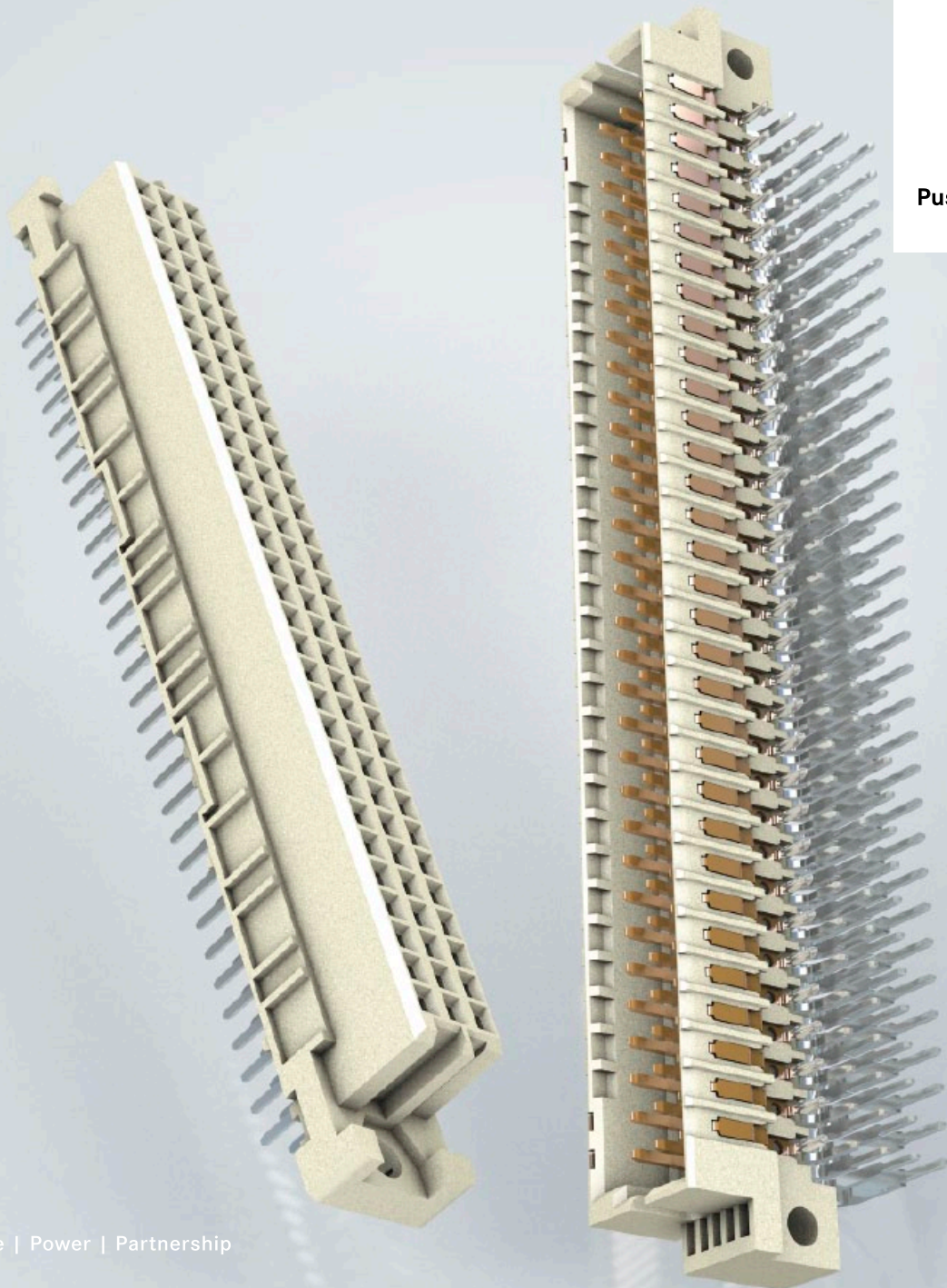




Pushing Performance



People | Power | Partnership

HARTING

Connectors DIN 41 612

	 Type	Termination								
		Solder termination	Reflow soldering (SMC)	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	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		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	Pages 01.22 f	Page 01.25	Page 01.24	Page 01.27	Page 01.25	Page 01.26		
	2C	Pages 01.28 f	Pages 01.28 f							
		Pages 01.30 f	Pages 01.30 f	Pages 01.30 f	Pages 01.30 f	Page 01.27	Pages 01.30 f			
	3C	Pages 01.32 f	Pages 01.32 f							
		Pages 01.34 f	Pages 01.34 f		Pages 01.34 f	Page 01.34				
	M	Page 01.41								
		Page 01.42			Page 01.42					
	M-flat	Page 01.43			Page 01.43					
	M invers	Pages 01.44 f			Pages 01.44 f		Pages 01.44 f			
	R	Pages 01.46 f	Pages 01.46 f		Pages 01.46 f		Pages 01.46 f			
		Page 01.49	Page 01.49							
	R (HE 11)	Page 01.50					Page 01.50			
		Page 01.51								
	RM				Page 01.48					
	Q	Page 01.52			Page 01.52		Page 01.52			
		Page 01.60								
	2Q	Page 01.53			Page 01.53		Page 01.53			
		Page 01.60								
	3Q	Pages 01.54 f	Pages 01.54 f		Pages 01.54 f		Pages 01.54 f			
	2R	Pages 01.56 f	Pages 01.56 f		Pages 01.56 f		Pages 01.56 f			
		Page 01.60								
	3R	Pages 01.58 f	Pages 01.58 f		Pages 01.58 f		Pages 01.58 f			
	<i>harbus® 64</i>	Page 02.11	Page 02.11							
		Page 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								
	F	Page 03.27	Page 03.27							
		Pages 03.32, 03.34 f		Page 03.33	Page 03.34	Page 03.31	Page 03.33			
	U						Page 03.30			
	I	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 03.46				
	U						Page 03.45			
	I					Page 03.44				
	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 04.22							Page 04.22	
		Page 04.23				Page 04.23	Page 04.23			
	MH 21 + 5	Page 04.24								
		Page 04.25								

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.

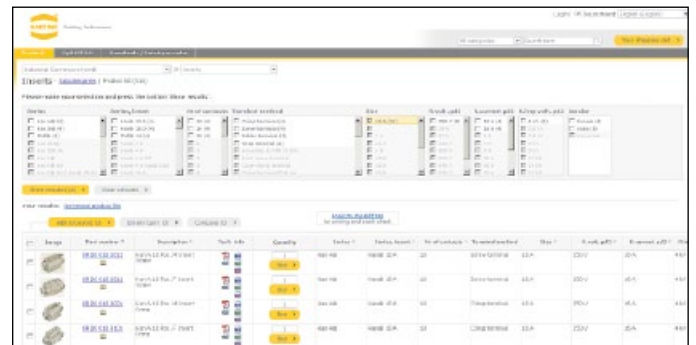
The parts are downloadable in 2D-format (DXF) and 3D-format (IGES, STEP).

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

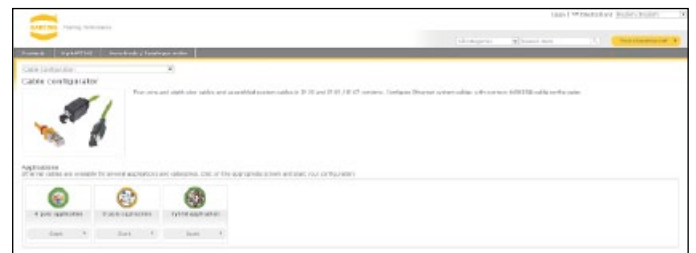
You can find the **HARTING eCatalogue** at www.HARTING.com.



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.

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Transforming customer wishes into concrete solutions



The HARTING Technology Group is skilled in the fields of electrical, electronic and optical connection, transmission and networking, 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 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 Enclosures and Shop Systems. The HARTING Group currently comprises 37 subsidiary companies and worldwide distributors employing a total of more than 3,500 staff.



HARTING Subsidiary company



HARTING Representatives



We aspire to top performance.

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

Always at hand, wherever our customers may be.

Increasing industrialization is creating growing markets characterized by widely diverging demands and requirements. The search for perfection, increasingly efficient processes and reliable technologies is a common factor in all sectors across the globe.

HARTING is providing these technologies – in Europe, America and Asia. The **HARTING** professionals at our international subsidiaries engage in close, partnership based interaction with our customers, right from the very early product development phases, in order to realize customer demands and requirements in the best possible manner.

Our people on location 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 serve our customers with the best possible solutions, **HARTING** is able to contribute a great deal more and play a closely integrative role in the value creation process.

From ready assembled cables through to control racks or ready-to-go control desks: Our aim is to generate the maximum benefits for our customers – without compromise!

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 to new requirements, which is why **HARTING** ranks among the first companies 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 mature network systems. In the course of many years of close, trust-based cooperation with its customers, the **HARTING** Technology Group has advanced to one of the worldwide leading specialists for connector technology. Extending beyond the basic functionalities demanded, we offer individual customers specific and innovative solutions. These tailored solutions deliver sustained effects, provide investment security and enable customers to achieve strong added value.

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

In order to develop connectivity and network solutions serving an exceptionally wide range of connector applications and task scopes in a professional and cost optimized manner, **HARTING** not only commands the full array of conventional tools and basic technologies. Over and beyond these capabilities, **HARTING** is constantly harnessing and refining its broad base of knowledge and experience to create new solutions that ensure continuity at the same time. In securing this know-how lead, **HARTING** draws on a wealth of sources from both in-house research and the world of applications alike.

Salient examples of these sources of innovative knowledge include microstructure technologies, 3D design and construction technology, as well as high temperature

or ultrahigh frequency applications that are finding use in telecommunications or 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 or stainless steel.

HARTING solutions extend across technology boundaries.

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 far more than components, and represent mature, comprehensive solutions attuned to individual customer requirements and wishes. The range covers ready-to-use cable configurations, completely assembled backplanes and board system carriers, as well as fully wired and tested control panels.

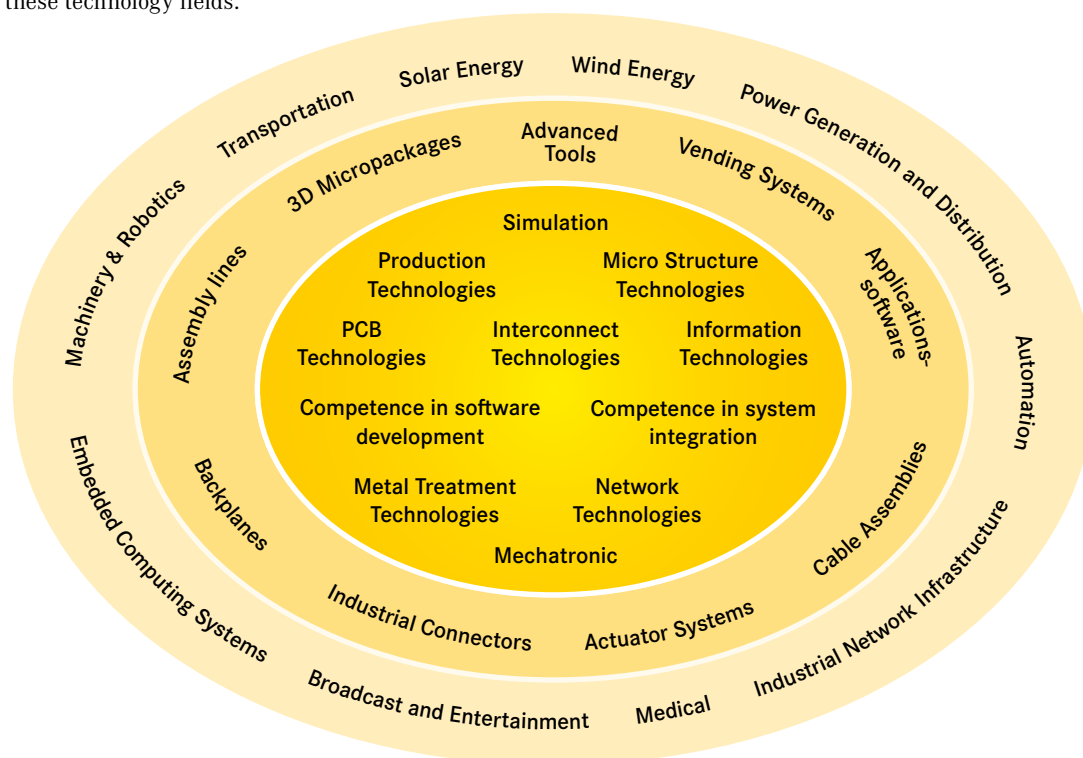
In order to ensure the future proof design of RF- and EMC-compatible interface solutions, the central **HARTING** laboratory (certified to EN 45001) provides simulation tools, as well as experimental, testing and diagnostics facilities all the way through to scanning electron microscopes. In the selection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



HARTING knowledge is practical know-how generating synergy effects.

HARTING commands decades of experience with regard to the applications conditions of connectors in telecommunications, computer and network technologies and medical technologies, as well as industrial automation technologies, such as the mechanical engineering and plant engineering areas, in addition to the power generation industry or the transportation sector. **HARTING** is highly conversant with the specific application areas in all of these technology fields.

The key focus is on applications in every solution approach. In this context, uncompromising, superior quality is our hallmark. Every new solution found will invariably flow 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. In this way, **HARTING** is synergy in action.



DIN 41 612 type 3C Crimp

Nowadays, many PCBs are smaller than the standard size 3HE. HARTING offers a new crimp connector with housing in order to assemble cables that require less space.

The well-known and reliable BC crimp contacts are used for this product.

For further details see pages 01.34 and 20.08.



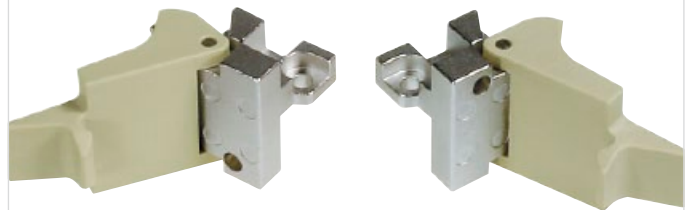
DIN 41 612 type 3C Crimp

Fixing brackets for full metal housings D20

The new metallized fixing brackets give a robust mechanical connection with reliable screws and additionally through our new screwless locking solution. Moreover a good electrical connection is guaranteed between the full metal housings D20, the fixing brackets and the rack systems.

The locking levers simplify the handling notably and can also be used for daughter cards mounting and removal.

For further details see page 20.32.



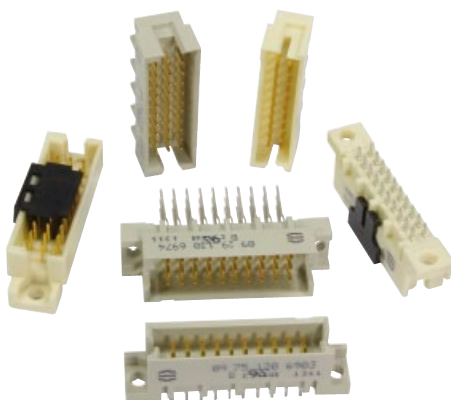
Fixing brackets

DIN 41 612 type 3Q / 3R – Even smaller, and just as rugged

The density of the electronics on PCBs is constantly increasing, while the PCBs and components are getting smaller and smaller. This trend also results in a need for smaller and smaller connectors.

The new type 3Q and 3R male connectors are available both with and without flange, enabling further space reductions. The connectors come in solder, SMC (Surface Mount Compatible) or press-in technology and are especially suitable for mezzanine applications.

For further details see pages 01.54 and 01.58.



DIN 41 612 types 3Q/3R

DIN 41 612 Female connector H 15 with press-in pins

Type H15 is used successfully as power connector for many years. Now, HARTING offers a female connector type H15 with press-in pins. Press-in is already our fourth termination technology for female connector type H15 besides cage clamp, solder and faston.

The new portfolio includes two versions with 2.54 mm and 5.08 mm contact pitch on the termination side.

For further details see page 04.15.



DIN 41 612 female connector H15 press-in

Printed Board Connectors according to DIN 41 612 / IEC 60 603-2

Chapter

Printed Board Connectors – general information

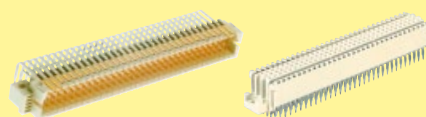
00

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



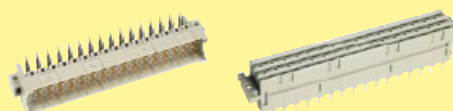
01

harbus® 64



02

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



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 2002/95/EG
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

General
information

00
03

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

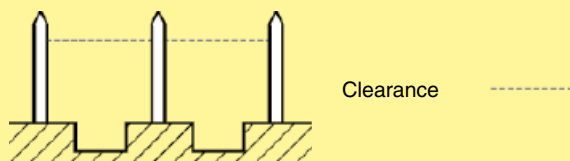
Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

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

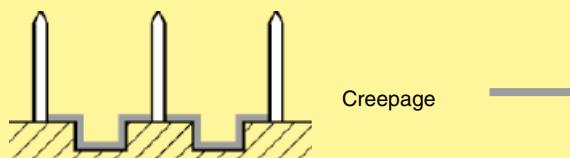
Exemplary calculation

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.

^{*)} It is the users responsibility to ensure that the complete current issue of the specification is considered.

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_{-}	Rated impulse withstand voltages in kV for installation category (Voltage form: 1.2/50 μ s according to DIN IEC 60 060-1)			
	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		0.1	
1.5	0.5	0.5	0.3	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 ₋)	Phase-to-earth
	$U_{r.m.s.}$ or U_{-}	$U_{r.m.s.}$ or U_{-}
$U_{r.m.s.}$ in V		
12.5	12.5	—
24	25	—
25	—	—
30	32	—
42	—	—
48	50	—
50 ²⁾	—	—
60	63	—
60/30	63	32
100 ²⁾	100	—
110	—	—
120	125	—
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	
	$U_{r.m.s.}$	$U_{r.m.s.}$	$U_{r.m.s.}$
$U_{r.m.s.}$ in V			
60	63	32	63
110	—	—	—
120	125	80	125
127	—	—	—
150 ²⁾	160	—	160
208	200	125	200
220	—	—	—
230	250	160	250
240	—	—	—
300 ²⁾	320	—	320
380	—	—	—
400	400	250	400
415	—	—	—
440	500	250	500
480	500	320	500
500	—	—	—
575	630	400	630
600 ²⁾	630	—	630
660	630	400	630
690	—	—	—
720	800	500	800
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_{-}	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 No. 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 No. 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 No. 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 No. 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 No. explanation **02** **1**

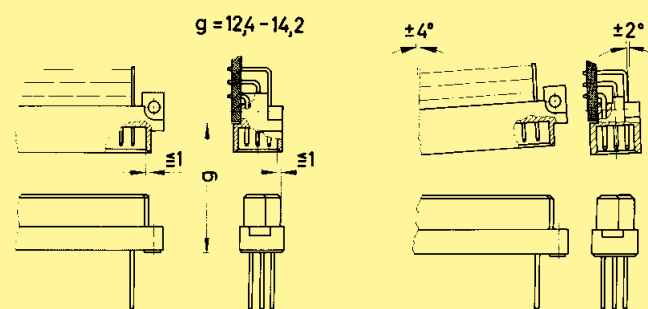
Other plating finishes available on request.

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.

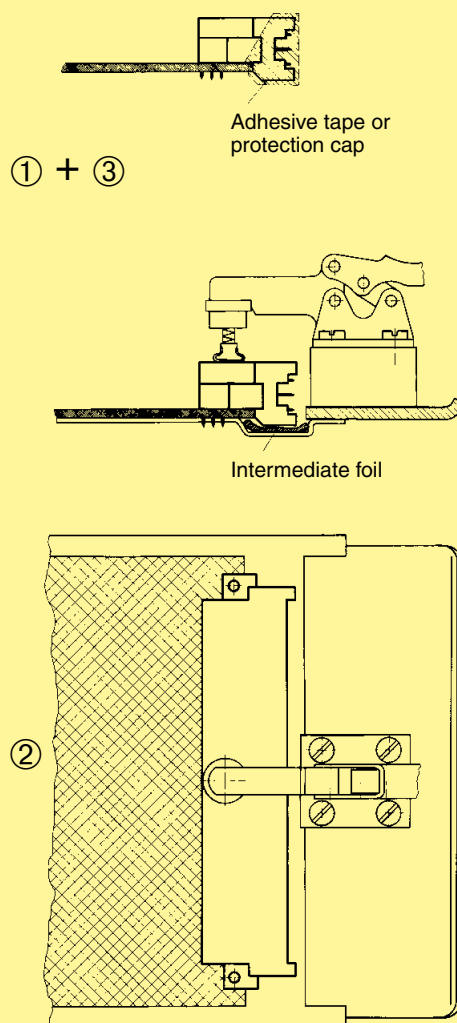
The connectors should not be coupled and decoupled under electrical load.



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.

- 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.
- 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.
- 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

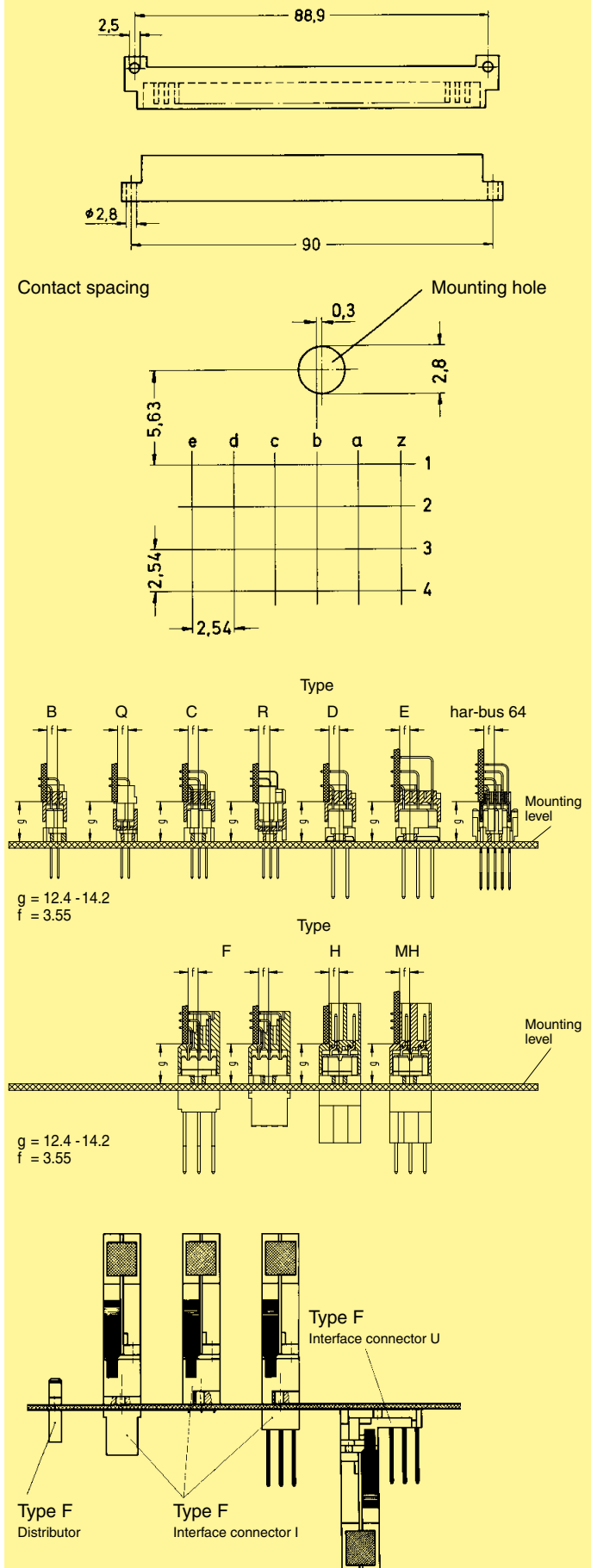
In the basic frame unit according to DIN EN 60297-3 pcb's are inserted from the front and make contact with the connectors fitted to the back. This basic arrangement gives the following advantages:

- 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

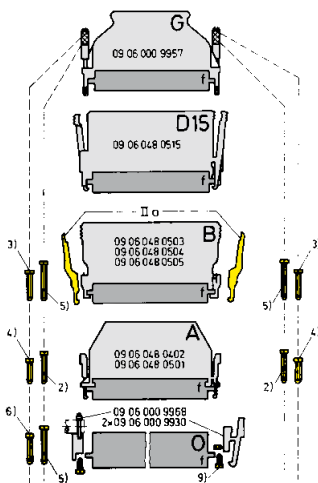
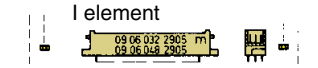
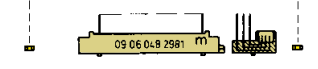
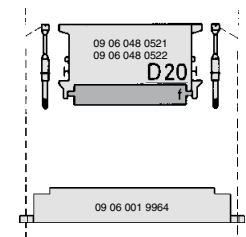
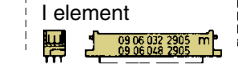
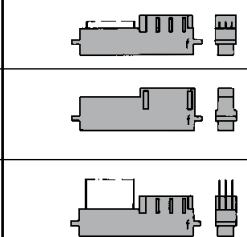
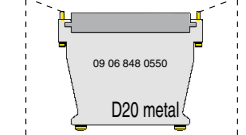
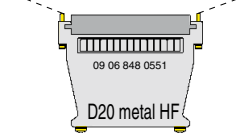
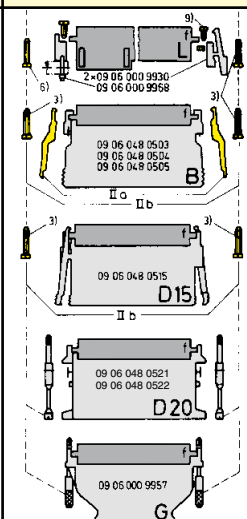
All connectors can be supplied with a complete range of accessories. These can be fitted above or below the wiring plane on the back of the card frame or on the front of the card frame. These connectors and accessories provide a complete connector system suitable for commonly used wiring techniques.

- 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 connectors I and U.
- 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.
- On the one plane the interface connector U has male contacts that are compatible with the flying lead connector. On the other plane it has wrap posts for interfacing to the internal wiring of the card frame. It can be mounted on the back of the card frame above or below other connectors arranged upright. Its wrap posts follow the same pitch as other connectors therefore allowing automated wiring. By using the U connector with the flying lead connector plug-in connections between the card frame and the peripheral equipment/ outlying stations are made easy.



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			

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				
Wrapped connections posts 1 x 1 mm				
Middle section				
Front side				

F	F, H, MH 24 + 7	MH 24 + 7																																																																																																					
Input access from the wiring side via a female connector  I element  U element 	Input access from the front side via a female connector  I element 	Input access from the front side via a female connector 	Ia <table><tr><th>Combinations</th><th>Fixing bracket a for male connectors Multiple fixing Single fixing</th><th>Fixing bracket b for male connectors Multiple fixing Single fixing</th></tr><tr><td>Housing A</td><td>latch (M 2.5 x 12) and screw fixing</td><td>latchable</td></tr><tr><td>Housing B</td><td></td><td>latch (M 2.5 x 20) and screw fixing</td></tr><tr><td>Housing D15</td><td></td><td>latch (M 2.5 x 20) and screw fixing</td></tr><tr><td>Housing D20</td><td></td><td>screw fixing</td></tr><tr><td>Housing G</td><td></td><td>screw fixing</td></tr><tr><td>(...9930)</td><td></td><td>latch (M 2.5 x 20) and screw fixing</td></tr><tr><td>Comb. O (...9968)</td><td></td><td>screw fixing</td></tr><tr><td>(...9930)</td><td></td><td>latch (M 2.5 x 20) and screw fixing</td></tr><tr><td>Comb. L (...9968)</td><td></td><td>screw fixing</td></tr></table> Ib <table><tr><th>Combinations</th><th>Fixing bracket b for female connectors Multiple fixing</th><th>I element</th><th>U element</th></tr><tr><td>Housing A</td><td></td><td>(M 2.5x22) latch and (M 2.5x16) screw fixing</td><td></td></tr><tr><td>Housing B</td><td>latchable</td><td>(M 2.5x26) latch and (M 2.5x20) screw fixing</td><td></td></tr><tr><td>Housing D15</td><td>latchable</td><td>latchable</td><td></td></tr><tr><td>Housing G</td><td></td><td>screw fixing</td><td></td></tr><tr><td>(...9930)</td><td></td><td>latchable</td><td></td></tr><tr><td>Comb. O (...9968)</td><td></td><td>(M 2.5x26) screw fixing (M 2.5x20)</td><td></td></tr><tr><td>Comb. M</td><td>latchable</td><td></td><td></td></tr></table> II <table><tr><th>Housing B/D 15</th><th colspan="2">II a</th><th colspan="2">II b</th></tr><tr><td>09 06 048 0503</td><td>2x</td><td>09 06 000 9913</td><td>and/or 2x</td><td>09 06 000 9926</td></tr><tr><td>09 06 048 0504</td><td>1x</td><td>{ 09 06 000 9913 09 06 000 9919</td><td>and/or 2x</td><td>09 06 000 9926</td></tr><tr><td>09 06 048 0505</td><td>1x</td><td>{ 09 06 000 9913 09 06 000 9919</td><td>and/or 2x</td><td>09 06 000 9926</td></tr><tr><td>09 06 048 0515</td><td>—</td><td>—</td><td>and 2x</td><td>09 06 000 9926</td></tr><tr><td>Comb. O + L</td><td>2x 2x</td><td>09 06 000 9930 09 06 000 9968</td><td>and 2x —</td><td>09 06 000 9926 —</td></tr><tr><td>Comb. M</td><td>2x</td><td>09 06 000 9930</td><td>—</td><td>—</td></tr></table> 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				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	(...9930)		latch (M 2.5 x 20) and screw fixing	Comb. O (...9968)		screw fixing	(...9930)		latch (M 2.5 x 20) and screw fixing	Comb. L (...9968)		screw fixing	Combinations	Fixing bracket b for female connectors Multiple fixing	I element	U 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		(...9930)		latchable		Comb. O (...9968)		(M 2.5x26) screw fixing (M 2.5x20)		Comb. M	latchable			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 2x	09 06 000 9930 09 06 000 9968	and 2x —	09 06 000 9926 —	Comb. M	2x	09 06 000 9930	—	—
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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

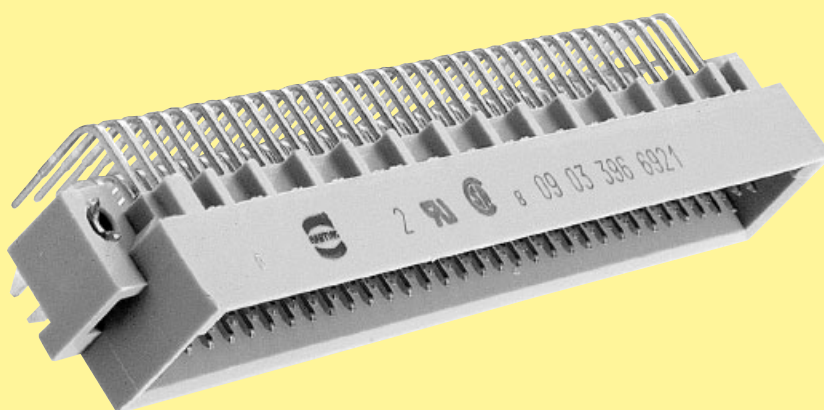
In the soldering process, all component terminations including the snap-in clips are soldered and therefore mechanically secured. This provides mechanical protection for the soldered contacts during mating and unmating of the connector.

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.

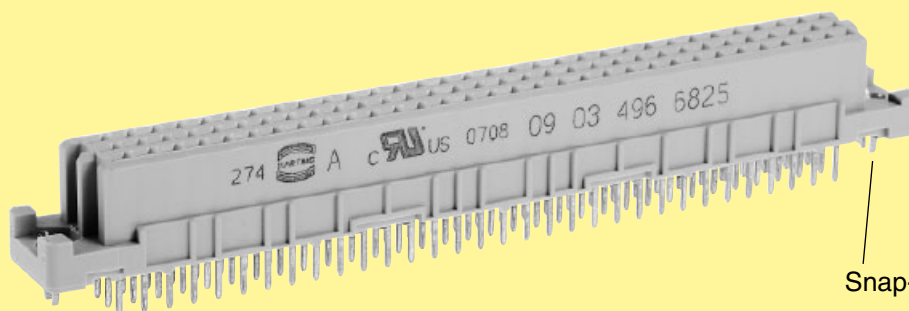
It is possible to supply the majority of male and female connectors with solder termination with snap-in clips (existing articles see product pages).

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



Mounting force
 40 - 60 N

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



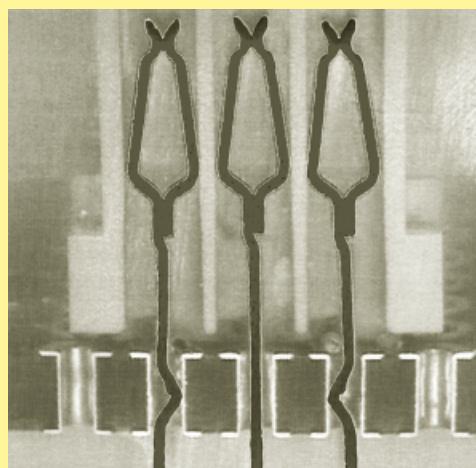
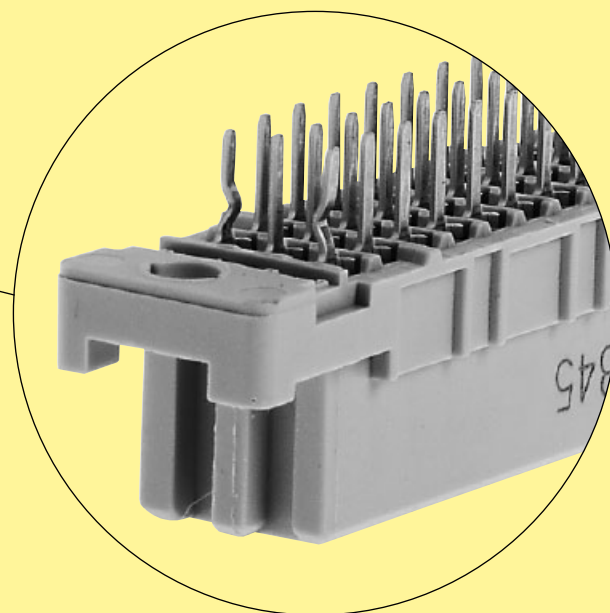
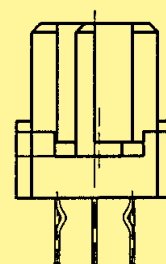
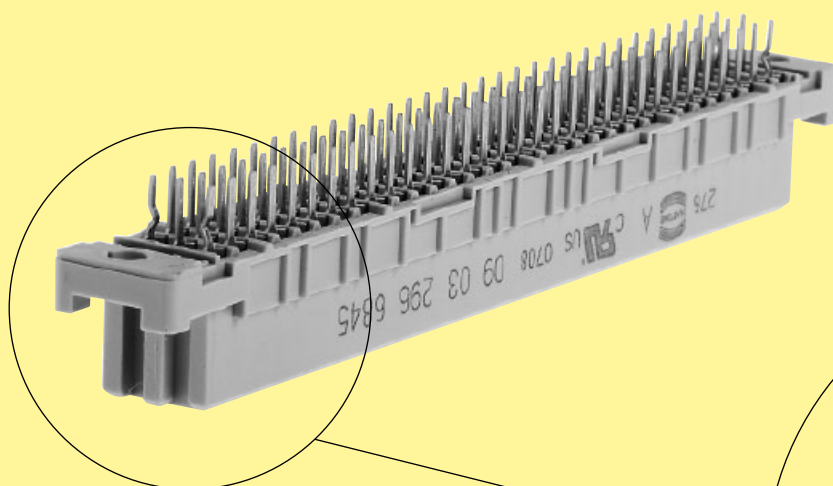
Snap-in clip

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.

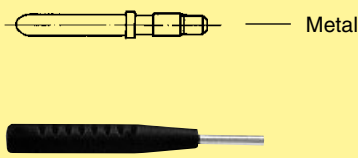
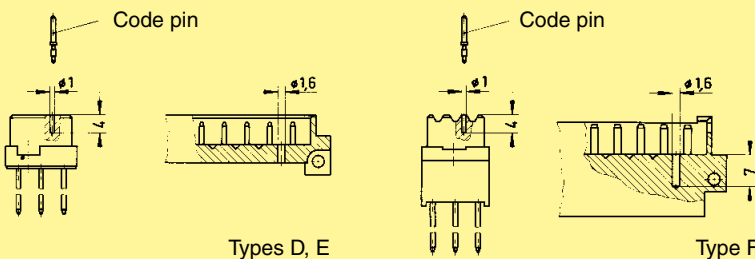
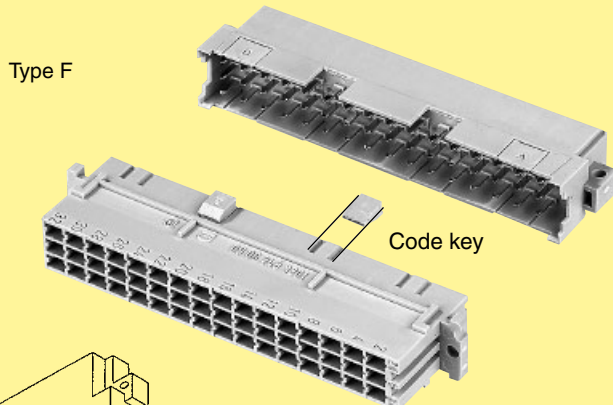
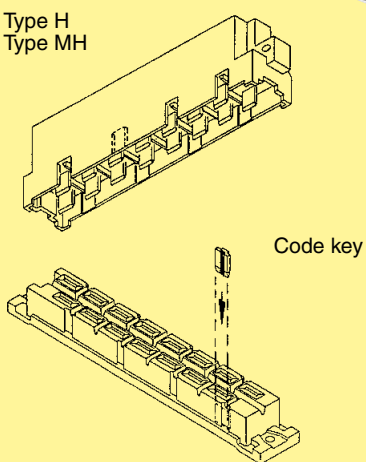


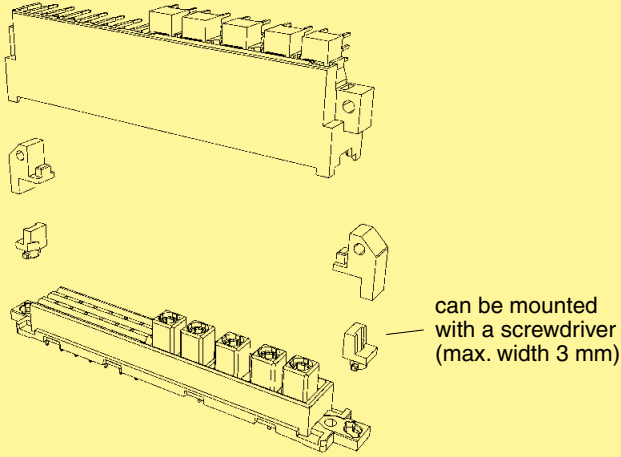
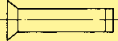
Cross section of a connector with kinked contacts assembled to a pcb

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.

Downloaded from Arrow.com.

Identification	Part No.	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  Types D, E Type F	
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.  Type F Code key	
shroud coding Types H, MH 24 + 7	Code key 09 06 001 9918	Type H Type MH  Code key	
Tool for breaking out the coding area of the male shroud	09 99 000 0242		

Identification	Part No.	Drawing	Dimensions in mm
Coding system <u>without</u> 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 <u>with</u> 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.  Plastic, grey  Plastic, black  	

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.

group1							group2						
	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						

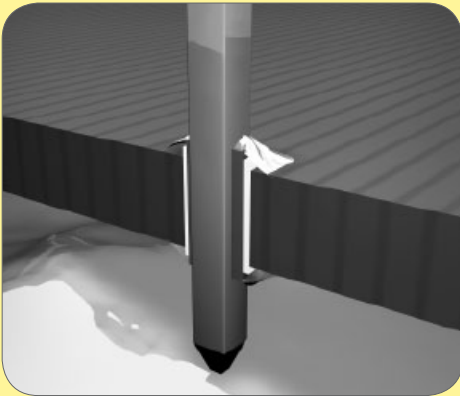
group3							group4						
	I0	I1	I2	I3	I4	NC		I0	I1	I2	I3	I4	NC
F0							F0						
F1			X				F1			X			
F2							F2						
F3							F3						
F4							F4						
F5							F5						

Diagram: Classification from NFF 16-102, April 1992

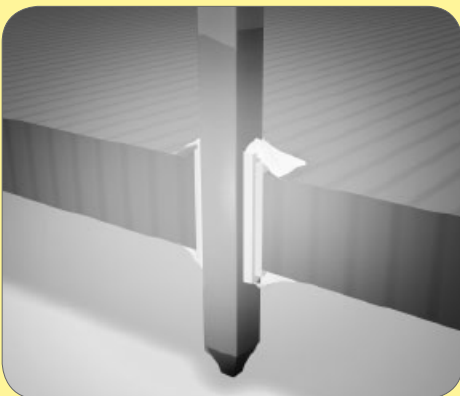
The HARTING DIN Power and DIN Signal-Portfolio looks back on a highly successful track record in the railroad engineering industry. Typical application areas include – among many others - control, steering, monitoring components and modules on board trains, as well as signal technology components or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

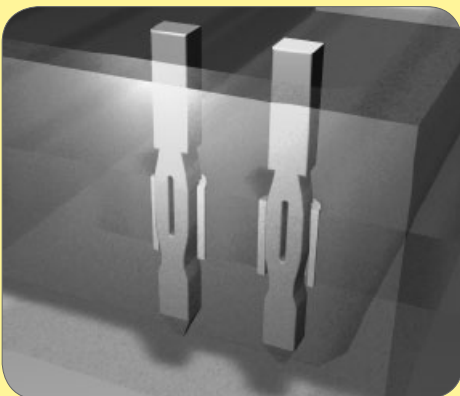
In order to facilitate rapid identification the additional, railway specific articles are designated accordingly on the product pages.



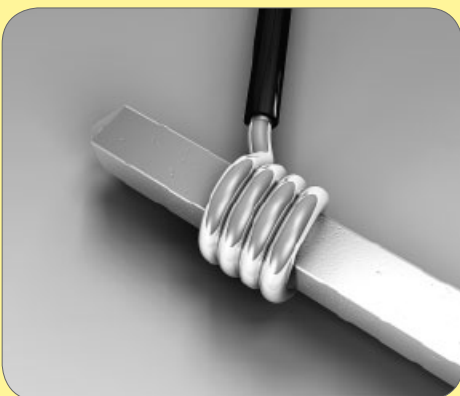
THT soldering technology



SMC 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.

SMC soldering technology

The connector is inserted into through-plated PCB holes similar to standard component assembly for processing with SMC (Surface Mount Compatible) 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

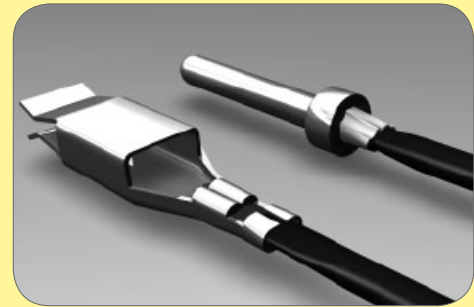
The solder lug termination is the optimized solution for production of small lot sizes and prototypes. Even without any special tooling a big variety of cables can be terminated to the cable connectors. The stripped wire is soldered individually by hand to the solder lug. This termination should however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

Faston blades terminals

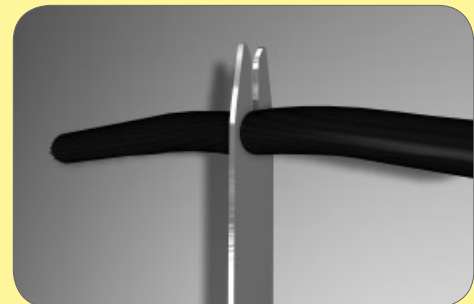
The faston blade termination is used for free wiring. Benefits are the high current carrying capacity (up to 15 A) and the easy possibility for variations.

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.



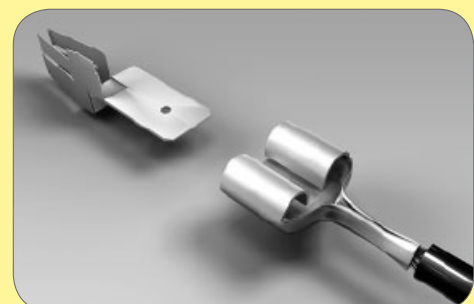
Crimp terminal



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.

SMC 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.

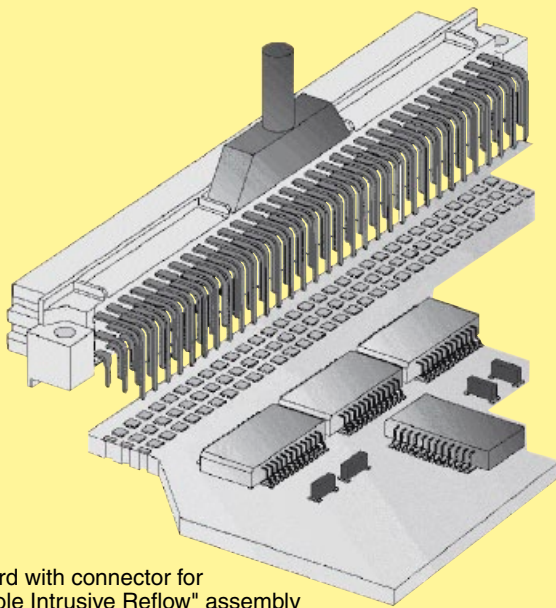


Fig. 1:
SMT board with connector for
"Pin in Hole Intrusive Reflow" assembly

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 SMC 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

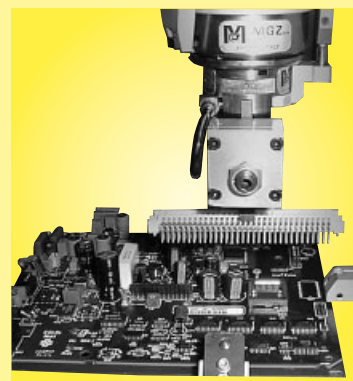


Fig. 2:
Pick-and-place machine for
odd form components
(Courtesy of JOT Automation GmbH)

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.

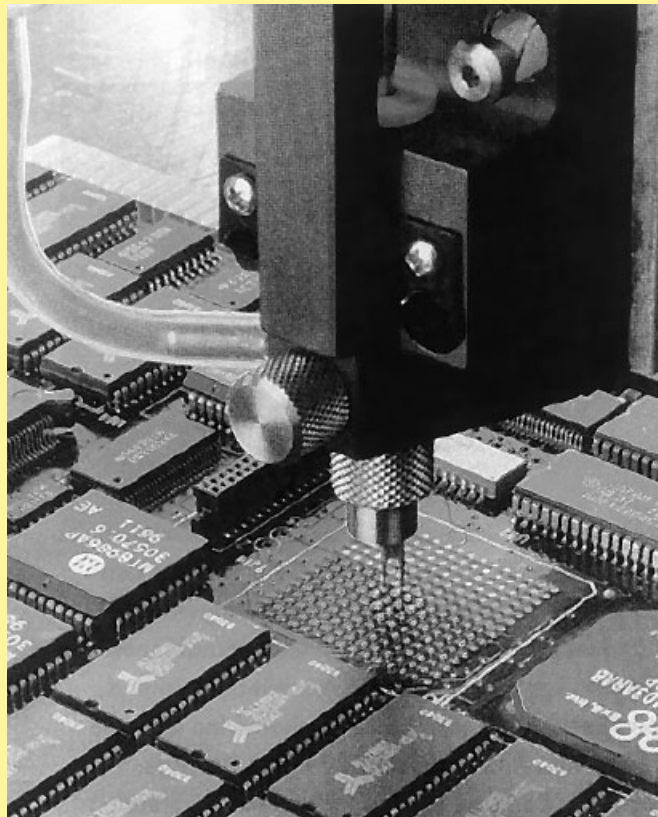


Fig. 3: Dispenser in operation

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 %.

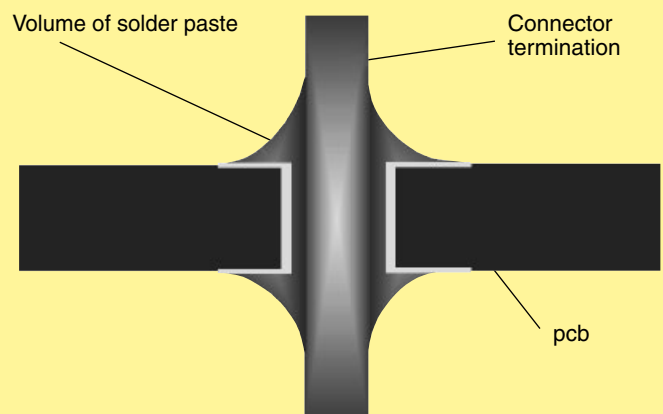


Fig. 4: Plated through hole with connector termination

Requirements for SMC connectors

SMC (Surface Mount Compatible) 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.

HARTING SMC technology

HARTING offers its customers a complete system concept for integrating SMC technology into existing production lines. We manufacture a wide range of SMC connectors (3 and 5 row) in compliance with IEC 60603-2, D-Sub connectors in compliance with IEC 60807 and connectors from the har-mik® series with contact spacing of 1.27 millimetres. In addition, HARTING supports the market with packaging and processing concepts, which have been developed in collaboration with renowned manufacturers of SMC 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



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

har:press Press-in technology

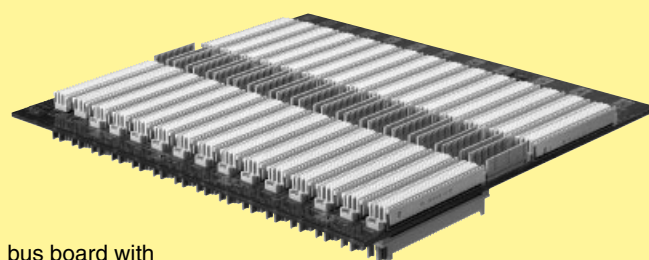
Solderless termination for connectors has proven to be reliable for decades. Today the use of press-in connectors encompasses all fields of electrical and electronical applications.

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 independent 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.

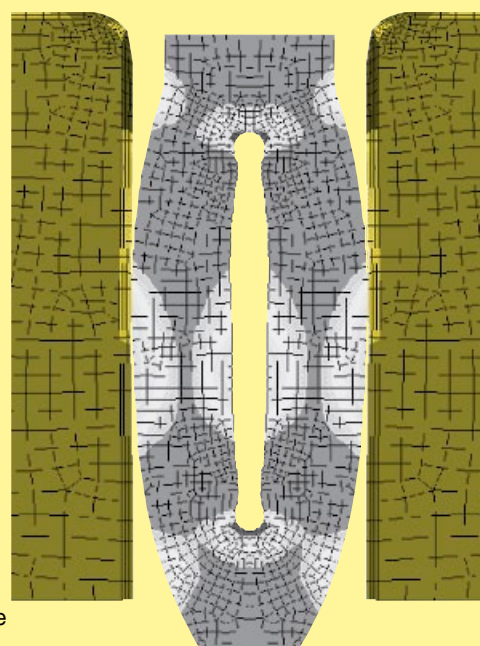
Although the scope of requirements at the press-in process is generally defined in time-tested specifications, the novel press-in zones should offer an optimal handling and a reliable termination. Essentially, this is guaranteed through the design of the press-in zone and the meticulous observance of 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

har:press 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

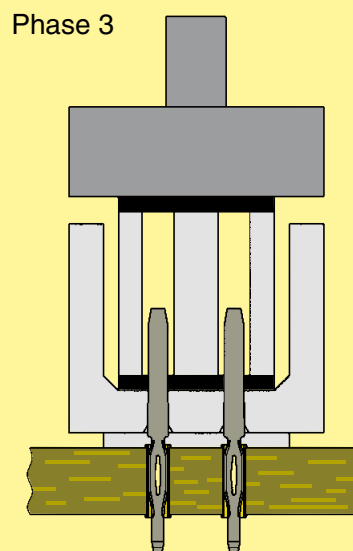
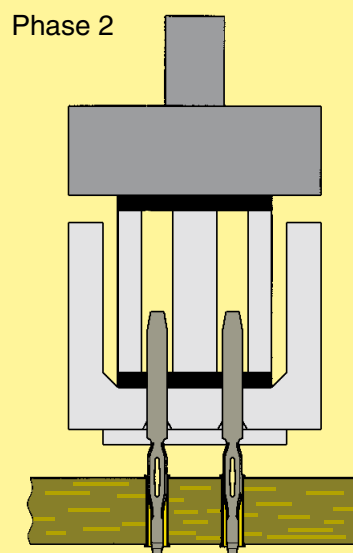
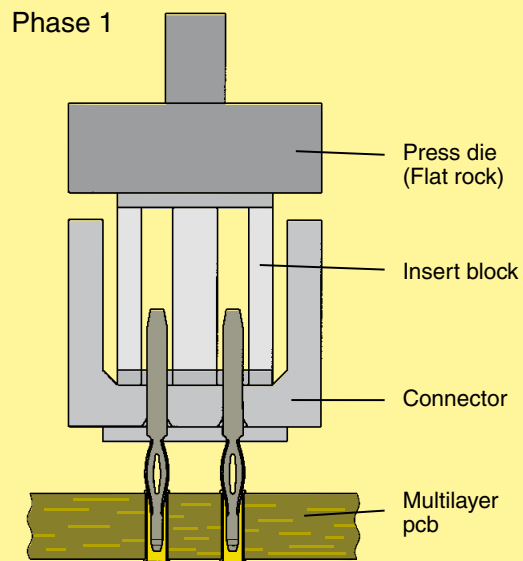
In the press-in process the insertion force is continuously transformed into compression force. The resulting friction frees the contacting bars of insulating films. Superfluous plating (tin) is transferred within the plated through hole. A gas-tight connection of fresh non-oxidised metal surfaces is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



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.

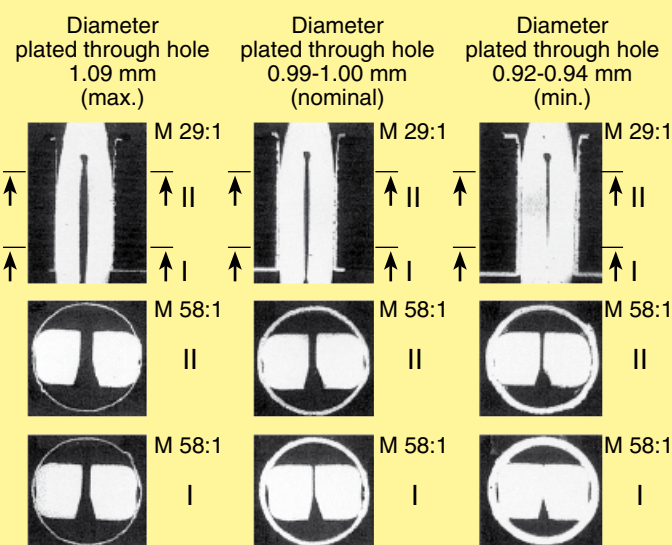
harpress is extremely versatile and offers a reliable electrical contact, therefore it is especially well suited for applications with these surfaces.

Please contact us for detailed test reports.

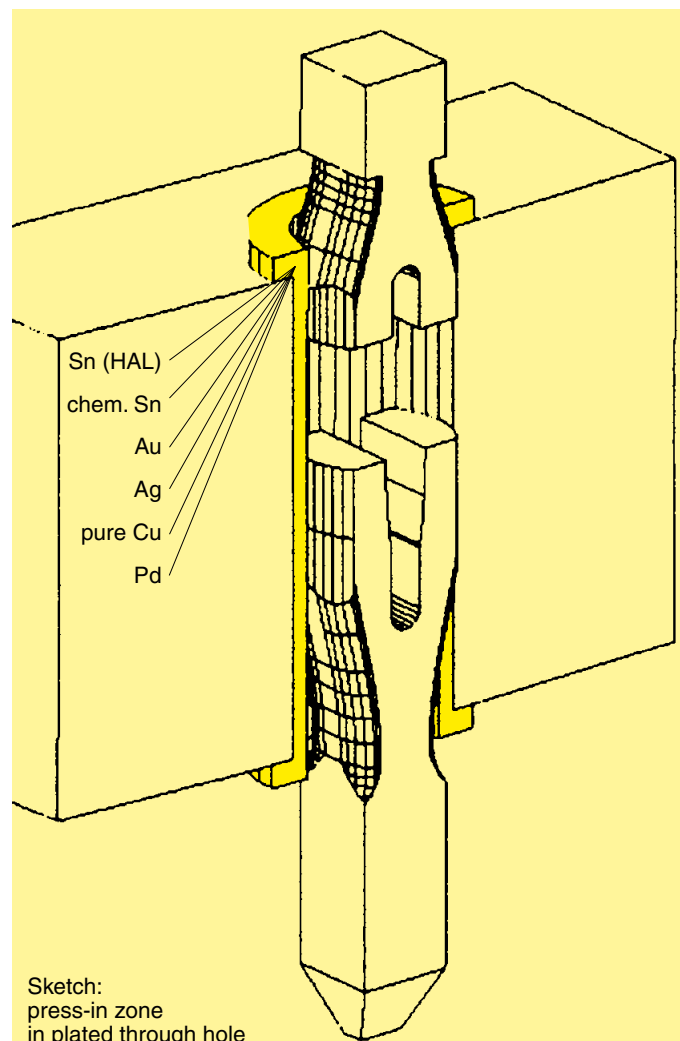
In addition to the hot-air-level (HAL) other pcb surfaces are getting more important. Due to their different properties, such as mechanical strength and coefficient of friction we recommend the following configuration of pcb through holes.

<i>Tin-lead plated PCB (HAL) acc. EN 60352-5</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

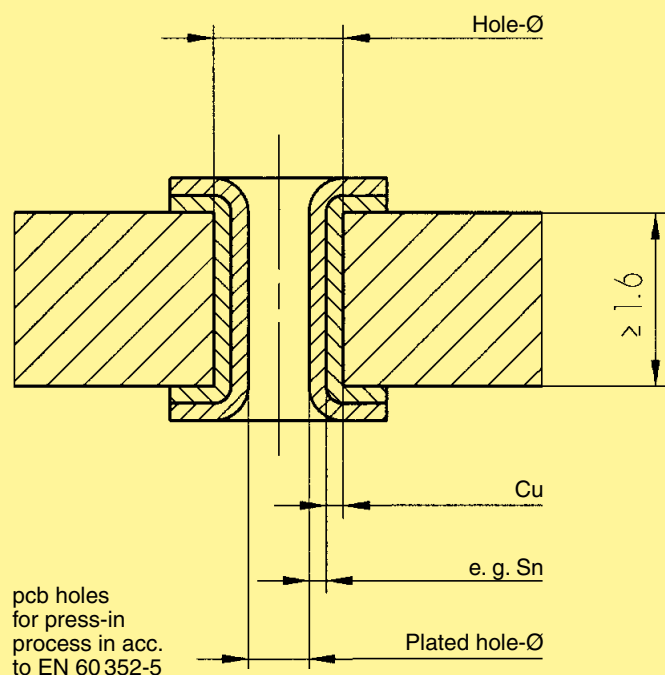
PCB board thickness: ≥ 1.6 mm



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



Sketch:
press-in zone
in plated through hole



pcb holes
for press-in
process in acc.
to EN 60352-5

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 60352-2.

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 60352, 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.

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.

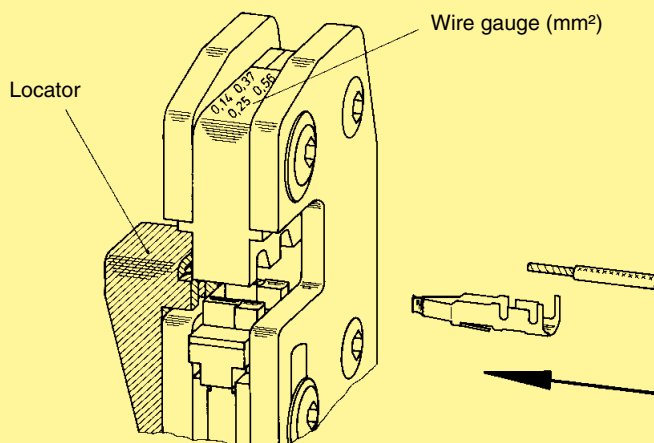


Crimp cross-section

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 60352-2, Amend. 2, table IV



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

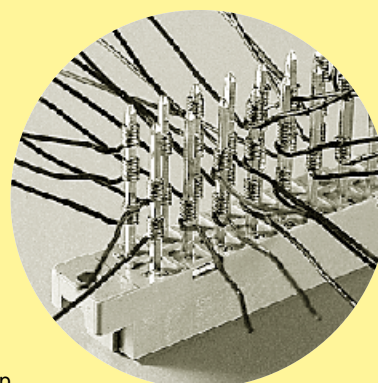
The top part of the wrapped connection is made using the cable conductor as stated above but an extra turn is made at the bottom. For this turn insulation is also wrapped around the post to give a great mechanical strength to the joint and also to provide insulation between adjacent posts.

