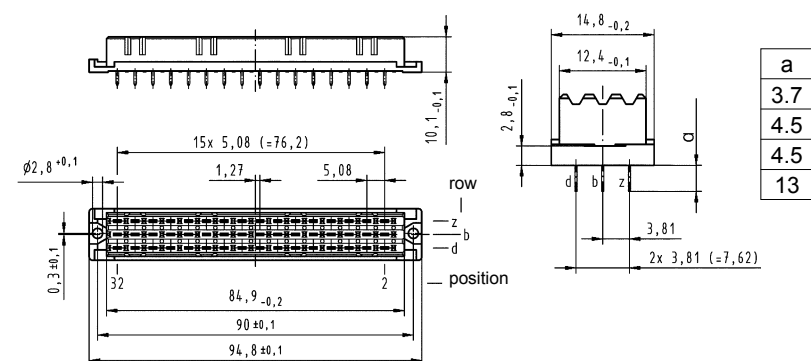
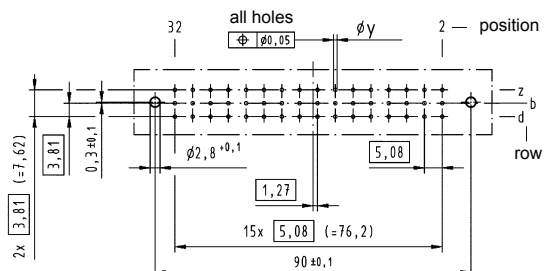
¹⁾ With shroud coding, see also chapter 00²⁾ Packaging unit 1,000 pieces³⁾ Solder contacts must not be used together with shell housing A. Special contact surface: 2 µm gold.^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

48, 32



Female connectors

Identification	No. of contacts	Contact arrangement	Part number 3	Performance levels according to IEC 60 603-2. 2	Explanation chapter 00 1						
Female connector ¹⁾ "low profile" with solder pins 3.7 mm	48 32 32		09 06 248 7833	09 06 248 6833 09 06 248 6833 222 ^{f)} 09 06 232 6833 09 06 232 6893	09 06 248 2833 09 06 248 2833 222 ^{f)}						
Female connector ¹⁾ "low profile" with solder pins 4.5 mm	48 32 32		 09 06 232 7894	09 06 248 6834 09 06 248 6834 222 ^{f)} 09 06 232 6834 09 06 232 6894	09 06 248 2834 09 06 232 2894						
Female connector ¹⁾ "low profile" with press-in pins 4.5 mm	48 32 32		09 06 248 7832	09 06 248 6832 09 06 232 6832 09 06 232 6892	09 06 248 2832 09 06 248 2832 222 ^{f)} 09 06 232 2832						
Female connector "low profile" with press-in pins 13 mm	48 32			09 06 248 6837 ^{w)} 09 06 248 6838* 09 06 232 6897 ^{w)}							
Dimensions	<table><tr><th>a</th></tr><tr><td>3.7</td></tr><tr><td>4.5</td></tr><tr><td>4.5</td></tr><tr><td>13</td></tr></table> Solder pins Press-in pins					a	3.7	4.5	4.5	13	
a											
3.7											
4.5											
4.5											
13											
Board drillings Mounting side	<table><tr><th></th><th>Y</th></tr><tr><td>Solder</td><td>1 ± 0.1</td></tr><tr><td>Press-in</td><td>see recommendation page 00.25</td></tr></table>						Y	Solder	1 ± 0.1	Press-in	see recommendation page 00.25
	Y										
Solder	1 ± 0.1										
Press-in	see recommendation page 00.25										

Dimensions in mm

Dimensions in mm

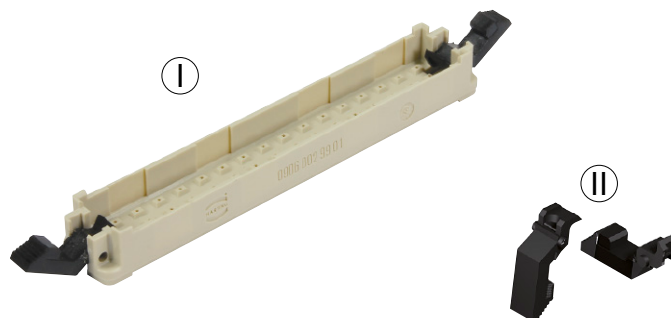
* Wrap posts for interfacing selectively gold plated (performance level 2)

¹⁾ With shroud coding, see also chapter 00^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2^{w)} Wrap posts not for interfacing, no performance level

Number of contacts

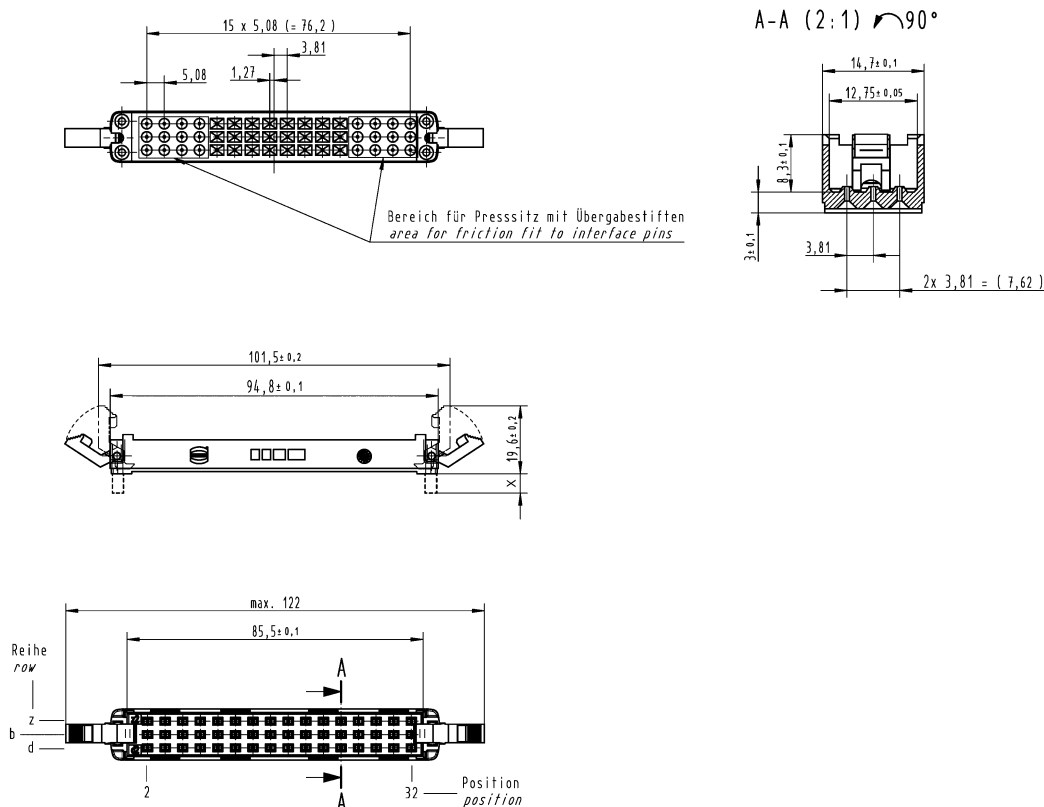
48

Pin shrouds
for type F “low profile”
with press-in pins 13 mm



Identification	pcb-thickness ± 10 %	Dimension X ± 0.1	Part number
Pin shrouds			
Ⓘ with locking levers ²⁾ and press-in fixing	1.6 - 2.4	1.6	09 06 002 9902
Ⓘ without locking levers for screw fixing	1.6 - 2.4	1.6	09 06 002 9912
Ⓘ with locking levers ²⁾ and press-in fixing	3.2 - 4.0	0	09 06 002 9901
Ⓘ without locking levers for screw fixing	3.2 - 4.0	0	09 06 002 9911
Ⓙ Locking lever for female connector type F ¹⁾			09 06 001 9946

Dimensions

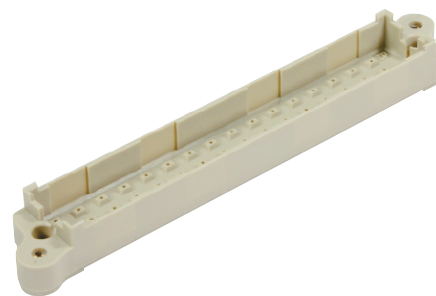


Dimensions in mm

¹⁾ order 2 pieces per connector
²⁾ Press-in tools see chapter 30

48

Pin shrouds
for type F “low profile”
with press-in pins 13 mm



Identification	pcb-thickness ± 10 %	Dimension X ± 0.1	Part number
Pin shrouds suitable for shell housing D20			
without locking levers with press-in nuts	1.6 - 2.4	1.6	09 06 002 9922
without locking levers with press-in nuts	3.2 - 4.0	0	09 06 002 9921

DIN Power
up to 6 A

Einpressmutter M2,5
press-in nut M2,5

15 x 5,08 = (76,2)

5,08

1,27

3,81

16,6

105,5

B

B

Einpressmutter M2,5
press-in nut M2,5

Reihe
row

z

b

d

2

32

Position
position

97,5 ± 0,1

90 ± 0,1

85,5 ± 0,1

0,3 ± 0,1

8,6 ± 0,05

A-A (2:1) 90°

14,7 ± 0,1

12,75 ± 0,05

8,3 ± 0,1

3 ± 0,1

3,81

2 x 3,81 = (7,62)

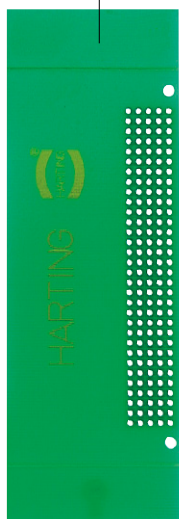
B-B (2:1) 90°

5,8 ± 0,15

Dimensions in mm

Application 1

Daughtercard



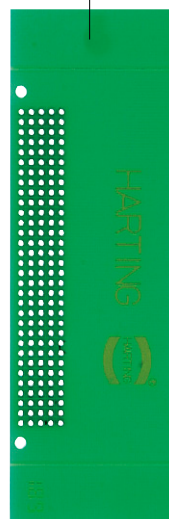
Male connector
09 06 148 6901



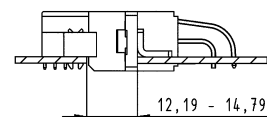
Female connector
09 06 248 6826
09 06 248 6836



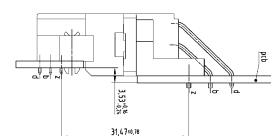
Daughtercard



... 6826

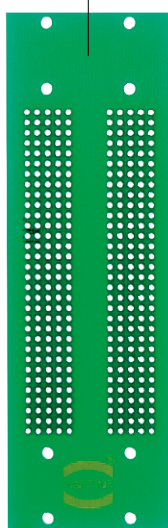


... 6836



Application 2

Backplane



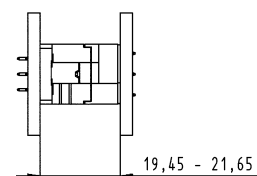
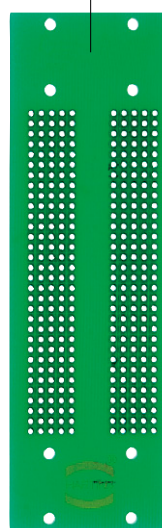
Male connector
09 06 048 2905



Female connector
09 06 248 2833



Backplane

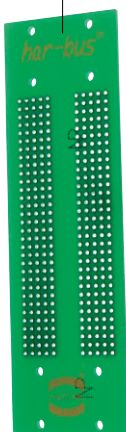


Application 3

Female connector
09 06 248 6838



Backplane



Pin shroud
09 06 002 9921



Shell housing D20
09 06 048 0521



Female connector
with crimp contacts
09 06 248 3201

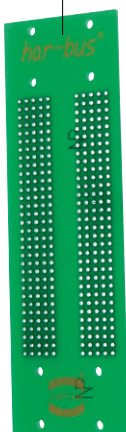
DIN Power
up to 6 A

Application 4

Female connector
09 06 248 6838



Backplane



Pin shroud
+ Locking lever
09 06 002 9901

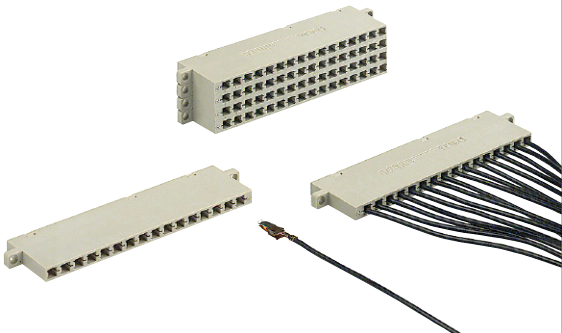


Female connector
for crimp contacts
09 06 248 3201



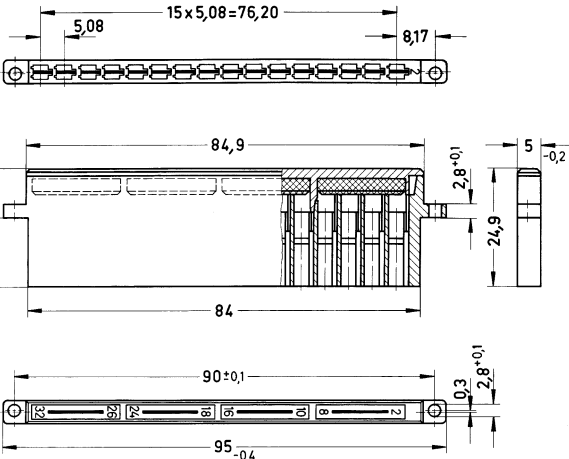
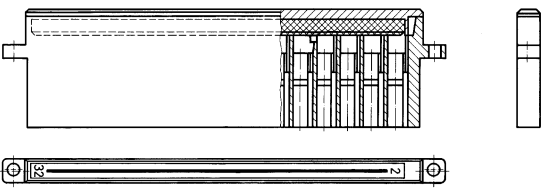
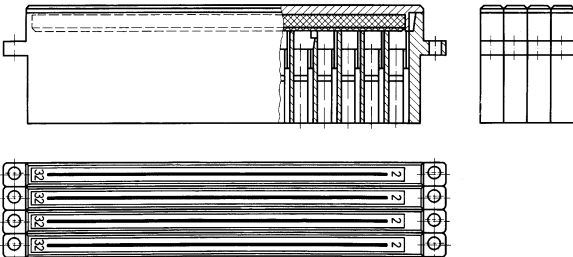
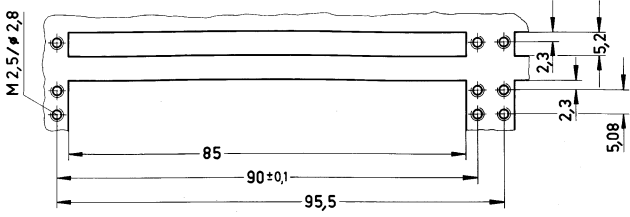
Number of contacts

64, 16



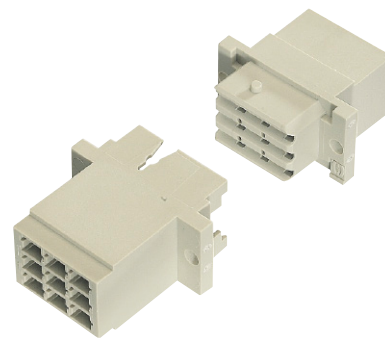
Universal adaptors

DIN Power
up to 6 A

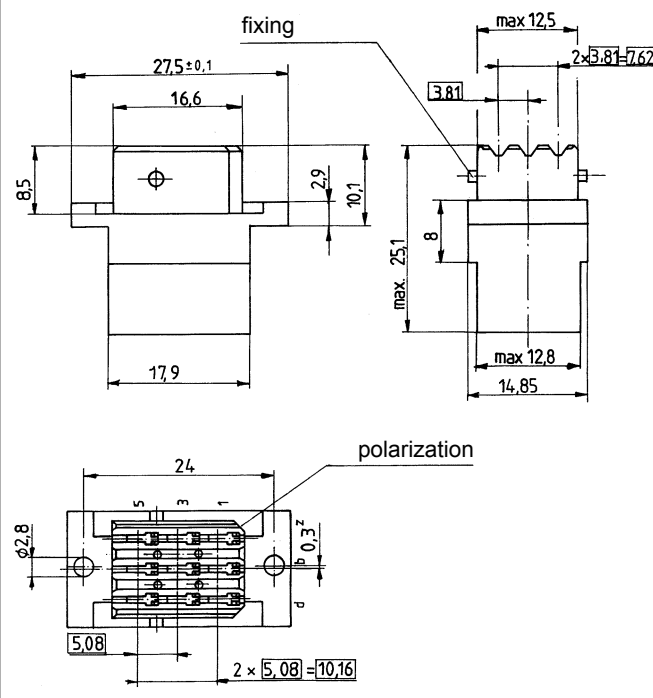
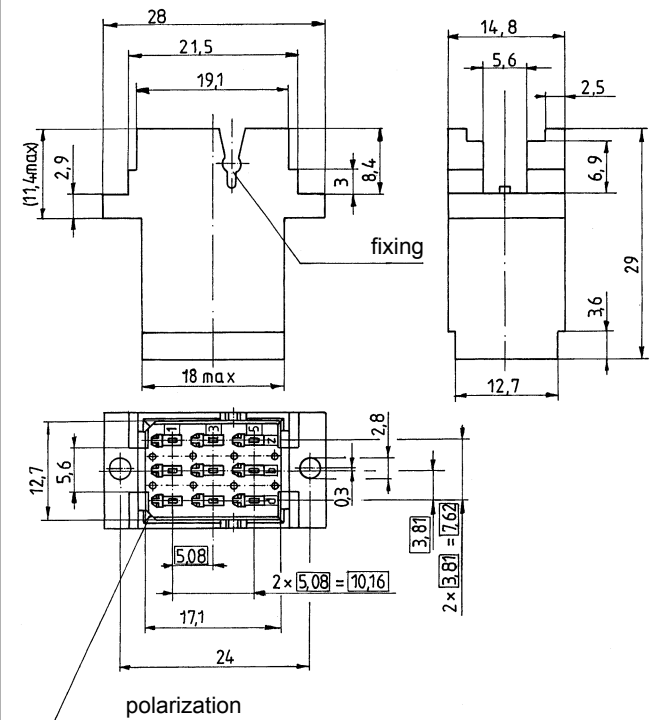
Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Universal adaptor utilising crimp contacts crimp contacts see page 03.33	4 x 4	09 06 016 3301 ^{f)}		
	16 x 1	09 06 016 3302 ^{f)}		
	16 x 4	09 06 064 3302 ^{f)}		
Panel cut out				

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

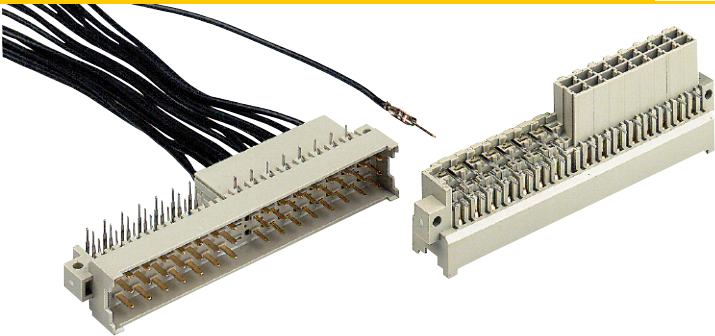
max. 9

Female and male connectors

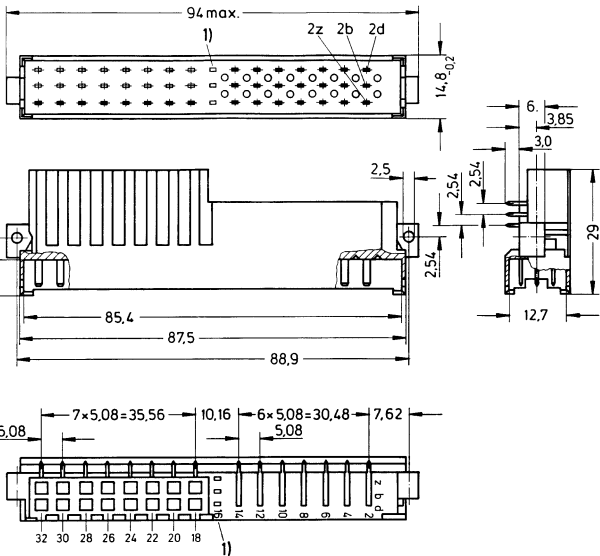
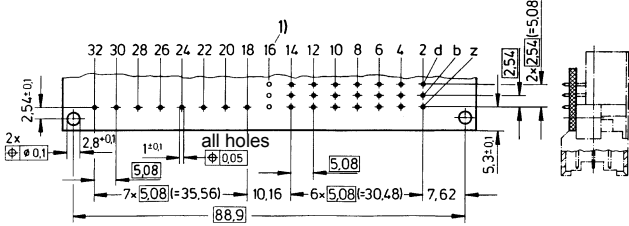
Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for crimp contacts Order contacts separately	9	09 06 209 3201		
Female crimp contacts		see page 03.33		
Male connector for crimp contacts Order contacts separately	9	09 06 109 3401		
Male crimp contacts		see page 03.44		

Number of contacts

45



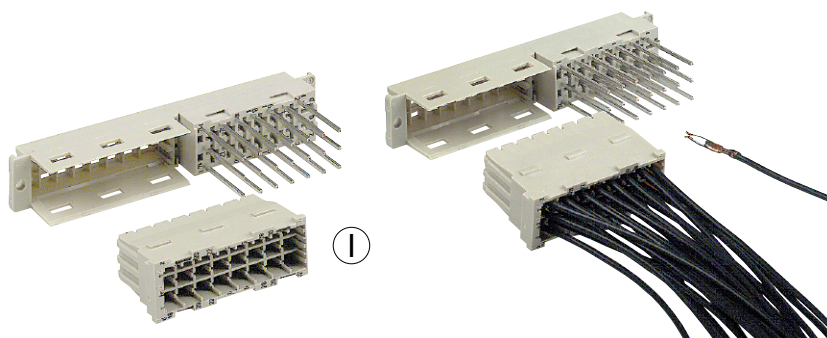
Male connectors

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Male connector 29 angled solder pins 16 cavities for male crimp contacts crimp contacts see page 03.44	45	Performance level 1 acc. to IEC 60 603-2 09 06 145 2971		
Board drillings Mounting side				1) A special 48 way version with 3 extra angled solder contacts at position 16 (rows d, b, z) can be supplied

DIN Power
up to 6 A

Number of contacts

45



Female connectors

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector Female moulding with 21 wrap posts 22 mm with 21 solder pins 4.5 mm	45 45	Performance level 1 acc. to IEC 60 603-2 09 06 045 2871^{f)} 09 06 045 2875^{f)}	① Crimp moulding for 24 female crimp contacts 09 06 024 3202^{f)} crimp contacts see page 03.33	84,9 10 19,5 13 10 22 12,4 2,9_{±0,3} 5,08 2 × 5,08 = 10,16 Latches Crimp moulding is supplied with the female moulding 2,8_{±0,1} 90_{±0,1} 2d 2b 2z 2 × 3,81 = 7,62 5,08 7 × 5,08 = 35,56 10,16 6 × 5,08 = 30,48 8,17 95 max. 0,3 14,8_{±0,2} Contact arrangement View from termination side
Panel cut out				M 2,5/ø 2,8 8,2 17 8,2 20,32 85 90_{±0,1} 95,5
Removal tool for the crimp moulding		09 99 000 0172		20 125 The crimp moulding can be extracted with the help of the removal tool.

DIN Power
up to 6 A

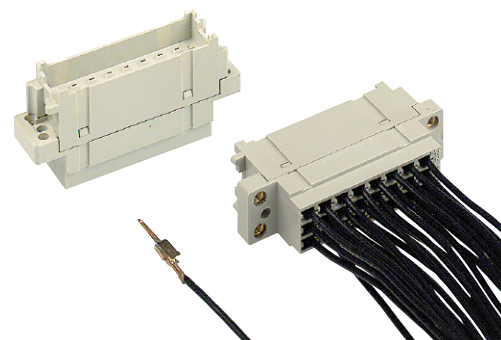
03
43

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

max. 24

Interface connector I



Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Interface connector I for male crimp contacts Order contacts separately	24	09 26 024 3411		

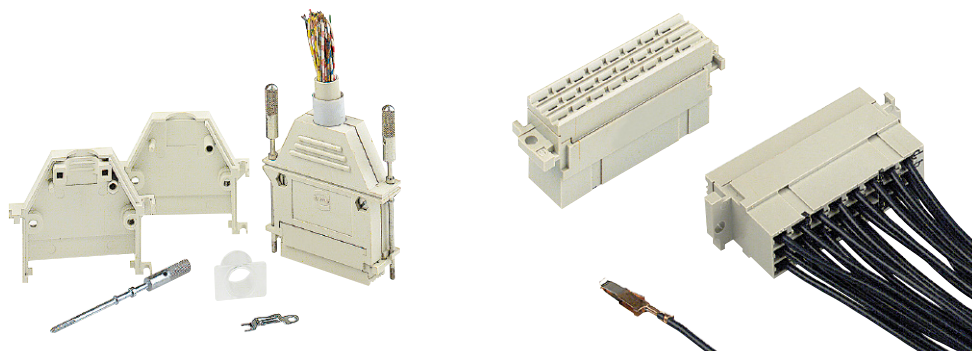
Identification	Identification Wire gauge	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00
			2 1
Male crimp FC contacts			
Bandoliered contacts (approx. 2,500 pieces)	1 2 3	09 06 000 9564 09 06 000 9561 09 06 000 9562	09 06 000 9544 09 06 000 9541 09 06 000 9542
Bandoliered contacts (approx. 250 pieces)	2 3		09 06 000 5541 09 06 000 5542
Individual contacts ¹⁾	1 2 3	09 06 000 9574 09 06 000 9571 09 06 000 9572	09 06 000 9554 09 06 000 9551 09 06 000 9552
FC 1 FC 2 FC 3	1 2 3	Wire gauge mm ² AWG Insulation ø mm 0.09 - 0.25 28 - 24 0.7 - 1.5 0.14 - 0.56 26 - 20 0.8 - 2.0 0.5 - 1.5 20 - 16 1.6 - 2.8 3.5 + 0.5 mm of insulation is stripped from the wires to be crimped For the fabrication in line with the specification please use exclusively crimp tools approved by HARTING (see DIN EN 60352-2) Insertion, removal and crimping tools see chapter 30	Identification Bandoliered contacts Individual contacts

¹⁾ Packaging unit 1,000 pieces

Number of contacts

max. 24

Female connectors



Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for crimp contacts Order contacts separately see page 03.33	24	09 26 024 3201 ^{f)}		
Shell housing A with integrated fixing screws Supplied with: Shell 2x Locking screw 2x Screw M3x10 2x Nut M3 2x Screw BZ 2.9x9.5 2x Cable clamp 1x Tension relief 1x		09 26 024 0401 ^{f)}		
Open hood Supplied with: Open hood 1x Locking screw 2x Screw BZ 2.2x9.5 2x Cable tie 1x		09 26 000 9901 ^{f)}		

**DIN Power
up to 6 A**
^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

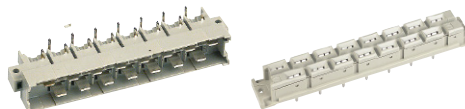
Types H, H15, H16, H3, MH 24 + 7, MH 21 + 5

Page

Technical characteristics type H

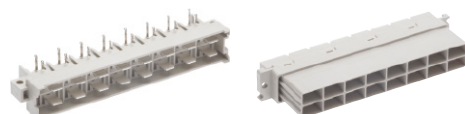
04.10

Type H15 connectors



04.11

Type H16 connectors



04.16

Type H3 connectors

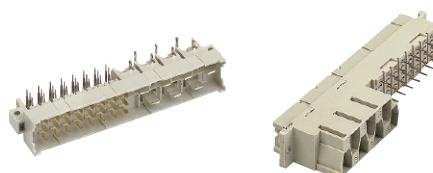


04.17

Technical characteristics type MH

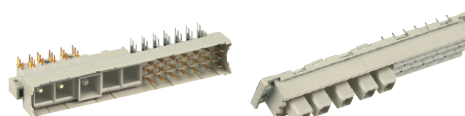
04.20

Type MH 24 + 7 connectors



04.21

Type MH 21 + 5 connectors



04.23

Number of contacts	15, 16
	14 + 1 leading contact (position z 32)
	13 + 2 leading contacts (position z 4 und z 32)
	3

Working current	15 A max.
-----------------	-----------

see current carrying capacity chart

Clearance	Type H15:	≥ 4.5 mm
	Type H3:	≥ 4.0 mm

Creepage	Type H15:	≥ 8.0 mm
	Type H3:	≥ 3.7 mm

Working voltage

The working voltage also depends on the clearance and creepage dimensions of the pcb itself and the associated wiring

according to the safety regulations of the equipment
Explanations see chapter 00

Connectors should not be mated under voltage

Test voltage $U_{r.m.s.}$	Type H15:	≥ 3.1 kV
	Type H3:	≥ 2.5 kV

Contact resistance	≤ 8 mΩ
--------------------	--------

Insulation resistance	≥ 10 ¹² Ω for standard articles
	≥ 10 ¹¹ Ω for special NFF articles (with part-no. ending 222)

Temperature range	– 55 °C ... + 125 °C
-------------------	----------------------

The higher temperature limit includes the local ambient and heating effects of the contacts under load

Electrical termination

Connector with faston
6.3 x 2.5 (faston blade
width x wire gauge)
according to DIN 46 245
and DIN 46 247
Solder pins for pcb
connections Ø 1.6 ± 0.1 mm
DIN EN 60 097

Cage clamp terminal
0.14-1.5 mm²

Insertion and withdrawal force

Type H15:	≤ 90 N
Type H3:	≤ 20 N

Materials

Mouldings	Thermoplastic resin, glass-fibre filled, UL 94-V0
Contacts	Copper alloy

Contact surface

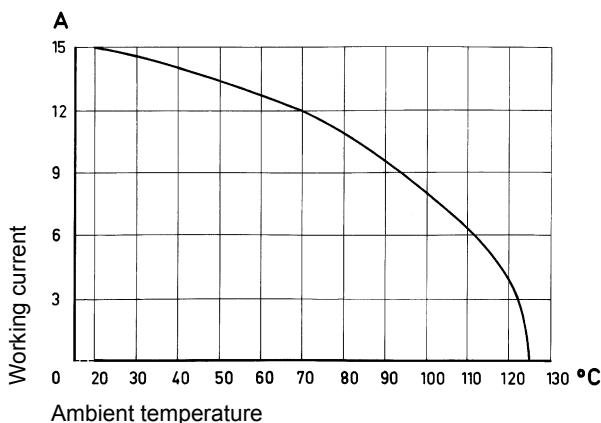
Contact zone	Hard silver plated or gold plated
--------------	--------------------------------------

Mating conditions	see chapter 00
Coding systems	see chapter 00

Current carrying capacity

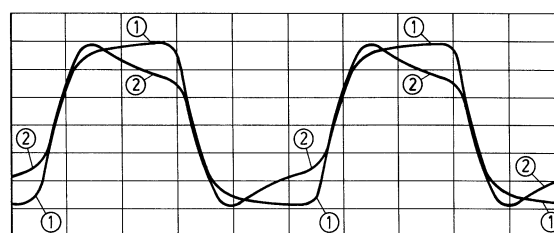
The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current load-ed contacts of connectors when simultaneous power on all contacts is given, without exceeding the maximum temperature.

