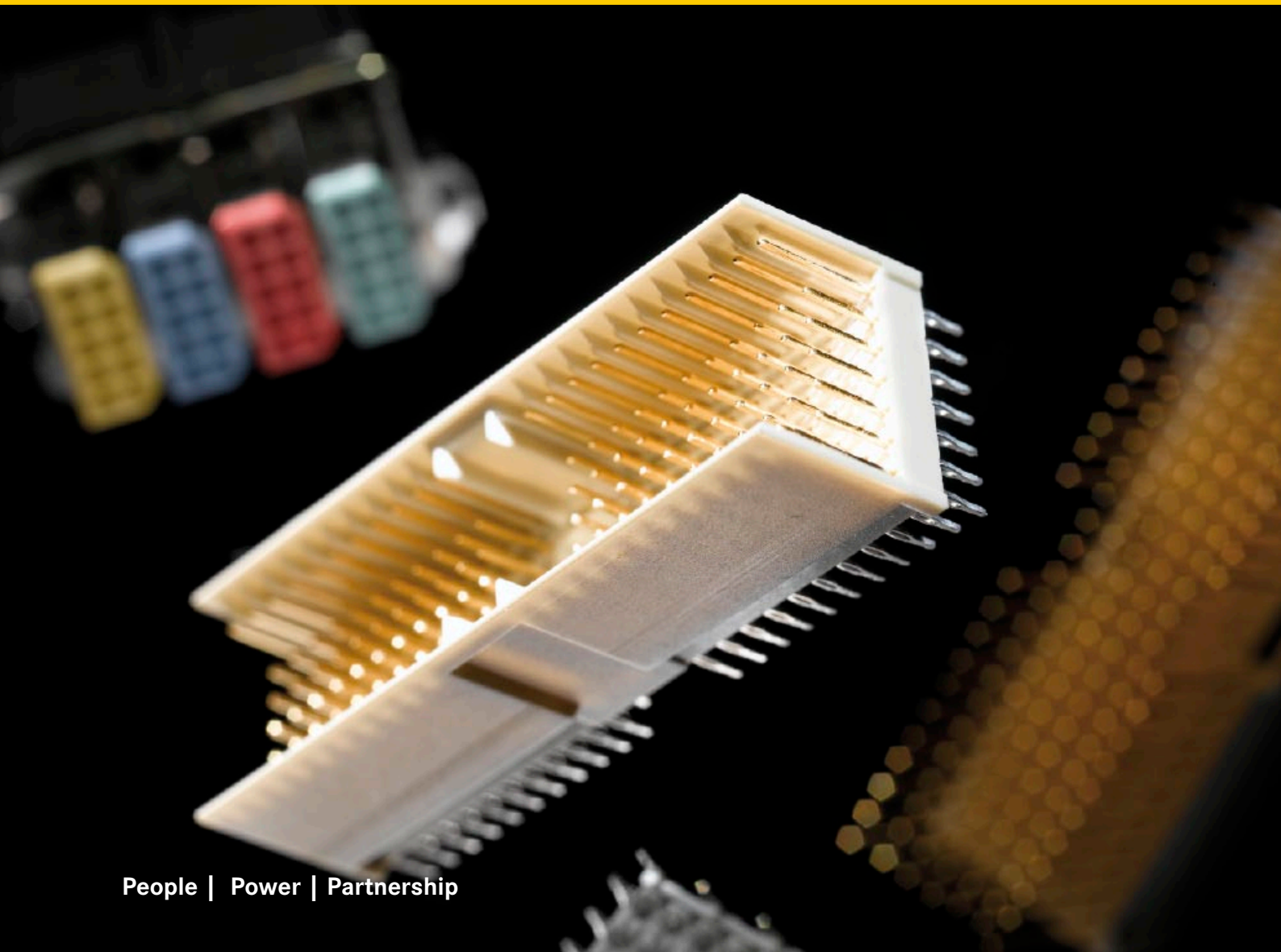




Pushing Performance

# HARTING Coaxial and Metric Connectors



## 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 32 subsidiary companies and worldwide distributors employing a total of approximately 3,200 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.

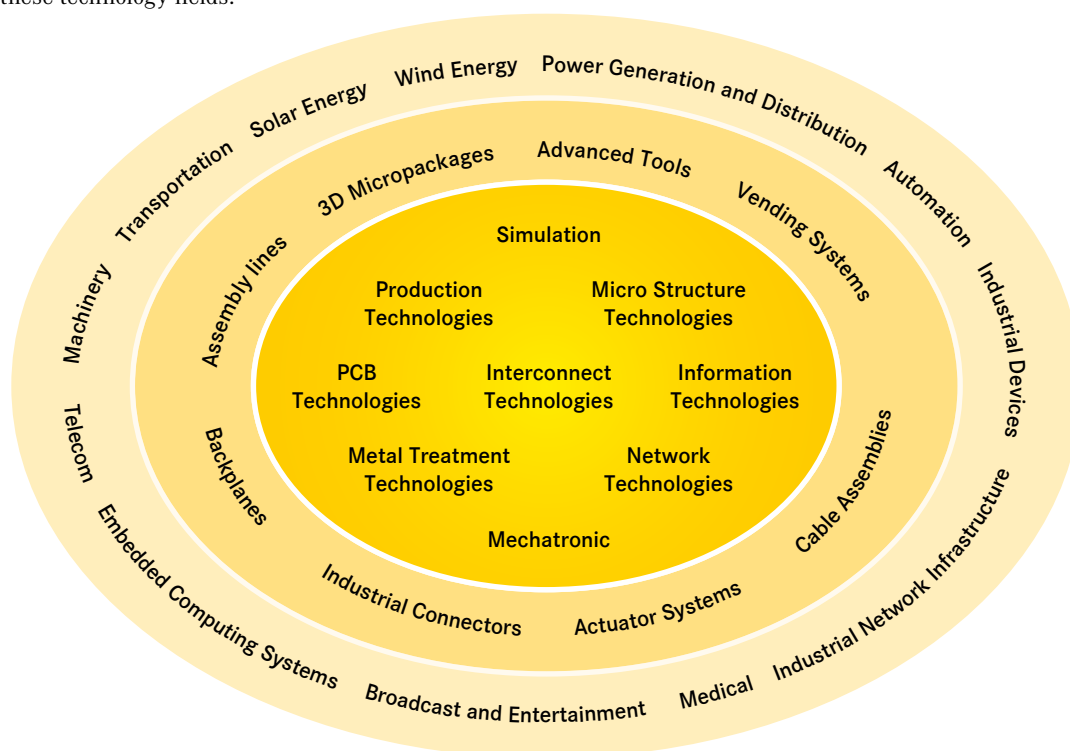




**HARTING knowledge is practical know-how generating synergy effects.**

**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.

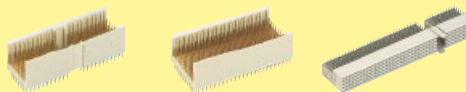
The key focus is on applications in every solution approach. In this context, uncompromising, superior quality is our hallmark. Every new solution found will invariably flow back into the **HARTING** technology pool, thereby enriching our resources. And every new solution we go on to create will draw on this wealth of resources in order to optimize each and every individual solution. In this way, **HARTING** is synergy in action.





# Coaxial and metric connectors

**harbus® HM** Standard, 2.00 mm pitch



00

**harbus® HM** with 6 rows, 2.00 mm pitch



02

**harbus® HM** Power



03

**Micro Card Edge** connector, 0.8 mm pitch



05

**Mini Coax** Standard  
low-profile  
single-row



07

**Mini Coax** cable assemblies and accessories



08

**harlink®**



11

**Tooling**



15

**Signal integrity support**

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**Customer request form**

20

**List of part numbers**

30

**Company addresses**

40

**HARKIS®** is the abbreviation for **HARTING-Katalog-Informationen-System** (HARTING catalogue information system).

**HARKIS®** is an electronic catalogue with part configuration and 3D components library. Here you can choose a connector according to your demands. Afterwards you are able to send your inquiry created with the listed parts. 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 **HARKIS®** at **www.HARKIS.HARTING.com**. It is also available on CD-ROM and DVD.

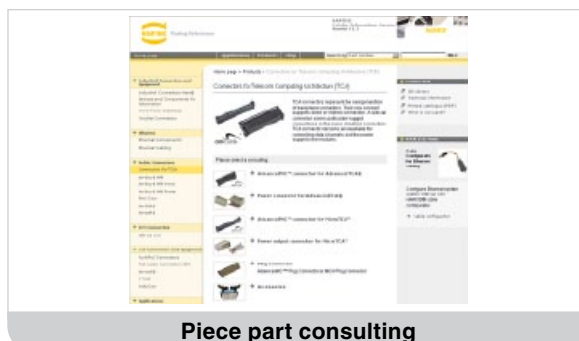
**Product samples:**  
**Fast-track delivery to your desk, free of charge**

With immediate effect, the new express sample dispatching service in the HARTING catalogue information system (**HARKIS®**) allows customers to order samples immediately, easily and free of charge on express delivery. A broad selection from the device connectivity product portfolio is now available. In the case of unavailable items the system offers alternative products with similar features that can be requested at a mouse click.

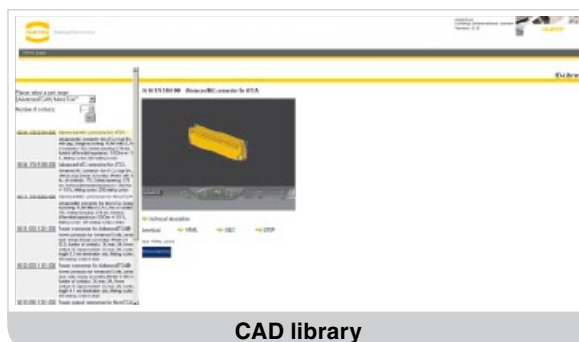
The samples are shipped within 48 hours after your order, free of charge. This service enables tremendous flexibility, especially in the design phase of projects.



**HARKIS®**



**Piece part consulting**



**CAD library**

Identification	Part number	
<b>HARKIS®</b> CD-ROM Basic product catalogue	98 40 000 0401	
<b>HARKIS®</b> DVD Basic product catalogue 2D and 3D CAD files inclusive	98 40 000 0405	

## General information

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

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

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



**harbus® HM** Standard, 2.00 mm pitch

Page

<b>harbus® HM</b> Standard – general information . . . . .	<b>00.04</b>
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**Types with 5 + 2 rows**

Straight male connectors . . . . .	<b>00.12</b>
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Angled female connectors . . . . .	<b>00.24</b>
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**Monoblock 47**

Straight male connectors . . . . .	<b>00.28</b>
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Angled female connectors . . . . .	<b>00.30</b>
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**Types with 8 + 2 rows**

Straight male connectors . . . . .	<b>00.32</b>
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**Accessories**


Coding keys . . . . .	<b>00.35</b>
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Shrouds . . . . .	<b>00.36</b>
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Guiding system . . . . .	<b>00.41</b>
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Special connectors for VME64x . . . . .	<b>00.42</b>
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**Any possible contact configuration can be requested with the customer request forms in chapter 20. Alternatively please contact your local HARTING representative.**

Design according	: IEC 61 076 - 4 - 101
Approvals	
Underwriters Laboratories Inc.®	:  us with their respective ratings documented in file E 102079
Number of contacts	: 55 – 220 signal (77 – 308 fully shielded); or customised
Contact spacing	: 2.00 mm
Working current	: 1 A @ 70 °C (80 % derating)
Test voltage $U_{r.m.s.}$	: AC 750 V min.
Contact resistance	: 20 mΩ max.
Insulation resistance	: 10 GΩ min.
Temperature range	: – 55 °C ... + 125 °C
Durability as per IEC 61076-4-101	<p>: Performance level 2 = <i>250 mating cycles</i> in total.</p> <p><i>First 125 mating cycles</i>, then 4 days gas test using 0.5 ppm SO<sub>2</sub> and 0.1 ppm H<sub>2</sub>S (at 25 ± 2 °C and 75 ± 3 % humidity). Measurement of contact resistance.</p> <p>The <i>remaining 125 mating cycles</i> are subject to measurement of contact resistance and visual inspection. No abrasion of the contact finish through to the base material. No functional impairment.</p> <p>Performance level 1 = <i>500 mating cycles</i> in total.</p> <p><i>First 250 mating cycles</i>, then 10 days gas test using 0.5 ppm SO<sub>2</sub> and 0.1 ppm H<sub>2</sub>S (at 25 ± 2 °C and 75 ± 3 % humidity). Measurement of contact resistance.</p> <p>The <i>remaining 250 mating cycles</i> are subject to measurement of contact resistance and visual inspection. No abrasion of the contact finish through to the base material. No functional impairment.</p>
Termination technique	: <b>compliant press-in</b>
Mating force	: 0.75 N/pin max.
Withdrawal force	: 0.15 N/pin min.
Materials	
Mouldings	: Thermoplastic resin, glass-fibre filled, UL 94-V0
Contacts	: Copper alloy
Contact surface	
Contact zone male	: Au/PdNi/Ni, contacts are treated with Belcore recommended lubricant (PPE)
Contact zone female	: Au/Ni, contacts are treated with Belcore recommended lubricant (PPE)
Press-in zone	: Ni
Packaging	: Tube

Due to the high deformation capability and resilience of **harbus<sup>®</sup> HM** press-in contacts, they can be easily and repeatedly removed in case of repairs without impairment to their functioning.

**harbus<sup>®</sup> HM** press-in contacts are extremely versatile and offer a reliable electrical contact, therefore they are especially well suited for applications with these surfaces.

Please contact us for detailed test reports.

### Benefits of 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
- Unlimited and efficient processing of partially gold-plated pins for rear I/O - manual soldering is no longer necessary!