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.

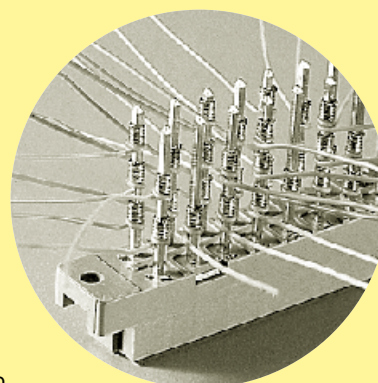
The adjacent tables show the maximum amount of wrapped connections that can be placed on the wire wrap post (in acc. to IEC 60352-1).



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
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



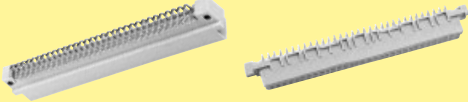
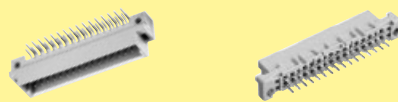
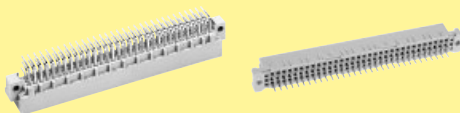
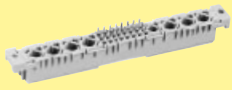
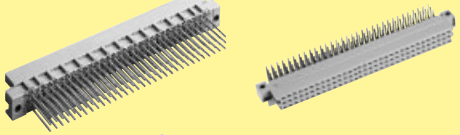
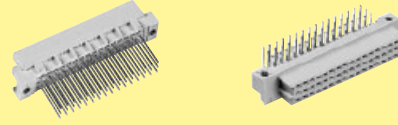
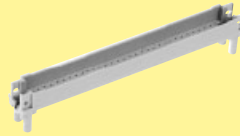
Modified wrap

		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
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

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

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Technical characteristics		01.10
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Type 2B connectors		01.16
Type 3B connectors		01.18
Type C connectors		01.20
Type 2C connectors		01.27
Type 3C connectors		01.32
Special contacts type M		01.36
Type M connectors		01.41
Type M-flat connectors		01.43
Type M invers connectors		01.44
Type R, RM, R (HE 11) connectors		01.46
Type Q, 2Q, 3Q, 2R and 3R connectors ...		01.52
Pin shroud, adapter		01.61
Application examples		01.64

Number of contacts	16-96
Contact spacing (mm)	2.54
Working current see current carrying capacity chart	2 A max. 1 A with insulation displacement 40 A max. type M
Clearance	≥ 1.2 mm
Creepage	≥ 1.2 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 kV
Contact resistance	≤ 20 mΩ
Insulation resistance	≥ 10 ¹² Ω for standard articles ≥ 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	– 55 °C ... + 125 °C – 40 °C ... + 105 °C for press-in connector
During reflow soldering	max. + 240 °C for 15 s for SMC connectors

Degree of protection for crimp terminal IP 20 according to DIN 40 050

Electrical termination	
Male and female connector	Solder pins for pcb connections Ø 1.0 ± 0.1 mm according to IEC 60 326-3 wrap posts 0.6 x 0.6 mm diagonal 0.79-0.86 mm Crimp terminal 0.09-0.5 mm ² 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 level ¹⁾

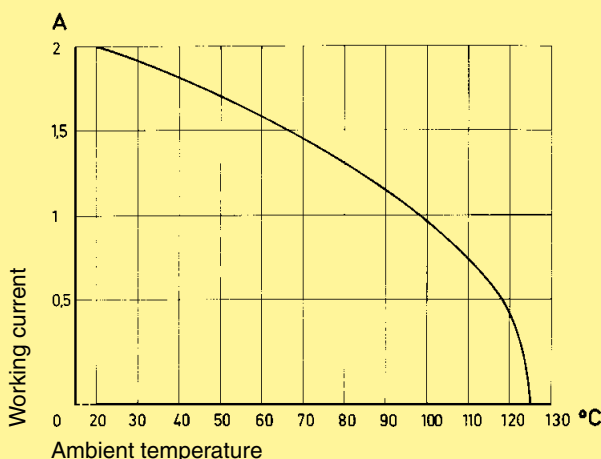
¹⁾ Explanation performance levels see chapter 00

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 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



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

A secure interfacing system for signals from the rear of 19" racks to connectors with wrap posts 0.6 x 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 01.64 ff).

Fitting and removing crimp contacts

see technical characteristics chapter 03

Number of contacts

64, 32



Male connectors

Identification	Number of contacts	Contact arrangement	Part No.	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
	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
	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

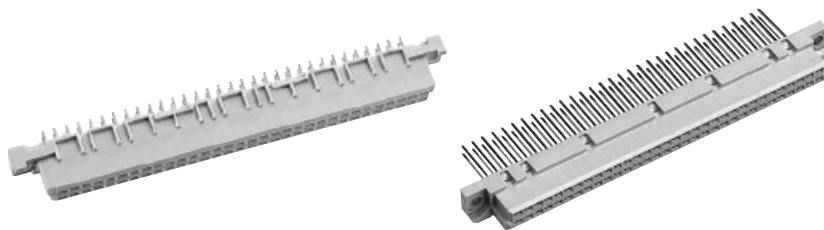
^{c)} Connectors with coding see chapter 00

^{d)} CTI > 400

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

Number of contacts

64



Female connectors

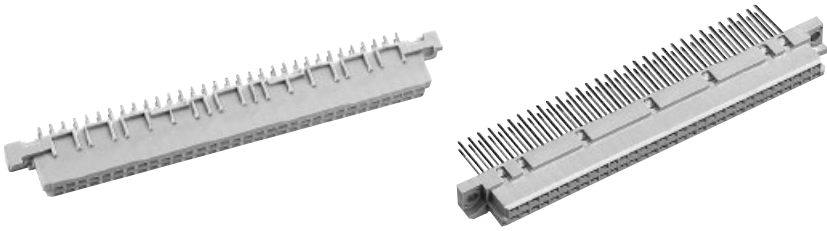
Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1
Female connector with solder pins 2.9 mm	64		Performance level 3 on request	09 02 264 6824 09 02 464 6824 ^{b)} 09 02 764 6824 ^{c)}	09 02 264 2824
SMC	64			09 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
SMC	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 without flange 5.3 mm	64			09 02 264 6870	
Female connector with press-in pins 13.2 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 5.2 mm	64			09 02 264 6823	

¹⁾ To be used only for wire wrap termination^{a)} Wrap posts 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

Number of contacts

64



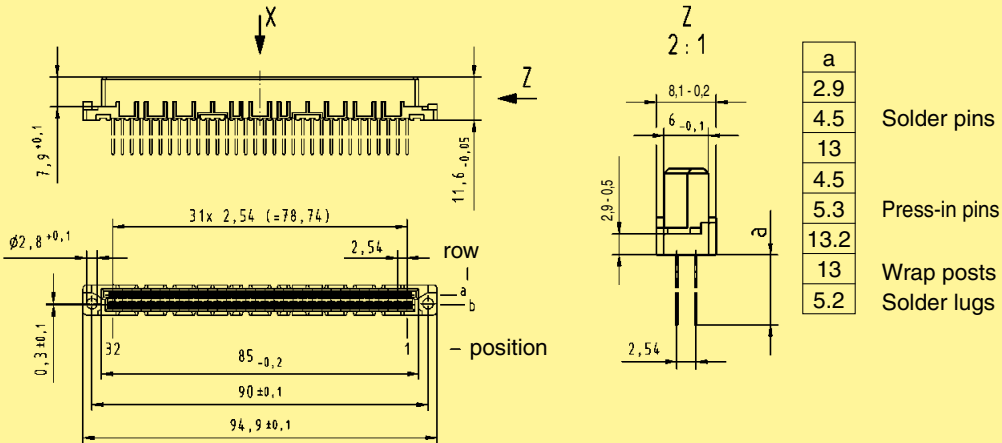
Female connectors

Identification

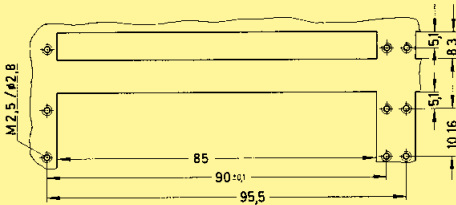
Drawing

Dimensions in mm

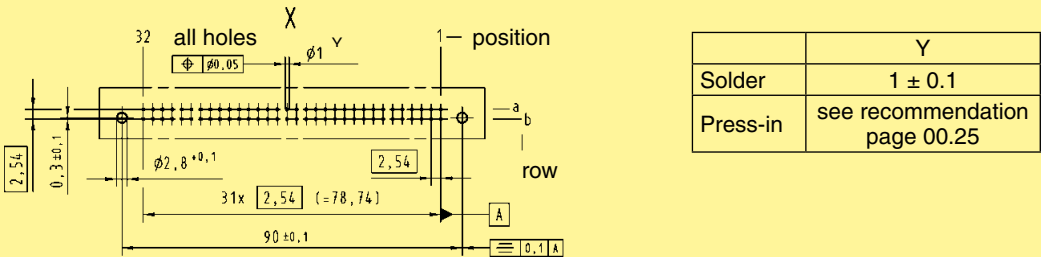
Dimensions



Panel cut out

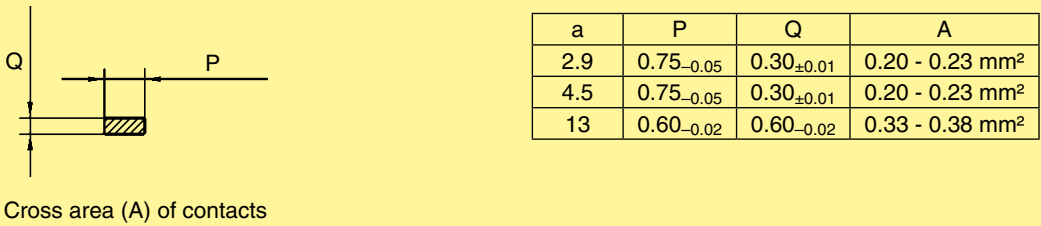


Board drillings
Mounting side



Identification strips for female connectors with wrap posts 09 02 000 9939

Cross section of
solder terminations



DIN Signal
up to 2 A

Number of contacts

64



Female connectors

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Female connector for insulation displacement	64	Performance level 2 ¹⁾ 09 02 264 6828 Performance level 3 ¹⁾ 09 02 264 7828	Cable 1 to contact 1 b Contact arrangement View from termination side	
Strain relief (metal)		09 03 000 9940		
Panel cut out				
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	09 18 064 7001 09 18 064 7004 09 18 064 7005 09 18 064 7006	2) Termination area spacing = 508 mm Important: always store reels vertically Wire (tinned) Cu Gauge AWG 28/7 0.089 mm² Insulation material as per UL style PVC	
Round flat cable ³⁾ with screening 30.48 m screening 100.00 m without screening 30.48 m screening 100.00 m	64	09 18 064 7007 09 18 064 7010 09 18 064 7008 09 18 064 7011	3) Termination area spacing = 100 mm Edge mark on first conductor AWG 28/7 grey	
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 40

¹⁾ acc. to IEC 60 603-2

Number of contacts

max. 64

Female connectors

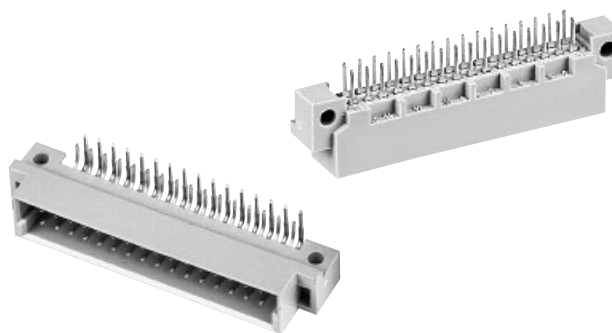
DIN Signal
up to 2 A

Identification	Number of contacts	Part No.	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 No.	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 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 pieces²⁾ Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

32, 16



**DIN Signal
up to 2 A**

01
16

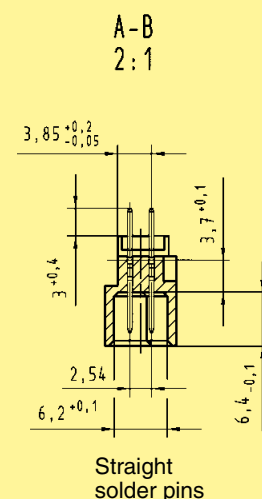
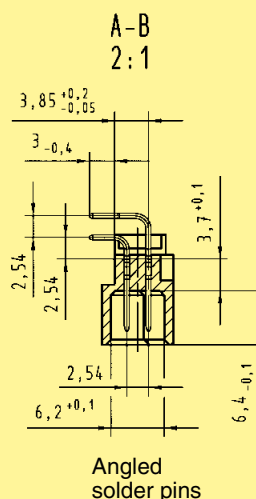
The image contains two technical drawings of electrical components, likely relays or switches, with dimensions in millimeters.

Top Drawing (Row Component):

- Overall Width:** $46,9 \pm 0,2$
- Internal Width:** $15 \times 2,54 (= 38,1)$
- Pin Spacing:** $2,54$
- Pin Count:** 16 pins
- Pin Length:** $44,6 \pm 0,1$
- Mounting Hole Diameter:** $\varnothing 2,5 \pm 0,1$
- Mounting Hole Spacing:** $48,26 \pm 0,05$
- Pin Length (Bottom View):** $54 \pm 0,1$
- Labels:** "row" and "position" are indicated on the right side.

Bottom Drawing (Position Component):

- Overall Width:** $46,9 \pm 0,2$
- Internal Width:** $15 \times 2,54 (= 38,1)$
- Pin Spacing:** $2,54$
- Pin Count:** 16 pins
- Pin Length:** $44,6 \pm 0,1$
- Mounting Hole Diameter:** $\varnothing 2,5 \pm 0,1$
- Mounting Hole Spacing:** $48,26 \pm 0,05$
- Pin Length (Bottom View):** $54 \pm 0,1$
- Labels:** "row" and "position" are indicated on the right side.



Technical drawing of a mechanical part with dimensions and tolerances. The drawing includes a top view and a side view. Key dimensions and tolerances are as follows:

- Top View:**
 - Overall width: $48,26 \pm 0,05$
 - Overall height: 16
 - Distance from left edge to first hole center: $5,3 \pm 0,1$
 - Distance between hole centers: $2,54 \pm 0,1$
 - Hole diameter: $\phi 1 \pm 0,1$
 - Position of hole: $\phi 2,8 \pm 0,1$
 - Distance from right edge to hole center: $2,54$
 - Number of holes: $15 \times 2,54 (=38,1)$
 - Dimension A: $0,1$
- Side View:**
 - Overall height: $2,54$
 - Distance from top edge to hole center: $5,3 \pm 0,1$
 - Distance between hole centers: $2,54 \pm 0,1$
 - Hole diameter: $\phi 1 \pm 0,1$
 - Position of hole: $\phi 2,8 \pm 0,1$
 - Distance from right edge to hole center: $2,54$
 - Number of holes: $15 \times 2,54 (=38,1)$
 - Dimension A: $0,1$

Technical drawing of a part with dimensions $0,6 -0,025$ and $0,5 +0,05$. The drawing shows a cross-section of a part with a hatched area indicating a specific material or feature.

Dimensions in mm

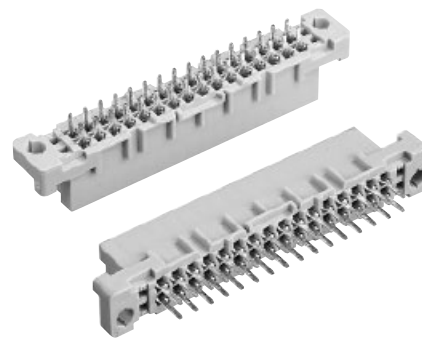
f) Railway classification NFF 16-101, Smoke index: F1,
Flammability class: I2
Other contact arrangements on request

d) $CTI > 400$

Number of contacts

32

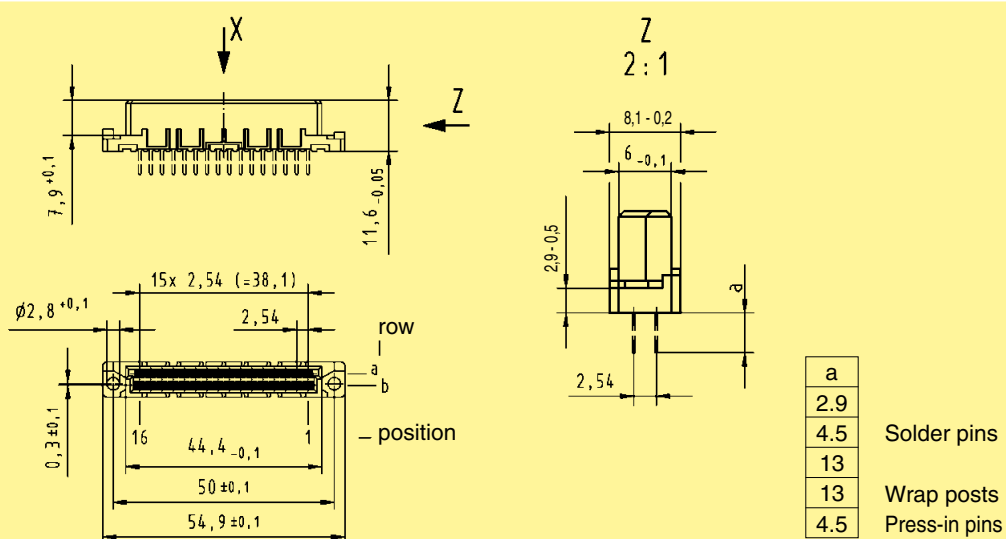
Female connectors



Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00	
				3	2 1
Female connector with solder pins	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
2.9 mm	32				
SMC	32				
4.5 mm	32			09 22 232 6825 09 22 232 6825 222 ^{f)} 09 22 432 6825 ^{b)} 09 22 232 6829 ^{d)}	
SMC	32				
13 mm	32			09 22 232 6421	
Female connector with wrap posts ¹⁾	32			09 22 232 6821	
13 mm					
Female connector with press-in pins	32			09 22 232 6850	
4.5 mm					

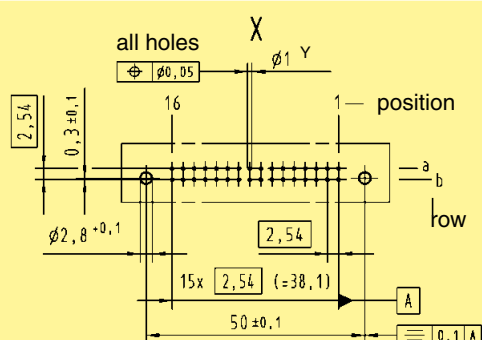
DIN Signal
up to 2 A

Dimensions



Board drillings

Mounting side



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

Cross section of solder terminations

see page 01.13

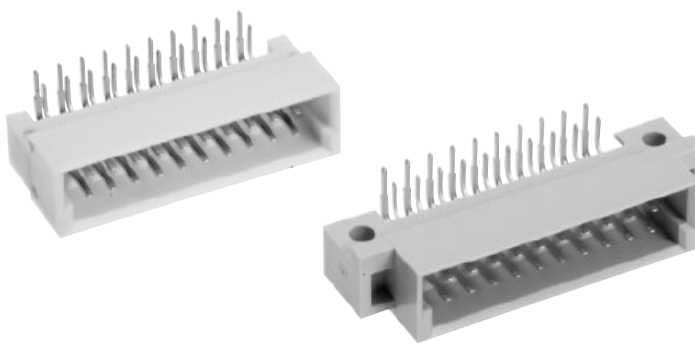
Dimensions in mm

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

Other contact arrangements on request

Number of contacts

20

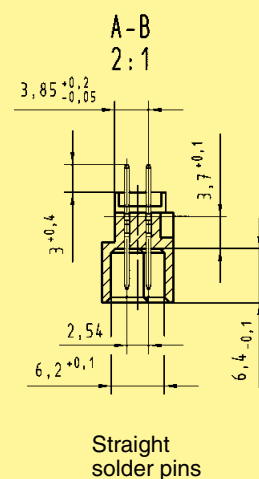
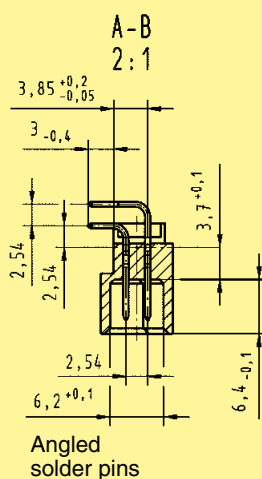
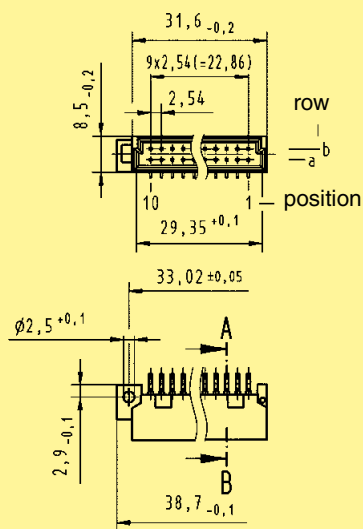


Male connectors

Identification	Number of contacts	Contact arrangement	Part No. 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, SMC	20			09 24 120 6919 ^{d)}	
without fixing flange	20			09 24 120 6571	
without fixing flange, SMC	20			09 24 120 6579 ^{d)}	
Male connector with straight solder pins with fixing flange	20			09 24 120 6922	

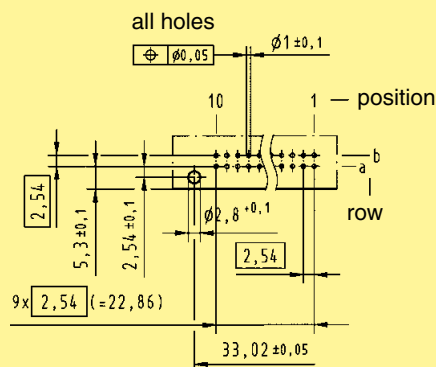
Dimensions

with fixing flange without fixing flange

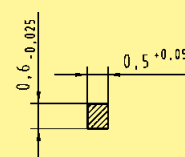


Board drillings

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 on request

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

DIN 41 612 · complementary type 3B

Number of contacts

20

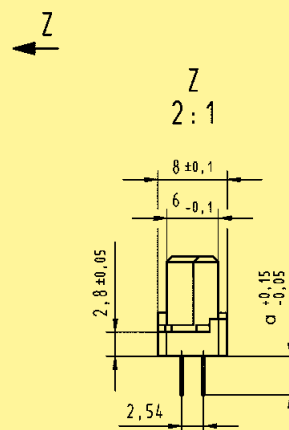
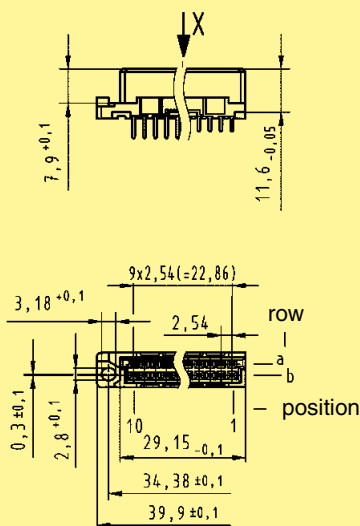


Female connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60 603-2.		
			3	2	1	
Female connector with solder pins 2.9 mm			Performance level 3 on request		Performance level 1 on request	
with fixing flange	20			09 24 220 6824		
with fixing flange, SMC	20			09 24 220 6841 ^{d)}		
without fixing flange, SMC	20			09 24 220 6414 ^{d)}		
Female connector with solder pins 4.5 mm						
with fixing flange	20			09 24 220 6825		
Female connector with press-in pins 4.5 mm						
with fixing flange	20			09 24 220 6850		
without fixing flange	20			09 24 220 6870		

Dimensions

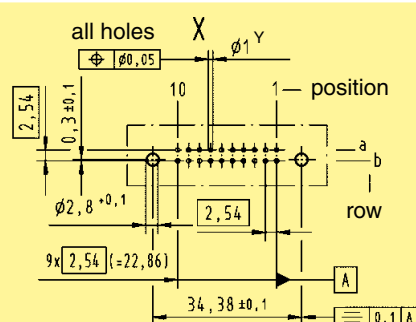
with fixing flange without fixing flange



a	
2.9	solder pins
4.5	press-in pins

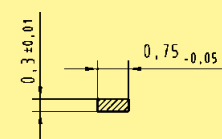
Board drillings

Mounting side



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

Cross section of solder terminations



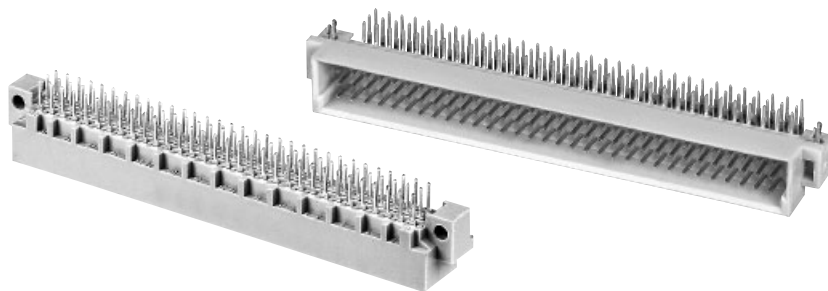
Cross area (A) of contacts row a, b, c: A = 0.20 - 0.23 mm²

Dimensions in mm

^{d)} CTI > 400

Number of contacts

96, 64, 32



Male connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1	
Male connector with angled solder pins	SMC	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)}	
		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)}	
		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)}	
	SMC	64		09 03 164 6919 ^{d)} 09 03 364 6919 ^{b)d)}	09 03 164 2919 ^{d)}	
		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)}	
		94 + 2▲	09 03 196 7951	09 03 196 6951 09 03 396 6951 ^{b)} 09 03 696 6951 ^{c)}	09 03 196 2951	
	SMC	94 + 2▲		09 03 396 6918 ^{b)d)}		
		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	
	SMC	62 + 2▲		09 03 164 6918 ^{d)}		
	Male connector with straight solder pins	SMC	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.

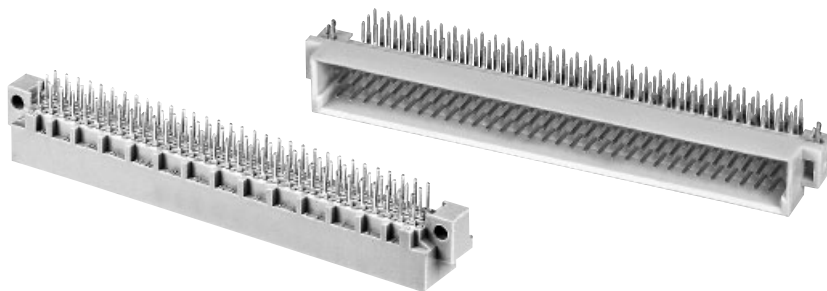
^{b)} Connectors with snap-in clips see chapter 00

^{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]

Technical drawing of a rectangular plate with dimensions and tolerances. The drawing includes a top view and a side view. The top view shows a plate with a width of 32 and a length of 88,9 ± 0,1. The side view shows a plate with a thickness of 2,54 ± 0,1. The drawing also includes a detail of a hole with a diameter of 2,8 + 0,1¹⁾ and a position of a hole with a diameter of 1 ± 0,1. The drawing is labeled with 'all holes' and 'position'.

all holes

$\varnothing 1 \pm 0,1$

position

32

1

row

$\varnothing 2,8 + 0,1^{1)}$

2,54

31 x 2,54 (= 78,74)

88,9 ± 0,1

2,54 ± 0,1

5,3 ± 0,1

2,54

(= 5,08)

2,54

2 x

0,1 A

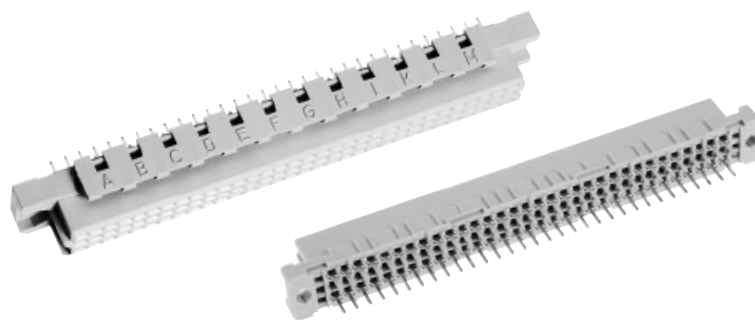
Technical drawing of a shaft-hub assembly. The shaft has a diameter of $0,6 -0,025$. The hub has a diameter of $0,49 \pm 0,06$. The shaft is shown with a hatched section.

Dimensions in mm

**DIN Signal
up to 2 A**

Number of contacts

96, 64, 32



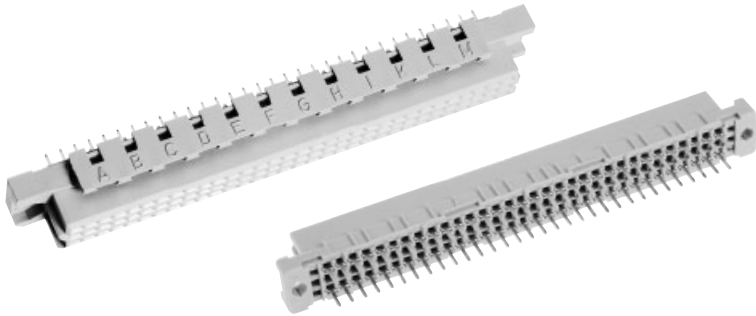
Female connectors

Identification	Number of contacts	Contact arrangement	Part No.	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)}		
				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)}		
				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 03 496 2825 222 ^{b)f)} 09 03 796 2825 ^{c)}		
				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)}		
				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



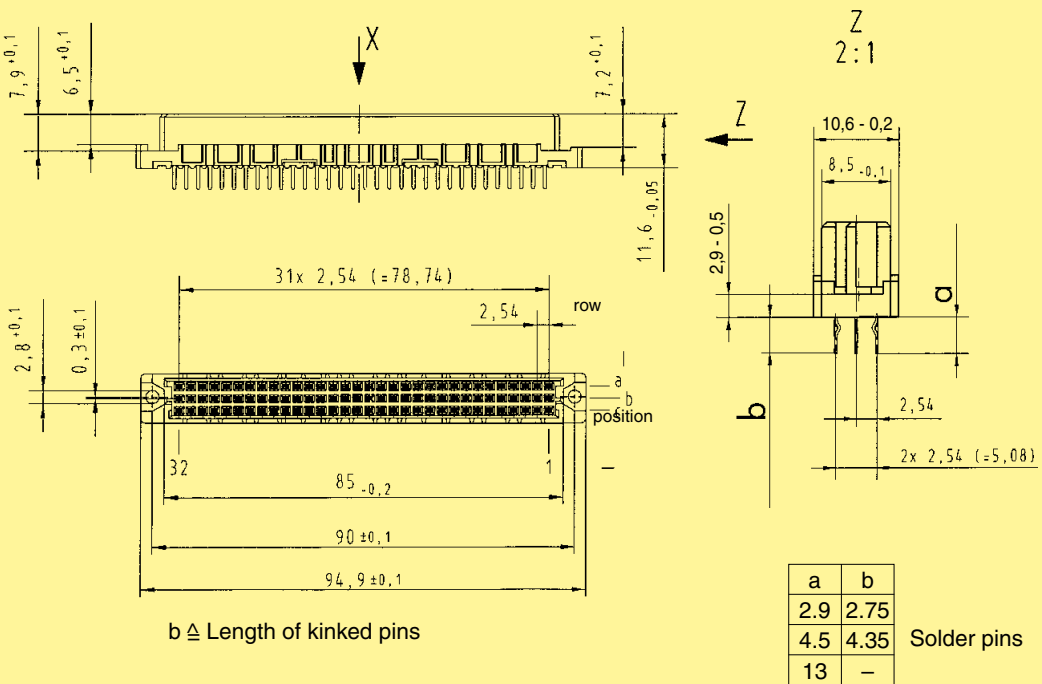
Female connectors

Identification

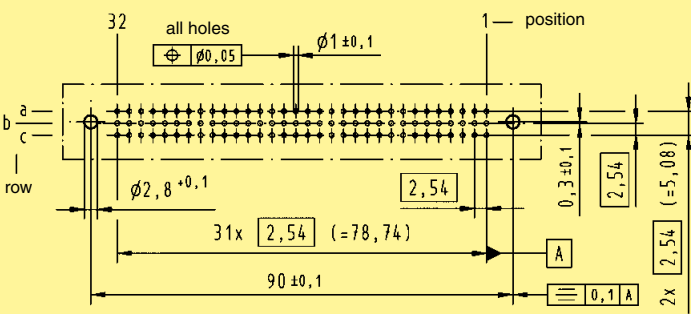
Drawing

Dimensions in mm

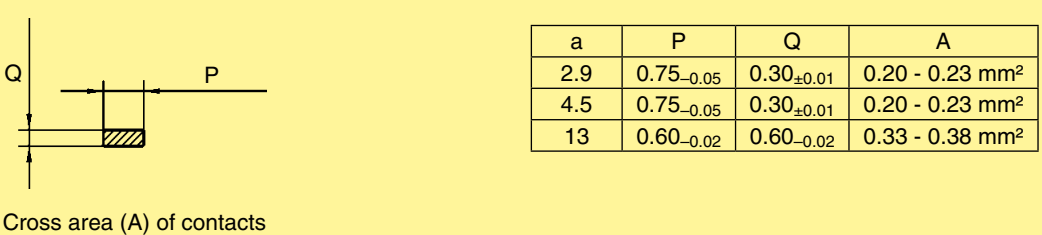
Dimensions



Board drillings
Mounting side



Cross section of
solder terminations

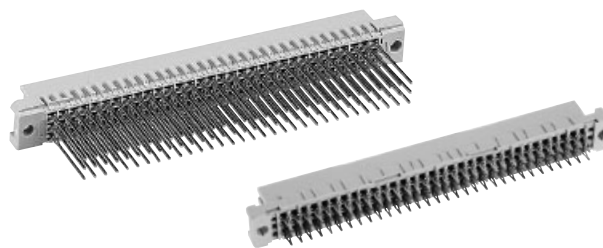


Dimensions in mm

DIN Signal
up to 2 A

Number of contacts

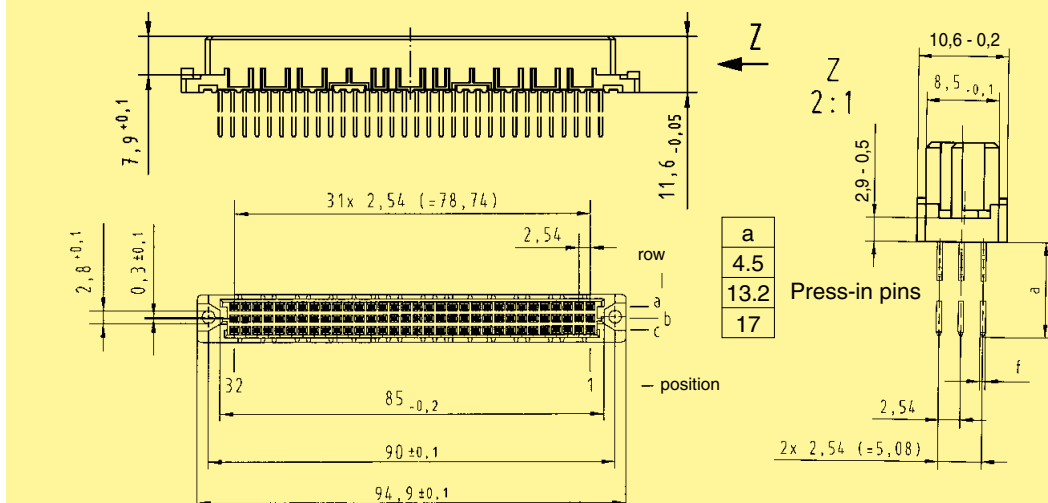
96, 64, 32



Female connectors

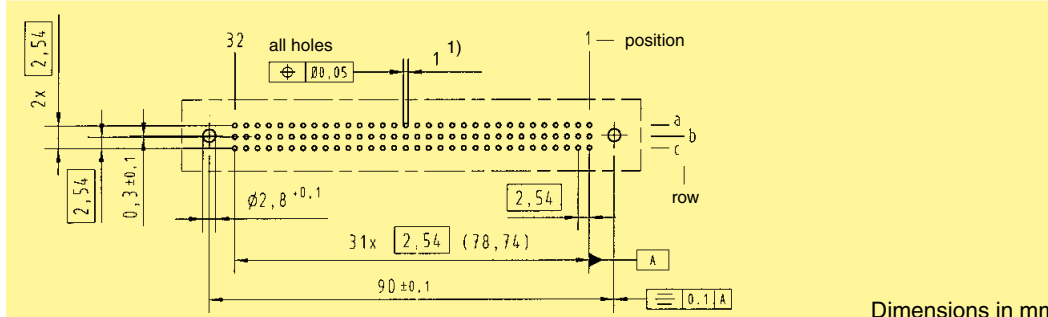
Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60 603-2.	Explanation chapter 00
			3	2	1
Female connector Type C with press-in terminations	96		09 03 296 7850	09 03 296 6850	09 03 296 2850
				09 03 296 6850 222 ^{f)}	09 03 296 2850 222 ^{f)}
				09 03 796 6850 ^{c)}	
	64		09 03 264 7850	09 03 264 6850	09 03 264 2850
				09 03 264 6850 222 ^{f)}	
	32			09 03 764 6850 ^{c)}	
	96			09 03 296 6851 ^{w)}	09 03 296 2861*
				09 03 296 6861*	
	64			09 03 796 6861* ^{c)}	
				09 03 264 6851 ^{w)}	
	96			09 03 264 6861*	
	64			09 03 296 6852 ^{w)}	09 03 296 2852
				09 03 296 6862*	
				09 03 796 6862* ^{c)}	
				09 03 264 6852	
				09 03 264 6862*	

Dimensions



Board drillings

Mounting side



Dimensions in mm

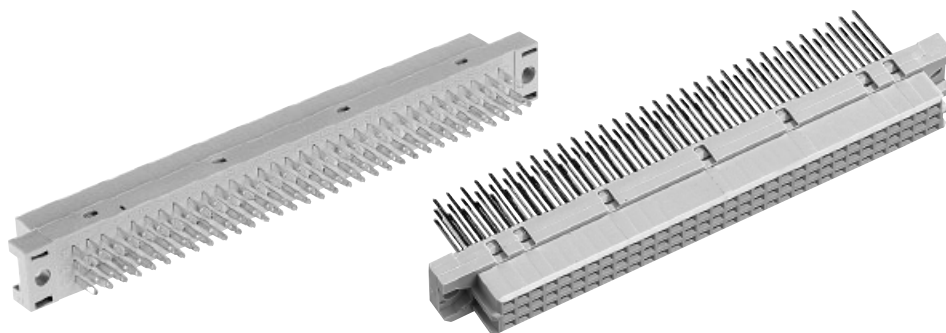
* Wrap posts for interfacing selectively gold plated (performance level 3)

¹⁾ refer to recommended configuration of pcb holes, see page 00.25^{c)} Connectors with coding see 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

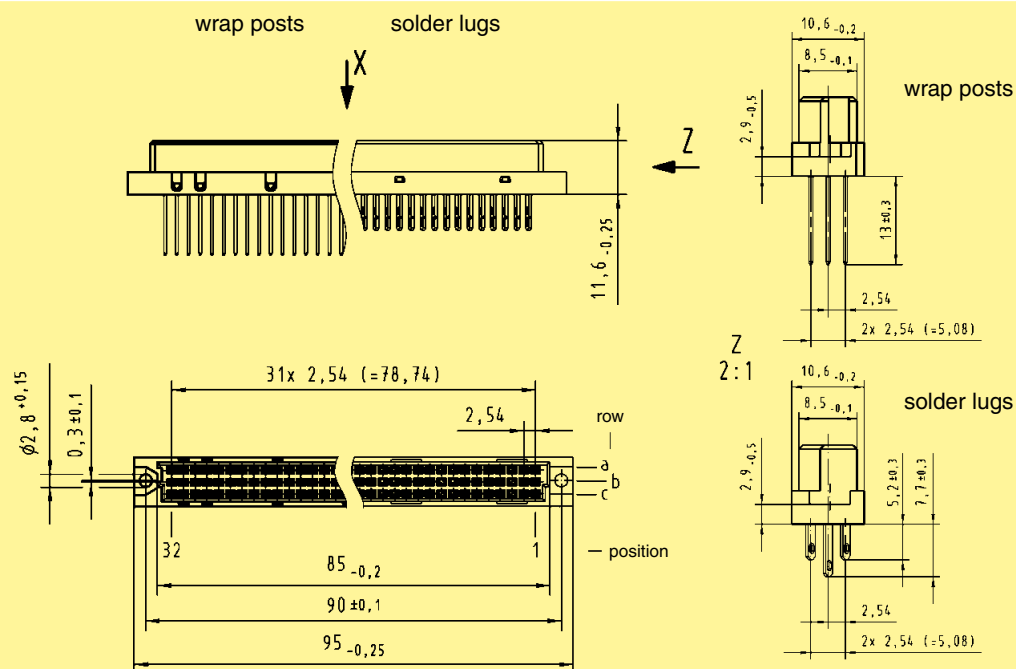
96, 64

Female connectors

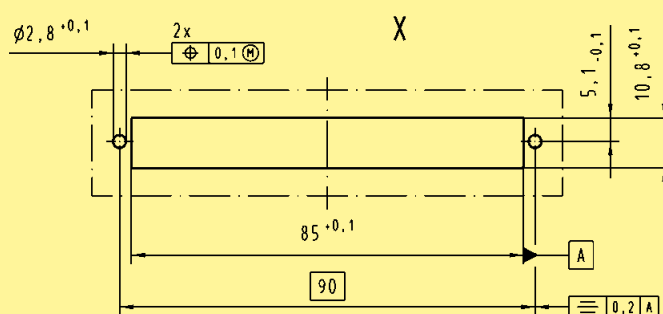


Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00
Female connector with wrap posts ²⁾ 13 mm	96			2
	64			
Female connector with solder lugs a + c 5.2 mm b 7.7 mm	96			
	64			

Dimensions



Panel cut out



Identification strips for female connectors with wrap posts
09 03 000 9939

Dimensions in mm

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
^{c)} Connectors with coding see chapter 00

64



Female connectors

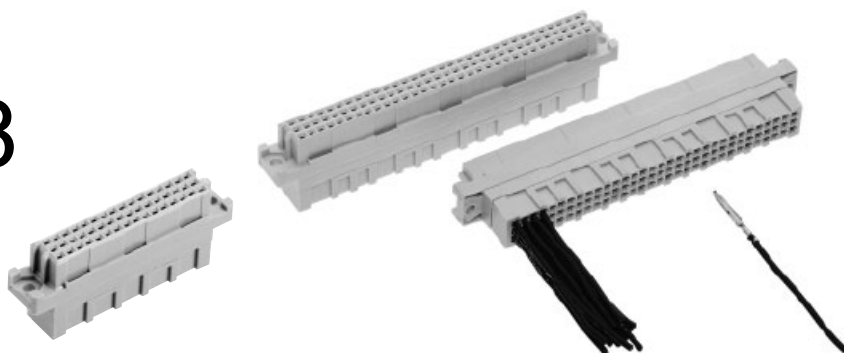
Dimensions in mm

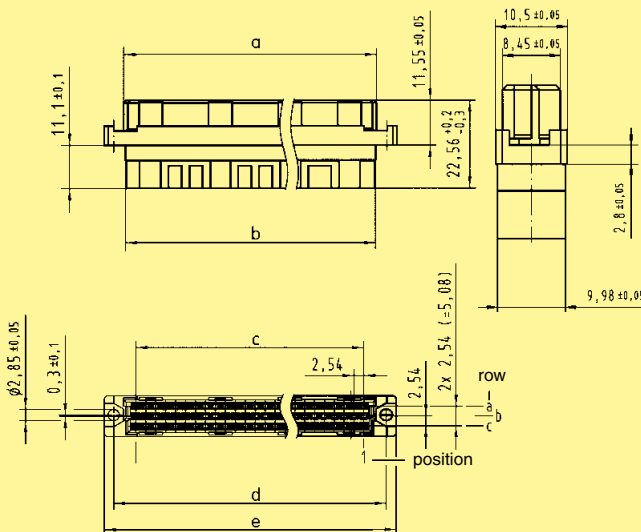
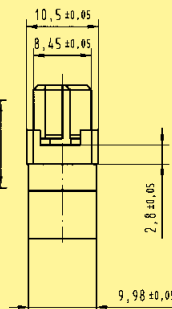


Number of contacts

max. 96, 48

Female connectors



Identification	Number of contacts	Part No.	Drawing	Dimensions in mm																		
Female connector for crimp contacts Order contacts separately																						
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)}																				
Type 2C	48	09 23 048 3214 ^{f)}																				
Type 2C Position marking turned for mating type 2R male	48	09 23 048 3217 ^{f)}																				
			<table><tr><th></th><th>a</th><th>b</th><th>c</th><th>d</th><th>e</th></tr><tr><td>C</td><td>84.93 ± 0.07</td><td>83.95 ± 0.05</td><td>31 x 2.54 (= 78.74)</td><td>90.00 ± 0.1</td><td>94.80 ± 0.1</td></tr><tr><td>2C</td><td>44.35 ± 0.05</td><td>43.85 ± 0.05</td><td>15 x 2.54 (= 38.1)</td><td>49.68 ± 0.1</td><td>54.80 ± 0.1</td></tr></table>		a	b	c	d	e	C	84.93 ± 0.07	83.95 ± 0.05	31 x 2.54 (= 78.74)	90.00 ± 0.1	94.80 ± 0.1	2C	44.35 ± 0.05	43.85 ± 0.05	15 x 2.54 (= 38.1)	49.68 ± 0.1	54.80 ± 0.1	
	a	b	c	d	e																	
C	84.93 ± 0.07	83.95 ± 0.05	31 x 2.54 (= 78.74)	90.00 ± 0.1	94.80 ± 0.1																	
2C	44.35 ± 0.05	43.85 ± 0.05	15 x 2.54 (= 38.1)	49.68 ± 0.1	54.80 ± 0.1																	
Shell housing see chapter 20																						

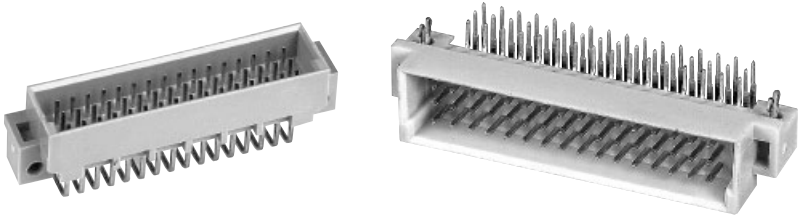
DIN Signal
up to 2 A

Identification	Part No.	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 0.09 - 0.5 AWG 28 - 20 Insulation ø mm 0.7 - 1.5	 Bandoliered contacts Individual 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	

^{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	Number of contacts	Contact arrangement	Part No.	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 2921 ^{b)}	
	48		09 23 148 7919	09 23 148 6919 ^{d)}	09 23 348 6919 ^{b)d)}	
	32		09 23 132 7921	09 23 132 6921	09 23 132 2921	
			09 23 332 7921 ^{b)}	09 23 332 6921 ^{b)}	09 23 332 2921 ^{b)}	
Male connector with straight solder pins	32			09 23 132 6919 ^{d)}	09 23 332 6919 ^{b)d)}	
	16			09 23 116 6931	09 23 116 2931	
	16			09 23 316 6931 ^{b)}		
Male connector with angled solder pins	46 + 2▲		09 23 148 7951	09 23 148 6951	09 23 348 6951 ^{b)}	
	48		09 23 148 7922	09 23 148 6922	09 23 148 2922	
	48			09 23 148 6920 ^{d)}		
	32		09 23 132 7922	09 23 132 6922	09 23 132 2922	
Male connector with straight solder pins	32			09 23 132 6920 ^{d)}		

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

Other contact arrangements on request

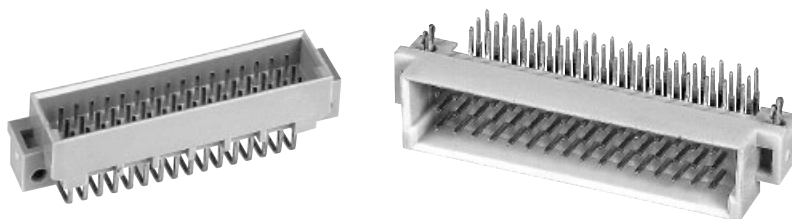
^{b)} Connectors with snap-in clips see chapter 00

^{d)} CTI > 400

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

Number of contacts

48, 32, 16



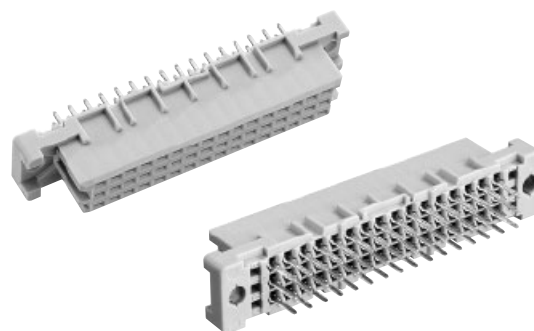
Male connectors

[illegible]

**DIN Signal
up to 2 A**

Number of contacts

48, 32



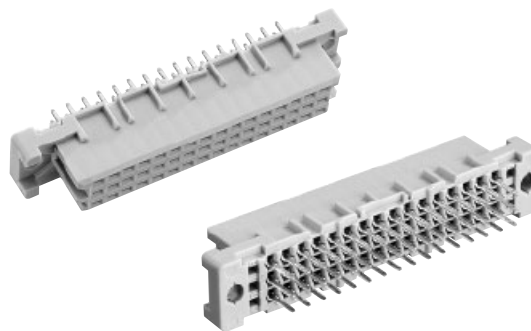
Female connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00		
				3	2	1
Female connector with solder pins 2.9 mm	48				09 23 248 6824 09 23 248 6824 222 ^{f)} 09 23 448 6824 ^{b)}	09 23 248 2824
	48				09 23 248 6841 ^{d)}	
Female connector with solder pins 4.5 mm	32				09 23 232 6824 09 23 432 6824 ^{b)}	
	32				09 23 232 6841 ^{d)}	
Female connector with solder pins 13 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)}	
Female connector with press-in pins 3.7 mm	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 press-in pins 4.5 mm	48				09 23 248 6850 09 23 248 6850 222 ^{f)}	09 23 248 2850
	32				09 23 232 6850	
Female connector with wrap posts ¹⁾ 13 mm	48				09 23 248 6821	
Female connector with solder lugs 5.2 mm	32				09 23 232 6823	
Female connector with crimp contacts	48		Part numbers and variants see page 01.27			

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

48, 32

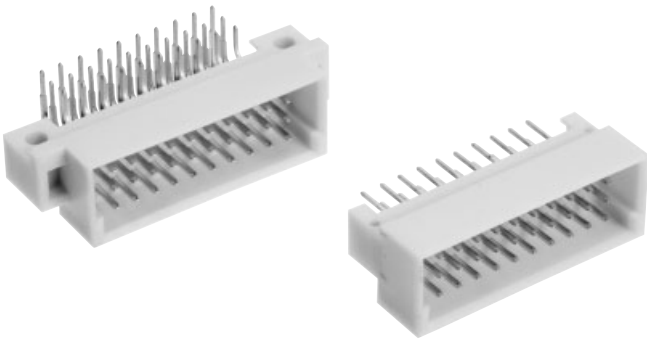


**DIN Signal
up to 2 A**

01
31



Number of contacts
30, 20

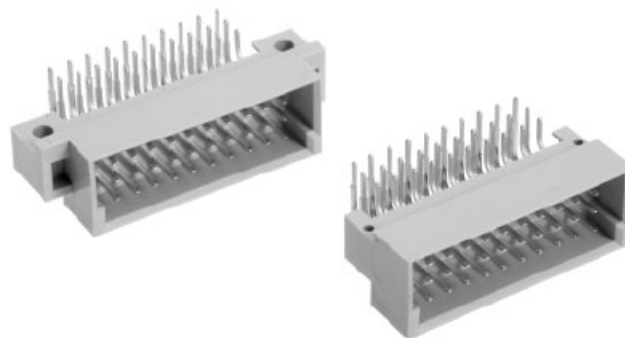


Male connectors

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

Other contact arrangements on request
^{b)} Connectors with snap-in clips see chapter 00
^{d)} CTI > 400

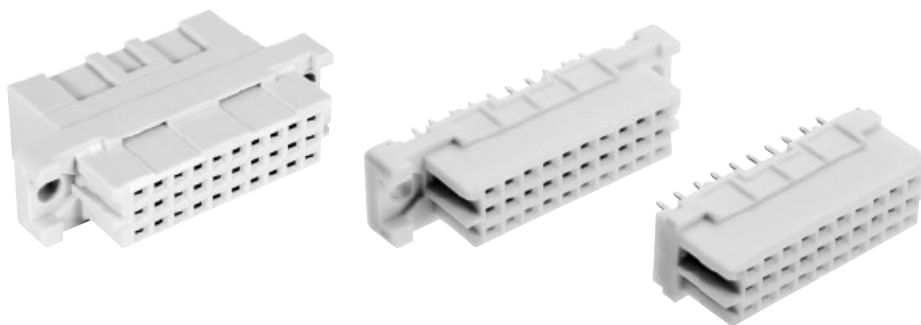
30, 20



Male connectors

**DIN Signal
up to 2 A**

30, 20



**DIN Signal
up to 2 A**

01
34

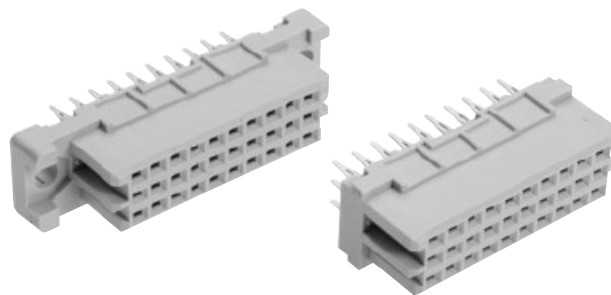
d) $CTI > 400$

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

Number of contacts

30, 20

Female connectors



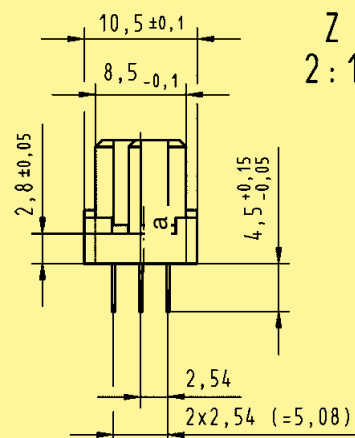
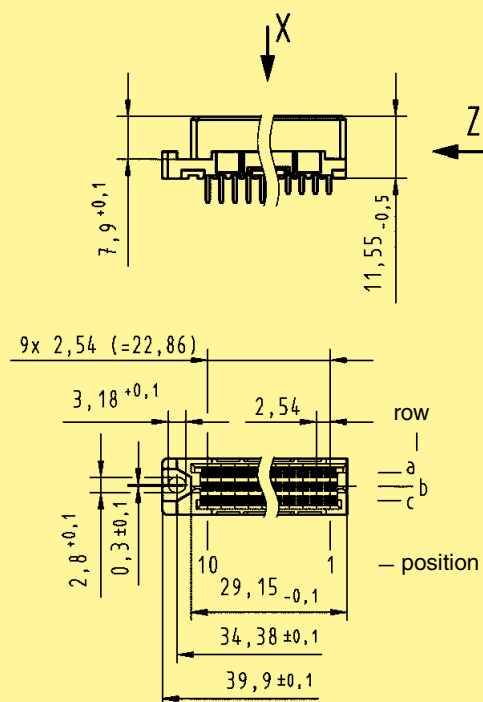
Identification

Drawing

Dimensions in mm

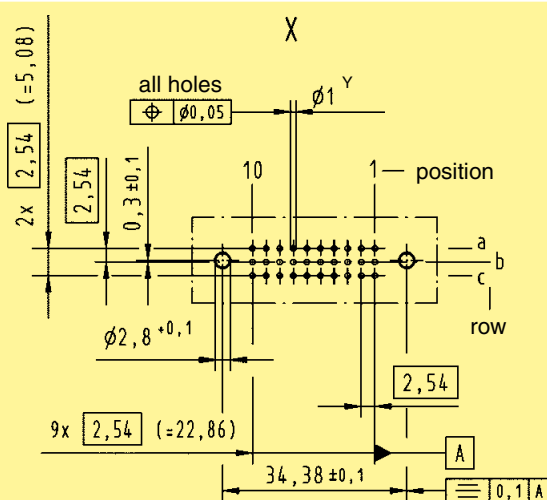
Dimensions

with fixing flange without fixing flange



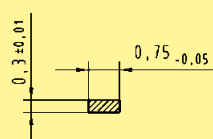
a	
2.9	solder pins
4.5	press-in pins

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

DIN Signal
up to 2 A

Application matrix

- Coax Contacts
- High Voltage Contacts
- FOC- Contacts

Board to Backplane

Mezzanine

1.

2.

3.

4.

5.