Control and test procedures according to DIN IEC 60 512



Low currents and voltages

Type H standard contacts have a silver plated surface. This precious metal has excellent conductive properties. In the course of a contact's lifetime, the silver surface generates a black oxide layer due to its affinity to sulphur. This layer is smooth and very thin and is partly interrupted when the contacts are mated and unmated, thus guaranteeing very low contact resistances. In the case of very low currents or voltages small changes to the transmitted signal may be encountered. This is illustrated below where an artificially aged contact representing a twenty year life is compared with a new contact.

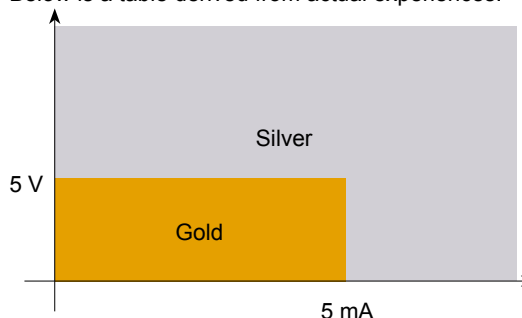


Changes to the transmitted signal after artificial ageing

① new contact ② after ageing

In systems where such a change to the transmitted signal could lead to faulty functions and also in extremely aggressive environments, HARTING recommend the use of gold plated contacts.

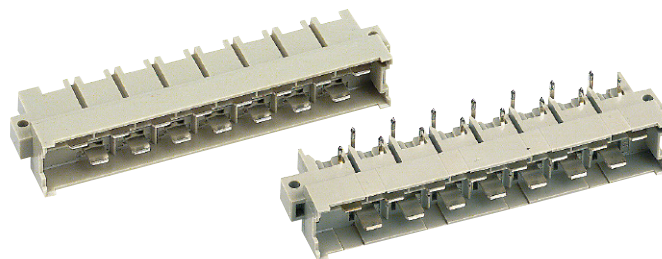
Below is a table derived from actual experiences.



Recommendation

Number of contacts

15



Male connectors

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Male connector for faston 6.3 x 2.5	15	Performance level 1 acc. to IEC 60603-2		
1 leading contact (position z 32)	14 + 1	09 06 015 2912 ^{1)f)}		
2 leading contacts (position z 4 + z 32)	13 + 2	09 06 015 2922 ^{1)f)}		
Male connector with angled solder pins ³⁾	15	09 06 115 2911 ¹⁾ 09 06 115 2911 222 ^{1)f)}		
1 leading contact (position z 32)	14 + 1	09 06 115 2932 ¹⁾ 09 06 115 2932 222 ^{1)f)}		
2 leading contacts (position z 4 + z 32)	13 + 2	09 06 115 2921 ¹⁾ 09 06 115 2991 ²⁾		
Male connector with straight solder pins	15	09 06 015 2913 ^{1)f)}		
1 leading contact (position z 32)	14 + 1	09 06 015 2914 ^{1)f)}		

Other contact arrangements on request

¹⁾ Variant with silver plated contacts

²⁾ Variant with gold plated contacts

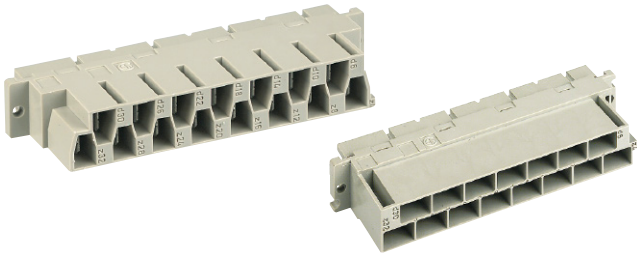
³⁾ With shroud coding, see chapter 00

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

DIN Power
up to 15 A

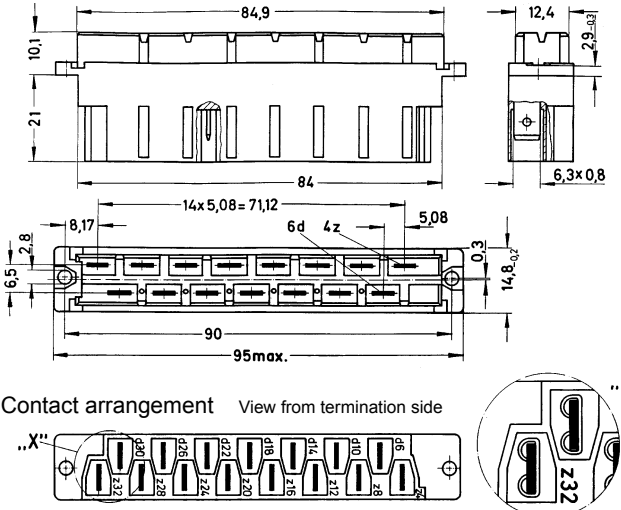
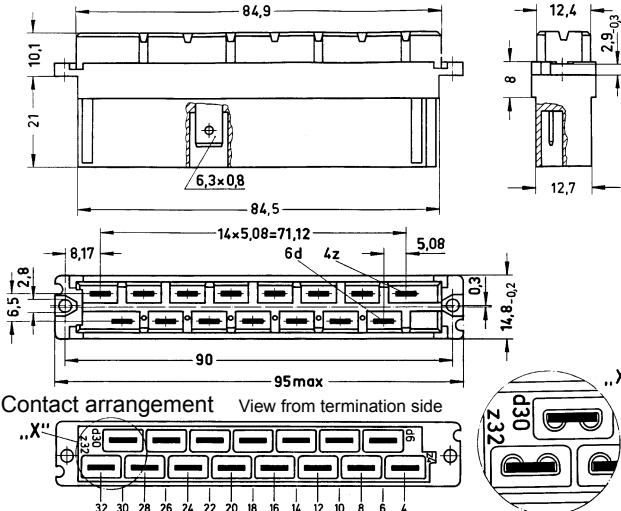
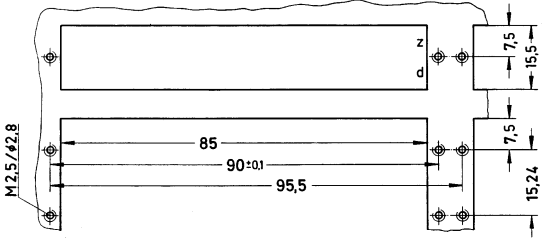
Number of contacts

15



Female connectors

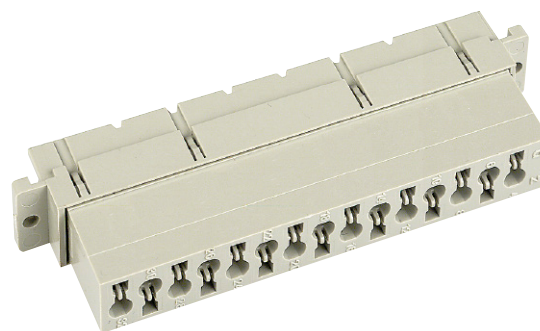
DIN Power
up to 15 A

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector for faston 6.3 x 2.5 ¹⁾ Cannot be used in a shell housing	15	Performance level 1 acc. to IEC 60603-2 09 06 215 2811	 Contact arrangement View from termination side	
Female connector for faston 6.3 x 2.5 ¹⁾ May be used in a shell housing	15 15	09 06 215 2871 09 06 215 2871 222 ²⁾	 Contact arrangement View from termination side Shell housing see chapter 20	
Panel cut out				

¹⁾ With shroud coding, see chapter 00
²⁾ Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

15



Female connectors

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector with cage clamp May be used in a shell housing	15	Performance level 1 acc. to IEC 60 603-2 09 06 015 2813 ^{f)}	Contact arrangement View from termination side Slot for screw driver Shell housing see chapter 20	
Panel cut out				
Termination instructions			Screw driver width: 2.5 x 0.4 mm Stripping length: 4 - 10 mm Wire gauge: 0.14 - 1.5 mm² (AWG 26 - 16)	

DIN Power
up to 15 A

04
13

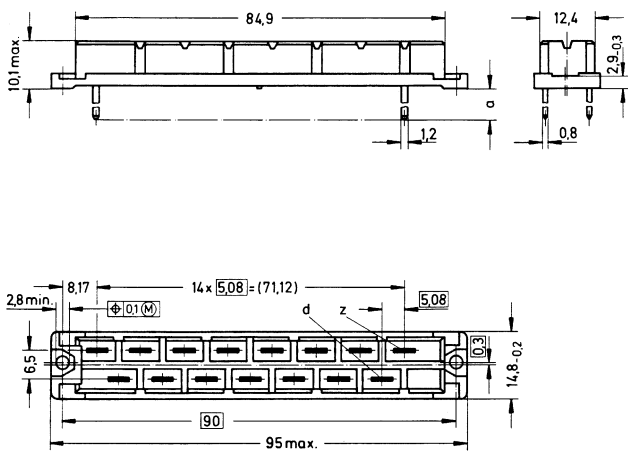
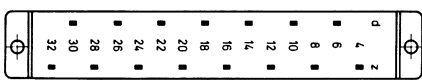
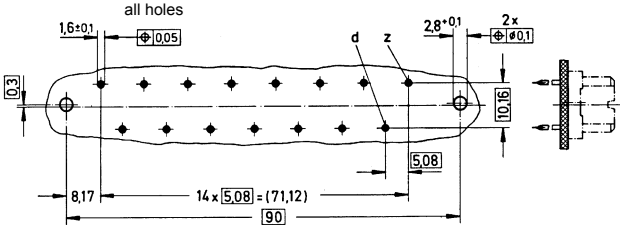
^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

15



Female connectors

Identification	No. of contacts	Part number	Drawing	Dimensions in mm						
Female connector “low profile” with solder pins ³⁾		Performance level 1 acc. to IEC 60 603-2		<table><tr><td>a</td></tr><tr><td>2.7</td></tr><tr><td>4</td></tr><tr><td>5.5</td></tr><tr><td>7</td></tr><tr><td>10</td></tr></table>	a	2.7	4	5.5	7	10
a										
2.7										
4										
5.5										
7										
10										
2.7 mm	15	09 06 215 2812 ¹⁾								
4 mm	15	09 06 215 2821 ¹⁾ 09 06 215 2821 222 ^{1)f)} 09 06 215 2892 ²⁾ 09 06 215 2892 222 ^{2)f)}								
5.5 mm	15	09 06 215 2890 ²⁾								
7 mm	15	09 06 215 2831 ¹⁾ 09 06 215 2891 ²⁾								
10 mm	15	09 06 215 2841 ¹⁾	Contact arrangement View from termination side 							
Board drillings Mounting side										

¹⁾ Variant with silver plated contacts
²⁾ Variant with gold plated contacts
³⁾ With shroud coding, see chapter 00

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

DIN Power
up to 15 A

Number of contacts

15



Female connectors

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Female connector "low profile" with press-in pins 3.6 mm Contact space termination side 5.08 mm	15	Performance level 1 acc. to IEC 60 603-2 09 06 215 2854 09 06 215 2854 222^{f)}	Board drillings Mounting side	
Contact space termination side 2.54 mm	15	09 06 215 2856 09 06 215 2856 222^{f)}	Board drillings Mounting side	

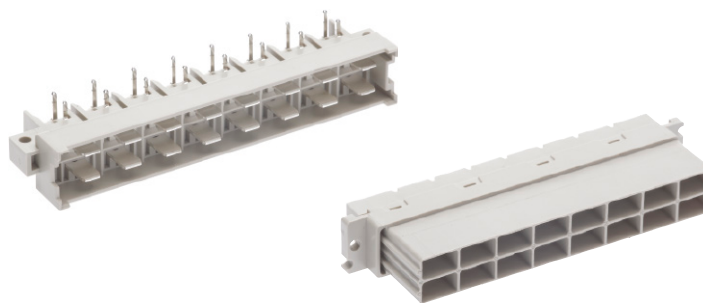
DIN Power
up to 15 A

04
15

¹⁾ Refer to recommended configuration of pcb holes, see page 00.25

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

16



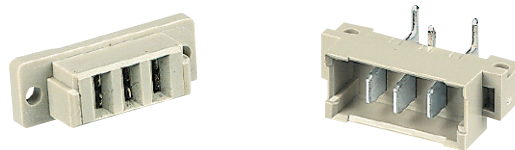
Male connectors

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Male connector with angled solder pins		Performance level 1 acc. to IEC 60 603-2		
	16	09 06 116 2511		
	16	09 06 316 2511 ^{b)}		
			Board drillings	
Female connector for faston 6.3 x 2.5				
	16	09 06 216 2411		

b) Connectors with snap-in clips see chapter 00

Number of contacts

3



Male and female connectors

Identification	No. of contacts	Part number	Drawing	Dimensions in mm
Male connector with angled solder pins and preleading middle contact	3	Performance level 1 acc. to IEC 60603-2 09 06 203 2911	Board drillings	
Female connector with solder pins	3	09 06 203 2811	Board drillings	

ELECTRONIC SECTION

Number of contacts 21, 24 + 7

Contact spacing (mm)

Male connector 2.54 x 5.08
Female connector 5.08

Working current

see current carrying capacity chart 6 A max.

Clearance

≥ 1.6 mm

Creepage

≥ 3 mm

Working voltage

The working voltage also depends on the clearance and creepage dimensions on the pcb itself, and the associated wiring according to the safety regulations of the equipment. Explanations see chapter 00

Test voltage $U_{r.m.s.}$

1.55 kV

Contact resistance

≤ 15 mΩ wrap, solder termination
≤ 20 mΩ including crimp connection

Electrical termination

Solder pins for pcb connection
Ø 1 ± 0.1 mm acc. to IEC 60326-3
Wrap posts 1 x 1 mm
diagonal 1.34-1.45 mm
Crimp terminal 0.09-1.5 mm²

Contact surface

Contact zone Selectively plated according to performance level¹⁾

HEAVY DUTY SECTION*

Number of contacts 7

Working current

see current carrying capacity chart 15 A max.

Clearance

≥ 4.5 mm

Creepage

≥ 8.0 mm

Working voltage

The working voltage also depends on the clearance and creepage dimensions on the pcb itself, and the associated wiring according to the safety regulations of the equipment. Explanations see chapter 00

Test voltage $U_{r.m.s.}$

3.1 kV

Contact resistance

≤ 8 mΩ

Electrical termination

Connector for faston 6.3 x 2.5
(faston width x wire gauge)
acc. to DIN 46245 and DIN 46247
Solder pins for pcb connection
Ø 1.6 ± 0.1 mm acc. to DIN EN 60097

Contact surface

Contact zone Hard silver plated

BOTH PARTS

Insulation resistance

≥ 10¹² Ω for standard articles
≥ 10¹¹ Ω for special NFF articles
(with part-no. ending 222)

Temperature range

– 55 °C ... + 125 °C

The higher temperature limit includes the local ambient and heating effects of the contacts under load

Insertion and withdrawal force ≤ 85 N

Materials

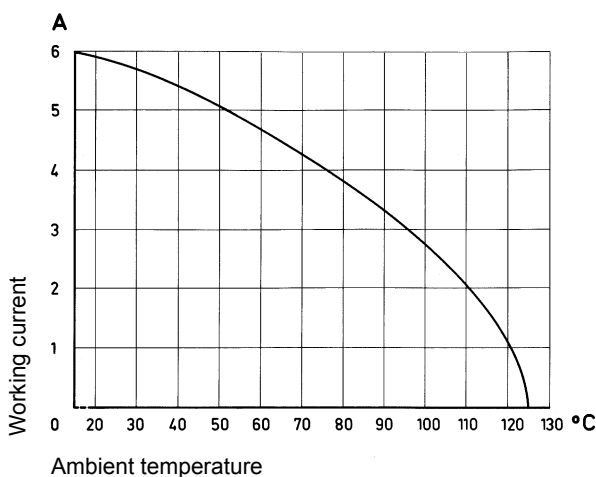
Mouldings Thermoplastic resin,
glass-fibre filled, UL 94-V0
Contacts Copper alloy

Current carrying capacity

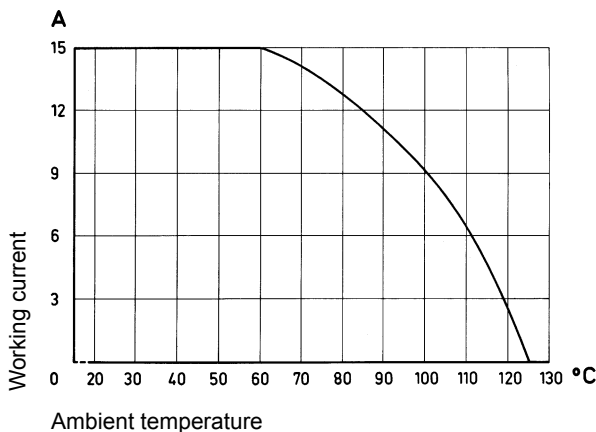
The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current load-ed contacts of connectors when simultaneous power on all contacts is given, without exceeding the maximum temperature.

Control and test procedures according to DIN IEC 60512

Electronic section



Heavy duty section

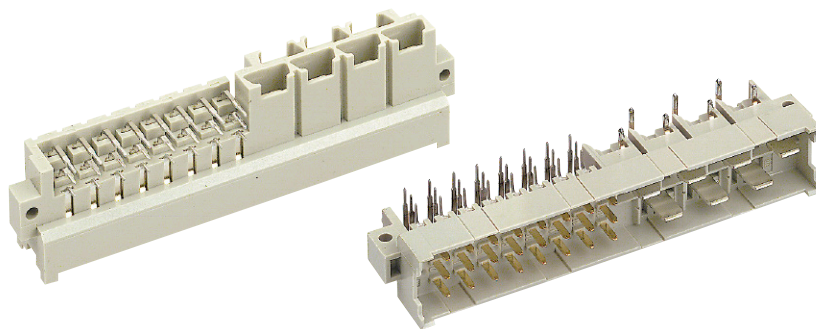


* only for type MH 24 + 7

¹⁾ Explanation of performance levels see chapter 00

Mating conditions see chapter 00

Coding systems see chapter 00

$$\begin{array}{ccc} 24 & + & 7 \\ F & + & H \end{array}$$


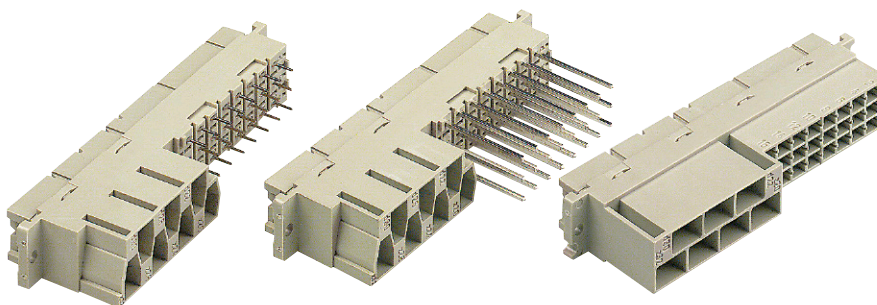
Identification	No. of contacts	Part number	Performance levels according to IEC 60 603-2. Explanation chapter 00				
		3	2	1			
Male connector for faston 6.3 x 2.5							
1 leading contact (position z 32)	24 + 7		09 06 031 6921 ^{f)}	09 06 031 2921 ^{f)}			
2 leading contacts (position z 2 + z 32)	24 + 7		09 06 031 6923 ^{f)}				
Male connector with angled solder pins ¹⁾							
1 leading contact (position z 32)	24 + 7		09 06 131 6922				
2 leading contacts (position z 2 + z 32)	24 + 7		09 06 131 6924 09 06 331 6924 ^{b)}				
	Faston terminal	Angled solder pins					
Board drillings							
Mounting side							

Dimensions in mm

**DIN Power
up to 15 A**

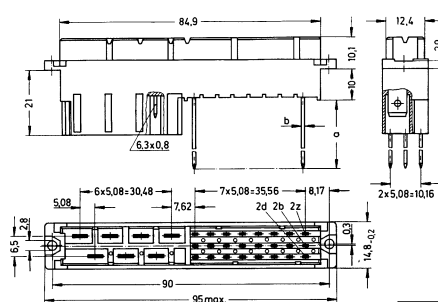
Number of contacts

24 + 7
F + H

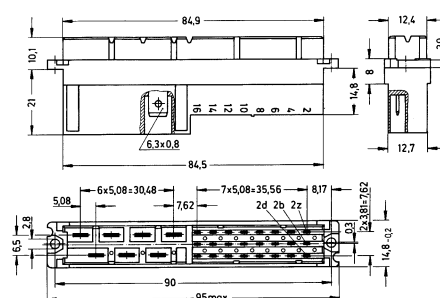


Female connectors

Identification	No. of contacts	Part number 3	Performance levels according to IEC 60 603-2. Explanation chapter 00 2	1
Female connector with solder pins 4.5 mm ¹⁾	24 + 7		09 06 231 6822	09 06 231 2822
Female connector with wrap posts 1 x 1 mm ¹⁾	24 + 7		09 06 231 6821	09 06 231 2821
Female connector for crimp contacts ¹⁾ Order contacts separately, see chapter 03	24 + 7			09 06 231 2881 09 06 231 2881 222 ^{f)}

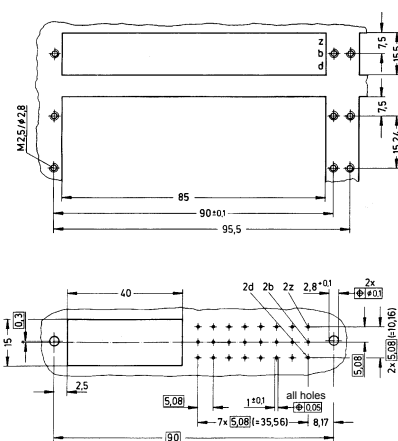


a	b
4.5	0.6
22	1

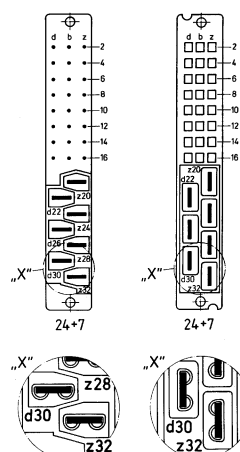


Panel cut out

Board drillings
Mounting side



Contact arrangement
View from termination side



Shell housing for female connector with crimp contacts
see chapter 20

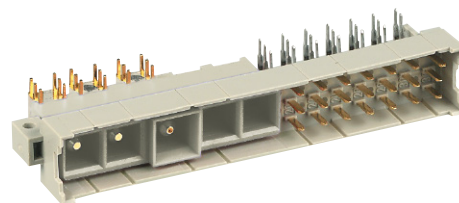
Dimensions in mm

¹⁾ With shroud coding, see chapter 00

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

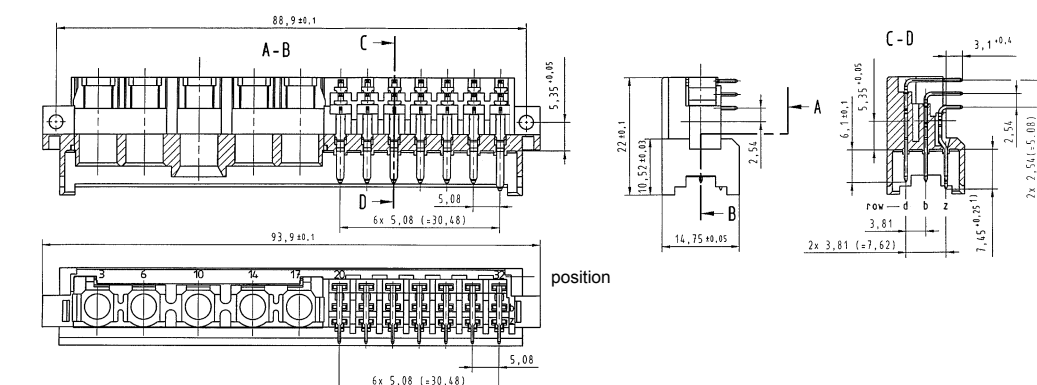
21 + 5
F + M



Male connectors

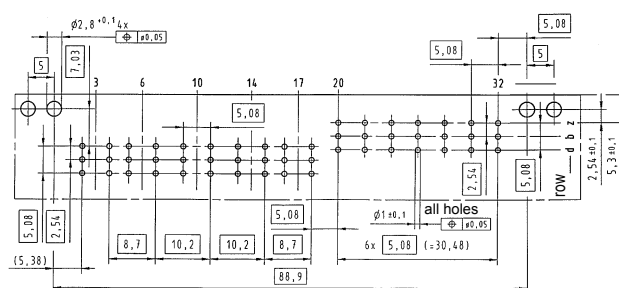
Identification	No. of contacts	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00	
		3	2	1
Male connector with angled solder pins (without special contacts)*	21 + 5	Performance level 3 on request	09 06 121 6981	Performance level 1 on request
High current contact for printed circuit terminations max. 40 A ²⁾			09 03 000 6127	
leading contact max. 40 A ²⁾			09 03 000 6128	
Removal tool			09 99 000 0328	