### Recommended configuration of plated through holes

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 plated PCB (HAL) acc. EN 60352-5</i>	Hole-Ø	0.7±0.02 mm
	Cu	min. 25 µm
	Sn	max. 15 µm
	Plated hole-Ø	0.60-0.65 mm
<i>Chemical tin plated PCB</i>	Hole-Ø	0.7±0.02 mm
	Cu	min. 25 µm
	Sn	min. 0.8 µm
	Plated hole-Ø	0.60-0.65 mm
<i>Au / Ni plated PCB</i>	Hole-Ø	0.7±0.02 mm
	Cu	min. 25 µm
	Ni	3-7 µm
	Au	0.05-0.12 µm
	Plated hole-Ø	0.60-0.65 mm
<i>Silver plated PCB</i>	Hole-Ø	0.7±0.02 mm
	Cu	min. 25 µm
	Ag	0.1-0.3 µm
	Plated hole-Ø	0.60-0.65 mm
<i>OSP copper plated PCB</i>	Hole-Ø	0.7±0.02 mm
	Cu	min. 25 µm
	Plated hole-Ø	0.60-0.65 mm

PCB board thickness: ≥ 1.4 mm

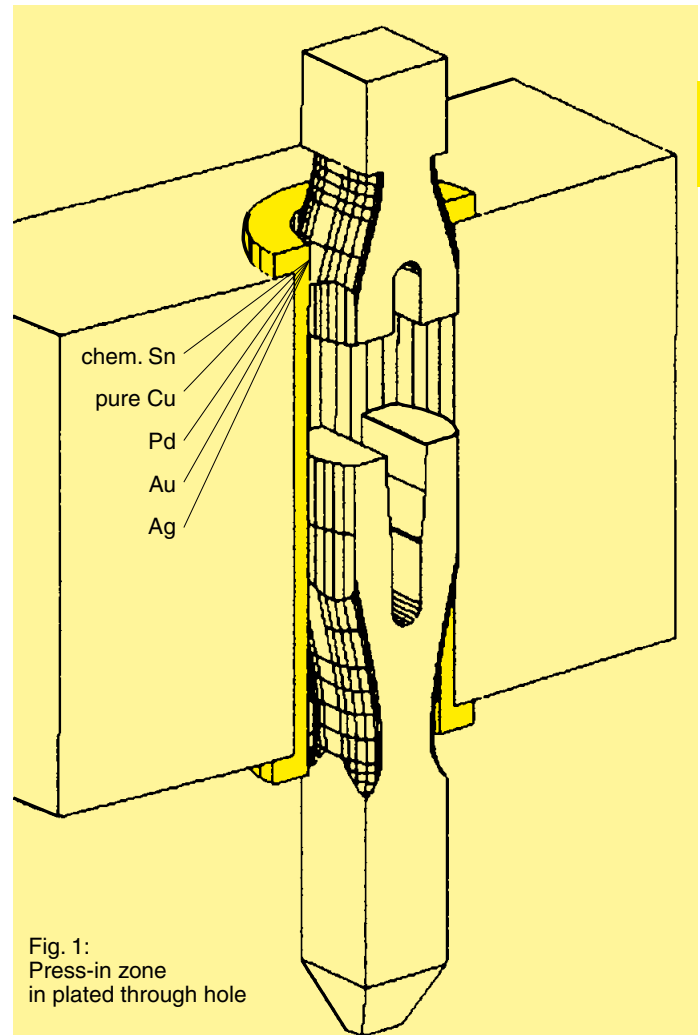


Fig. 1:  
Press-in zone  
in plated through hole

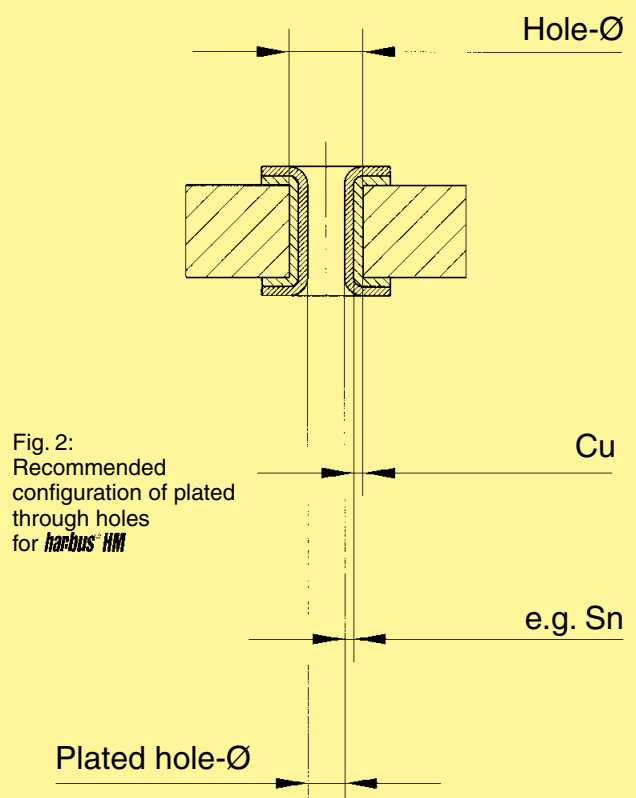


Fig. 2:  
Recommended  
configuration of plated  
through holes  
for **harbus<sup>®</sup> HM**

HARTING offers 13 contact lengths for **harbus<sup>®</sup> HM** male connectors: the standard mating length of 8.2 mm, pre-leading contacts with 9.7 mm and extra long contacts preferred for shielding with 11.2 mm mating length.

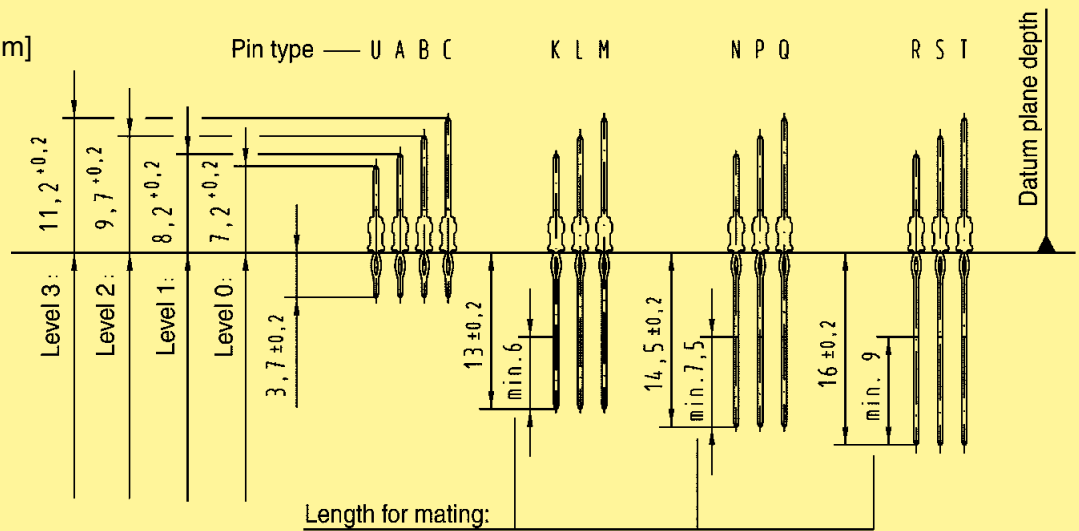
On the termination side the standard length is 3.7 mm. With the three termination lengths of 13.0, 14.5 and 16.0 mm even for rear I/O applications different mating levels are possible, depending on the pcb thickness and shroud height.

For the standard termination length, an extra short contact for special applications with a mating length of 7.2 mm is available.

The different contact lengths are designated with letters to identify them in the configurations. For special loadings please use the customer request form at the end of this catalogue.

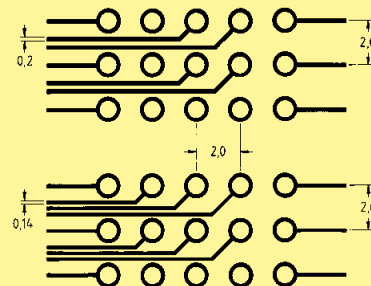
All contacts are offered with press-in termination 'eye of the needle'. In accordance with the application they can be delivered in performance level 1 or 2.

Contact dimensions [mm]



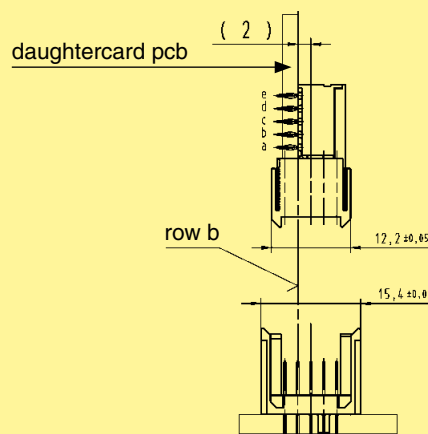
## Circuit density

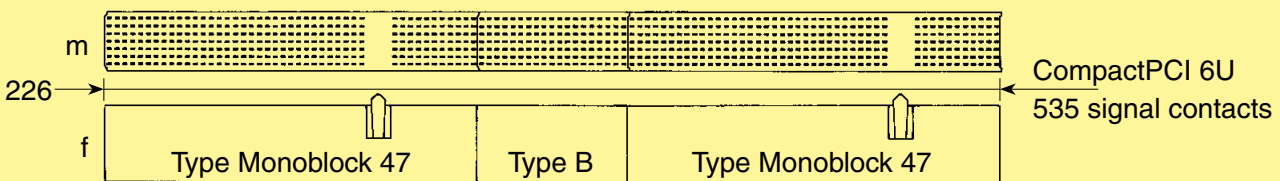
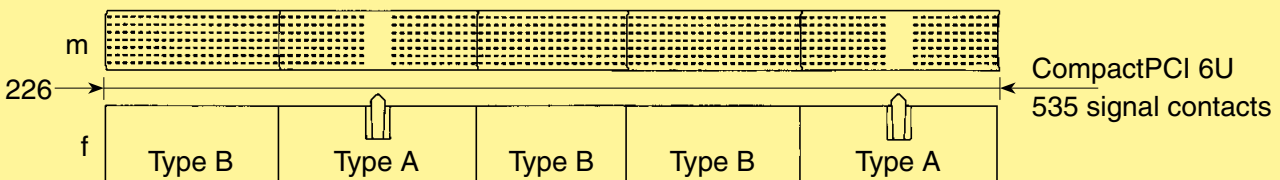
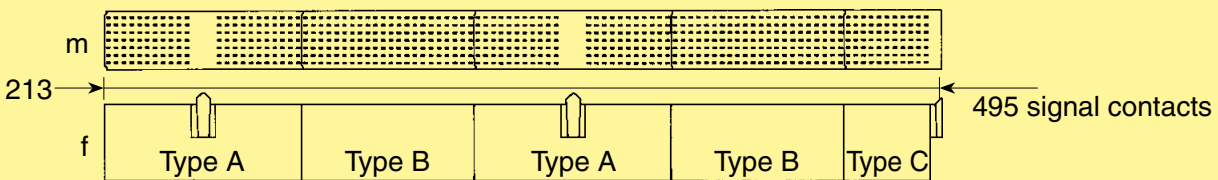
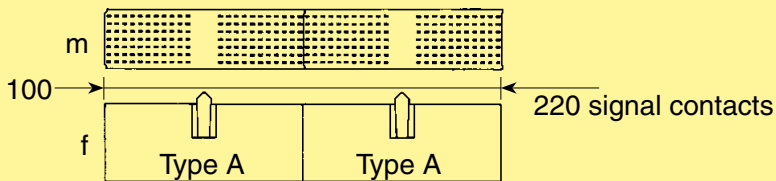
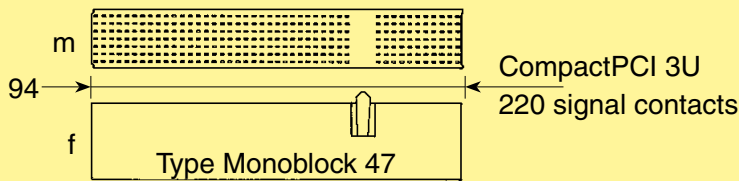
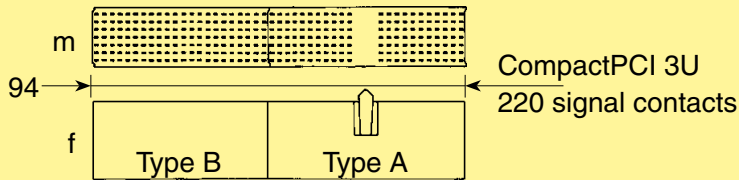
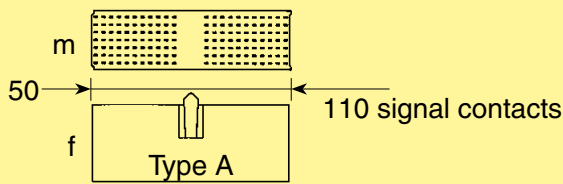
When using the specified diameter of the finished through hole according to IEC 61076-4-101 ( $0.6 \pm 0.05$  mm) with an appropriate annular ring, the remaining distance between the rings is about 1 mm. Under the condition that the width of the track and the space between should be equal, two tracks of 0.2 mm width or three tracks of 0.14 mm width can be placed between two rings. Typical designs are shown in the drawing on the right side.



## Alignment of male and female connector

For the alignment of male and female connector, a common reference plane is defined. This reference plane is the top side of the daughtercard pcb and the contact rows "b" of the female and the male connector (see drawing).





All HARTING *harbus<sup>®</sup> HM* connectors can be assembled end to end in any configuration.

General rules:

- Type B connectors should always be used in combination with an A type and/or C type connectors that are fitted with alignment features.
- Type C connectors must be assembled at the end of a connector stack, to achieve polarisation and avoid mismatching.
- To ensure the correct slot position of connector stacks coding can be added with type A connectors.
- Starting with an A type module (50 mm) any module can be added within the above recommendation (see typical examples shown in the diagram).

m = male connector  
f = female connector



### Improved guiding with AB-modules:

In accordance with the equipment practice each front side arrangement of harbus® HM connectors shall have at least one A-module per slot to ensure that the connector can accommodate  $\pm 2$  mm alignment tolerances in rack systems.

On some rear I/O arrangements the A-module's alignment capability cannot be utilised, because only B-modules are used for feed through. Consequently AB-modules were introduced to ensure guiding capabilities where formerly only B-modules were used. Those AB-modules represent a combination of A- and B-modules and are specified in **CompactPCI by PICMG 2.0 Rev. 3.0** for certain rear I/O applications.

The AB-modules have guiding pegs similar (but not mating compatible to prevent mismating) to those

of the A-module providing the same proven mating tolerances of  $\pm 2$  mm. The AB-modules have no coding center but are fully equipped with contacts in order to maintain the full density as per the B-modules.