M male
& M femaleM male
& M flat
femaleMH 21+ 5
male
& MH 21+ 5
femaleM invers
male
& M femaleM invers
male
& M flat
female

Connector

Part number

Male connector type M angled

09 03 1XX X901

Female connector type M straight

09 03 2XX 6804

Female connector type M straight

09 03 2XX 6805

Female connector type M straight

09 03 2XX 6850

Female connector type M flat

09 03 2XX 6864

Female connector type M flat

09 03 2XX 6865

Female connector type M flat

09 03 2XX 6830

Male connector type MH 21+5

09 06 X21 6883

Female connector type MH 21+5

09 06 121 6981

Male connector type M invers

09 73 1XX 6902

Male connector type M invers

09 73 1XX 6903

Male connector type M invers

09 73 1XX 6904

Male connector type M invers

09 73 1XX 6907

Male connector type M invers

09 73 1XX 6974

Male connector type M invers

09 73 1XX 6991

Impedance

Termination

Part number

50 Ω

cable

solder/crimp

09 03 000 6160

50 Ω

cable

solder/crimp

09 03 000 6161

50 Ω

pcb

solder

09 03 000 6165

75 Ω

cable

solder/crimp

09 03 000 6181

50 Ω

pcb

solder

09 03 000 6182

50 Ω

cable

solder/crimp

09 03 000 6260

50 Ω

cable

solder/crimp

09 03 000 6261

50 Ω

pcb

solder

09 03 000 6262

50 Ω

pcb

solder

09 03 000 6263

50 Ω

pcb

solder

09 03 000 6265

75 Ω

pcb

solder

09 03 000 6269

50 Ω

cable

solder/crimp

09 03 000 6274

75 Ω

cable

solder/crimp

09 03 000 6281

High voltage 1.5 KV

09 03 000 6140

09 03 000 6240

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

* details see catalogue Industrial Connectors Han®

◆ = can be used in ◇ female connector

◇ = female connector for ◆ contacts

Application matrix • High Power Contacts					Board to Backplane			Mezzanine	
					1.	2.	3.	4.	5.
					M male & M female	M male & M flat female	MH 21+ 5 male & MH 21+ 5 female	M invers male & M female	M invers male & M flat female
Connector	Part number								
Male connector type M angled	09 03 1XX X901				○	○			
Female connector type M straight	09 03 2XX 6804				◇			◇	
Female connector type M straight	09 03 2XX 6805				◇			◇	
Female connector type M straight	09 03 2XX 6850				◇			◇	
Female connector type M flat	09 03 2XX 6864					◇			◇
Female connector type M flat	09 03 2XX 6865					◇			◇
Female connector type M flat	09 03 2XX 6830					◇			◇
Male connector type MH 21+5	09 06 X21 6883						○		
Female connector type MH 21+5	09 06 121 6981						◇		
Male connector type M invers	09 73 1XX 6902							○	○
Male connector type M invers	09 73 1XX 6903							○	○
Male connector type M invers	09 73 1XX 6904							○	○
Male connector type M invers	09 73 1XX 6907							○	○
Male connector type M invers	09 73 1XX 6974							○	○
Male connector type M invers	09 73 1XX 6991							○	○
Currency	Termination	Preleading	Part number						
10 A	cable	solder	–	09 03 000 6101	●	●	●	●	●
20 A	cable	solder	–	09 03 000 6102	●	●	●	●	●
40 A	cable	solder	–	09 03 000 6103	●	●	●	●	●
40 A	pcb	solder	–	09 03 000 6104	●	●	●		
40 A	pcb	solder	–	09 03 000 6110	●	●	●		
10 A	cable	crimp	–	09 03 000 6113	●	●	●	●	●
20 A	cable	crimp	–	09 03 000 6114	●	●	●	●	●
40 A	cable	crimp	–	09 03 000 6115	●	●	●	●	●
40 A	pcb	solder	–	09 03 000 6127*	●	●	●		
40 A	pcb	solder	1.8	09 03 000 6128*	●	●	●		
40 A	cable	solder	0.8	09 03 000 6133	●	●	●	●	●
40 A	pcb	solder	0.6	09 03 000 6134	●	●	●		
40 A	pcb	solder	–	09 03 000 6135				●	●
10 A	cable	solder	–	09 03 000 6201	◆		◆	◆	
20 A	cable	solder	–	09 03 000 6202	◆		◆	◆	
40 A	cable	solder	–	09 03 000 6203	◆		◆	◆	
10 A	cable	crimp	–	09 03 000 6213	◆		◆	◆	
20 A	cable	crimp	–	09 03 000 6214	◆		◆	◆	
40 A	cable	crimp	–	09 03 000 6215	◆		◆	◆	
20 A	cable	crimp	–	09 03 000 6220*	◆		◆	◆	
40 A	pcb	solder	–	09 03 000 6225		◆			◆
40 A	busbar	screw	–	09 03 000 6245		◆	◆	◆	
40 A	pcb	press-in	–	09 03 000 6250		◆			◆

DIN Signal
up to 2 A01
37

● = can be used in ○ male connector

○ = male connector for ● contacts

* see also chapter 04

◆ = can be used in ◇ female connector

◇ = female connector for ◆ contacts

11
6

crimp
solder

Insert insulator,
solder closing-washer

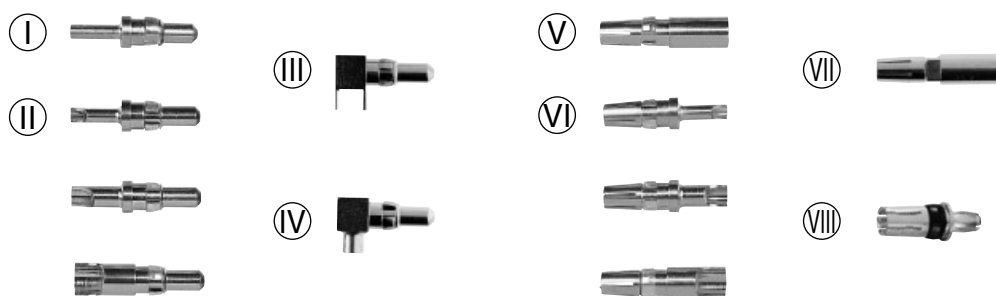


High voltage contacts

Identification		Part No.	Drawing	Dimensions in mm																																	
Performance level 1																																					
High voltage male contact for male connectors ²⁾		acc. to DIN 41 626																																			
I for straight solder termination	2.8 kV	09 03 000 6140																																			
High voltage female contact for female connectors ²⁾																																					
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		<table><tr><td>Impedance</td><td>50 Ω</td><td>75 Ω</td></tr><tr><td>Max. working frequency</td><td>0 up to 10 GHz</td><td>0 up to 1.5 GHz</td></tr><tr><td>Return loss</td><td>≥ 20 dB up to 6 GHz</td><td>≥ 20 dB</td></tr><tr><td>RF-leakage</td><td colspan="2">≥ 80 dB up to 0.5 GHz ≥ 68 dB up to 1.5 GHz</td></tr><tr><td>Test voltage</td><td colspan="2">750 V_{rms}</td></tr><tr><td>Working voltage</td><td colspan="2">250 V_{max.}</td></tr><tr><td>Insulation resistance</td><td>≥ 1 GΩ</td><td>≥ 200 MΩ</td></tr><tr><td>Contacts resistance – Center contact</td><td colspan="2">≤ 10 mΩ</td></tr><tr><td>– Outer contact</td><td colspan="2">≤ 3 mΩ</td></tr><tr><td>Contact current max.</td><td colspan="2">1.5 A</td></tr><tr><td>Admissible power (depends on: frequency, application, return loss, environmental characteristics)</td><td colspan="2">Data on request</td></tr></table>			Impedance	50 Ω	75 Ω	Max. working frequency	0 up to 10 GHz	0 up to 1.5 GHz	Return loss	≥ 20 dB up to 6 GHz	≥ 20 dB	RF-leakage	≥ 80 dB up to 0.5 GHz ≥ 68 dB up to 1.5 GHz		Test voltage	750 V _{rms}		Working voltage	250 V _{max.}		Insulation resistance	≥ 1 GΩ	≥ 200 MΩ	Contacts resistance – Center contact	≤ 10 mΩ		– Outer contact	≤ 3 mΩ		Contact current max.	1.5 A		Admissible power (depends on: frequency, application, return loss, environmental characteristics)	Data on request	
Impedance	50 Ω	75 Ω																																			
Max. working frequency	0 up to 10 GHz	0 up to 1.5 GHz																																			
Return loss	≥ 20 dB up to 6 GHz	≥ 20 dB																																			
RF-leakage	≥ 80 dB up to 0.5 GHz ≥ 68 dB up to 1.5 GHz																																				
Test voltage	750 V _{rms}																																				
Working voltage	250 V _{max.}																																				
Insulation resistance	≥ 1 GΩ	≥ 200 MΩ																																			
Contacts resistance – Center contact	≤ 10 mΩ																																				
– Outer contact	≤ 3 mΩ																																				
Contact current max.	1.5 A																																				
Admissible power (depends on: frequency, application, return loss, environmental characteristics)	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 max. 1.5 mΩ

²⁾ Contact resistance internal wire max. 3 mΩ



High current contacts

Identification		Part No.	Performance level 1	Drawing	Dimensions in mm
High current male contacts for male connectors ¹⁾					
I for straight crimp termination	10 A	09 03 000 6113			

¹⁾ Contact resistance max. 1.5 mΩ

²⁾ Contact resistance internal wire max. 3 mΩ

Number of contacts

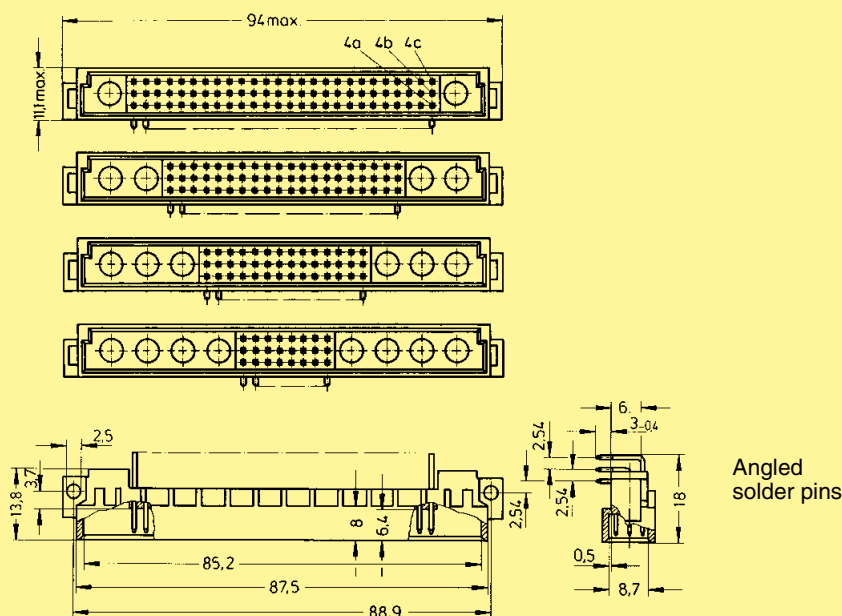
78+2, 60+4, 42+6, 24+8

Male connectors



Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00	
			3	2	1
Male connector with angled solder pins (without special contacts)*	78 + 2		09 03 178 7901	09 03 178 6901 09 03 178 6901 222 ^{f)} 09 03 378 6901 ^{b)}	09 03 178 2901 09 03 378 2901 ^{b)}
	60 + 4		09 03 160 7901	09 03 160 6901	09 03 160 2901
	42 + 6		09 03 142 7901	09 03 142 6901	09 03 142 2901
	24 + 8		09 03 124 7901	09 03 124 6901 09 03 124 6901 222 ^{f)}	09 03 124 2901

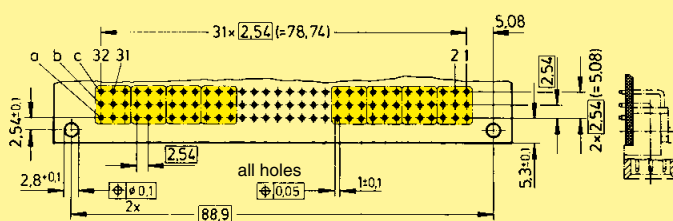
Dimensions



Order high current, high voltage, coaxial and fibre optic contacts separately, see pages 01.38 ff

Board drillings

Mounting side



Board drillings depend on type and special contact loading

Dimensions in mm

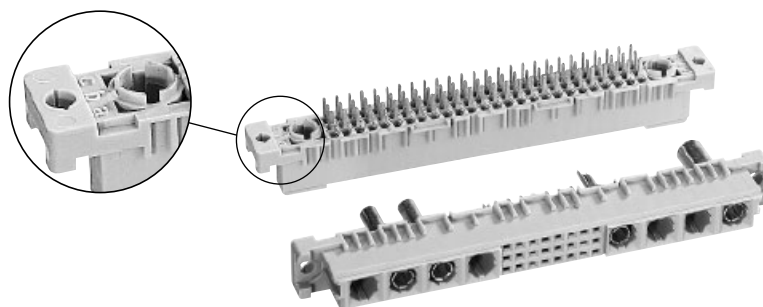
* Pre-loaded with special contacts on request

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

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

Number of contacts

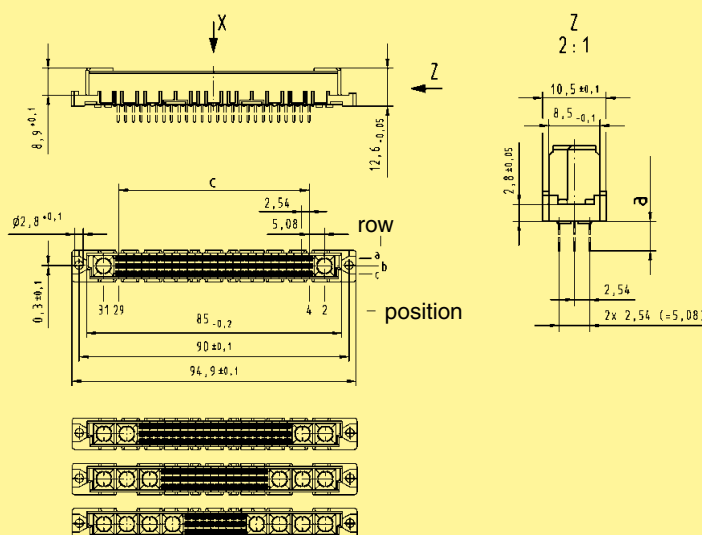
78+2, 60+4, 42+6, 24+8



Female connectors

Identification	Number of contacts	Contact arrangement	Part No.	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 60 + 4 42 + 6 24 + 8		Performance level 3 on request	09 03 278 6804 09 03 260 6804 09 03 242 6804 09 03 224 6804	
Female connector with solder pins 4.5 mm (without special contacts)	78 + 2 60 + 4 42 + 6 24 + 8			09 03 278 6805 09 03 278 6805 222 ^{f)} 09 03 260 6805 09 03 242 6805 09 03 224 6805 09 03 224 6805 222 ^{f)}	
Female connector with press-in pins 4.5 mm (without special contacts)	78 + 2 60 + 4 42 + 6 24 + 8			09 03 278 6850 09 03 260 6850 09 03 242 6850 09 03 224 6850	09 03 278 2850

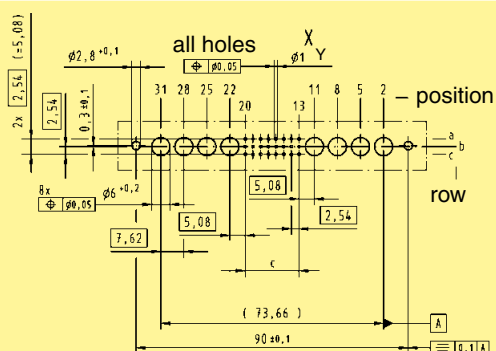
Dimensions



Order high current, high voltage, coaxial and fibre optic contacts separately, see pages 01.38 ff

Board drillings

Mounting side



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

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

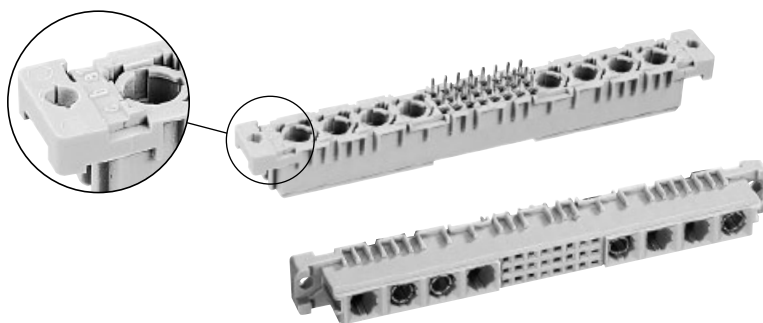
Dimensions in mm

Other contact arrangements on request

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

Number of contacts

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

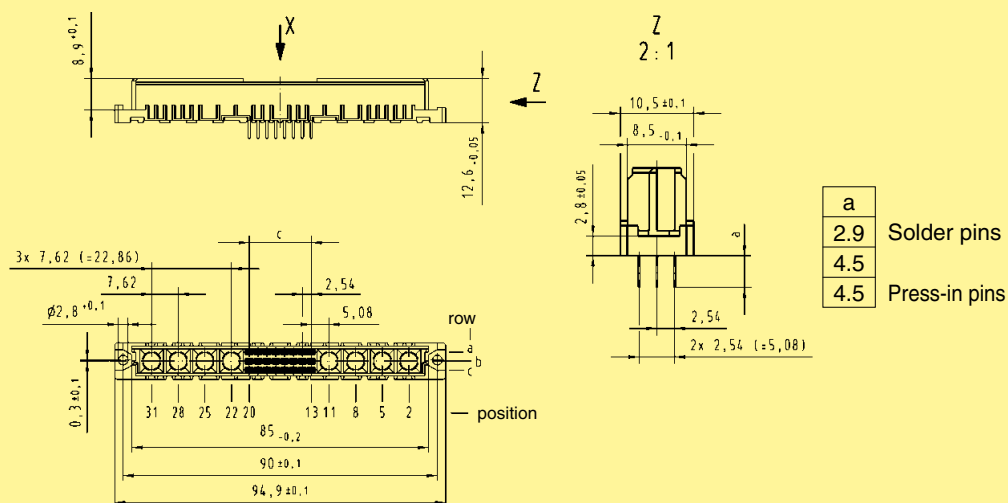


Female connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60 603-2.	Explanation chapter 00
			3	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 09 03 224 6864 222 ^{f)}	
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

Dimensions

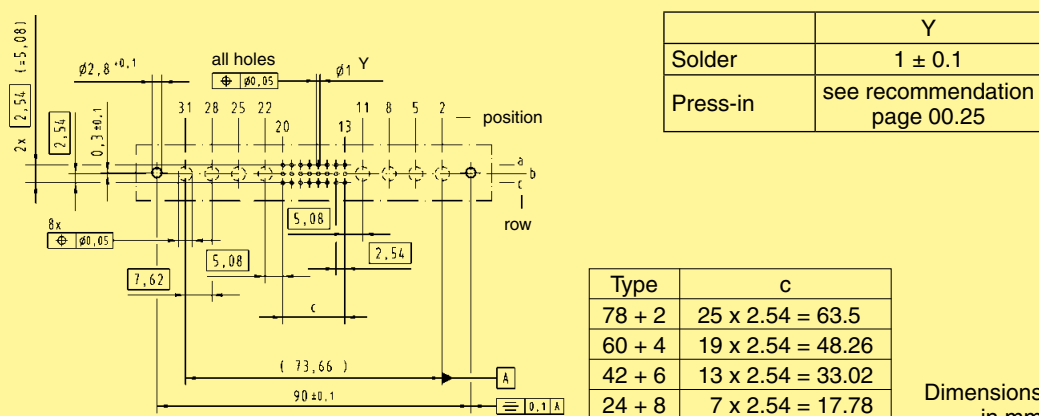
Order high current, high voltage, coaxial and fibre optic contacts separately, see pages 01.38 ff



Board drillings

Mounting side

Board drillings depend on type and special contact loading



Dimensions in mm

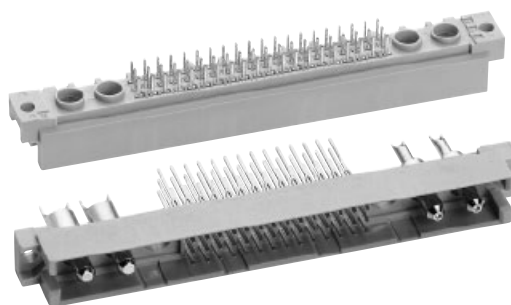
* Pre-loaded with special contacts on request

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

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

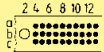
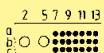
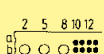
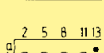
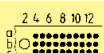
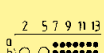
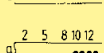
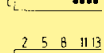
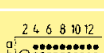
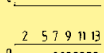
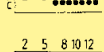
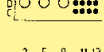
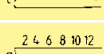
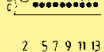
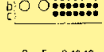
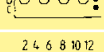
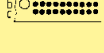
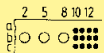
Number of contacts

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



Male connectors

DIN Signal
up to 2 A

Identification	Number of contacts	Contact arrangement	Part No.	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		
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		
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		
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		
Male connector with press-in pins 13 mm (5.0 mm on request)	78 + 2			09 73 178 6985 ^{w)} 09 73 178 6974●		
	60 + 4			09 73 160 6985 ^{w)} 09 73 160 6974●		
	42 + 6			09 73 142 6985 ^{w)} 09 73 142 6974●		
	24 + 8			09 73 124 6985 ^{w)}		

Male connectors with 17 mm wrap posts on request

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

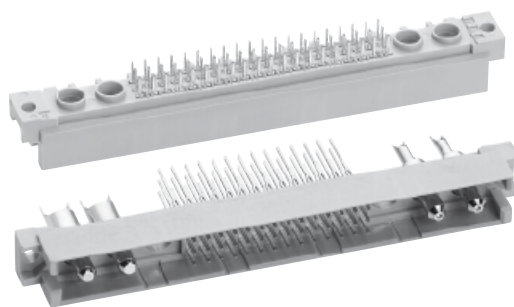
Other contact arrangements on request

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

Number of contacts

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

Male connectors

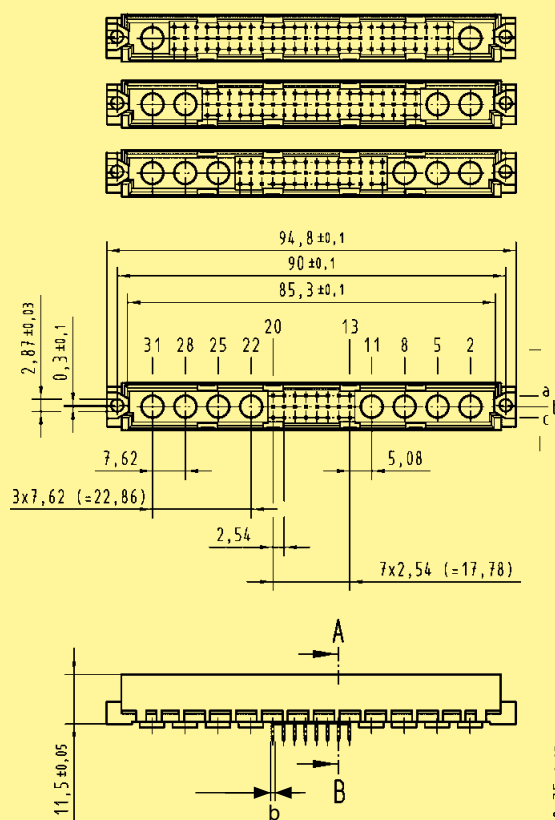


Identification

Drawing

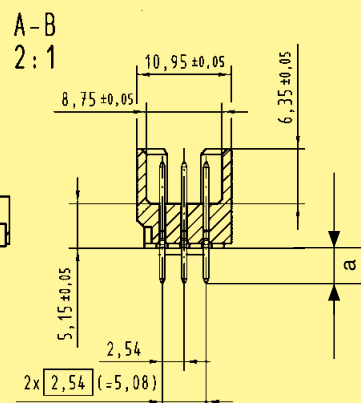
Dimensions in mm

Dimensions



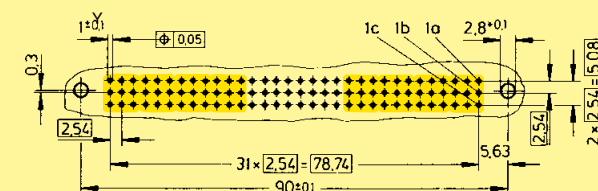
a	b	
2.5	ø 0.7	Solder pins
4.0		
6.0		
13	□ 0.6	Wrap posts
5.0	—	Press-in pins
13	—	

Order high current, high voltage, coaxial and fibre optic contacts separately, see pages 01.38 ff



Board drillings

Mounting side



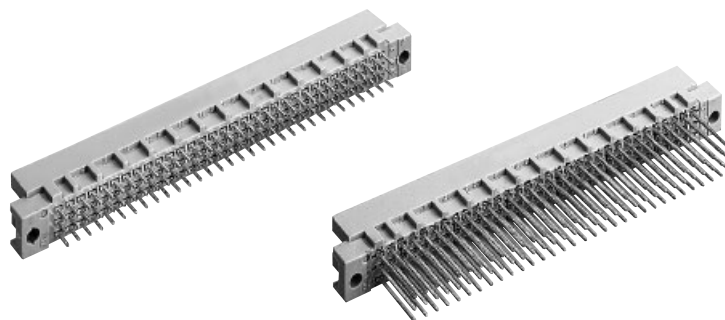
	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

Board drillings depend on type and special contact loading

DIN Signal
up to 2 A

Number of contacts

96, 64



Male connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00		
				3	2	1
Male connector with solder pins 2.5 mm	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)}		
Male connector with solder pins 4.0 mm	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)}		
Male connector with solder pins 13 mm	96		09 73 164 7902	09 73 164 6902 09 73 364 6902 ^{b)}	09 73 164 2902 09 73 364 2902 ^{b)}	
	64					
Male connector with solder pins 13 mm	96		09 73 164 7903	09 73 164 6903 09 73 364 6903 ^{b)}	09 73 164 2903	
	64					
Male connector with wrap posts ¹⁾ 13 mm	96		09 73 196 7907	09 73 196 6907 09 73 696 6947 ^{b,c)}	09 73 196 2907	
	64			09 73 164 6907 09 73 164 6947 ^{b)} 09 73 664 6947 ^{b,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 6904	09 73 164 2904	
Male connector with press-in pins 13 mm	96		09 73 196 7974 ^{b)}	09 73 196 6985 ^{w)} 09 73 196 6974 ^{b)} 09 73 196 6995 ^{w)}	Performance level 1 on request	
	64			09 73 164 6985 ^{w)} 09 73 164 6974 ^{b)}		

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

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

^{f)} 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

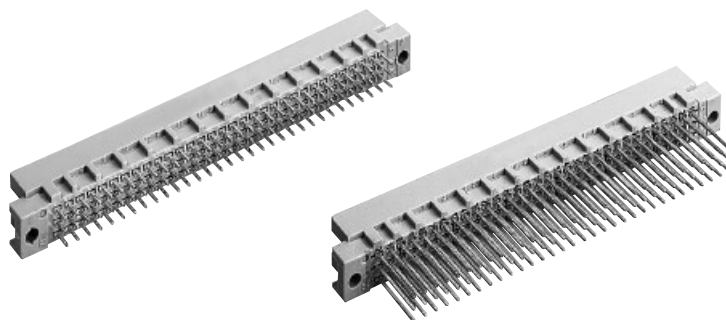
^{d)} CTI > 400

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

Number of contacts

96, 64

Male connectors

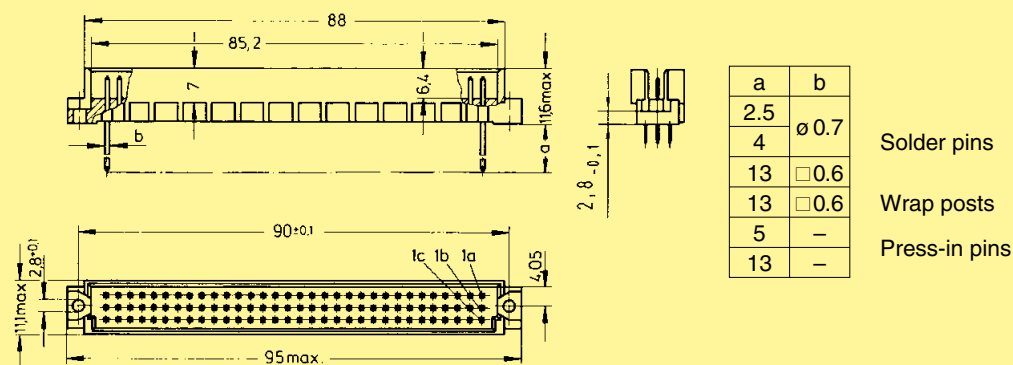


Identification

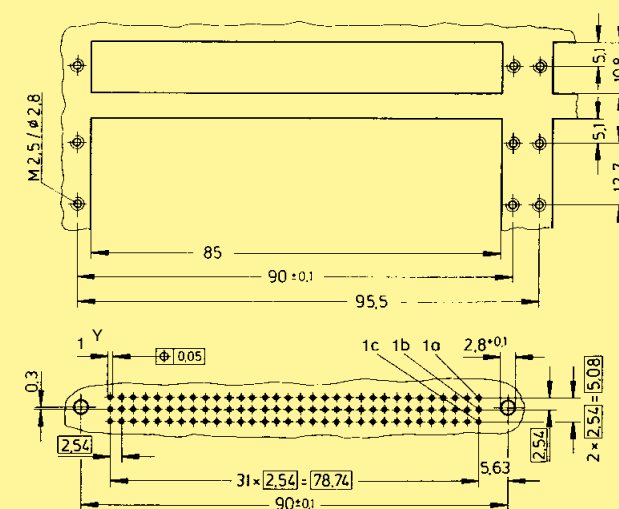
Drawing

Dimensions in mm

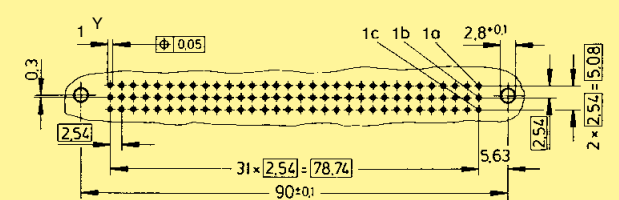
Dimensions



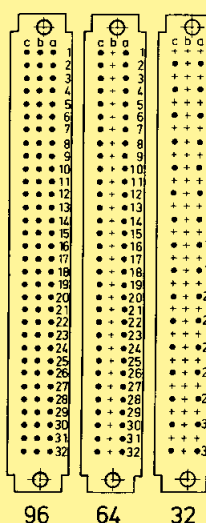
Panel cut out



Board drillings
Mounting side

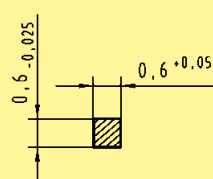


	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25



Contact arrangement
View from termination side

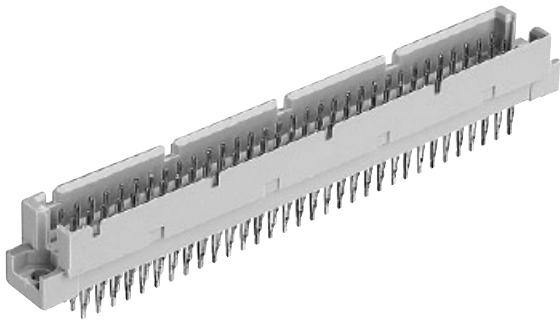
Cross section of solder terminations



Cross area (A) of contacts row a, b, c: $A = 0.35 - 0.39 \text{ mm}^2$

Number of contacts

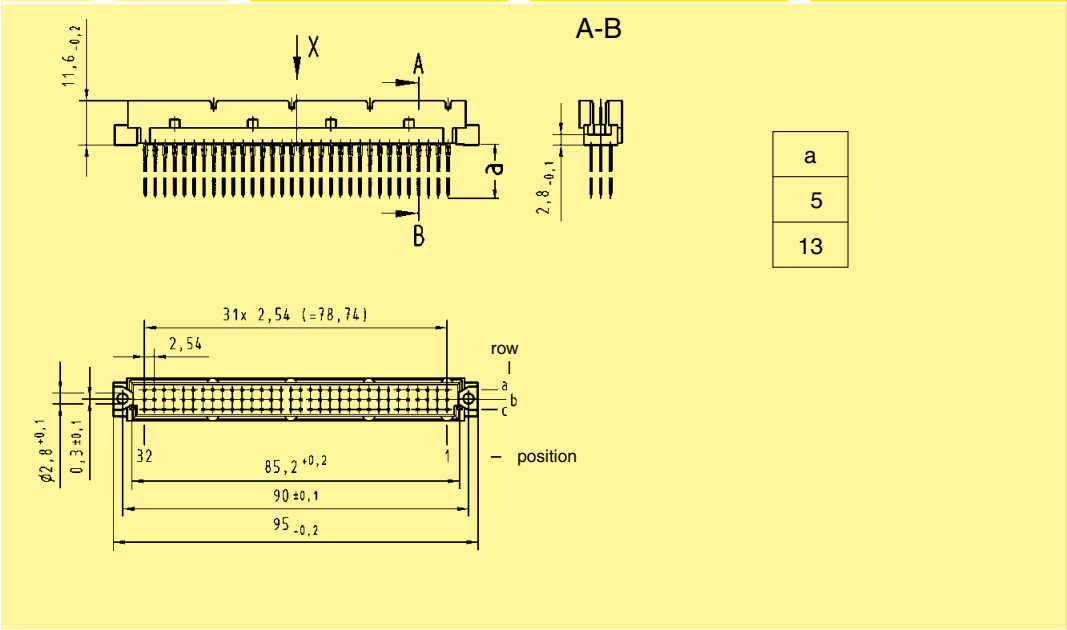
96, 64



Male connectors

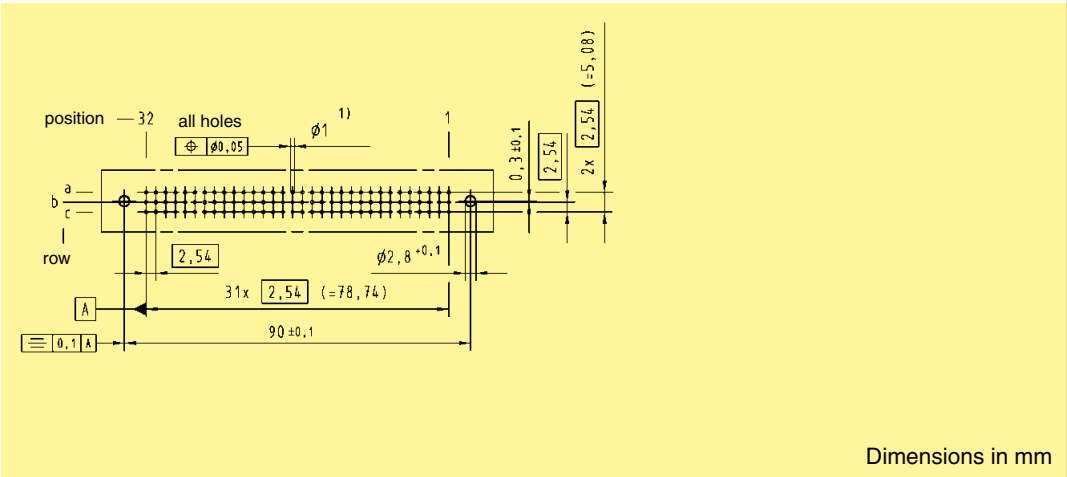
Identification	Number of contacts	Contact arrangement	Part No. 3	Performance levels according to IEC 60 603-2. 2	Explanation chapter 00 1
Male connector with press-in terminations	5.0 mm		Performance level 3 on request	Performance level 2 on request	09 79 196 2950
					09 79 164 2950
	13 mm				09 79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

Number of contacts

96, 64, 32



Female connectors

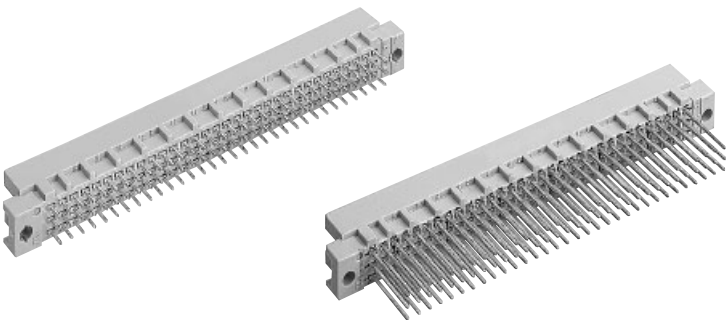
Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00			
			3	2	1		
Female connector with angled solder pins	96		09 73 296 7801	09 73 296 6801 09 73 296 6801 222 ^{f)} 09 73 496 6801 ^{b)} 09 73 796 6801 ^{c)}	09 73 296 2801		
			09 73 496 7801 ^{b)}				
	SMC	96			09 73 296 6804 ^{d)} 09 73 496 6804 ^{b)d)}	09 73 496 2804 ^{b)d)}	
	SMC	64		09 73 264 7801 09 73 464 7801 ^{b)}	09 73 264 6801 09 73 464 6801 ^{b)}	09 73 264 2801	
SMC	64			09 73 264 6804 ^{d)} 09 73 464 6804 ^{b)d)}	09 73 264 2804 ^{d)} 09 73 464 2804 ^{b)d)}		
	32		09 73 232 7801	09 73 232 6801	09 73 232 2801		
	32			09 73 232 6811			
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 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

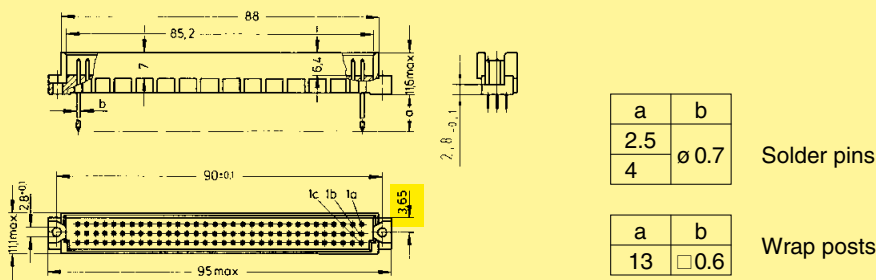
96, 64



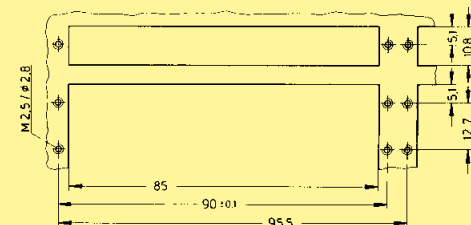
Male connectors

Identification	Number of contacts	Contact arrangement	Part No.	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	

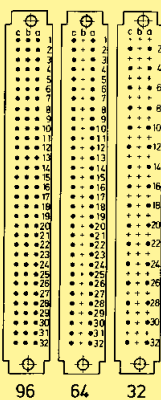
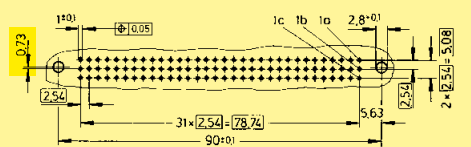
Dimensions



Panel cut out



Board drillings
Mounting side



Contact arrangement
View from termination side

Dimensions in mm

Other contact arrangements on request

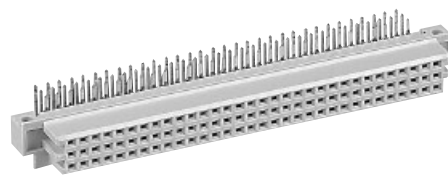
= deviating dimensions from standard male connectors (see page 01.46f)

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

¹⁾ To be used only for wire wrap termination

Number of contacts

96, 64



Female connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00
			3	2

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

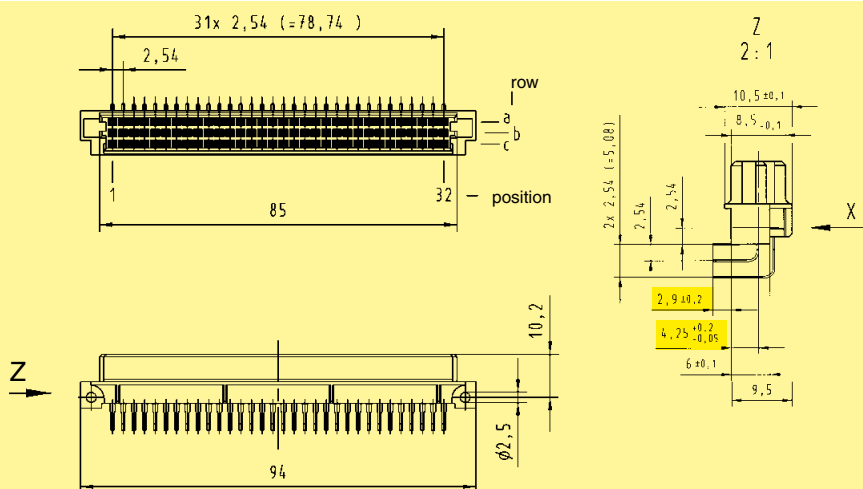
64



09 79 264 7801

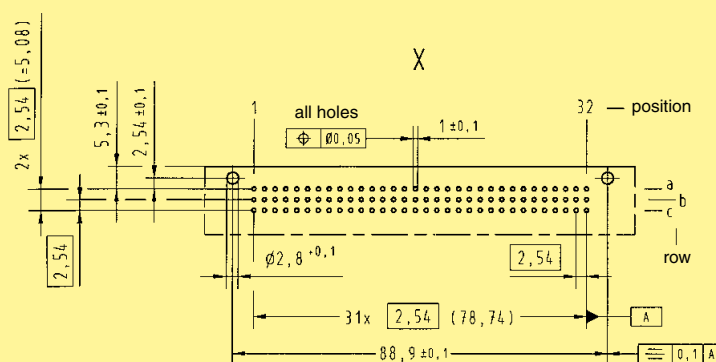
09 79 264 6801
09 79 464 6801^{b)}

Dimensions



Board drillings

Mounting side



Dimensions in mm

Other contact arrangements on request

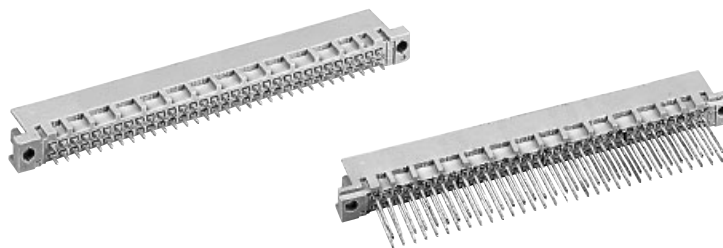
^{b)} Connectors with snap-in clips see chapter 00

 = deviating dimensions from standard female connectors (see page 01.49)

DIN Signal
up to 2 A

01
51

64



**DIN Signal
up to 2 A**

Dimensions

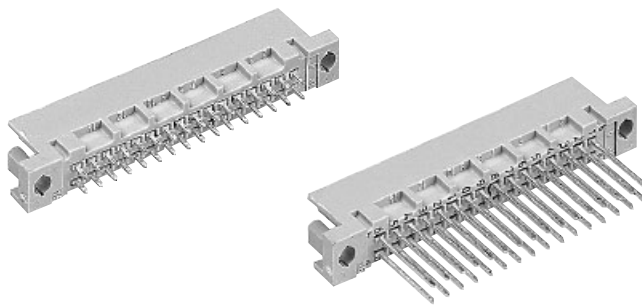
a	b	
2.5	∅ 0.7	Solder pins
4		
13	□ 0.6	Wrap posts
13	□ 0.6	
17		
5	—	Press-in pins
13	—	

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

- b) Connectors with snap-in clips see 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

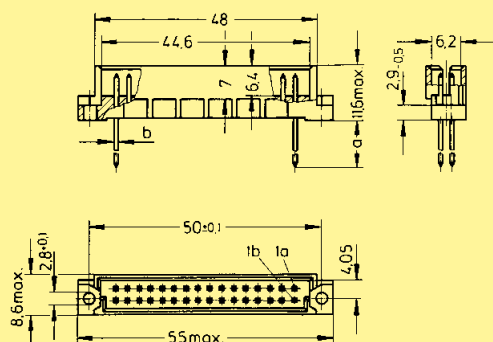
32



Male connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1	
Male connector with solder pins 2.5 mm	32		09 27 132 7902 09 27 332 7902	09 27 132 6902	09 27 132 2903	
	4.0 mm		09 27 132 7903	09 27 132 6903 09 27 132 6903 222 ^{f)}		
	13 mm			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



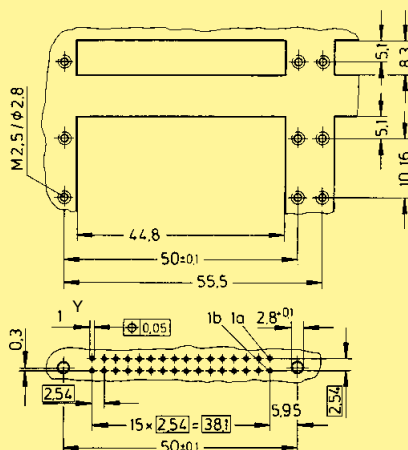
a	b
2.5	ø 0.7
4	
13	□ 0.6
13	□ 0.6
5	—

Solder pins

Wrap posts

Press-in pins

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

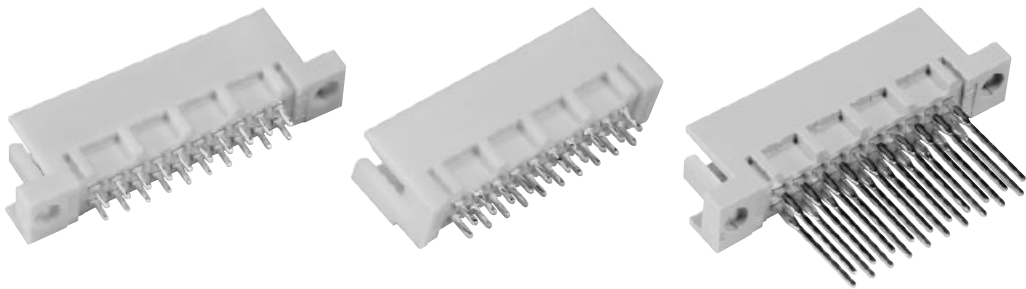
[▲] Male connectors with 2 leading contacts (0.8 mm) pos. a1 and a32/a16

¹⁾ To be used only for wire wrap termination

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

Number of contacts

20



Male connectors

Identification	Number of contacts	Contact arrangement	Part No.	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					
with fixing flange, SMC	20					
without fixing flange	20					
without fixing flange, SMC	20					
Male connector with solder pins 4.0 mm						
with fixing flange	20					
with fixing flange, SMC	20					
without fixing flange	20					
without fixing flange, SMC	20					
Male connector with solder pins 13 mm						
with fixing flange	20					
with fixing flange, SMC	20					
Male connector with wrap posts ¹⁾ 13 mm						
with fixing flange	20					
Male connector with press-in pins 5.0 mm						
with fixing flange	20					
without fixing flange	20					
Male connector with press-in pins 13 mm						
with fixing flange	20					
without fixing flange	20					

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

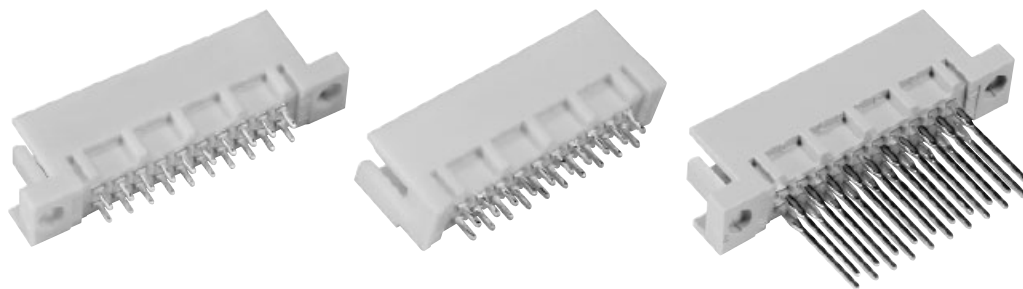
¹⁾ To be used only for wire wrap termination

^{d)} CTI > 400

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

Number of contacts

20



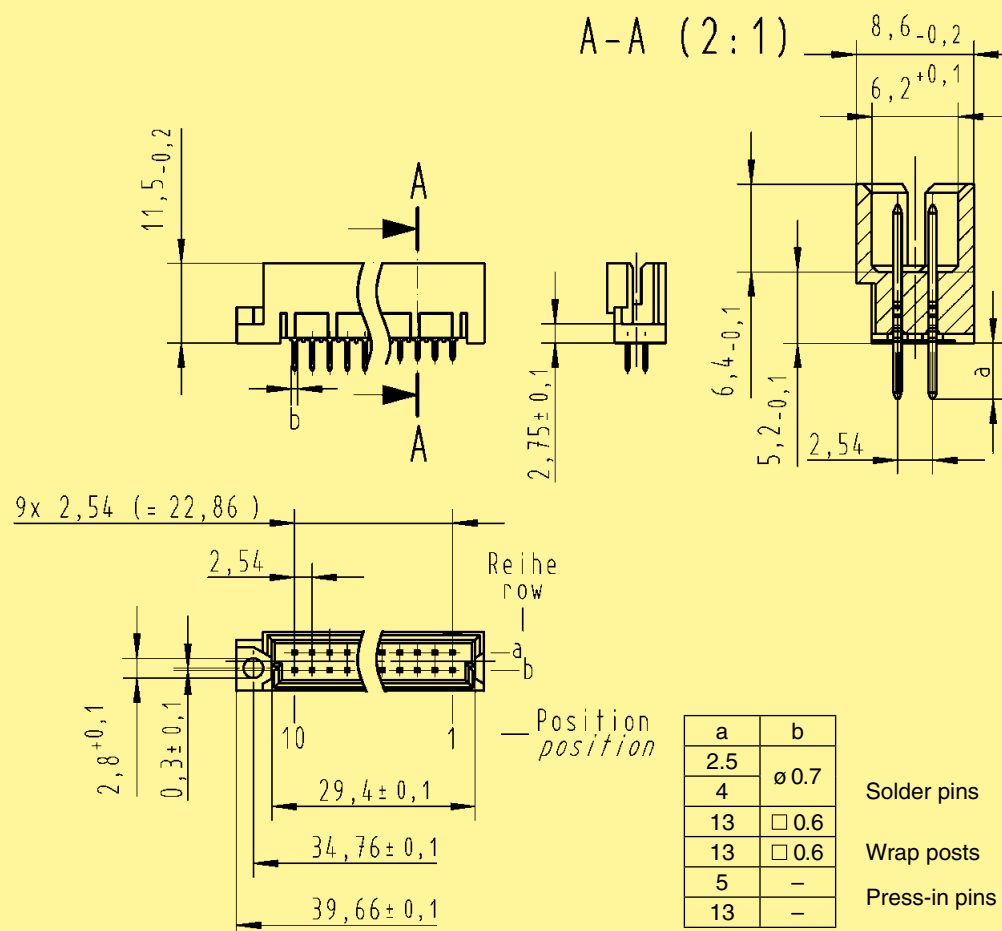
Male connectors

Identification

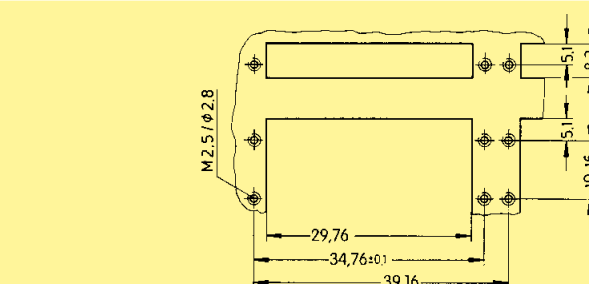
Drawing

Dimensions in mm

Dimensions

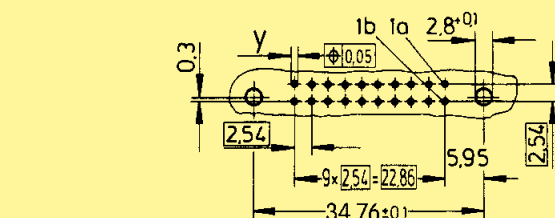


Panel cut out

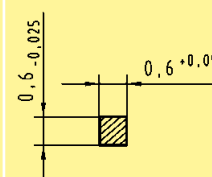


	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

Board drillings
Mounting side



Cross section of solder terminations



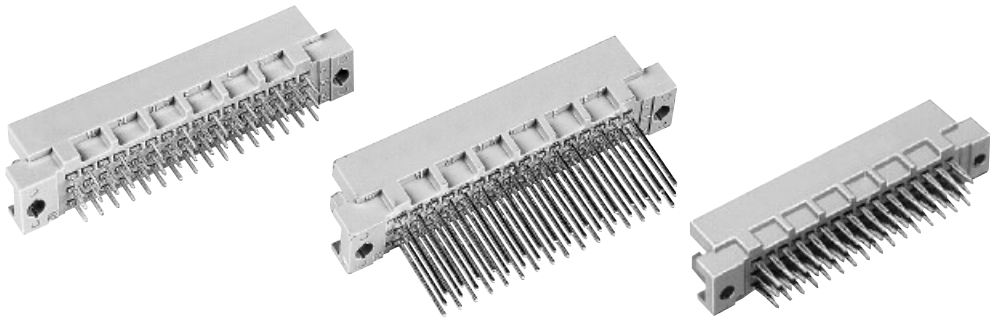
Cross area (A) of contacts
row a, b, c: A = 0.35 - 0.39 mm²

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

DIN Signal
up to 2 A

Number of contacts

48, 32



Male connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00		
				3	2	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	
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		
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 09 28 148 6904 222 ^{f)}		
	32					
Male connector with press-in pins 13 mm	48		09 28 148 7985	09 28 148 6985 ^{w)} 09 28 148 6974*		
	32					

* 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

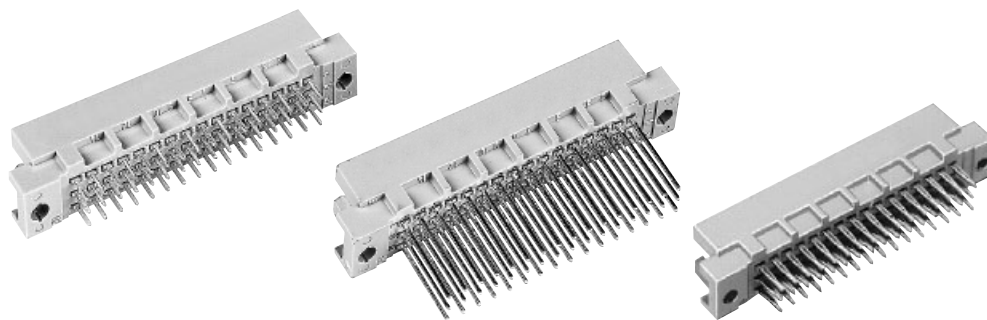
^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

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

Number of contacts

48, 32

Male connectors

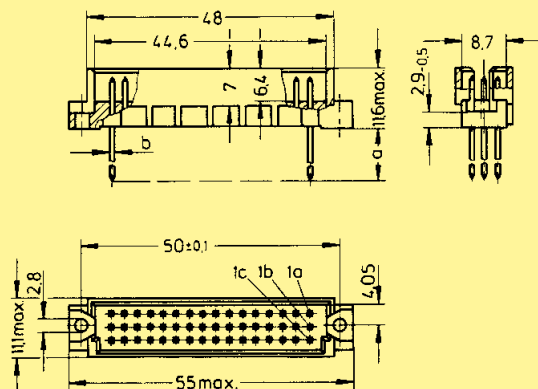


Identification

Drawing

Dimensions in mm

Dimensions



a	b
2.5	4
13	13
13	5
13	13

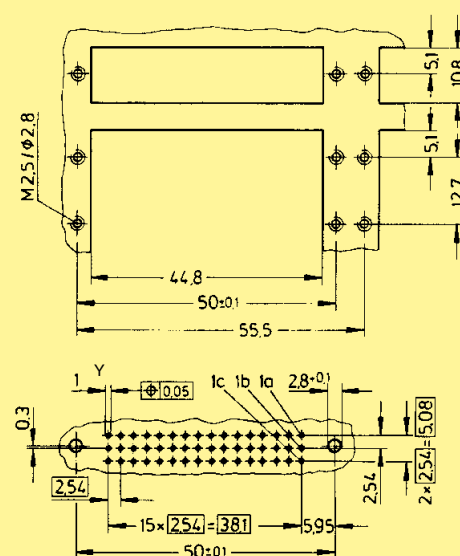
Solder pins

Wrap posts

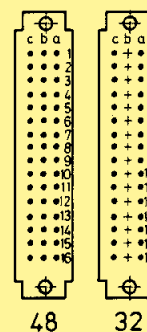
Press-in pins

Panel cut out

Board drillings
Mounting side

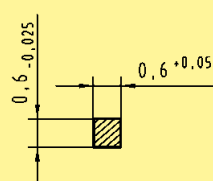


Contact arrangement
View from termination side



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

Cross section of
solder terminations

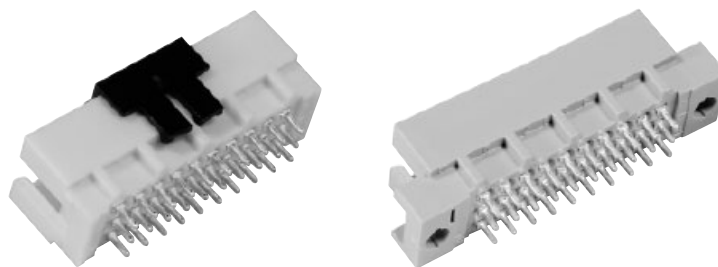


Cross area (A) of contacts row a, b, c: A = 0.35 - 0.39 mm²

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

Number of contacts

30, 20



Male connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00		
			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	
with fixing flange	20			09 29 120 6902		
with fixing flange, SMC	30			09 29 130 6519 ^{d)}		
without fixing flange	30			09 29 130 6592		
without fixing flange, SMC	30			09 29 130 6569 ^{d)}		
Male connector with solder pins 4.0 mm	30			09 29 130 6903		
with fixing flange	20			09 29 120 6903		
with fixing flange, SMC	30			09 29 130 6520 ^{d)}		
without fixing flange	30			09 29 130 6593		
without fixing flange, SMC	30			09 29 130 6570 ^{d)}		
Male connector with solder pins 13 mm	30			09 29 130 6577		
with fixing flange	20			09 29 120 6577		
with fixing flange, SMC	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		
with fixing flange	20			09 29 120 6904		
without fixing flange	30			09 29 130 6504		
Male connector with press-in pins 13 mm	30			09 29 130 6985 ^{w)} 09 29 130 6974 [*]		
with fixing flange	20			09 29 120 6974 [*]		
without fixing flange	30			09 29 130 6574 [*]		

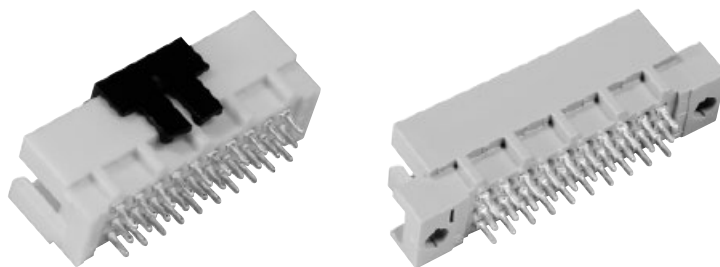
* Wrap posts for interfacing selectively gold plated (performance level 3)

¹⁾ To be used only for wire wrap termination^{d)} CTI > 400^{w)} Wrap posts not for interfacing, no performance level

Number of contacts

30, 20

Male connectors

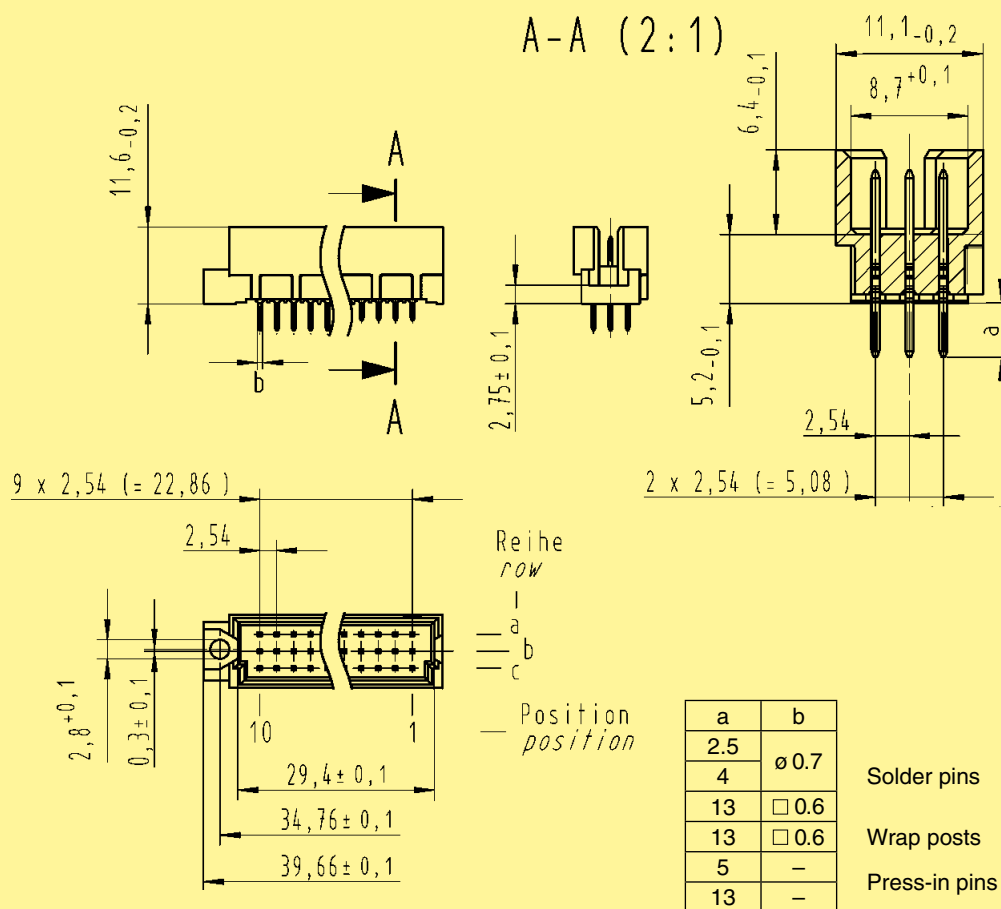


Identification

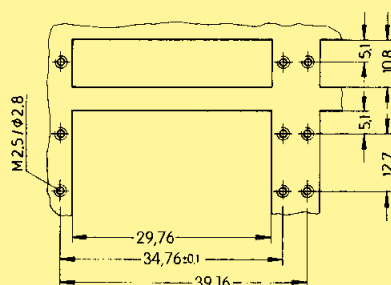
Drawing

Dimensions in mm

Dimensions



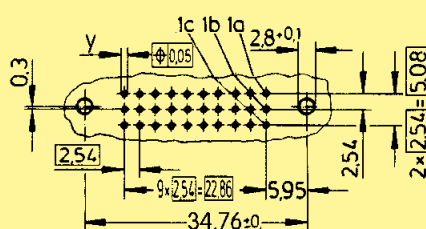
Panel cut out



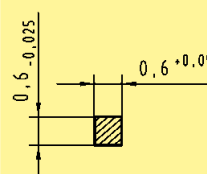
	Y
Solder	1 ± 0.1
Press-in	see recommendation page 00.25