Dimensions



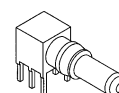
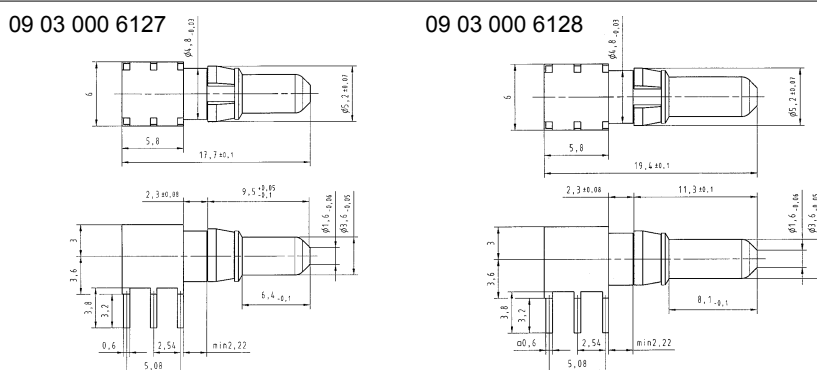
Board drillings

Mounting side



¹⁾ Leading contact in position z 32

Dimensions



Dimensions in mm

* Pre-loaded with special contacts on request

Code keys see chapter 00

²⁾ Depending on the pcb design

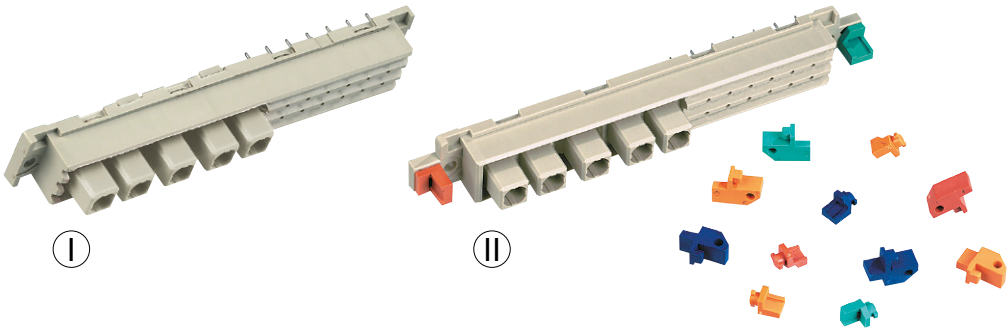
Further special contacts see chapter 01

DIN Power
up to 15 A

Number of contacts

21 + 5

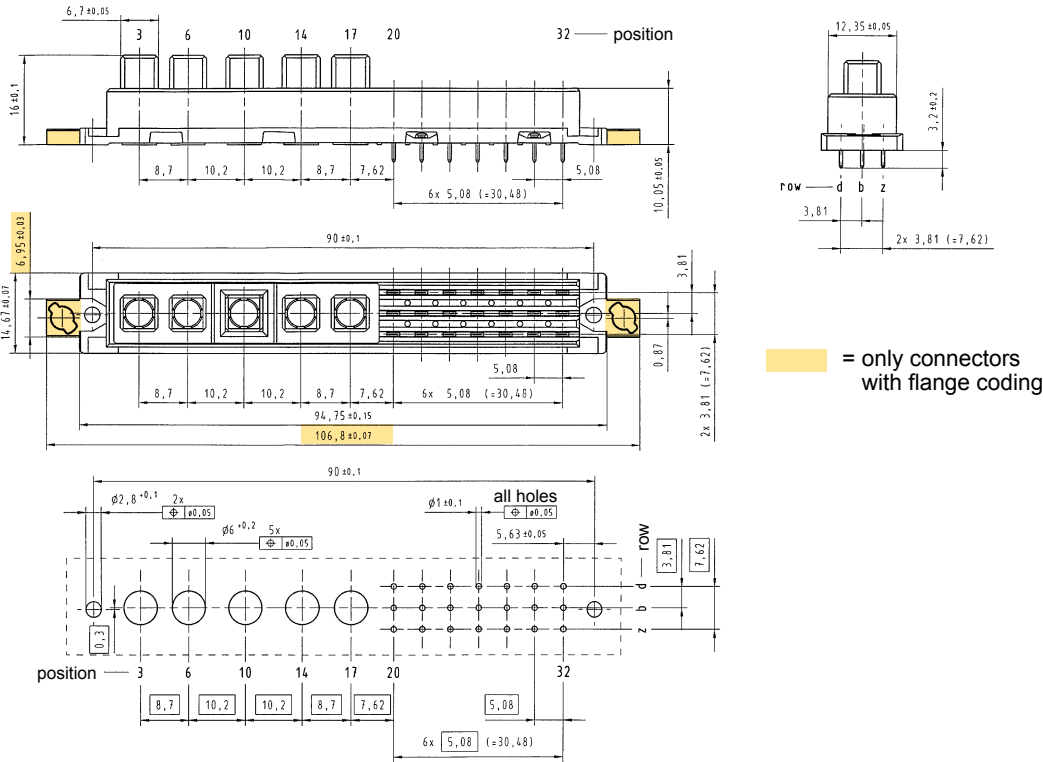
F + M



Female connectors

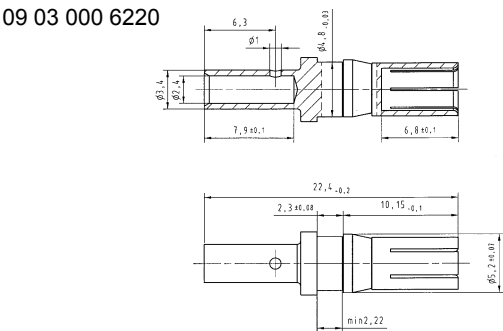
Identification	No. of contacts	Part number	Performance levels according to IEC 60603-2. Explanation chapter 00		
		3	2	1	
Female connector with solder pins 3.2 mm (without special contacts) without flange coding (I) with flange coding ¹⁾ (II)	21 + 5	Performance level 3 on request	09 06 221 6883	Performance level 1 on request	
	21 + 5		09 06 721 6883		
High current contact Crimp contacts for printed circuit termination 20 A			09 03 000 6220		

Dimensions



Board drillings
Mounting side

Dimensions



Dimensions in mm

Shell housings and accessories

Page

Summary of shell housings and accessories **20.02**

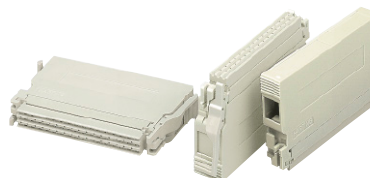
Shell housing C **20.04**



Shell housing 2C, 3C **20.08**

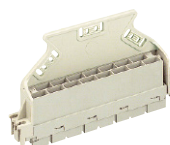
Shell housing A **20.10**

Shell housing B **20.12**



Shell housing D 15 **20.16**

Open hood G **20.19**



Junction element O **20.19**

Shell housings D 20/2 and D 20/4 **20.20**

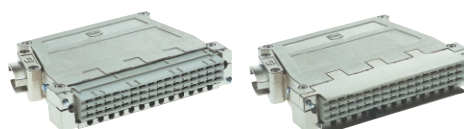


EMC housing **20.26**

Shell housings D 20/2 and D 20/4 metallised. **20.27**



Shell housings D 20 metal **20.30**



Electronic connectors in Heavy Duty Housings **20.33**

Summary shell housings and accessories



Appropriate connectors in shell housings	Types B, C, D, E, har-bus® 64	Types 2C, 3C	Type F	Types F, H, MH	Types E, F, H, MH
Check list: How to order shell housings and accessories. The Part number is stated.					
Shell housings	C 09 02 064 0501 09 02 064 0502 09 03 096 0501 09 05 048 0501	2C, 3C 09 23 048 0501 09 25 030 0501	A 09 06 048 0501 09 06 048 0402	B 09 06 048 0503 09 06 048 0504 09 06 048 0505	G 09 06 000 9957
Cable insert	09 02 000 9910 09 02 000 9911			09 06 000 9914 09 06 000 9915	
Insert for LED				09 06 000 9917	
Locking lever Order 2 pieces, in some cases each with different Part Nos. for left and right hand	09 02 000 9902 09 02 000 9903	Supplied with the shell housing	Supplied with the shell housing	09 06 000 9913 09 06 000 9919	
Locking screws Order 2 sets for fixing elements with male connectors	09 02 000 9909 M 2.5 x 16 M 2.5	09 02 000 9909 M 2.5 x 16 M 2.5	M 2.5 x 12 M 2.5	09 06 000 9926 M 2.5 x 20 M 2.5	Supplied with the shell housing
for interface connectors I	09 02 000 9909 M 2.5 x 16 M 2.5		M 2.5 x 22 Supplied with the interface connector I	09 06 000 9955 M 2.5 x 26	Supplied with the shell housing
Fixing brackets for 19" racks for male connectors	C 	C 	A 	B 	B
Multiple left fixing	09 02 000 9919	09 02 000 9919	09 06 000 9901	09 06 000 9907 09 06 000 9966 09 06 000 9908 09 06 000 9967	09 06 000 9907 09 06 000 9966 09 06 000 9908 09 06 000 9967
Multiple right fixing	09 02 000 9920	09 02 000 9920	09 06 000 9902		
Single left fixing	09 02 000 9921	09 02 000 9921	09 06 000 9905	09 06 000 9909 09 06 001 9934 09 06 000 9910 09 06 001 9935	09 06 000 9909 09 06 001 9934 09 06 000 9910 09 06 001 9935
Single right fixing	09 02 000 9922	09 02 000 9922	09 06 000 9906		
for female connectors				B 	
Multiple left fixing				09 06 000 9933 09 06 000 9933	
Multiple right fixing					
Fixing brackets for angled male connectors on pcb	C 	C 			
left	09 02 000 9926	09 02 000 9926			
right	09 02 000 9927	09 02 000 9927			
Fixing brackets for inverse male connectors on pcb	R 	R 			
R 1	09 02 000 9953	09 02 000 9953			
R 32	09 02 000 9954	09 02 000 9954			
Distance fixing brackets for piggyback connectors					
Type D top	09 04 000 9907				09 04 000 9907
Type E bottom	09 04 000 9906				09 04 000 9906
Type F top	09 06 000 9936				09 06 000 9936
Type F bottom	09 06 000 9937				09 06 000 9937
Protection strip for 20 mm shell housing				09 06 000 9929	
Protection and fixing strip for 20 mm shell housing				09 06 001 9909	

Female connectors Male connectors

Detailed system description see chapter 00

Summary shell housings and accessories



Appropriate connectors in shell housings	Types F, H, MH	Types F, H, MH	Types F, H, MH	Types F, H, MH	Types F, H, MH
Check list: How to order shell housings and accessories. The Part number is stated.	 ... 9968 ... 9930	 09 06 048 0515	 09 06 048 0521 09 06 048 0522	 09 06 948 0521 09 06 948 0522	 09 06 848 0550 09 06 848 0551
Shell housings	O 09 06 000 9968 09 06 000 9930° ° order 2 pieces	D 15 09 06 048 0515	D 20 09 06 048 0521 09 06 048 0522	D 20 metallised 09 06 948 0521 09 06 948 0522	D 20 metal 09 06 848 0550 09 06 848 0551
Cable insert			09 06 000 9988 09 06 000 9989	09 06 900 9988	
Insert for LED			09 06 000 9986 09 06 000 9987	09 06 900 9986 09 06 900 9987	
Locking lever Order 2 pieces, in some cases each with different Part Nos. for left and right hand		Supplied with the shell housing			
Locking screws Order 2 sets for fixing elements with male connectors for interface connectors I	09 06 000 9926 M 2.5 x 20 M 2.5	09 06 000 9926 M 2.5 x 16 M 2.5	Supplied with the shell housing	Supplied with the shell housing	Supplied with the shell housing
Shroud for screw fixing with interface connector I	—	—	09 06 001 9964	09 06 001 9964	—
Fixing brackets for 19" racks for male connectors Multiple fixing	B left 09 06 000 9907 09 06 000 9966 right 09 06 000 9908 09 06 000 9967	B left 09 06 000 9907 09 06 000 9966 right 09 06 000 9908 09 06 000 9967	B left 09 06 000 9907 09 06 000 9966 09 06 000 9995 09 06 000 9997 right 09 06 000 9908 09 06 000 9967 09 06 000 9996 09 06 000 9998	B left 09 06 900 9907 09 06 900 9966 09 06 900 9995 09 06 900 9997 right 09 06 900 9908 09 06 900 9967 09 06 900 9996	B left 09 06 800 9943 09 06 901 9924 right 09 06 800 9944 09 06 901 9925
for female connectors Multiple fixing	B left only ... 9930 09 06 000 9933 09 06 000 9933 right	B left 09 06 000 9933 09 06 000 9933 right			
Protection and fixing strip for 20 mm shell housing			09 06 001 9909	09 06 901 9909	

Shell housings

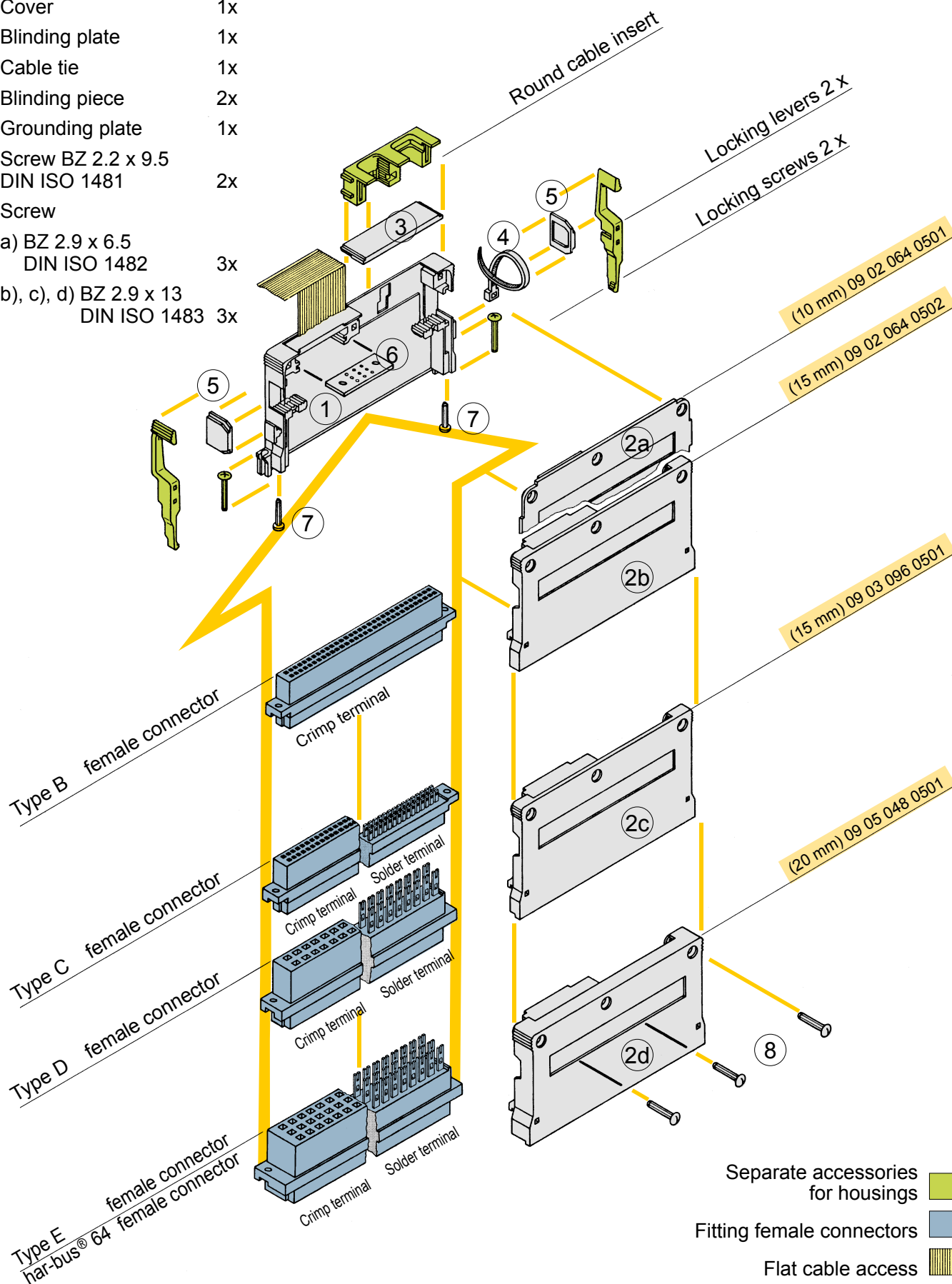
Female connectors Male connectors

Detailed system description see chapter 00

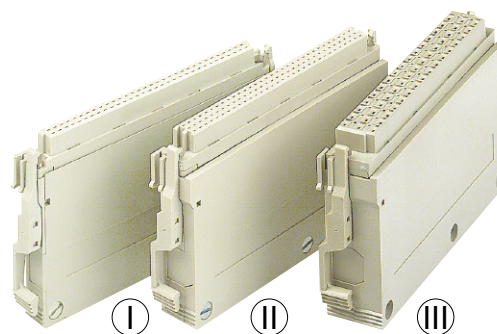
Shell housing C for types B, C, D, E and har-bus® 64



- ① Shell 1x
- ② Cover 1x
- ③ Blinding plate 1x
- ④ Cable tie 1x
- ⑤ Blinding piece 2x
- ⑥ Grounding plate 1x
- ⑦ Screw BZ 2.2 x 9.5
DIN ISO 1481 2x
- ⑧ Screw
 - a) BZ 2.9 x 6.5
DIN ISO 1482 3x
 - b), c), d) BZ 2.9 x 13
DIN ISO 1483 3x

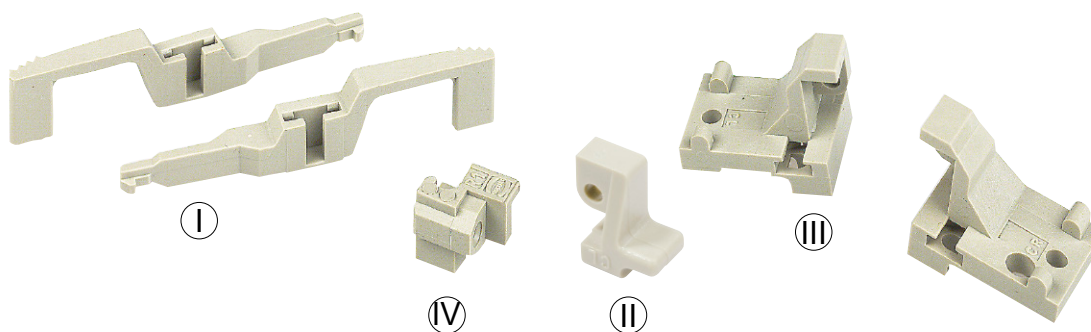


Shell housing C for types B, C, D, E and har-bus® 64



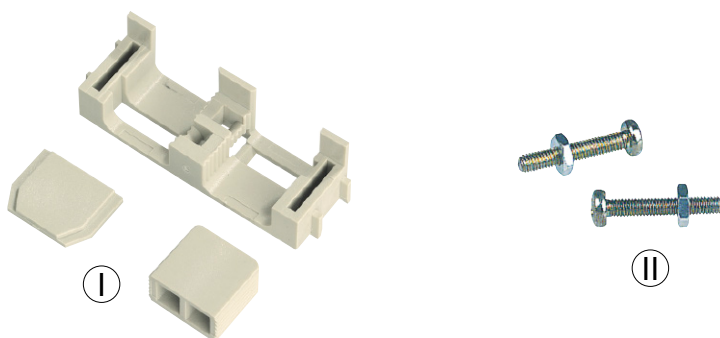
Identification	Part number	Drawing	Dimensions in mm
Shell housing C for female connectors type B I	10 mm 09 02 064 0501		
Shell housing C for female connectors types C, D II	15 mm 09 02 064 0502		
Shell housing C for female connectors type E, har-bus® 64 III	20 mm 09 05 048 0501		

1) Possible access for flat cable (18 x Ø 1.27). Remove the blanking piece.



Accessories

Identification	Part number	Drawing	Dimensions in mm
Locking lever for shell housing C I	left 09 02 000 9902 right 09 02 000 9903		
Fixing brackets C for male connectors for 19" racks according to DIN EN 60 297, part 3-101 Multiple fixing II	left 09 02 000 9919 right 09 02 000 9920		
Single fixing III	left 09 02 000 9921 right 09 02 000 9922		
Fixing brackets R for inverse male connectors on pcb's IV Screw DIN ISO 7049 M 2.2 x 9.5	R 1 09 02 000 9953 R 32 09 02 000 9954 09 06 001 9974		See application example 4, chapter 01

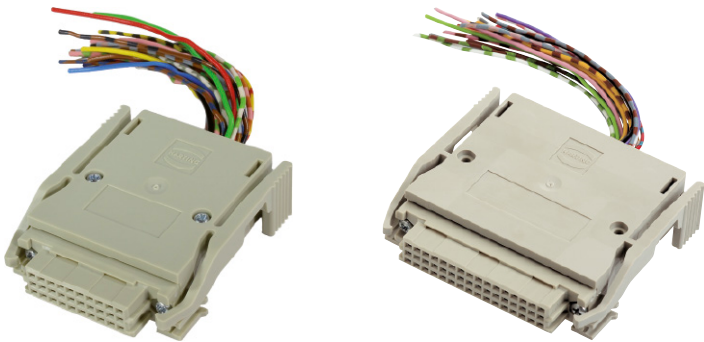


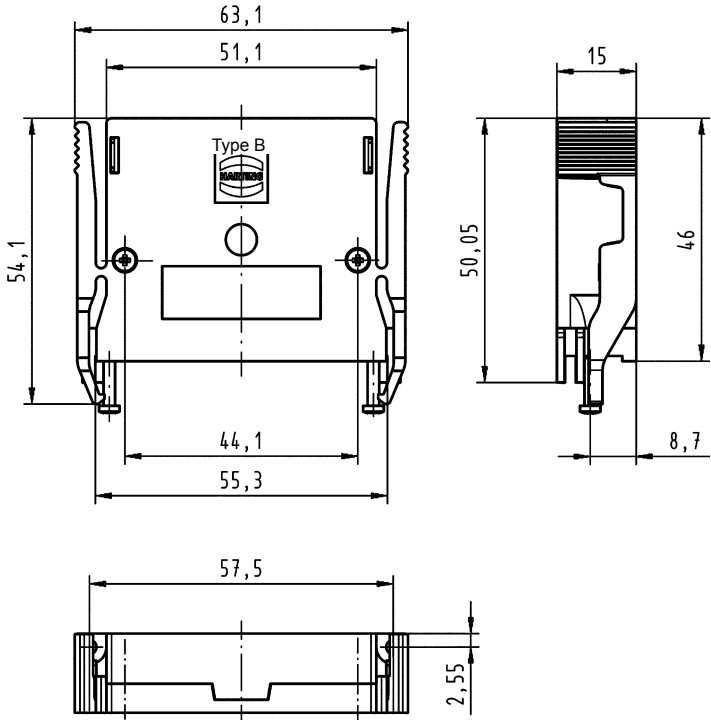
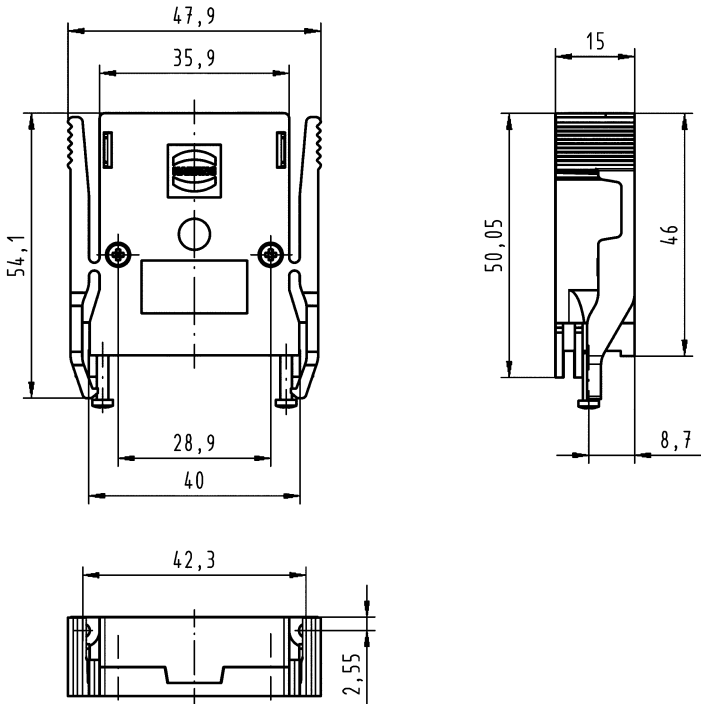
Accessories

Identification	Part number	Drawing	Dimensions in mm
Fixing brackets C for angled male connectors on pcb without fixing possibility in 19" racks left 09 02 000 9926 ^{f)} right 09 02 000 9927 ^{f)}			
Round cable insert 2 x $\varnothing$ 6.5 for shell housing C 09 02 064 0501 Supplied with: Round cable insert 1x Blinding piece A 1x Blinding piece B 1x Cable tie 1x	09 02 000 9910 ^{f)}		
Round cable insert 2 x $\varnothing$ 11.5 I for shell housings C 09 02 064 0502 09 03 096 0501 09 05 048 0501 Supplied with: Round cable insert 1x Blinding piece A 1x Blinding piece B 1x Cable tie 1x	09 02 000 9911 ^{f)}		
Locking screws II	09 02 000 9909 ¹⁾		