The **AB-female** connector mates either with an **AB-shroud** or with **AB-male** connectors. The centered pin positions of the shielding rows of male connectors are simply equipped with short spill contacts (if standard connector and shroud are used). This prevents that the guiding peg of the female AB-module stubbing on the feed through contacts of the front side's fixed connector. These fixed connector loadings are called **AB-friendly**.

The AB-male connector will not be equipped with shielded contacts in the centre where the guiding peg will engage.

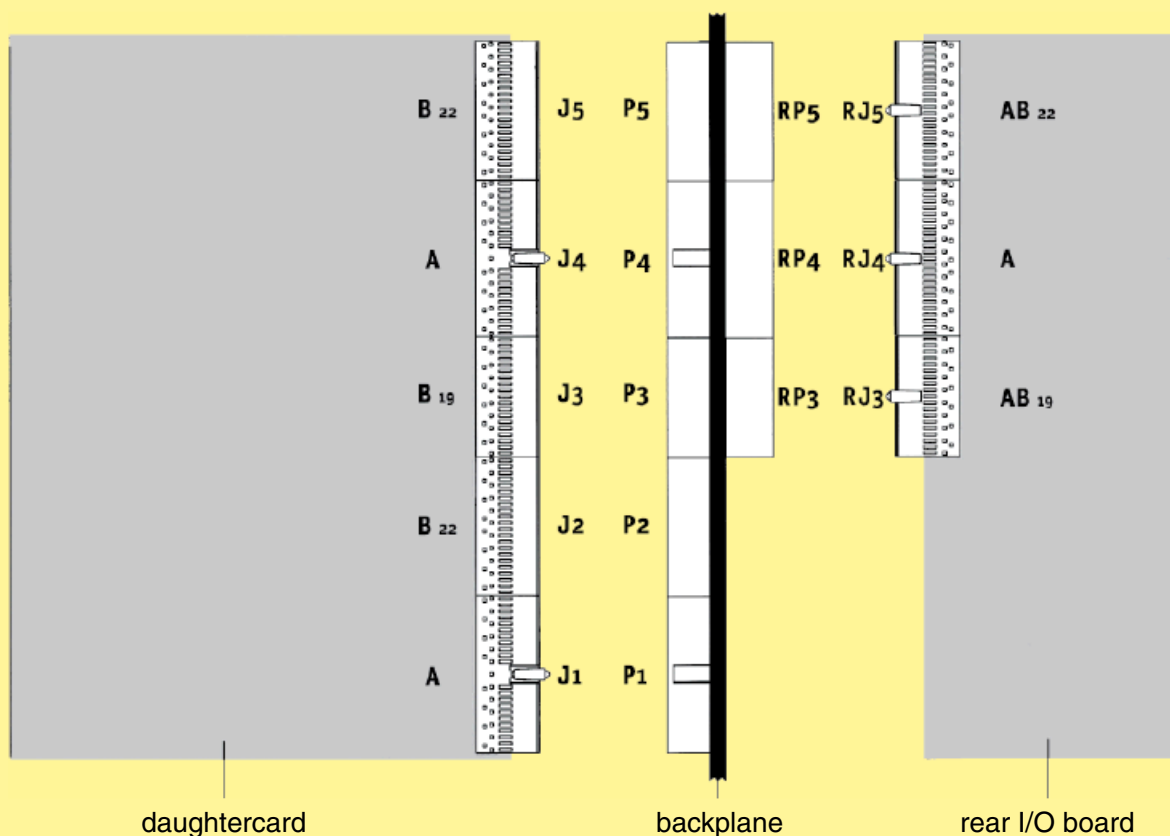
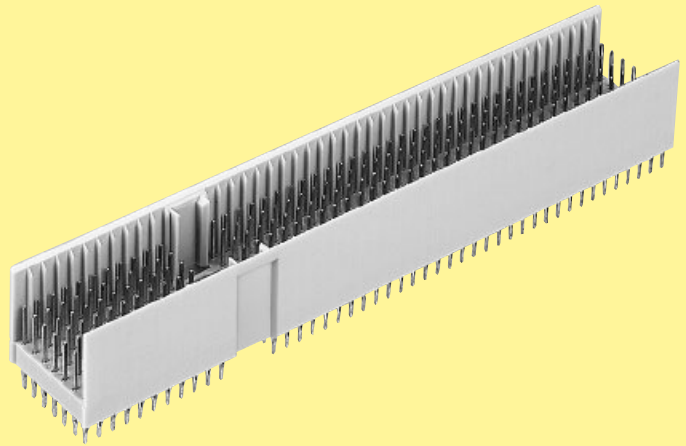


Fig. 3: CompactPCI 6U configuration

*CompactPCI<sup>®</sup>* as a standard is maintained and enhanced by the PCI Industrial Computer Manufacturers Group (PICMG<sup>®</sup>). It defines a combination of the electrical and logical specifications of the PCI standard and the mechanical specifications of the IEEE 1101 and IEC 60297 series of standards. The board connector has been developed from the IEC 61076-4-101 series of 2.0 mm connectors. The mounting location and dimensions for the 2.0 mm connectors are specified in IEEE 1101.11. Some additional mechanical definitions for 2.0 mm connectors in the Eurocard format are being specified in the VITA 30 draft.

Other international standards are listed in the *CompactPCI<sup>®</sup>* standard for environmental and related specifications. This gives *CompactPCI<sup>®</sup>*

the full complement of connectors to be compatible with any type of board.

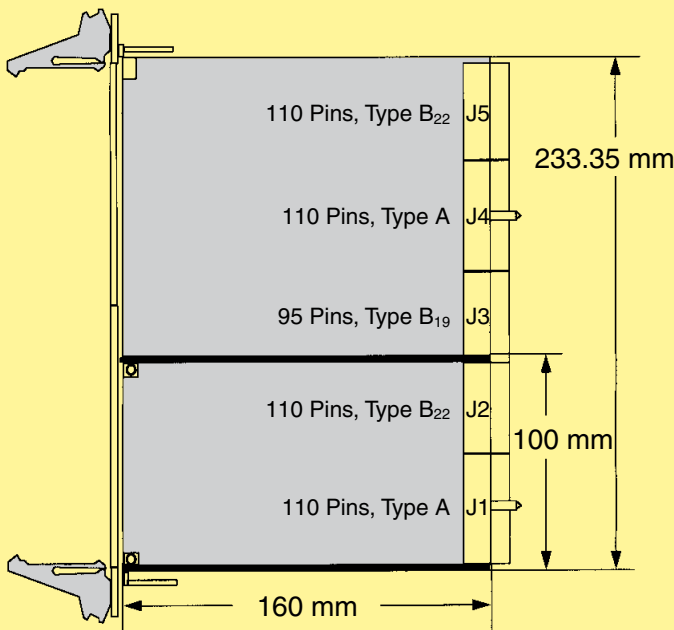


As opposed to the CPCI standard (pins numbered from bottom to top), the contact numbers on the connector are numbered from top to bottom (according to the IEC standard).

The front panel of CPCI cards may be equipped with additional keying pegs to code individual board types. There is also an extended pin length to remove any electro static charge before contacts on the rear connectors mate. This pin also functions as a mechanical guide to position the board as straight as possible for insertion. This prevents pin bending and lowers the insertion force. Some applications could require up to 500 pins to be pushed into sockets simultaneously.

Connectors for high availability applications (hot swap) come with 3 different lengths of pins for a staged sequence of mate or break of contact.

Connector J1/P1 carries the signals for a 32 bit PCI bus (see table of contact assignments for J1/P1). Connector J2/P2 on a system card has the additional signals for a 64 bit PCI bus and some user-defined I/O (see table of contact assignments for J2/P2). On slave cards all of J2/P2 might be user-defined I/O except the top row which carries the signals for geographical addressing. J3/P3 should be reserved for other system bus definitions. J4/P4 and J5/P5 are used for I/O or secondary buses, e.g. H.110 in telecom applications or for bridges into other buses like VMEbus. This is used to accommodate two bus platforms in one card cage on one backplane.



a solid foundation of international standards and practices for mechanical robustness.

The board format is either a 3U or a 6U Eurocard as defined in IEC 60297. There are two or five connectors specified for 3U or 6U boards respectively. Connectors are numbered from J1/P1 through J5/P5 (bottom to top) on the board or backplane. Slave or peripheral boards need J1/P1 as a minimum, master or system boards need both J1/P1 and J2/P2 as a minimum. Backplanes should always have

Contact assignment on *CompactPCI®* system position (J1/P1)

	a	b	c	d	e	
25	+5 V	REQ64#	ENUM#	+3,3 V	+5 V	25
24	AD[1]	+5 V	V(I/O)	AD[0]	ACK64#	24
23	+3,3 V	AD[4]	AD[3]	+5 V	AD[2]	23
22	AD[7]	GND	+3,3 V	AD[6]	AD[5]	22
21	+3,3 V	AD[9]	AD[8]	M66EN	C/BE[0]#	21
20	AD[12]	GND	V(I/O)	AD[11]	AD[10]	20
19	+3,3 V	AD[15]	AD[14]	GND	AD[13]	19
18	SERR#	GND	+3,3 V	PAR	C/BE[1]#	18
17	+3,3 V	SDONE	SBO#	GND	PERR#	17
16	DEVSEL#	GND	V(I/O)	STOP#	LOCK#	16
15	+3,3 V	FRAME#	IRDY#	GND	TRDY#	15
14						14
13	Key Area					13
12						12
11	AD[18]	AD[17]	AD[16]	GND	C/BE[2]#	11
10	AD[21]	GND	+3,3 V	AD[20]	AD[19]	10
9	C/BE[3]#	IDSEL	AD[23]	GND	AD[22]	9
8	AD[26]	GND	V(I/O)	AD[25]	AD[24]	8
7	AD[30]	AD[29]	AD[28]	GND	AD[27]	7
6	REQ#	GND	+3,3 V	CLK	AD[31]	6
5	Bus Reserved	Bus Reserved	RST#	GND	GNT#	5
4	Bus Reserved	GND	V(I/O)	INTP	INTS	4
3	INTA#	INTB#	INTC#	+5 V	INTD#	3
2	TCK	+5 V	TMS	TDO	TDI	2
1	+5 V	-12 V	TRST#	+12 V	+5 V	1
	a	b	c	d	e	

 Contact assignment on *CompactPCI®* system position (J2/P2)

	a	b	c	d	e	
22	GA4	GA3	GA2	GA1	GA0	22
21	CLK6	GND	Reserved	Reserved	Reserved	21
20	CLK5	GND	Reserved	GND	Reserved	20
19	GND	GND	Reserved	Reserved	Reserved	19
18	Bus Reserved	Bus Reserved	Bus Reserved	GND	Bus Reserved	18
17	Bus Reserved	GND	PRST#	REQ6#	GNT6#	17
16	Bus Reserved	Bus Reserved	DEG#	GND	Bus Reserved	16
15	Bus Reserved	GND	FAL#	REQ5#	GNT5#	15
14	AD[35]	AD[34]	AD[33]	GND	AD[32]	14
13	AD[38]	GND	V(I/O)	AD[37]	AD[36]	13
12	AD[42]	AD[41]	AD[40]	GND	AD[39]	12
11	AD[45]	GND	V(I/O)	AD[44]	AD[43]	11
10	AD[49]	AD[48]	AD[47]	GND	AD[46]	10
9	AD[52]	GND	V(I/O)	AD[51]	AD[50]	9
8	AD[56]	AD[55]	AD[54]	GND	AD[53]	8
7	AD[59]	GND	V(I/O)	AD[58]	AD[57]	7
6	AD[63]	AD[62]	AD[61]	GND	AD[60]	6
5	C/BE[5]#	GND	V(I/O)	C/BE[4]#	PAR64	5
4	V(I/O)	Bus Reserved	C/BE[7]#	GND	C/BE[6]#	4
3	CLK4	GND	GNT3#	REQ4#	GNT4#	3
2	CLK2	CLK3	SYSEN#	GNT2#	REQ3#	2
1	CLK1	GND	REQ1#	GNT1#	REQ2#	1
	a	b	c	d	e	

In mechanical terms J1/P1 is a 25x5 matrix of contacts. Three rows of 5 contacts (rows 12 - 14) are not used for electrical contacts. Instead, plastic keys of different orientation and configuration are used to key board locations as to system or peripheral slot, voltage options, etc.

J2/P2 is a shortened connector with only 22 rows of contacts instead of 25 rows for a standard size. HARTING now offers monolithic versions with J1/P1 and J2/P2 combined in one single connector.

This combination together with some space left on the card to fit into guide rails makes maximum use of the 100 mm rear edge of the 3U Eurocard.

On a 6U card this connector setup is repeated on J4/P4 and J5/P5.

The J3/P3 connector is a shortened version of the 2.0 mm connector with 19 rows of 5 signal contacts.

The size results from the height of a 6U board (233 mm) which is more than double the height of a 3U board.