Board drillings

Mounting side



Cross section of solder terminations



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

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

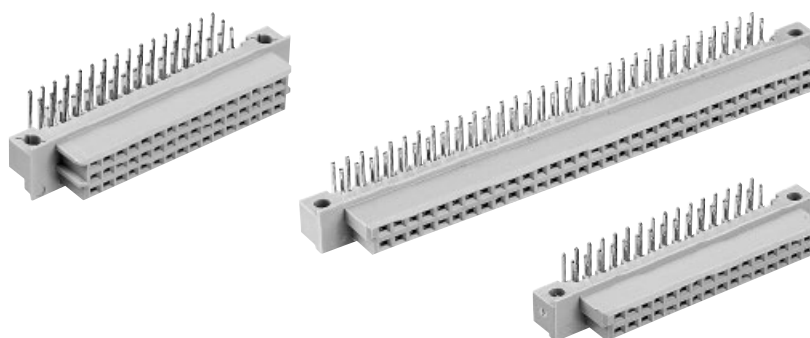
DIN Signal
up to 2 A

DIN 41 612 · Type Q – complementary types 2Q, 2R



Number of contacts

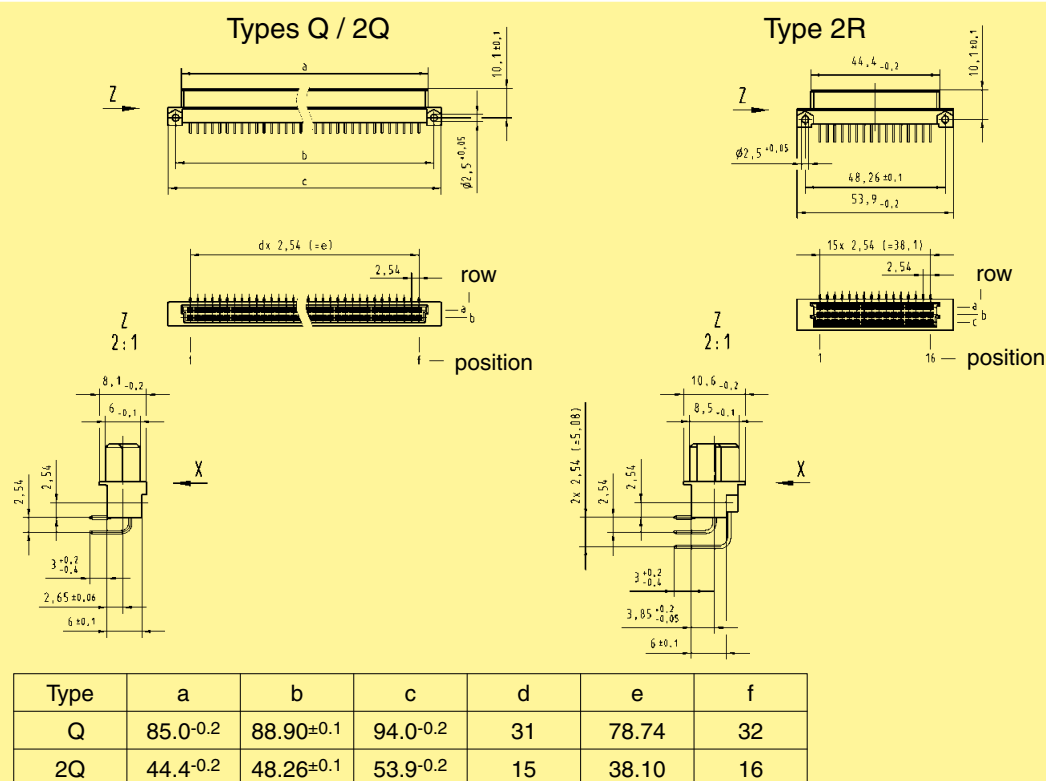
64, 48, 32



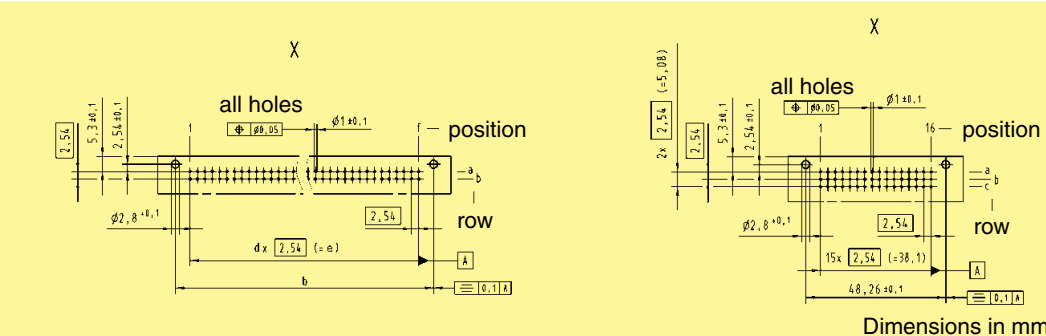
Female connectors

Identification	Number of contacts	Contact arrangement	Part No. Performance level 2 according to IEC 60 603-2. Explanation chapter 00
Female connector with angled solder pins Type Q	64		09 72 264 6801 09 72 464 6801 ^{b)}
Type 2Q	32		09 27 232 6801
Type 2R	48		09 28 248 6801 09 28 448 6801 ^{b)}

Dimensions



Board drillings
Mounting side

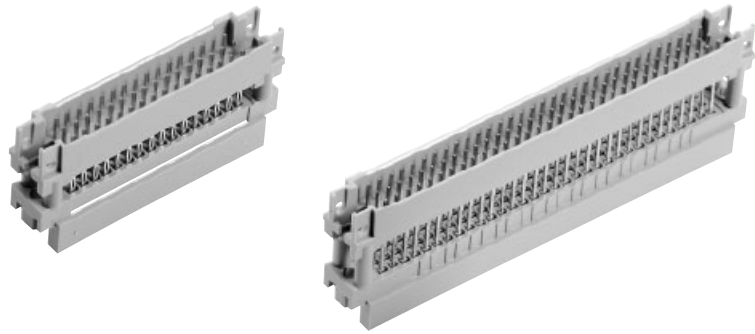


Other contact arrangements on request

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

Number of contacts

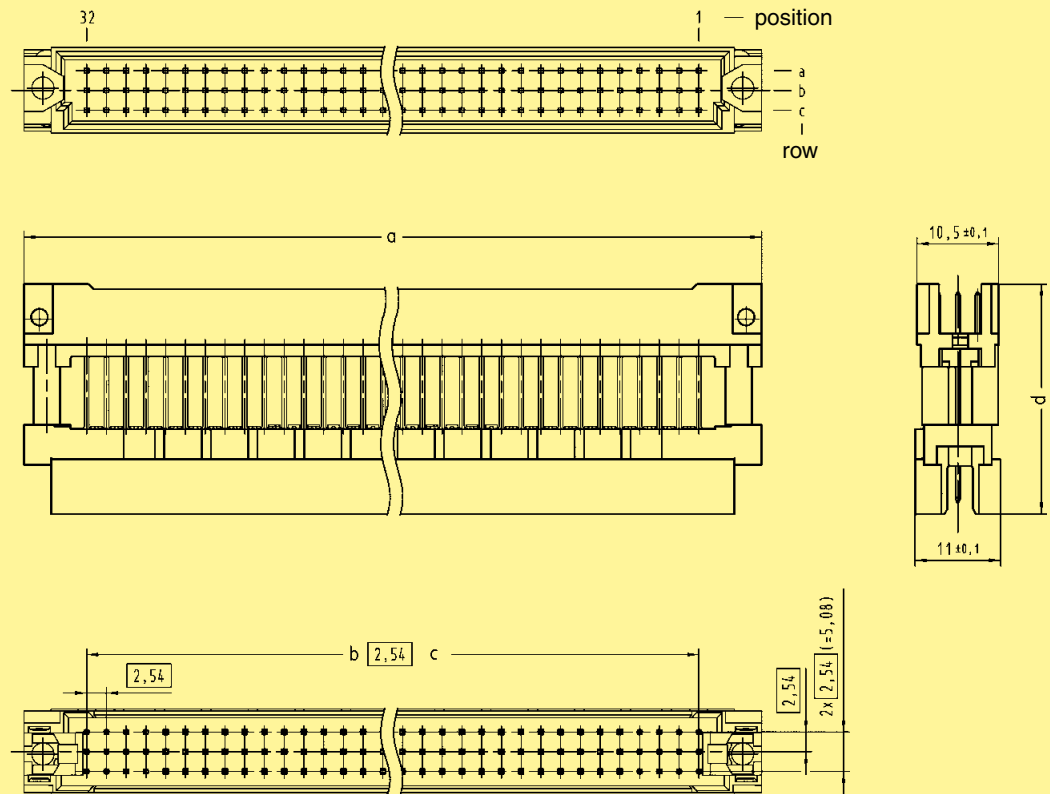
96, 48



Mezzanine Adapter

Identification	Number of contacts	Contact arrangement	Part No.	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	DIN Signal up to 2 A
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

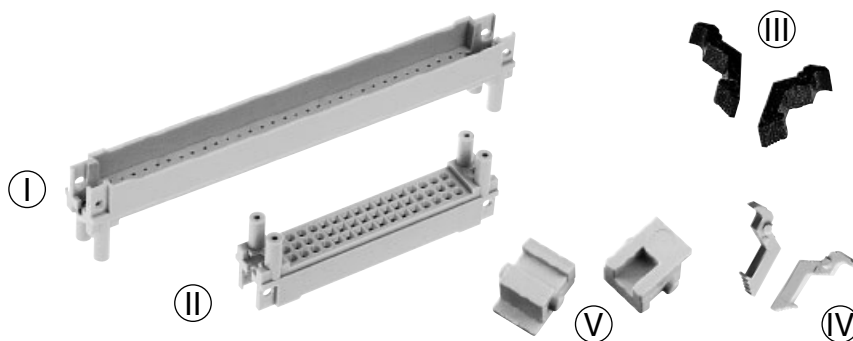
Pin shroud



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 No. – Pin shrouds with	
				press-in fixing ¹⁾	screw fixing
Pin shrouds for female connectors type C, 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	9.9	09 03 000 9952	09 03 000 9962
		2.4	9.1	09 03 000 9953	09 03 000 9963
		3.2	8.3	09 03 000 9954	09 03 000 9964
		4.0	7.5	09 03 000 9955	09 03 000 9965
		4.8	6.7	09 03 000 9956	09 03 000 9966
		5.6	5.9	09 03 000 9957	09 03 000 9967
		6.4	5.1	09 03 000 9958	09 03 000 9968
	20.0	3.2	11.75	09 03 000 9950	09 03 000 9960
		4.0	10.7	09 03 000 9951	09 03 000 9961
		4.8	9.9	09 03 000 9952	09 03 000 9962
		5.6	9.1	09 03 000 9953	09 03 000 9963
		6.4	8.3	09 03 000 9954	09 03 000 9964
		7.2	7.5	09 03 000 9955	09 03 000 9965
Pin shrouds for female connectors type 2C, 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	9.9	09 23 000 9952	09 23 000 9962
		2.4	9.1	09 23 000 9953	09 23 000 9963
		3.2	8.3	09 23 000 9954	09 23 000 9964
		4.0	7.5	09 23 000 9955	09 23 000 9965
		4.8	6.7	09 23 000 9956	09 23 000 9966
		5.6	5.9	09 23 000 9957	09 23 000 9967
		6.4	5.1	09 23 000 9958	09 23 000 9968
	20.0	3.2	11.75	09 23 000 9950	09 23 000 9960
		4.0	10.7	09 23 000 9951	09 23 000 9961
		4.8	9.9	09 23 000 9952	09 23 000 9962
		5.6	9.1	09 23 000 9953	09 23 000 9963
		6.4	8.3	09 23 000 9954	09 23 000 9964
		7.2	7.5	09 23 000 9955	09 23 000 9965

Identification	Part No.
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

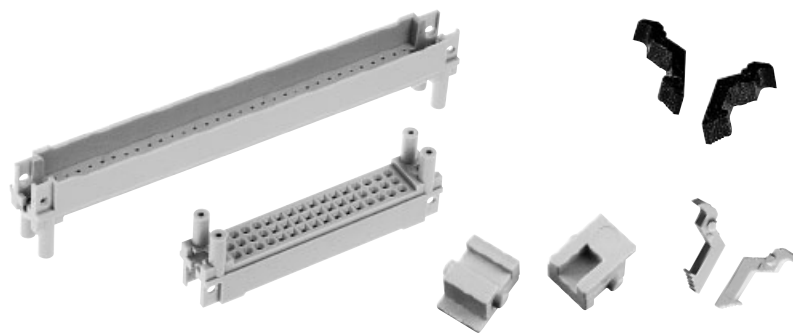
Pin shroud



Number of contacts

96, 48

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

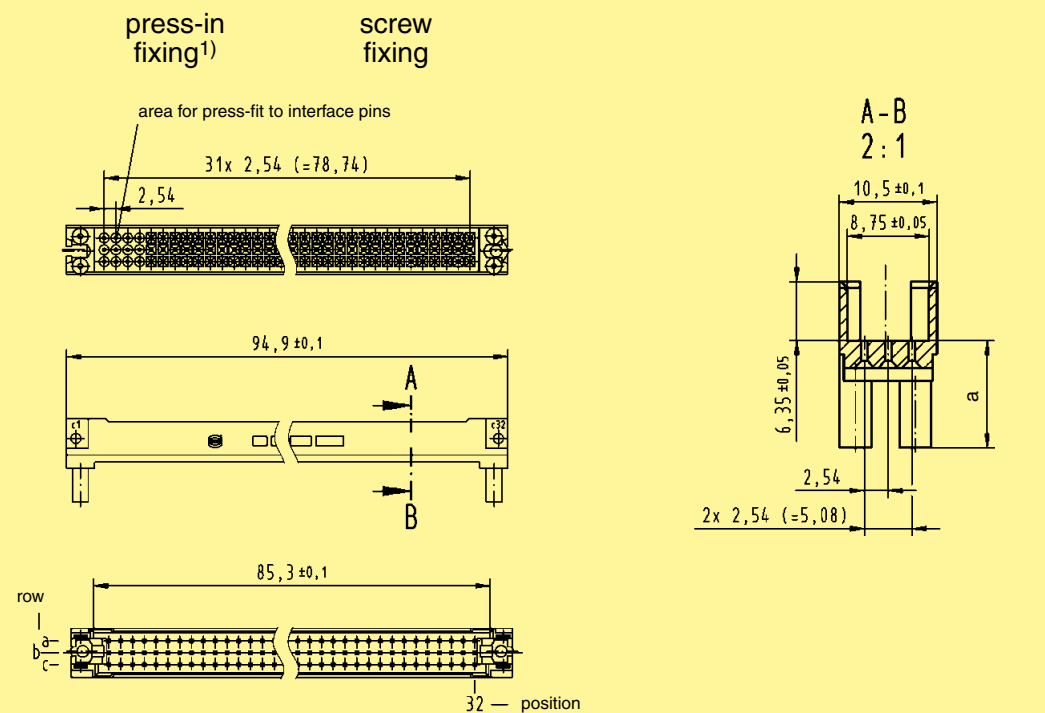


Identification

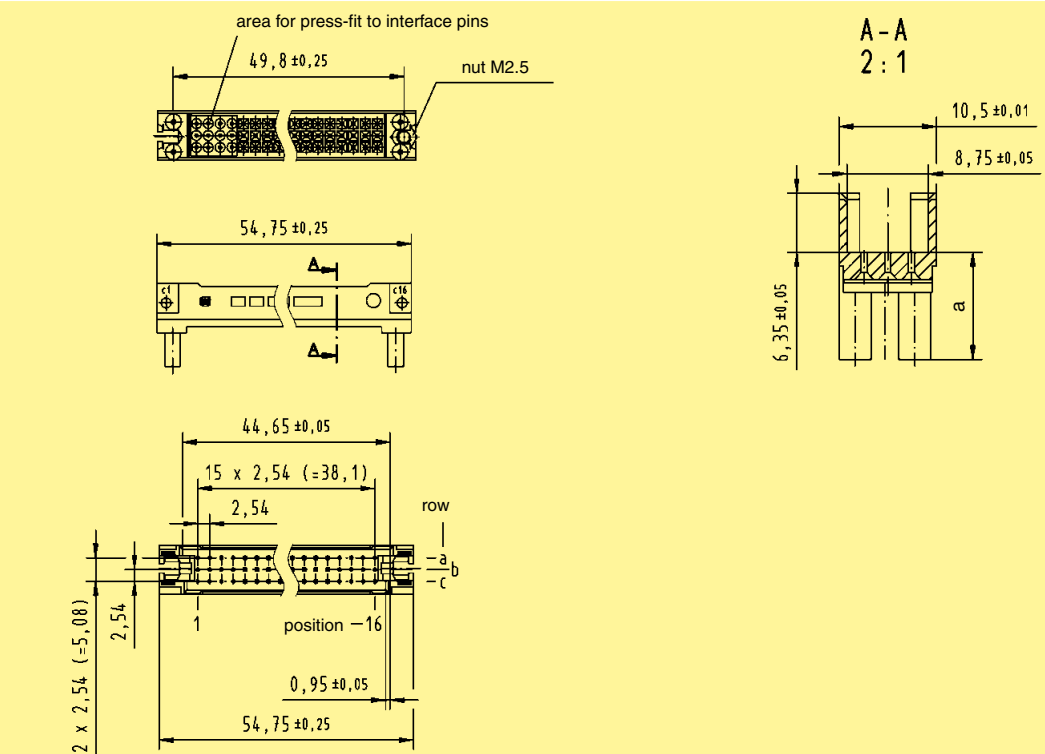
Drawing

Dimensions in mm

Pin shrouds
for female connectors
type C, R



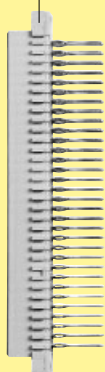
Pin shrouds
for female connectors
type 2C, 2R



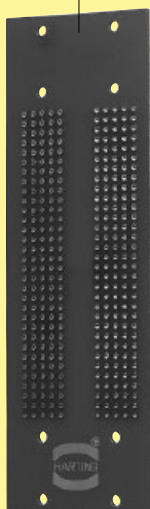
¹⁾ Tooling see chapter 30

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

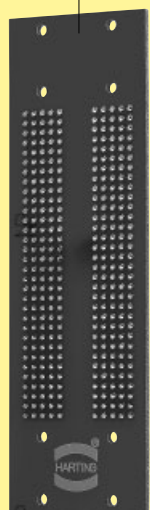


Application 2

Female connector
09 03 296 6862



Backplane



Pin shroud
09 03 000 9953



Locking lever
09 03 000 9913



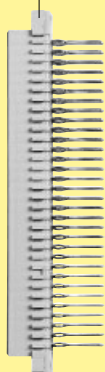
Female connector
09 73 296 6801



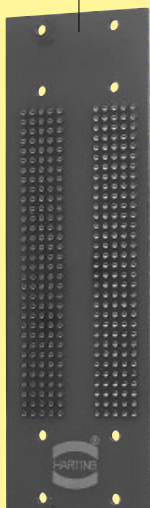
Daughtercard

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

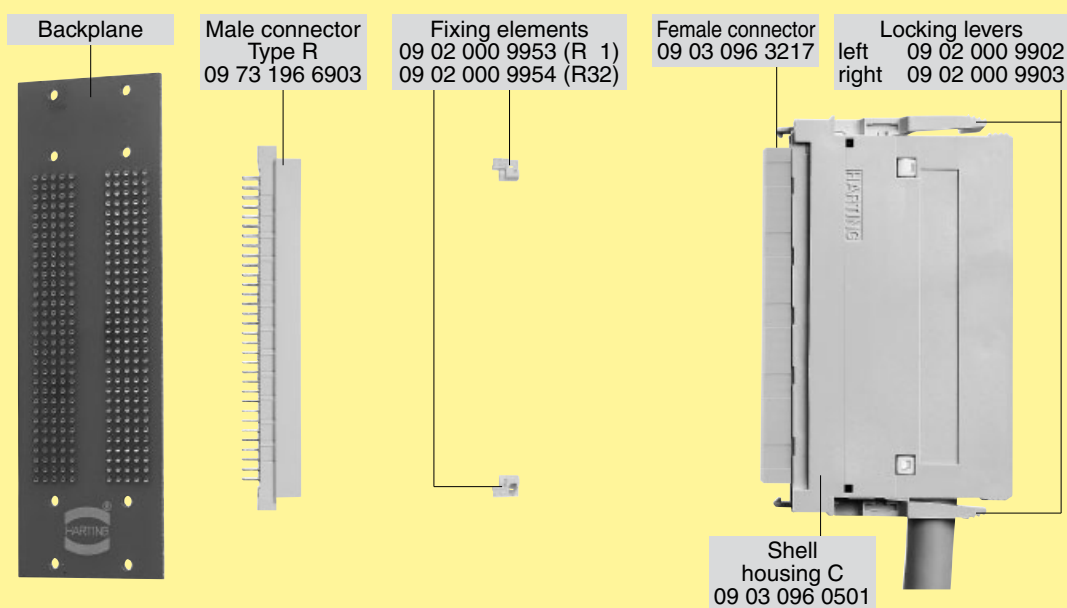


Locking levers
left 09 02 000 9902
right 09 02 000 9903

Shell housing C
09 03 096 0501

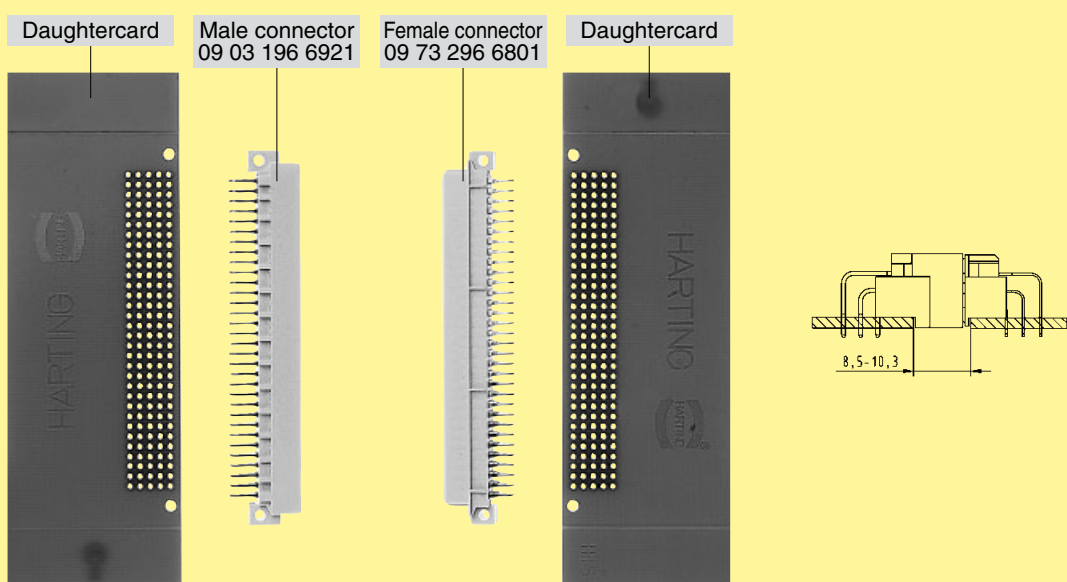


Application 4

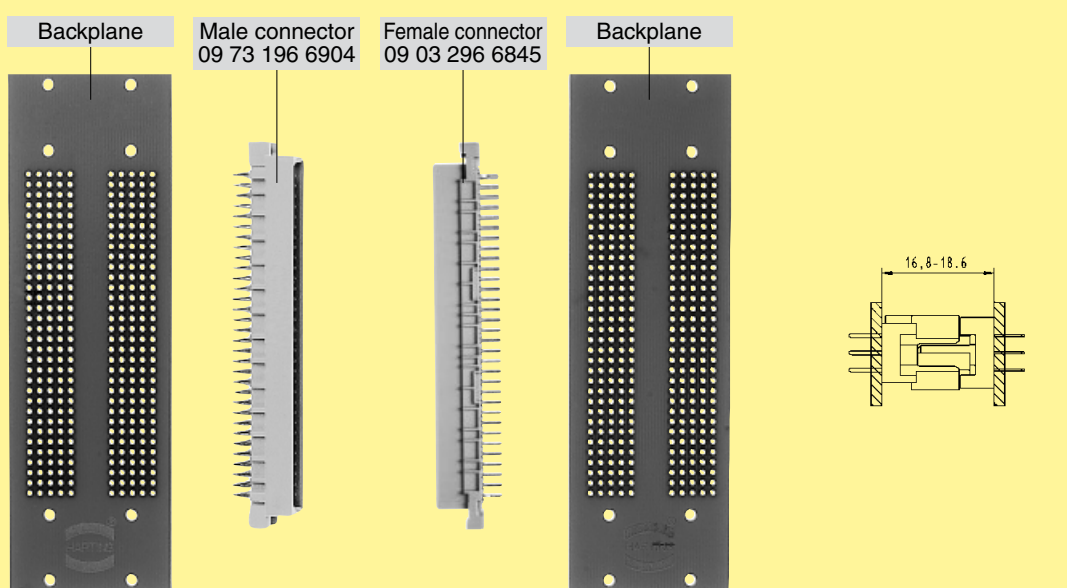


DIN Signal
up to 2 A

Application 5*

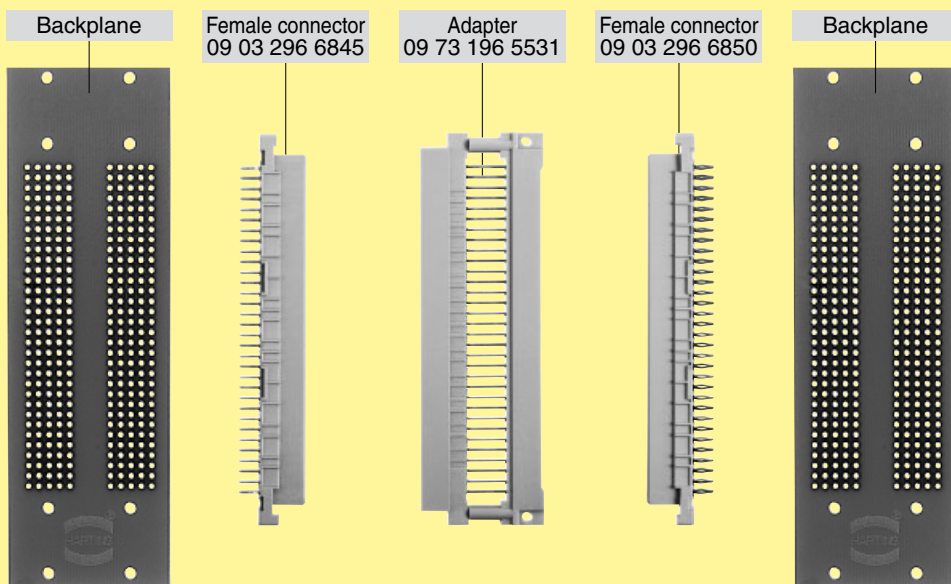
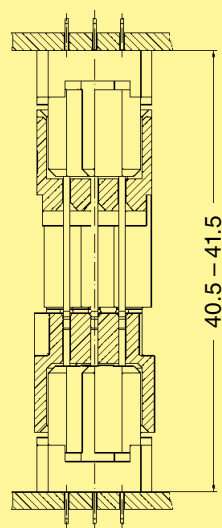


Application 6*

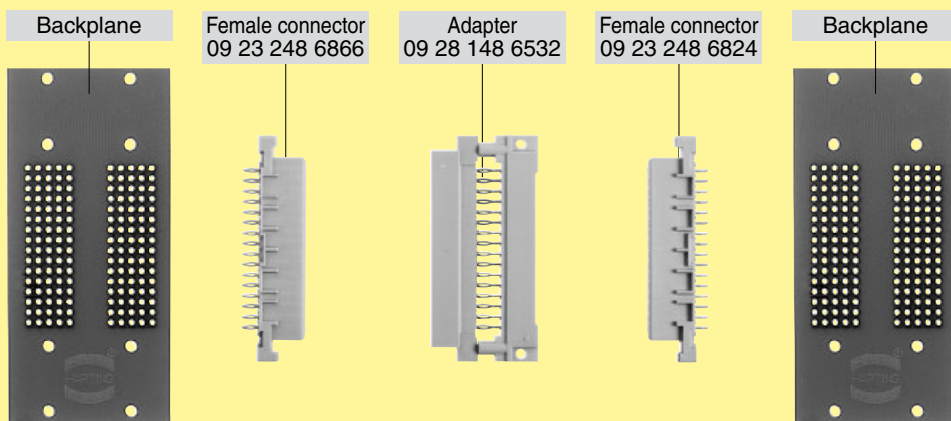
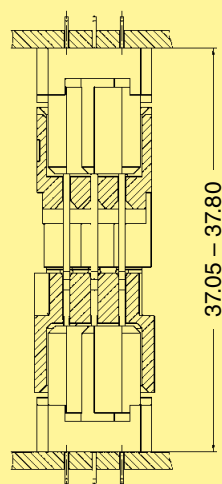


* Position marking turned: a1 contacts a32, a2 contacts a31, ...

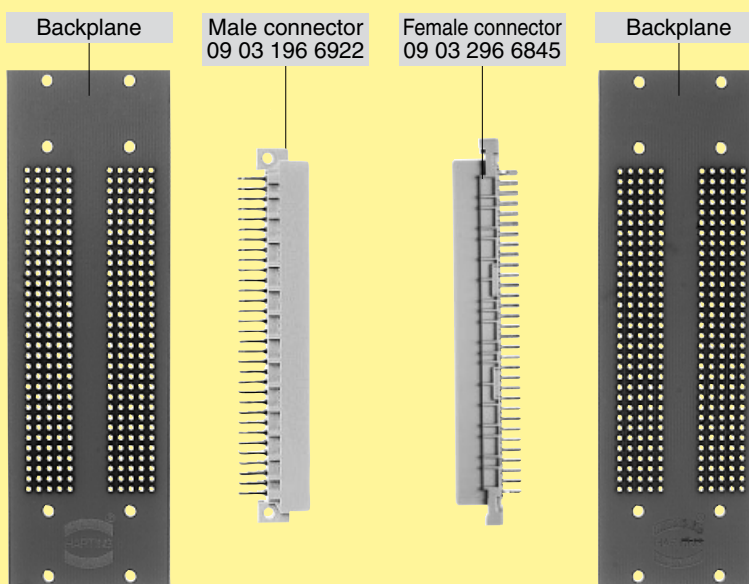
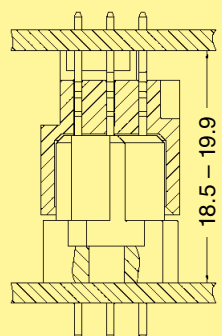
Application 7



Application 8



Application 9



DIN Signal
up to 2 A

harbus® 64

Page

VMEbus systems **02.02**

harbus® 64

System description **02.03**

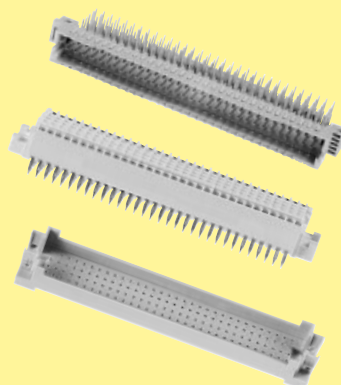
Technical characteristics **02.10**

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.

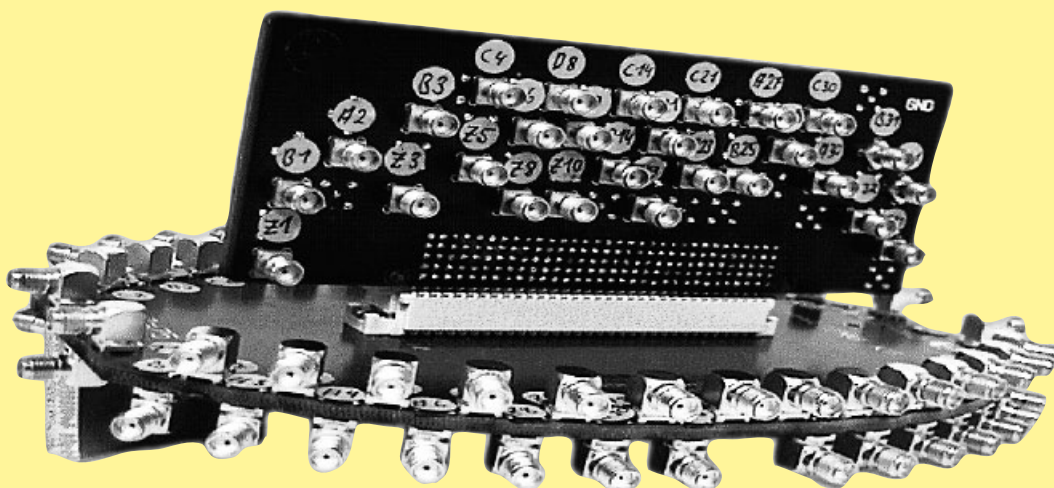
Additional advantages appear under real-time conditions, where unforeseen events have to be managed. This is realised with the program interrupt concept and variable control that closely monitors the bus system.



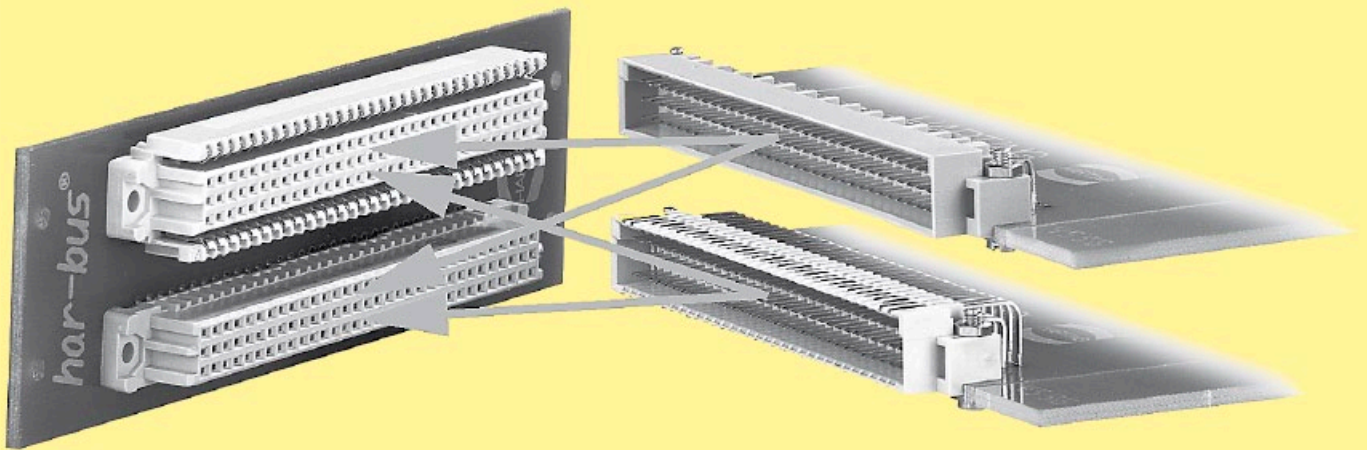
With the increase in processing speeds and data transmission rates, 3 row DIN 41612 connectors have reached their limit, so the VME standard needs to be enhanced further.

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.

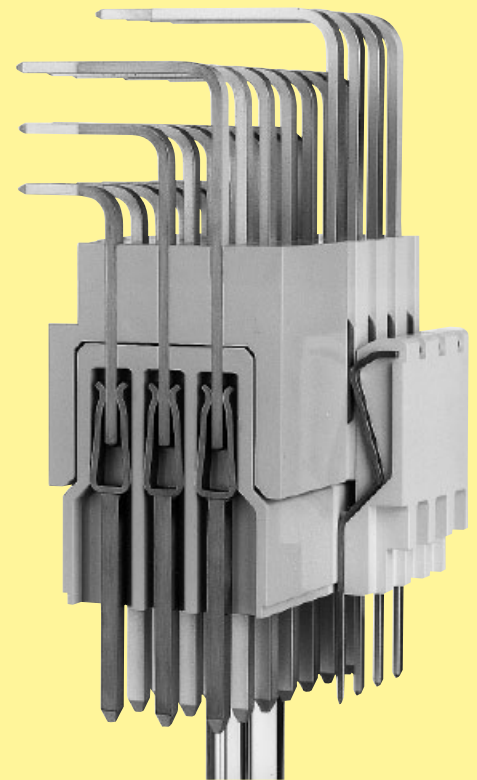


Backward compatibility

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:

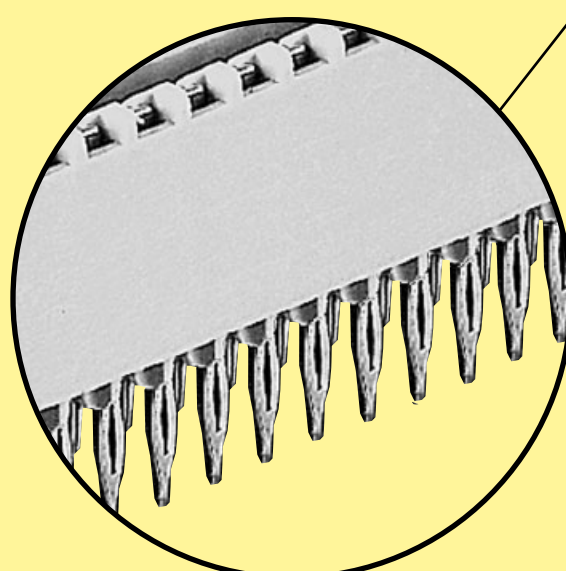
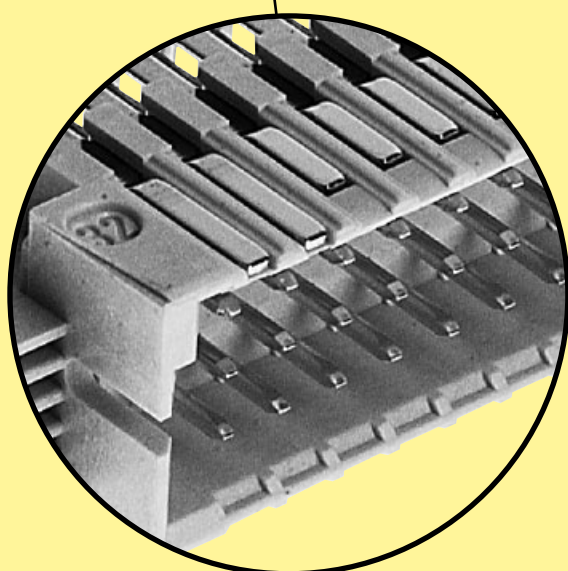
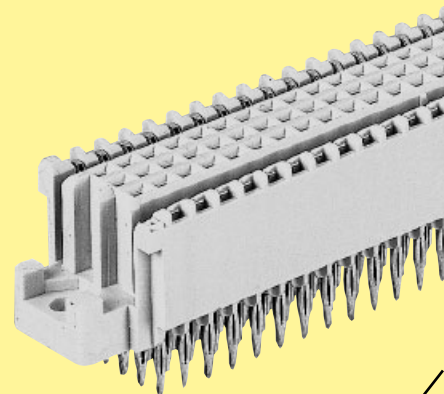
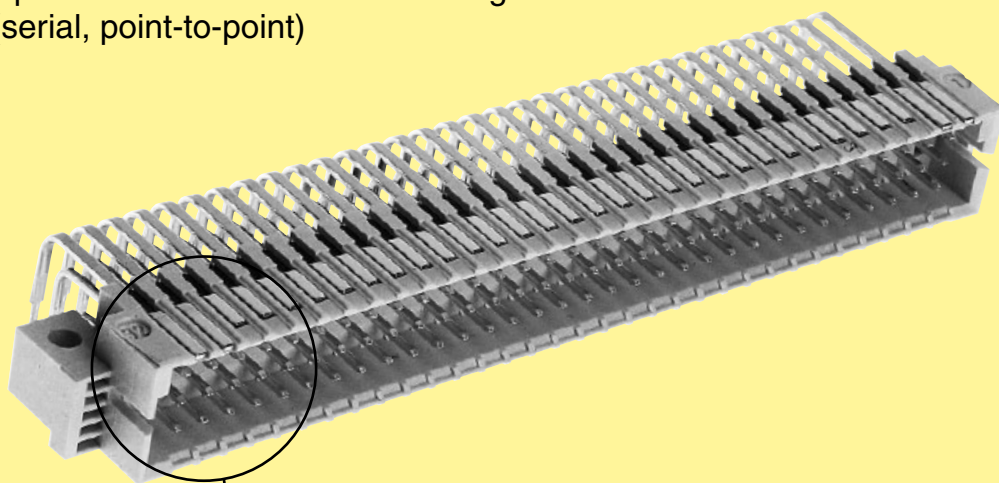
- Additional contacts for I/O and system upgrade
- New voltage supplies for 3.3 V and 48 V system components
- Identifying locations of system components and the bus length. “Plug & Play”
- Improved signal/ground ratio for reliable signal data transfer at rates up to 320 MByte/s (VMEbus) resp. 1.25 Gb/s (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.

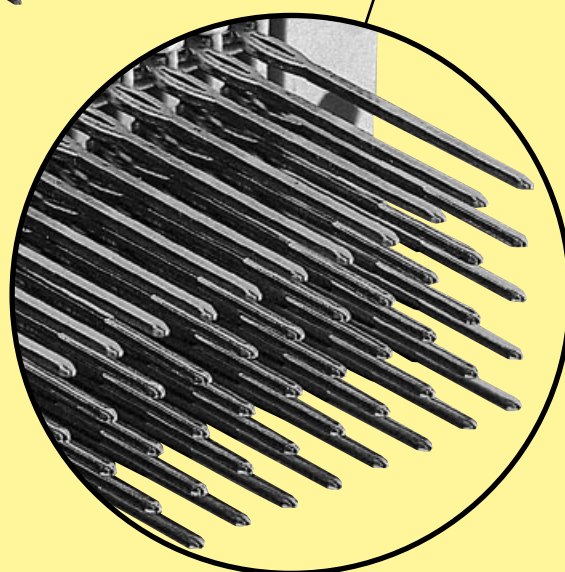
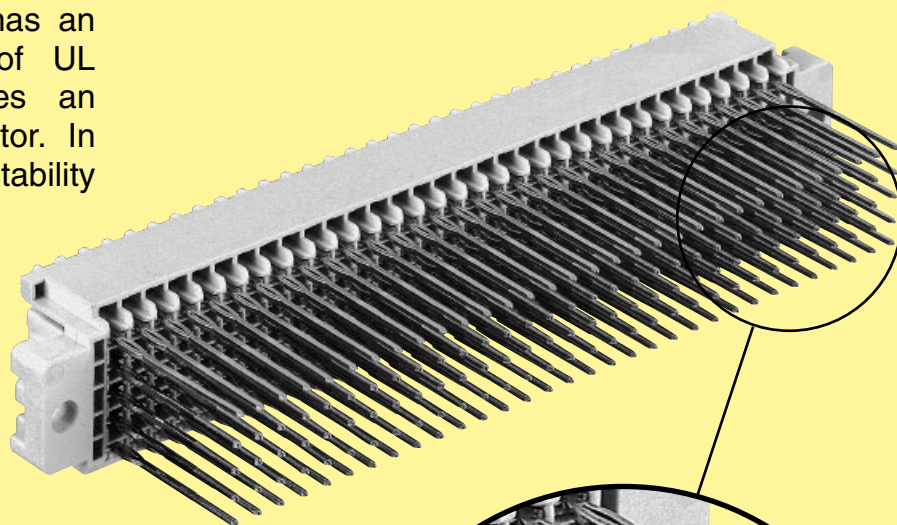
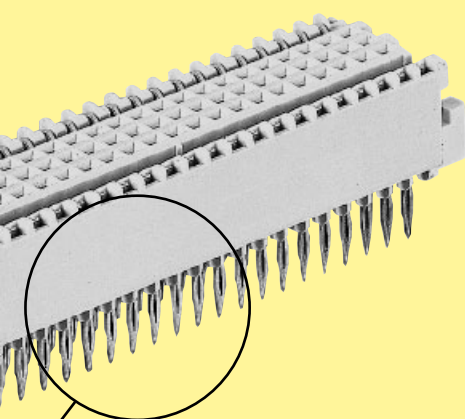


Four preleading contacts (1.5 mm) serve to pre-load the transmit and receive logic so that the bus will not experience glitches during **live insertion** of new cards into the backplane.

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.

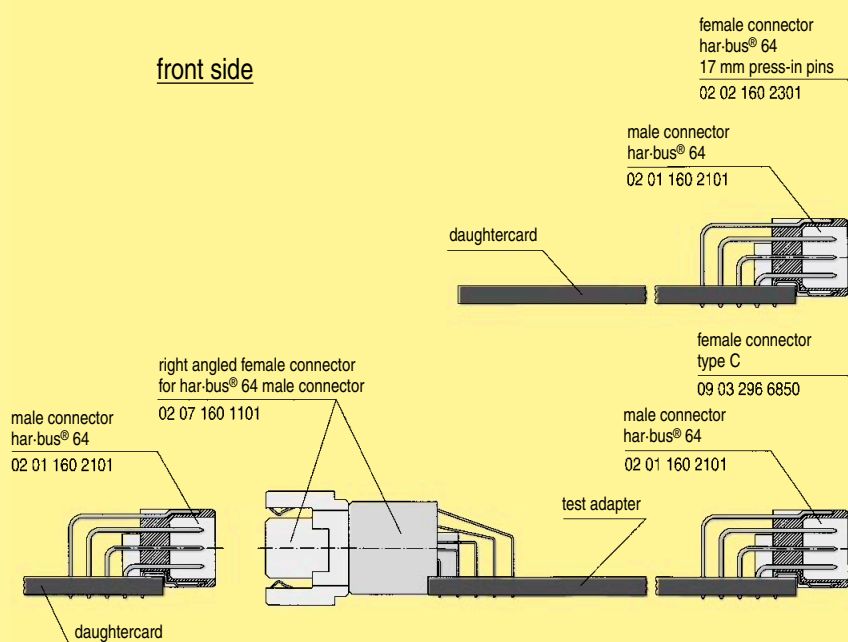
The insulator, made of LCP, has an inherent flammability rating of UL 94-V0 and therefore provides an **environment friendly** connector. In addition, the heat deformation stability of LCP makes the connector **surface-mount compatible** (see chapter 00).



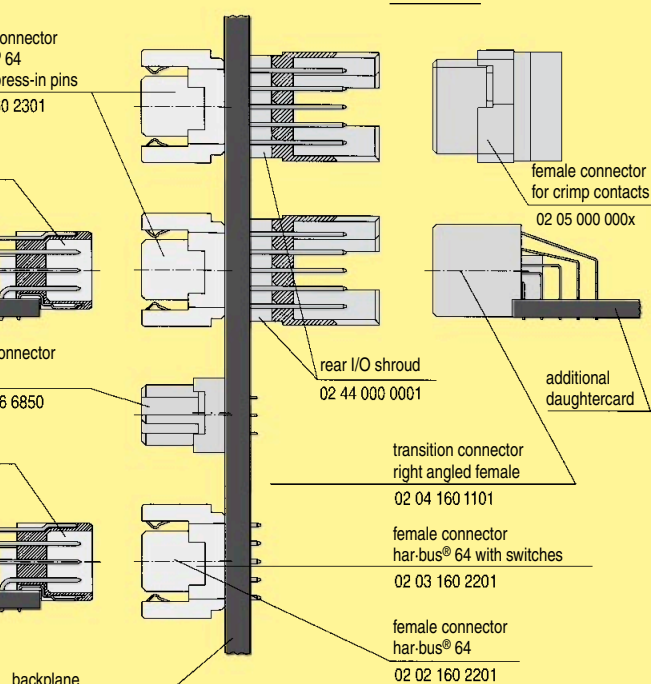
Partially gold plated terminations with precisely formed tips serve as contact area for **rear transition boards**.

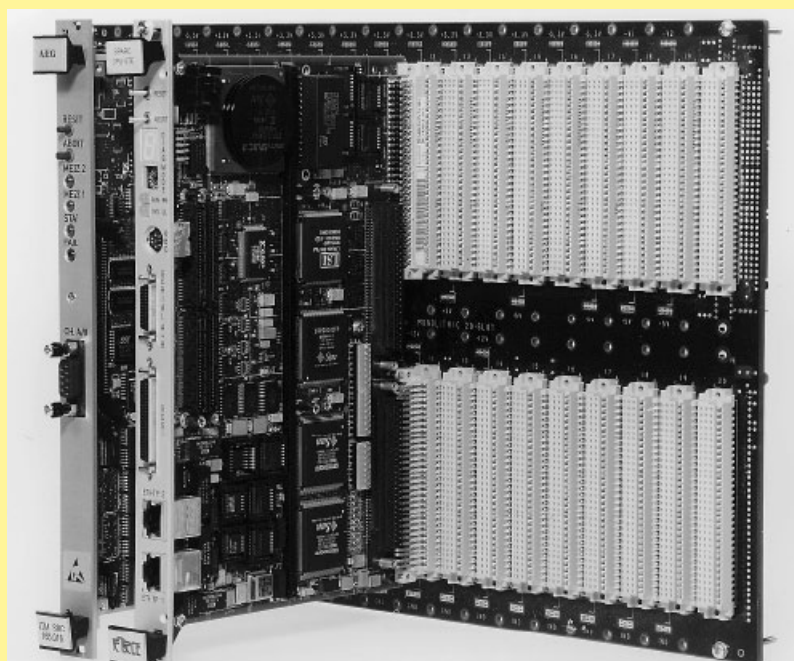
system description

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.

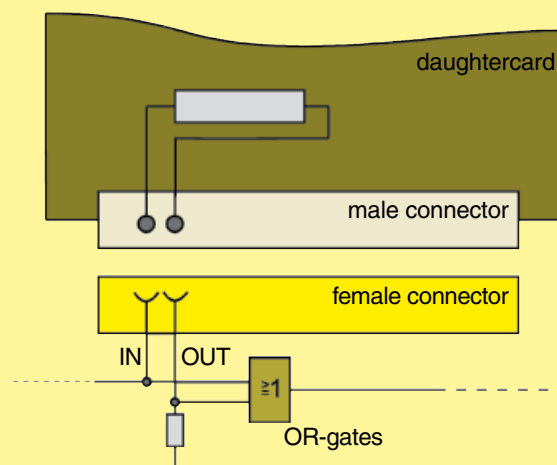
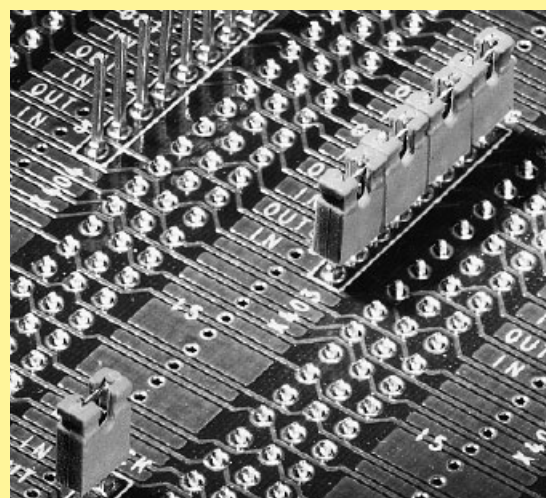
The VME protocol requests 5 daisy-chains on position 1 of every backplane.

These lines are defined to go through every daughter card.

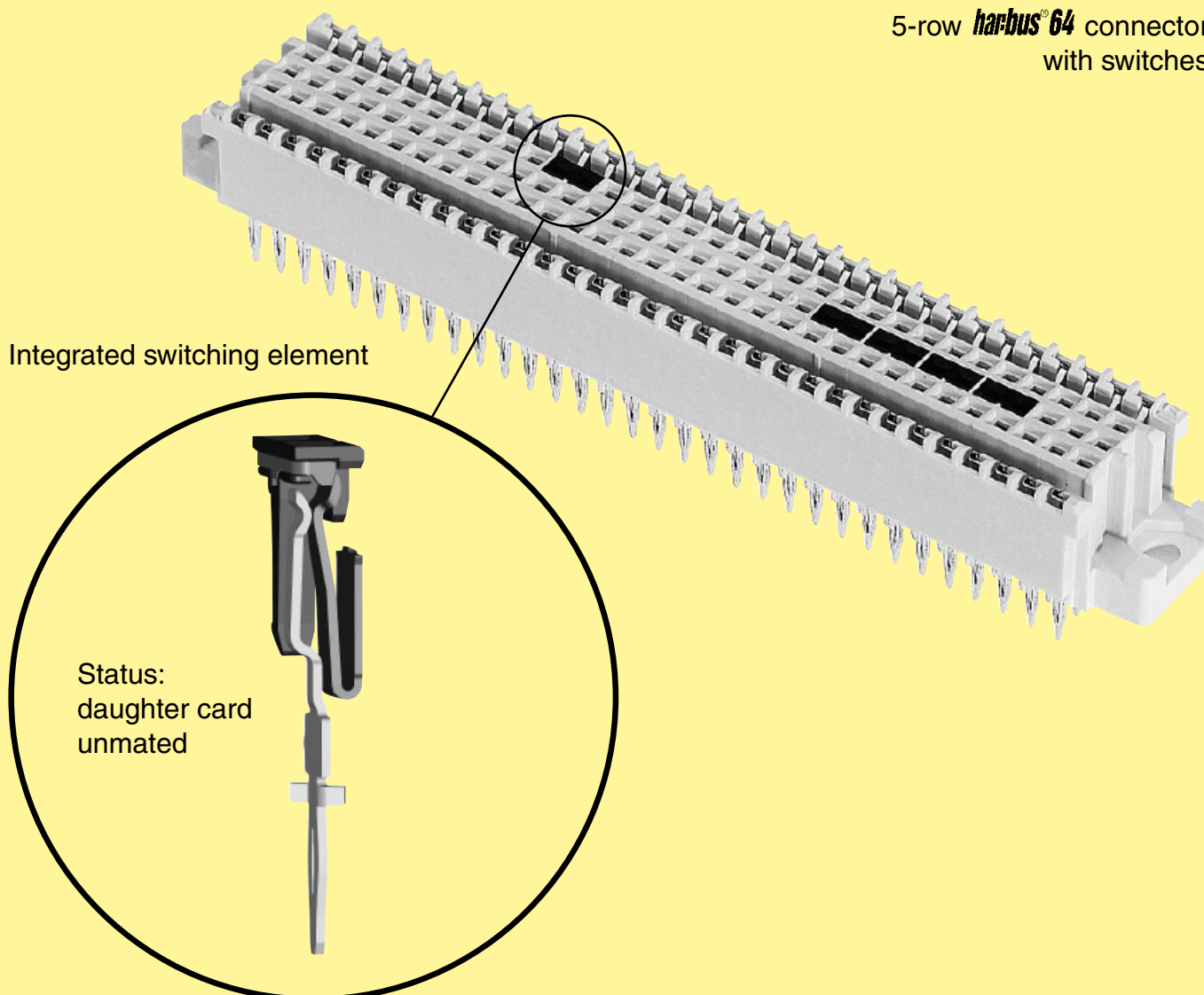
Therefore, in case of unloaded card slots the signal have to be bridged across the connector.