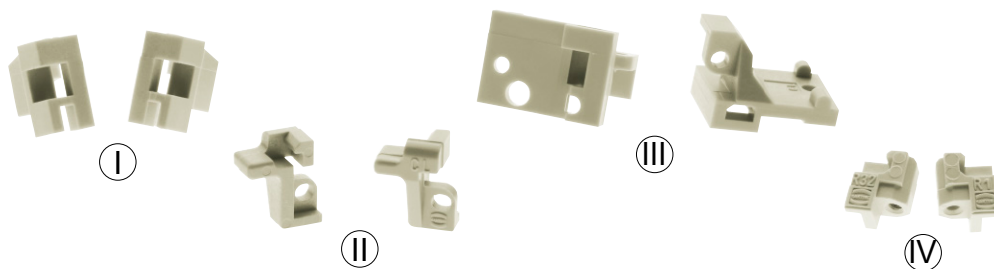
¹⁾ Order 2 pieces for one shell housing

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2



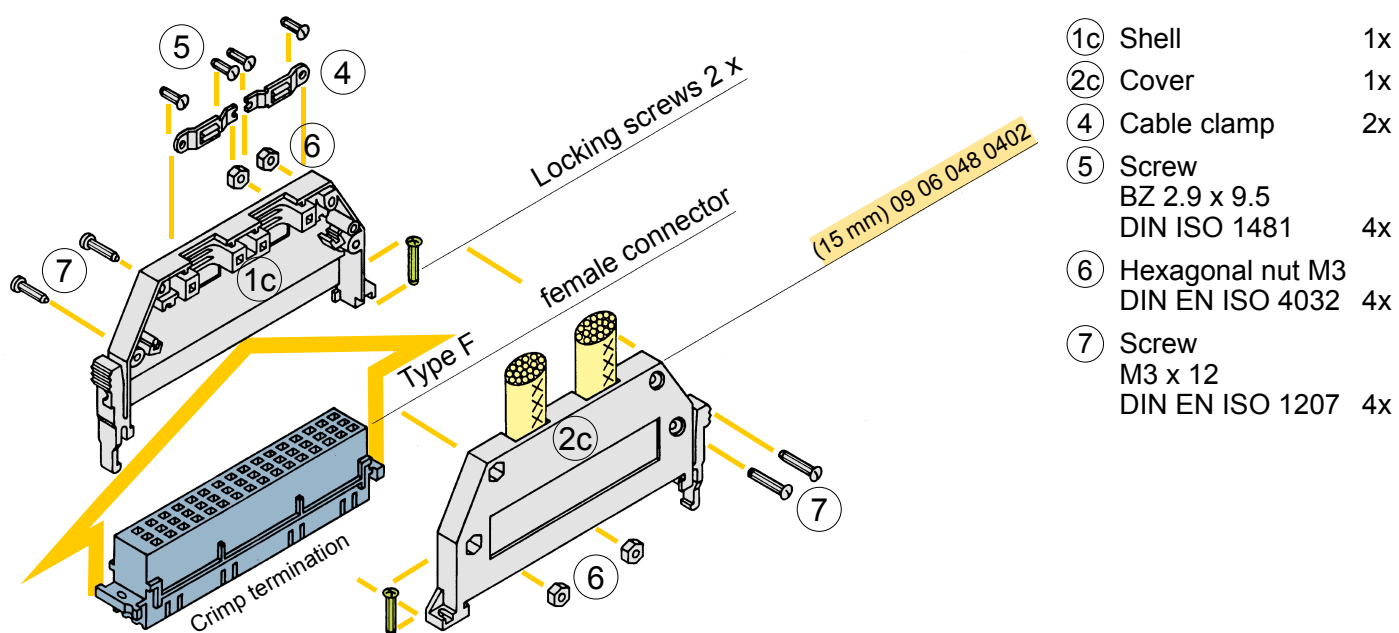
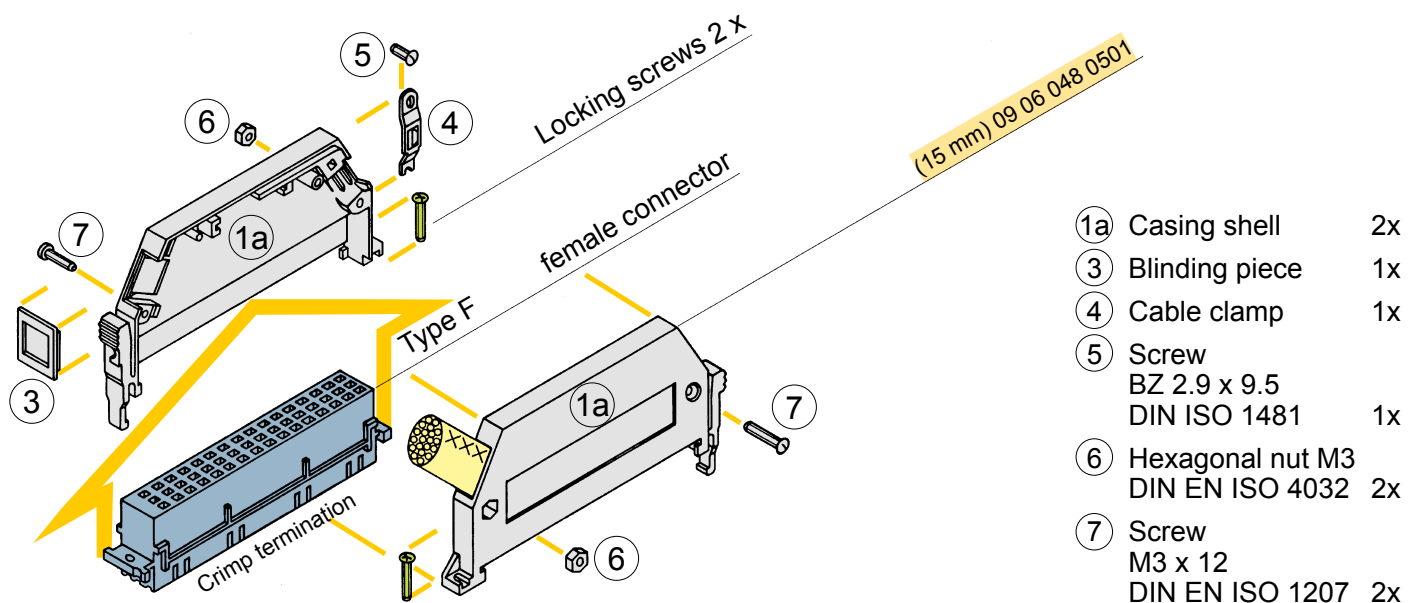
Identification	Part number	Drawing	Dimensions in mm
Shell housing 2C for female connectors type 2C Supplied with: Shell 1x Cover with 2 locking levers 1x Cable tie 1x Screw 2.2 x 9.5 4x (09 06 001 9974)	09 23 048 0501		
Shell housing 3C for female connectors type 3C Supplied with: Shell 1x Cover with 2 locking levers 1x Cable tie 1x Screw 2.2 x 9.5 4x (09 06 001 9974)	09 25 030 0501		

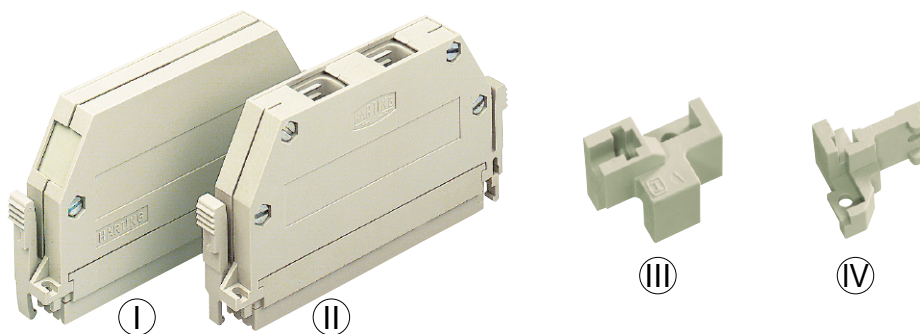
Shell housings



Accessories

Identification	Part number	Drawing	Dimensions in mm									
Fixing brackets C for angled male connectors on pcb without fixing possibility in 19" racks I	left 09 02 000 9926 right 09 02 000 9927		<table><tr><td></td><td>a</td></tr><tr><td>2C</td><td>63.7</td></tr><tr><td>3C</td><td>48.4</td></tr></table>		a	2C	63.7	3C	48.4			
	a											
2C	63.7											
3C	48.4											
Fixing brackets C for male connectors for 19" racks according to DIN EN 60 297, part 3-101 Multiple fixing II	left 09 02 000 9919 right 09 02 000 9920											
Single fixing III	left 09 02 000 9921 right 09 02 000 9922		<table><tr><td></td><td>b</td><td>c</td></tr><tr><td>2C</td><td>82.3</td><td>88.4</td></tr><tr><td>3C</td><td>67.1</td><td>73.2</td></tr></table>		b	c	2C	82.3	88.4	3C	67.1	73.2
	b	c										
2C	82.3	88.4										
3C	67.1	73.2										
Fixing brackets R for inverse male connectors on pcb's IV Screw DIN ISO 7049 M2.2 x 9.5	R 1 09 02 000 9953 R 32 09 02 000 9954 09 06 001 9974		<table><tr><td></td><td>d</td></tr><tr><td>2C</td><td>64.1</td></tr><tr><td>3C</td><td>48.9</td></tr></table>		d	2C	64.1	3C	48.9			
	d											
2C	64.1											
3C	48.9											





Identification	Part number	Drawing	Dimensions in mm
Shell housing A Side entry I	15 mm 09 06 048 0501 ^{f)}		
	15 mm 09 06 048 0402 ^{f)}		
Cable clamp incl. screw	09 06 001 9986	1 x ④ + 2 x ⑤ on page 20.10	
Fixing brackets A for male connectors for 19" racks according to DIN EN 60 297, part 3-101 Multiple fixing III	left 09 06 000 9901 ^{f)} right 09 06 000 9902 ^{f)}	 left right	
	left 09 06 000 9905 ^{f)} right 09 06 000 9906 ^{f)}	 left right	

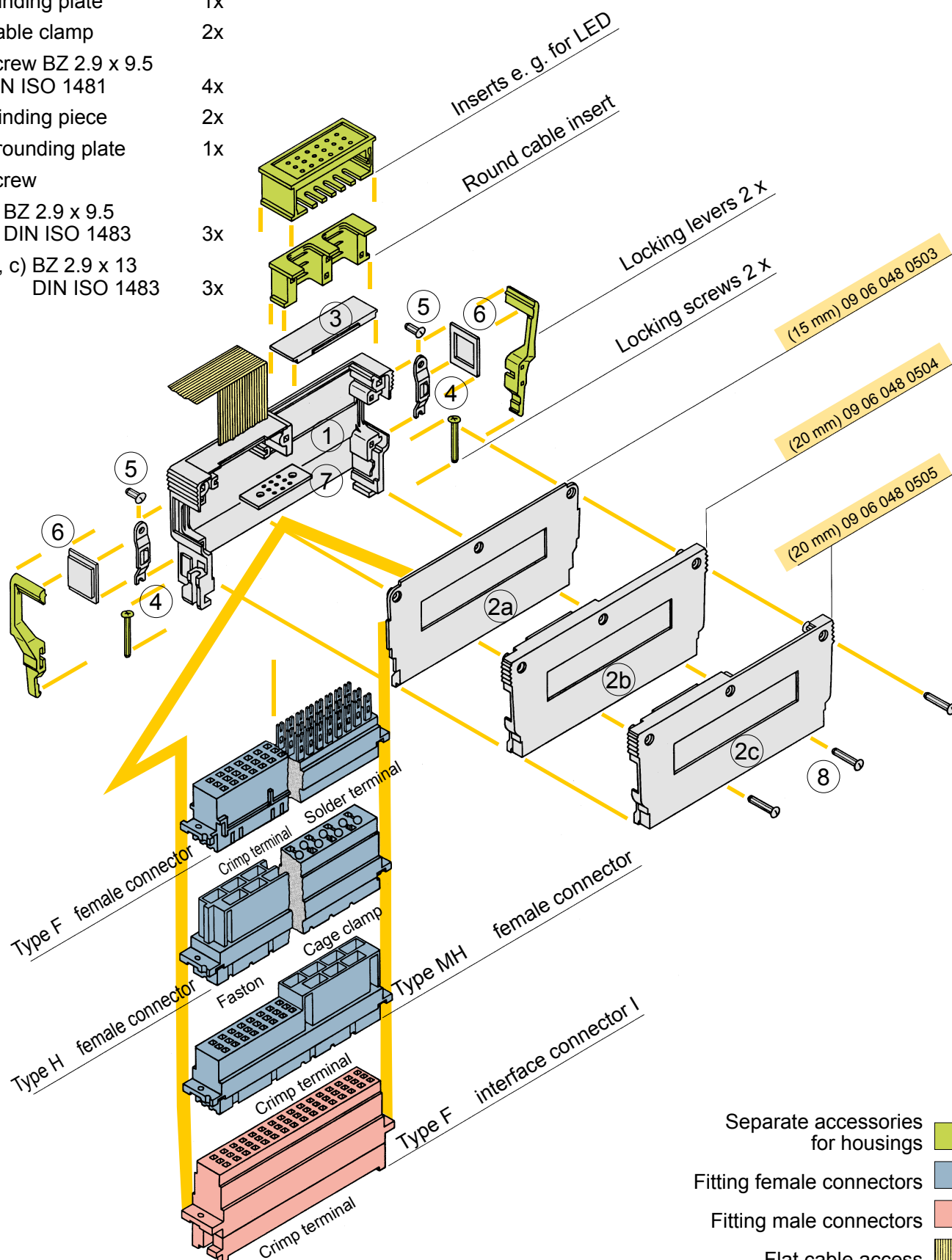
1) nut and screw not supplied with bracket

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Shell housing B for types F, H and MH

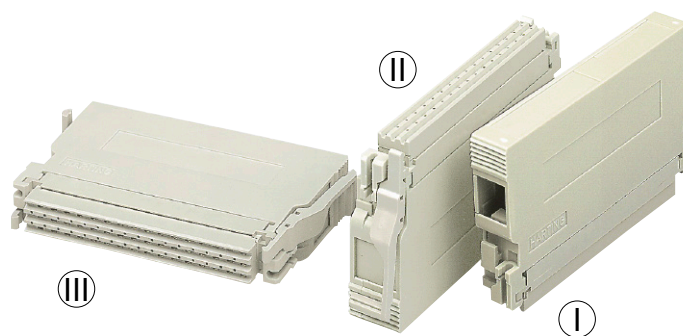


- | | |
|--------------------------------------|----|
| ① Shell | 1x |
| ② Cover | 1x |
| ③ Blinding plate | 1x |
| ④ Cable clamp | 2x |
| ⑤ Screw BZ 2.9 x 9.5
DIN ISO 1481 | 4x |
| ⑥ Blinding piece | 2x |
| ⑦ Grounding plate | 1x |
| ⑧ Screw | |
| a) BZ 2.9 x 9.5
DIN ISO 1483 | 3x |
| b), c) BZ 2.9 x 13
DIN ISO 1483 | 3x |



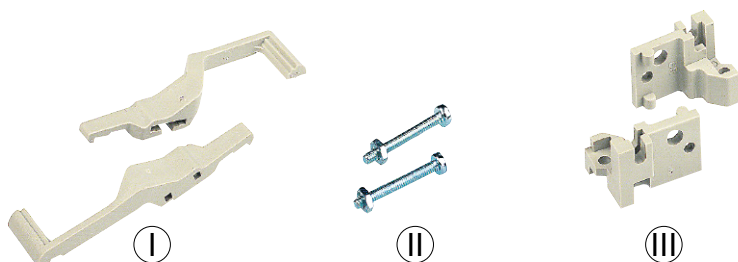
- Separate accessories for housings
- Fitting female connectors
- Fitting male connectors
- Flat cable access
- Housing parts supplied

Shell housing B for types F, H and MH



Identification	Part number	Drawing	Dimensions in mm
Shell housing B I II III	15 mm 09 06 048 0503		
	20 mm 09 06 048 0504		
	20 mm 09 06 048 0505		
		1) Possible access for flat cable (18 x 1.27). Remove the blanking piece	

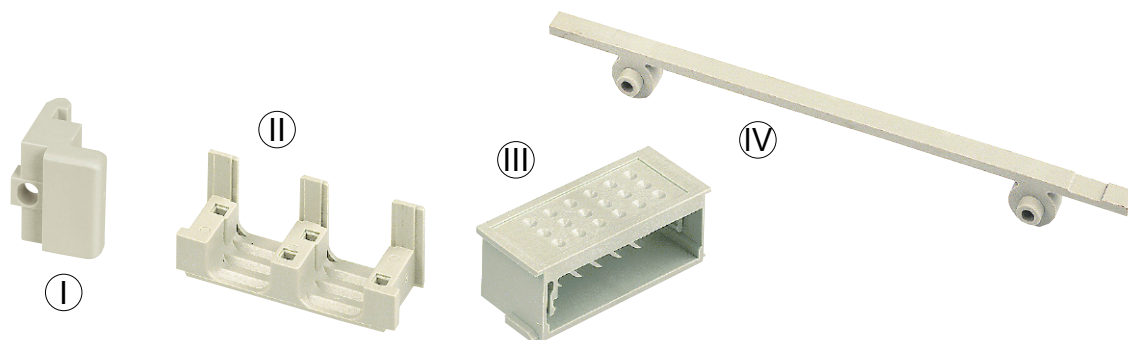
Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2



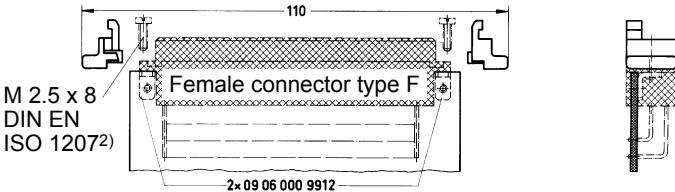
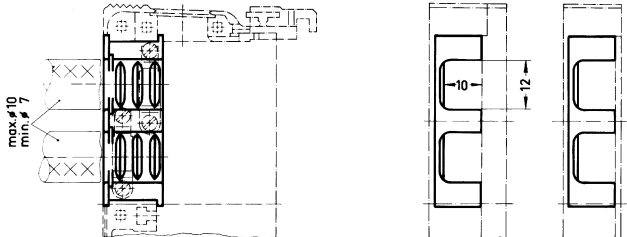
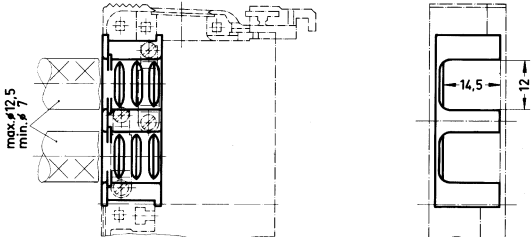
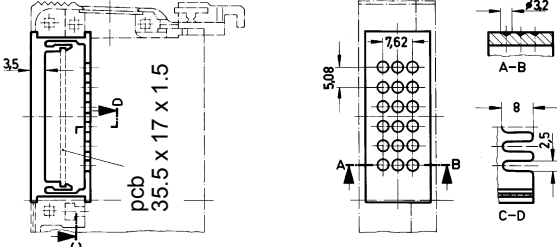
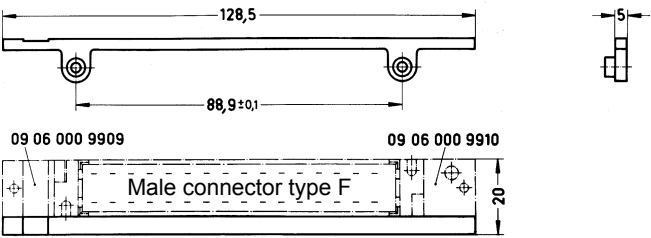
Accessories

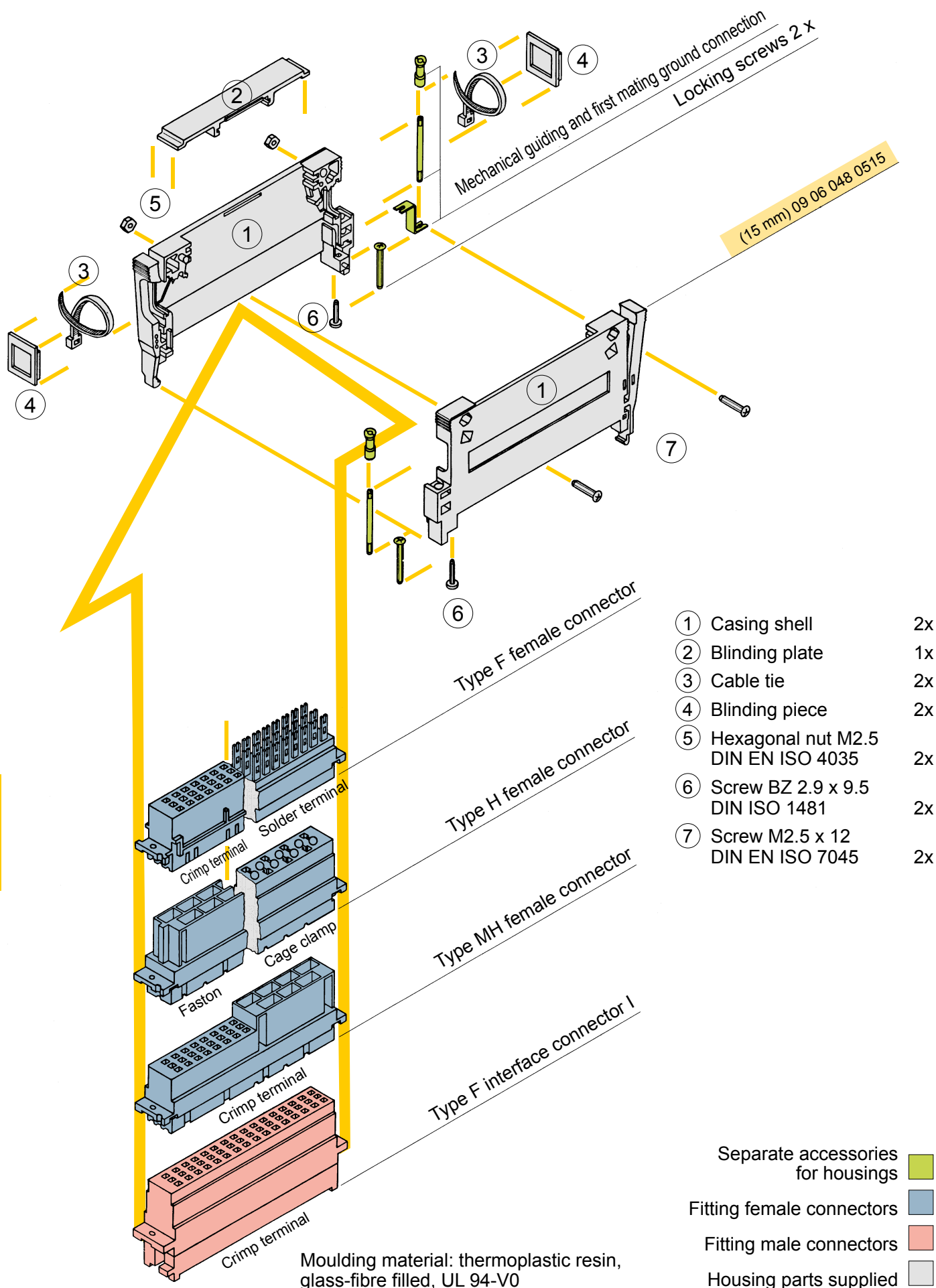
Identification	Part number	Drawing	Dimensions in mm
Locking lever for shell housing B 09 06 048 0503 ①	09 06 000 9913 ¹⁾ f)		
09 06 048 0504 09 06 048 0505 1) Order 2 pieces for one shell housing	left 09 06 000 9913 ^{f)} right 09 06 000 9919 ^{f)}		
Locking screws ②	09 06 000 9926 ¹⁾		
Fixing brackets B for male connectors for 19" racks according to DIN EN 60 297, part 3-101 Multiple fixing without nut with nut M 2.5 DIN 562	left 09 06 000 9907 ^{f)} right 09 06 000 9908 ^{f)} left 09 06 000 9966 ^{f)} right 09 06 000 9967 ^{f)}		
Single fixing without nut ③ with nut M 2.5 DIN 562	left 09 06 000 9909 ^{f)} right 09 06 000 9910 ^{f)} left 09 06 001 9934 right 09 06 001 9935		

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

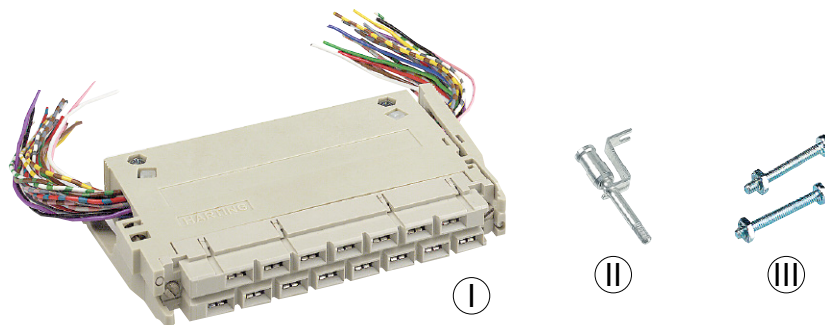


Accessories

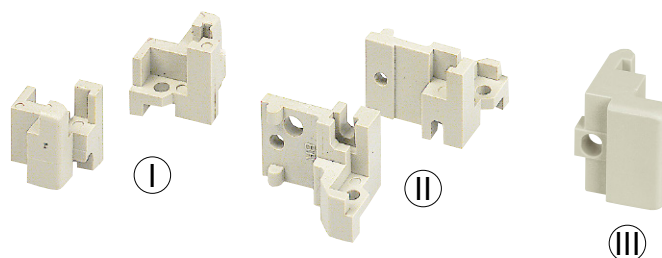
Identification	Part number	Drawing	Dimensions in mm
Fixing brackets B for female connectors for 19" racks according to DIN EN 60 297, part 3-101 Multiple fixing  1) Order 2 pieces for one female connector	09 06 000 9933 ¹⁾	 2) nut and screw not supplied with fixing brackets	
Round cable insert 2 x $\varnothing 10$ for shell housings B 09 06 048 0503 09 06 048 0504 Supplied with: Round cable insert 1x Blinding piece 1x	09 06 000 9914		
Round cable insert 2 x $\varnothing 12.5$  for shell housing B 09 06 048 0505 Supplied with: Round cable insert 1x Blinding piece 1x	09 06 000 9915		
Insert for LED  for shell housing B 09 06 048 0505	09 06 000 9917		
Protection strip  Used with shell housings type B for front side access 09 06 048 0504 09 06 048 0505	09 06 000 9929		



Shell housing D 15 for types F, H and MH



Identification	Part number	Drawing	Dimensions in mm
Shell housing D 15 I	15 mm 09 06 048 0515 ¹⁾		
Mechanical guiding and first mating ground connection II	09 06 000 9961		
Locking screws III 1) Order 2 pieces for one shell housing	09 06 000 9926 ¹⁾		

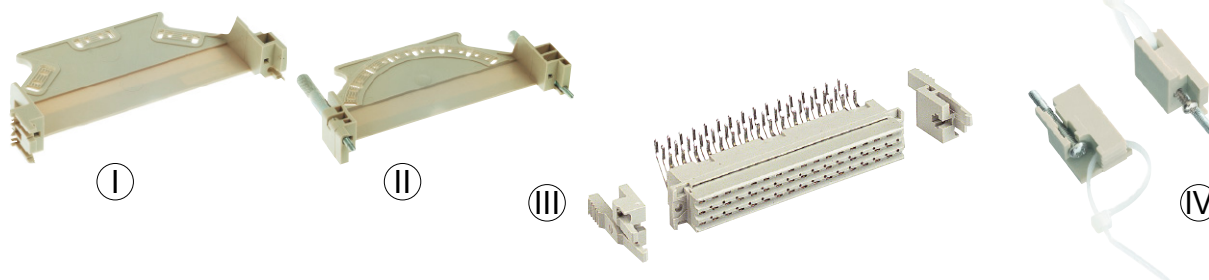


Accessories

Identification	Part number	Drawing	Dimensions in mm
Fixing brackets B for male connectors for 19" racks according to DIN EN 60 297, part 3-101 Multiple fixing without nut ① with nut M 2.5 DIN 562	left 09 06 000 9907 right 09 06 000 9908 left 09 06 000 9966 right 09 06 000 9967		
Single fixing without nut ② with nut M 2.5 DIN 562	left 09 06 000 9909 right 09 06 000 9910 left 09 06 001 9934 right 09 06 001 9935		
Fixing brackets B for female connectors for 19" racks according to DIN EN 60 297, part 3-101 Multiple fixing ③	09 06 000 9933¹⁾		