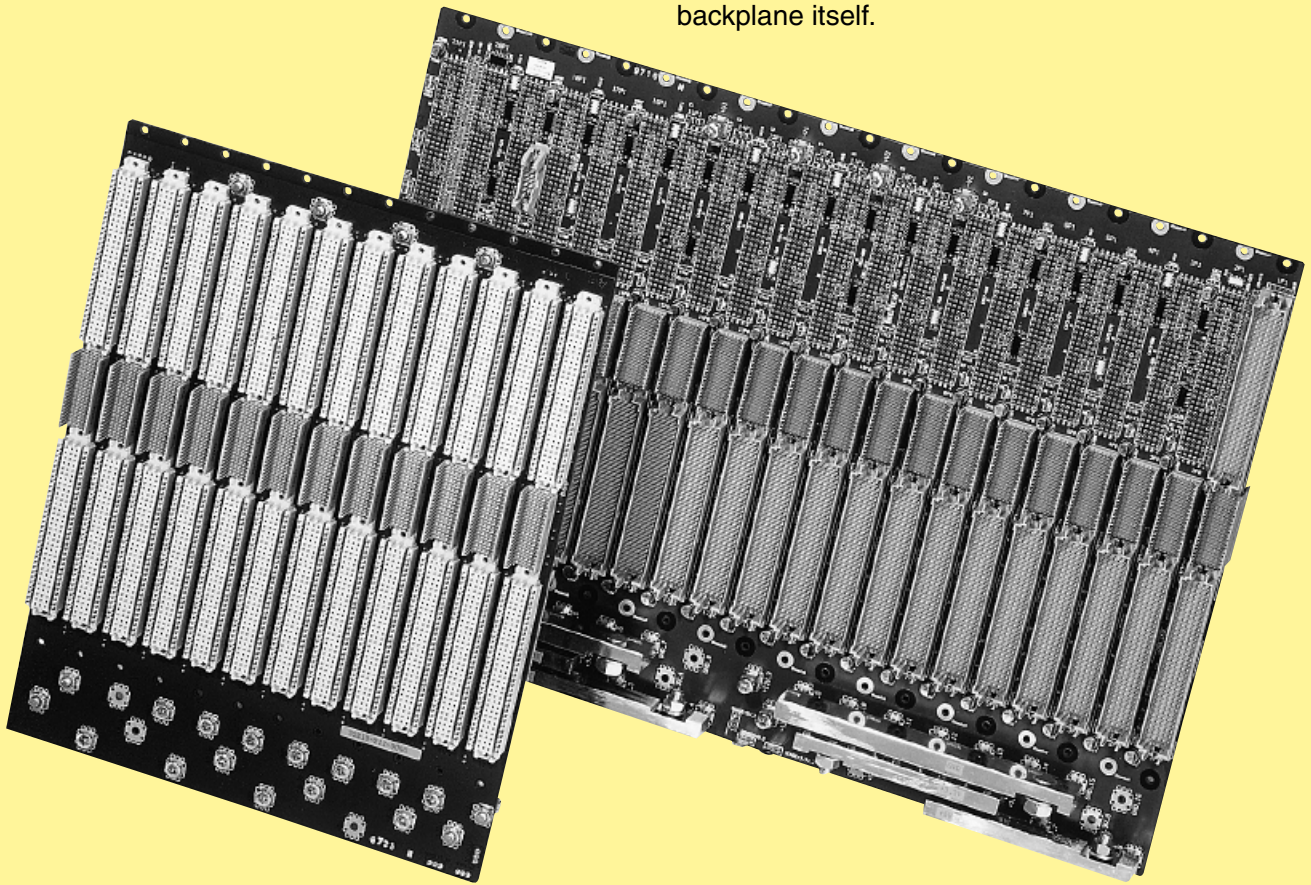
All connectors used for *CompactPCI®* are based on a 7 column pitch. The inner 5 columns are used for logic signals and power. The outer columns on either side are reserved for shielding or ground.



Executive Member

The VMEbus has evolved over a period of more than 25 years to become the leading bus architecture in open industrial applications. The specification is an ANSI norm, the original specification has been extended to become a draft standard VME64x ANSI/VITA 1.1-1997. This draft standard includes the specification for the 5-row DIN compatible connector (IEC 61076-4-113) and for a centre connector J0/P0 on 6U VME cards, which is identical to J3/P3 in *CompactPCI*® systems.

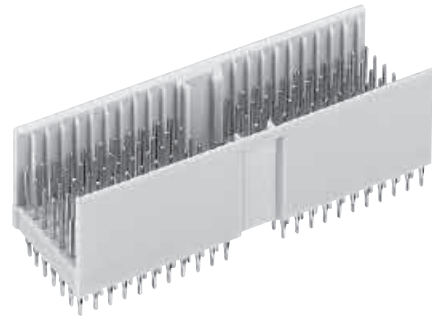
In VMEbus systems it is possible to use custom connectors in the J0/P0 area (e.g. coax connectors). To prevent problems with non-mating backplanes it is strongly recommended to use front panel keying. The IEEE 1101 documents J0/P0 can also be used with rear transition modules for pluggable I/O cabling. As mentioned above, the contacts on this connector may be bussed. One example is the ATM CellBus, which is in the process of being standardised. The bus on J0/P0 connectors might actually be a plug-on mezzanine backplane rather than conducting traces integrated into the backplane itself.



The 2.0 mm J0/P0 connector in VME64x systems is used for additional I/O, for new high speed sub busses or I/O for mezzanine modules, e.g. IP modules on VMEbus boards. The connector is placed on the Eurocard to work in combination with the non-metric original VMEbus connectors DIN 41 612 type C or the newer 5-row connector harbus® 64. The mounting location and dimensions for the J0/P0 VMEbus connector (IEC 61076-4-101) is specified in IEEE 1101.11. The VMEbus 2.0 mm connector uses 5 columns of signal contacts and optional two additional outer columns on either side for shielding. All 95 signal contacts are user defined.



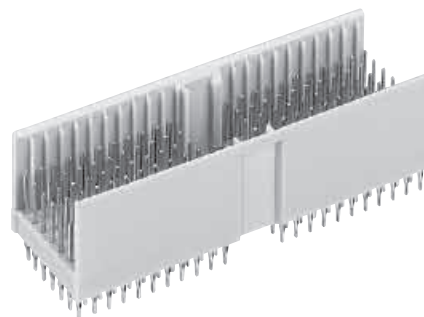




## Male connectors, straight

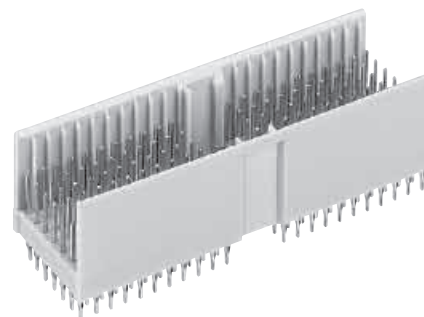
Identification	Number of contacts	Contact mating side	Contact length [mm] termination side	Part number	Contact configuration
Type A	110	8.2	3.7	17 01 110 1201 17 01 110 2201	
Type A	132	8.2/ 11.2	3.7	17 01 132 1203 17 01 132 2203	
Type A	132	8.2/ 11.2	3.7/ 13.0/ 16.0	17 01 132 1007 17 01 132 2007	
Type A	154	8.2/ 11.2	3.7	17 01 154 1201 17 01 154 2201	
Type A	110	9.7	3.7	17 01 110 1204 17 01 110 2204	
Type A	154	9.7/ 11.2	3.7	17 01 154 1205 17 01 154 2205	





Male connectors, straight

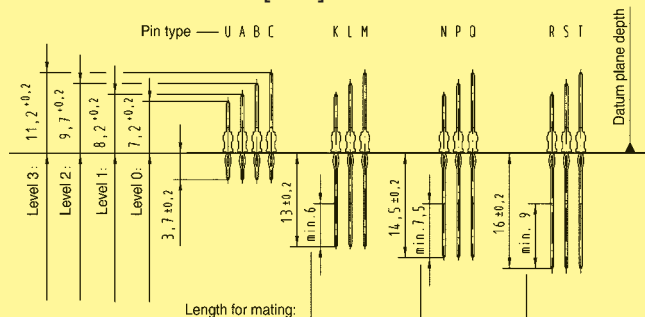
Identification	Number of contacts	Contact length [mm] mating side	termination side	Part number	Contact configuration
Type A	110	8.2	13.0	17 01 110 1402 17 01 110 2402	
Type A	154	9.7/ 11.2	14.5/ 16.0	17 01 154 1001 17 01 154 2001	
Type A CompactPCI Position P1	154	8.2/ 9.7/ 11.2	3.7	17 01 154 1203 17 01 154 2203	
Type A CompactPCI Position P4	154	9.7/ 11.2	16.0	17 01 154 1604 17 01 154 2604	
Type A CompactPCI Position P4	154	8.2/ 9.7/ 11.2	16.0	17 01 154 1603 17 01 154 2603	
Type A CompactPCI hot swap Position P1	154	8.2/ 9.7/ 11.2	3.7	17 01 154 1204 17 01 154 2204	



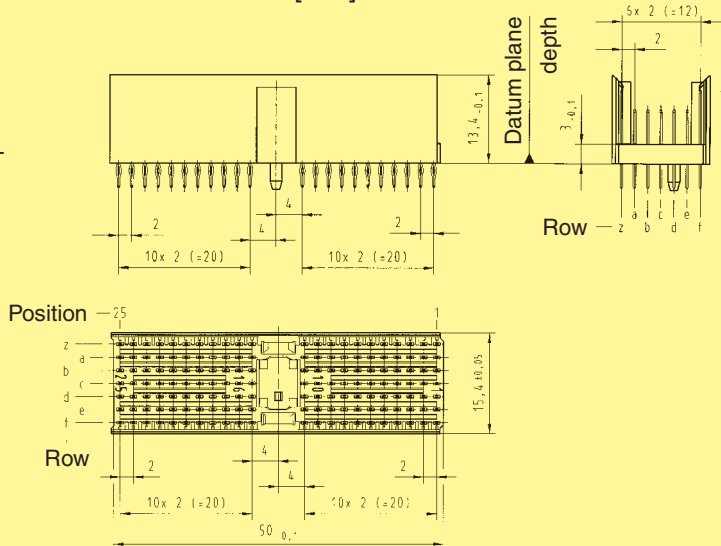
### Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side	termination side	Part number	Contact configuration
Type A CompactPCI computer telephony Position P4	100	/ 8.2/ / 9.7/ 11.2	/13.0/ /14.5/ 16.0	17 01 100 1001 17 01 100 2001	
Type A CompactPCI computer telephony Position P4	100	/ 8.2/ / 9.7/ 11.2	3.7	17 01 100 1201 17 01 100 2201	

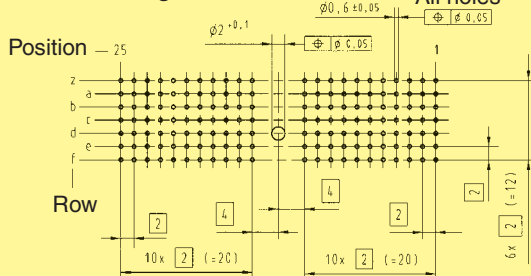
### Contact dimensions [mm]

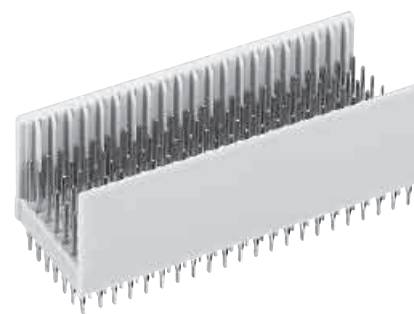


### Connector dimensions [mm]



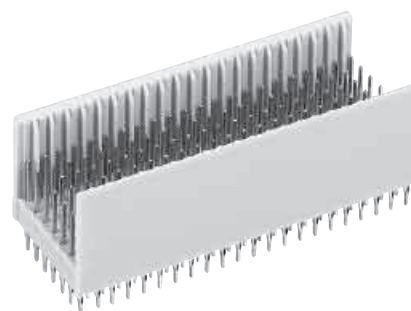
### Board drillings





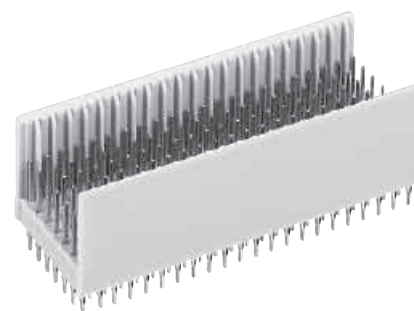
## Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side	termination side	Part number	Contact configuration
Type B25	125	8.2	3.7	17 02 125 1201 17 02 125 2201	
Type B25	150	8.2/ 11.2	3.7	17 02 150 1201 17 02 150 2201	
Type B25	175	8.2/ 11.2	3.7	17 02 175 1201 17 02 175 2201	
Type B25	125	9.7/ 11.2	3.7	17 02 125 1205 17 02 125 2205	
Type B25	175	8.2/ 9.7/ 11.2	3.7	17 02 175 1202 17 02 175 2202	
Type B25	175	8.2/ 11.2	13.0/ 16.0	17 02 175 1006 17 02 175 2006	



### Male connectors, straight

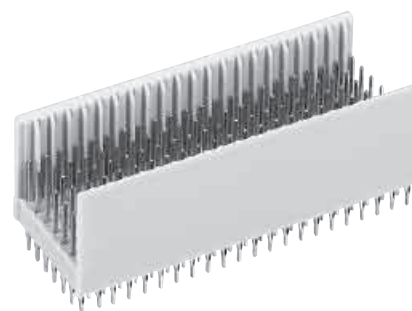
Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Type B22	110	8.2 3.7	17 04 110 1201 17 04 110 2201	
Type B22	154	8.2/ 11.2 3.7	17 04 154 1201 17 04 154 2201	
Type B22 CompactPCI Position P2	154	9.7/ 11.2 3.7	17 04 154 1203 17 04 154 2203	
Type B22 CompactPCI computer telephony	132	8.2/ 9.7/ 11.2 13.0/ 14.5/ 16.0	17 04 132 1001 17 04 132 2001	
Type B22 CompactPCI AB friendly	154	9.7/ 11.2 3.7/ 16.0	17 04 154 1010 17 04 154 2010	
Type B22 CompactPCI AB friendly	154	9.7/ 11.2 3.7/ 14.5/ 16.0	17 04 154 1002 17 04 154 2002	



### Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Type B19 VME Position J0	95	8.2 3.7	17 05 095 1201 <b>17 05 095 2201</b>	
Type B19 VME Position J0	133	8.2/ 11.2 3.7	17 05 133 1201 <b>17 05 133 2201</b>	
Type B19 VME Position J0	133	9.7/ 11.2 3.7	17 05 133 1203 <b>17 05 133 2203</b>	
Type B19 VME Position J0	95	8.2 13.0	17 05 095 1401 <b>17 05 095 2401</b>	
Type B19 CompactPCI AB friendly Position P3	133	9.7/ 11.2 3.7/ 16.0	17 05 133 1005 <b>17 05 133 2005</b>	
Type B19 Compact PCI Position P3 VME Position J0	133	8.2/ 11.2 16.0	17 05 133 1602 <b>17 05 133 2602</b>	