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 new 5-row *harbus*[®] 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 *har-bus*[®] 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

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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
for press-in termination
– 55 °C ... + 125 °C
– 40 °C ... + 105 °C
acc. to IEC 60512-11
During reflow soldering
max. + 240 °C for 20 s
for SMC 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

Contacts
Copper alloy

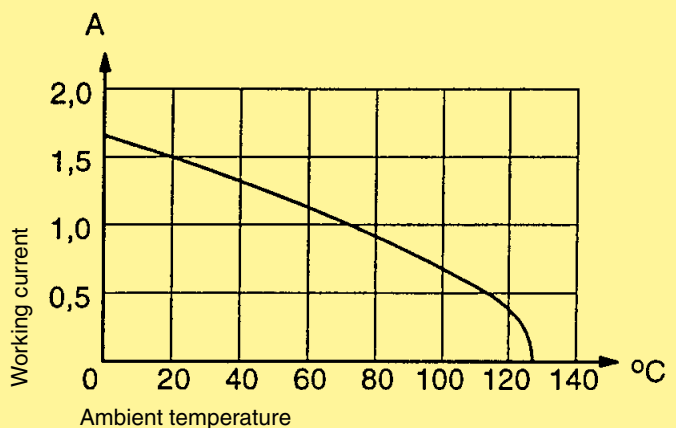
Contact surface

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 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 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 $\leq 180 \text{ N}$

Number of contacts

160

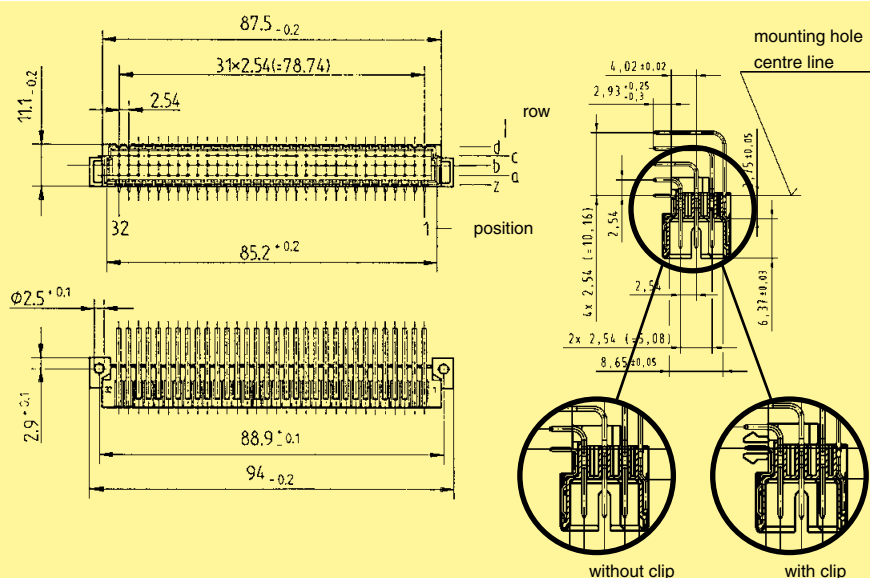


Male connectors, angled, SMC compatible

Identification	Number of contacts	Contact arrangement	Part No. 2	Performance levels according to IEC 61 076-4-113 Explanation chapter 00 1
Male connector*				
without retention clip	160	z, a, b, c, d	02 01 160 2101	02 01 160 1101 02 01 160 1105 ²⁾
with retention clip	160	z, a, b, c, d	02 01 160 2102	02 01 160 1102 02 01 160 1106 ²⁾

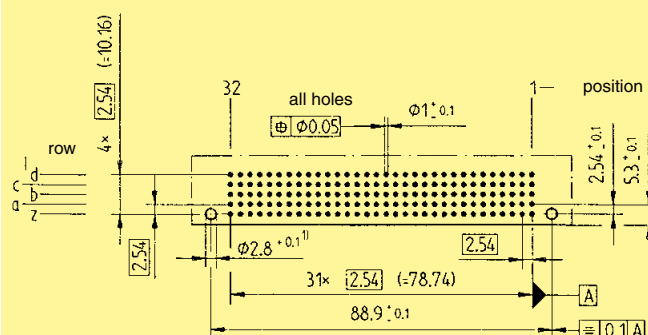
har-bus 64

Dimensions

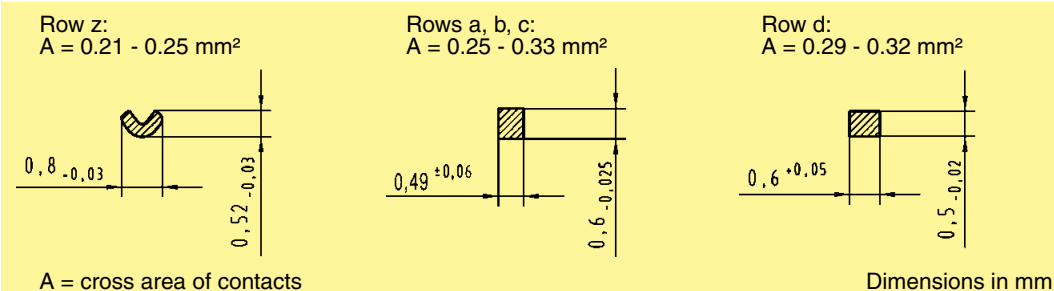


Board drillings

Mounting side



Cross section of solder terminations



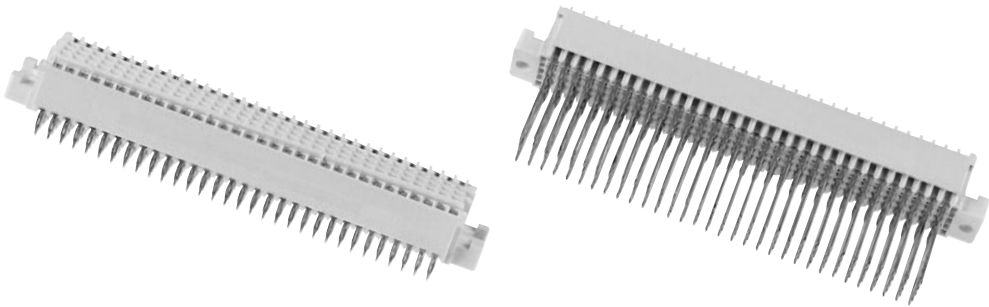
* Pre-leading contacts at positions d1, d2, d31 and d32

¹⁾ Recommendation for variants with clip: Drillings can be enlarged up to 3.1 mm ϕ to reduce standard mounting force (see chapter 00)

²⁾ Special variant with min. 1.27 μ m (50 pinch) Au and SnPb on termination

Number of contacts

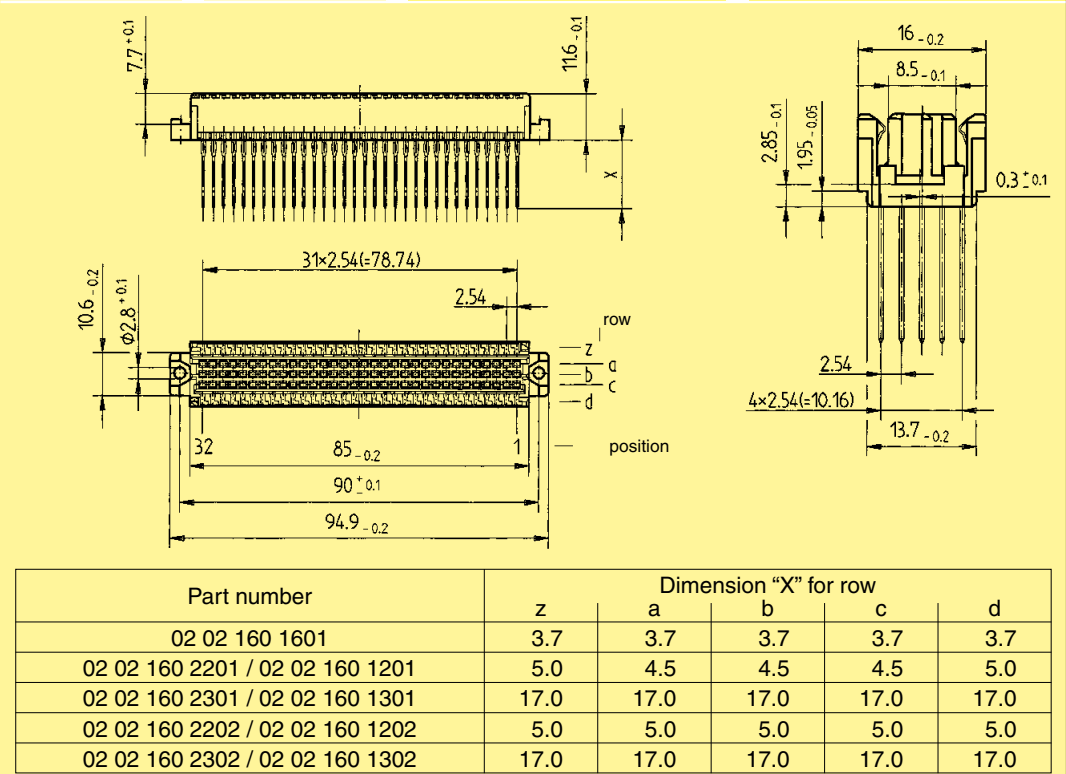
160



Female connectors

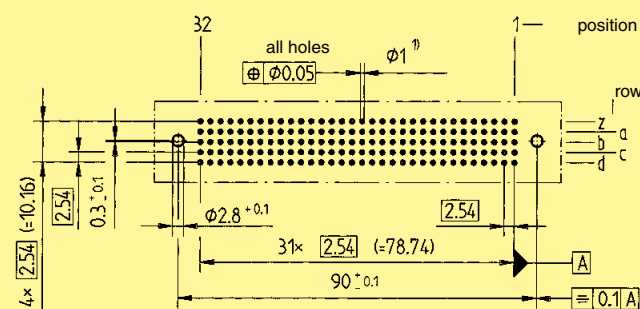
Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 61 076-4-113	
			2	Explanation chapter 00	
Female connectors, straight ²⁾ with press-in terminations				1	
	with 3.7 mm	z, a, b, c, d		02 02 160 1601	
	fixing flange 4.5/5 mm	z, a, b, c, d	02 02 160 2201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

Dimensions



Board drillings

Mounting side



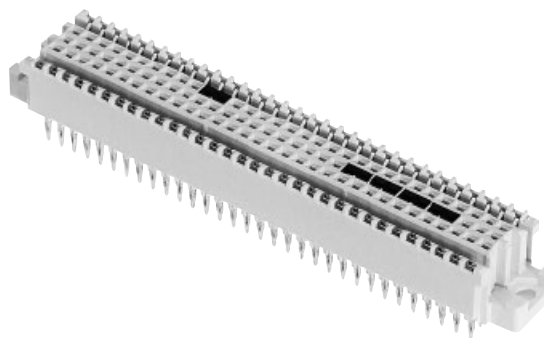
Dimensions in mm

Tooling see chapter 30

¹⁾ Press-in technology and refer to recommended configuration of pcb holes, see page 00.25

* selectively gold-plated

160



Identification		Number of contacts	Contact arrangement	Performance level 2 according to IEC 61 076-4-113 Explanation chapter 00	Part No.
Female connectors, straight with switches ²⁾					
with press-in terminations					
with flange	4.5/5 mm	160	z, a, b, c, d		02 03 160 2201

[illegible]

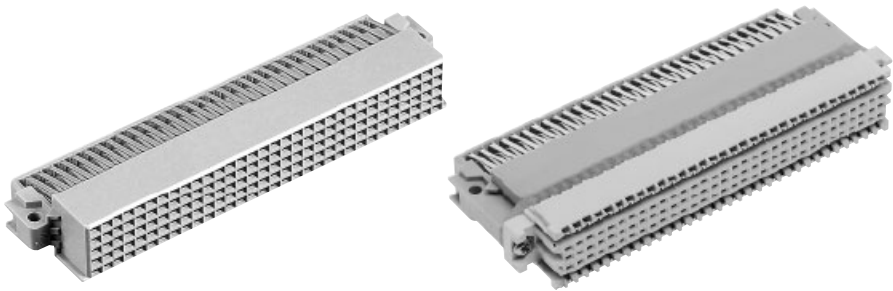
Technical drawing of a rectangular plate with a grid of holes. The plate has a width of 32 and a height of 1. The grid of holes is 31x25, with a pitch of 2.54 (78.74). The holes have a diameter of 2.8 and a tolerance of +0.1. The plate has a tolerance of 0.3 on the width and 0.1 on the height. The holes are located at a distance of 2.54 from the edges. The drawing includes a section line 'A-A' and a position line '1-1'.

02
13

Downloaded from Arrow.com.

Number of contacts

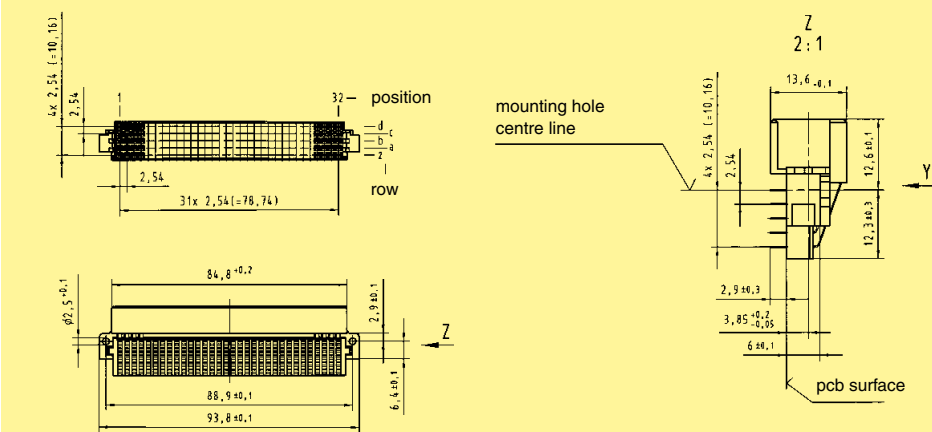
160



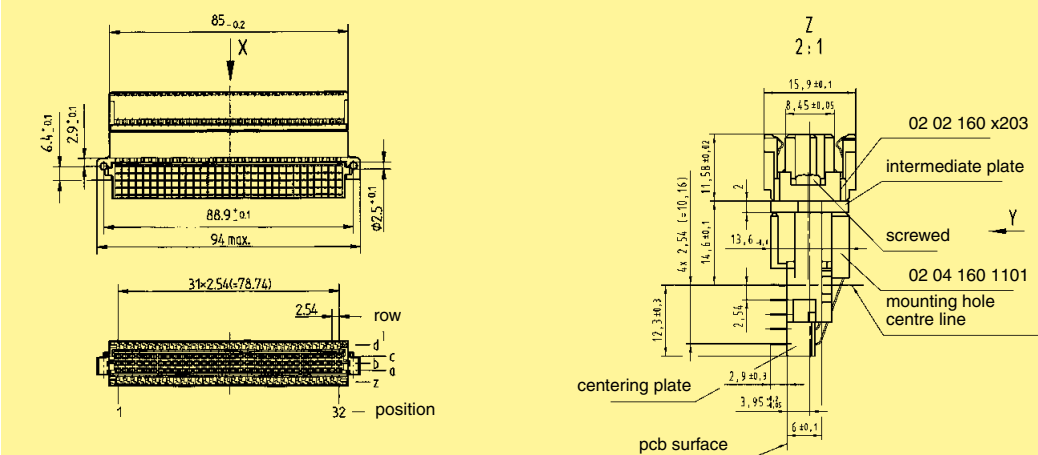
Female connectors

Identification	Number of contacts	Contact arrangement	Part No. Performance level 1 according to IEC 61076-4-113 Explanation chapter 00
Female connectors, angled with solder pins			
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

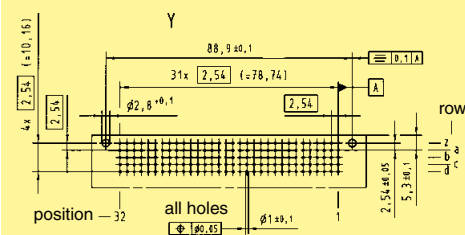
Dimensions
02 04 160 1101



Dimensions
02 07 160 1101



Board drillings
Mounting side

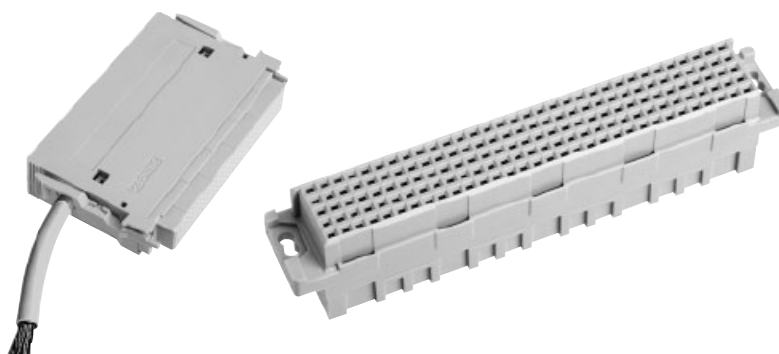


Dimensions in mm

Number of contacts

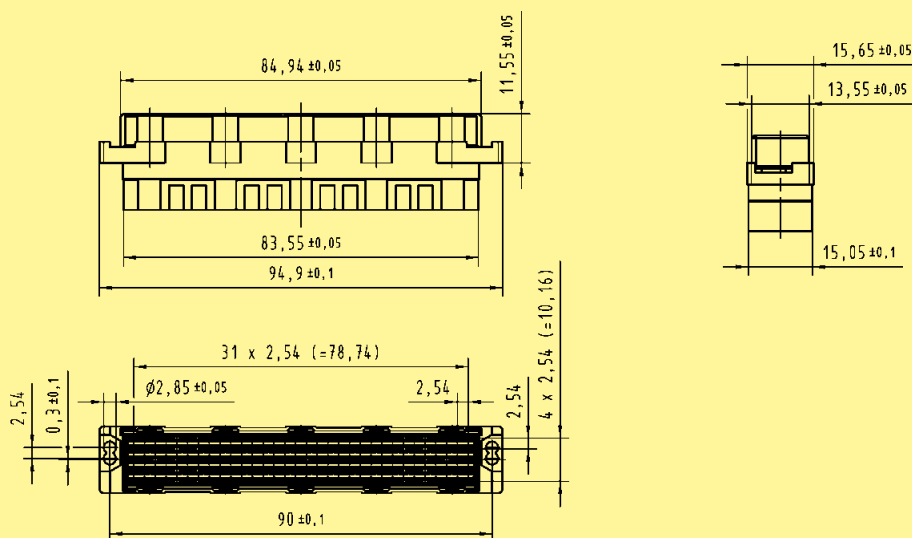
max. 160

Female connectors



Identification	Number of contacts	Contact-arrangement	Suitable for	Part No.
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

Dimensions

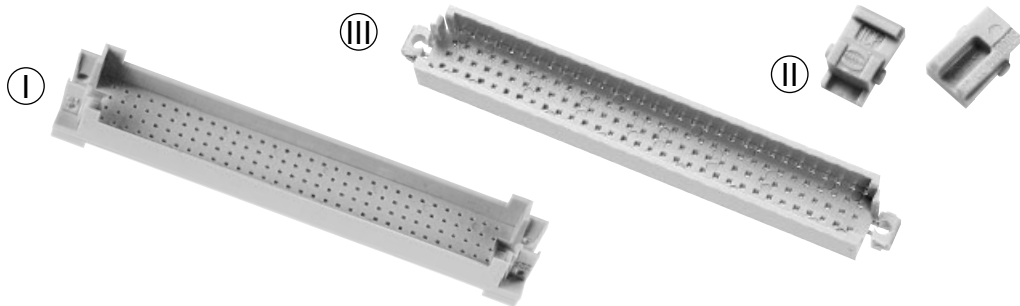


Identification	Part No.	Performance levels according to IEC 61076-4-113. Explanation chapter 00
	2	1
Female crimp contacts har-bus® 64		
Bandoliered contacts (approx. 5,000 pieces)	02 05 000 2511	02 05 000 1511
Bandoliered contacts (approx. 500 pieces)	02 05 000 2512	02 05 000 1512
Individual contacts 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

¹⁾ Packaging unit 1,000 pieces

Number of contacts

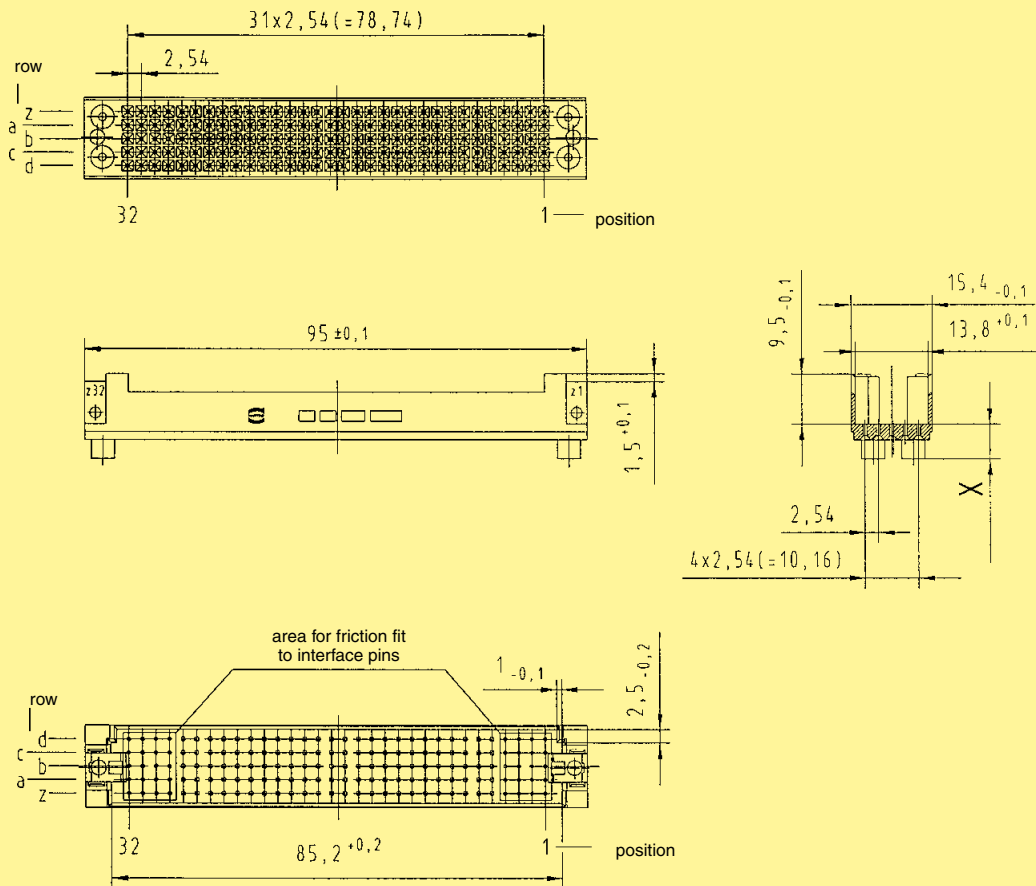
160



Pin shrouds

Identification	pcb-thickness ± 0.3	Dimension X - 0.1	Part No.
Pin shrouds ¹⁾			
I	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
II Fixing brackets for shell housing C ²⁾			02 44 000 0009
III Shroud insert for 3 row female connectors			02 44 000 0008

Dimensions



Dimensions in mm

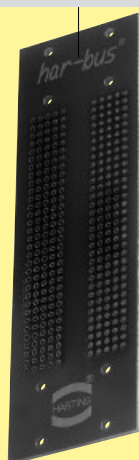
¹⁾ Insert block (02 09 000 0012) for assembly see chapter 30
²⁾ order 2 pieces per connector

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

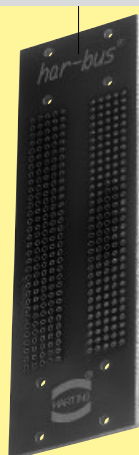
Locking lever
left 09 02 000 9902
right 09 02 000 9903

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

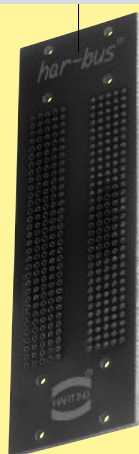


Application 3

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



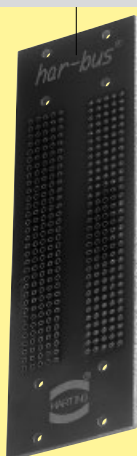
* Only for applications without rear P0-connector

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/U

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

DIN Power
up to 6 A

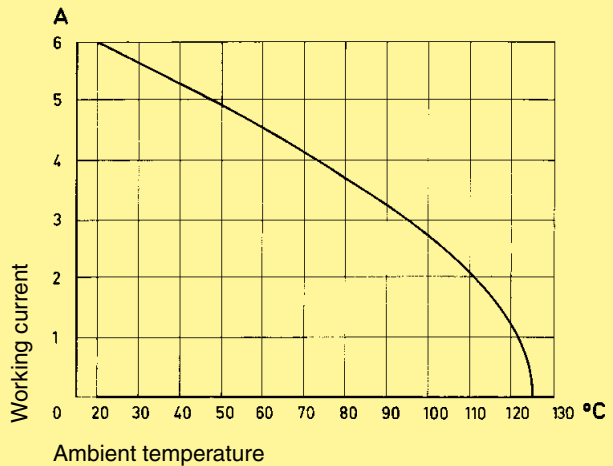
Number of contacts	Type D	32
	Type E	48
Contact spacing (mm)	Type D	5,08
	Type E	male connector 5.08 x 5.08 male connector 2.54 x 5.08 female connector 5.08 x 5.08
Working current	see current carrying capacity chart	6 A max. 1 A max. for female connector type E angled
Clearance	Types D and E	≥ 3.0 mm
	Type E male connector row separation 2.54 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		≥ 10 ¹² Ω for standard articles ≥ 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	– 55 °C ... + 125 °C – 40 °C ... + 105 °C for press-in connectors
Degree of protection for crimp terminal according to DIN 40 050		IP 20
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 mm ² Compliant press-in terminations PCB thickness Recommended PCB holes for press-in technology
Insertion and withdrawal force	32 way ≤ 40 N 48 way ≤ 75 N	
Materials	Mouldings	Thermoplastic resin, glass-fibre filled, UL 94-V0
Contacts		Copper alloy
Contact surface		Selectively gold plated according to performance level ¹⁾
Contact zone		

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 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

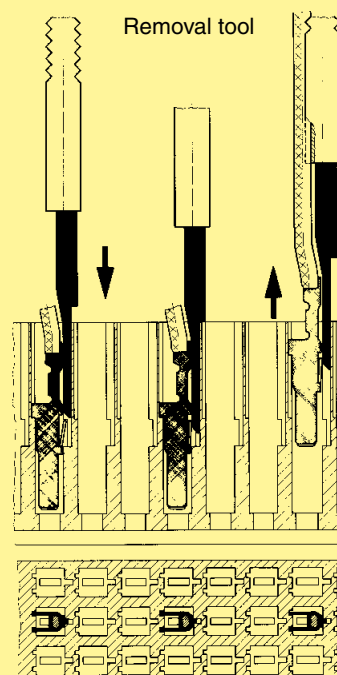


Fitting the crimp contacts

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



Male connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1	
Male connector with angled solder pins	SMC	32	09 04 132 7921	09 04 132 6921 09 04 132 6921 222 ^{f)} 09 04 332 6921 ^{b)} 09 04 632 6921 ^{c)}	09 04 132 2921 09 04 132 2921 222 ^{f)}	DIN Power up to 6 A
		32		09 04 332 6919 ^{b)d)}		
		30 + 2▲		09 04 132 6951 09 04 632 6951 ^{c)}	09 04 632 2951 ^{c)}	
Male connector with straight solder pins		32		09 04 132 6922		
		30 + 2▲		09 04 132 6952		
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

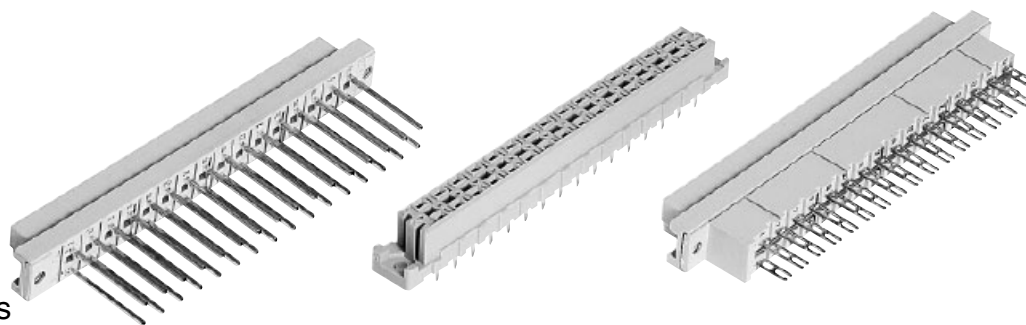
d) CTI > 400

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

Number of contacts

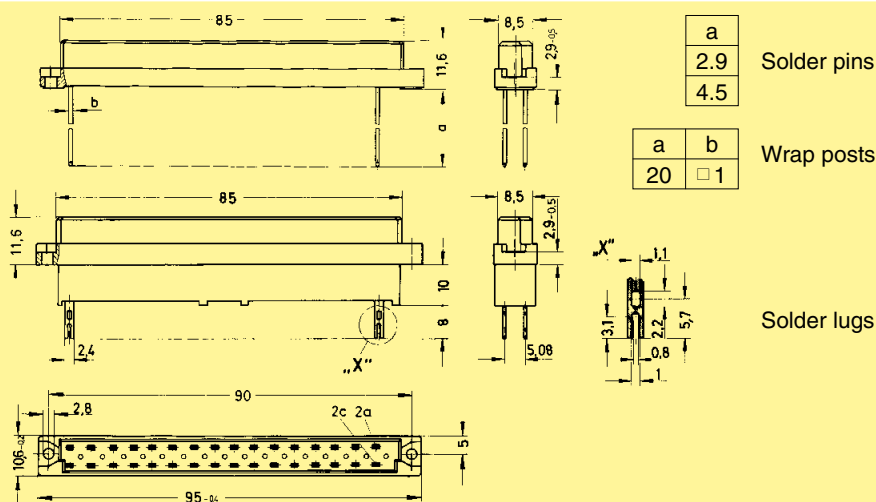
32

Female connectors

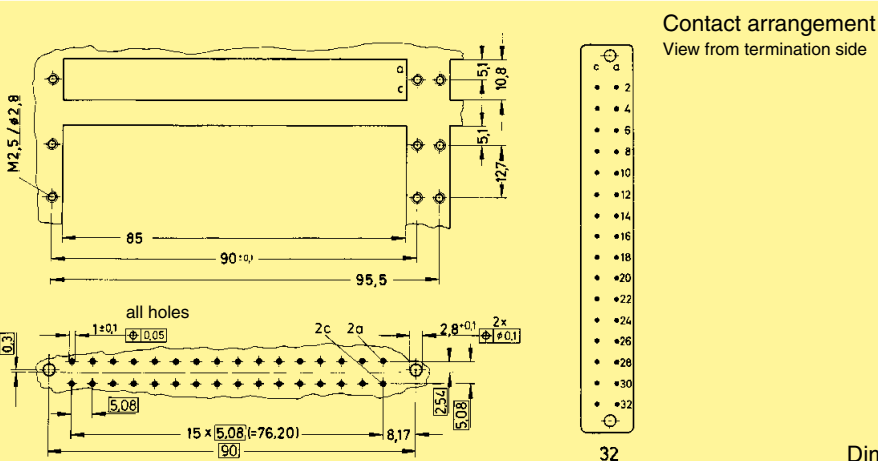
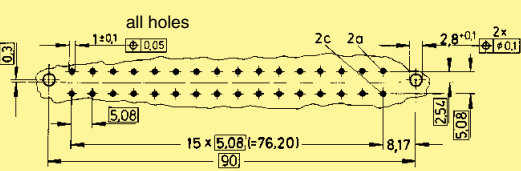


Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1	
Female connector with solder pins 2.9 mm	32		09 04 232 7832	09 04 232 6832 09 04 732 6832 ^{c)}	09 04 232 2832	
Female connector with solder pins 4.5 mm	32		09 04 232 7831	09 04 232 6831 09 04 232 6831 222 ^{f)} 09 04 332 6831 ^{b)} 09 04 732 6831 ^{c)}	09 04 232 2831 09 04 232 2831 222 ^{f)}	
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

Board drillings
Mounting side

Dimensions in mm

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

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

Number of contacts

32



Female connectors

Identification	Number of contacts	Contact arrangement	Part No.	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 6826 222 ^{f)}	09 04 232 2826
Dimensions					
Fixing bracket Metal			09 06 000 9912 ¹⁾		
Board drillings Mounting side					

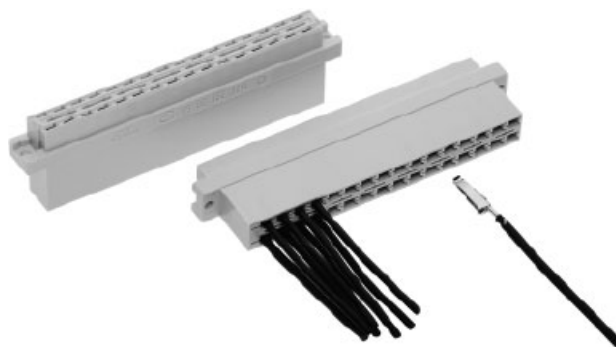
DIN Power
up to 6 A

Dimensions in mm

03
13^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

max. 32



Female connectors

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

Identification	Identification Wire gauge	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00
Female crimp FC contacts		2	1
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

Identification	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				
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				

¹⁾ Packaging unit 1,000 pieces²⁾ 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

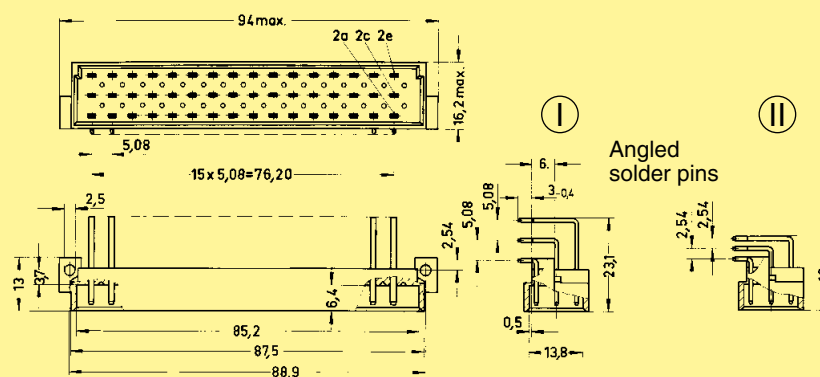
48



Male connectors

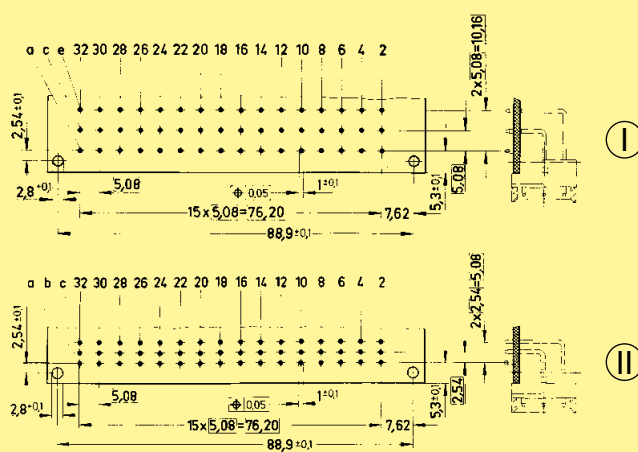
Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	1	
Male connector with angled solder pins Row separation termination side 5.08 mm (I) Row separation termination side 2.54 mm (II) SMC	48		09 05 148 7921	09 05 148 6921 09 05 148 6921 222 ^{f)} 09 05 348 6921 ^{b)} 09 05 648 6921 ^{c)} 09 05 848 6921 ^{b)c)}	09 05 148 2921 09 05 148 2921 222 ^{f)} 09 05 648 2921 ^{c)}	DIN Power up to 6 A
	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

▲ Male connectors with 2 leading contacts [(0.8 mm) pos. a2 and a32]

Other contact arrangements on request

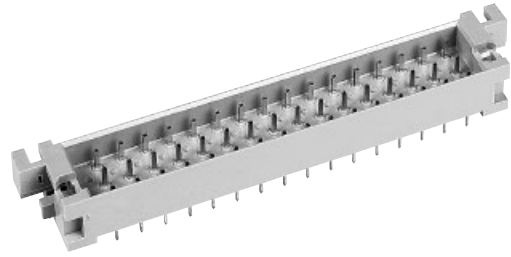
b) Connectors with snap-in clips see chapter 00

c) Connectors with coding see chapter 00

d) CTI > 400

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

48



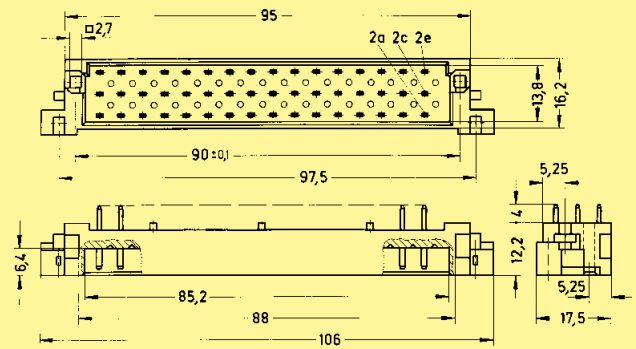
Identification

Part No.

Dimensions in mm

48

09 05 048 6924^{f)}



Technical drawing of a mechanical part, likely a bracket or support, showing dimensions and a cross-section.

Dimensions:

- Overall width: 106.5
- Main body width: 85.2
- Cutout width: 10.2
- Flange width: 16.4
- Flange thickness: 5.35
- Central hole diameter: 10.2
- Flange thickness (cross-section): 5.35
- Overall height: 17.78
- Central hole diameter (cross-section): 10.2

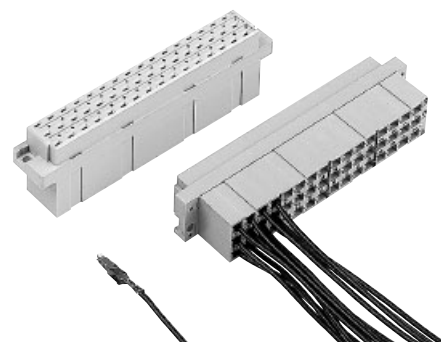
Note: M2,5/ø2,8 (Screw size)

Technical drawing of a 15x508-76,20 plate. The drawing shows a rectangular plate with a grid of 15 columns and 20 rows of holes. The overall dimensions are 15 x 508-76,20. The hole pitch is 5,08. The plate has a thickness of 0,3. The drawing includes a detail view of the hole and a reference to M 2.5 DIN EN ISO 4032. Dimensions shown include 32, 30, 28, 26, 24, 22, 20, 18, 16, 14, 12, 10, 8, 6, 4, 2, 2,54, 5,08, 5,08, 2x5,08-10,16, 8,17, 15 x 5,08-76,20, 90±0,1, 1±0,1, 2,8±0,1, 6,2, and 5,08.

Number of contacts

max. 48

Female connectors



Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Female connector for crimp contacts Order contacts separately	48	09 05 048 3202 ¹⁾ 09 05 548 3202 ²⁾	85, 84, 13,6, 11,6, 14,8, 15,1, 2,8^{+0/-0,1}, 50^{+0/-0,1}, 2e, 2c, 2a, 2x5,08=10,16, 5,08, 15x5,08=76,20, 8,17, 95^{+0/-0,4}, 15,7^{+0/-0,2}, 5 Contact arrangement View from termination side Shell housing 09 05 048 0501 see chapter 20	

DIN Power
up to 6 A

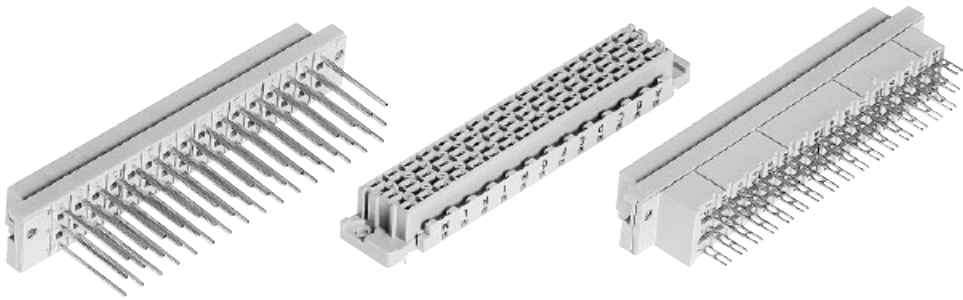
Identification	Identification Wire gauge	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00
Female crimp FC contacts		2	1
Bandoliered contacts (approx. 2,500 pieces)	1 2 3	09 06 000 6484 09 06 000 6481 09 06 000 6482	09 06 000 6474 09 06 000 6471 09 06 000 6472
Bandoliered contacts (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

Identification	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				
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

^{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

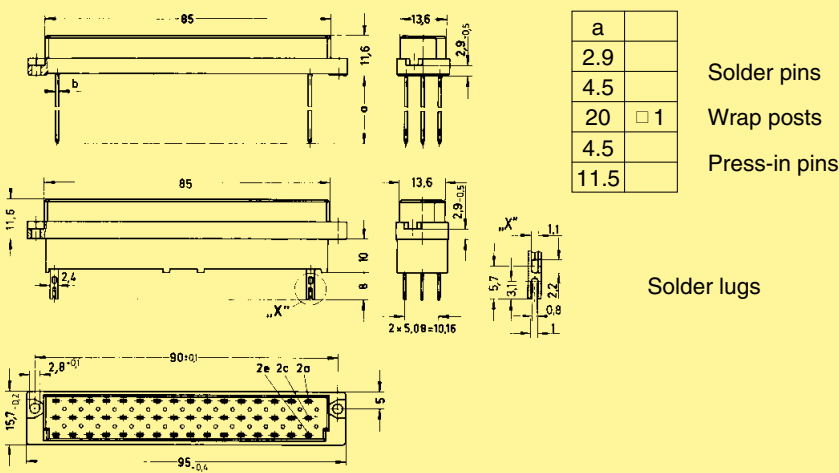


Female connectors

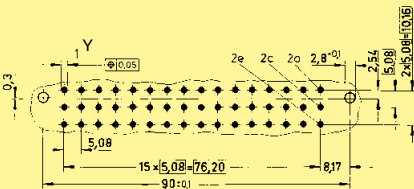
DIN Power
up to 6 A

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00		
			3	2	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 05 248 2831 222 ^{f)} 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 6851 222 ^{*f)}	09 05 248 2851*	

Dimensions



Board drillings
Mounting side



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

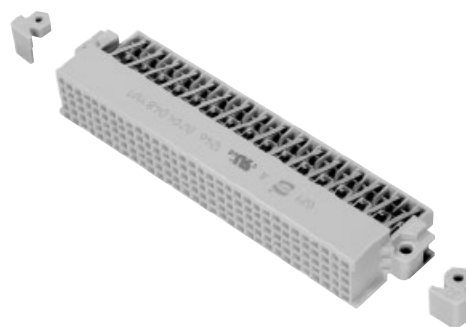
Dimensions in mm

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

Number of contacts

48

Female connectors



Identification

Part No.

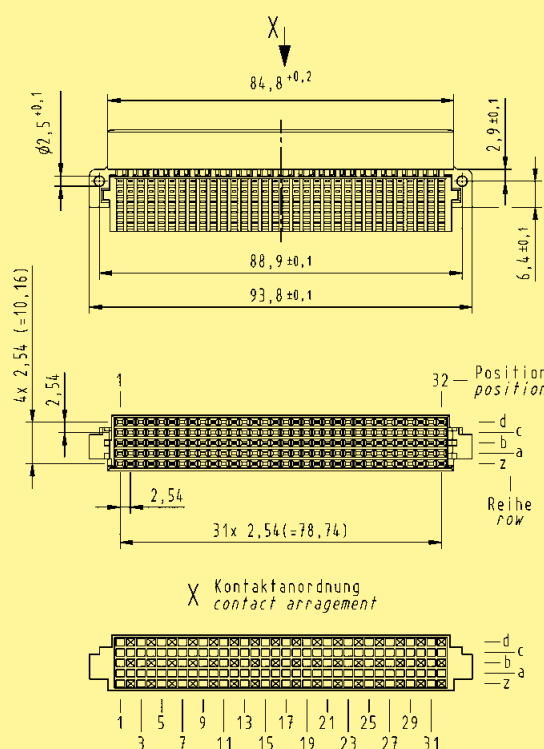
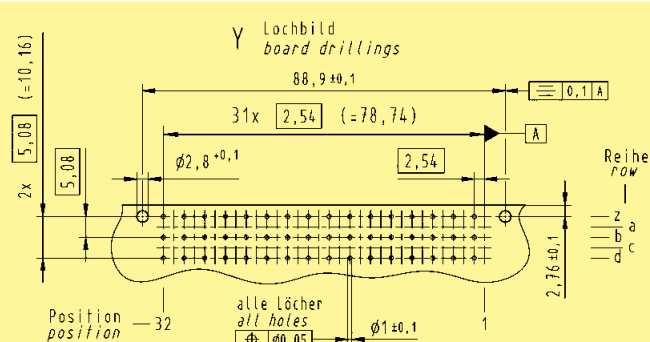
Drawing

Dimensions in mm

Female connector
with angled
solder pins

Performance
level 1

02 04 048 1101


Board drillings
Mounting side


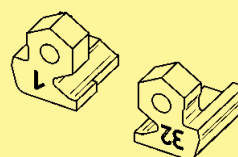
Fixing bracket

Position 1

Position 32

02 09 000 0018

02 09 000 0017



Dimensions in mm

DIN Power
up to 6 A

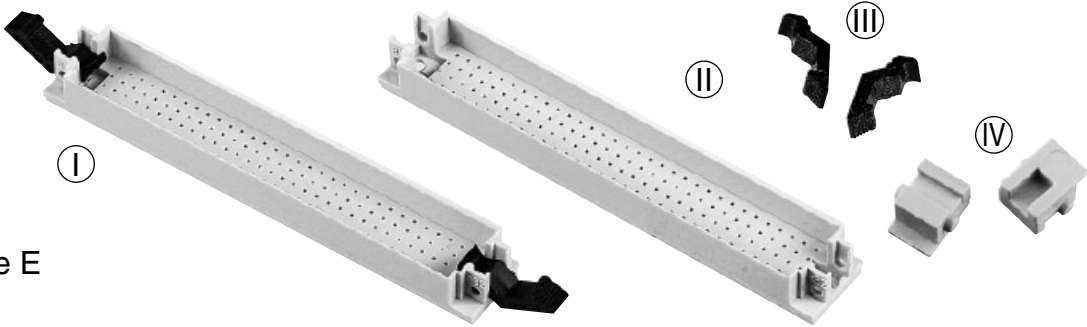
Pin shroud



Number of contacts

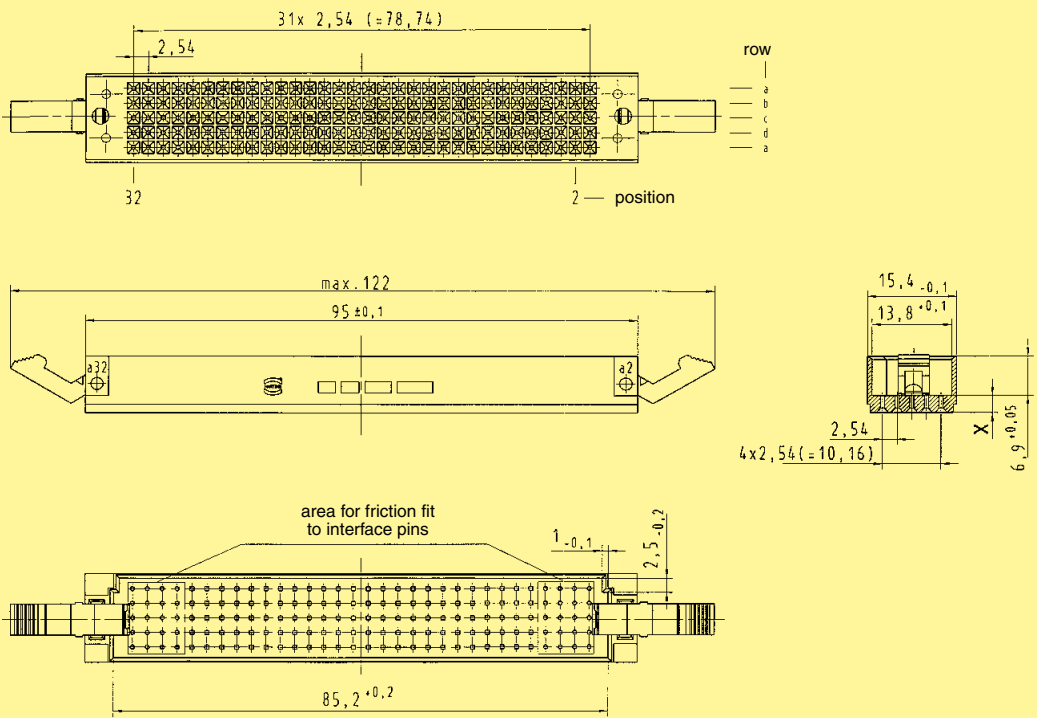
48

Pin shrouds for type E
with press-in pins



Identification	pcb-thickness + 0.2 / - 0.3	Dimension X - 0.1	Part No.
Pin shrouds			
I with locking levers	2.8	3.6	09 05 000 9924
II without locking levers	2.8	3.6	09 05 000 9914 ¹⁾
I with locking levers	3.4	3.0	09 05 000 9922
II without locking levers	3.4	3.0	09 05 000 9912 ¹⁾
III Locking lever for female connector type E ¹⁾			09 03 000 9914
IV Fixing brackets for shell housing C ¹⁾			09 03 000 9921 ¹⁾

Dimensions



Dimensions in mm

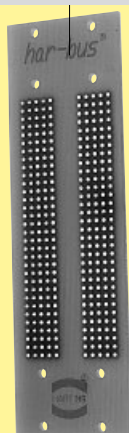
¹⁾ order 2 pieces per connector
²⁾ Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Application 1

Female connector
09 05 248 6851



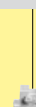
Backplane



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

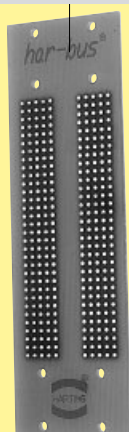


Application 2

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



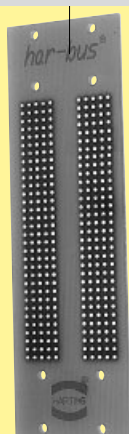
DIN Power
up to 6 A

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



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.

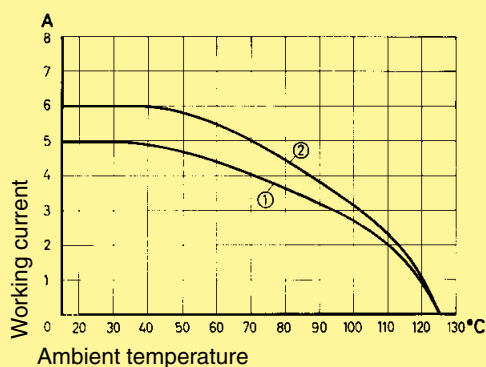
After crimping they can be easily inserted into the chambers of the connector body with the aid of an insertion tool. Insertion errors can be simply rectified with the use of a removal tool.

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.

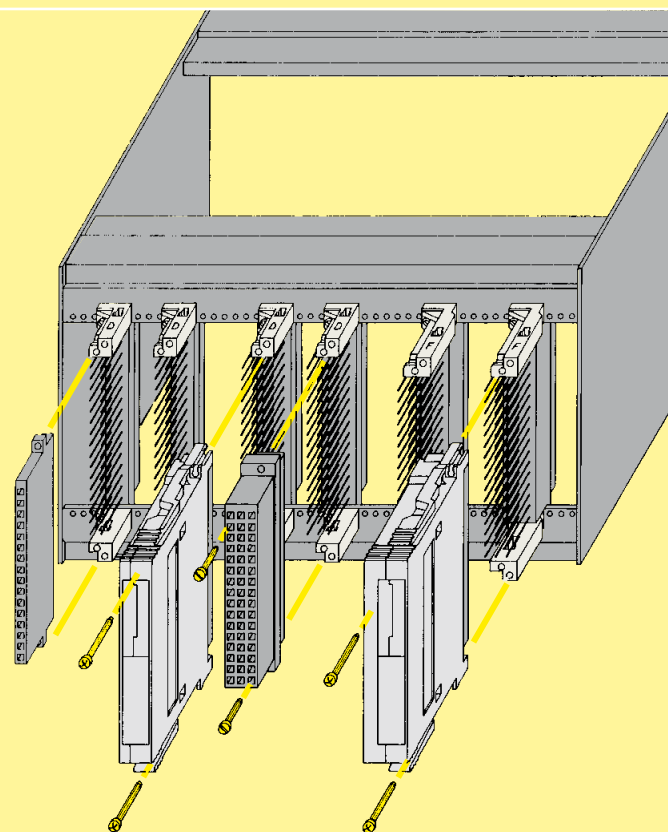
Current carrying capacity

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



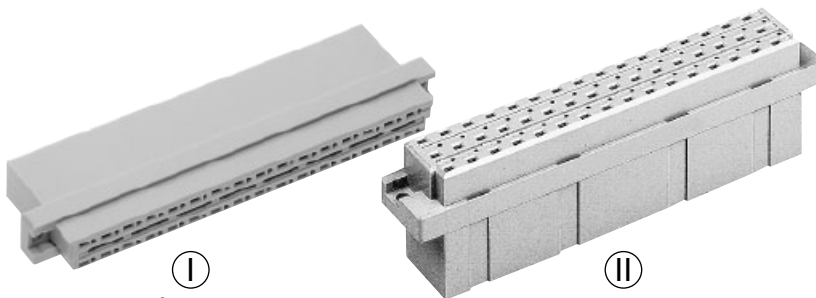
① with shell housing ② without shell housing



Piggyback connectors

Number of contacts

max. 48



Piggyback connectors for 1 x 1 mm wrap posts

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Piggyback connector for crimp contacts Order contacts separately I	16	09 04 016 3201 ¹⁾		
	32	09 04 032 3215 ¹⁾		
	48	09 05 048 3204 ¹⁾		

DIN Power up to 6 A

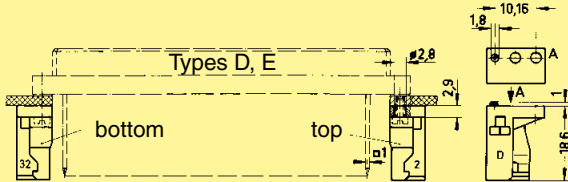
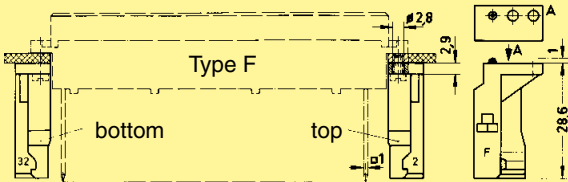
¹⁾ Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

max. 48



Accessories

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Female FC crimp contacts				
individual contacts ¹⁾	FC1	09 06 000 6464	Identi- fication	Wire gauge mm ²
	FC2	09 06 000 6461		AWG
	FC3	09 06 000 6462		Insulations ø mm
Bandoliered contacts			1	0.09-0.25
	FC1	09 06 000 6454	2	0.14-0.56
(approx. 2,500 pcs.)	FC2	09 06 000 6451	3	0.50-1.50
	FC3	09 06 000 6452		
			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	
				
Distance fixing brackets for female connectors				
Type D		top (pos. 2)		
Type E		09 04 000 9907 ¹⁾		
		bottom (pos. 32)		
		09 04 000 9906 ¹⁾		
Type F		top (pos. 2)		
		09 06 000 9936 ¹⁾		
		bottom (pos. 32)		
		09 06 000 9937 ¹⁾		

DIN Power
up to 6 A

¹⁾ Packaging unit 1,000 pieces
²⁾ Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

DIN Power
up to 6 A

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 m Ω
Insulation resistance	$\geq 10^{12}$ 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 SMC connectors

Electrical termination

Solder pins for pcb connections $\varnothing 1 \pm 0.1$ 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 $\varnothing 1.6 \pm 0.1$ 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

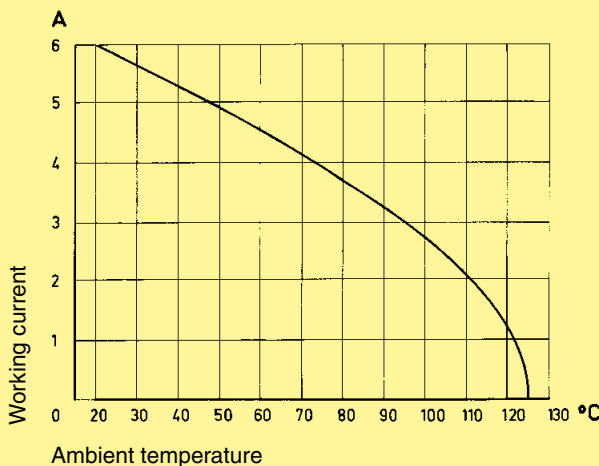
Mouldings	Thermoplastic resin, glass-fibre filled, UL 94-V0
Contacts	Copper alloy
Contact surface	Selectively plated according to performance level ¹⁾
Contact zone	

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 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

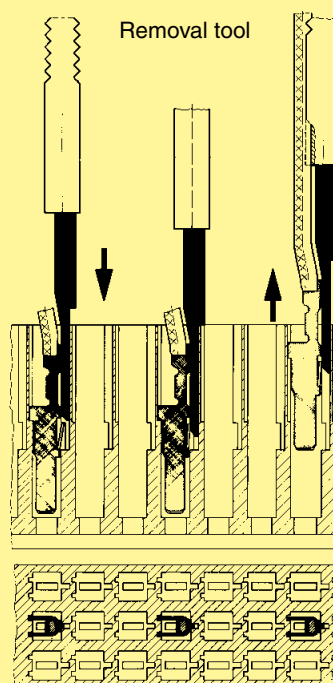


Fitting the crimp contacts

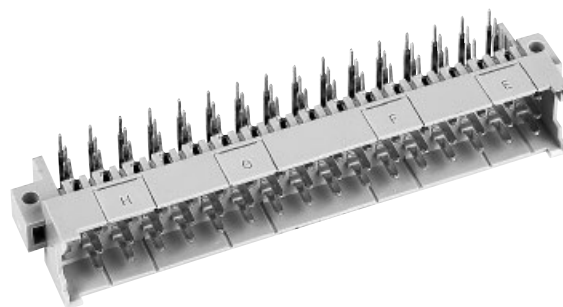
After crimping the wires onto the contacts with the help of a crimping tool or an automatic crimping machine the contacts should be correctly oriented and inserted into the cavities of the connector moulding in the required configuration. They snap into position and are firmly held in place. A light 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



Male connectors

**DIN Power
up to 6 A**

[illegible]

 Cross area (A) of contacts row z, b, d: A = 0.29 - 0.34 mm²

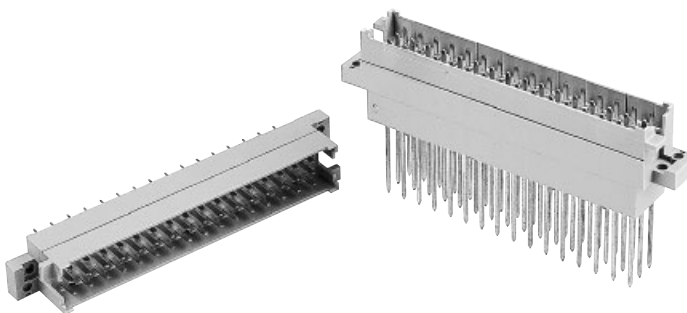
Dimensions in mm

1) With shroud coding, see also chapter 00
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

Interface connectors I



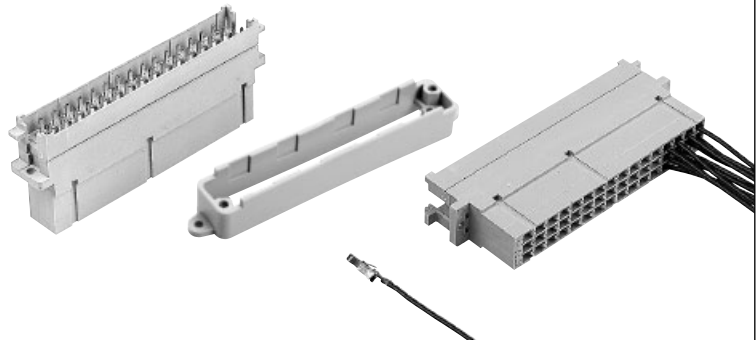
Identification	Number of contacts	Contact arrangement	Part No.	Drawing	Dimensions in mm
Interface connector I with solder pins ¹⁾ 0.6 x 0.6 mm	48		Performance level 1* 09 06 048 2905 ^{f)}		
	32		09 06 032 2905 ^{f)}		
	32		09 06 032 2941 ^{f)}		
Board drillings Mounting side					
Interface connector I with wrap posts ¹⁾ 1 x 1 mm			Performance level 1*		
without nut	48		09 06 048 2903 ^{f)}		
with nut	48		09 06 048 2963 ^{f)}		
without nut	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



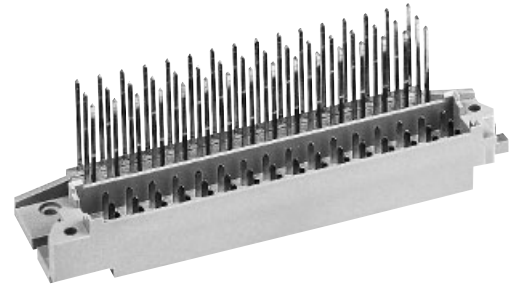
Interface connector I

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Interface connector I utilising female crimp contacts ¹⁾ Order crimp contacts separately see page 03.31	48	Performance level 1 acc. to IEC 60 603-2 09 06 048 2906 ¹⁾	 Contact arrangement View from termination side 	
Shell housing see chapter 20				
Panel cut out				
Shroud ¹⁾ 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

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

48



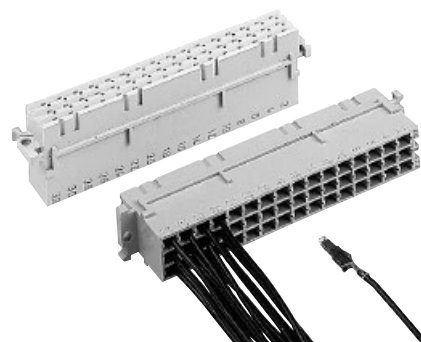
Interface connector U

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Interface connector U with wrap posts 1 x 1 mm	48	Performance level 1 acc. to IEC 60 603-2 09 06 048 2981 ¹⁾	Technical drawing of the interface connector U. The top view shows a rectangular component with dimensions: 106,5^{+0,2} x 15,2. The side view shows a height of 15,2 and a width of 15,2. The drawing includes details of the wrap posts and mounting holes.	
Mounting example			Technical drawing showing the mounting example of the interface connector U. The drawing illustrates the connector's placement on a PCB, with dimensions for the mounting area and the connector's footprint. The drawing includes labels for the connector's dimensions and the mounting area.	