¹⁾ Order 2 pieces for one female connector

²⁾ nut and screw not supplied with fixing brackets

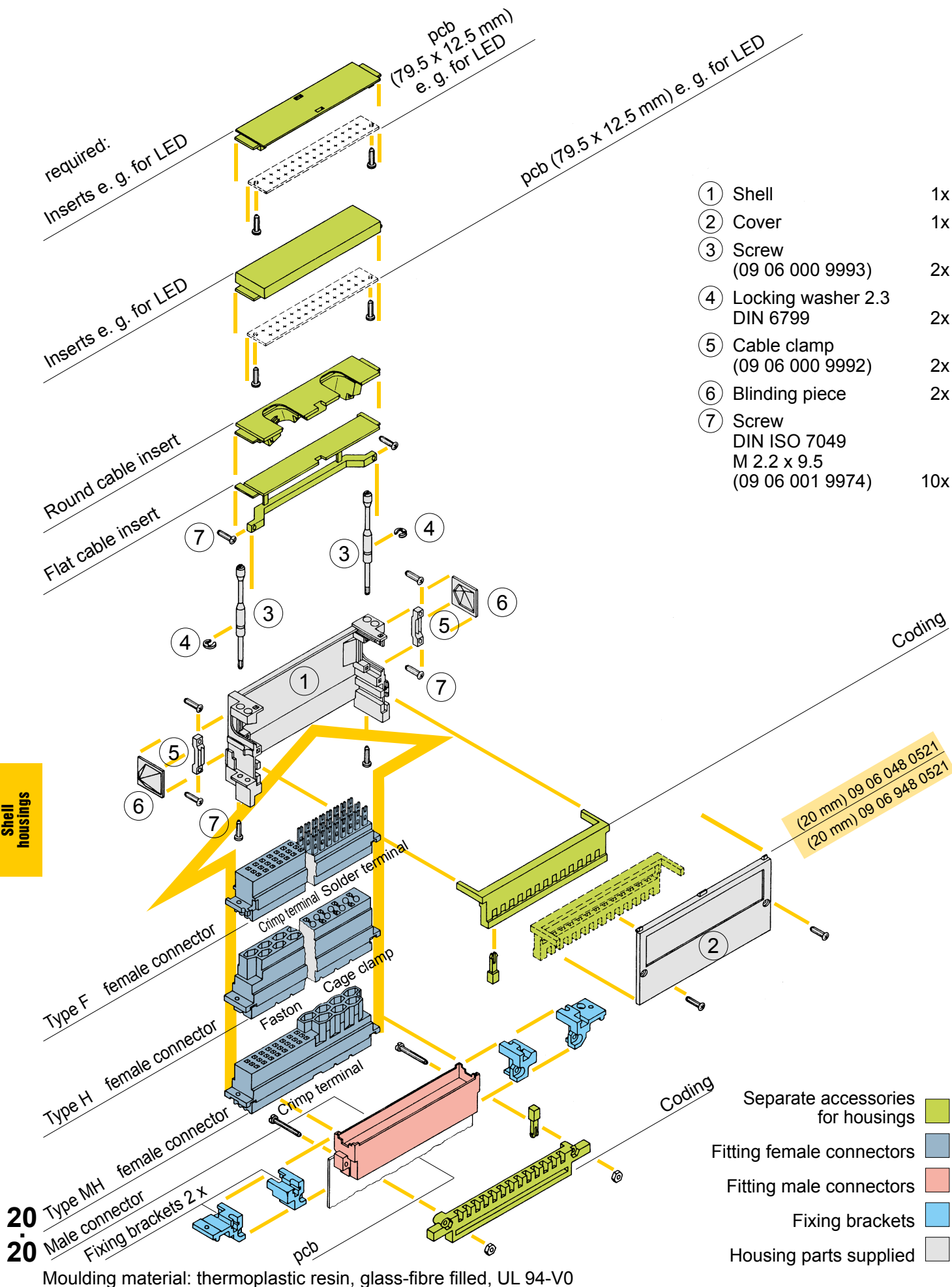


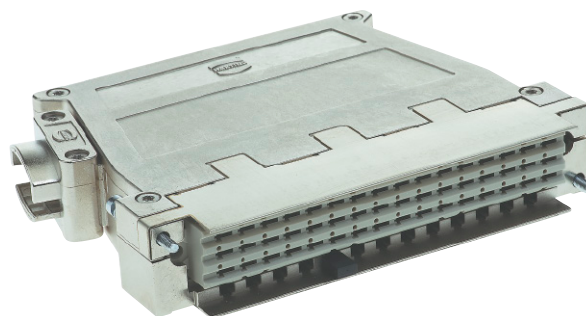
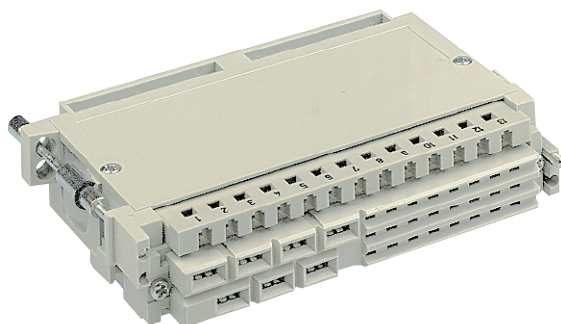
Identification	Part number	Drawing	Dimensions in mm
Open hood G ① for types E, F, H and MH, for applications A B C Supplied with: Open hood 1x Locking screw 2x (09 06 000 9958) Cable tie 1x Screw 2x	09 06 000 9957		
Open hood G ② for types E, F, H and MH, for application C Supplied with: Open hood 1x Pre-assembled, undetachable locking screw 2x Cable tie 1x Screw 2x	09 06 001 9939		
Junction element O for type F ④ Supplied with: Junction element 2x Cable tie 2x Screw 2x Screw M2.5 x 20 2x	09 06 000 9968		
Locking lever for type F, H and MH ③ 1) Order 2 pieces for one female connector	09 06 000 9930¹⁾ 09 06 000 9911¹⁾	2) nut and screw not supplied with locking levers	

Shell housing D 20/2 for types F, H and MH



Shell housings





Fitting female connectors

Part-No.	Type	D 20/2	D 20/4	D 20 metal	D 20 metal HF
09 06 2__ 823	F with open solder lugs	X		X	X
09 06 2__ 853	F with closed solder lugs	X		X	X
09 06 248 3201	F moulding for crimp contacts	X	X	X	X
09 06 215 2871	H for faston	X		X	X
09 06 015 2813	H with cage clamps	X		X	X
09 06 231 2881	MH moulding for crimp contacts	X		X	X

Order example:

32 = 32 contacts
48 = 48 contacts

09 06 2__ 853



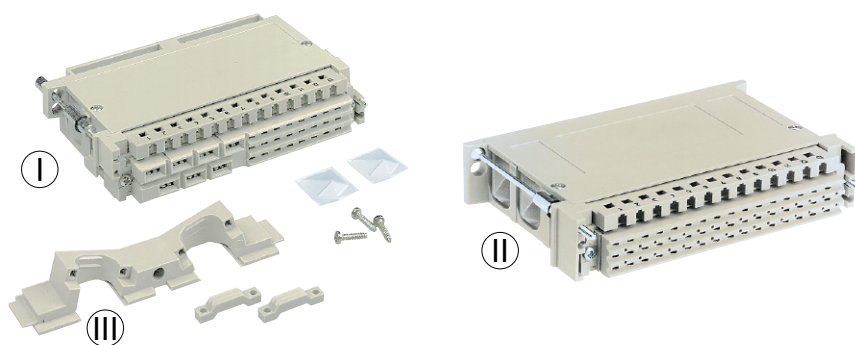
7 = performance level 3
6 = performance level 2
2 = performance level 1

Technical characteristics

	D 20/2	D 20/2 metallised ¹⁾	D 20/4	D 20/4 metallised ¹⁾	D 20 metal	D 20 metal HF
Part number	09 06 048 0521	09 06 948 0521	09 06 048 0522	09 06 948 0522	09 06 848 0550	09 06 848 0551
Material	Polycarbonate	Polycarbonate	Polycarbonate	Polycarbonate	Zinc alloy	Zinc alloy
Surface	none	nickel/copper	none	nickel/copper	nickel-plated	nickel-plated
Weight [g]	36	44	43	52	182	188
Cable entries	side (2 x), top (2 x)	side (2 x), top (2 x)	side (4 x)	side (4 x)	side (2 x), top (2 x)	side (2 x), top (2 x)
Protection	IP20	IP20	IP20	IP20	IP20	IP20

¹⁾ upper temperature limit is +105 °C

Shell housing D 20 for types F, H and MH

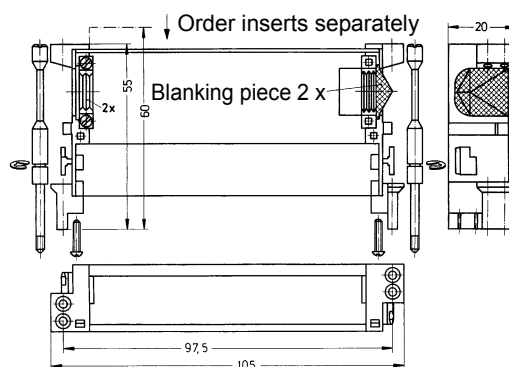


Identification	Part number	Drawing	Dimensions in mm
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Shell housing
D 20/2
Two side
cable entries

I

20 mm
09 06 048 0521

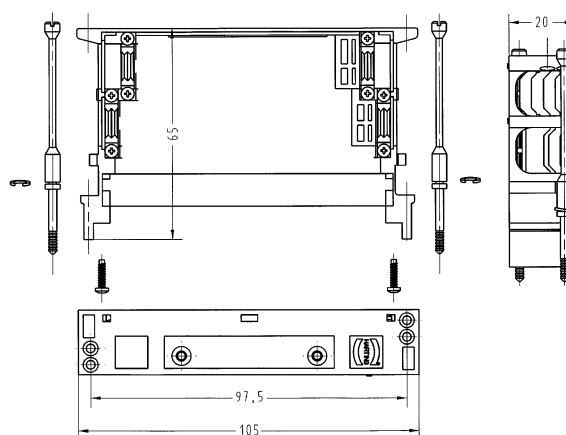


Shell housing
D 20/4
Four side
cable entries

II

Supplied with:
Shell 1x
Cover 1x
Locking screw 2x
(09 06 000 9920)
Locking washer 2.3 2x
Screw BZ 2.2x9.5 12x
Blinding piece 3x
Cable clamp 2x

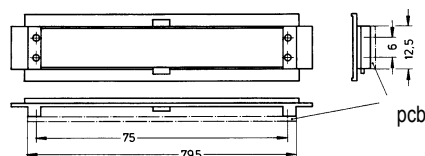
20 mm
09 06 048 0522



Inserts e. g. for LED*

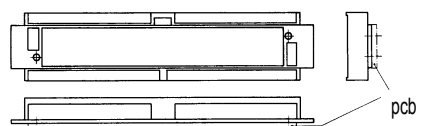
for 55 mm height

09 06 000 9986



for 60 mm height

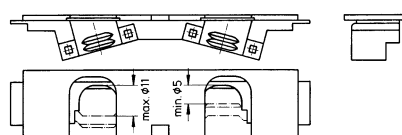
09 06 000 9987



Round cable insert*
2 x ø 11

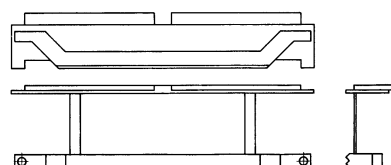
III

09 06 000 9988



Flat cable insert*

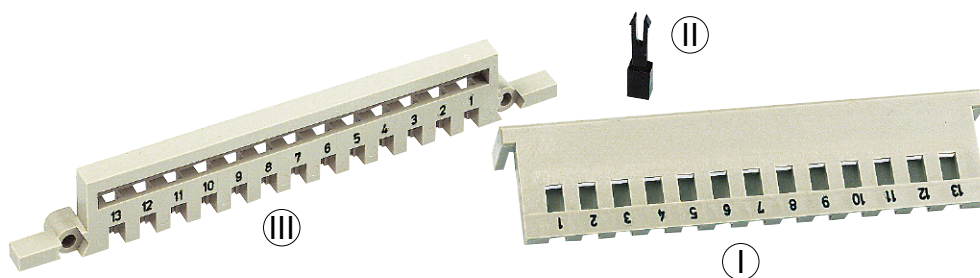
09 06 000 9989



Shell
 housings

20
22

* Fits D 20/2
Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2



Coding

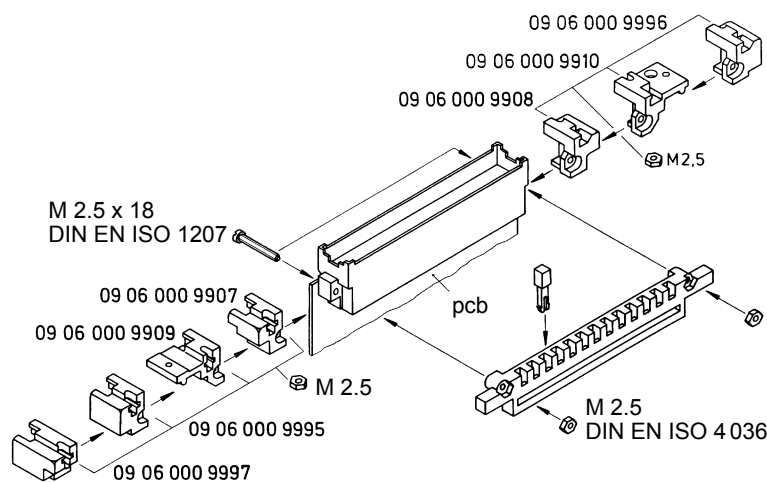
Identification	Part number	Drawing	Dimensions in mm
Code comb for shell housing³⁾ (can also be used as a blanking cover) Ⓘ	09 06 000 9984 ^{f)}		
Coding pin³⁾ Ⓢ 1) Order 13 pieces per code comb	09 06 001 9905 ¹⁾		
Code comb for male connectors³⁾ ⓈⓈ short version for a full metal locking lever with nut M2.5	09 06 000 9985 ^{f)} 09 06 001 9985 ^{f)} 09 06 001 9995 ^{f)}		
Mounting possibilities for the code comb in the shell housing D 20/2			2) Use the lower slot when coding the male connector with fixing brackets Mounting example A max. cable entry $\varnothing$ 14 mm to the top, see page 20.25 Mounting example B max. cable entry $\varnothing$ 14 mm to the bottom, see page 20.25

³⁾ Fits D 20/2 and D 20/4

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Identification	Part number	Drawing	Dimensions in mm
----------------	-------------	---------	------------------

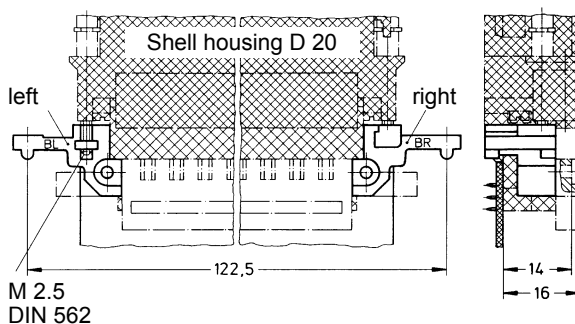
Mounting possibilities for code comb at the male connector with fixing brackets



Fixing brackets B for male connectors*
for 19" racks according to DIN EN 60 297, part 3-101
Single fixing*
without nut

left
09 06 000 9909
right
09 06 000 9910

left
09 06 001 9934
right
09 06 001 9935



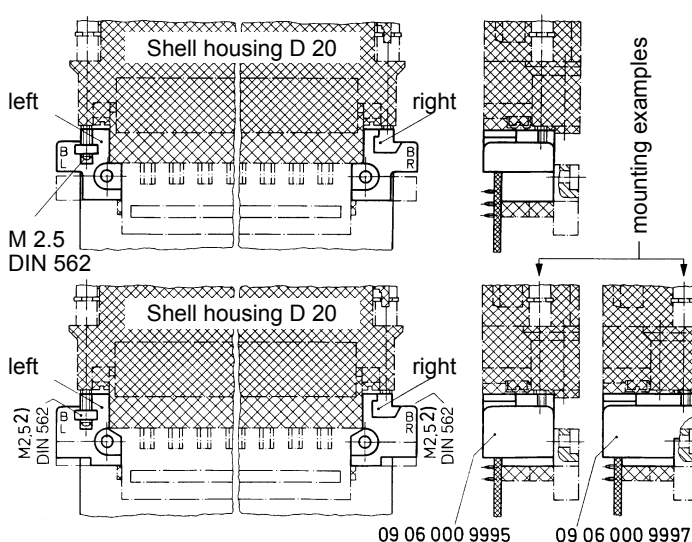
Multiple fixing*
without coding at the fixing bracket
without nut

left
09 06 000 9907
right
09 06 000 9908

left
09 06 000 9966
right
09 06 000 9967

left
09 06 000 9995
09 06 000 9997

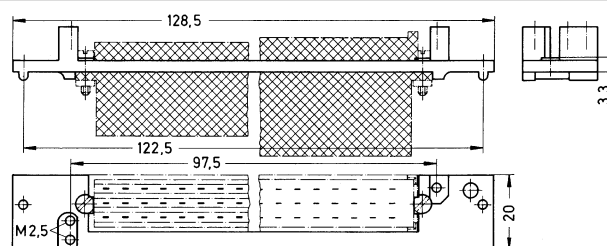
right
09 06 000 9996
09 06 000 9998



2) supplied with fixing

Protection and fixing strip* for 20 mm shell housing
Single fixing
fits female connectors and I element crimp

09 06 001 9909



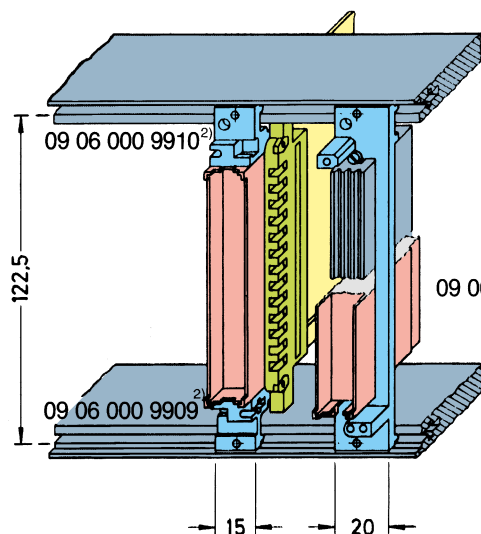
* Fits D 20/2 and D 20/4

1) Specific coding between the fixing bracket and the pcb guiding rail.
The guiding rail and corresponding coding pins are not scope of delivery

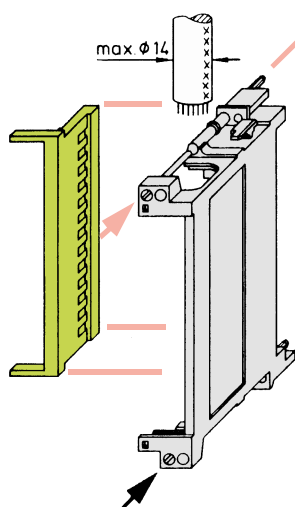
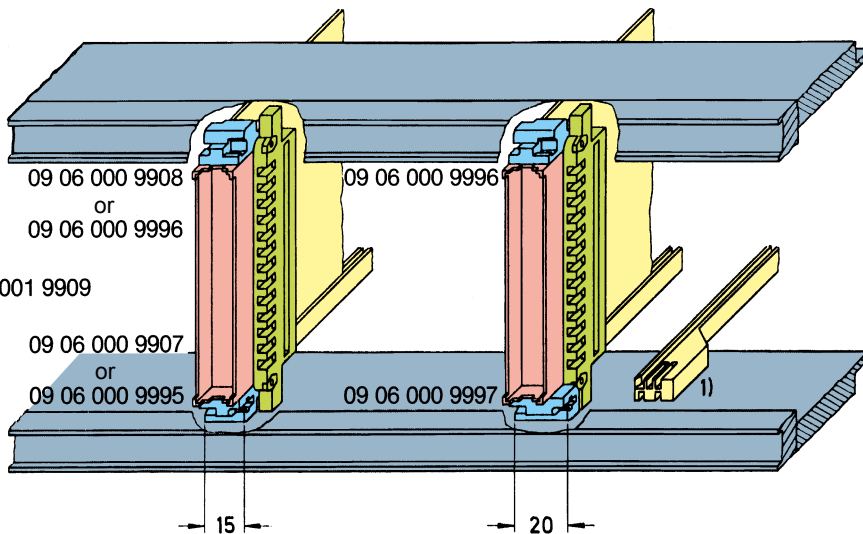
Mounting examples

Dimensions in mm

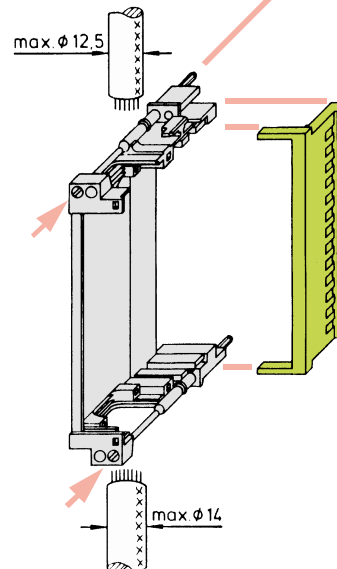
Single fixing



Multiple fixing



Mounting example A²⁾
max. cable entry to the top



Mounting example B
max. cable entry
to the bottom

Separate accessories
for housings

Fitting female connectors

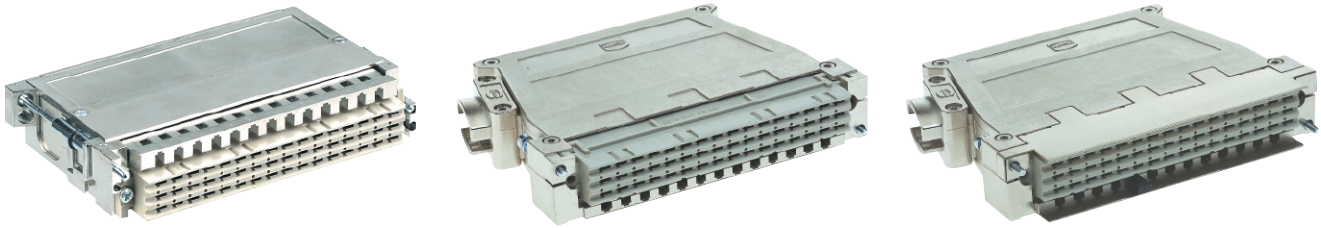
Fitting male connectors

Fixing brackets

Housing parts supplied

¹⁾ Specific coding between the fixing bracket and the pcb guiding rail

²⁾ Max. cable entry (Ø 14 mm) from the bottom with fixing brackets 09 06 901 9924/...9925 possible. See page 20.32.



EMC with HARTING connectors

HARTING offers metallised D 20 housings and full metal housings for EMC connectors according to IEC 60603-2. Its strong EMI characteristics and metallised fixing elements offers optimal shielding and grounding.

The connection of the cable braid to different types of connector housings, as well as the influence of the connector itself on EMC characteristics of an instrument application, were analysed in regard to **the shielding effectiveness against electromagnetic radiation**. The shielded signal data lines of a railway application were carried via two eurocard pcb's installed into a 19"-rack. The fixing of the cable braid was realised with different HARTING D 20 housings.

The application including the connectors was then exposed to RF signals, transient bursts and electrostatic discharges.

The standard plastic housings showed minimal EMC performance. The EMC performance of metallised and full metal housings showed significant improvements.

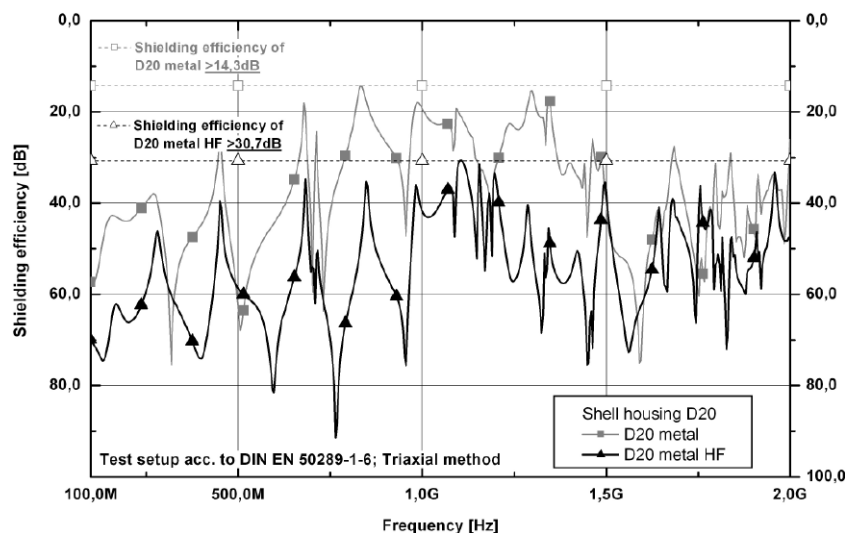
One advantage of metallised housings is their reduced weight (40 grams compared to 180 grams of a full metal housing). Therefore, minimal interference is applied to the pcb in applications where strong vibration is occurring. The HARTING housings are comparatively light through the use of metallised plastic.

The main advantages of a full metal housing are improved cable braid fixing, easy mounting and robustness.

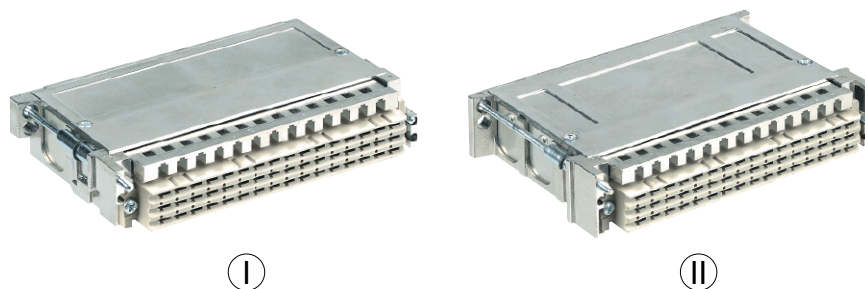
In general, one should keep in mind that an unshielded cable entry leads to loss of the shielding against electromagnetic interference.

"A high-resistance interruption of the cable shield (e.g. by using "pigtailed" via twisted stranded wires of the cable shield) may affect the EMC performance and therefore cause unacceptable effects to the electromagnetic environment."

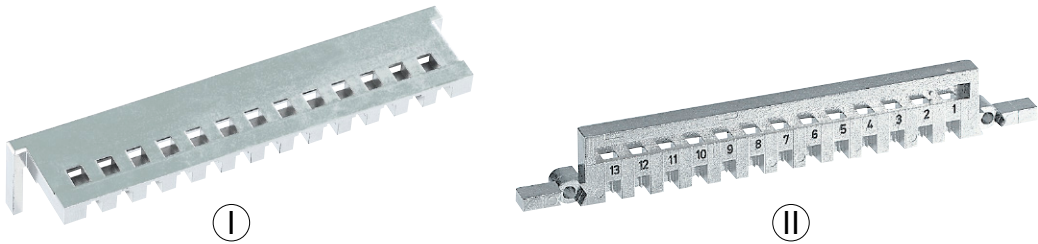
These housings are applied in electronic installations of the railway vehicles of the GERMAN RAILWAY. They are also recommended for stationary installations of the GERMAN RAILWAY (see norm BN 74016, part 1 of December 1989).