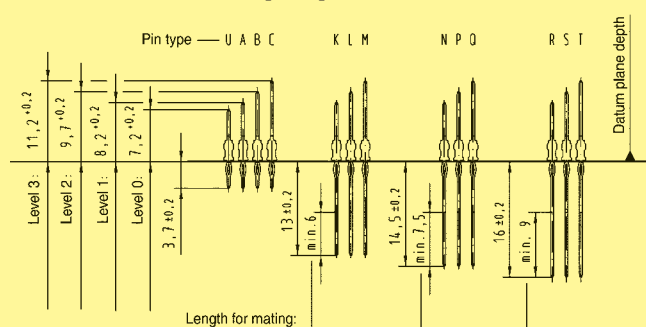


### Male connectors, straight

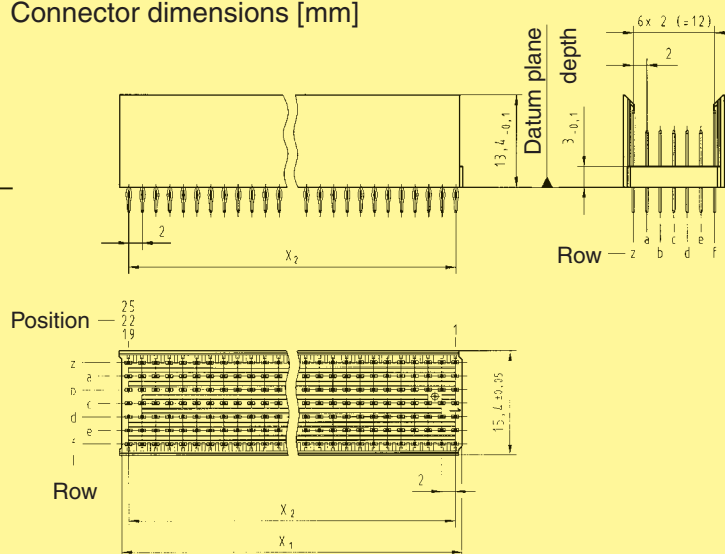
#### Drawing

Dimensions in mm

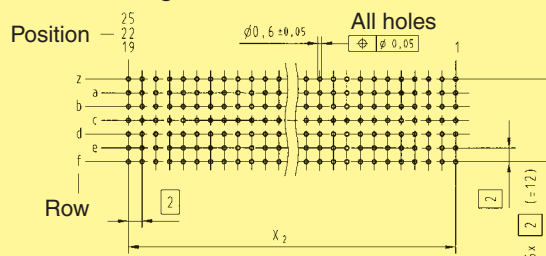
#### Contact dimensions [mm]



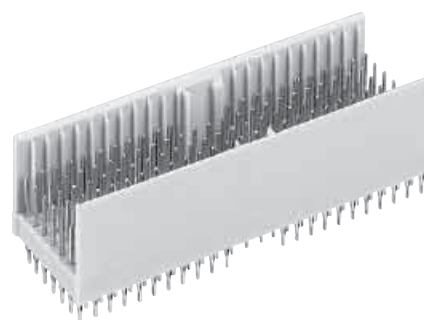
#### Connector dimensions [mm]



#### Board drillings



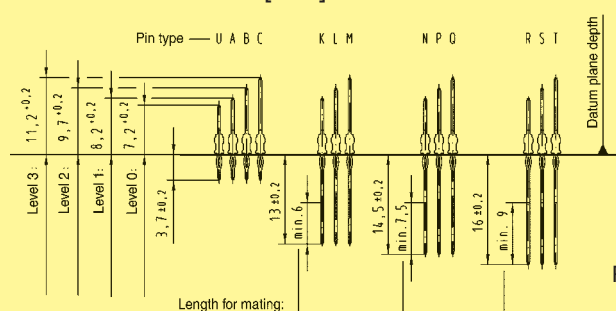
Contact positions	x <sub>1</sub>	x <sub>2</sub>
19	37.9	18 x 2 (= 36)
22	43.9	21 x 2 (= 42)
25	49.9	24 x 2 (= 48)



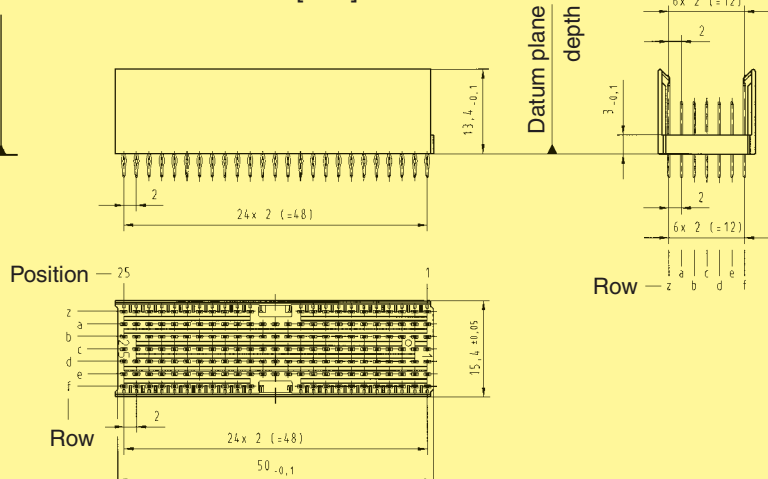
### Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Type AB <sub>25</sub>	125	8.2 3.7	17 15 125 1201 17 15 125 2201	
Type AB <sub>25</sub>	169	8.2/ 11.2 3.7	17 15 169 1201 17 15 169 2201	
Type AB <sub>25</sub>	169	8.2/ 11.2 13.0/ 16.0	17 15 169 1003 17 15 169 2003	

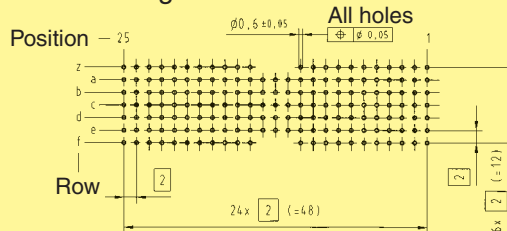
### Contact dimensions [mm]

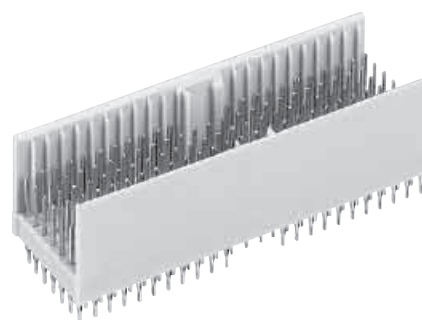


### Connector dimensions [mm]



### Board drillings

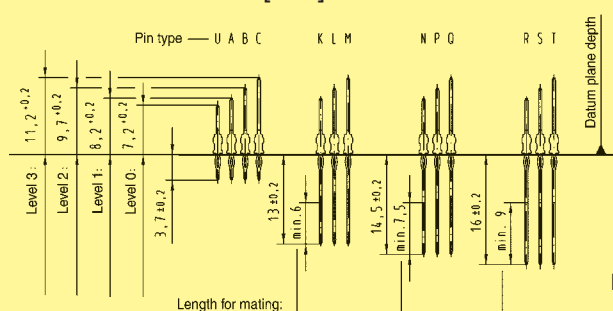




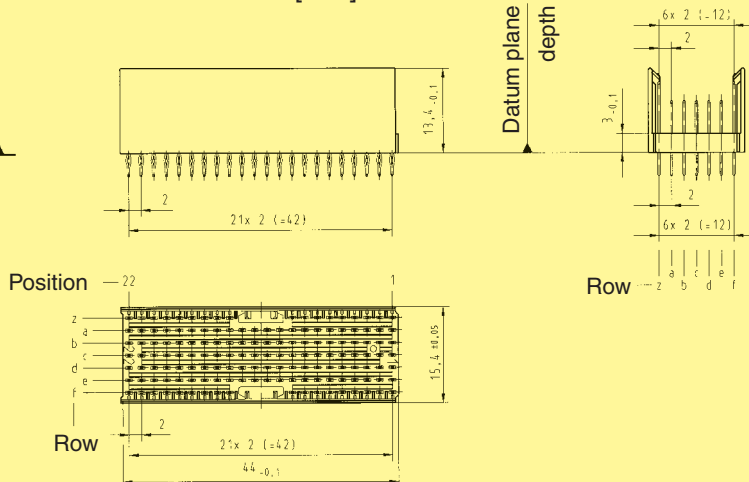
## Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Type AB <sub>22</sub>	110	8.2 3.7	17 14 110 1201 <b>17 14 110 2201</b>	
Type AB <sub>22</sub>	146	8.2/ 11.2 3.7	17 14 146 1201 <b>17 14 146 2201</b>	
Type AB <sub>22</sub>	146	9.7/ 11.2 16.0	17 14 146 1601 <b>17 14 146 2601</b>	

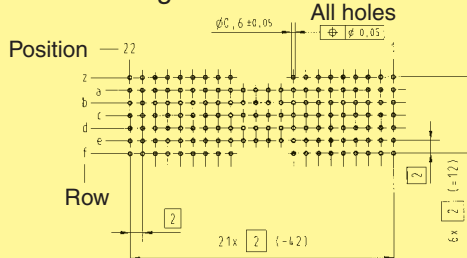
## Contact dimensions [mm]

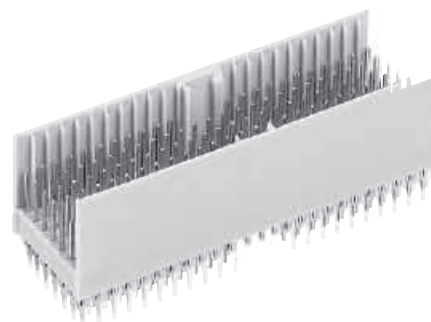


## Connector dimensions [mm]



## Board drillings

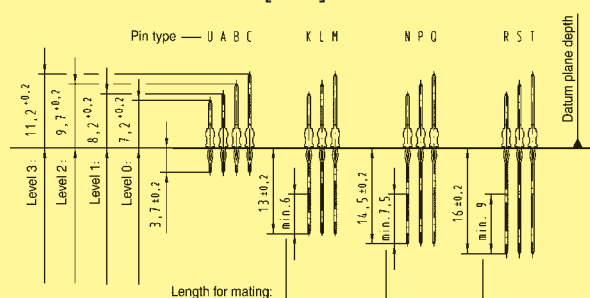




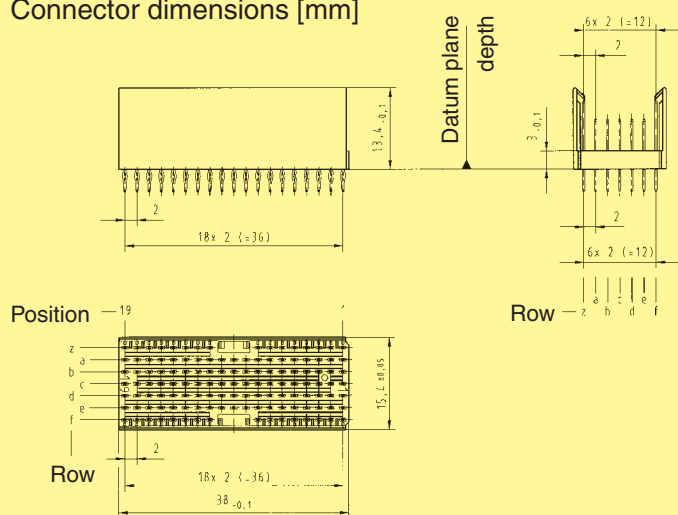
### Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Type AB <sub>19</sub>	95	8.2 3.7	17 13 095 1201 17 13 095 2201	
Type AB <sub>19</sub>	127	8.2/ 11.2 3.7	17 13 127 1201 17 13 127 2201	
Type AB <sub>19</sub>	127	9.7/ 11.2 16.0	17 13 127 1601 17 13 127 2601	

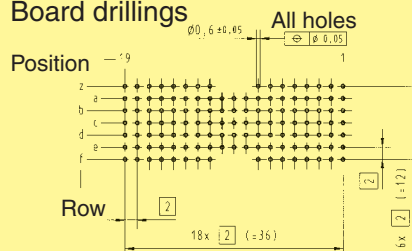
### Contact dimensions [mm]



### Connector dimensions [mm]



### Board drillings

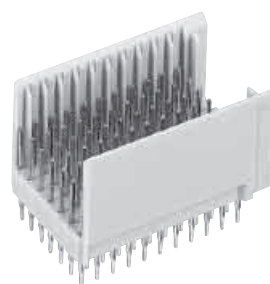




## Male connectors, straight

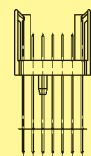
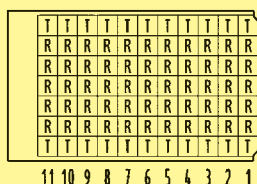
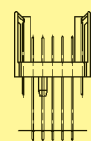
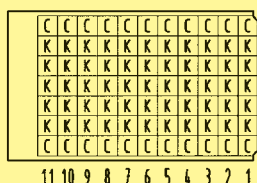
Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Type C	55	8.2	3.7	<div> 17 03 055 1201  17 03 055 2201 </div>
Type C	77	8.2/ 11.2	3.7	<div> 17 03 077 1201  17 03 077 2201 </div>
Type C	55	9.7	3.7	<div> 17 03 055 1202  17 03 055 2202 </div>
Type C	77	9.7/ 11.2	3.7	<div> 17 03 077 1202  17 03 077 2202 </div>
Type C	55	8.2	13.0	<div> 17 03 055 1401  17 03 055 2401 </div>
Type C	66	8.2/ 11.2	13.0/ 16.0	<div> 17 03 066 1001  17 03 066 2001 </div>