Number of contacts

max. 48

Female connectors



Identification	Number of contacts	Part No.	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

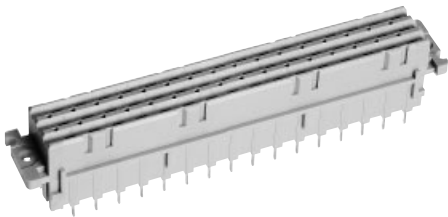
Identification	Identification Wire gauge	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00
Female crimp FC contacts		2	1
Bandoliered contacts (approx. 2,500 pieces)	1	09 06 000 6484	09 06 000 6474
	2	09 06 000 6481	09 06 000 6471
	3	09 06 000 6482	09 06 000 6472
Bandoliered 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

Identification	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				
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⁾ With shroud coding, see also chapter 30²⁾ 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

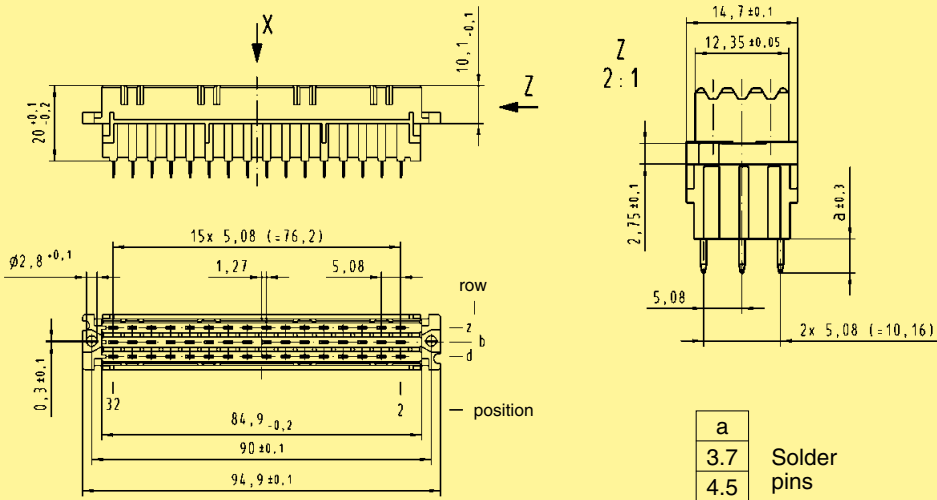
48, 32



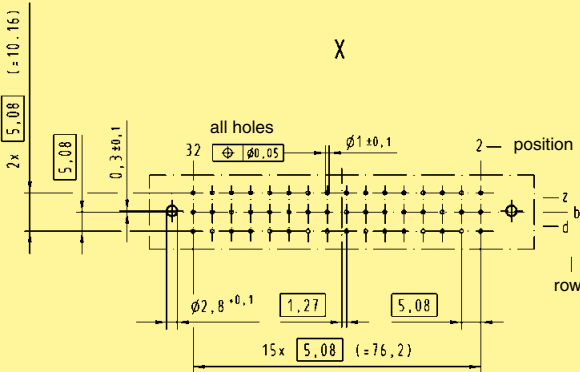
Female connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60 603-2. Explanation chapter 00		
			3	2	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 6835 222 ^{f)}	09 06 248 2835	
	32			09 06 232 6835	09 06 232 2835	
	32			09 06 232 6845	09 06 232 2845	

Dimensions



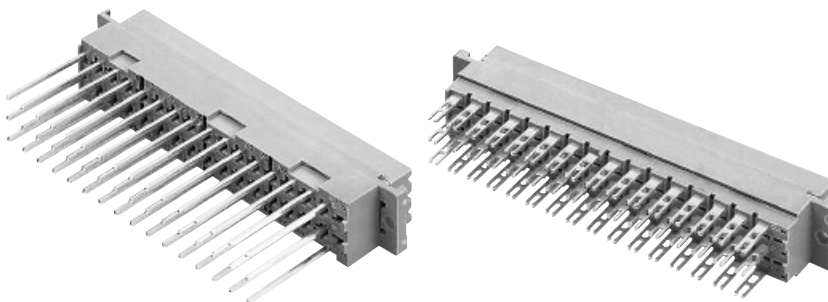
Board drillings
Mounting side



Dimensions in mm

¹⁾ With shroud coding, see also chapter 00
^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

48, 32

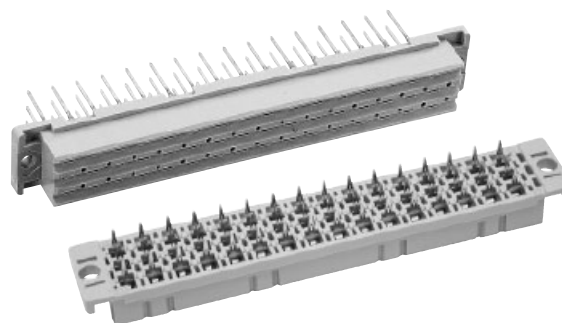


Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60 603-2. Explanation chapter 00	
			3	2	1
Female connector with wrap posts 22 mm	48		09 06 248 7821	09 06 248 6821 09 06 248 6821 222 ^{h)}	09 06 248 2821 09 06 248 2821 222 ^{h)}
	32		09 06 232 7821	09 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	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 6843 222 ^{h)}	09 06 232 2843
Dimensions					
Panel cut out					

DIN Power
up to 6 A

Number of contacts

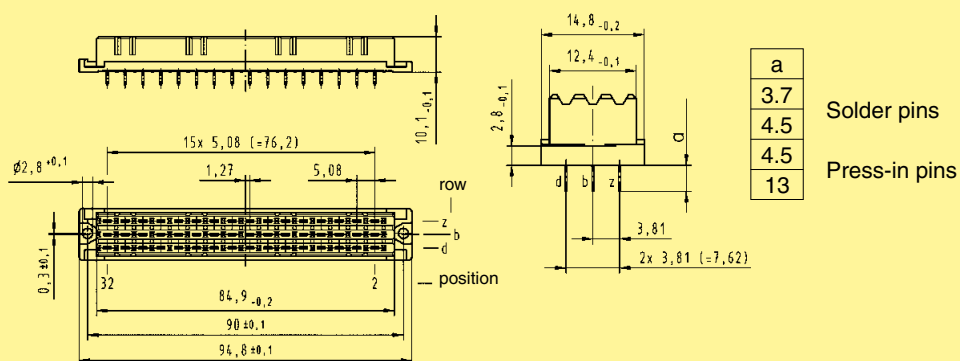
48, 32



Female connectors

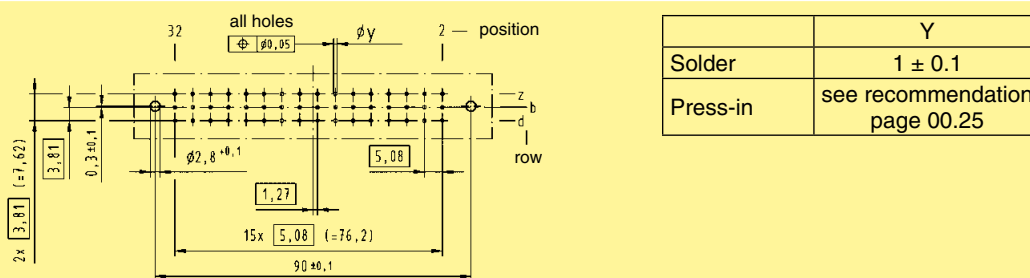
Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60 603-2. Explanation chapter 00		
			3	2	1	
Female connector ¹⁾ "low profile" with solder pins 3.7 mm	48		09 06 248 7833	09 06 248 6833 09 06 248 6833 222 ^{f)}	09 06 248 2833 09 06 248 2833 222 ^{f)}	
	32			09 06 232 6833		
	32			09 06 232 6893		
Female connector ¹⁾ "low profile" with solder pins 4.5 mm	48			09 06 248 6834 09 06 248 6834 222 ^{f)}	09 06 248 2834	
	32			09 06 232 6834		
	32		09 06 232 7894	09 06 232 6894	09 06 232 2894	
Female connector ¹⁾ "low profile" with press-in pins 4.5 mm	48		09 06 248 7832	09 06 248 6832	09 06 248 2832 09 06 248 2832 222 ^{f)}	
	32			09 06 232 6832	09 06 232 2832	
	32			09 06 232 6892	09 06 232 2832 222 ^{f)}	
Female connector "low profile" with press-in pins 13 mm	48			09 06 248 6837 ^{w)} 09 06 248 6838*		
	32			09 06 232 6897 ^{w)}		

Dimensions



Board drillings

Mounting side



Dimensions in mm

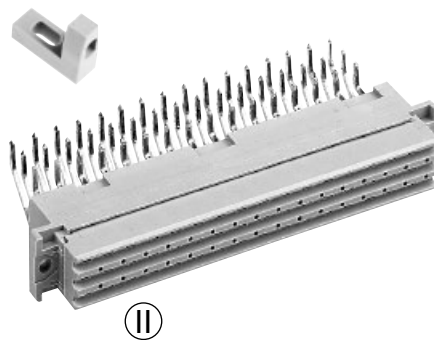
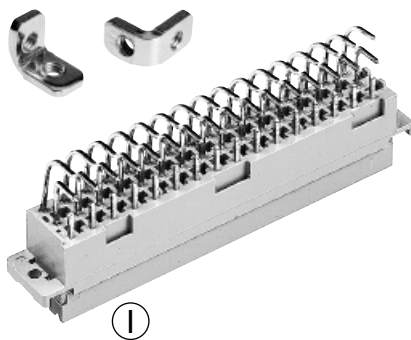
* Wrap posts for interfacing selectively gold plated (performance level 2)

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, 32

Female connectors



Identification			Part No.	Performance levels according to IEC 60 603-2. Explanation chapter 00	
Number of contacts			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				
		48			
	32				
		32			
	32				
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DIN Power
up to 6 A

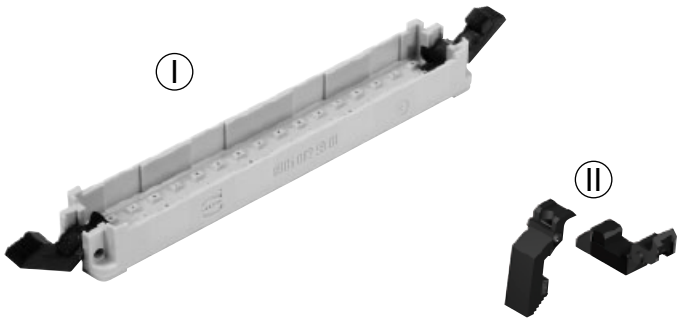
Pin shroud



Number of contacts

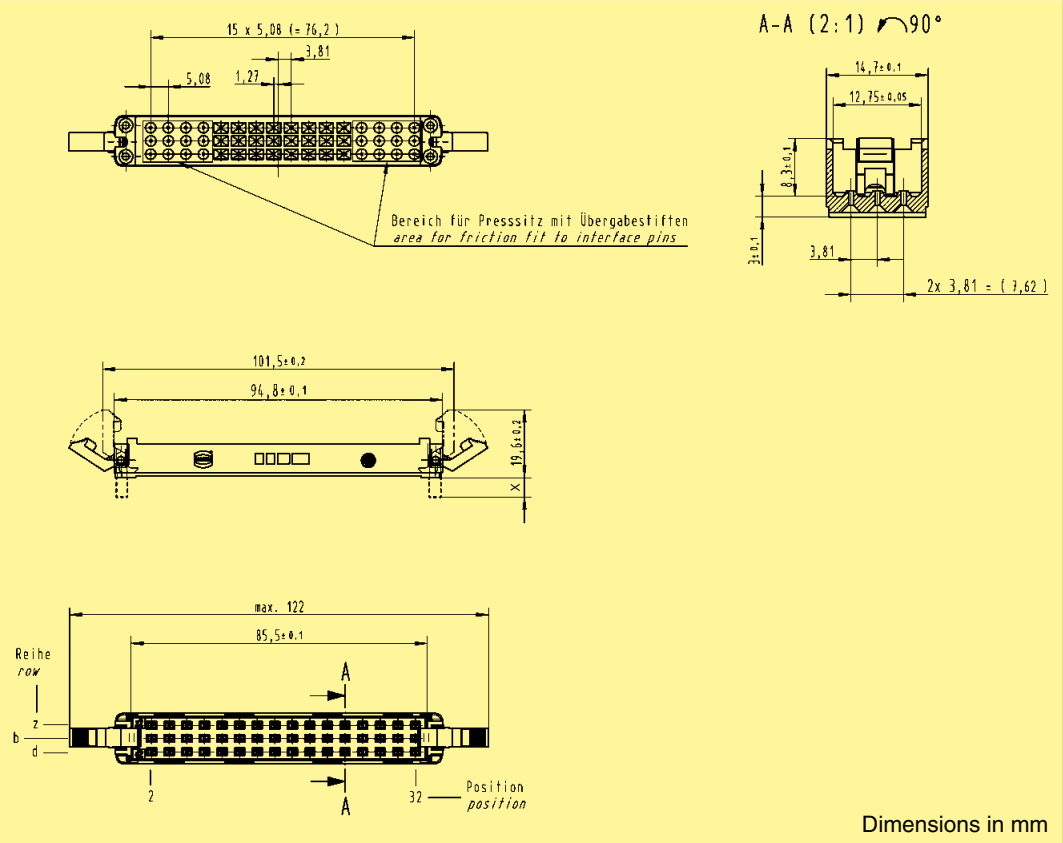
48

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



Identification	pcb-thickness ± 10 %	Dimension X ± 0.1	Part No.
Pin shrouds			
I with locking levers ²⁾ and press-in fixing	1.6 - 2.4	1.6	09 06 002 9902
I without locking levers for screw fixing	1.6 - 2.4	1.6	09 06 002 9912
I with locking levers ²⁾ and press-in fixing	3.2 - 4.0	0	09 06 002 9901
I without locking levers for screw fixing	3.2 - 4.0	0	09 06 002 9911
II Locking lever for female connector type F ¹⁾			09 06 001 9946

Dimensions



Dimensions in mm

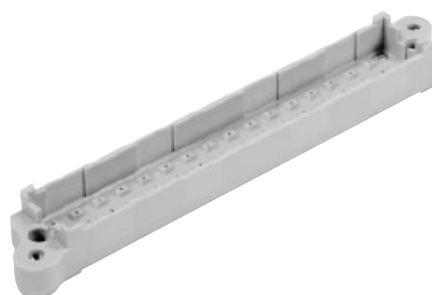
DIN Power
up to 6 A

03
36

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



**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

3+0,1

14,7±0,1

12,75±0,05

8,3±0,1

3,81

2x 3,81 = (7,62)

B-B (2:1) 90°

5,8±0,15

8,6±0,05

0,3±0,1

Reihe
row

z

b

d

2

32

Position
position

03
37

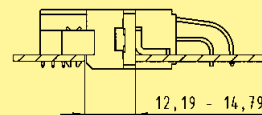
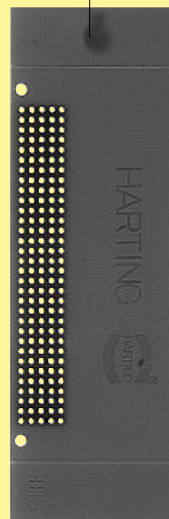
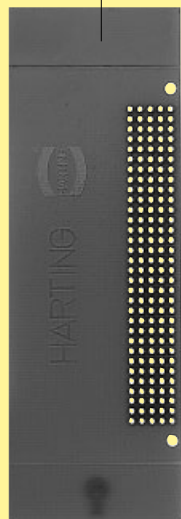
Application 1

Daughtercard

Male connector
09 06 148 6901

Female connector
09 06 248 6826

Daughtercard



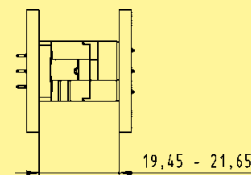
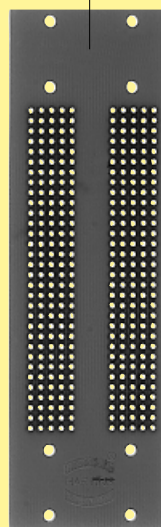
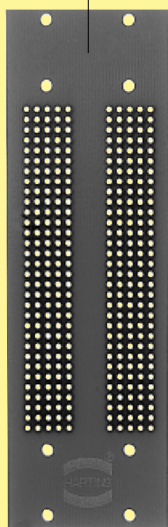
Application 2

Backplane

Male connector
09 06 048 2905

Female connector
09 06 248 2833

Backplane

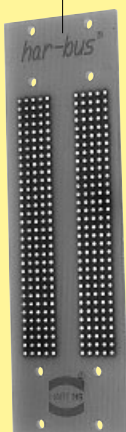


Application 3

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

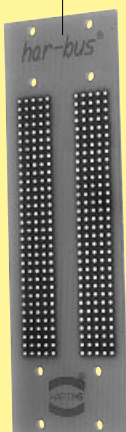
DIN Power
up to 6 A

Application 4

Female connector
09 06 248 6838



Backplane



Pin shroud
+ Locking lever
09 06 002 9901



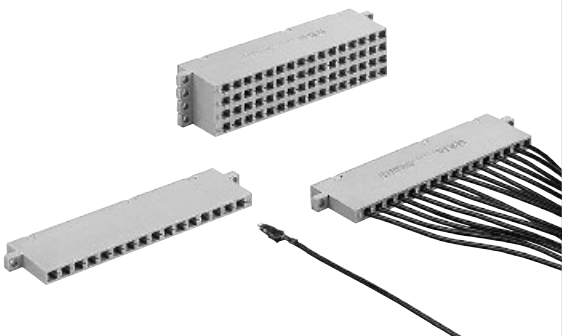
Female connector
for crimp contacts
09 06 248 3201



Number of contacts

64, 16

Universal adaptors



DIN Power
up to 6 A

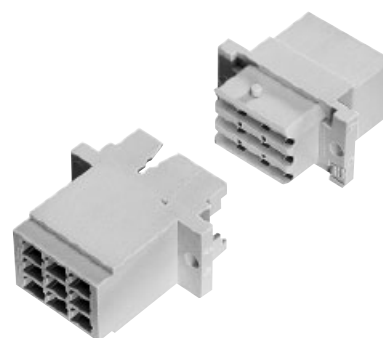
Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Universal adaptor utilising crimp contacts crimp contacts see page 03.31	4 x 4	09 06 016 3301 ¹⁾		
	16 x 1	09 06 016 3302 ¹⁾		
	16 x 4	09 06 064 3302 ¹⁾		
Panel cut out				

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

Number of contacts

max. 9

Female and male connectors

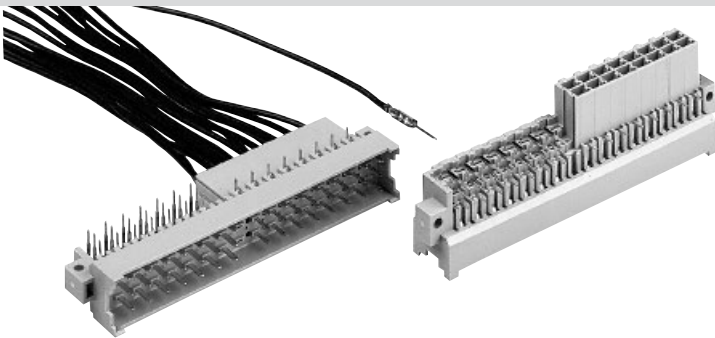


Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Female connector for crimp contacts Order contacts separately	9	09 06 209 3201		
Female crimp contacts		see page 03.31		
Male connector for crimp contacts Order contacts separately	9	09 06 109 3401		
Male crimp contacts		see page 03.44		

DIN Power
up to 6 A

Number of contacts

45



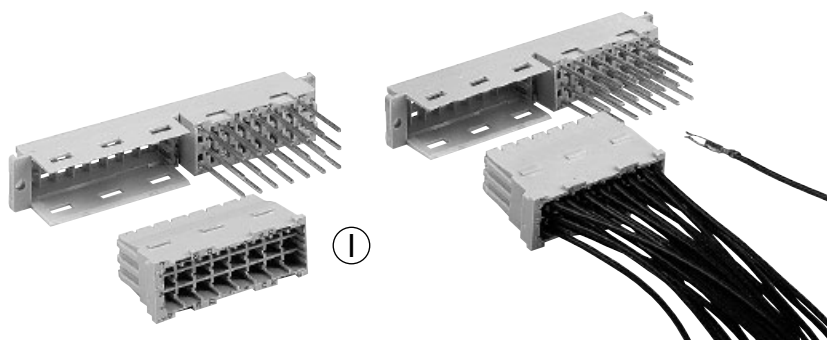
Male connectors

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Male connector 29 angled solder pins 16 cavities for male crimp contacts crimp contacts see page 03.44 Board drillings Mounting side	45	Performance level 1 acc. to IEC 60 603-2 09 06 145 2971	Technical drawing of the male connector showing top, side, and front views with dimensions and contact positions.	Technical drawing of the mounting side showing board drillings and dimensions.

1) A special 48 way version with 3 extra angled solder contacts at position 16 (rows d, b, z) can be supplied

Number of contacts

45



Female connectors

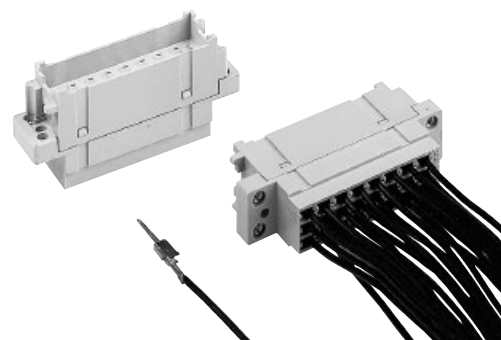
Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Female connector				
Female moulding with 21 wrap posts 22 mm	45	09 06 045 2871 ^{†)}	Performance level 1 acc. to IEC 60 603-2 Crimp moulding is supplied with the female moulding View from termination side	
with 21 solder pins 4.5 mm	45	09 06 045 2875 ^{†)}		
Crimp moulding for 24 female crimp contacts		09 06 024 3202 ^{†)}		
crimp contacts see page 03.31				
Panel cut out				
Removal tool for the crimp moulding		09 99 000 0172	The crimp moulding can be extracted with the help of the removal tool.	

DIN Power
up to 6 A03
43
^{†)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2

Number of contacts

max. 24

Interface connector I

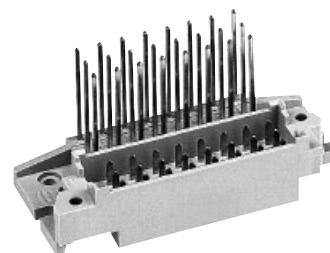


Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Interface connector I for male crimp contacts Order contacts separately	24	09 26 024 3411		

Identification	Identification Wire gauge	Part No.	Performance levels according to IEC 60603-2. Explanation chapter 00
Male crimp FC contacts		2	1
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 0.09 - 0.25 28 - 24 0.14 - 0.56 26 - 20 0.5 - 1.5 20 - 16 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

max. 24

[illegible]

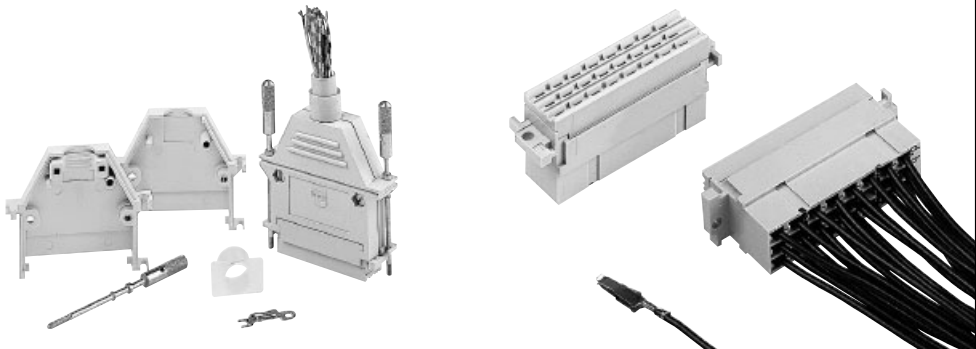
**DIN Power
up to 6 A**

Downloaded from Arrow.com.

Number of contacts

max. 24

Female connectors



Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Female connector for crimp contacts Order contacts separately see page 03.31	24	09 26 024 3201 ¹⁾	Technical drawing of the female connector for crimp contacts. It includes front, side, and top views. Dimensions include: 44.4, 10.1, 15.2, 43.8, 12.4, 2.8_{-0.3}, 9.5, 12.7, 8.7, 5.08, 7x5.08=35.56, 8.49, 2d, 2b, 2z, 2.8^{+0.1}, 0.3, 2x3.81=7.62, 14.8_{-0.2}, 50±0.1, 54_{-0.2}, 7.2, 15, 44.8, 50±0.1, 54.5, 15.24, M2.5/42.8.	Pinout diagram for the 24-pin connector, showing a 4x6 grid of pins labeled a, b, z, and 2.
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 ¹⁾	Technical drawing of the shell housing A with integrated fixing screws. It includes front, side, and top views. Dimensions include: max. 9.11, 17, 13.5, 1.5, 50, 53.4, 58.5, 60, 15, 8.6, M2.5.	
Open hood Supplied with: - Open hood 1x - Locking screw 2x - Screw BZ 2.2x9.5 2x - Cable tie 1x		09 26 000 9901 ¹⁾	Technical drawing of the open hood. It includes front, side, and top views. Dimensions include: 60, 53.4, 15, 8.6, M2.5, 2 x BZ 2.2 x 9.5 DIN ISO 1481.	

DIN Power up to 6 A

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

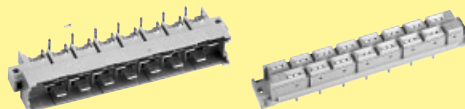
Types H, H15, H16, H3, MH 24 + 7, MH 21 + 5

Page

Technical characteristics type H

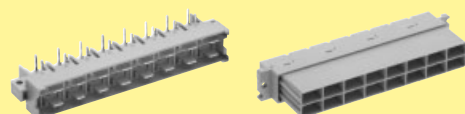
04.10

Type H15 connectors



04.11

Type H16 connectors



04.16

Type H3 connectors

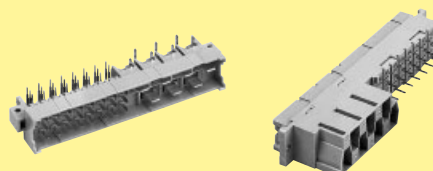


04.17

Technical characteristics type MH

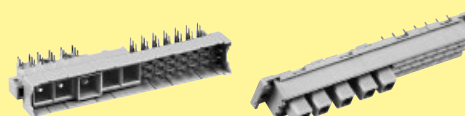
04.20

Type MH 24 + 7 connectors



04.22

Type MH 21 + 5 connectors



04.24

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 m Ω
--------------------	---------------------

Insulation resistance	$\geq 10^{12}$ Ω for standard articles
	$\geq 10^{11}$ 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 $\varnothing 1.6 \pm 0.1$ mm DIN EN 60 097
	Cage clamp terminal 0.14-1.5 mm ²

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

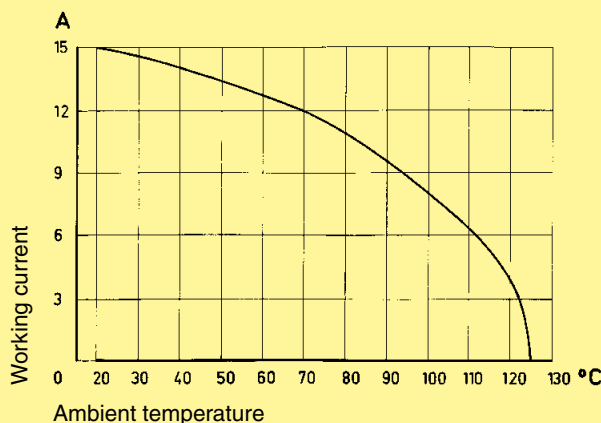
Contact surface	
Contact zone	Hard silver plated or gold plated

Mating conditions	see chapter 00
Coding systems	see chapter 00

Current carrying capacity

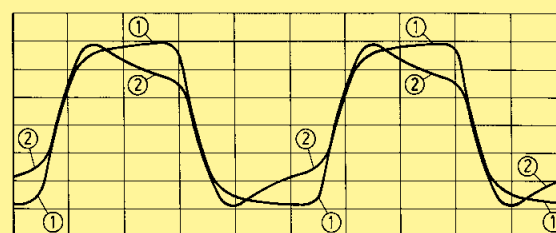
The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current loaded contacts of connectors when simultaneous power on all contacts is given, without exceeding the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

Control and test procedures according to DIN IEC 60512



Low currents and voltages

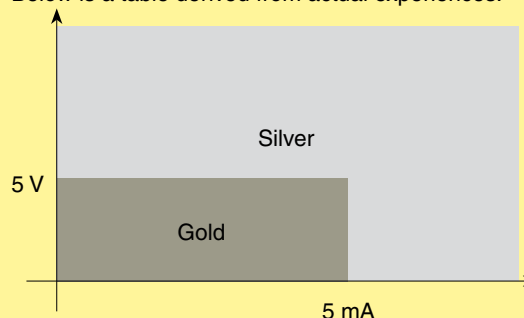
Type H standard contacts have a silver plated surface. This precious metal has excellent conductive properties. In the course of a contact's lifetime, the silver surface generates a black oxide layer due to its affinity to sulphur. This layer is smooth and very thin and is partly interrupted when the 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.

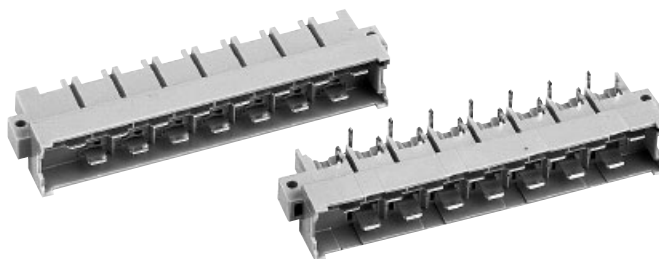
Below is a table derived from actual experiences.



Recommendation

Number of contacts

15



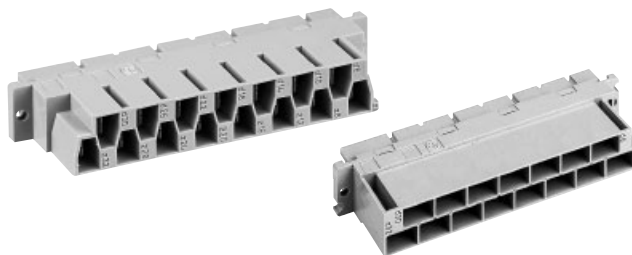
Male connectors

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Male connector for faston 6.3 x 2.5	15	Performance level 1 acc. to IEC 60603-2 09 06 015 2912 ¹⁾ f)	94 max. 6.5 508 7.62 14 x 5.08 = 71.12 88.9 2.5 6.3 x 0.8 4.8 x 0.8 8.4 ± 0.3 85.4 87.5 14.8 ± 0.2 6 3.85 25.1 12.7 Contact arrangement View from termination side Board drillings 2.8 ± 0.1 88.9 ± 0.1 2.75 ± 0.1	94 max. 6.5 508 7.62 14 x 5.08 = 71.12 88.9 2.5 6.3 x 0.8 4.8 x 0.8 8.4 ± 0.3 85.4 87.5 14.8 ± 0.2 6 3.85 25.1 12.7 Contact arrangement View from termination side Board drillings 2.8 ± 0.1 88.9 ± 0.1 2.75 ± 0.1
1 leading contact (position z 32)	14 + 1	09 06 015 2931 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)	94 max. 6.5 508 7.62 14 x 5.08 = 71.12 88.9 2.5 6.3 x 0.8 4.8 x 0.8 8.4 ± 0.3 85.4 87.5 14.8 ± 0.2 6 3.85 25 12.7 Contact arrangement View from termination side Board drillings 2.8 ± 0.1 88.9 ± 0.1 2.75 ± 0.1	94 max. 6.5 508 7.62 14 x 5.08 = 71.12 88.9 2.5 6.3 x 0.8 4.8 x 0.8 8.4 ± 0.3 85.4 87.5 14.8 ± 0.2 6 3.85 25 12.7 Contact arrangement View from termination side Board drillings 2.8 ± 0.1 88.9 ± 0.1 2.75 ± 0.1
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)	94 max. 6.5 508 7.62 14 x 5.08 = 71.12 88.9 2.5 6.3 x 0.8 4.8 x 0.8 8.4 ± 0.3 85.4 87.5 14.8 ± 0.2 6 3.85 25 12.7 Contact arrangement View from termination side Board drillings 2.8 ± 0.1 88.9 ± 0.1 2.75 ± 0.1	94 max. 6.5 508 7.62 14 x 5.08 = 71.12 88.9 2.5 6.3 x 0.8 4.8 x 0.8 8.4 ± 0.3 85.4 87.5 14.8 ± 0.2 6 3.85 25 12.7 Contact arrangement View from termination side Board drillings 2.8 ± 0.1 88.9 ± 0.1 2.75 ± 0.1
1 leading contact (position z 32)	14 + 1	09 06 015 2914 ¹⁾ f)		

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: l2

15

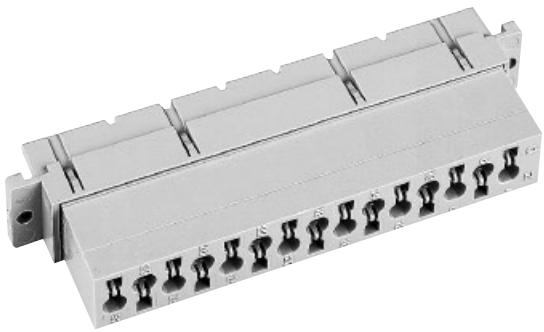


Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
----------------	--------------------	----------	---------	------------------

Female connector for faston 6.3 x 2.5¹⁾ Cannot be used in a shell housing		Performance level 1 acc. to IEC 60603-2	
Female connector for faston 6.3 x 2.5¹⁾ May be used in a shell housing	15	09 06 215 2811	
Female connector for faston 6.3 x 2.5¹⁾ May be used in a shell housing	15	09 06 215 2871	
Panel cut out	15	09 06 215 2871 222^{f)}	

Number of contacts

15



Female connectors

Identification	Number of contacts	Part No.	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^{†)}	84,9 10,1 21,4 84 14,8 12,4 2,9^{+0,3} 8^{+0,3} 12,3 12,7 14,8^{+0,2} 0,3 90^{+0,1} 95^{+0,4} 8,17 14×5,08=71,12 6d 4z 5,08 6,5^{+0,1} 2,8^{+0,1} Contact arrangement View from termination side Slot for screw driver 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 Shell housing see chapter 20	
Panel cut out			M2,5/ø2,8 85 90^{+0,1} 95,5 7,2 15 7,2 15,24	
Termination instructions			① ② ③ ④ 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

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

Number of contacts

15



Female connectors

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm						
Female connector “low profile“ with solder pins ³⁾		Performance level 1 acc. to IEC 60 603-2								
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)}		<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										
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										

DIN Power
up to 15 A

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

Number of contacts

15



Female connectors

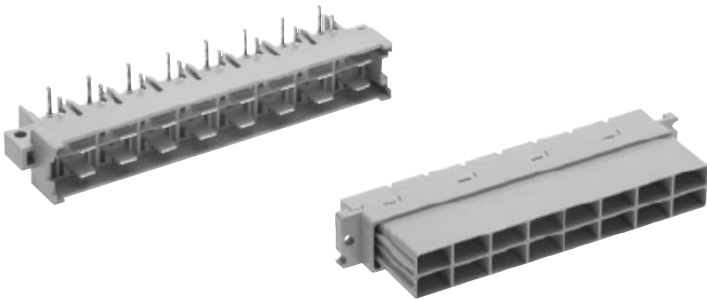
Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Female connector "low profile" with press-in pins 3.6 mm Contact space termination side 5.08 mm	15	Performance level 1 acc. to IEC 60 603-2 09 06 215 2854 09 06 215 2854 222 ¹⁾	Board drillings Mounting side	Board drillings Mounting side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

DIN Power
up to 15 A04
15
¹⁾ Refer to recommended configuration of pcb holes, see page 00.25

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

Number of contacts

16



Male connectors

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Male connector with angled solder pins	16	Performance level 1 acc. to IEC 60 603-2 09 06 116 2511	position row Board drillings position all holes row	position row
Female connector for faston 6.3 x 2.5	16	09 06 216 2411	position row	position row

DIN Power
up to 15 A

Number of contacts

3



Male and female connectors

Identification	Number of contacts	Part No.	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	

DIN Power
up to 15 A

ELECTRONIC SECTION

Number of contacts 21, 24 + 7

Contact spacing (mm)

Male connector 2.54 x 5.08
Female connector 5.08

Working current

6 A max.
see current carrying capacity chart

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 60 326-3
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

15 A max.
see current carrying capacity chart

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 46 245 and DIN 46 247
Solder pins for pcb connection
Ø 1.6 ± 0.1 mm acc. to DIN EN 60 097

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

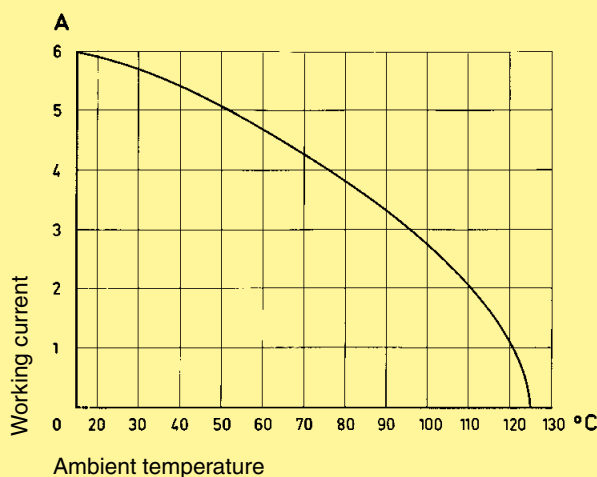
Mouldings Thermoplastic resin,
glass-fibre filled, UL 94-V0
Contacts Copper alloy

Current carrying capacity

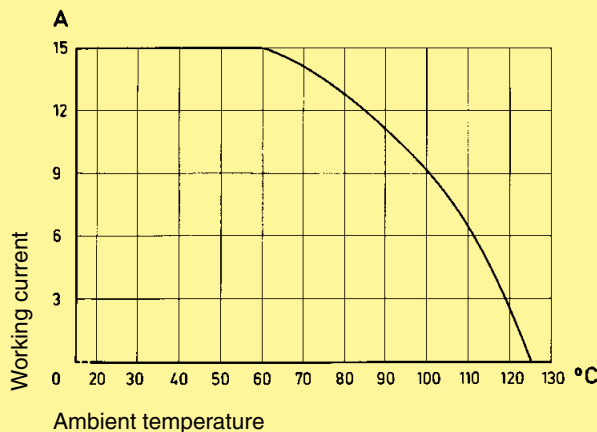
The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current loaded contacts of connectors when simultaneous power on all contacts is given, without exceeding the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

Control and test procedures according to DIN IEC 60 512

Electronic section



Heavy duty section

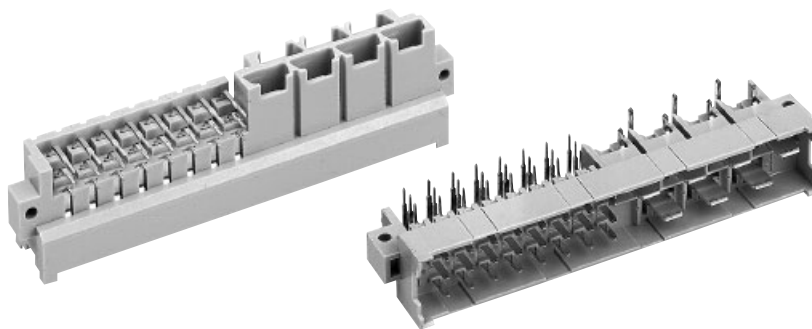


* only for type MH 24 + 7

¹⁾ Explanation of performance levels see chapter 00

Mating conditions see chapter 00

Coding systems see chapter 00

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


Identification	Number of contacts	Performance levels according to IEC 60 603-2. Explanation chapter 00		
		Part No. 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 pins¹⁾				
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)}	

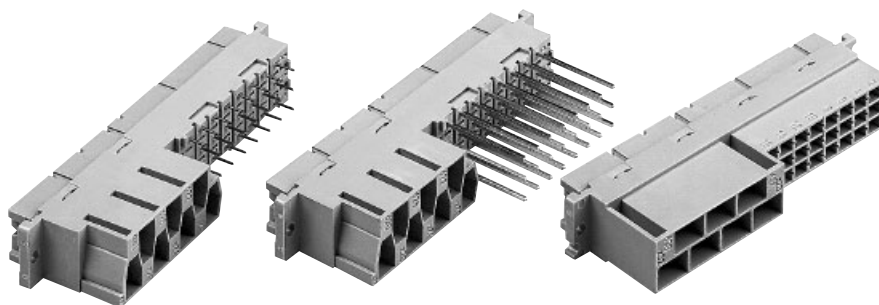
[illegible]

Dimensions in mm

Downloaded from Arrow.com.

Number of contacts

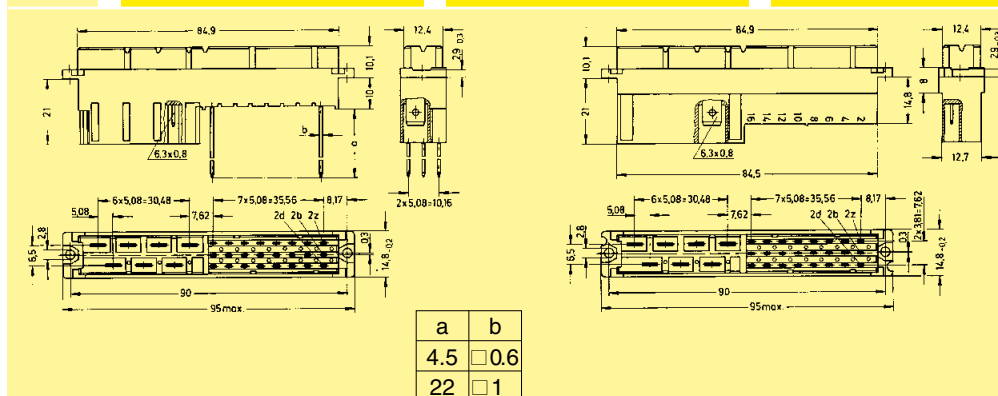
24 + 7
F + H



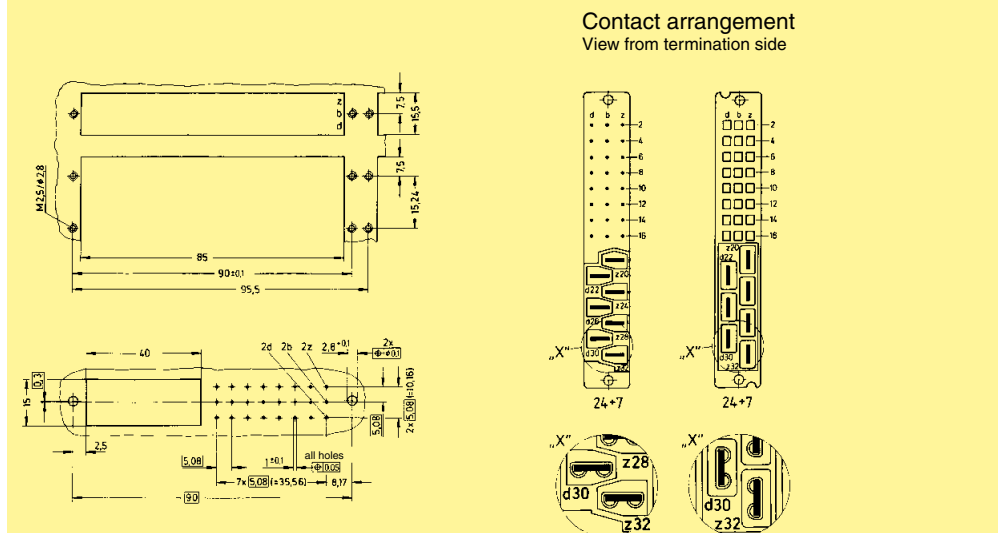
Female connectors

Identification	Number of contacts	Part No. 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 6822 222 ^{f)}	09 06 231 2822
Female connector with wrap posts 1 x 1 mm ¹⁾	24 + 7		09 06 231 6821	09 06 231 2821 09 06 231 2821 222 ^{f)}
Female connector for crimp contacts ¹⁾ Order contacts separately, see chapter 03	24 + 7			09 06 231 2881 09 06 231 2881 222 ^{f)}

DIN Power
up to 15 A



Panel cut out



Board drillings
Mounting side

Shell housing for female connector with crimp contacts
see chapter 20

Dimensions in mm

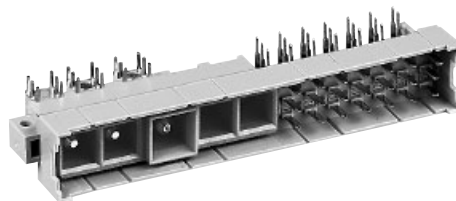
¹⁾ With shroud coding, see chapter 00

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

Number of contacts

21 + 5

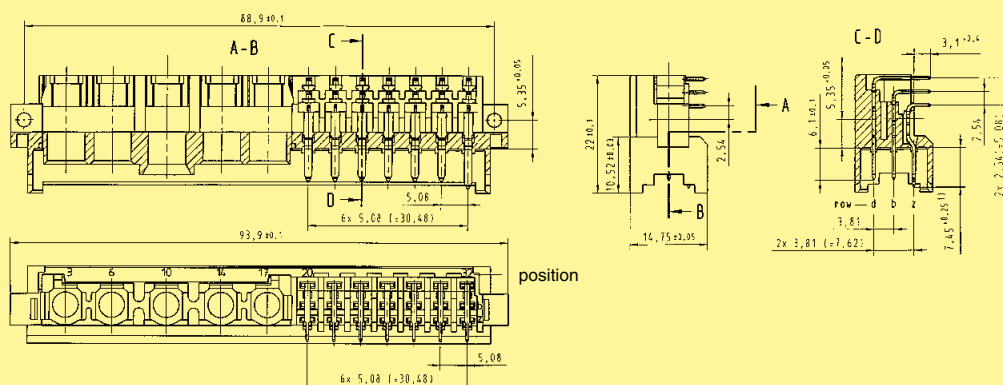
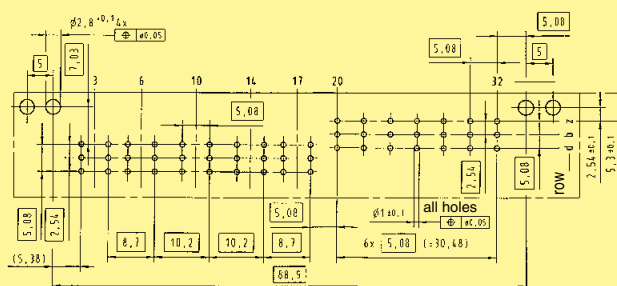
F + M



Male connectors

Identification	Number of contacts	Part No. 3	Performance levels according to IEC 60603-2. Explanation chapter 00 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

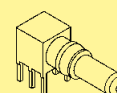
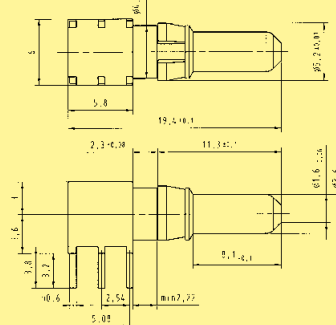
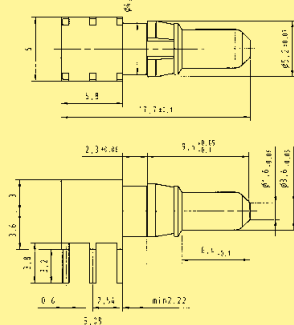
Board drillings
Mounting side

1) Leading contact in position z 32

Dimensions

09 03 000 6127

09 03 000 6128



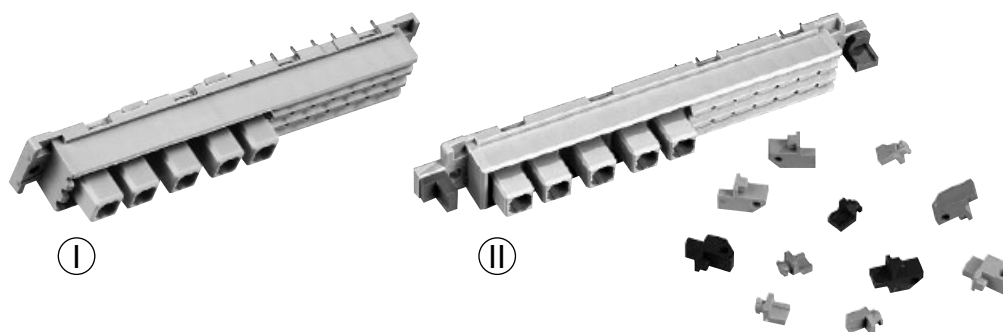
Dimensions in mm

* Pre-loaded with special contacts on request

Code keys see chapter 00

²⁾ Depending on the pcb design

Further special contacts see chapter 01

$$\begin{array}{ccc} 21 & + & 5 \\ \text{F} & + & \text{M} \end{array}$$


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

09 03 000 6220

Technical drawing showing two views of a mechanical part with dimensions in mm.

Front View Dimensions:

- Total length: 77.4 ± 0.2
- Section 1 length: 7.3 ± 0.1
- Section 2 length: 10.1 ± 0.1
- Section 3 length: 6.8 ± 0.1
- Section 4 length: 6.8 ± 0.1
- Section 5 length: 6.8 ± 0.1
- Section 6 length: 6.8 ± 0.1
- Section 7 length: 6.8 ± 0.1
- Section 8 length: 6.8 ± 0.1
- Section 9 length: 6.8 ± 0.1
- Section 10 length: 6.8 ± 0.1
- Section 11 length: 6.8 ± 0.1
- Section 12 length: 6.8 ± 0.1
- Section 13 length: 6.8 ± 0.1
- Section 14 length: 6.8 ± 0.1
- Section 15 length: 6.8 ± 0.1
- Section 16 length: 6.8 ± 0.1
- Section 17 length: 6.8 ± 0.1
- Section 18 length: 6.8 ± 0.1
- Section 19 length: 6.8 ± 0.1
- Section 20 length: 6.8 ± 0.1
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- Section 25 length: 6.8 ± 0.1
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- Section 30 length: 6.8 ± 0.1
- Section 31 length: 6.8 ± 0.1
- Section 32 length: 6.8 ± 0.1
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- Section 80 length: 6.8 ± 0.1
- Section 81 length: 6.8 ± 0.1
- Section 82 length: 6.8 ± 0.1
- Section 83 length: 6.8 ± 0.1
- Section 84 length: 6.8 ± 0.1
- Section 85 length: 6.8 ± 0.1
- Section 86 length: 6.8 ± 0.1
- Section 87 length: 6.8 ± 0.1
- Section 88 length: 6.8 ± 0.1
- Section 89 length: 6.8 ± 0.1
- Section 90 length: 6.8 ± 0.1
- Section 91 length: 6.8 ± 0.1
- Section 92 length: 6.8 ± 0.1
- Section 93 length: 6.8 ± 0.1
- Section 94 length: 6.8 ± 0.1
- Section 95 length: 6.8 ± 0.1
- Section 96 length: 6.8 ± 0.1
- Section 97 length: 6.8 ± 0.1
- Section 98 length: 6.8 ± 0.1
- Section 99 length: 6.8 ± 0.1
- Section 100 length: 6.8 ± 0.1

Side View Dimensions:

- Outer diameter: $\varnothing 1.6$
- Inner diameter: $\varnothing 1$
- Flange outer diameter: $\varnothing 1.3$
- Flange inner diameter: $\varnothing 1$
- Threaded section outer diameter: $\varnothing 1.3$
- Threaded section inner diameter: $\varnothing 1$
- Threaded section length: 6.8 ± 0.1
- Threaded section thread: $M6 \times 0.5$
- Threaded section pitch: $p = 0.5$
- Threaded section start: $Z = 0$
- Threaded section end: $Z = 6.8$
- Threaded section middle: $Z = 3.4$
- Threaded section quarter: $Z = 1.7$
- Threaded section eighth: $Z = 0.85$
- Threaded section sixteenth: $Z = 0.425$
- Threaded section thirtysecond: $Z = 0.2125$
- Threaded section sixtyfourth: $Z = 0.10625$
- Threaded section one hundred twentyeighth: $Z = 0.053125$
- Threaded section two hundred fifty-sixth: $Z = 0.0265625$
- Threaded section five hundred twelve: $Z = 0.01328125$
- Threaded section one thousand two hundred fifty: $Z = 0.006640625$
- Threaded section two thousand five hundred: $Z = 0.0033203125$
- Threaded section five thousand: $Z = 0.00166015625$
- Threaded section ten thousand: $Z = 0.000830078125$
- Threaded section twenty thousand: $Z = 0.0004150390625$
- Threaded section forty thousand: $Z = 0.00020751953125$
- Threaded section eighty thousand: $Z = 0.000103759765625$
- Threaded section one hundred thousand: $Z = 0.000103759765625$
- Threaded section two hundred thousand: $Z = 0.0000518798828125$
- Threaded section four hundred thousand: $Z = 0.00002593994140625$
- Threaded section eight hundred thousand: $Z = 0.000012969970703125$
- Threaded section one million: $Z = 0.000012969970703125$
- Threaded section two million: $Z = 0.0000064849853515625$
- Threaded section four million: $Z = 0.00000324249267578125$
- Threaded section eight million: $Z = 0.000001621246337890625$
- Threaded section sixteen million: $Z = 0.0000008106231689453125$
- Threaded section thirtytwo million: $Z = 0.00000040531158447265625$
- Threaded section sixtyfour million: $Z = 0.000000202655792236328125$
- Threaded section one hundred million: $Z = 0.00000012969970703125$
- Threaded section two hundred million: $Z = 0.000000064849853515625$
- Threaded section four hundred million: $Z = 0.0$

Dimensions in mm

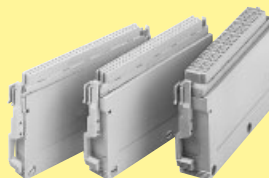
DIN Power
up to 15 A

Shell housings and accessories

Page

Summary of shell housings and accessories **20.02**

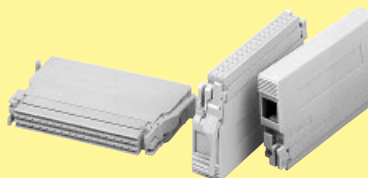
Shell housing C **20.04**



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**

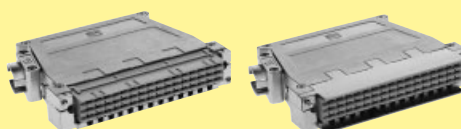


EMC housing **20.26**

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



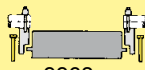
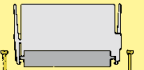
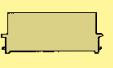
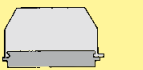
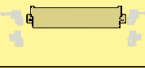
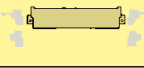
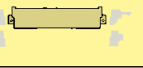
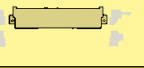
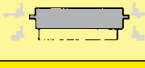
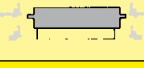
Appropriate connectors in shell housings	Types B, C, D, E, har-bus® 64	Types 2C, 3C	Type F	Types F, H, MH	Types E, F, H, MH
Check list: How to order shell housings and accessories. The Part No. is stated.					
Shell housings	C 09 02 064 0501 09 02 064 0502 09 03 096 0501 09 05 048 0501	2C, 3C 09 23 048 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 U			09 02 000 9909 M 2.5 x 16 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 fixing left	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 fixing right	09 02 000 9920	09 02 000 9920	09 06 000 9902		
Single fixing left	09 02 000 9921	09 02 000 9921	09 06 000 9905	09 06 000 9909	09 06 000 9909
Single fixing right	09 02 000 9922	09 02 000 9922	09 06 000 9906	09 06 000 9910	09 06 000 9910
for female connectors				B 	
Multiple fixing left				09 06 000 9933 09 06 000 9933	
Multiple fixing right					
Fixing brackets for angled male connectors on pcb	C 	C 			
left	09 02 000 9926 09 02 000 9927	09 02 000 9926 09 02 000 9927			
right					
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 No. is stated.	 ... 9968  ... 9930	 			
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	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
for interface connectors U	—	—	—	—	—
for interface connectors I	—	—	—	—	—
Shroud for screw fixing with interface connector I	—	—	09 06 001 9964	09 06 001 9964	—
Fixing brackets for 19" racks for male connectors	B 	B 	B 	B 	B 
Multiple fixing left	09 06 000 9907 09 06 000 9966	09 06 000 9907 09 06 000 9966	09 06 000 9907 09 06 000 9966 09 06 000 9995 09 06 000 9997	09 06 900 9907 09 06 900 9966 09 06 900 9995 09 06 900 9997	09 06 900 9997
Multiple fixing right	09 06 000 9908 09 06 000 9967	09 06 000 9908 09 06 000 9967	09 06 000 9908 09 06 000 9967 09 06 000 9996 09 06 000 9998	09 06 900 9908 09 06 900 9967 09 06 900 9996	09 06 900 9996
Single fixing left	09 06 000 9909	09 06 000 9909	09 06 000 9909 09 06 001 9934	09 06 900 9909 09 06 901 9934	09 06 800 9943 09 06 901 9924
Single fixing right	09 06 000 9910	09 06 000 9910	09 06 000 9910 09 06 001 9935	09 06 900 9910 09 06 901 9935	09 06 800 9944 09 06 901 9925
for female connectors	B 	B 			
Multiple fixing left right	only ... 9930 09 06 000 9933 09 06 000 9933	09 06 000 9933 09 06 000 9933			
Protection and fixing strip for 20 mm shell housing			09 06 001 9909	09 06 901 9909	

Shell housings

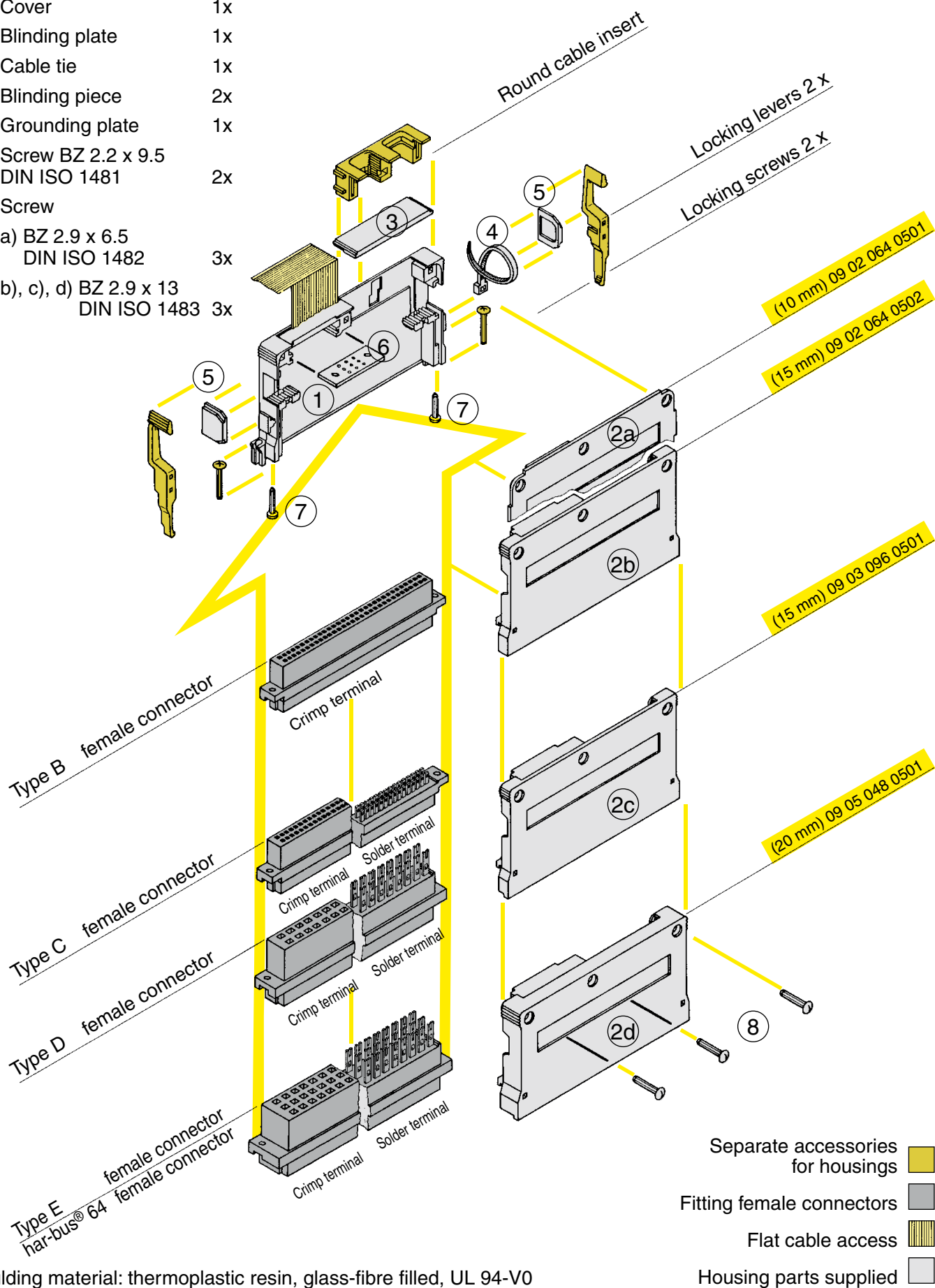
 Female connectors  Male connectors

Detailed system description see chapter 00

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



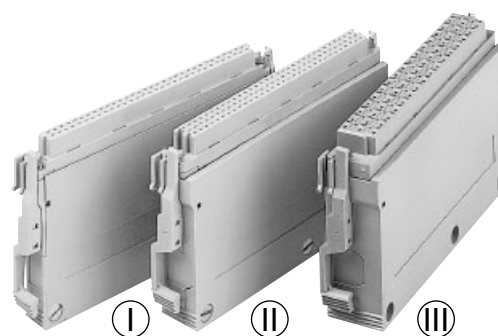
- ① Shell 1x
- ② Cover 1x
- ③ Blinding plate 1x
- ④ Cable tie 1x
- ⑤ Blinding piece 2x
- ⑥ Grounding plate 1x
- ⑦ Screw BZ 2.2 x 9.5
DIN ISO 1481 2x
- ⑧ Screw
 - a) BZ 2.9 x 6.5
DIN ISO 1482 3x
 - b), c), d) BZ 2.9 x 13
DIN ISO 1483 3x