Shell housing D 20 metallised for types F, H and MH



Identification	Part number	Drawing	Dimensions in mm
Shell housing D 20/2 metallised with two side cable entries I Supplied with: see page 20.20	20 mm 09 06 948 0521	Order inserts separately	
Shell housing D 20/4 metallised with four side cable entries II Supplied with: Shell 1x Cover 1x Locking screw 2x (09 06 000 9920) Locking washer 2.3 2x Screw BZ 2.2x7.5 12x Blinding piece 3x Cable clamp 2x	20 mm 09 06 948 0522		
Metallised insert e. g. for LED* for 55 mm height	09 06 900 9986		
for 60 mm height	09 06 900 9987		
Metallised round cable insert* 2 x Ø 11	09 06 900 9988		



Coding

Identification	Part number	Drawing	Dimensions in mm
Metallised code comb for shell housing³⁾ (can also be used as blanking cover) Ⓘ	09 06 900 9984 ^{f)}		
Code pin³⁾ 1) Order 13 pieces per code comb	09 06 001 9905 ¹⁾		
Metallised code comb for male connector³⁾ Ⓢ short version for a full metal locking lever	09 06 900 9985 ^{f)} 09 06 901 9985 ^{f)}		
Mounting possibilities for the code comb in shell housing D 20/2 metallised			2) Use the lower slot when coding the male connector with fixing brackets Mounting example A max. cable entry $\varnothing$ 14 mm to the top, see page 20.25 Mounting example B max. cable entry $\varnothing$ 14 mm to the bottom, see page 20.25

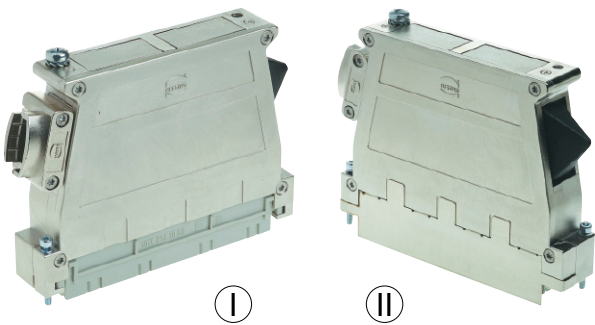
³⁾ Fits D 20/2 and D 20/4 metallised
^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

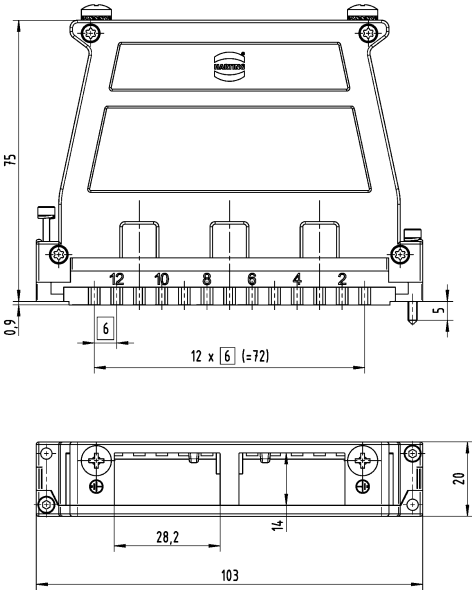
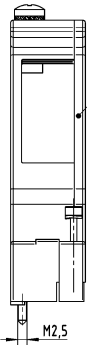
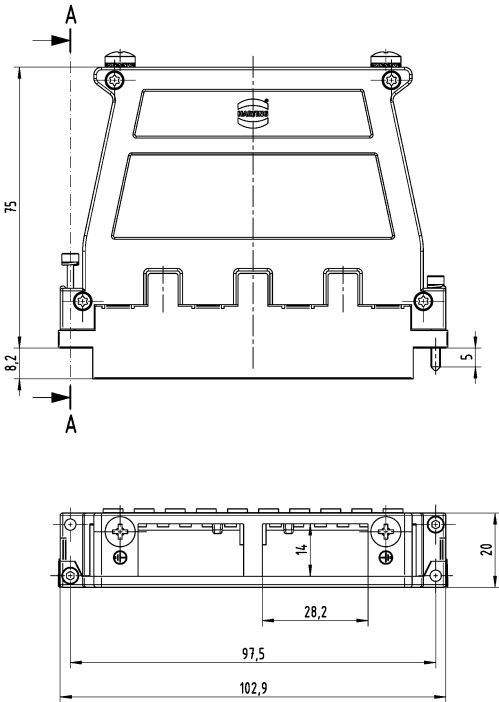
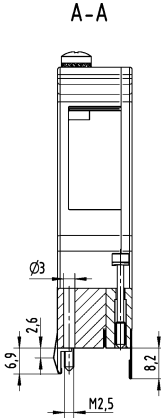
Identification	Part number	Drawing	Dimensions in mm
Mounting possibilities for coding at the male connector with fixing brackets			
Fixing brackets B metallised for male connectors* for 19" racks according to DIN EN 60 297, part 3-101 Single fixing* without nut with nut M 2.5 DIN EN ISO 4036	left 09 06 900 9909 right 09 06 900 9910 left 09 06 901 9934 right 09 06 901 9935		
Multiple fixing* without coding at fixing bracket without nut without coding at fixing bracket with nut M 2.5 DIN 562 with coding at fixing bracket ¹⁾ with nut M 2.5 DIN 562	left 09 06 900 9907 right 09 06 900 9908 left 09 06 900 9966 right 09 06 900 9967 left 15 mm 09 06 900 9995 20 mm 09 06 900 9997 right 15 mm 09 06 900 9996		
Protection and fixing* strip for 20 mm shell housing Single fixing fits female connectors and I element crimp	09 06 901 9909		

* Fits D 20/2 and D 20/4 metallised

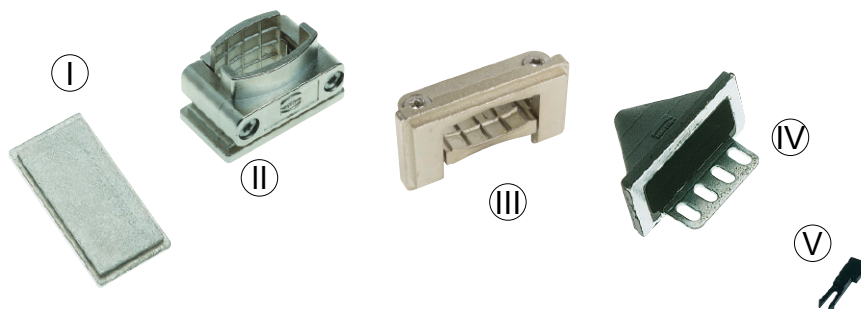
¹⁾ Specific coding between the fixing bracket and pcb guiding rail

Railway classification NFF 16-101,
Smoke index: F1, Flammability class: I2



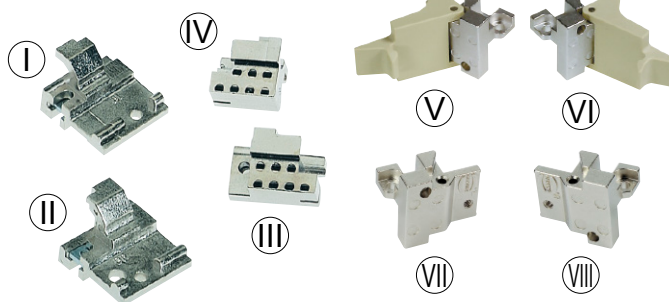
Identification	Part number	Drawing	Dimensions in mm
Shell housing D 20 metal ⓘ Supplied with: Shell with coding 1x Cover 1x Locking screw (hexagonal) M2.5 x 23 (09 06 800 9953) 2x Screw (torx) M2.5 x 10 (09 06 800 9960) 4x Earth screw M4 x 8 (09 06 800 9958) 2x	09 06 848 0550		
Shell housing D 20 metal HF with nickel-plated surface Ⓔ Supplied with: Shell with coding and HF-sealing spring 1x Cover with shielding plate 1x Locking screw (hexagonal) M2.5 x 23 (09 06 800 9953) 2x Screw (torx) M2.5 x 10 (09 06 800 9960) 4x Earth screw M4 x 8 (09 06 800 9958) 2x	09 06 848 0551		

Shell housing D 20 metal for types F, H and MH



Identification	Part number	Drawing	Dimensions in mm
Blinding piece Ⓡ	09 06 800 9951		
Cable clamp wide Ⓡ	09 06 800 9955		
small Ⓡ	09 06 800 9962		
Cable grommet with strain relief Ⓡ	09 06 800 9950		
Crimp flange insert	09 06 800 9952		
Cable clamp cable-Ø appr. 5- 7 mm cable-Ø appr. 7-10 mm cable-Ø appr. 10-12 mm	61 03 000 0141 61 03 000 0044 61 03 000 0143		
Blanking piece for hoods	61 03 000 0042		
Code pin Ⓡ	09 06 001 9905	Order 13 pieces per code comb 	
Hexagon ball-head screw driver	09 99 000 0003	Werkzeugsatz Set of tools 	

Shell housing D 20 metal HF for types F, H and MH



Identification	Part number	Drawing	Dimensions in mm
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Fixing brackets B metallised for male connectors for 19" racks according to DIN EN 60 297, part 3-101

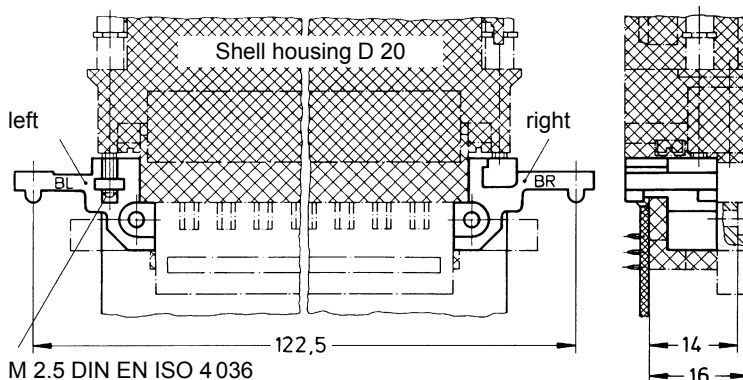
Ⓘ

Single fixing

with nut M 2.5 DIN EN ISO 4 036

Ⓜ

left 20 mm 09 06 901 9924 ^{f)}
right 20 mm 09 06 901 9925 ^{f)}

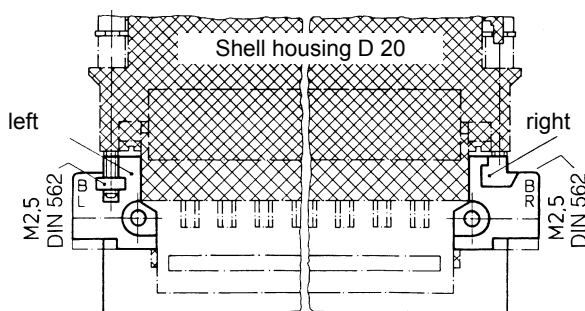


Multiple fixing with coding at fixing bracket with nut M 2.5 DIN 562

Ⓜ

Ⓜ

left 20 mm 09 06 900 9997 ^{f)}
right 15 mm 09 06 900 9996 ^{f)}



Fixing brackets B metal for male connectors for 19" racks according to DIN EN 60 297, part 3-101

Single fixing with ejector handle

Ⓜ

Ⓜ

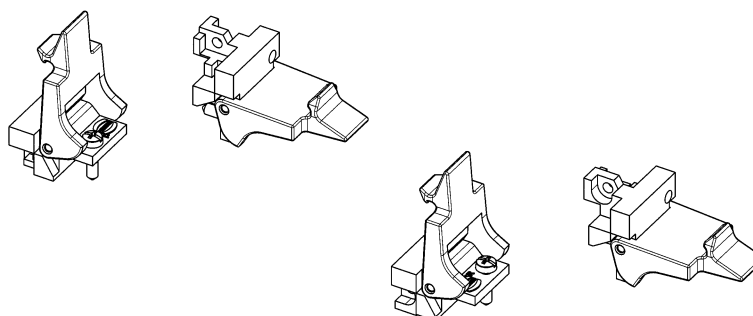
left 09 06 800 9946
right 09 06 800 9948

without ejector handle

Ⓜ

Ⓜ

left 09 06 800 9966
right 09 06 800 9968



20
32

^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

For applications where robust, high density, splash-proof connectors are required, e.g. in the automated control and industrial processing systems, HARTING have combined the proven reliability of DIN 41 612 connectors with standard Han® 24 B heavy duty hoods and housings, to bring forward a connector system with up to 96 ways and various contact plating thicknesses to suit the individual requirements.

Advantages

- The combination enhances design flexibility, as it permits an identical wiring interface between the standard 19" racking systems and the peripheral equipment.
- Simplified stock-holding, identical operating tools.

Inserts

Female	2 x 48 way type F female connectors with crimp contact elements see chapter 03
Male	2 x 48 way type F interface connectors I with crimp contact elements see chapter 03

Hoods and housings

see catalogue "Heavy Duty Han® Connectors"

chapter 30
size 24 B

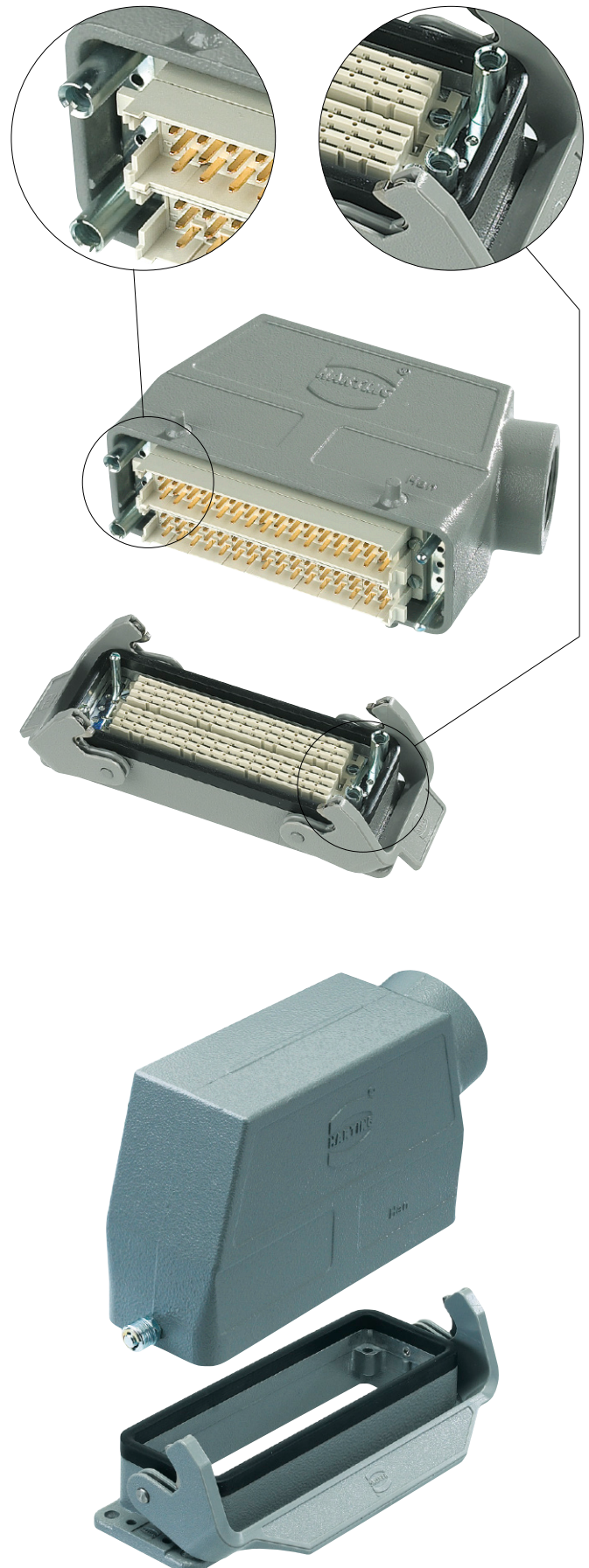
Degree of protection for hoods and housings: IP65

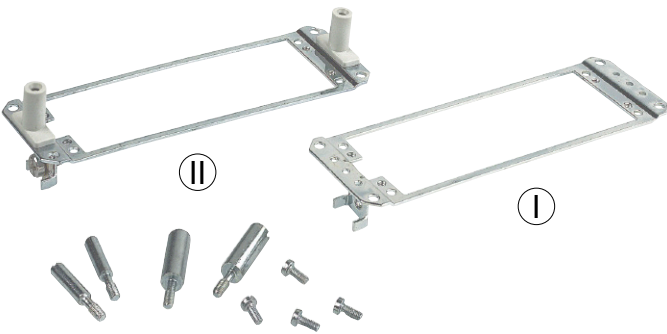
Retaining frames

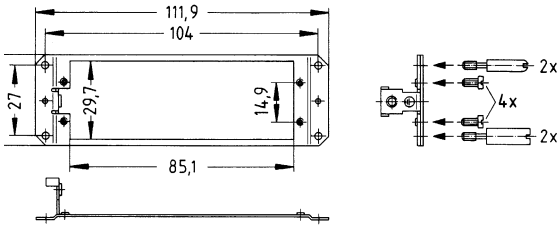
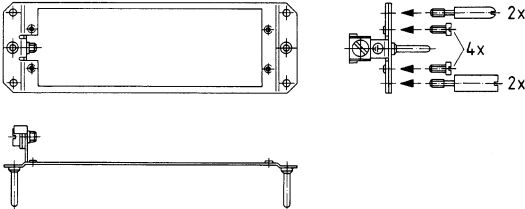
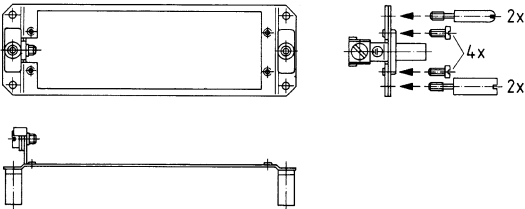
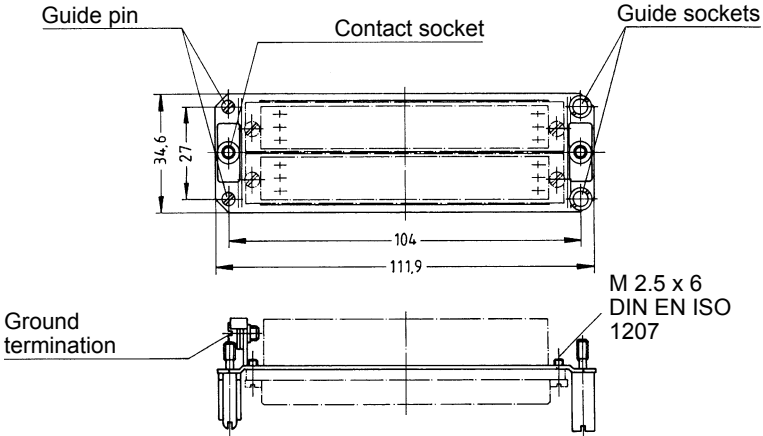
For fixing the inserts into the housing.

Alternative versions with pre-mating contacts and ground termination.

If the working voltages are in excess of 42 V (50 V) it is essential to use retaining frames which have pre-mating ground contacts.





Identification	Part number	Drawing	Dimensions in mm
Retaining frame without contact elements I	09 06 001 9904		
Retaining frame with 2 contact pins and ground termination	09 06 001 9902		
Retaining frame with 2 contact sockets and ground termination II	09 06 001 9903		
		Each retaining frame is supplied with 4 fixing screws for mounting the inserts and with 2 guide pins and sockets that provide mechanical protection for the contacts during mating and disconnection. These can also be used as a coding system to prevent cross plugging of adjacent connectors.	
Mounting example		Connectors in the retaining frame with contact sockets 	

Shell housings

Tooling

Page

Press-in technology

Modular tooling system for starting connector press-in **30.02**

Handling indications **30.03**

Press-in tooling **30.05**

Repair tooling **30.07**

Hand bench presses / pneumatic presses **30.11**

CPM press-in machines **30.12**

Crimp technology

Manual crimping tools. **30.16**

Insertion and removal tools **30.17**

Semiautomatic crimping tools **30.17**

Automatic crimping tools **30.18**

Overview: Tools for crimp contacts **30.20**

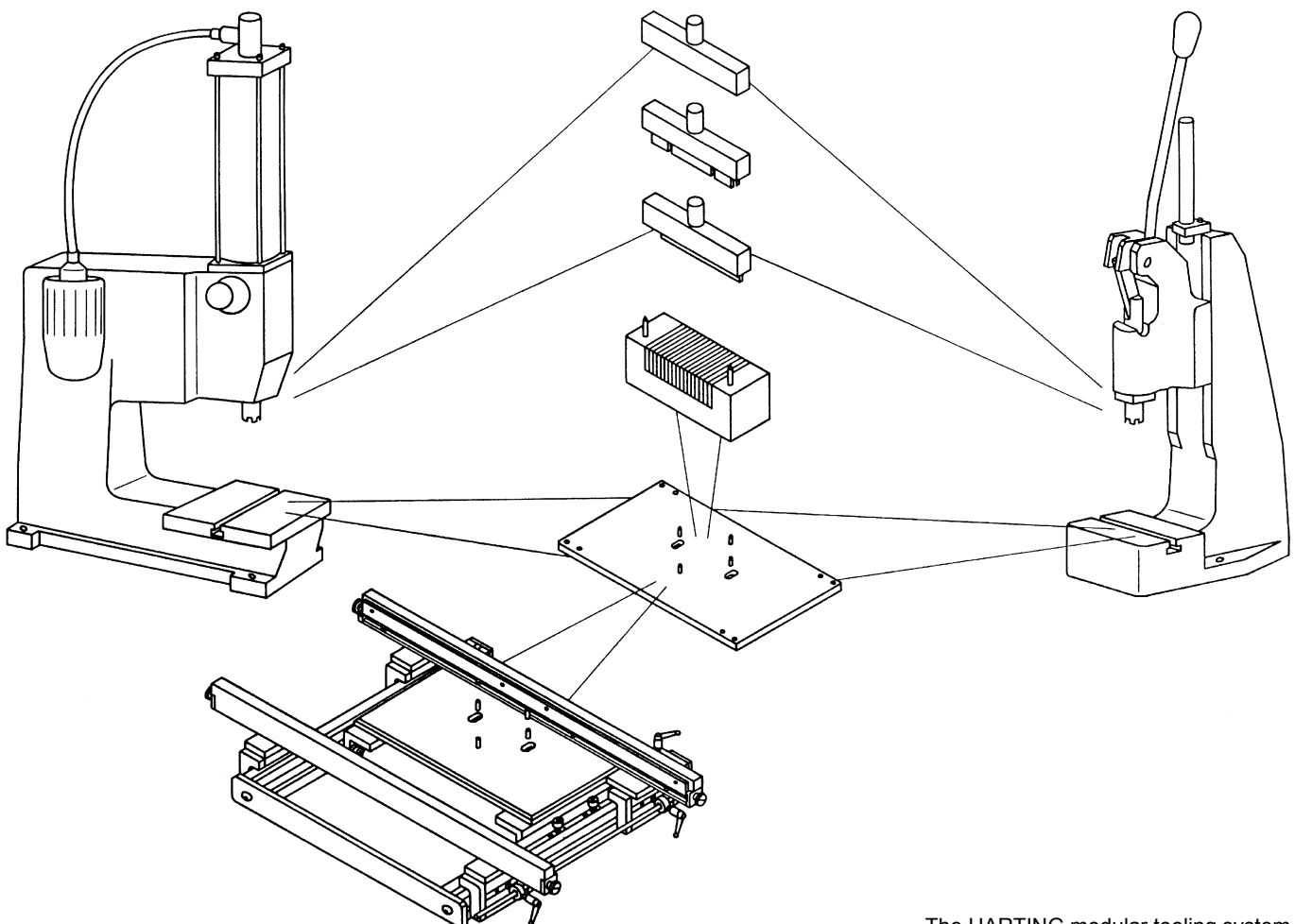
The diversity of connector types with press-in terminations and varying termination styles make it necessary to have a simple, flexible tooling system that can be continuously updated.

The HARTING modular tooling system has significant advantages in terms of economic assembly of the many connector types with press-in terminations. The basic modules of the tooling system which will always be required are:

- Press
- Top tool
- Bottom tool
- Base plate

To increase automation and productivity the following modules may be added to the basic assembly:

- Guide frame with base plate for accurate positioning of the pcb up to a length of 600 mm
- Guide frame "Standard" for hand bench press and pneumatic press and pcb height of 123.5 up to 309.5 mm
- Guide frame "Long" for pneumatic press and pcb height of 123.5 up to 668.5 mm



When setting up an assembly machine it is not necessary to set the working height of the press and adjust the base plate more than once. There is no need for further adjustments. All the other adaptations for various applications are performed efficiently and are reliant by various combinations of individual modules.

Positioning the bottom tool in relation to the top tool

The ram of the HARTING press is generally provided with a cross-shaped groove which accurately positions the top tool in steps of 90°.

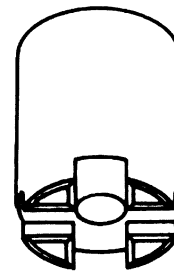
Two guide pins position the bottom tool in relation to the top tool simply and accurately.

These guide pins cannot be used for positioning the pcb or the connector!

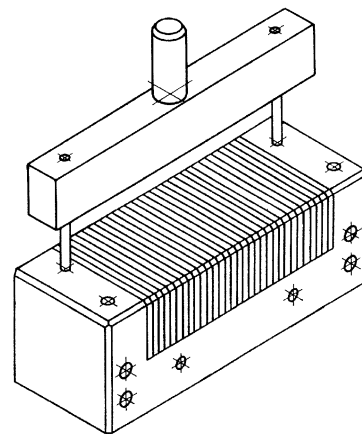
Two pairs of pins on the base plate locate the bottom tool in relation to the top tool in steps of 90°.

Height compensation

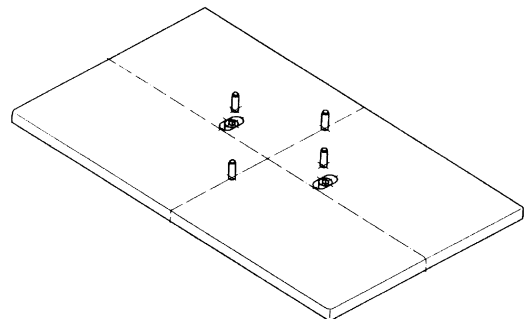
- Various overall heights of connectors are accommodated by type-specific top tools.
- Various pcb thicknesses are accommodated by the use of spacers between the bottom tool and base plate.



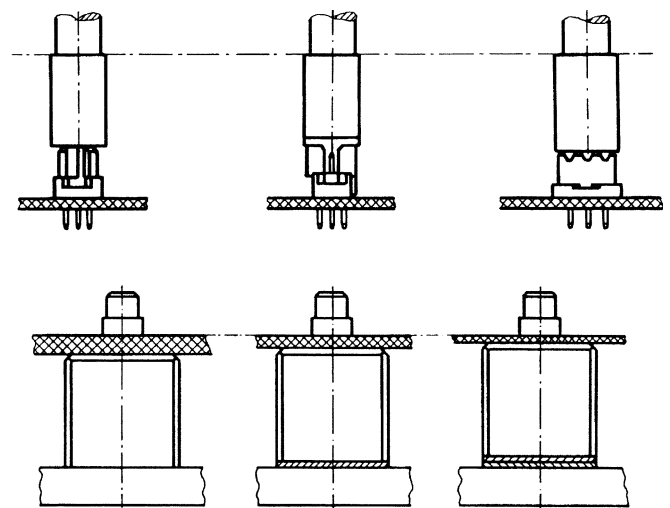
Ram with cross-shaped groove



Positioning the bottom tool in relation to top tool



Base plate with pairs of location pins at 90°



Range of applications for the bottom tool

One bottom tool can be used to assemble connectors with straight or angled press-in terminations.

When pressing in the connectors with angled press-in terminations the positioning pins remain in the bottom tool and serve as guide pins for the connector.

By rotating the bottom tool in steps of 90° and relocating the positioning pins it is possible to assemble half-length connectors with angled press-in terminations.

Bottom tool (narrow version)

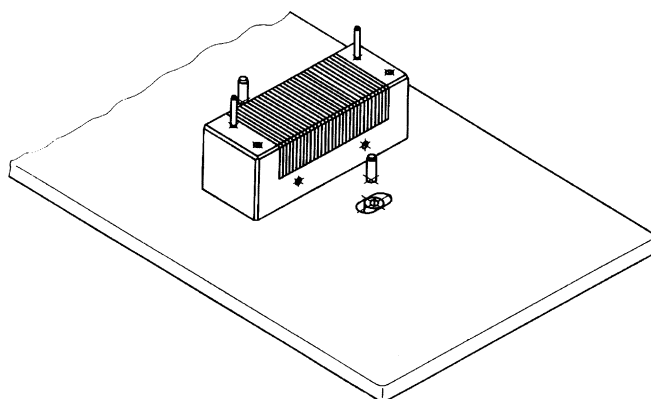
In addition to the square bottom tool with multi-functional properties, HARTING offers the alternative of a narrow bottom tool for assembling connectors with straight press-in terminations. This tool supports the pcb within the press-in connector zone and therefore makes it possible to assemble connectors where electronic components are to be placed in close proximity.

Guide frame

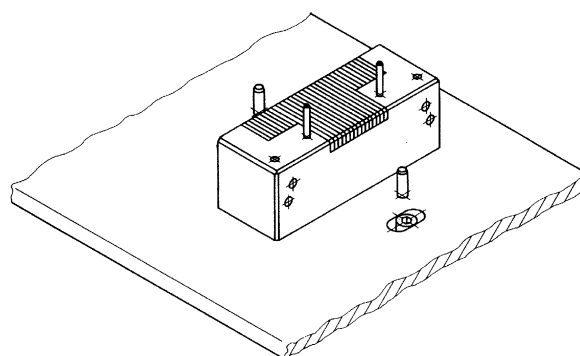
The guide frame screwed to the base plate ensures the correct positioning of the pcb in relation to the top and bottom tools and permits a much higher rate of assembly.

Both guide rails are adjustable to accommodate various pcb sizes.

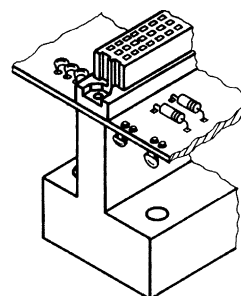
A spring-loaded supporting rail lifts the pcb away from the bottom tool after the press-in operation ensuring that no damage occurs to the conductors as it passes through the machine.