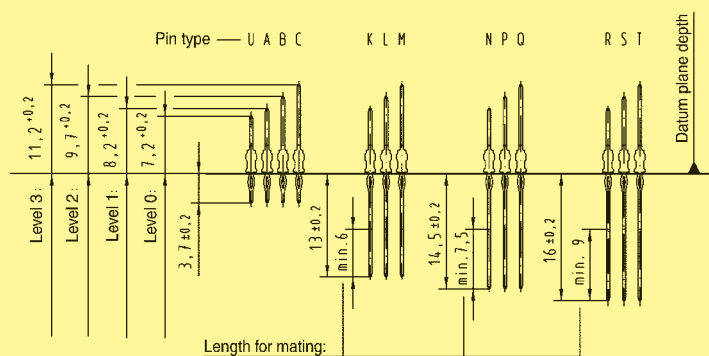


### Male connectors, straight

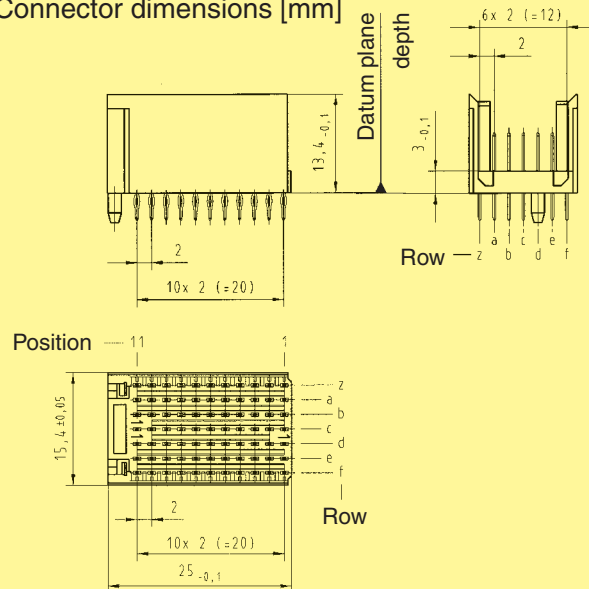
Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Type C	77	8.2/ 11.2	3.7/ 13.0	17 03 077 1001 17 03 077 2001
Type C	77	8.2/ 11.2	16.0	17 03 077 1601 17 03 077 2601



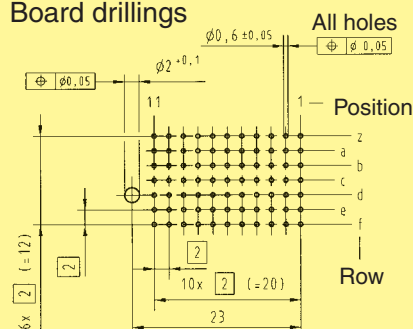
### Contact dimensions [mm]

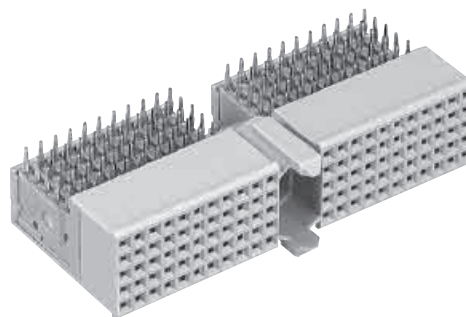


### Connector dimensions [mm]



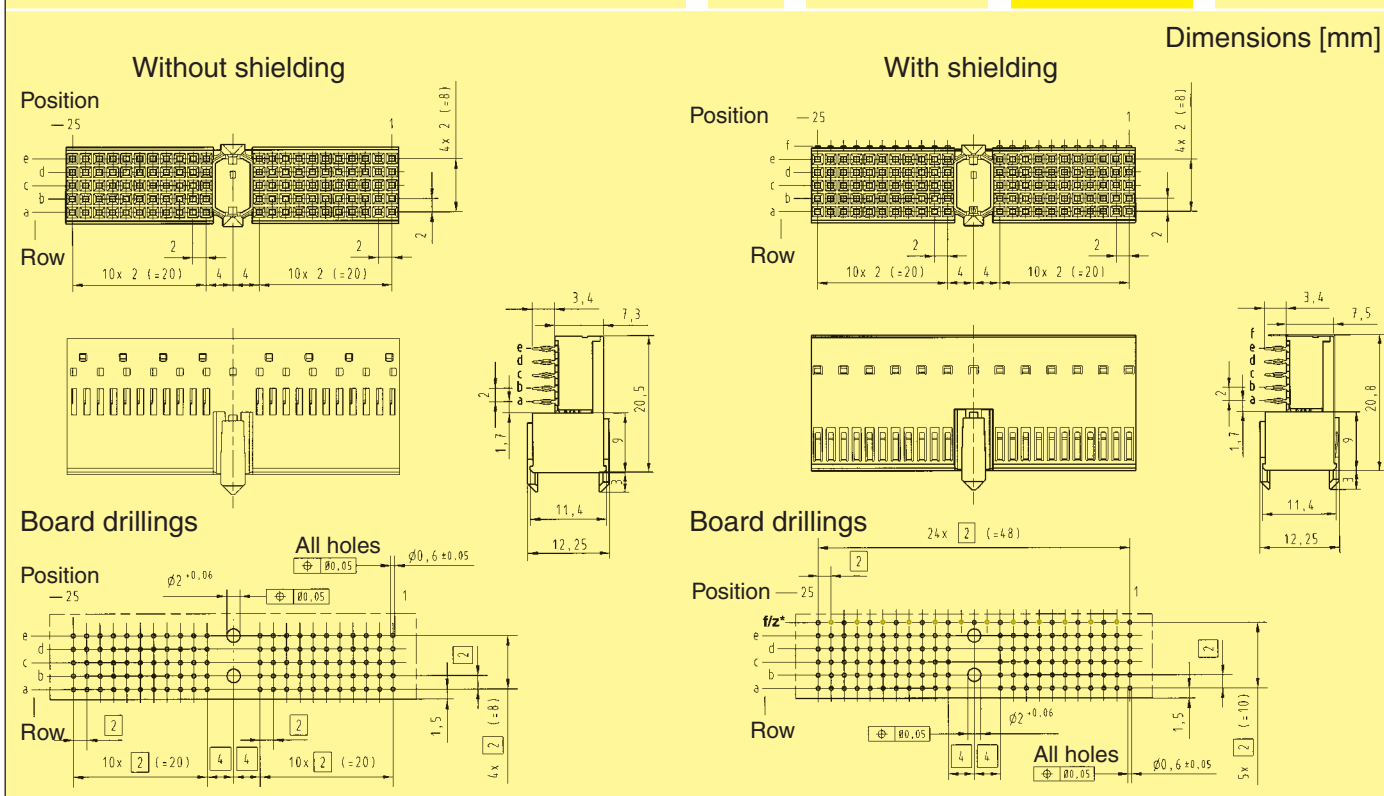
### Board drillings





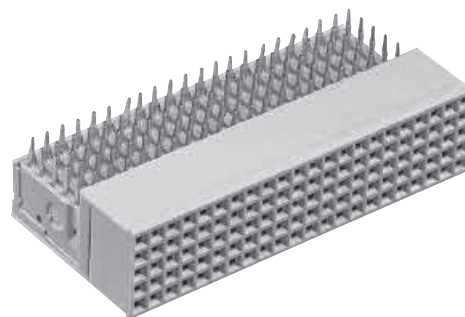
## Female connectors, angled

Identification	No. of contacts	Contact length [mm] termination side	Part number	
Type A	110	3.4	17 21 110 1101 <b>17 21 110 2101</b>	
Type A with upper shield CompactPCI Positions J1, J4	110	3.4	17 21 110 1102 <b>17 21 110 2102</b>	
Lower shield for type A connectors			17 21 000 4102	
Type A with split upper shield CompactPCI computer telephony Position J4	90	3.4	17 21 090 1103 <b>17 21 090 2103</b>	
Lower shield for type A connectors (rows 1 – 5) CompactPCI computer telephony			17 29 000 4102	
Lower shield for type A connectors (rows 15 – 25) CompactPCI computer telephony			17 23 000 4102	



Thin print part numbers: performance level 1  
**Bold print part numbers: performance level 2**

\* hole on even contact numbers  
 only needed for lower shielding

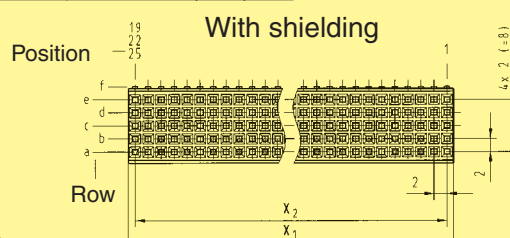
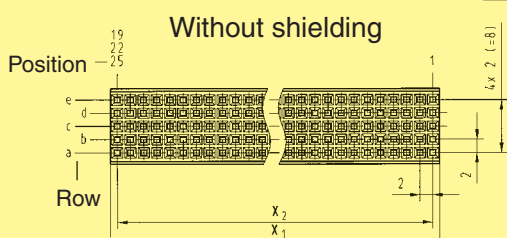


### Female connectors, angled

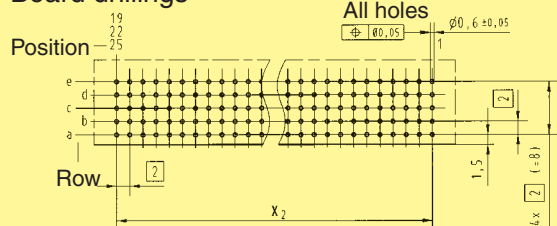
Identification	No. of contacts	Contact length [mm] termination side	Part number	
Type B19 VME, Position P0	95	3.4	17 25 095 1101 <b>17 25 095 2101</b>	
Type B19 with upper shield CompactPCI, Position J3 – VME, Position P0	95	3.4	17 25 095 1102 <b>17 25 095 2102</b>	
Lower shield for type B19 connectors			17 25 000 4102	
Type B22	110	3.4	17 24 110 1101 <b>17 24 110 2101</b>	
Type B22 with upper shield CompactPCI, Positions J2, J5	110	3.4	17 24 110 1102 <b>17 24 110 2102</b>	
Lower shield for type B22 connectors			17 24 000 4102	
Type B25	125	3.4	17 22 125 1101 <b>17 22 125 2101</b>	
Type B25 with upper shield	125	3.4	17 22 125 1102 <b>17 22 125 2102</b>	
Lower shield for type B25 connectors			17 22 000 4102	

Contact positions	X <sub>1</sub>	X <sub>2</sub>
19	37.9	18 x <b>2</b> (= 36)
22	43.9	21 x <b>2</b> (= 42)
25	49.9	24 x <b>2</b> (= 48)

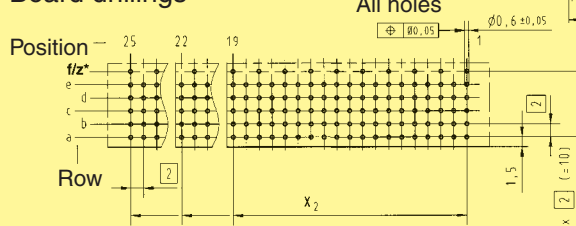
Dimensions [mm]



#### Board drillings

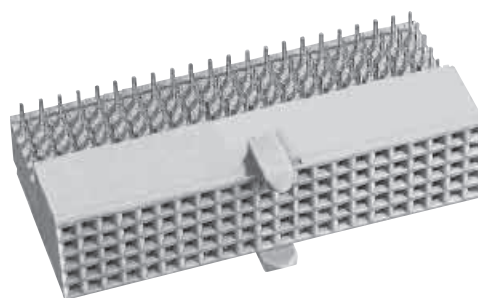


#### Board drillings



Thin print part numbers: performance level 1  
**Bold print part numbers: performance level 2**

\* hole on even contact numbers  
only needed for lower shielding

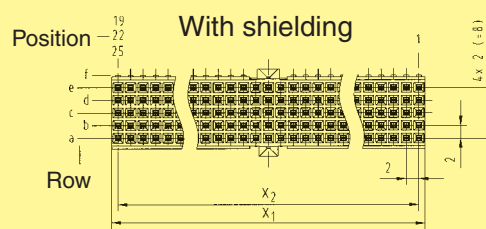
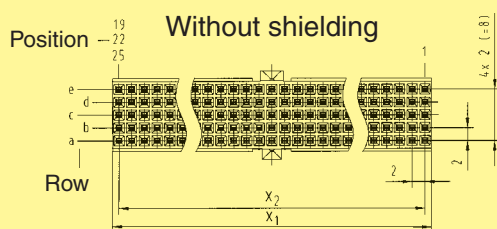


## Female connectors, angled

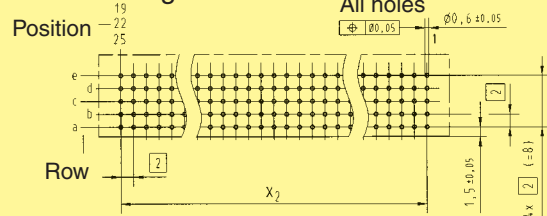
Identification	No. of contacts	Contact length [mm] termination side	Part number	
Type AB <sub>19</sub>	95	3.4	17 33 095 1101 <b>17 33 095 2101</b>	
Type AB <sub>19</sub> with upper shield CompactPCI, Position RJ3	95	3.4	17 33 095 1102 <b>17 33 095 2102</b>	
Lower shield for type AB <sub>19</sub> connectors			17 33 000 4102	
Type AB <sub>22</sub>	110	3.4	17 34 110 1101 <b>17 34 110 2101</b>	
Type AB <sub>22</sub> with upper shield CompactPCI, Positions RJ2, RJ5	110	3.4	17 34 110 1102 <b>17 34 110 2102</b>	
Lower shield for type AB <sub>22</sub> connectors			17 34 000 4102	
Type AB <sub>25</sub>	125	3.4	17 35 125 1101 <b>17 35 125 2101</b>	
Type AB <sub>25</sub> with upper shield	125	3.4	17 35 125 1102 <b>17 35 125 2102</b>	
Lower shield for type AB <sub>25</sub> connectors			17 21 000 4102	

Contact positions	X <sub>1</sub>	X <sub>2</sub>
19	37.9	18 x <b>2</b> (= 36)
22	43.9	21 x <b>2</b> (= 42)
25	49.9	24 x <b>2</b> (= 48)

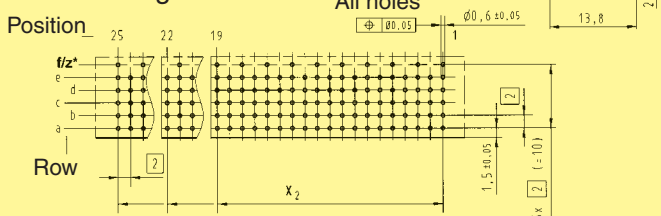
Dimensions [mm]