20
04

Moulding material: thermoplastic resin, glass-fibre filled, UL 94-V0

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



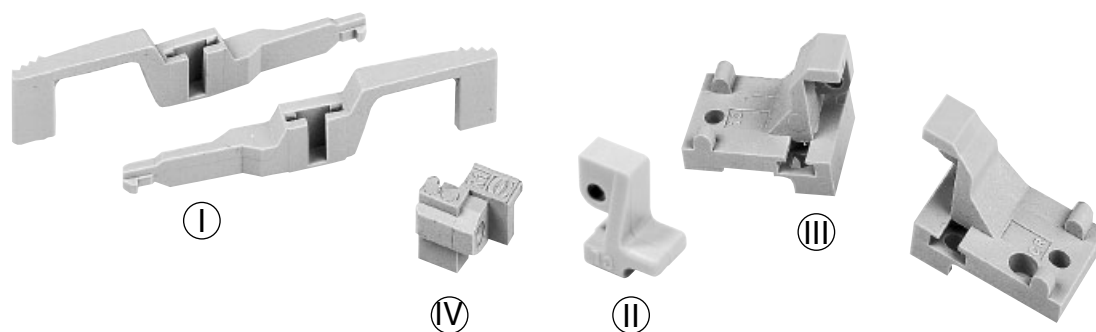
Identification	Part No.	Drawing	Dimensions in mm
Shell housing C for female connectors type B I	10 mm 09 02 064 0501		
Shell housing C for female connectors types C, D II	15 mm 09 02 064 0502		
Shell housing C for female connectors type E, har-bus® 64 III	20 mm 09 05 048 0501		

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

Shell
 housings

20
05

Shell housing C

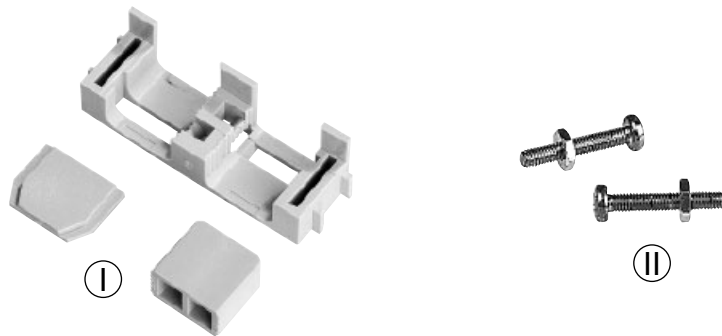


Accessories

Identification	Part No.	Drawing	Dimensions in mm
Locking lever for shell housing C ①	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 ②	left 09 02 000 9919 right 09 02 000 9920		
Single fixing ③	left 09 02 000 9921 right 09 02 000 9922		
Fixing brackets R for inverse male connectors on pcb's ④	R 1 09 02 000 9953 R 32 09 02 000 9954 Screw DIN ISO 7049 M 2.2 x 9.5 09 06 001 9974		See application example 4, chapter 01

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

Shell housing C



Accessories

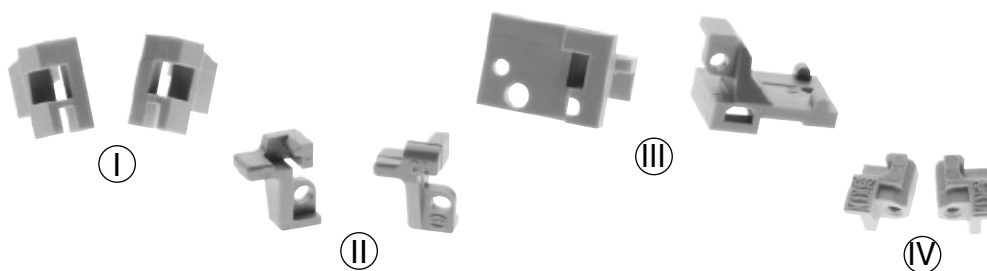
Identification	Part No.	Drawing	Dimensions in mm
Fixing brackets C for angled male connectors on pcb without fixing possibility in 19" racks	left 09 02 000 9926 ^{f)} right 09 02 000 9927 ^{f)}		
Round cable insert 2 x $\varnothing$ 6.5 for shell housing C 09 02 064 0501 Supplied with: Round cable insert 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 ① 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 ②	09 02 000 9909 ¹⁾		

Shell
housings

¹⁾ Order 2 pieces for one shell housing
^{f)} Railway classification NFF 16-101, Smoke index: F1, Flammability class: I2



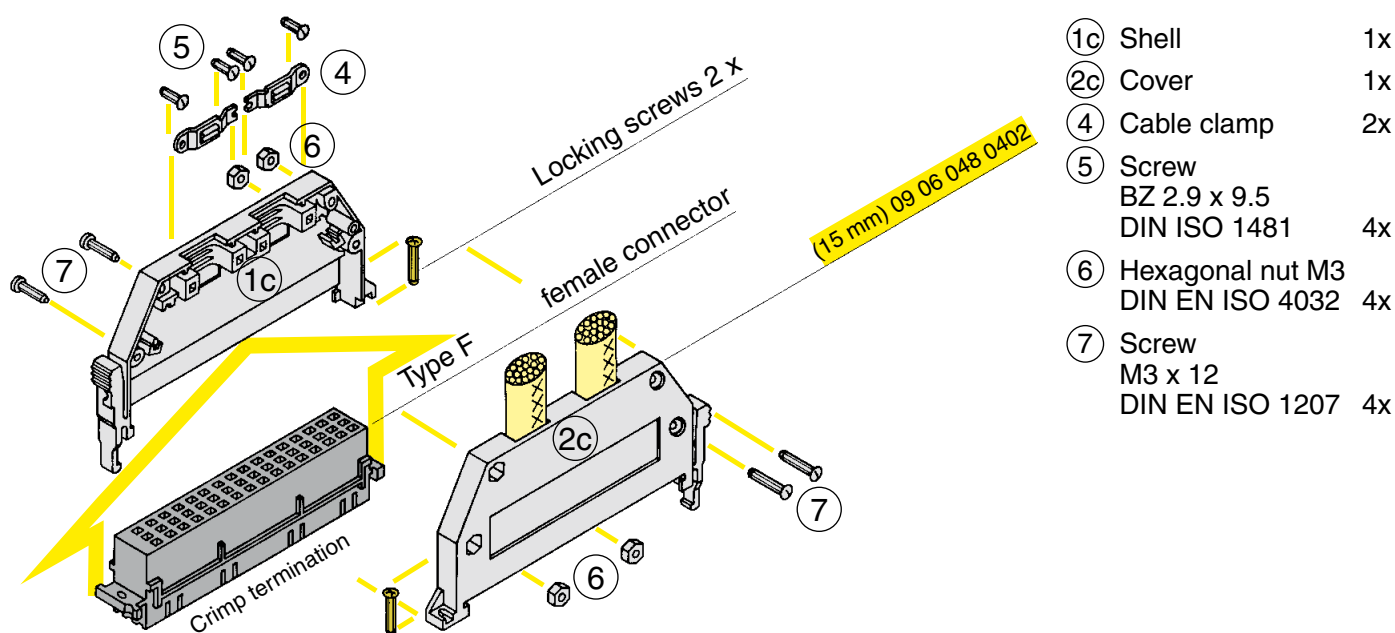
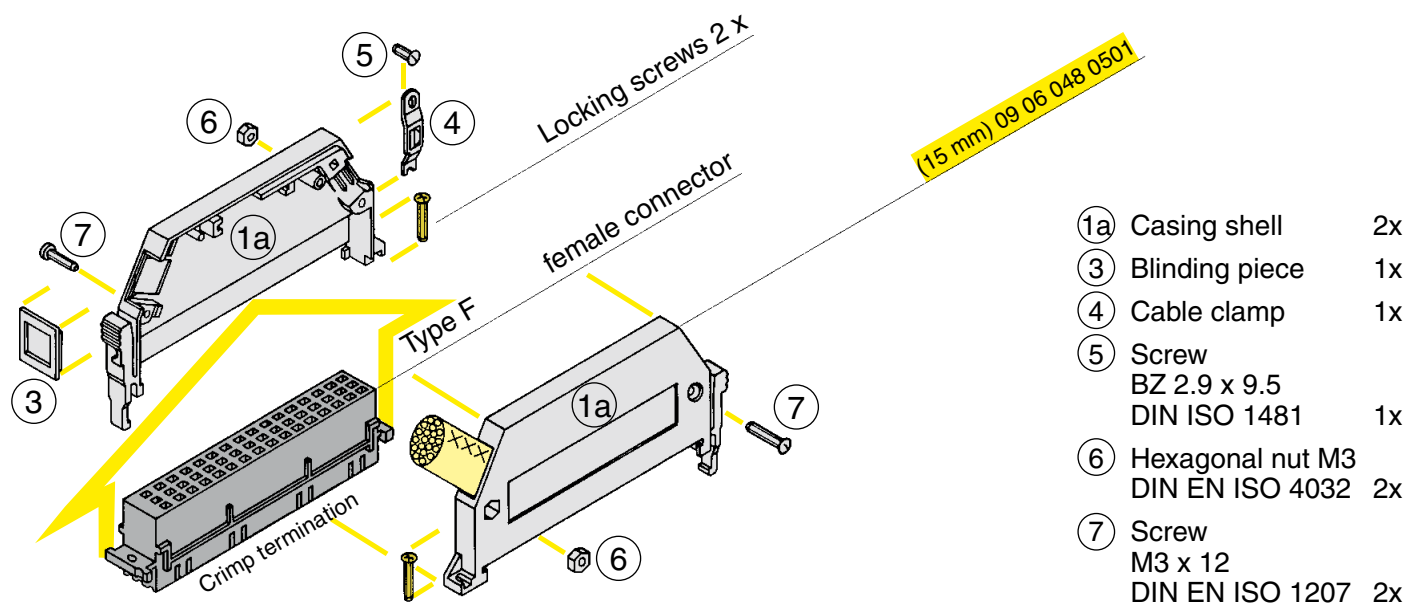
Shell housings



Accessories

Identification	Part No.	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	R 1 09 02 000 9953 R 32 09 02 000 9954		<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											
Screw DIN ISO 7049 M2.2 x 9.5	09 06 001 9974											

Shell housing A for type F



Separate accessories
for housings

Fitting female connectors

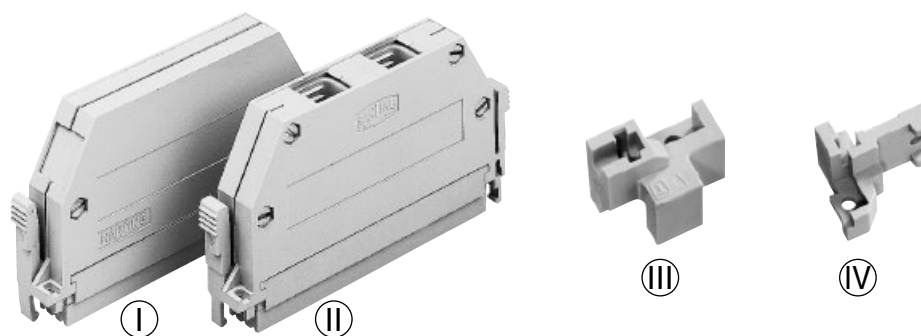
Cable access

Housing parts supplied

20

10 Moulding material: thermoplastic resin, glass-fibre filled, UL 94-V0

Shell housing A for type F



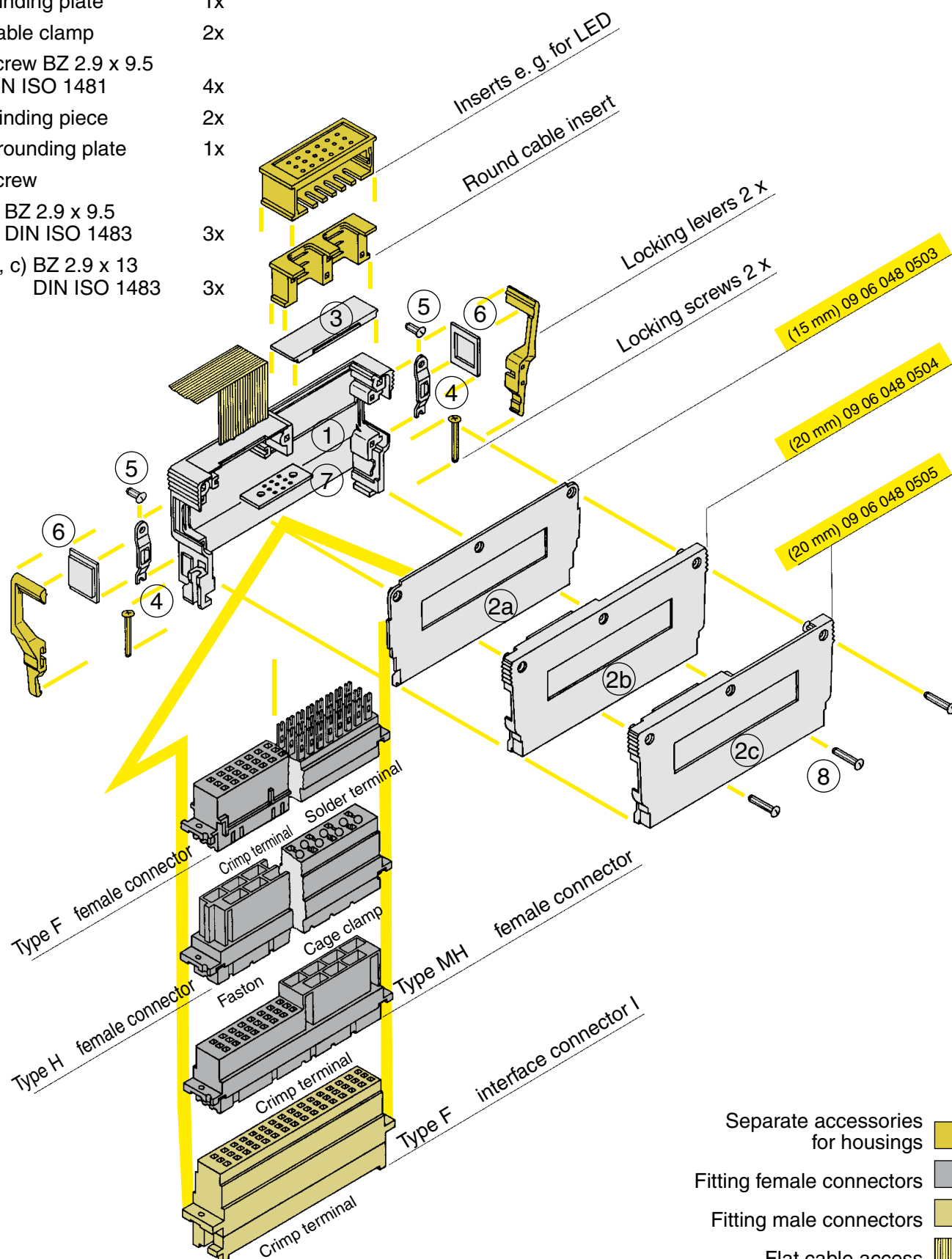
Identification	Part No.	Drawing	Dimensions in mm
Shell housing A Side entry I	15 mm 09 06 048 0501 ^{f)}		
Top entry II	15 mm 09 06 048 0402 ^{f)}		
Cable clamp incl. screw	09 06 001 9986	1 x ④ + 2 x ⑤ on page 20.10	
Fixing brackets A for male connectors for 19" racks according to DIN EN 60 297, part 3-101 Multiple fixing III	left 09 06 000 9901 ^{f)} right 09 06 000 9902 ^{f)}		
Single fixing IV	left 09 06 000 9905 ^{f)} right 09 06 000 9906 ^{f)}		

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

Shell housing B for types F, H and MH

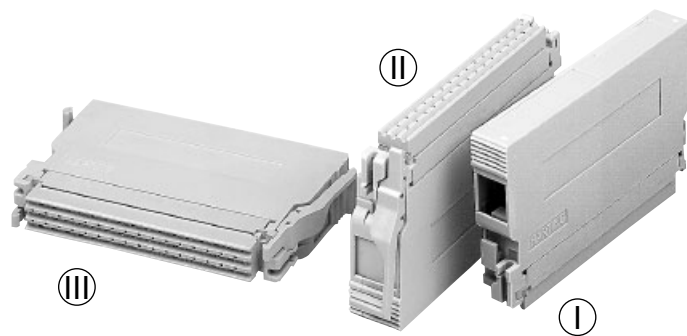


- | | |
|--------------------------------------|----|
| ① Shell | 1x |
| ② Cover | 1x |
| ③ Blinding plate | 1x |
| ④ Cable clamp | 2x |
| ⑤ Screw BZ 2.9 x 9.5
DIN ISO 1481 | 4x |
| ⑥ Blinding piece | 2x |
| ⑦ Grounding plate | 1x |
| ⑧ Screw | |
| a) BZ 2.9 x 9.5
DIN ISO 1483 | 3x |
| b), c) BZ 2.9 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 No.

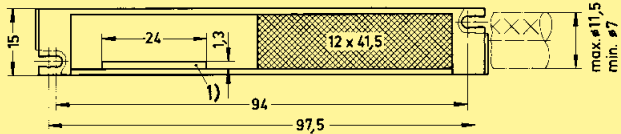
Drawing

Dimensions in mm

Shell housing B

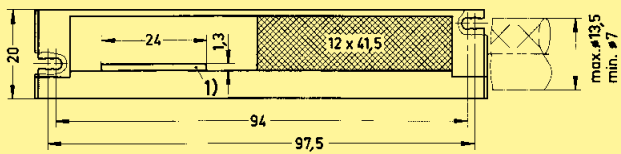
I

15 mm
09 06 048 0503



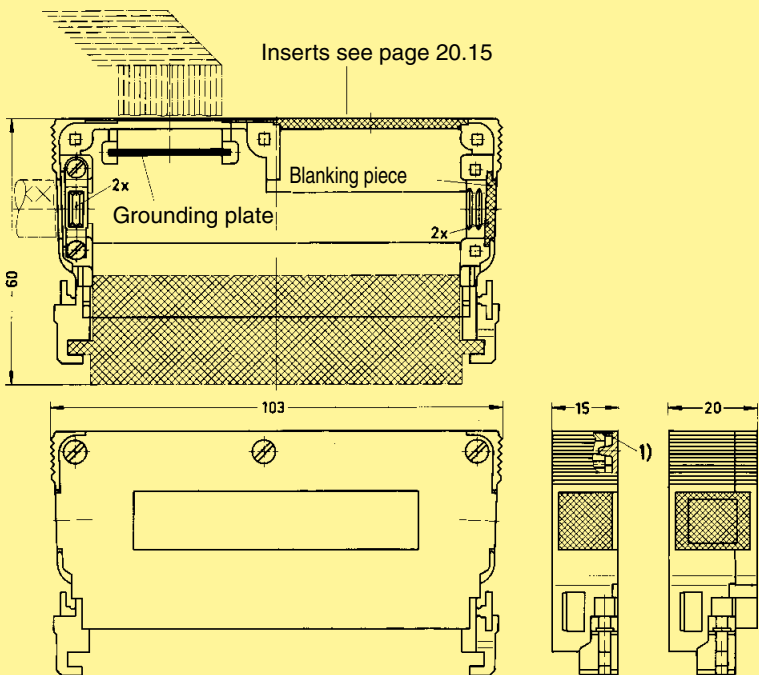
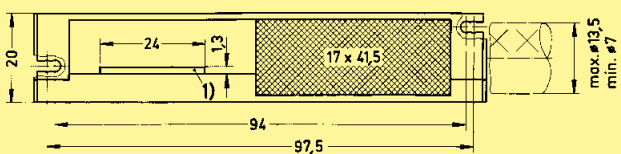
II

20 mm
09 06 048 0504

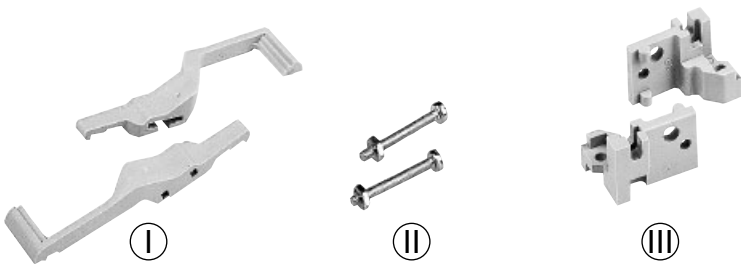


III

20 mm
09 06 048 0505



Shell housings

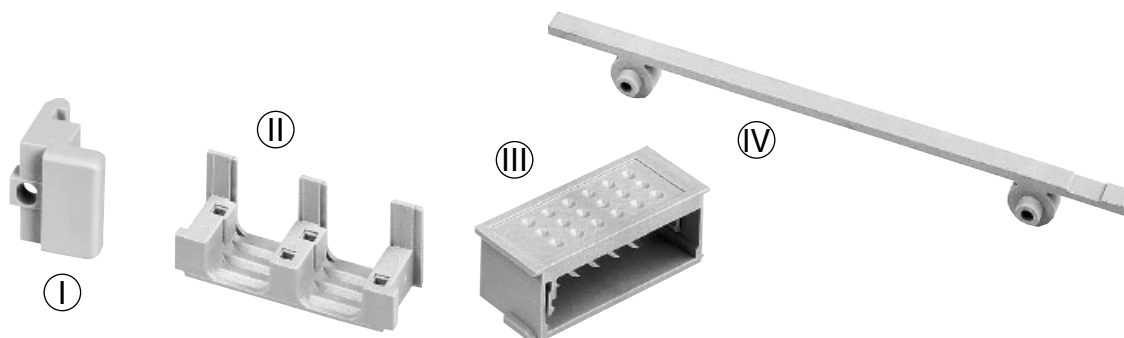


Accessories

Identification	Part No.	Drawing	Dimensions in mm
Locking lever for shell housing B 09 06 048 0503 I	09 06 000 9913 ¹⁾		
09 06 048 0504 09 06 048 0505 left 09 06 000 9913¹⁾ right 09 06 000 9919¹⁾			
Locking screws II	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	left 09 06 000 9907¹⁾ right 09 06 000 9908¹⁾		
with nut M 2.5 DIN 562 left 09 06 000 9966¹⁾ right 09 06 000 9967¹⁾			
Single fixing without nut III	left 09 06 000 9909¹⁾ right 09 06 000 9910¹⁾		

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

Shell housing B

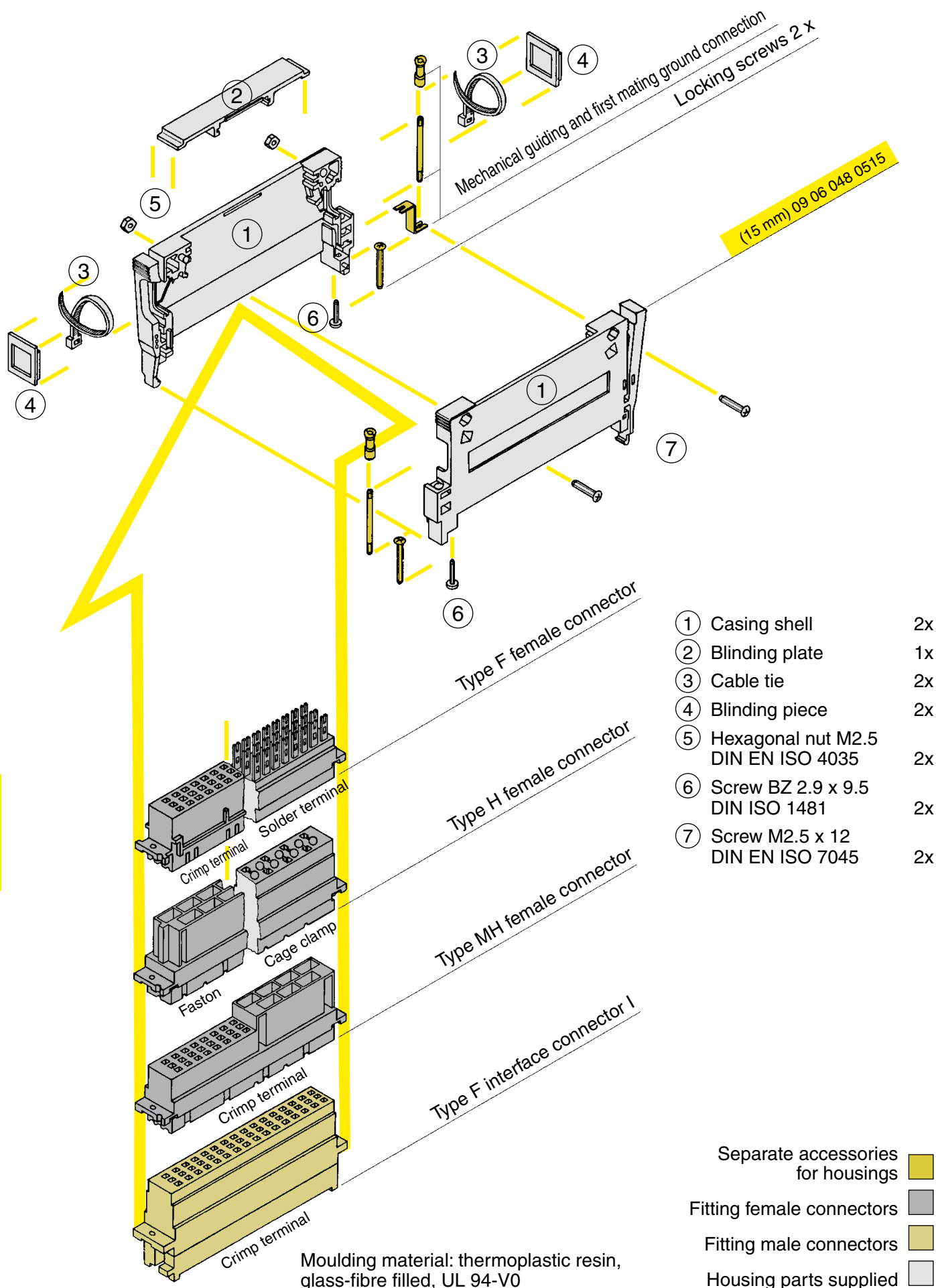


Accessories

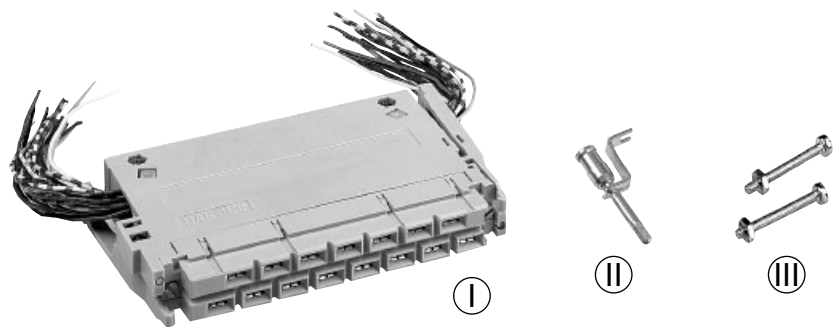
Identification	Part No.	Drawing	Dimensions in mm
Fixing brackets B for female connectors for 19" racks according to DIN EN 60 297, part 3-101 Multiple fixing I 1) Order 2 pieces for one female connector	09 06 000 9933 ¹⁾	Female connector type F M 2.5 x 8 DIN EN ISO 12072²⁾ 2x 09 06 000 9912	
Round cable insert 2 x ø 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 ø 12.5 II for shell housing B 09 06 048 0505 Supplied with: Round cable insert 1x Blinding piece 1x	09 06 000 9915		
Insert for LED III for shell housing B 09 06 048 0505	09 06 000 9917	pcb 35.5 x 17 x 1.5	
Protection strip IV Used with shell housings type B for front side access 09 06 048 0504 09 06 048 0505	09 06 000 9929	09 06 000 9909 09 06 000 9910 Male connector type F	

Shell housings

20
15



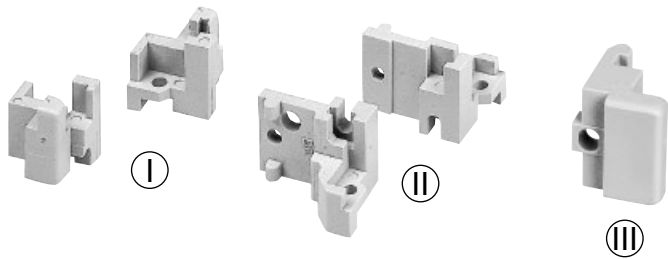
Shell housing D 15 for types F, H and MH



Identification	Part No.	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	09 06 000 9926 ¹⁾		

¹⁾ Order 2 pieces for one shell housing

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



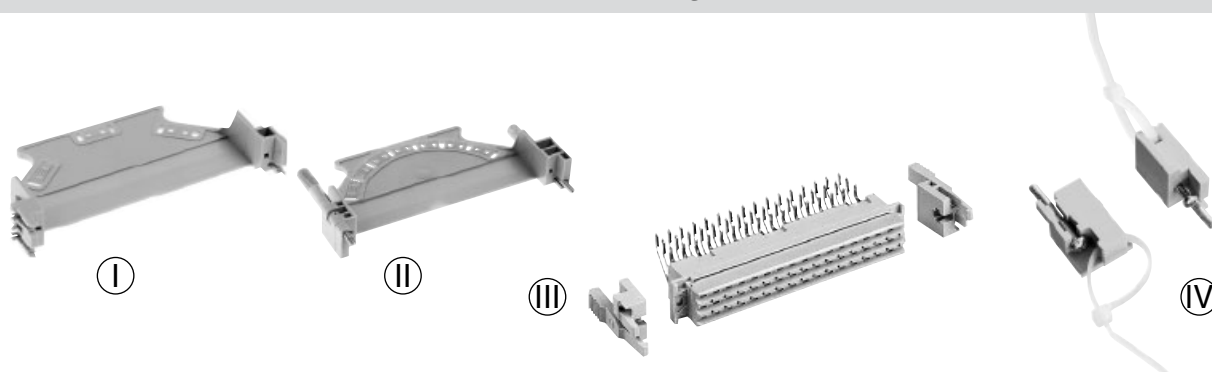
Accessories

Identification	Part No.	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 I	left 09 06 000 9907 right 09 06 000 9908		
with nut M 2.5 DIN 562 II	left 09 06 000 9966 right 09 06 000 9967		
Single fixing without nut II	left 09 06 000 9909 right 09 06 000 9910		
Fixing brackets B for female connectors for 19" racks according to DIN EN 60 297, part 3-101 Multiple fixing III	09 06 000 9933¹⁾		

¹⁾ Order 2 pieces for one female connector

²⁾ nut and screw not supplied with fixing brackets

Open hood G, junction element O, locking lever



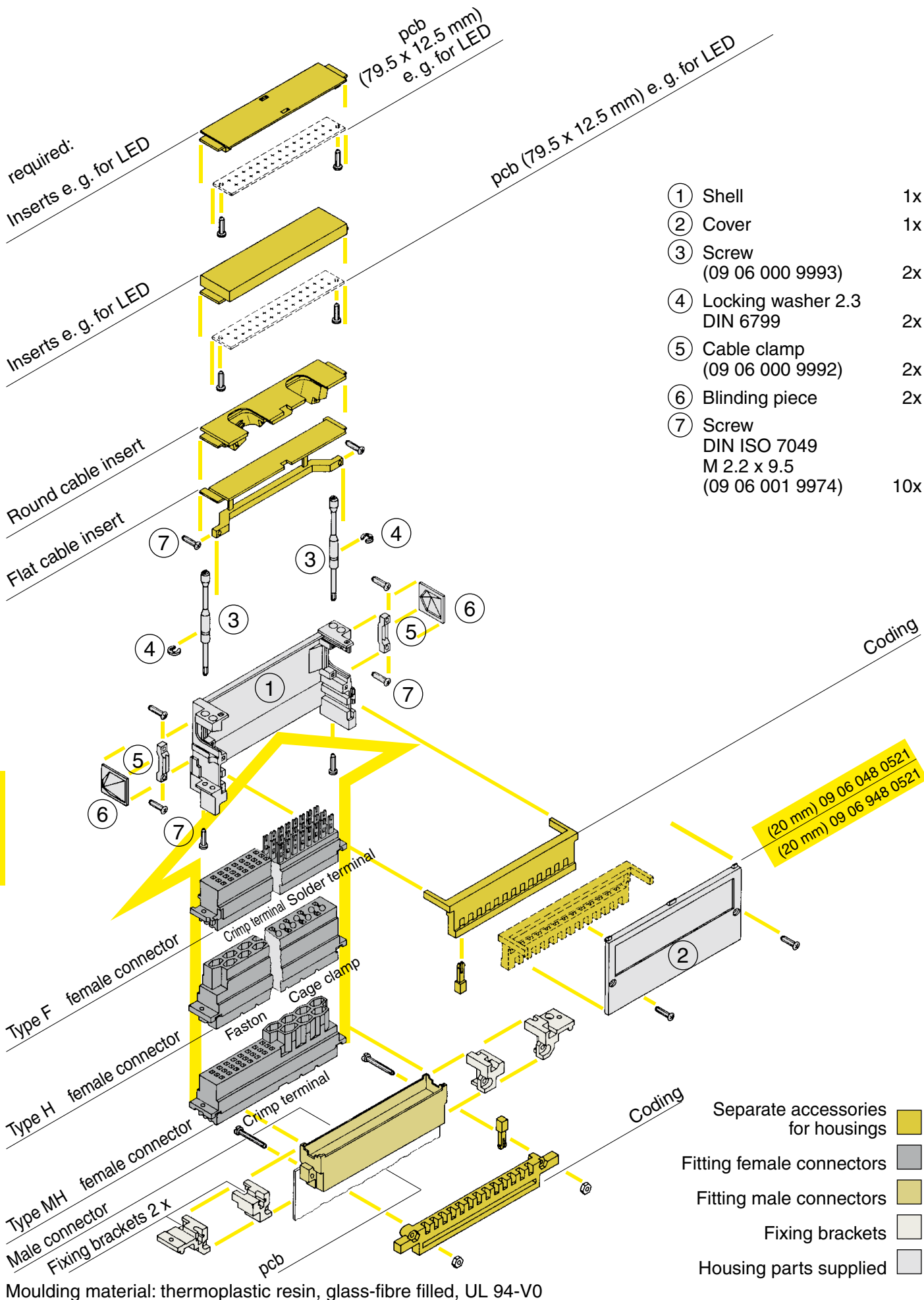
Identification	Part No.	Drawing	Dimensions in mm
Open hood G I for types E, F, H and MH, for applications A B C Supplied with: Open hood 1x Locking screw 2x (09 06 000 9958) Cable tie 1x Screw 2x	09 06 000 9957		
Open hood G II for types E, F, H and MH, for application C Supplied with: Open hood 1x Pre-assembled, undetachable locking screw 2x Cable tie 1x Screw 2x	09 06 001 9939		
Junction element O for type F IV 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 III 1) Order 2 pieces for one female connector	09 06 000 9930 ¹⁾ 09 06 000 9911 ¹⁾		2) nut and screw not supplied with locking levers

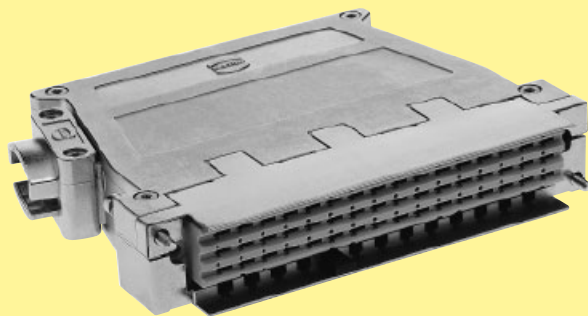
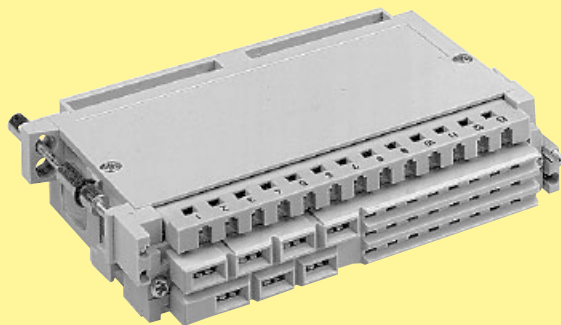
Shell housings

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:

09 06 2__ _853

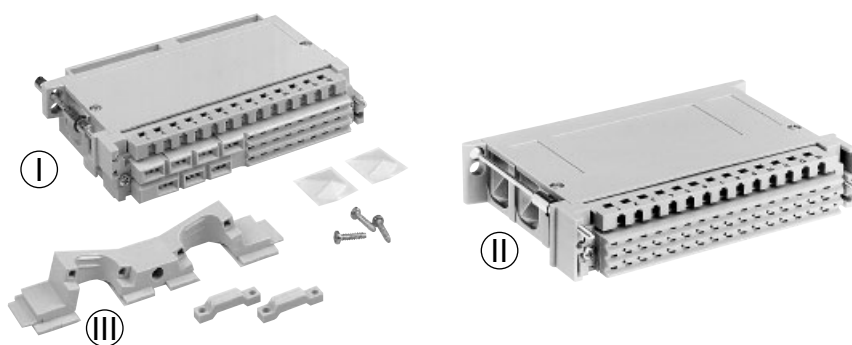
32 = 32 contacts
48 = 48 contacts

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

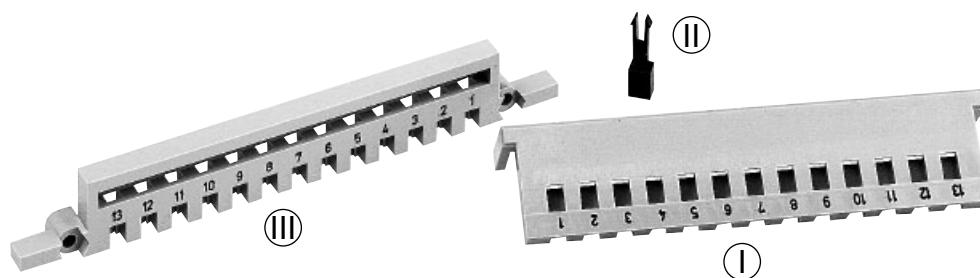
Technical characteristics

	D 20/2	D 20/2 metallised ¹⁾	D 20/4	D 20/4 metallised ¹⁾	D 20 metal	D 20 metal HF
Part No.	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	IP 20	IP 20	IP 20	IP 20	IP 20	IP 20

¹⁾ upper temperature limit is +105 °C



Shell housings



Coding

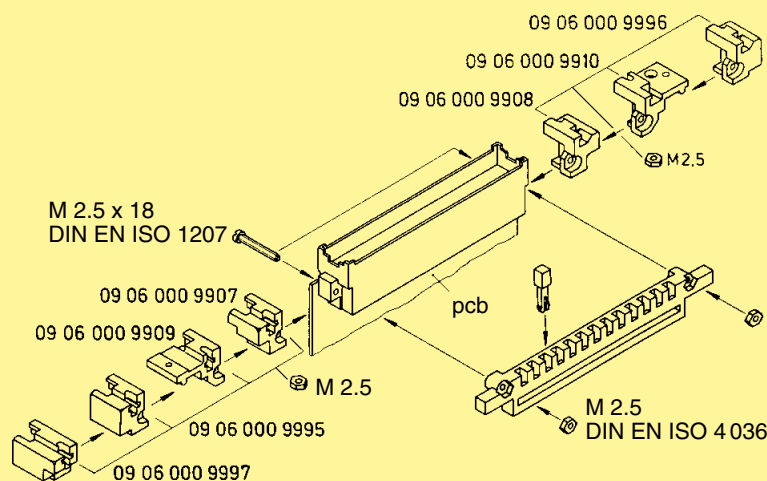
Identification	Part No.	Drawing	Dimensions in mm
Code comb for shell housing³⁾ (can also be used as a blanking cover) I	09 06 000 9984 ^{f)}		
Coding pin³⁾ II 1) Order 13 pieces per code comb	09 06 001 9905 ¹⁾		
Code comb for male connectors³⁾ III short version for a full metal locking lever with nut 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 No.	Drawing	Dimensions in mm
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Mounting possibilities
for code comb
at the male connector
with fixing brackets



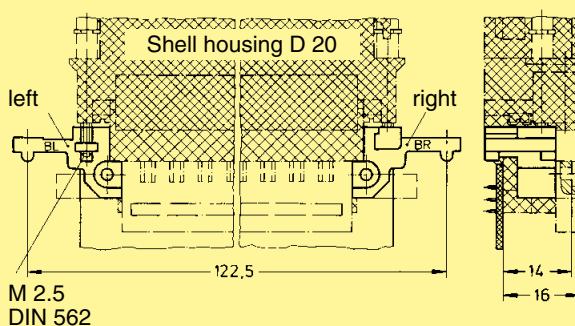
Fixing brackets B
for male connectors*
for 19" racks according
to DIN EN 60 297,
part 3-101

Single fixing*
without nut

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



Multiple fixing*
without coding
at the fixing bracket
without nut

left
09 06 000 9907
right
09 06 000 9908

without coding
at the fixing bracket
with nut
M 2.5 DIN 562

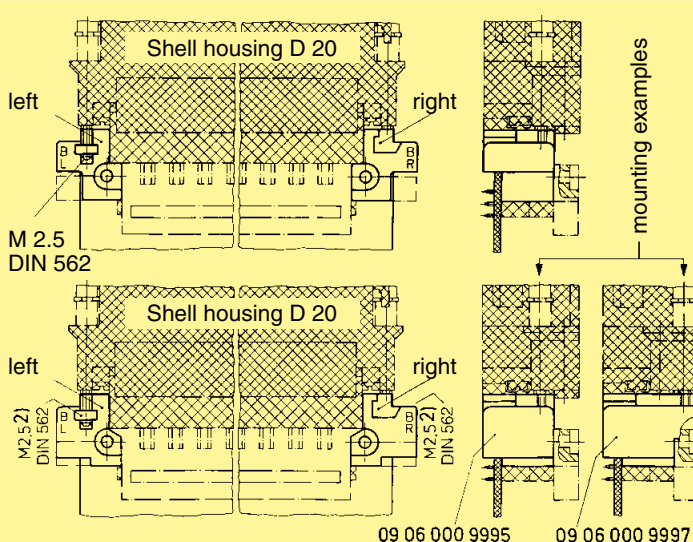
left
09 06 000 9966
right
09 06 000 9967

with coding
at fixing bracket¹⁾
with nut
M 2.5
DIN 562

15 mm
20 mm

left
09 06 000 9995
09 06 000 9997

right
09 06 000 9996
09 06 000 9998

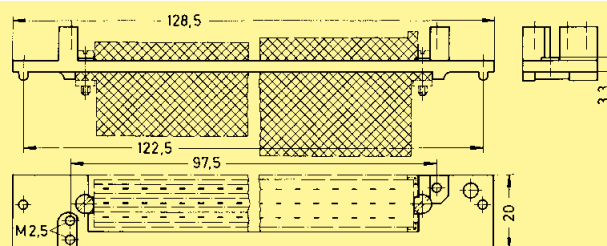


²⁾ supplied with fixing

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

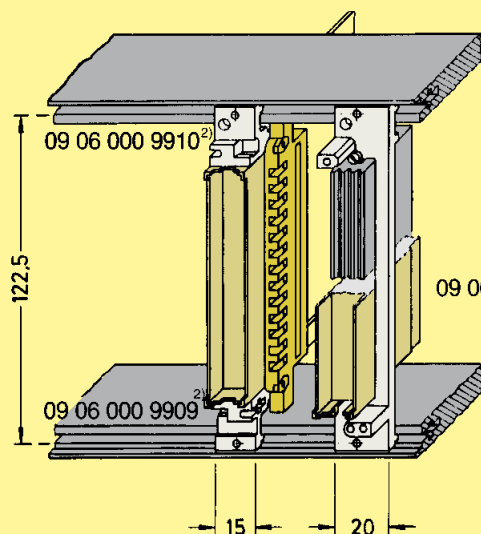
¹⁾ Specific coding between the fixing bracket and the pcb guiding rail.

The guiding rail and corresponding coding pins are not scope of delivery

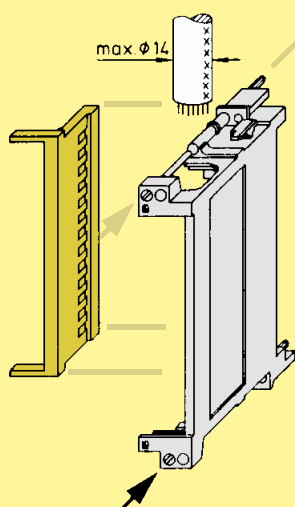
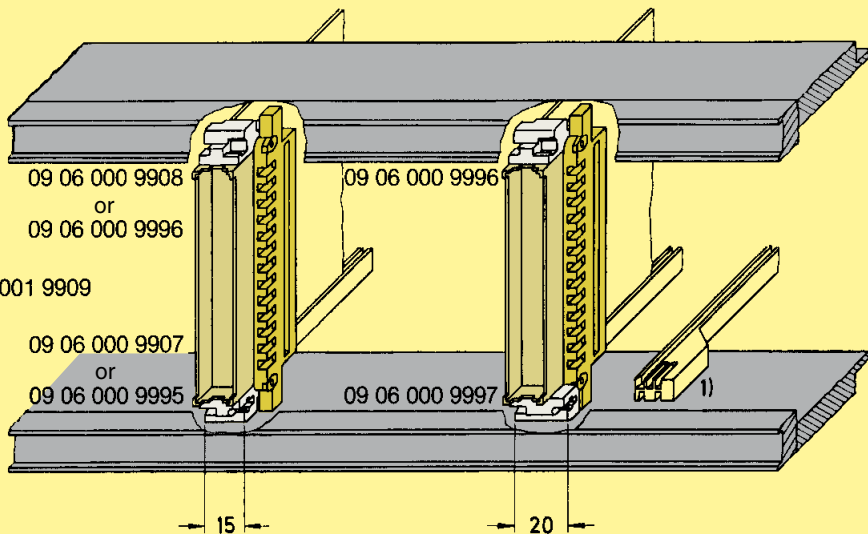
Mounting examples

Dimensions in mm

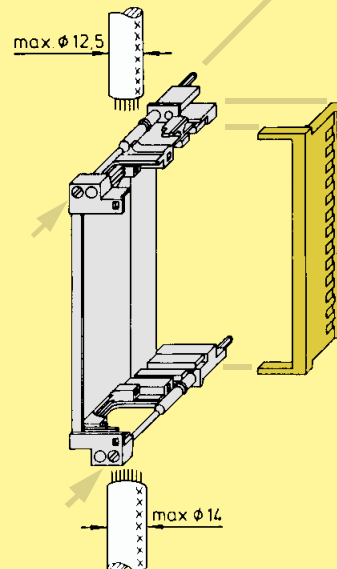
Single fixing



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

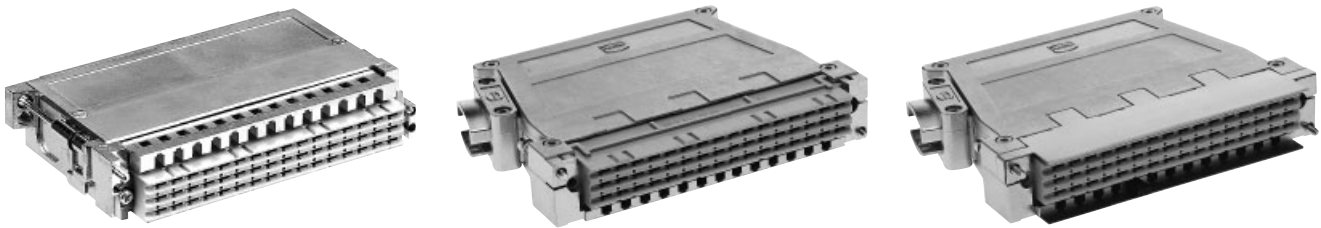
Fitting male connectors

Fixing brackets

Housing parts supplied

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

²⁾ Max. cable entry ($\phi 14$ 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 60 603-2. 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.

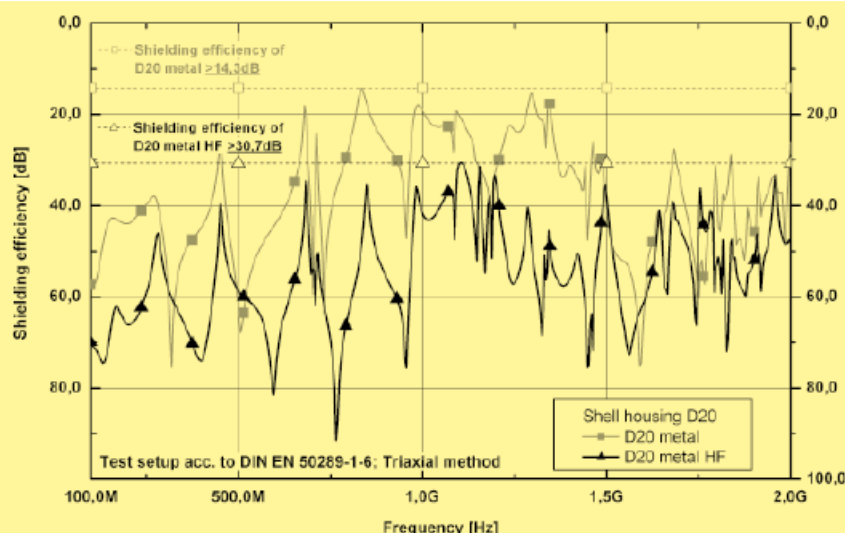
One advantage of metallised housings is their reduced weight (40 grams compared to 180 grams of a full metal housing). Therefore, minimal interference is applied to the pcb in applications where strong vibration is occurring. The HARTING housings are comparatively light through the use of metallised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

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

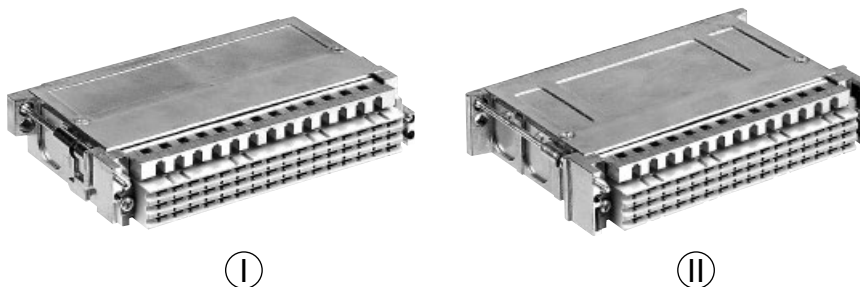
In general, one should keep in mind that an unshielded cable entry leads to loss of the shielding against electromagnetic interference.

“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



I

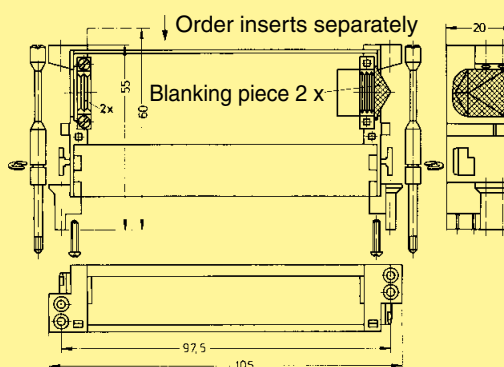
II

Identification	Part No.	Drawing	Dimensions in mm
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Shell housing
D 20/2 metallised
with two side
cable entries

I

20 mm
09 06 948 0521

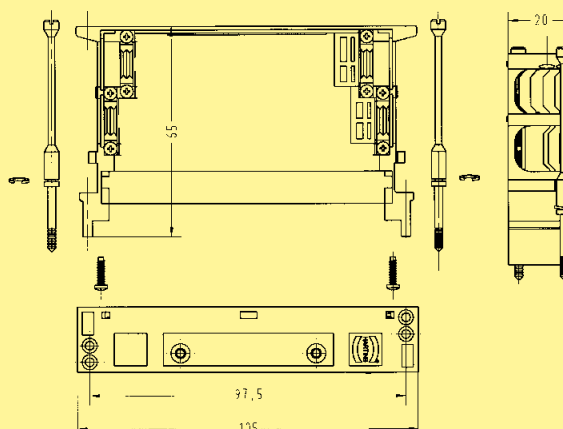


Supplied with:
see page 20.20

Shell housing
D 20/4 metallised
with four side
cable entries

II

20 mm
09 06 948 0522

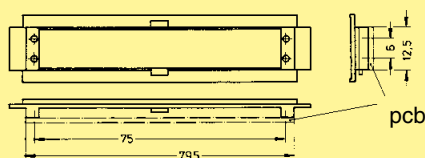


Supplied with:
Shell 1x
Cover 1x
Locking screw 2x
(09 06 000 9920)
Locking washer 2.3 2x
Screw BZ 2.2x7.5 12x
Blinding piece 3x
Cable clamp 2x

Metallised insert
e. g. for LED*

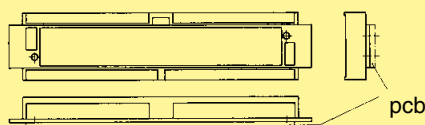
for 55 mm height

09 06 900 9986



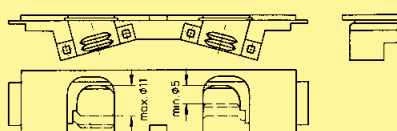
for 60 mm height

09 06 900 9987



Metallised
round cable insert*
2 x ø 11

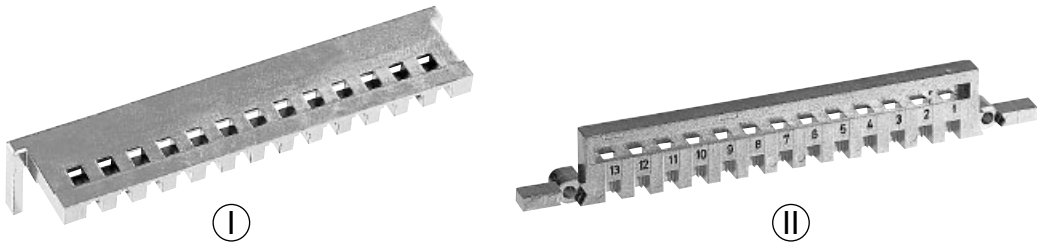
09 06 900 9988



Shell
 housings

20
27

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



Coding

Identification	Part No.	Drawing	Dimensions in mm
Metallised code comb for shell housing³⁾ (can also be used as blanking cover) ①	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⁾ ② 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	

Shell housings

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

Identification	Part No.	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 4 036	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

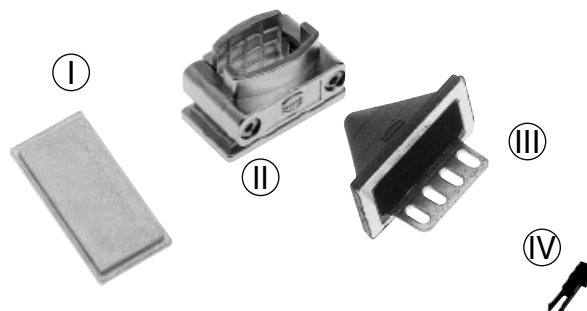
¹⁾ Specific coding between the fixing bracket and pcb guiding rail

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



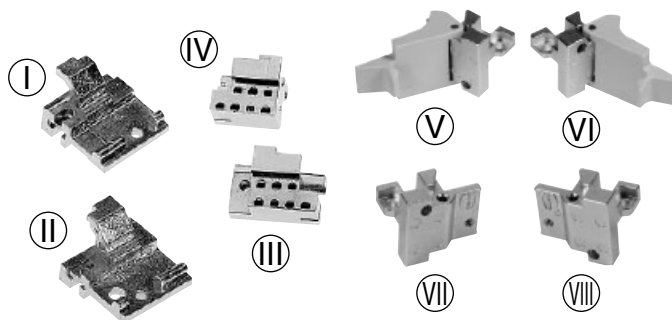
Shell mousings

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



Identification	Part No.	Drawing	Dimensions in mm
Blinding piece Ⓘ	09 06 800 9951		
Cable clamp Ⓜ	09 06 800 9955		
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 No.	Drawing	Dimensions in mm
Fixing brackets B metallised for male connectors for 19" racks according to DIN EN 60 297, part 3-101 Single fixing (I) with nut M 2.5 DIN EN ISO 4 036 (II)	left 20 mm 09 06 901 9924 ¹⁾ right 20 mm 09 06 901 9925 ¹⁾		
Multiple fixing with coding at fixing bracket with nut M 2.5 DIN 562 (III) (IV)	left 20 mm 09 06 900 9997 ¹⁾ right 15 mm 09 06 900 9996 ¹⁾		
Fixing brackets B metal for male connectors for 19" racks according to DIN EN 60 297, part 3-101 Single fixing with ejector handle (V) (VI) without ejector handle (VII) (VIII)	left 09 06 800 9946 right 09 06 800 9948 left 09 06 800 9966 right 09 06 800 9968		

¹⁾ 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

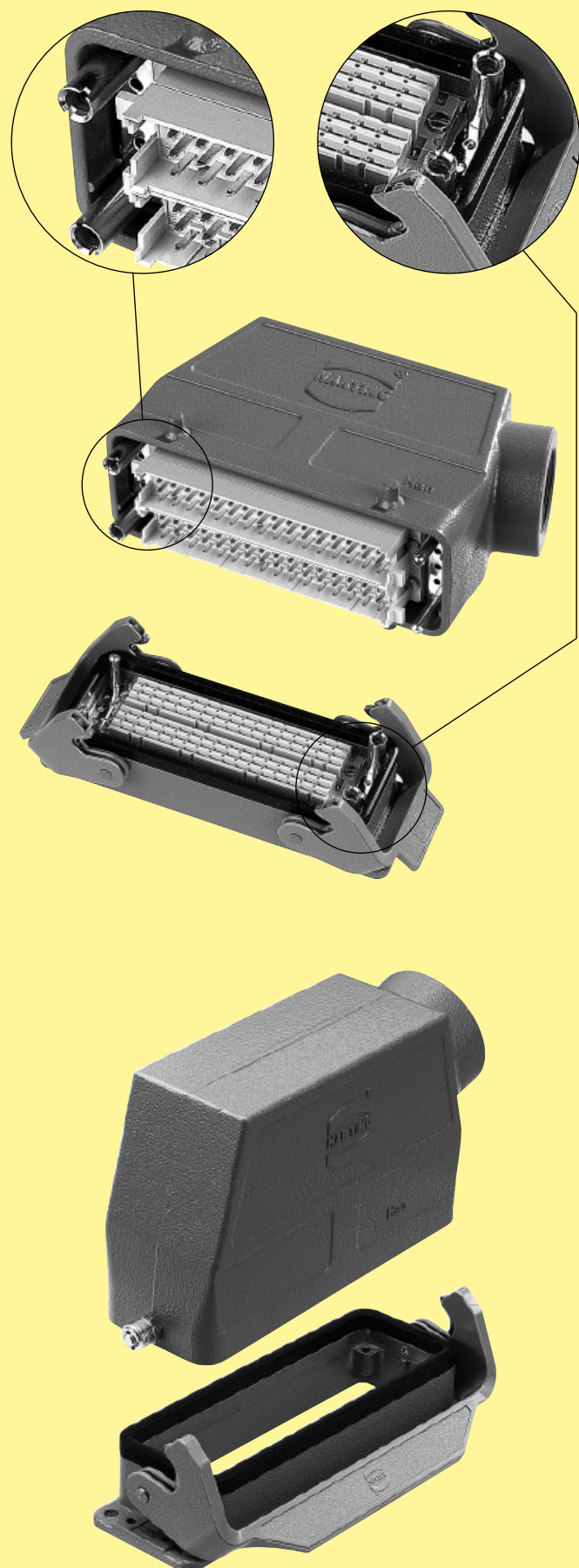
Degree of protection for hoods and housings: IP 65

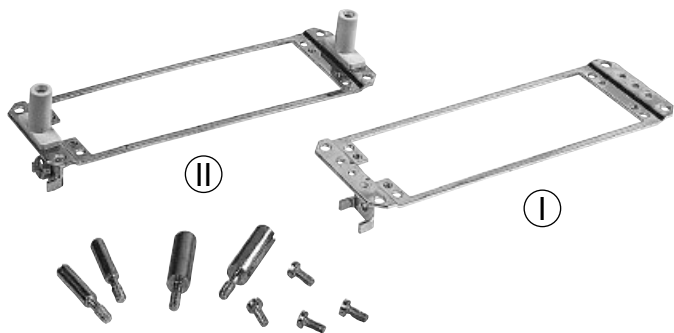
Retaining frames

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 No.	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		
Mounting example		Connectors in the retaining frame with contact sockets	

Tooling	Page
<u>Press-in technology</u>	
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
<u>Crimp technology</u>	
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

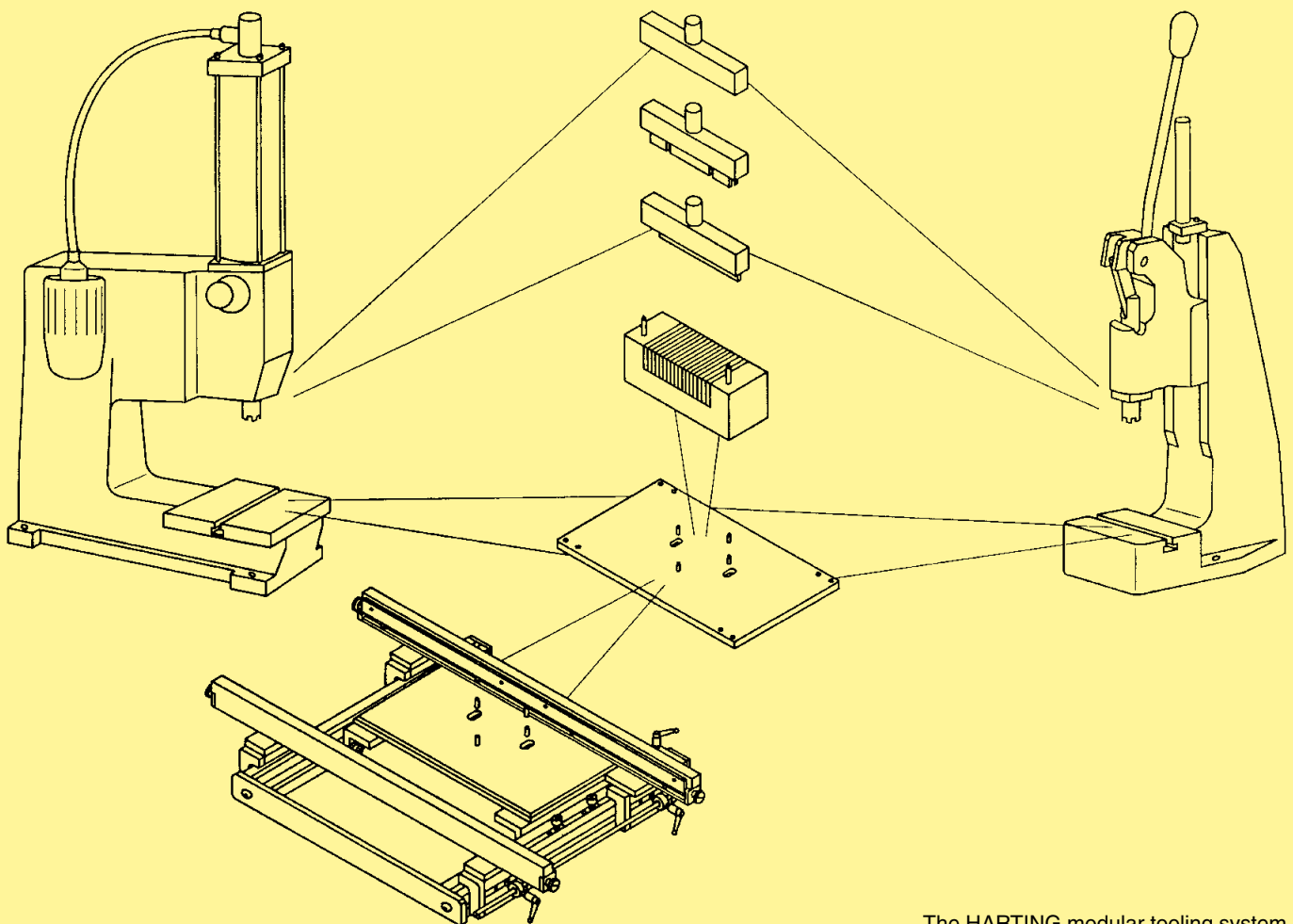
The diversity of connector types with press-in terminations and varying termination styles make it necessary to have a simple, flexible tooling system that can be continuously updated.