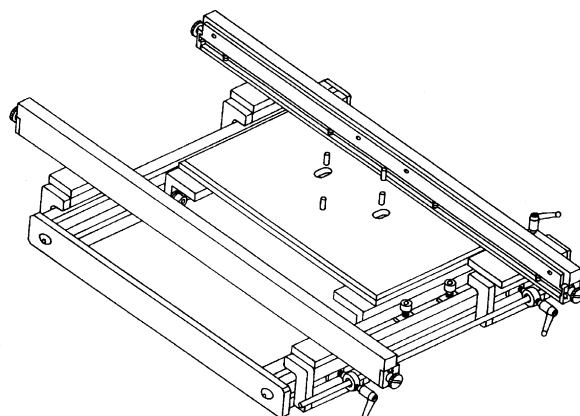
Bottom tool set for assembling connectors with angled pins



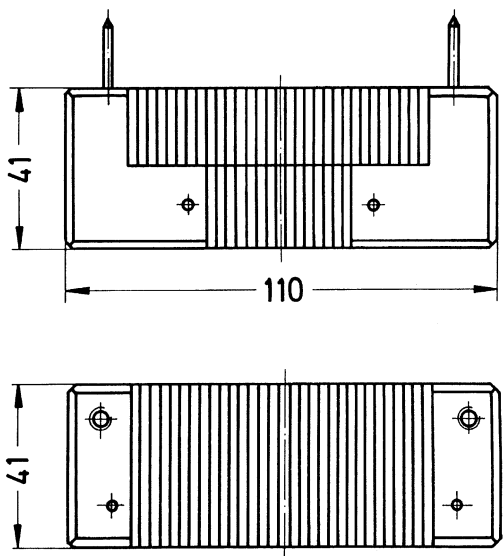
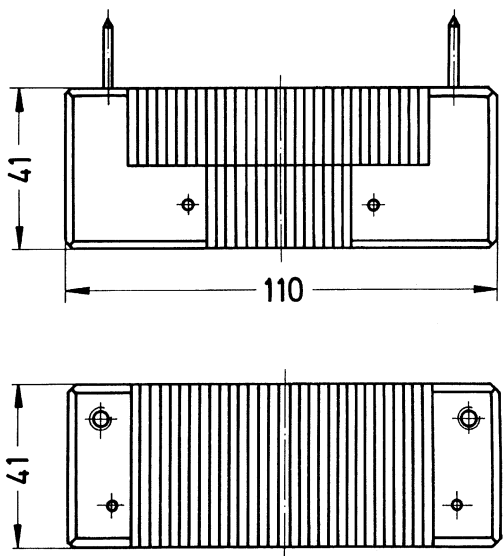
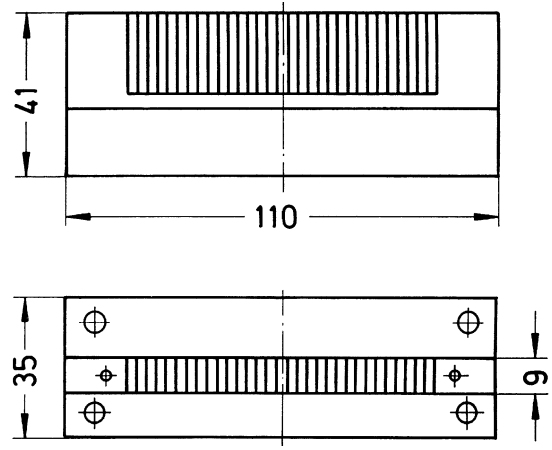
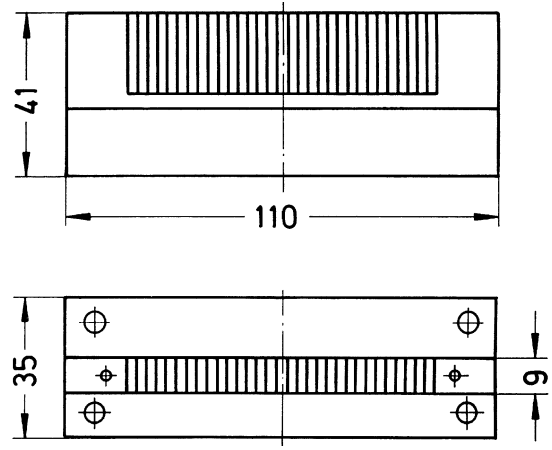
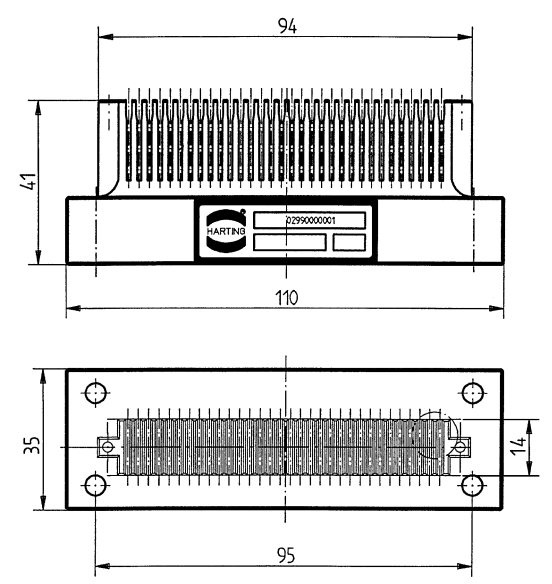
Bottom tool set for assembling half-length connectors with angled pins



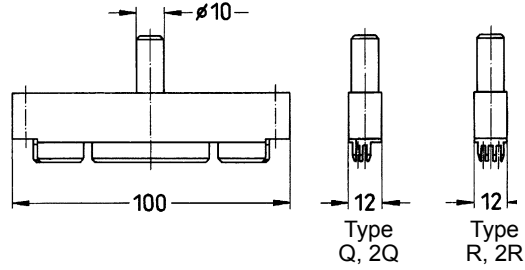
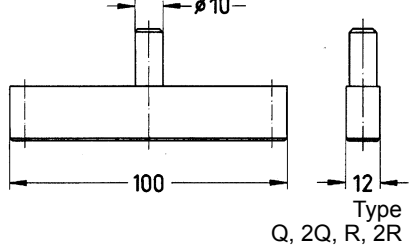
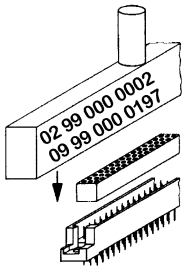
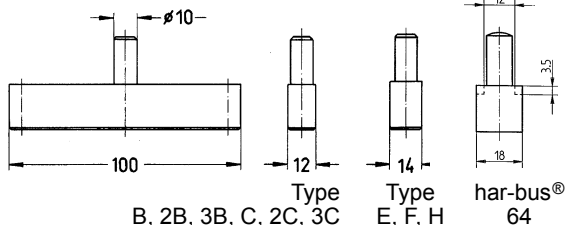
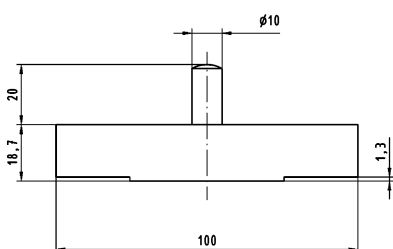
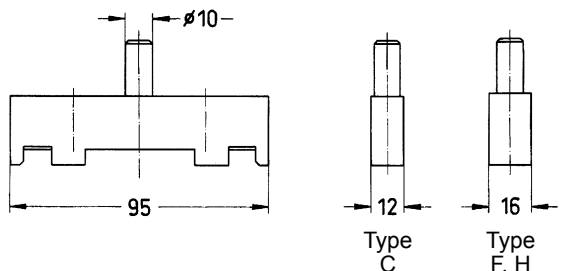
Narrow version of the bottom tool for special applications



Guide frame for positioning the pcb in relation to the top and bottom tools

Identification		Part number	Drawing	Dimensions in mm
Bottom tool Universal	for use with male and female connectors	Type B, 2B, 3B C, 2C, 3C M Q, 2Q, 3Q R, 2R, 3R E F H har-bus® 64 SEK 18*		
		09 99 000 0185		
Bottom tool Narrow	for use with male connectors	Type Q, 2Q, 3Q R, 2R, 3R SEK 18*		
	for use with female connectors	Type B, 2B, 3B C, 2C, 3C M F H		
Bottom tool Narrow har-bus® 64	for use with female connectors	har-bus® 64	02 99 000 0001	

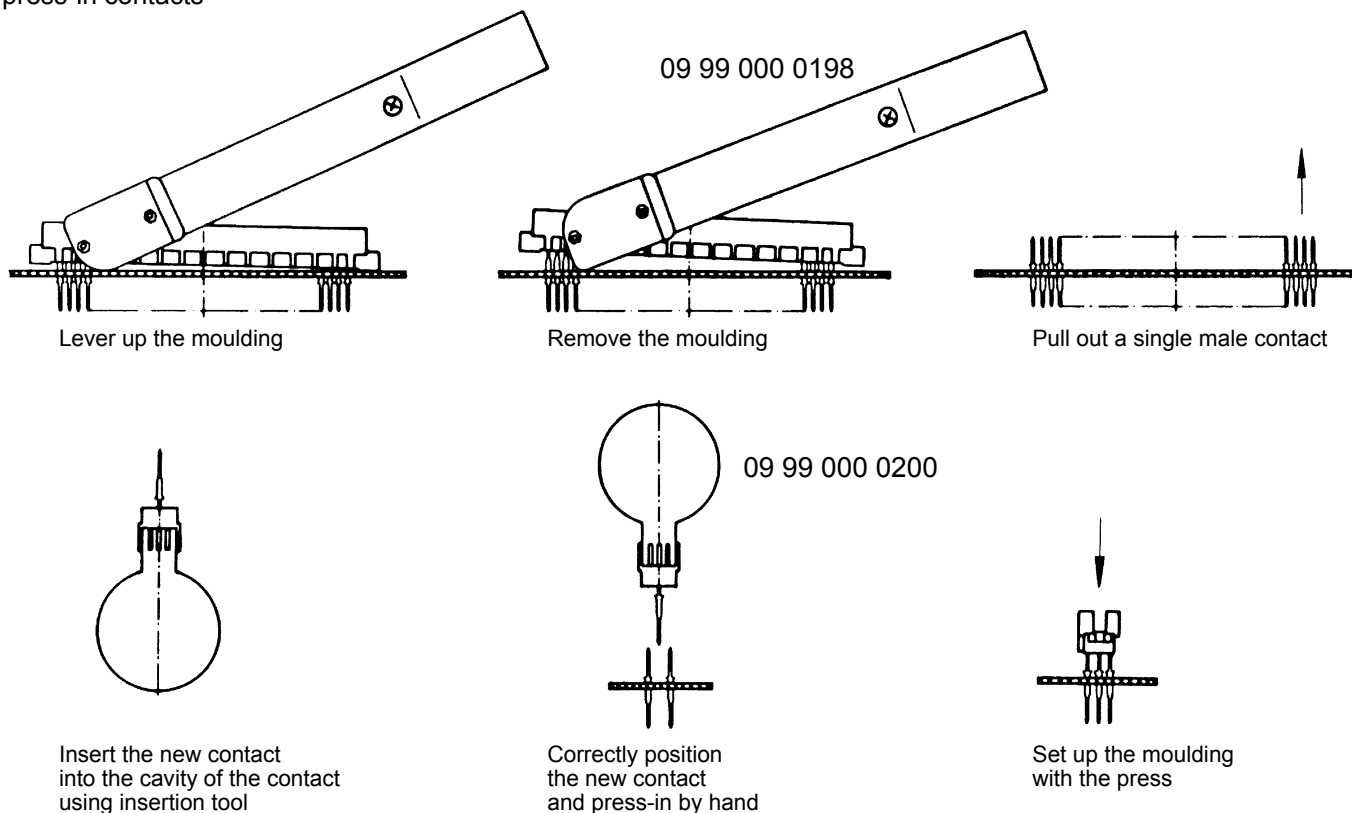
* Connectors see separate catalogue

Identification		Part number	Drawing	Dimensions in mm
Top tool without insert block for use with male connectors	Type Q, 2Q R, 2R	09 99 000 0181 09 99 000 0183		
	with insert block for use with male connectors	Type Q, 2Q, 3Q R, 2R, 3R	09 99 000 0197	
Insert blocks for use with male connectors	Type Q 2Q 3Q R 2R 3R	09 99 000 0275 09 99 000 0274 09 99 000 0263 09 99 000 0277 09 99 000 0276 09 99 000 0264		
	for use with shrouds	har-bus® 64 Type E Type C, R Type 2C, 2R Type F	02 09 000 0012 09 99 000 0277 09 99 000 0276 09 06 248 3201	
Top tool for use with female connectors	Type B, 2B, 3B C, 2C, 3C D-Sub* SEK 18* har-mik*	09 99 000 0197		
	Type E F H har-bus® 64 Type M (24+8) M (42+6) M (60+4) M (78+2)	09 99 000 0221 02 99 000 0002 09 99 000 0269 09 99 000 0270 09 99 000 0271 09 99 000 0272		
Top tool only for short posts and pcb thickness > 1.6 mm and without guide frame	Type C	09 99 000 0228		
	Type F H har-bus® 64	09 99 000 0229 02 99 000 0016		

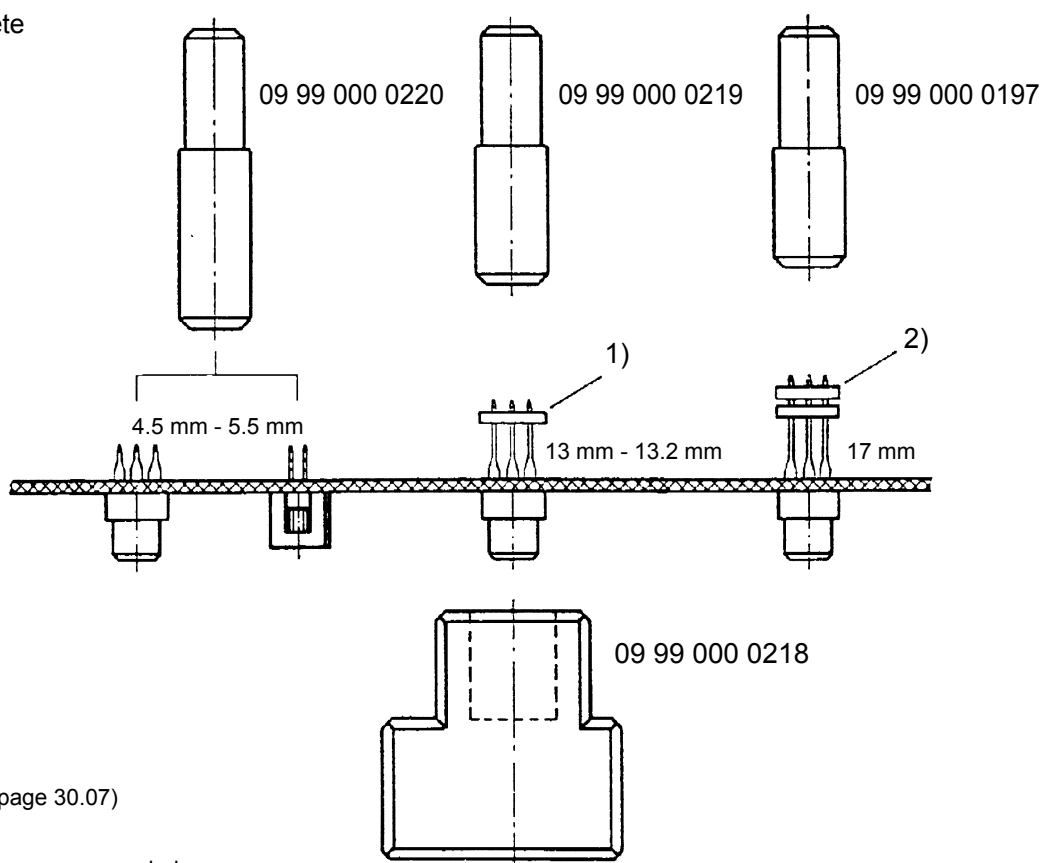
* Connectors see separate catalogues

Tooling

Replacement of single male press-in contacts



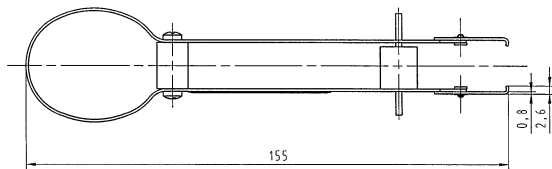
Replacement of complete press-in connectors



¹⁾ Termination support (see page 30.07)

²⁾ for 17 mm wrap posts
two termination supports are recommended

Identification	for use with	Part number	Drawing	Dimensions in mm
Removal tool for moulding	Female connectors har-bus® 64	02 99 000 0003		
Removal tool (heavy duty) for moulding	Female connectors har-bus® 64	02 99 000 0006		
Press-out tool for 17 mm terminations	Female connectors har-bus® 64	02 99 000 0004		
Press-out tool for 5 mm / 4.5 mm terminations	Female connectors har-bus® 64	02 99 000 0008		
Support block	Female connectors har-bus® 64	02 99 000 0005		

Identification	for use with	Part number	Drawing	Dimensions in mm
Removal tool for shroud	rear I/O shroud har-bus® 64	02 99 000 0007		
	rear I/O shroud Type C, 2C R, 2R	09 99 000 0278		

Replacement of complete **har-bus® 64** press-in connectors

Steps in detail

1. Lever up the moulding by using a removal tool

- The removal tool with Part number 02 99 000 0003 is suitable for repairing small quantities. It can only be used if the adjacent components on the pcb are at least 2 mm apart from the moulding of the connector.
- The removal tool with Part number 02 99 000 0006 is suitable for repairing large quantities. Due to its design it can also be used if components on the pcb are in close proximity to the moulding of the connector.

2. Lever up the rear I/O shroud with the removal tool 02 99 000 0007. This step is only required with 17 mm termination length.

3. Pull out the female contacts with the press-out tool

- for 17 mm termination length use Part number 02 99 000 0004 and
- for 5 mm termination length use Part number 02 99 000 0008.

During this process the press-out tool replaces the top tool and the pcb is supported by the support block (Part number 02 99 000 0005) from the bottom.

Tooling

2) not suitable for hand bench press

The **CPM prestige SI** press-in machine with a graphical user interface

The **CPM prestige SI** is a consequential development of the successful CPM 2001 press-in machines. The excellent design, supported by a wide range of tools presents a convenient, easy and comfortable way of processing backplanes and daughtercards. The machine is fully programmable and is supplied with a graphical user interface for control and visualisation of the complete process. The use of a microprocessor control allows the recognition and storage of different component heights, so that the pressing-in of different components is initiated simultaneously with only one button. The user-friendly touch-screen guides the user through the menu-orientated process controls.

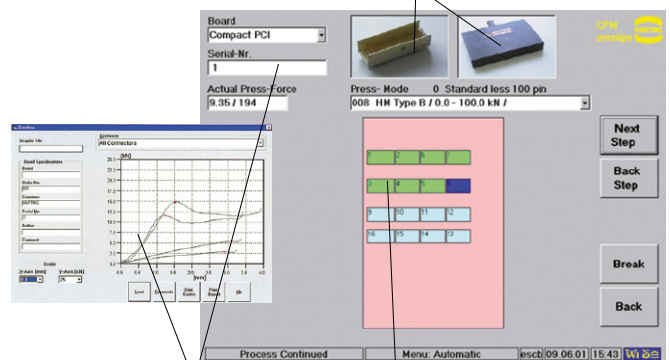
The visualisation of the entire press-in process (the position of the connector, press-in forces etc.) allows the rapid recognition and eradication of the possible error sources. With the addition of a barcode reader (1D and 2D)¹⁾ the parameters of every pcb layout can be stored, recalled and loaded into the automated press-in programme. The extensive operation monitor functions simplify the service and support of the machine.

The machine employs the automatic switch-off system "autosense", known worldwide for its reliability. The different connector types and the tolerances of the pcb are automatically recognised and taken into consideration at the press-in operation, thus maximising the process security.



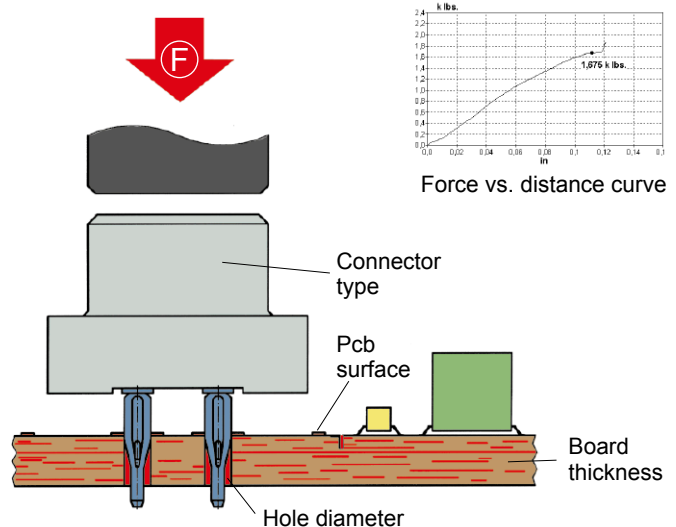
Visual guiding system via touch monitor

Real photos of connectors and tools

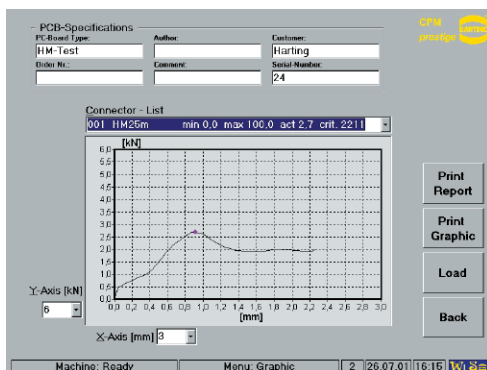


Process data

Layout with current position highlighted



Shown are the four most considerable influences of the press-in process.



Quality control of press-in termination

The press-in force correlates with the diameter of the plated through hole and with the friction coefficient of the surface; therefore it can be used for a continuous monitoring of the process.

The retention force, as an indirect measure of the normal force, serves to qualify the process or random tests.



Part number 09 89 050 0000

Technical characteristics

Drive	electro-mechanical, servo
Press-in force	100 kN
max. pcb dimensions	600 x 1000 mm
Floor space	1200 x 1150 mm
Weight	980 kg
Power supply	208 / 380 / 400 / 415 V
Consumption	< 1 kW
Colour	on request

CPM prestige SI
(incl. PC, control software, barcode reader, keyboard, touch screen)

Built-in features:

- Guiding rails (carbon/spring-loaded) for the secure positioning of the pcb
- Touch-screen and IPC (WES7)
- 2D-Barcode reader for management ease of press-in programs
- All dimensions allow an easy integration into production lines

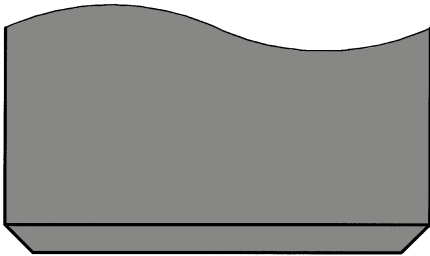
Process monitoring and quality assurance:

- Touch screen interface with graphical and verbal menus for all machine functions
- Autosense: automated press-in interruption at incorrect press-in forces
- Storage and validation of all press-in parameters via quality assurance software (press-in force tolerances)
- Continuous high-precision measurement and recording of press-in forces and distances
- Remote determination of errors and maintenance
- High flexibility through a modular tool range

Options:

- Rotatable tool changer
- Position plates with "Roll & Drop"

Today nearly all female connectors are designed for flat rock tooling. For every type of male connector specific tooling and a high degree of X-Y-process accuracy is required. Therefore HARTING offers press-in insert blocks that transfer all well known assembling advantages from female connectors to male headers.

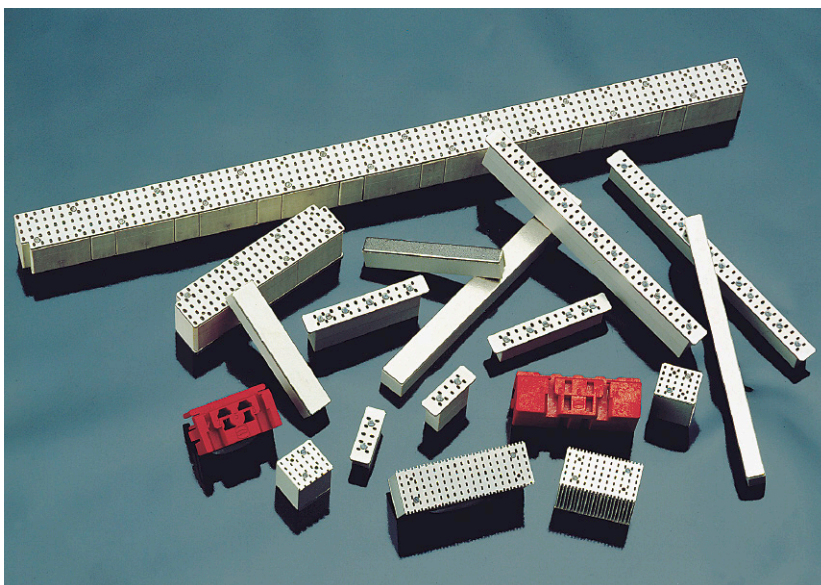
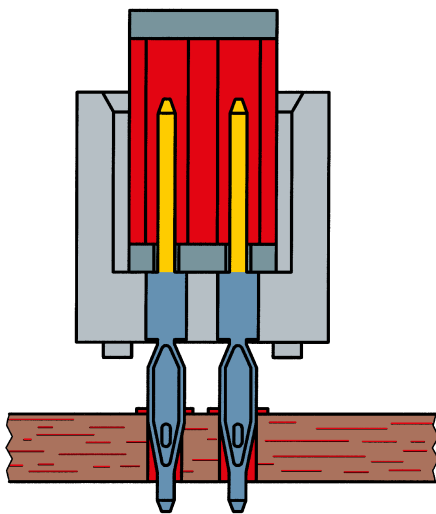


Advantages of press inserts

Robust tooling

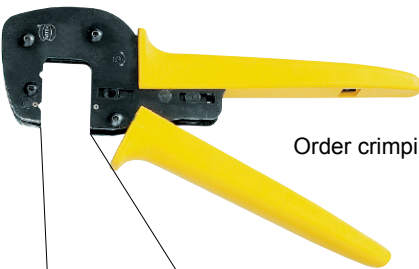
No lateral force to pcb hole

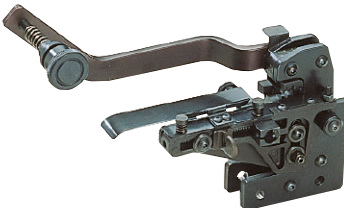
No abrasion of the contact mating surface by the press tool

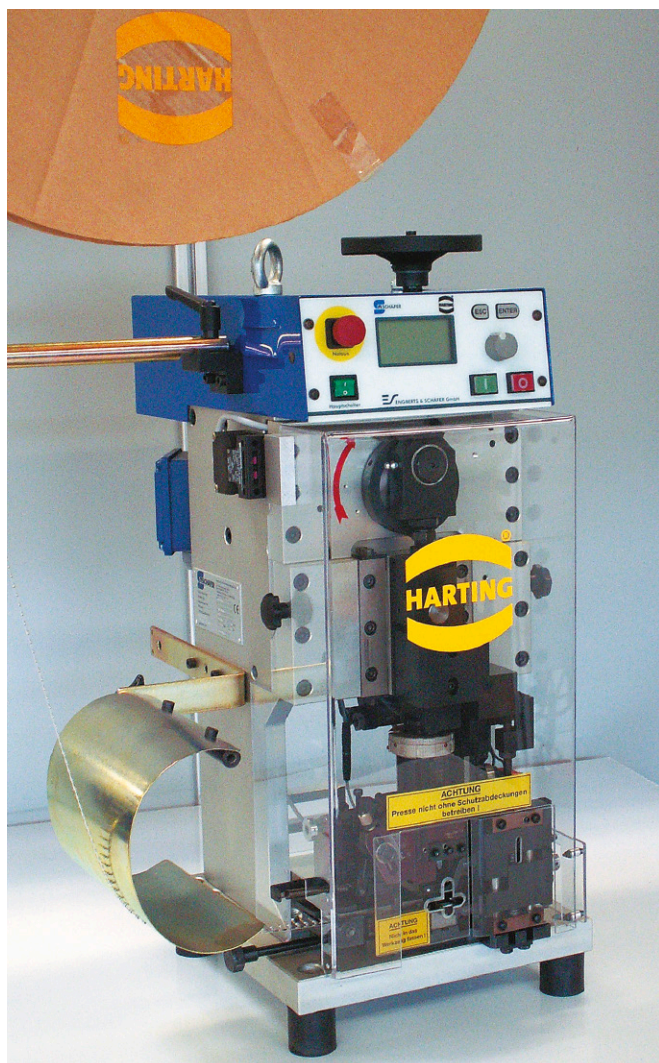


HARTING has already developed press-in inserts for all major male connector families on 2.54 mm and 2 mm pitches.