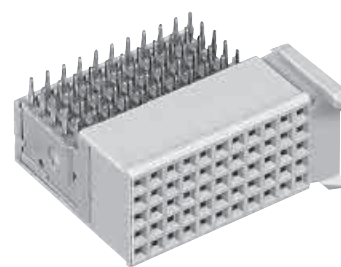


## Board drillings



## Board drillings

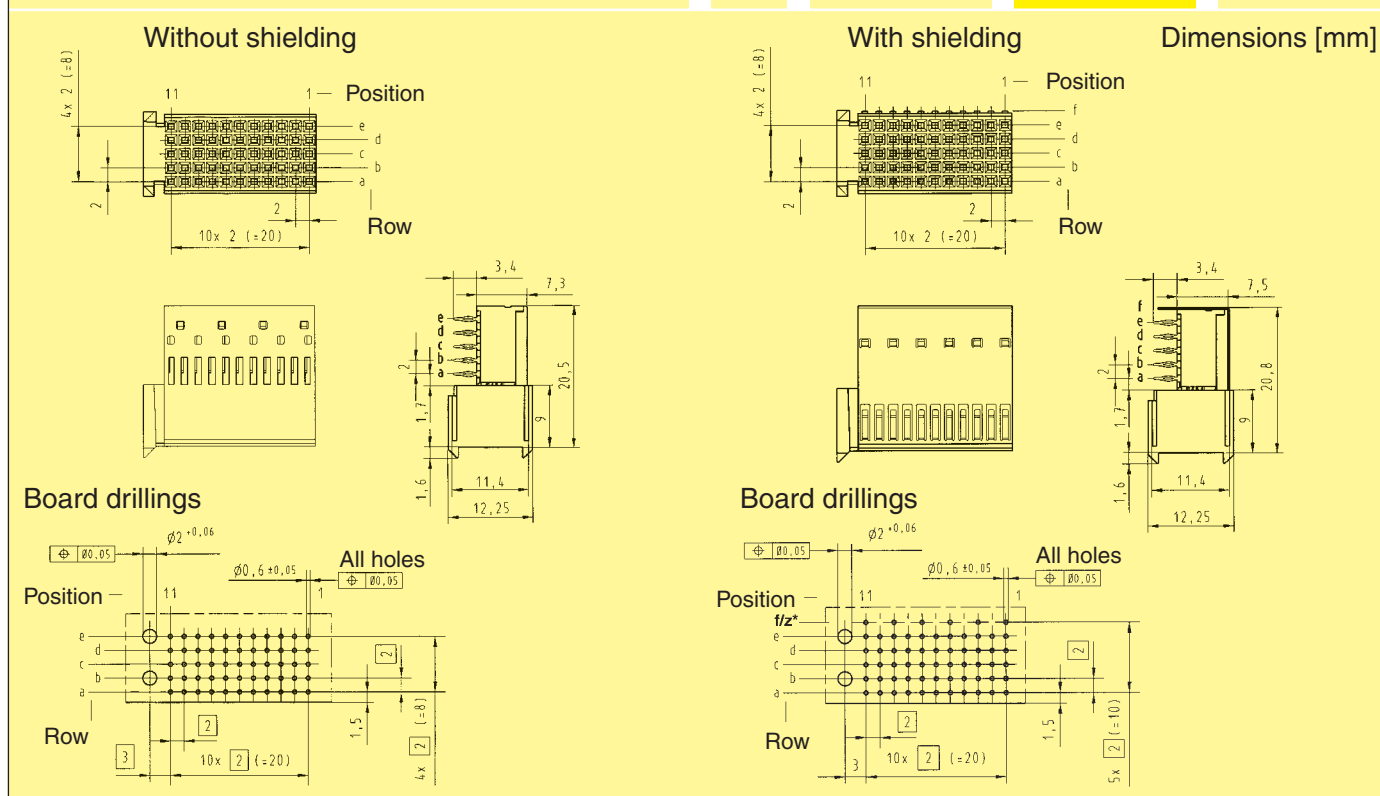




# harbus<sup>®</sup> HM

## Female connectors, angled

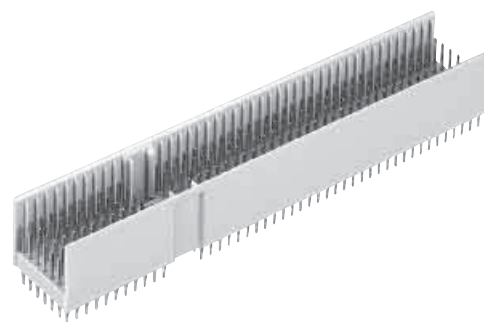
Identification	No. of contacts	Contact length [mm] termination side	Part number	
Type C	55	3.4	17 23 055 1101 <b>17 23 055 2101</b>	
Type C with upper shield	55	3.4	17 23 055 1102 <b>17 23 055 2102</b>	
Lower shield for type C connectors			17 23 000 4102	



Thin print part numbers: performance level 1  
**Bold print part numbers: performance level 2**

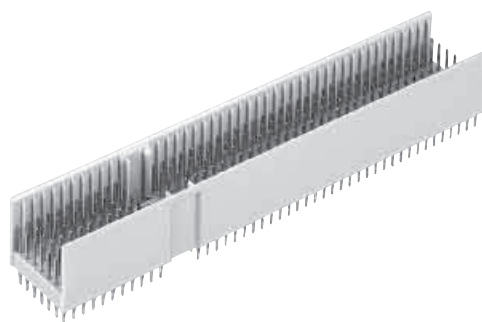
\* hole on even contact numbers  
only needed for lower shielding





## Male connectors, straight

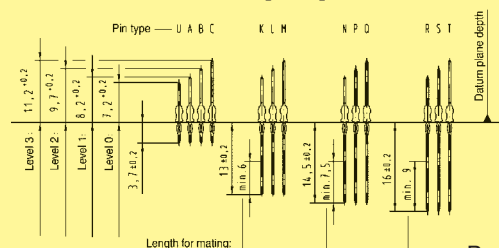
Identification	Number of contacts	Contact length [mm] mating side	termination side	Part number	Contact configuration
Type Monoblock 47	220	8.2	3.7	17 06 220 1201 <b>17 06 220 2201</b>	
Type Monoblock 47	308	8.2/ 11.2	3.7	17 06 308 1201 <b>17 06 308 2201</b>	
Type Monoblock 47	220	9.7	3.7	17 06 220 1202 <b>17 06 220 2202</b>	
Type Monoblock 47 CompactPCI Positions P1 and P2	308	8.2/ 9.7/ 11.2	3.7	17 06 308 1202 <b>17 06 308 2202</b>	
Type Monoblock 47 CompactPCI hot swap	308	8.2/ 9.7/ 11.2	3.7	17 06 308 1203 <b>17 06 308 2203</b>	
Type Monoblock 47 CompactPCI computer telephony	232	8.2/ 9.7/ 11.2	3.7	17 06 232 1201 <b>17 06 232 2201</b>	



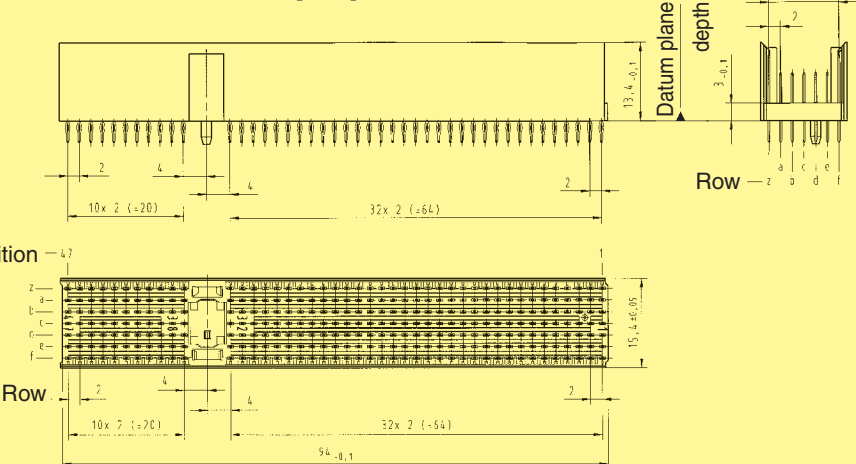
### Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side	termination side	Part number	Contact configuration
Type Monoblock 47 CompactPCI I/O	308	8.2/ 9.7/ 11.2	3.7/ 16.0	17 06 308 1001 <b>17 06 308 2001</b>	
Type Monoblock 47 CompactPCI AB friendly Positions P4 and P5	308	9.7/ 11.2	3.7/ 16.0	17 06 308 1005 <b>17 06 308 2005</b>	

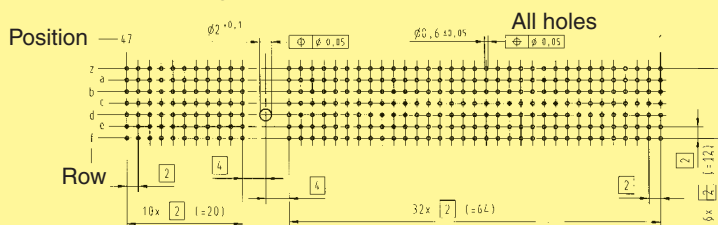
### Contact dimensions [mm]

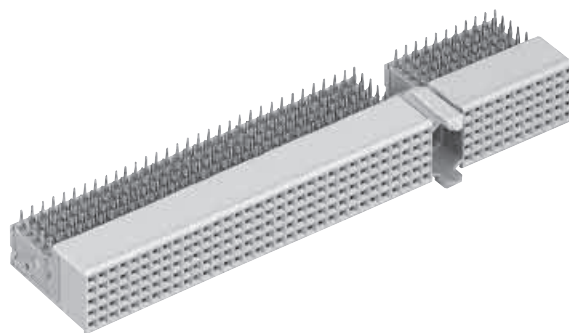


### Connector dimensions [mm]



### Board drillings

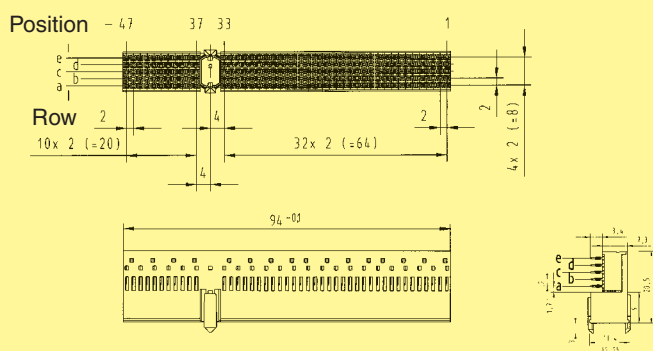




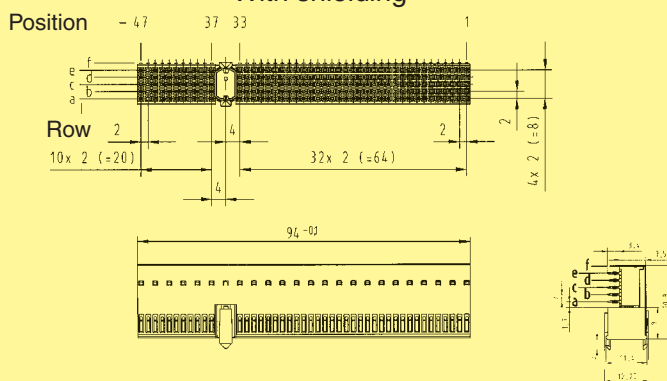
## Female connectors, angled

Identification	No. of contacts	Contact length [mm] termination side	Part number	
Type Monoblock 47	220	3.4	17 26 220 1101 <b>17 26 220 2101</b>	
Type Monoblock 47 with upper shield	220	3.4	17 26 220 1102 <b>17 26 220 2102</b>	
Type Monoblock 47 with upper shield CompactPCI computer telephony	200	3.4	17 26 200 1103 <b>17 26 200 2103</b>	
Lower shield for type Monoblock 47 connectors			17 26 000 4102	
Lower shield for type Monoblock 47 connectors (rows 1 – 22) CompactPCI computer telephony			17 24 000 4102	
Lower shield for type Monoblock 47 connectors (rows 23 – 27) CompactPCI computer telephony			17 29 000 4102	
Lower shield for type Monoblock 47 connectors (rows 37 – 47) CompactPCI computer telephony			17 23 000 4102	

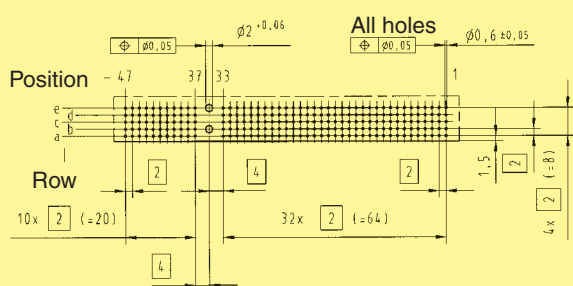
## Without shielding



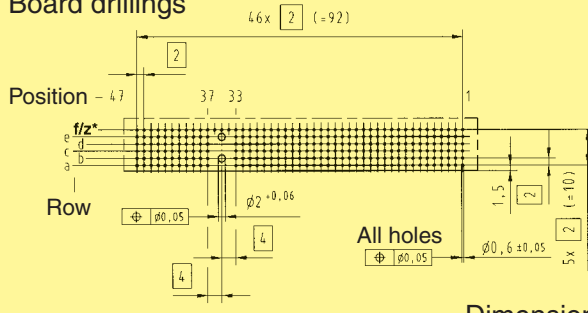
## With shielding



## Board drillings



## Board drillings

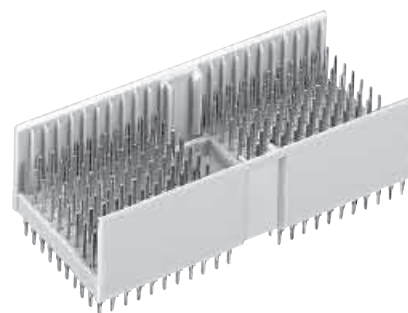


Dimensions [mm]

Thin print part numbers: performance level 1  
**Bold print part numbers:** performance level 2