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



The HARTING modular tooling system

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°.

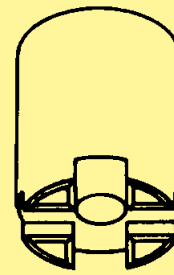
Two guide pins position the bottom tool in relation to the top tool simply and accurately.

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

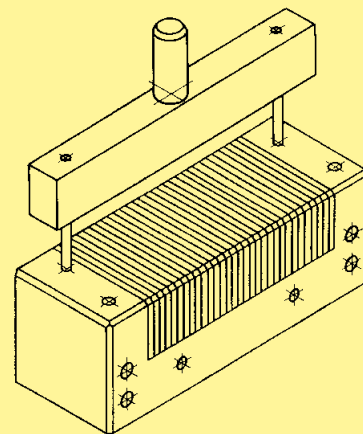
Two pairs of pins on the base plate locate the bottom tool in relation to the top tool in steps of 90°.

Height compensation

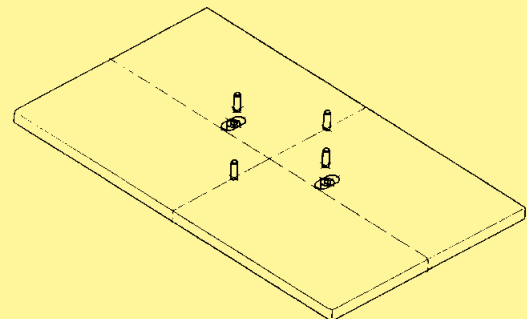
- Various overall heights of connectors are accommodated by type-specific top tools.
- Various pcb thicknesses are accommodated by the use of spacers between the bottom tool and base plate.



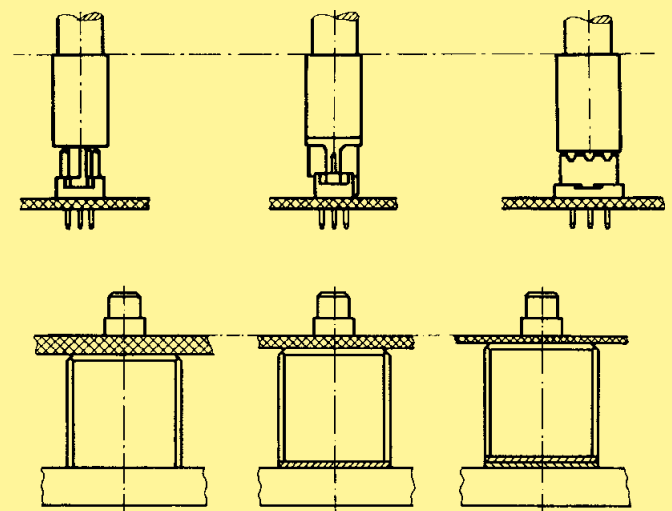
Ram with cross-shaped groove



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)

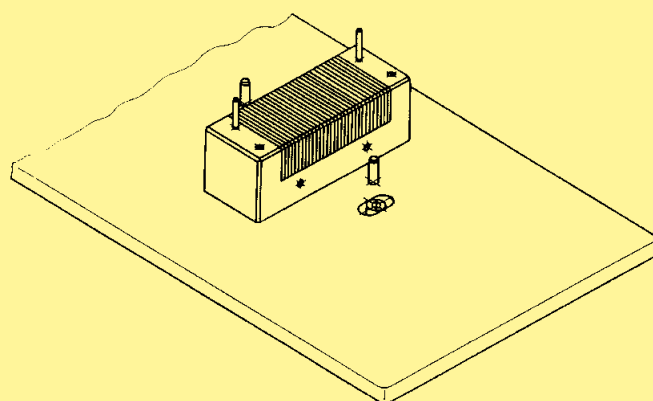
In addition to the square bottom tool with multi-functional properties, HARTING offers the alternative of a narrow bottom tool for assembling connectors with straight press-in terminations. This tool supports the pcb within the press-in connector zone and therefore makes it possible to assemble connectors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

Guide frame

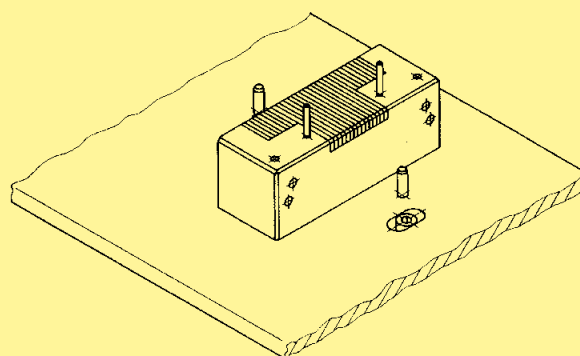
The guide frame screwed to the base plate ensures the correct positioning of the pcb in relation to the top and bottom tools and permits a much higher rate of assembly.

Both guide rails are adjustable to accommodate various pcb sizes.

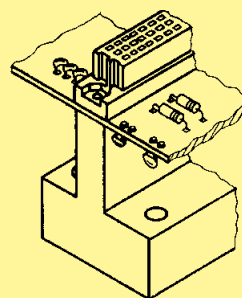
A spring-loaded supporting rail lifts the pcb away from the bottom tool after the press-in operation ensuring that no damage occurs to the conductors as it passes through the machine.



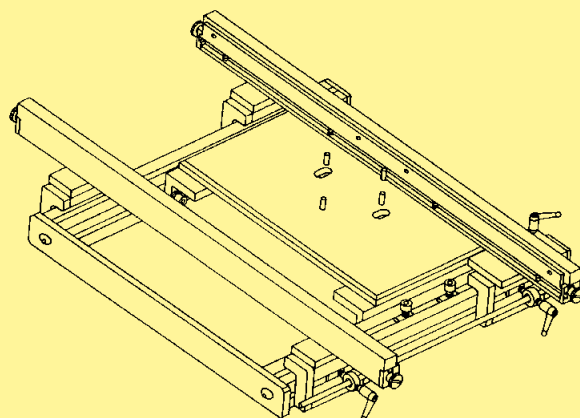
Bottom tool set for assembling connectors with angled pins



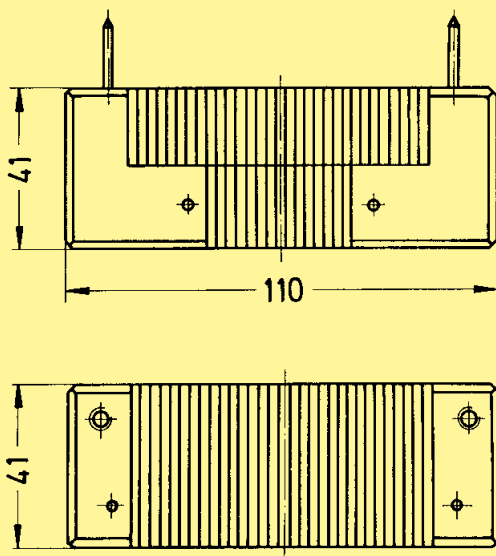
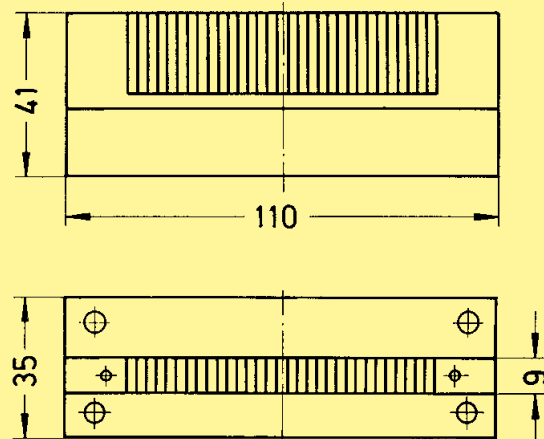
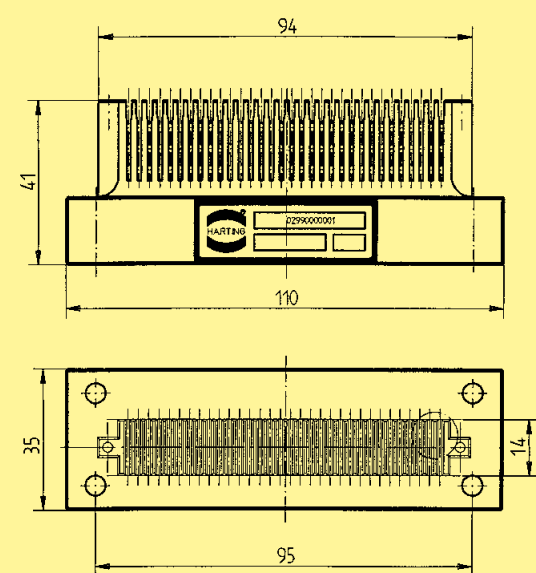
Bottom tool set for assembling half-length connectors with angled pins



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 No.	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 for use with female connectors	Type Q, 2Q, 3Q R, 2R, 3R SEK 18* Type B, 2B, 3B C, 2C, 3C M F H	09 99 000 0256 09 99 000 0256		
Bottom tool Narrow har-bus® 64 for use with female connectors	har-bus® 64	02 99 000 0001		

* Connectors see separate catalogue

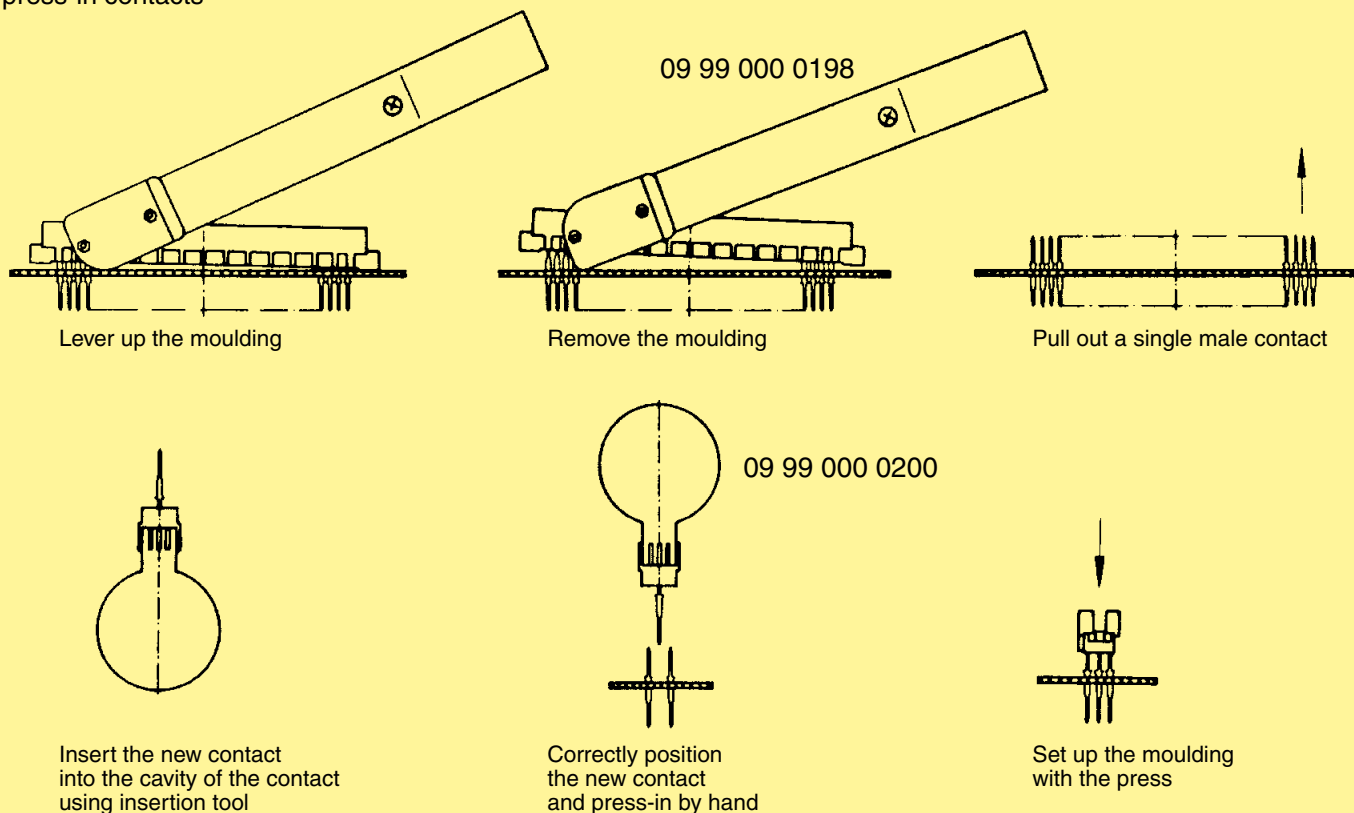
Identification	Part No.	Drawing	Dimensions in mm
Top tool without insert block for use with male connectors	Type Q, 2Q R, 2R	09 99 000 0181 09 99 000 0183	
with insert block for use with male connectors	Type Q, 2Q, 3Q R, 2R, 3R	09 99 000 0197	
Insert blocks for use with male connectors	Type Q 2Q 3Q R 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* Type E F H har-bus® 64 Type M (24+8) M (42+6) M (60+4) M (78+2)	09 99 000 0197 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 for use with female connectors	Type C Type F H har-bus® 64	09 99 000 0228 09 99 000 0229 02 99 000 0016	

* Connectors see separate catalogues

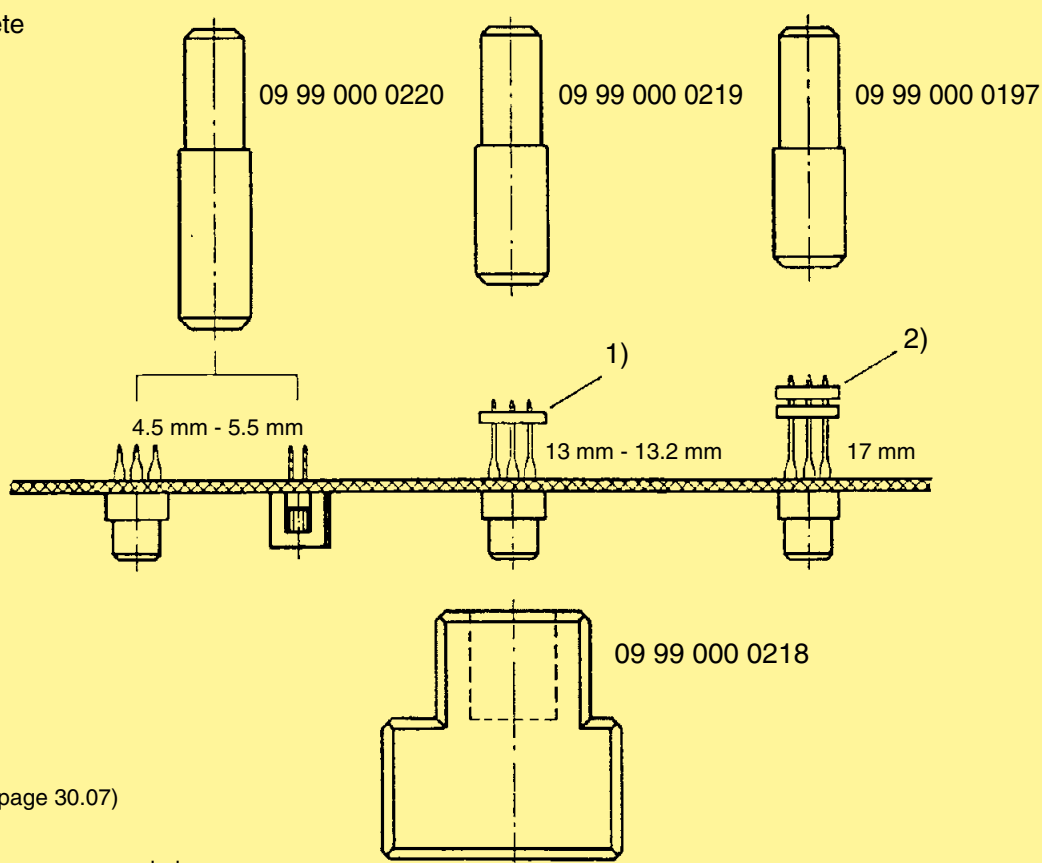
Identification	for use with	Part No.	Drawing	Dimensions in mm															
Removal tool for moulding	Male connectors Type Q, 2Q, 3Q R, 2R, 3R	09 99 000 0198																	
Removal tool for single male contacts		09 99 000 0239																	
Insertion tool for single male press-in contacts		09 99 000 0200																	
Press-out tool	Termination length 17 mm 13 - 13.2 mm 11.5 mm 4.5 - 5.3 mm	09 99 000 0197 09 99 000 0219 09 99 000 0221 09 99 000 0220	<table><tr><th>Termination length [mm]</th><th>x [mm]</th><th>y [mm]</th></tr><tr><td>17</td><td>12</td><td>18.7</td></tr><tr><td>13 - 13.2</td><td>12</td><td>22.7</td></tr><tr><td>11.5</td><td>14</td><td>20.1</td></tr><tr><td>4.5 - 5.3</td><td>12</td><td>30.2</td></tr></table>	Termination length [mm]	x [mm]	y [mm]	17	12	18.7	13 - 13.2	12	22.7	11.5	14	20.1	4.5 - 5.3	12	30.2	With the different dimension y no adjustment of hand bench press necessary.
Termination length [mm]	x [mm]	y [mm]																	
17	12	18.7																	
13 - 13.2	12	22.7																	
11.5	14	20.1																	
4.5 - 5.3	12	30.2																	
Termination support for protection against bending of 13 mm - 17 mm terminations	Male connectors Type Q, 2Q, 3Q R, 2R, 3R Female connectors Type B, 2B, 3B C, 2C, 3C	09 99 000 0240																	
	Female connectors Type F	09 99 000 0241																	
Support block for repair and removal	Male connectors Type Q, 2Q, 3Q R, 2R, 3R SEK 18* Female connectors Type B, 2B, 3B C, 2C, 3C F	09 99 000 0218																	

* Connectors see separate catalogue

Replacement of single male press-in contacts

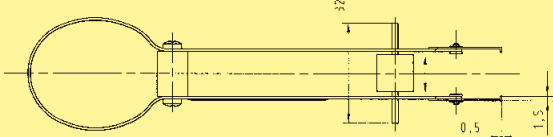
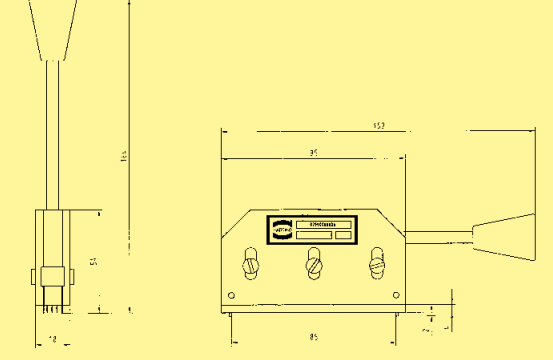
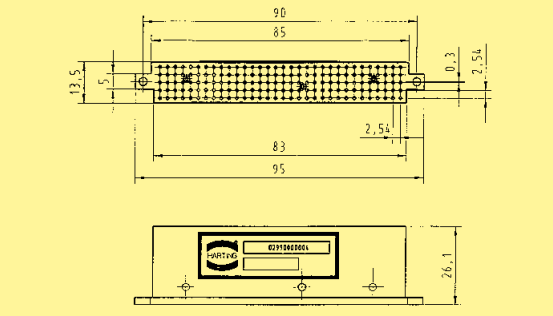
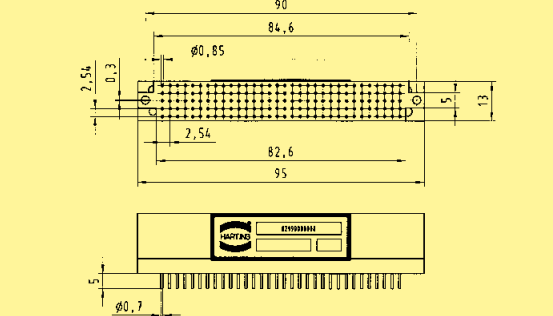
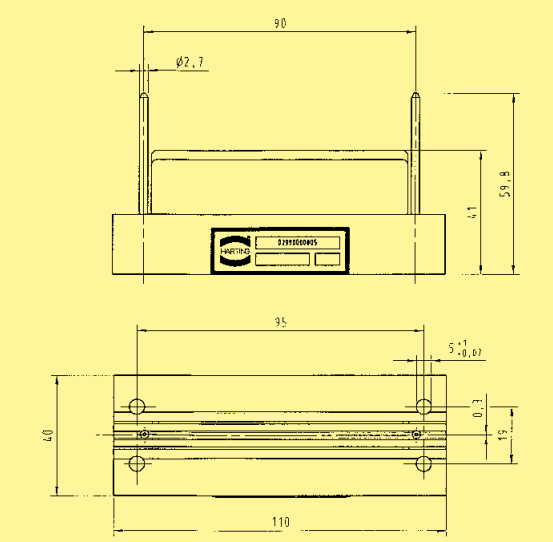


Replacement of complete press-in connectors



¹⁾ Termination support (see page 30.07)

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

Identification	for use with	Part No.	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 No.	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

- Lever up the moulding by using a removal tool
 - The removal tool with Part No. 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 No. 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.
- 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.
- Pull out the female contacts with the press-out tool
 - for 17 mm termination length use Part No. 02 99 000 0004 and
 - for 5 mm termination length use Part No. 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 No. 02 99 000 0005) from the bottom.

Identification	Part No.	Drawing	Dimensions in mm
Hand bench press	09 99 000 0201		Technical characteristics Working stroke 25 mm Press force 15 kN max. Hole $\varnothing$ in the ram $\varnothing$ 10 mm Net weight approx. 23 kg
Pneumatic press 40 kN	09 99 000 0282		Technical characteristics Total stroke 48 mm Working stroke 0-6 mm Press force 40 kN max. Air pressure 6 bar Hole $\varnothing$ in the ram $\varnothing$ 10.01 mm Net weight 136 kg Power supply 110 V / 220 V AC
Adaptor for height compensation ¹⁾	09 99 000 0279		
Guide frame with base plate Standard type for pcb size x = 123,5 - 309,5 mm	09 99 000 0244		
Long type ²⁾ for pcb size x = 123,5 - 668,5 mm	09 99 000 0261		
Base plate	09 99 000 0255		

¹⁾ suitable for 09 99 000 0282 and all CPM machines (see page 30.12 ff.)

²⁾ not suitable for hand bench press

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

The **CPM prestige** 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.

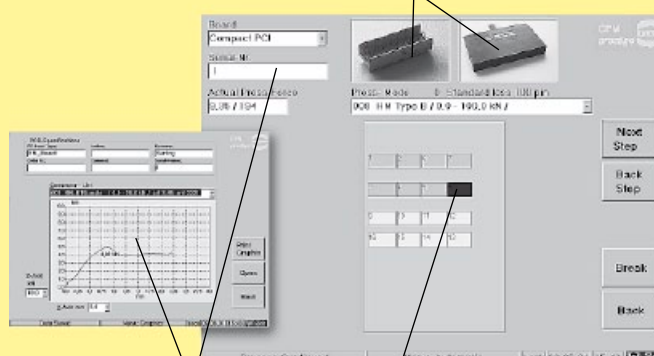
The visualisation of the entire press-in process (the position of the connector, press-in forces etc.) allows the rapid recognition and eradication of the possible error sources. With the addition of a barcode reader (1D and 2D)¹⁾ the parameters of every pcb layout can be stored, recalled and loaded 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.



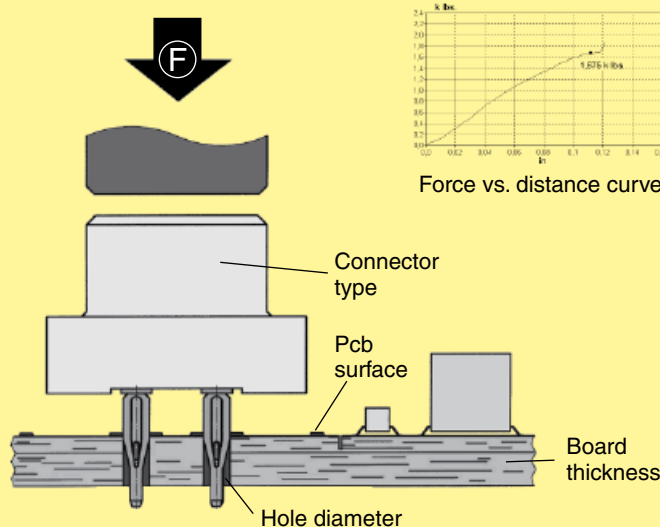
Visual guiding system via touch monitor

Real photos of connectors and tools

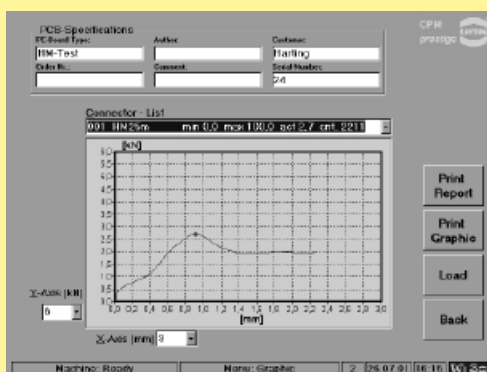


Process data

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 No. 09 89 040 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
(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 Industrial PC with UPS (uninterruptable power supply)
- 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
- Insertion removal station

Insertion removal station

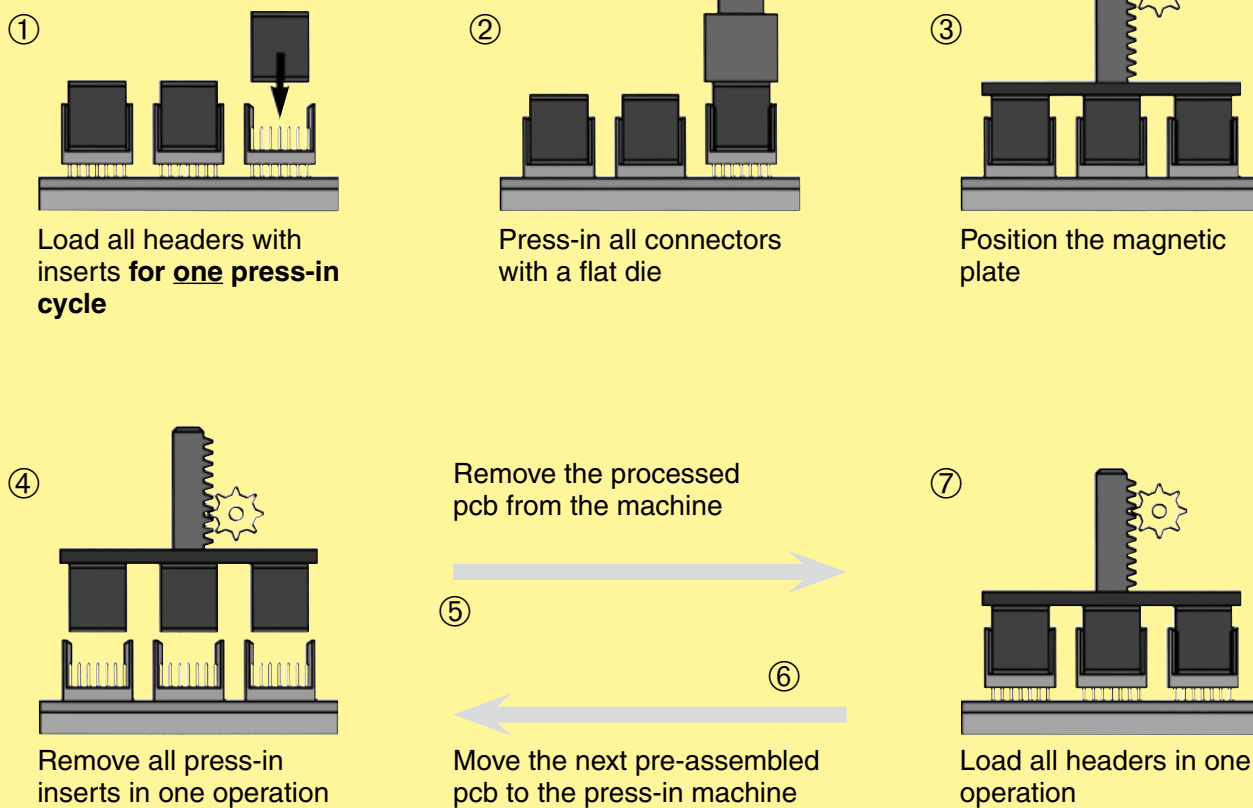


Power supply 220 V / 50 Hz
Air pressure 6 bar (15-16 l/min.)

Part No. **on request**
for pcb dimensions
of max.
710 mm x 540 mm

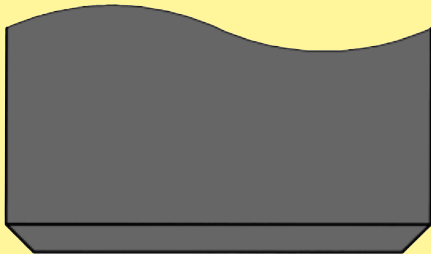
Bestseller **CPM prestige** with **insertion removal station**, adaptable to all HARTING press-in machines.

Principle:



The insertion removal station has been developed both for the **CPM prestige** and the CPM 2001/s. It can additionally be used as stand alone equipment.

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.

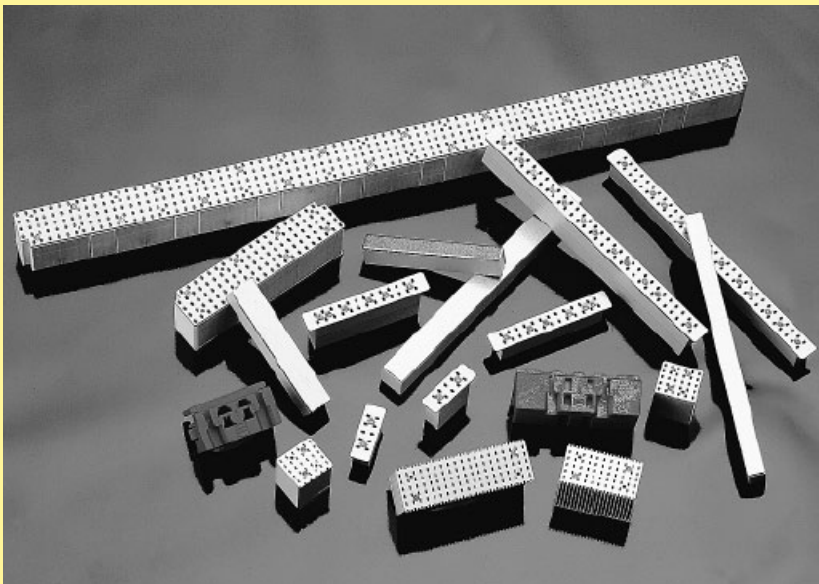
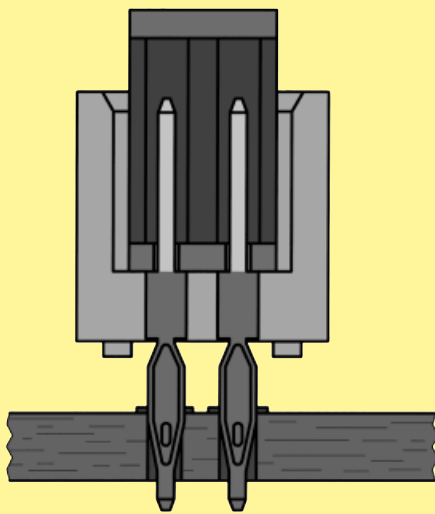


Advantages of press inserts

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, 2.5 mm and 2 mm pitches.

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

The additional process for inserting and removing the press-in inserts can be efficiently done with the insertion removal station. This station removes all press-in inserts with a magnetic plate in one operation and inserts them into the next pre-assembled pcb with the necessary precision. (Principle see page 30.14).

The cycle time for loading all headers is between 4 and 6 seconds, independent from the amount of press-in inserts.

To load the inserts automatically means also that connectors assembled in a wrong way will be recognised and errors consequently prevented.

Identification	Part No.	Drawing	Dimensions in mm
----------------	----------	---------	------------------

HARTING crimping tool

for individual contacts

BC / FC 1 / har-bus® 64

09 99 000 0075

FC 2

09 99 000 0076

FC 3

09 99 000 0077

Wire gauge

BC: 0.09 - 0.50 mm²

FC 1: 0.09 - 0.25 mm²

FC 2: 0.14 - 0.56 mm²

FC 3: 0.50 - 1.50 mm²



Locator

BC / FC 1 / har-bus® 64

09 99 000 0640

FC 2

09 99 000 0641

FC 3

09 99 000 0642

HARTING crimping tool

for individual contacts
BC / FC and har-bus® 64

09 99 000 0620

Crimping insert set

for individual contacts
each set contains
locator and crimp insert
top and bottom part

BC / FC 1 / har-bus® 64

09 99 000 0621

FC 2

09 99 000 0622

FC 3

09 99 000 0623

BC / har-bus® 64
solid wire

09 99 000 0629

Locator

BC / har-bus® 64
FC

09 99 000 0630

09 99 000 0631

Service case

for crimping tool and
5 sets inserts,
incl. screwdriver
for insert change,
without contents

09 99 000 0632

Wire gauge

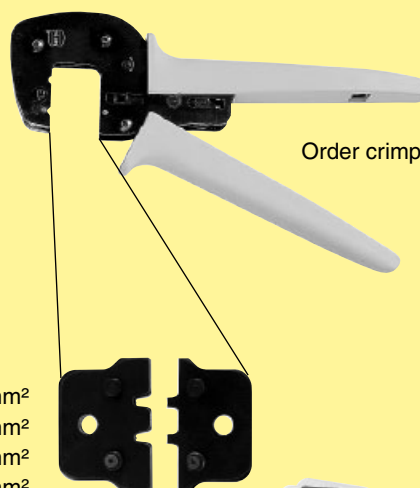
BC: 0.09 - 0.50 mm²

FC 1: 0.09 - 0.25 mm²

FC 2: 0.14 - 0.56 mm²

FC 3: 0.50 - 1.50 mm²

BC: 0.13 mm² (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 mm²

FC 2: 0.25 - 0.56 mm²

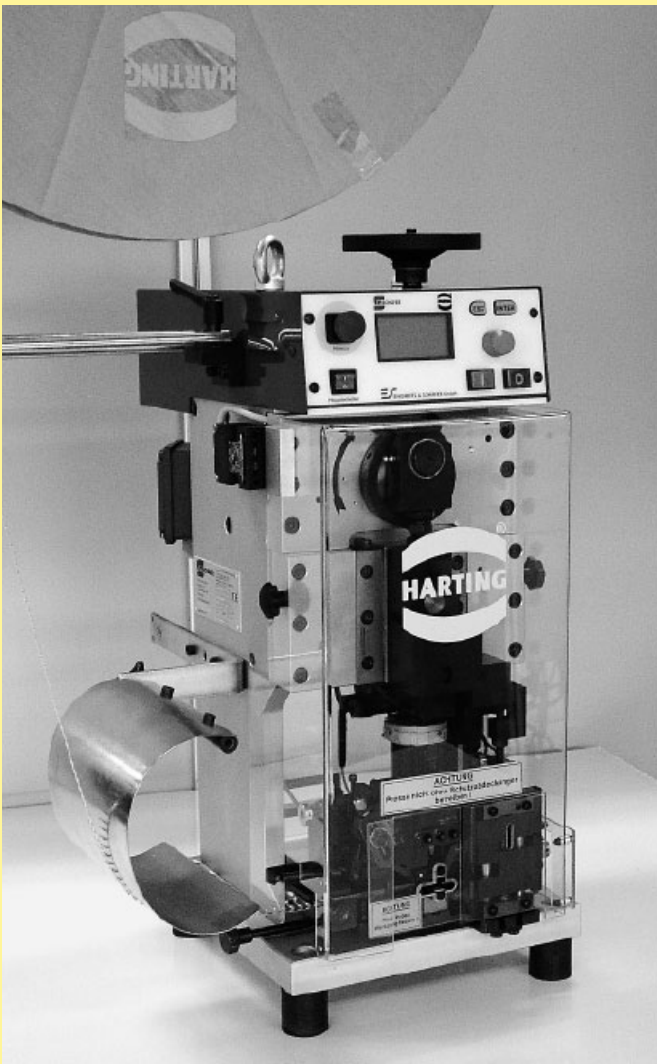
FC 3: 0.75 - 1.50 mm²

Locator is supplied with the tool.



Identification	Part No.	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 mm² Wire gauge 0.09 - 0.25 mm² 0.14 - 0.56 mm² 0.50 - 1.50 mm² 0.13 mm² (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 mm² 0.09 - 0.25 mm² 0.14 - 0.56 mm² 0.5 - 1.5 mm² 0.13 mm² (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 No. 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

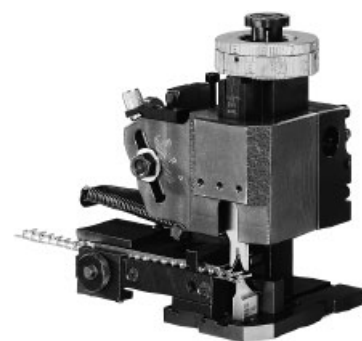
Stroke counter Daywise and fixed

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 No.	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		

List of part numbers



Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page
02 01 160 1101	02.11	02 09 000 0017	03.19	09 02 000 9902	01.64	09 02 000 9954	20.02	09 02 264 6861	01.12
02 01 160 1102	02.11	02 09 000 0017	03.21	09 02 000 9902	01.65	09 02 000 9954	20.06	09 02 264 6870	01.12
02 01 160 1105	02.11	02 09 000 0018	03.19	09 02 000 9902	02.17	09 02 000 9954	20.09		
02 01 160 1106	02.11	02 09 000 0018	03.21	09 02 000 9902	03.21			09 02 264 7828	01.14
				09 02 000 9902	03.25	09 02 064 0501	00.08		
02 01 160 2101	02.05	02 44 000 0001	02.05	09 02 000 9902	20.02	09 02 064 0501	20.02	09 02 332 6931	01.11
02 01 160 2101	02.11	02 44 000 0001	02.16	09 02 000 9902	20.06	09 02 064 0501	20.04	09 02 364 6921	01.11
02 01 160 2102	02.11	02 44 000 0002	02.16	09 02 000 9903	00.08	09 02 064 0501	20.05		
		02 44 000 0003	02.16	09 02 000 9903	00.09	09 02 064 0501	20.07	09 02 464 6824	01.12
		02 44 000 0004	02.16	09 02 000 9903	00.10	09 02 064 0502	00.08	09 02 464 6825	01.12
02 02 160 1201	02.12	02 44 000 0005	02.16	09 02 000 9903	01.64	09 02 064 0502	20.02		
02 02 160 1202	02.12	02 44 000 0006	02.16	09 02 000 9903	01.65	09 02 064 0502	20.04	09 02 632 6921	01.11
02 02 160 1301	02.12	02 44 000 0007	02.16	09 02 000 9903	02.17	09 02 064 0502	20.05	09 02 664 6921	01.11
02 02 160 1302	02.12	02 44 000 0007	02.17	09 02 000 9903	03.21	09 02 064 0502	20.07		
02 02 160 1601	02.12	02 44 000 0007	02.18	09 02 000 9903	03.25			09 02 764 6824	01.12
		02 44 000 0008	02.16	09 02 000 9903	20.02	09 02 064 3214	01.15	09 02 764 6825	01.12
02 02 160 2201	02.05	02 44 000 0008	02.17	09 02 000 9903	20.06	09 02 132 2921	01.11		
02 02 160 2201	02.12	02 44 000 0009	00.09	09 02 000 9909	00.08	09 02 132 2931	01.11		
02 02 160 2202	02.12	02 44 000 0009	02.16	09 02 000 9909	00.09			09 03 000 6101	01.37
02 02 160 2301	02.05	02 44 000 0009	02.17	09 02 000 9909	00.11	09 02 132 6921	01.11	09 03 000 6101	01.40
02 02 160 2301	02.12			09 02 000 9909	20.02	09 02 132 6922	01.11	09 03 000 6102	01.37
02 02 160 2301	02.17			09 02 000 9909	20.07	09 02 132 6931	01.11	09 03 000 6102	01.40
02 02 160 2301	02.18			09 02 000 9910	20.02	09 02 132 6932	01.11	09 03 000 6103	01.37
02 02 160 2302	02.12	02 99 000 0001	30.05	09 02 000 9910	20.07			09 03 000 6103	01.40
		02 99 000 0002	30.06	09 02 000 9911	20.02	09 02 132 7921	01.11	09 03 000 6104	01.37
		02 99 000 0003	30.09	09 02 000 9911	20.07	09 02 132 7922	01.11	09 03 000 6104	01.40
		02 99 000 0003	30.10	09 02 000 9911	20.07	09 02 132 7931	01.11	09 03 000 6110	01.37
02 03 160 2201	02.05	02 99 000 0004	30.09	09 02 000 9919	00.09	09 02 164 2921	01.11	09 03 000 6110	01.40
02 03 160 2201	02.13	02 99 000 0004	30.10	09 02 000 9919	20.02	09 02 164 2922	01.11	09 03 000 6113	01.37
		02 99 000 0005	30.09	09 02 000 9919	20.06	09 02 164 2951	01.11	09 03 000 6113	01.40
		02 99 000 0005	30.10	09 02 000 9919	20.09	09 02 164 2952	01.11	09 03 000 6114	01.37
02 04 048 1101	03.19	02 99 000 0006	30.09	09 02 000 9920	00.09			09 03 000 6114	01.40
02 04 048 1101	03.21	02 99 000 0006	30.10	09 02 000 9920	20.02	09 02 164 6919	01.11	09 03 000 6115	01.37
		02 99 000 0007	30.10	09 02 000 9920	20.06	09 02 164 6920	01.11	09 03 000 6115	01.40
02 04 160 1101	02.05	02 99 000 0008	30.09	09 02 000 9920	20.09	09 02 164 6921	01.11	09 03 000 6127	01.37
02 04 160 1101	02.14	02 99 000 0008	30.10	09 02 000 9921	00.09	09 02 164 6921 222	01.11	09 03 000 6127	04.24
		02 99 000 0016	30.06	09 02 000 9921	20.02	09 02 164 6922	01.11	09 03 000 6128	01.37
				09 02 000 9921	20.06	09 02 164 6951	01.11	09 03 000 6128	04.24
02 05 000 0003	02.15			09 02 000 9921	20.09	09 02 164 6952	01.11	09 03 000 6133	01.37
02 05 000 0004	02.15			09 02 000 9922	00.09			09 03 000 6133	01.40
02 05 000 0004	02.17			09 02 000 9922	20.02	09 02 164 7919	01.11	09 03 000 6134	01.37
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		09 02 000 6484	01.15	09 02 000 9926	20.02			09 03 000 6140	01.36
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		09 02 000 8434	01.27	09 02 000 9927	20.07			09 03 000 6161	01.36
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09 06 000 9911	20.19	09 06 000 9966	20.18	09 06 001 9950	00.16	09 06 048 0402	20.11	09 06 048 2906	00.10
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09 06 131 6924	04.22	09 06 231 2881	04.23	09 06 248 3201	30.06	09 06 848 0550	20.30	09 06 948 0522	20.21
09 06 132 2901	03.27	09 06 231 2881	20.21	09 06 248 3201 222	03.31	09 06 848 0551	00.11	09 06 948 0522	20.27
09 06 132 2921	03.27	09 06 231 2881 222	04.23	09 06 248 6821	03.33	09 06 848 0551	20.03		
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09 06 132 6901	03.27	09 06 231 6822	04.23	09 06 248 6823	03.33	09 06 848 0551	20.30	09 18 064 7001	01.26
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09 06 132 6921	03.27	09 06 232 2821	03.33	09 06 248 6826	03.38	09 06 900 9907	20.29	09 18 064 7004	01.26
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09 06 132 6931 222	03.27	09 06 232 2831	03.33	09 06 248 6833	03.34	09 06 900 9908	20.29	09 18 064 7005	01.26
09 06 132 7901	03.27	09 06 232 2832	03.34	09 06 248 6833 222	03.34	09 06 900 9909	20.03	09 18 064 7006	01.14
09 06 132 7921	03.27	09 06 232 2832 222	03.34	09 06 248 6834	03.34	09 06 900 9909	20.29	09 18 064 7006	01.26
09 06 132 7931	03.27	09 06 232 2835	03.32	09 06 248 6834 222	03.34	09 06 900 9910	20.03	09 18 064 7007	01.14
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09 06 148 2925	03.27	09 06 232 2894	03.34	09 06 248 6838	03.34	09 06 900 9967	20.29	09 18 064 7010	01.26
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09 06 148 6901 222	03.27	09 06 232 6823	03.33	09 06 248 7821	03.33	09 06 900 9985	20.28	09 18 064 7011	01.26
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09 06 148 6925 222	03.27	09 06 232 6832	03.34	09 06 248 7833	03.34	09 06 900 9987	20.03	09 22 116 6921	01.16
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09 06 203 2811	04.17	09 06 232 6834	03.34	09 06 331 6924	04.22	09 06 900 9988	20.03	09 22 132 2921	01.16
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09 06 209 3201	03.41	09 06 232 6836	03.35	09 06 332 6931	03.27	09 06 900 9995	20.03	09 22 132 6919	01.16
09 06 215 2811	04.12	09 06 232 6843	03.33	09 06 332 7901	03.27	09 06 900 9996	00.11	09 22 132 6920	01.16
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09 23 000 9955	01.62	09 23 248 2824	01.30			09 28 132 6902	01.56	09 29 130 6593	01.58
09 23 000 9956	01.62	09 23 248 2825	01.30	09 25 120 6921	01.32	09 28 132 6903	01.56	09 29 130 6902	01.58
09 23 000 9957	01.62	09 23 248 2850	01.30	09 25 120 6922	01.32	09 28 132 6904	01.56	09 29 130 6903	01.58
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09 23 000 9959	01.62	09 23 248 6421	01.30	09 25 130 6571	01.32	09 28 132 6985	01.56	09 29 130 6907	01.58
09 23 000 9960	01.62	09 23 248 6821	01.30	09 25 130 6572	01.32			09 29 130 6974	01.58
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09 23 000 9962	01.62	09 23 248 6824	01.66	09 25 130 6590	01.32	09 28 132 7903	01.56	09 29 130 6985	01.58
09 23 000 9963	01.62	09 23 248 6824 222	01.30	09 25 130 6919	01.32	09 28 132 7907	01.56		
09 23 000 9964	01.62	09 23 248 6825	01.30	09 25 130 6921	01.32				
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09 23 000 9967	01.62	09 23 248 6841	01.30	09 25 220 6824	01.34	09 28 148 2907	01.56	09 72 164 6903	01.52
09 23 000 9968	01.62	09 23 248 6850	01.30	09 25 220 6825	01.34			09 72 164 6904	01.52
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09 23 048 0501	20.02			09 25 230 6825	01.34	09 28 148 6520	01.56	09 72 164 6954	01.52
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09 23 048 3217	01.27			09 25 230 6870	01.34	09 28 148 6902	01.56		
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09 23 132 6920	01.28	09 23 348 6921	01.28	09 26 024 2981	03.45	09 28 148 7903	01.56		
09 23 132 6921	01.28	09 23 348 6951	01.28			09 28 148 7904	01.56	09 73 124 6902	01.44
09 23 132 6922	01.28			09 26 024 3201	03.46	09 28 148 7907	01.56	09 73 124 6903	01.44
		09 23 348 7921	01.28	09 26 024 3411	03.44	09 28 148 7985	01.56	09 73 124 6907	01.44
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09 23 148 2921	01.28	09 23 448 6825	01.30			09 28 348 6903	01.56	09 73 142 6902	01.44
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09 23 148 6920	01.28	09 24 120 6571	01.18	09 27 132 6903	01.53	09 28 448 6801	01.60	09 73 142 6985	01.44
09 23 148 6921	01.28	09 24 120 6579	01.18	09 27 132 6903 222	01.53			09 73 142 6991	01.44
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09 23 148 7921	01.28	09 24 220 6824	01.19	09 27 132 7902	01.53	09 29 120 6974	01.58	09 73 160 6985	01.44
09 23 148 7922	01.28	09 24 220 6825	01.19	09 27 132 7903	01.53	09 29 130 6504	01.58	09 73 160 6991	01.44
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09 73 164 6902	01.46	09 73 264 6804	01.49			09 99 000 0150	01.14	09 99 000 0274	30.06
09 73 164 6903	01.46					09 99 000 0150	01.26	09 99 000 0275	30.06
09 73 164 6904	01.46	09 73 264 7801	01.49	09 79 164 2950	01.48	09 99 000 0158	30.17	09 99 000 0276	30.06
09 73 164 6907	01.46	09 73 296 2801	01.49	09 79 164 6903	01.50	09 99 000 0172	03.43	09 99 000 0277	30.06
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09 73 164 6974	01.46	09 73 296 6801	01.49	09 79 196 2950	01.48	09 99 000 0174	04.25	09 99 000 0279	30.11
09 73 164 6985	01.46	09 73 296 6801	01.64	09 79 196 2961	01.48	09 99 000 0179	01.14	09 99 000 0282	30.11
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09 73 164 7902	01.46	09 73 296 6801	02.17	09 79 196 6902	01.50	09 99 000 0180	01.14	09 99 000 0328	04.24
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09 73 164 7904	01.46	09 73 296 6804	01.49	09 79 196 6907	01.50	09 99 000 0181	30.06	09 99 000 0621	30.16
09 73 164 7907	01.46					09 99 000 0183	30.06	09 99 000 0622	30.16
		09 73 296 7801	01.49	09 79 264 6801	01.51	09 99 000 0185	30.05	09 99 000 0623	30.16
09 73 178 6902	01.44	09 73 364 2902	01.46	09 79 264 7801	01.51	09 99 000 0191	30.16	09 99 000 0627	30.17
09 73 178 6903	01.44			09 79 296 6801	01.51	09 99 000 0194	01.39	09 99 000 0628	30.17
09 73 178 6907	01.44	09 73 364 6902	01.46			09 99 000 0196	01.39	09 99 000 0629	30.16
09 73 178 6974	01.44	09 73 364 6903	01.46	09 79 296 7801	01.51	09 99 000 0197	30.06	09 99 000 0630	30.16
09 73 178 6985	01.44					09 99 000 0197	30.07	09 99 000 0631	30.16
09 73 178 6991	01.44	09 73 396 6902	01.46	09 79 364 6903	01.50	09 99 000 0197	30.08	09 99 000 0632	30.16
		09 73 396 6903	01.46	09 79 396 6903	01.50	09 99 000 0198	30.07	09 99 000 0640	30.16
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09 73 196 2903	01.46	09 73 464 6804	01.49	09 79 496 6801	01.51	09 99 000 0200	30.08		
09 73 196 2904	01.46					09 99 000 0201	30.11		
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09 73 196 6902	01.46			09 98 000 3009	30.19	09 99 000 0229	30.06		
09 73 196 6903	01.46	09 73 696 6902	01.46	09 98 000 3012	30.19	09 99 000 0239	30.07		
09 73 196 6903 222	01.46	09 73 696 6904	01.46			09 99 000 0240	30.07		
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09 73 196 6953	01.46			09 99 000 0003	20.31	09 99 000 0244	30.11	61 03 000 0141	20.31
09 73 196 6954	01.46			09 99 000 0038	00.16	09 99 000 0246	30.17	61 03 000 0143	20.31
09 73 196 6974	01.46	09 75 120 6504	01.54	09 99 000 0075	30.16	09 99 000 0247	30.17		
09 73 196 6985	01.46	09 75 120 6519	01.54	09 99 000 0076	30.16	09 99 000 0248	30.17		
09 73 196 6995	01.46	09 75 120 6520	01.54	09 99 000 0077	30.16	09 99 000 0249	30.17		
		09 75 120 6521	01.54	09 99 000 0087	30.17	09 99 000 0250	30.17		
09 73 196 7902	01.46	09 75 120 6569	01.54	09 99 000 0088	30.17	09 99 000 0251	30.17		
09 73 196 7903	01.46	09 75 120 6570	01.54	09 99 000 0100	30.17	09 99 000 0252	30.17		
09 73 196 7904	01.46	09 75 120 6574	01.54	09 99 000 0101	30.17	09 99 000 0255	30.11		
09 73 196 7907	01.46	09 75 120 6577	01.54	09 99 000 0103	00.15	09 99 000 0256	30.05		
09 73 196 7974	01.46	09 75 120 6592	01.54	09 99 000 0114	01.14	09 99 000 0261	30.11		
		09 75 120 6593	01.54	09 99 000 0114	01.26	09 99 000 0263	30.06		
09 73 232 2801	01.49	09 75 120 6902	01.54	09 99 000 0116	01.14	09 99 000 0264	30.06		
09 73 232 6801	01.49	09 75 120 6903	01.54	09 99 000 0116	01.26	09 99 000 0269	30.06		
09 73 232 6811	01.49	09 75 120 6904	01.54						

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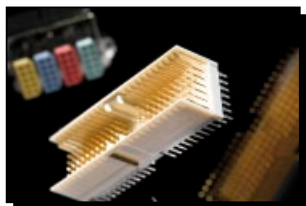
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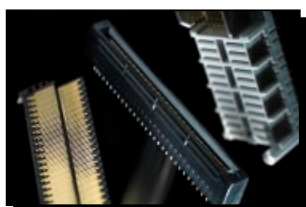
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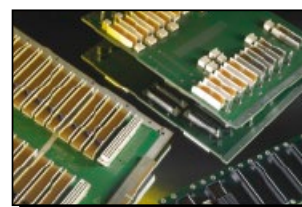
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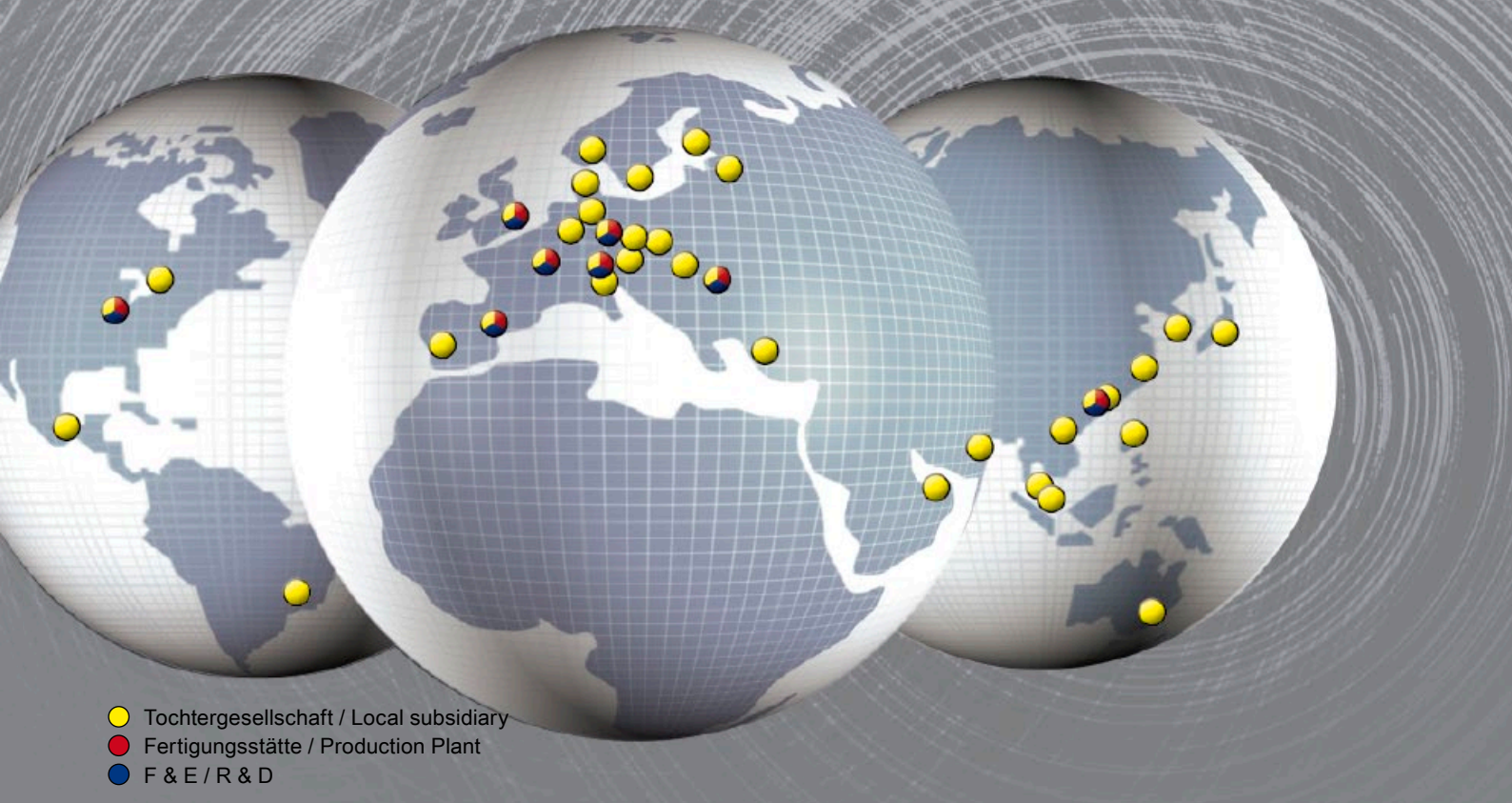
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