Inserts for any other special components can be developed on request.

Identification	Part number	Drawing	Dimensions in mm
HARTING crimping tool for individual contacts BC / FC 1 / har-bus® 64 FC 2 FC 3 Locator BC / FC 1 / har-bus® 64 FC 2 FC 3	09 99 000 0075 09 99 000 0076 09 99 000 0077 09 99 000 0640 09 99 000 0641 09 99 000 0642	Wire gauge BC: 0.09 - 0.50 mm ² FC 1: 0.09 - 0.25 mm ² FC 2: 0.14 - 0.56 mm ² FC 3: 0.50 - 1.50 mm ²	
HARTING crimping tool for individual contacts BC / FC and har-bus® 64 Crimping insert set for individual contacts each set contains locator and crimp insert top and bottom part BC / FC 1 / har-bus® 64 FC 2 FC 3 BC / har-bus® 64 solid wire Locator BC / har-bus® 64 FC Service case for crimping tool and 5 sets inserts, incl. screwdriver for insert change, without contents	09 99 000 0620 09 99 000 0621 09 99 000 0622 09 99 000 0623 09 99 000 0629 09 99 000 0630 09 99 000 0631 09 99 000 0632	Wire gauge BC: 0.09 - 0.50 mm ² FC 1: 0.09 - 0.25 mm ² FC 2: 0.14 - 0.56 mm ² FC 3: 0.50 - 1.50 mm ² BC: 0.13 mm ² (solid wire)	 Order crimping inserts separately  
Crimping tool for individual contacts FC 1, FC 2 and FC 3 (Service tool)	09 99 000 0191	Wire gauge FC 1: 0.14 - 0.25 mm ² FC 2: 0.25 - 0.56 mm ² FC 3: 0.75 - 1.50 mm ² Locator (09 99 000 0205) is supplied with the tool.	

Identification	Part number	Drawing	Dimensions in mm
HARTING crimping tool for bandoliered contacts (500 pieces) BC / har-bus® 64 for bandoliered contacts (250 pieces) FC 1 FC 2 FC 3 BC / har-bus® 64 solid wire	09 99 000 0248 09 99 000 0247 09 99 000 0119 09 99 000 0120 09 99 000 0627	Wire gauge 0.09 - 0.5 mm ² Wire gauge 0.09 - 0.25 mm ² 0.14 - 0.56 mm ² 0.50 - 1.50 mm ² 0.13 mm ² (solid wire)	
HARTING semi-automatic crimping device Main drive, foot-operated 115/230 V – 50 Hz Real holder for 2,500 contacts FC 1, FC 2 or FC 3 and for 5,000 contacts BC / har-bus® 64	09 99 000 0246 09 99 000 0158	 Locator not necessary	
Crimping head for bandoliered contacts BC / har-bus® 64 FC 1 FC 2 FC 3 BC/har-bus® 64 solid wire	09 99 000 0252 09 99 000 0249 09 99 000 0250 09 99 000 0251 09 99 000 0628	Wire gauge 0.09 - 0.5 mm ² 0.09 - 0.25 mm ² 0.14 - 0.56 mm ² 0.5 - 1.5 mm ² 0.13 mm ² (solid wire)	
Insertion tool for contacts BC / har-bus® 64 for contacts FC 1, FC 2 and FC 3	09 99 000 0100 09 99 000 0088		
Removal tool for contacts BC / har-bus® 64 for contacts FC 1, FC 2 and FC 3	09 99 000 0101 09 99 000 0087		

Automated crimping machine type BK**Main characteristics**

- Smooth run through electronic brakes
- Hand wheel for manual adjustments
- Maintenance friendly through needle bearing rail
- Simple handling by quick change tool and stripper

Part number 09 98 000 5000**Technical Characteristics****Dimensions**

Height 690 mm
(1400 mm with a contact reel)

Width 350 mm

Depth 370 mm

Total weight 72 kg

Power supply 230 V, 50/60 Hz, 2.5 A

Consumption 0.75 kW

Motor speed 440 - 2000 rpm

Cable length 2 m incl. plug

Control SPS

Work cycle trigger Sensor

Work cycle 0.35 s for stripping and crimping

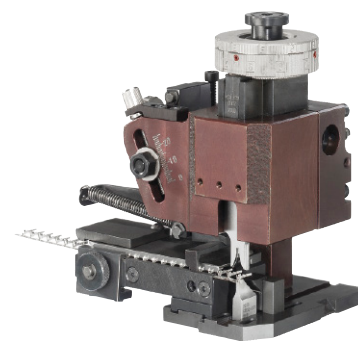
Illumination Integrated tool light

Stroke counter Daywise and fixed

Crimp force monitor BB07i

Crimping tool Quick change tool

Adjustable process parameters
 Crimping height on wire
 Crimping height on insulation
 Depth of insulation stripping
 Length of insulation stripping
 Wire retainer position
 Wire position in the crimp contact
 Band thrust



Identification	for use with	Part number	Wire gauge [mm ²]	AWG	Insulation [Ø mm]
Crimping tool for DIN 41 612 connectors ¹⁾	contacts BC / har-bus® 64	09 98 000 3004	0.09 - 0.56	28 - 20	0.7 - 1.6
	contacts FC 1	09 98 000 3005	0.09 - 0.25	28 - 24	0.7 - 1.6
	FC 2	09 98 000 3006	0.14 - 0.56	26 - 20	0.8 - 2.3
	FC 3	09 98 000 3007	0.50 - 1.50	20 - 16	1.6 - 2.8
for D-Sub connectors ²⁾	standard contacts	09 98 000 3008 09 98 000 3009	0.09 - 0.25 0.25 - 0.56	28 - 24 24 - 20	0.7 - 1.4 0.9 - 1.7
	high density contacts	09 98 000 3012		26 - 24	0.8 - 1.4

¹⁾ 3.5 + 0.5 mm of insulation is stripped from the wire to be crimped

²⁾ 2.5 + 0.5 mm of insulation is stripped from the wire to be crimped

Tools for HARTING DIN 41 612 crimp contacts



DIN 41 612 Signal crimp contact type			BC crimp contacts 09 02 000						har-bus® 64 crimp contacts 02 05 000					
Part number	Female contacts	PL 1	6474	8444	8474	6474	8444	8474	1511	1512	1513	1511	1512	1513
		PL 2	6484	8434	8484	6484	8434	8484	2511	2512	2513	2511	2512	2513
Bandoliered contacts: 5,000 pieces/reel			X			X			X			X		
Bandoliered contacts: 500 pieces/reel				X			X			X			X	
Individual contacts					X			X			X			X
Cable diameter		mm²	0.09-0.5			0.13 mm² solid wire			0.09-0.5			0.13 mm² solid wire		
		AWG	28-20						28-20					
Hand crimp tool		09 99 000 0075			X						X			
		09 99 000 0248		X						X				
		09 99 000 0627					X						X	
Hand crimp tool 09 99 000 0620 with insert		09 99 000 0621			X						X			
		09 99 000 0629						X						X
Semi automatic crimp tool 09 99 000 0246 with head		09 99 000 0252	X	X					X	X				
		09 99 000 0628				X	X					X	X	
and reel holder		09 99 000 0158	X			X			X			X		
Automatic crimp machine type BK 09 98 000 5000 with tools		09 98 000 3004	X			X			X			X		
Insertion tool		09 99 000 0100	X						X					
Removal tool		09 99 000 0101	X						X					

DIN 41612 Power crimp contacts			FC crimp contacts 09 06 000								
			FC 1			FC 2			FC 3		
Part number	Female contacts	PL 1	6474	7474	8474	6471	7471	8471	6472	7472	8472
		PL 2	6484	7484	8484	6481	7481	8481	6482	7482	8482
	Male contacts	PL 1	9544	–	9554	9541	5541	9551	9542	5542	9552
		PL 2	9564	–	9574	9561	–	9571	9562	–	9572
	Female contacts for 1 x 1 wire wrap posts		–	6454	–	6464	6451	–	6461	6452	–
Bandoliered contacts: 2,500 pieces/reel			X			X			X		
Bandoliered contacts: 250 pieces/reel				X			X			X	
Individual contacts					X			X			X
Cable diameter		mm²	0.09-0.25			0.14-0.56			0.5-1.5		
		AWG	28-24			26-20			20-16		
Hand crimp tool		09 99 000 0075			X						
		09 99 000 0076						X			
		09 99 000 0077									X
		09 99 000 0191			X			X			X
		09 99 000 0247		X							
		09 99 000 0119					X				
		09 99 000 0120								X	
Hand crimp tool 09 99 000 0620 with insert		09 99 000 0621			X						
		09 99 000 0622						X			
		09 99 000 0623									X
Semi automatic crimp tool 09 99 000 0246 with head		09 99 000 0249	X	X							
		09 99 000 0250				X	X				
		09 99 000 0251							X	X	
and reel holder		09 99 000 0158	X			X			X		
Automatic crimp machine type BK 09 98 000 5000 with tools		09 98 000 3005	X								
		09 98 000 3006				X					
		09 98 000 3007							X		
Insertion tool		09 99 000 0088	X			X			X		
Removal tool		09 99 000 0087	X			X			X		

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02 01 160 1102	02.11	02 09 000 0017	03.21	09 02 000 9902	01.76	09 02 000 9954	20.09	09 02 364 6921	01.11
02 01 160 1105	02.11	02 09 000 0018	03.19	09 02 000 9902	01.77	09 02 064 0501	00.08	09 02 464 6824	01.12
02 01 160 1106	02.11	02 09 000 0018	03.21	09 02 000 9902	02.17	09 02 064 0501	20.02	09 02 464 6825	01.12
02 01 160 2101	02.05			09 02 000 9902	03.21	09 02 064 0501	20.04	09 02 632 6921	01.11
02 01 160 2101	02.11			09 02 000 9902	03.25	09 02 064 0501	20.05	09 02 664 6921	01.11
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		02 44 000 0001	02.16	09 02 000 9902	20.06	09 02 064 0502	00.08	09 02 764 6825	01.12
		02 44 000 0002	02.16	09 02 000 9903	00.08	09 02 064 0502	20.02		
		02 44 000 0003	02.16	09 02 000 9903	00.09	09 02 064 0502	20.04		
02 02 160 1201	02.12	02 44 000 0004	02.16	09 02 000 9903	00.10	09 02 064 0502	20.05		
02 02 160 1202	02.12	02 44 000 0005	02.16	09 02 000 9903	01.76	09 02 064 0502	20.07		
02 02 160 1301	02.12	02 44 000 0006	02.16	09 02 000 9903	01.77				
02 02 160 1302	02.12	02 44 000 0007	02.16	09 02 000 9903	02.17	09 02 064 3214	01.15	09 03 000 6101	01.39
02 02 160 1601	02.12	02 44 000 0007	02.17	09 02 000 9903	03.21	09 02 132 2921	01.11	09 03 000 6101	01.42
02 02 160 2201	02.05	02 44 000 0007	02.18	09 02 000 9903	03.25	09 02 132 2931	01.11	09 03 000 6102	01.39
02 02 160 2201	02.12	02 44 000 0008	02.16	09 02 000 9903	20.02			09 03 000 6102	01.42
02 02 160 2202	02.12	02 44 000 0008	02.17	09 02 000 9903	20.06	09 02 132 6921	01.11	09 03 000 6103	01.39
02 02 160 2301	02.05	02 44 000 0009	00.09	09 02 000 9909	00.08	09 02 132 6922	01.11	09 03 000 6103	01.42
02 02 160 2301	02.12	02 44 000 0009	02.16	09 02 000 9909	00.09	09 02 132 6931	01.11	09 03 000 6104	01.39
02 02 160 2301	02.17	02 44 000 0009	02.17	09 02 000 9909	00.11	09 02 132 6932	01.11	09 03 000 6104	01.42
02 02 160 2301	02.18	02 44 000 0011	02.16	09 02 000 9909	20.02			09 03 000 6110	01.39
02 02 160 2302	02.12	02 44 000 0012	02.16	09 02 000 9909	20.07	09 02 132 7921	01.11	09 03 000 6110	01.42
02 02 160 2804	02.12			09 02 000 9910	20.02	09 02 132 7922	01.11	09 03 000 6113	01.39
				09 02 000 9910	20.07	09 02 132 7931	01.11	09 03 000 6113	01.42
		02 99 000 0001	30.05	09 02 000 9911	20.02	09 02 164 2921	01.11	09 03 000 6114	01.39
02 03 160 2201	02.05	02 99 000 0002	30.06	09 02 000 9911	20.07	09 02 164 2922	01.11	09 03 000 6114	01.42
02 03 160 2201	02.13	02 99 000 0003	30.09	09 02 000 9919	00.09	09 02 164 2951	01.11	09 03 000 6115	01.39
		02 99 000 0003	30.10	09 02 000 9919	20.02	09 02 164 2952	01.11	09 03 000 6115	01.42
		02 99 000 0004	30.09	09 02 000 9919	20.06			09 03 000 6127	01.39
		02 99 000 0004	30.10	09 02 000 9919	20.09	09 02 164 6919	01.11	09 03 000 6127	04.23
02 04 048 1101	03.19	02 99 000 0005	30.09	09 02 000 9920	00.09	09 02 164 6920	01.11	09 03 000 6128	01.39
02 04 048 1101	03.21	02 99 000 0005	30.10	09 02 000 9920	20.02	09 02 164 6921	01.11	09 03 000 6128	04.23
02 04 160 1101	02.05	02 99 000 0006	30.09	09 02 000 9920	20.06	09 02 164 6921 222	01.11	09 03 000 6133	01.39
02 04 160 1101	02.14	02 99 000 0006	30.10	09 02 000 9920	20.09	09 02 164 6922	01.11	09 03 000 6133	01.42
		02 99 000 0007	30.10	09 02 000 9921	00.09	09 02 164 6951	01.11	09 03 000 6134	01.39
		02 99 000 0008	30.09	09 02 000 9921	20.02	09 02 164 6952	01.11	09 03 000 6134	01.42
02 05 000 0003	02.15	02 99 000 0008	30.10	09 02 000 9921	20.06			09 03 000 6135	01.39
02 05 000 0004	02.05	02 99 000 0016	30.06	09 02 000 9921	20.09	09 02 164 7919	01.11	09 03 000 6135	01.42
02 05 000 0004	02.15			09 02 000 9922	00.09	09 02 164 7921	01.11	09 03 000 6140	01.38
02 05 000 0004	02.17			09 02 000 9922	20.02	09 02 164 7922	01.11	09 03 000 6140	01.41
02 05 000 0004	02.18			09 02 000 9922	20.06	09 02 264 2824	01.12	09 03 000 6160	01.38
02 05 000 0005	02.15			09 02 000 9922	20.09	09 02 264 2825	01.12	09 03 000 6160	01.40
		09 02 000 6474	01.15	09 02 000 9926	20.02	09 02 264 2850	01.12	09 03 000 6161	01.38
02 05 000 1511	02.15	09 02 000 6474	01.28	09 02 000 9926	20.07			09 03 000 6161	01.40
02 05 000 1512	02.15	09 02 000 6484	01.15	09 02 000 9926	20.09	09 02 264 6421	01.12	09 03 000 6162	01.38
02 05 000 1513	02.15	09 02 000 6484	01.28	09 02 000 9927	20.02	09 02 264 6821	01.12	09 03 000 6162	01.40
				09 02 000 9927	20.07	09 02 264 6823	01.12	09 03 000 6165	01.38
02 05 000 2511	02.15	09 02 000 8434	01.15	09 02 000 9927	20.09	09 02 264 6824	01.12	09 03 000 6165	01.40
02 05 000 2512	02.15	09 02 000 8434	01.28	09 02 000 9928	00.14	09 02 264 6825	01.12	09 03 000 6181	01.38
02 05 000 2513	02.15	09 02 000 8444	01.15	09 02 000 9935	00.06	09 02 264 6825 222	01.12	09 03 000 6181	01.40
		09 02 000 8444	01.28	09 02 000 9939	01.13	09 02 264 6828	01.14	09 03 000 6182	01.38
		09 02 000 8474	01.15	09 02 000 9953	01.77	09 02 264 6829	01.12	09 03 000 6182	01.40
02 07 160 1101	02.05	09 02 000 8474	01.28	09 02 000 9953	20.02	09 02 264 6841	01.12	09 03 000 6201	01.39
02 07 160 1101	02.14	09 02 000 8484	01.15	09 02 000 9953	20.06	09 02 264 6850	01.12	09 03 000 6201	01.42
		09 02 000 8484	01.28	09 02 000 9953	20.09	09 02 264 6850 222	01.12	09 03 000 6202	01.39
				09 02 000 9953	20.02	09 02 264 6861	01.12	09 03 000 6202	01.42
02 09 000 0012	02.16	09 02 000 9901	00.16	09 02 000 9954	01.77			09 03 000 6203	01.39
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09 03 000 6215	01.42	09 03 000 9964	01.72	09 03 178 7901	01.43	09 03 260 6804	01.44		
09 03 000 6220	01.39	09 03 000 9965	01.72			09 03 260 6805	01.44	09 03 296 6411	01.24
09 03 000 6220	04.24	09 03 000 9966	01.72	09 03 196 2919	01.20	09 03 260 6830	01.46	09 03 296 6416	01.24
09 03 000 6225	01.39	09 03 000 9967	01.72	09 03 196 2921	01.20	09 03 260 6840	01.46	09 03 296 6421	01.22
09 03 000 6225	01.42	09 03 000 9968	01.72	09 03 196 2921 222	01.20	09 03 260 6850	01.44	09 03 296 6821	01.26
09 03 000 6240	01.38	09 03 000 9969	01.72	09 03 196 2922	01.20	09 03 260 6864	01.46	09 03 296 6823	01.26
09 03 000 6240	01.41			09 03 196 2951	01.20	09 03 260 6865	01.46	09 03 296 6824	01.22
09 03 000 6245	01.39	09 03 096 0501	00.08					09 03 296 6824 222	01.22
09 03 000 6245	01.42	09 03 096 0501	00.09	09 03 196 6569	01.20	09 03 264 2824	01.22	09 03 296 6825	01.22
09 03 000 6250	01.39	09 03 096 0501	00.10	09 03 196 6919	01.20	09 03 264 2824 222	01.22	09 03 296 6825 222	01.22
09 03 000 6250	01.42	09 03 096 0501	01.76	09 03 196 6920	01.20	09 03 264 2825	01.22	09 03 296 6829	01.22
09 03 000 6260	01.38	09 03 096 0501	01.77	09 03 196 6921	01.77	09 03 264 2845	01.22	09 03 296 6841	01.22
09 03 000 6260	01.40	09 03 096 0501	03.25	09 03 196 6921 222	01.20	09 03 264 2850	01.24	09 03 296 6845	01.22
09 03 000 6261	01.38	09 03 096 0501	20.02	09 03 196 6922	01.20			09 03 296 6845	01.77
09 03 000 6261	01.40	09 03 096 0501	20.04	09 03 196 6922	01.78	09 03 264 6411	01.24	09 03 296 6845	01.78
09 03 000 6262	01.38	09 03 096 0501	20.05	09 03 196 6951	01.20	09 03 264 6421	01.22	09 03 296 6845 222	01.22
09 03 000 6262	01.40	09 03 096 0501	20.07			09 03 264 6821	01.26	09 03 296 6850	01.24
09 03 000 6263	01.38			09 03 196 7921	01.20	09 03 264 6823	01.26	09 03 296 6850	01.78
09 03 000 6263	01.40	09 03 096 3214	01.28	09 03 196 7922	01.20	09 03 264 6824	01.22	09 03 296 6850	02.05
09 03 000 6265	01.38	09 03 096 3214	01.76	09 03 196 7951	01.20	09 03 264 6824 222	01.22	09 03 296 6850 222	01.24
09 03 000 6265	01.40	09 03 096 3217	01.28			09 03 264 6825	01.22	09 03 296 6851 252	01.24
09 03 000 6269	01.38	09 03 096 3217	01.77	09 03 224 2830	01.46	09 03 264 6828	01.27	09 03 296 6855	01.22
09 03 000 6269	01.40			09 03 224 6401	01.44	09 03 264 6828	01.76	09 03 296 6861	01.24
09 03 000 6274	01.38	09 03 124 2901	01.43	09 03 224 6804	01.44	09 03 264 6829	01.22	09 03 296 6861	01.76
09 03 000 6274	01.40	09 03 124 6901	01.43	09 03 224 6805	01.44	09 03 264 6841	01.22	09 03 296 6862	01.24
09 03 000 6281	01.38	09 03 124 7901	01.43	09 03 224 6830	01.46	09 03 264 6845	01.22	09 03 296 6862	01.76
09 03 000 6281	01.40			09 03 224 6840	01.46	09 03 264 6850	01.24	09 03 296 6878	01.26
		09 03 132 2921	01.20	09 03 224 6850	01.44	09 03 264 6850 222	01.24		
09 03 000 9913	00.09	09 03 132 6921	01.20	09 03 224 6864	01.46	09 03 264 6851 252	01.24	09 03 296 7824	01.22
09 03 000 9913	01.72			09 03 224 6865	01.46	09 03 264 6855	01.22	09 03 296 7825	01.22
09 03 000 9913	01.76	09 03 132 7921	01.20			09 03 264 6861	01.24	09 03 296 7845	01.22
09 03 000 9913	02.17			09 03 232 2824	01.22	09 03 264 6862	01.24	09 03 296 7850	01.24
09 03 000 9914	01.72	09 03 142 2901	01.43	09 03 232 2825	01.22	09 03 264 6878	01.26	09 03 296 7855	01.22
09 03 000 9914	01.76	09 03 142 6901	01.43	09 03 232 2845	01.22				
09 03 000 9914	03.20			09 03 232 2850	01.24	09 03 264 7824	01.22	09 03 332 2921	01.20
09 03 000 9914	03.21	09 03 142 7901	01.43	09 03 232 2855	01.22	09 03 264 7825	01.22	09 03 332 6921	01.20
09 03 000 9921	01.72					09 03 264 7828	01.27		
09 03 000 9921	01.76	09 03 160 2901	01.43	09 03 232 6411	01.24	09 03 264 7845	01.22	09 03 332 7921	01.20
09 03 000 9921	03.20	09 03 160 6901	01.43	09 03 232 6421	01.22	09 03 264 7850	01.24		
09 03 000 9921	03.21			09 03 232 6824	01.22	09 03 264 7855	01.22	09 03 364 2921	01.20
09 03 000 9939	01.26	09 03 160 7901	01.43	09 03 232 6825	01.22				
09 03 000 9940	01.14			09 03 232 6845	01.22	09 03 278 2850	01.44	09 03 364 6919	01.20
09 03 000 9940	01.27	09 03 164 2919	01.20	09 03 232 6850	01.24	09 03 278 6401	01.44	09 03 364 6921	01.20
09 03 000 9950	01.72	09 03 164 2921 222	01.20	09 03 232 6855	01.22	09 03 278 6804	01.44	09 03 364 6951	01.20
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09 03 000 9952	01.72	09 03 164 2951	01.20	09 03 232 7824	01.22	09 03 278 6830	01.46	09 03 364 7921	01.20
09 03 000 9953	01.72			09 03 232 7825	01.22	09 03 278 6840	01.46	09 03 364 7951	01.20
09 03 000 9953	01.76	09 03 164 6918	01.20	09 03 232 7845	01.22	09 03 278 6850	01.44	09 03 378 2901	01.43
09 03 000 9954	01.72	09 03 164 6919	01.20	09 03 232 7855	01.22	09 03 278 6864	01.46		
09 03 000 9955	01.72	09 03 164 6921	01.20			09 03 278 6865	01.46	09 03 378 6901	01.43
09 03 000 9956	01.72	09 03 164 6921 222	01.20	09 03 242 6401	01.44				
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09 03 396 6921	01.20			09 05 000 9914	03.20	09 05 748 2831	03.18	09 06 000 8472	03.14
09 03 396 6951	01.20			09 05 000 9922	03.20			09 06 000 8472	03.17
				09 05 000 9924	03.20	09 05 748 6831	03.18	09 06 000 8472	03.33
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09 03 432 2824	01.22	09 04 000 9907	03.24	09 05 048 0501	00.10	09 05 848 6921	03.15	09 06 000 8474	03.33
		09 04 000 9907	20.02	09 05 048 0501	02.17			09 06 000 8474	03.33
09 03 432 6824	01.22	09 04 000 9908	00.16	09 05 048 0501	03.21			09 06 000 8481	03.14
09 03 432 6825	01.22			09 05 048 0501	03.25			09 06 000 8481	03.17
		09 04 016 3201	00.08	09 05 048 0501	20.02	09 06 000 5541	03.44	09 06 000 8481	03.33
09 03 464 2824	01.22	09 04 016 3201	00.09	09 05 048 0501	20.04	09 06 000 5542	03.44	09 06 000 8482	03.14
09 03 464 2825	01.22	09 04 016 3201	00.10	09 05 048 0501	20.05			09 06 000 8482	03.17
		09 04 016 3201	03.23	09 05 048 0501	20.07	09 06 000 6420	03.14	09 06 000 8482	03.33
09 03 464 6824	01.22					09 06 000 6420	03.17	09 06 000 8484	03.14
09 03 464 6825	01.22	09 04 032 3213	03.14	09 05 048 3202	03.17	09 06 000 6420	03.33	09 06 000 8484	03.17
		09 04 032 3215	00.08	09 05 048 3202	03.21	09 06 000 6451	03.24	09 06 000 8484	03.33
09 03 464 7824	01.22	09 04 032 3215	00.09	09 05 048 3204	00.09	09 06 000 6452	03.24		
09 03 464 7825	01.22	09 04 032 3215	00.10	09 05 048 3204	00.10	09 06 000 6454	03.24		
		09 04 032 3215	03.23	09 05 048 3204	03.23	09 06 000 6461	03.24	09 06 000 9541	03.44
09 03 478 6864	01.46					09 06 000 6462	03.24	09 06 000 9542	03.44
		09 04 132 2921	03.11	09 05 048 6924	00.09	09 06 000 6464	03.24	09 06 000 9544	03.44
09 03 496 2824	01.22	09 04 132 6921	03.11	09 05 048 6924	03.16	09 06 000 6471	03.14	09 06 000 9551	03.44
09 03 496 2825	01.22	09 04 132 6922	03.11			09 06 000 6471	03.17	09 06 000 9552	03.44
		09 04 132 6951	03.11	09 05 148 2921	03.15	09 06 000 6471	03.33	09 06 000 9554	03.44
09 03 496 6824	01.22	09 04 132 6952	03.11	09 05 148 2931	03.15	09 06 000 6472	03.14	09 06 000 9561	03.44
09 03 496 6825	01.22					09 06 000 6472	03.17	09 06 000 9562	03.44
09 03 496 7825	01.22	09 04 132 7921	03.11	09 05 148 6920	03.15	09 06 000 6472	03.33	09 06 000 9564	03.44
				09 05 148 6921	03.15	09 06 000 6474	03.14	09 06 000 9571	03.44
09 03 596 3214	01.28	09 04 232 2821	03.12	09 05 148 6931	03.15	09 06 000 6474	03.17	09 06 000 9572	03.44
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09 03 664 2921	01.20	09 04 232 2826	03.13	09 05 148 6961	03.15	09 06 000 6474	03.33	09 06 000 9901	00.11
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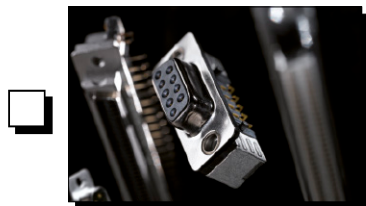
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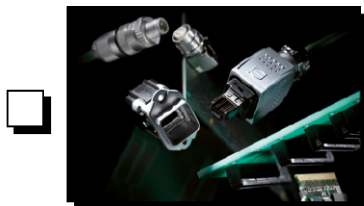


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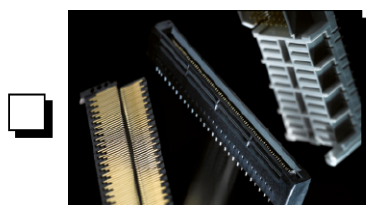
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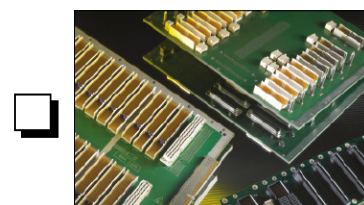
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