\* hole on even contact numbers  
 only needed for lower shielding

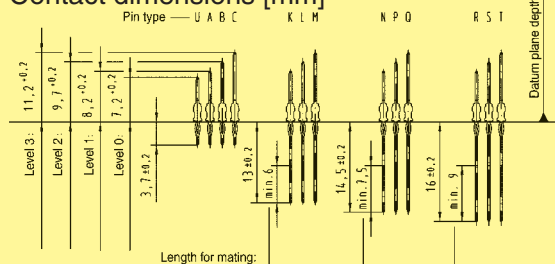




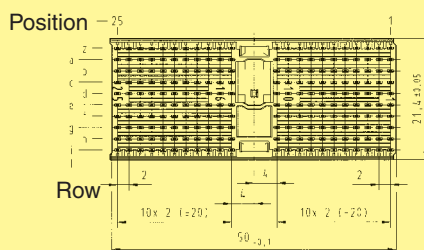
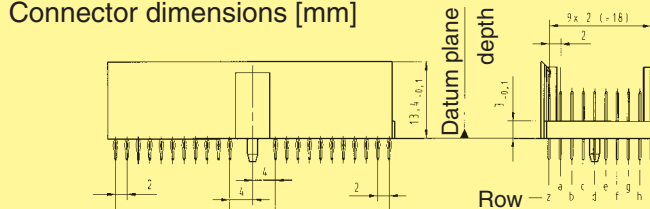
## Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Type D	176	8.2 3.7	17 11 176 1201 17 11 176 2201	
Type D	220	8.2/ 11.2 3.7	17 11 220 1201 17 11 220 2201	
Type D	220	9.7/ 11.2 14.5/ 16.0	17 11 220 1001 17 11 220 2001	

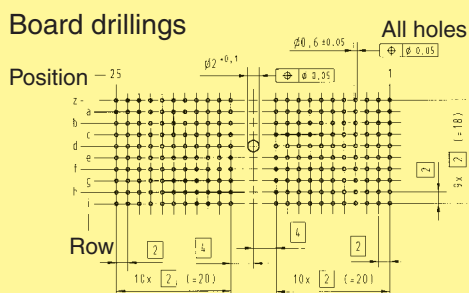
## Contact dimensions [mm]



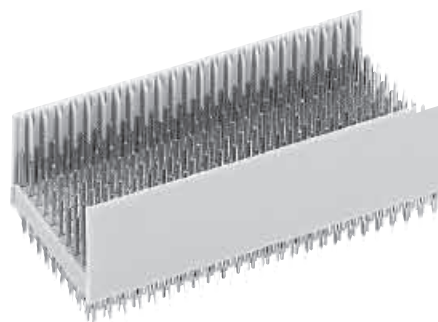
## Connector dimensions [mm]



## Board drillings



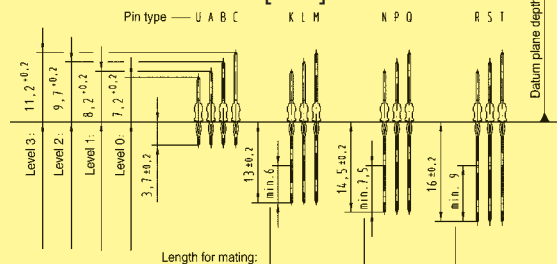




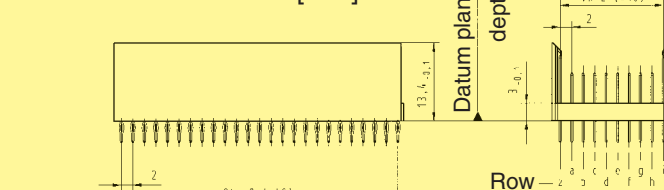
### Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Type E	200	8.2 3.7	17 12 200 1201 17 12 200 2201	
Type E	250	8.2/ 11.2 3.7	17 12 250 1201 17 12 250 2201	
Type E	250	9.7/ 11.2 14.5/ 16.0	17 12 250 1001 17 12 250 2001	

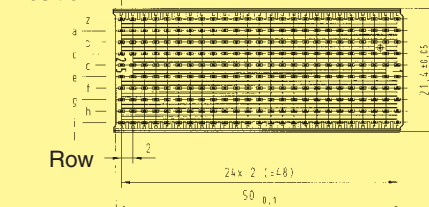
### Contact dimensions [mm]



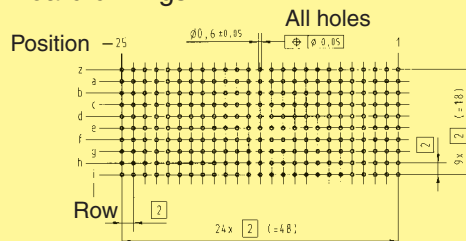
### Connector dimensions [mm]

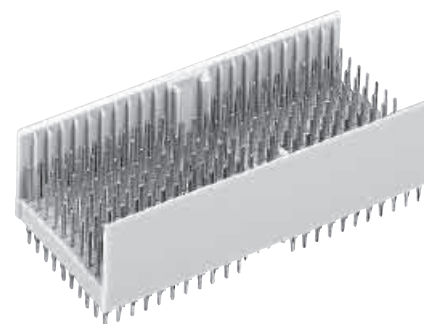


### Position



### Board drillings

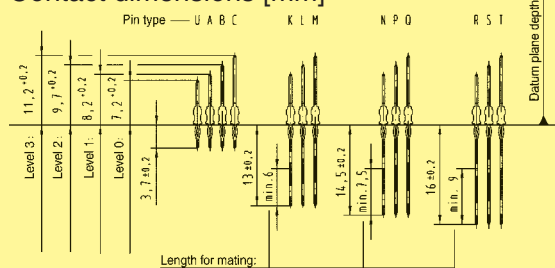




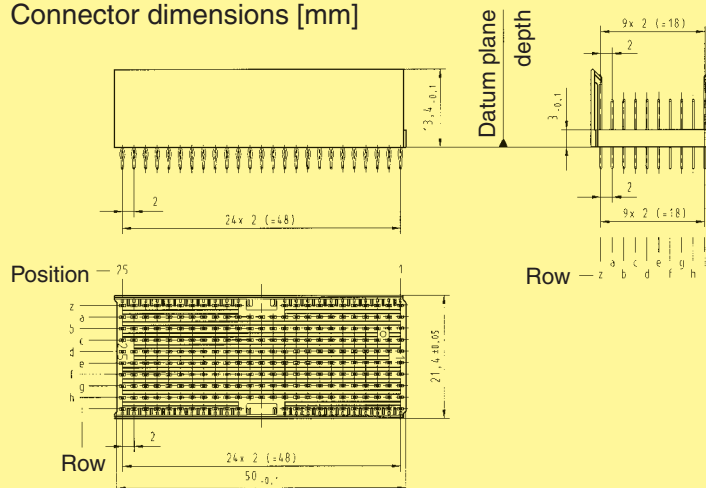
## Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Type DE	200	8.2 3.7	17 10 200 1201 17 10 200 2201	
Type DE	244	8.2/ 11.2 3.7	17 10 244 1201 17 10 244 2201	
Type DE	244	9.7/ 11.2 14.5/ 16.0	17 10 244 1001 17 10 244 2001	

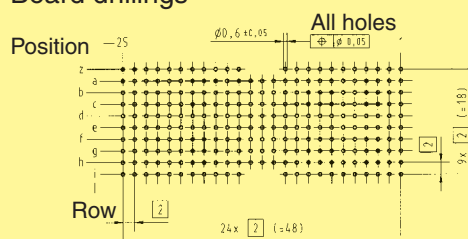
## Contact dimensions [mm]



## Connector dimensions [mm]



## Board drillings



Coding keys are used to prevent mismatching of boards. They can be inserted into the multifunctional area of male and female connectors with special tooling. This can be easily done after the connectors have been pressed in.

Coding keys have different bright and pre-defined RAL colours to simplify the identification. In the table below the colours and code numbers in acc. with the IEC 61076-4-101 are listed. They are used for the following applications:

- Cadmium yellow for CompactPCI to identify 3.3 V bus signalling
- Brilliant blue for CompactPCI to identify 5.0 V bus signalling
- Reseda green to prevent accidental board insertion in VME64x on CompactPCI applications
- Strawberry red to prevent accidental board insertion in telephony applications
- Pastel orange for user defined bus
- Nut brown for rear I/O and user I/O

### Coding keys for male connectors

Coding key	Code number	Colour	Part number
	3568	Pastel orange RAL 2003	17 79 000 0010
	3478	Steel blue RAL 5011	17 79 000 0011
	3467	Slate grey RAL 7015	17 79 000 0012
	3456	Cadmium yellow RAL 1021 for CPCI, 3.3 V	17 79 000 0013
	2578	Reseda green Ral 6011	17 79 000 0014
	1567	Brilliant blue RAL 5007 for CPCI, 5.0 V	17 79 000 0015
	1356	Blue lilac RAL 4005	17 79 000 0016
	1248	Strawberry red RAL 3018	17 79 000 0018
	1236	Nut brown RAL 8011	17 79 000 0019

### Coding keys for female connectors

Coding key	Code number	Colour	Part number
	1247	Pastel orange RAL 2003	17 79 000 0020
	1256	Steel blue RAL 5011	17 79 000 0021
	1258	Slate grey RAL 7015	17 79 000 0022
	1278	Cadmium yellow RAL 1021 for CPCI, 3.3 V	17 79 000 0023
	1346	Reseda green Ral 6011	17 79 000 0024
	2348	Brilliant blue RAL 5007 for CPCI, 5.0 V	17 79 000 0025
	2478	Blue lilac RAL 4005	17 79 000 0026
	3567	Strawberry red RAL 3018	17 79 000 0028
	4578	Nut brown RAL 8011	17 79 000 0029

HARTING's *harbus® HM* shrouds protect the pins protruding the rear side of the backplane from irregular mating tolerances, thus ensuring a quality connection.

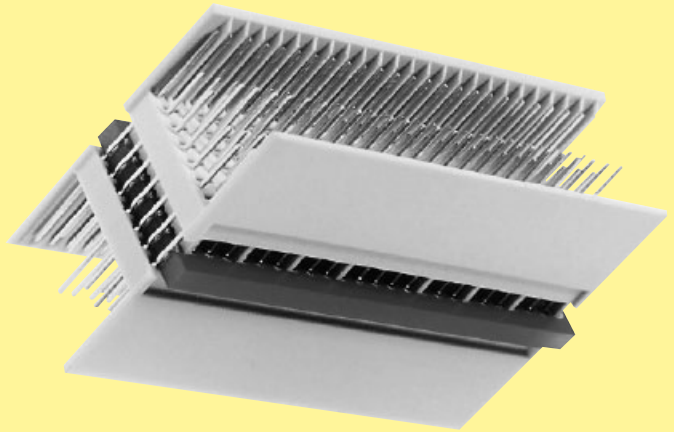
To accommodate pcb thickness, from 1.6 up to 4 mm nominal, the shrouds have integrated standoffs of corresponding height.

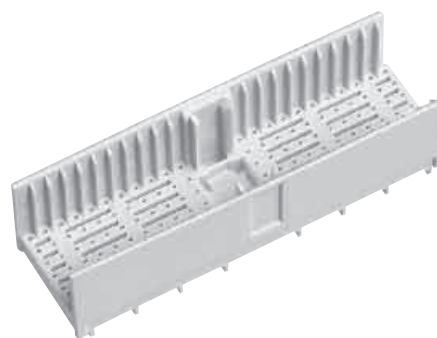
Thus forming a one piece solution that reduces assembling cost significantly.

The shroud can be mounted without the additional requirement of spacers to ensure the desired pin lengths on the rear side of the pcb.

Fixing of the component is carried out on the rear post via a smooth friction fit process.

For ease of assembly the same tooling as for the press-in connectors on the front side is utilised for assembly.





Identification

Board thickness [mm]

Part number

Type A shroud

25 positions

$1.6 \pm 0.4$

$2.4 \pm 0.4$

$3.2 \pm 0.4$

$4.0 \pm 0.4$

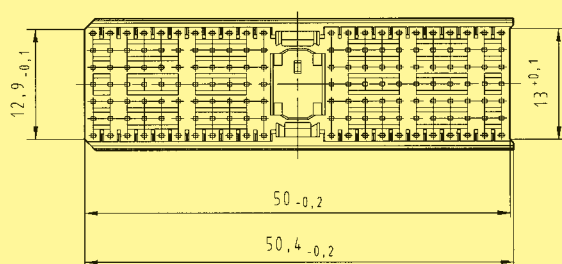
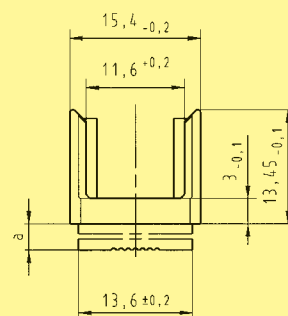
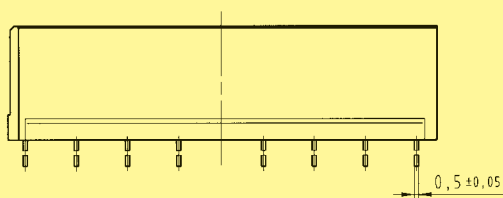
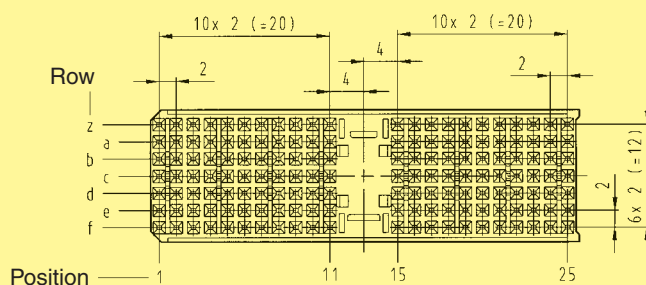
17 70 000 1001

17 70 000 1002

17 70 000 1003

17 70 000 1004

Dimensions



Board thickness [mm]	a [mm]
$1.6 \pm 0.4$	$3.1 \pm 0.05$
$2.4 \pm 0.4$	$2.3 \pm 0.05$
$3.2 \pm 0.4$	$1.5 \pm 0.05$
$4.0 \pm 0.4$	$0.7 \pm 0.05$





### Identification

### Board thickness [mm]

### Part number

#### Type B shroud

25 positions

1.6 ± 0.4  
2.4 ± 0.4  
3.2 ± 0.4  
4.0 ± 0.4

17 70 000 2001  
17 70 000 2002  
17 70 000 2003  
17 70 000 2004

22 positions

1.6 ± 0.4  
2.4 ± 0.4  
3.2 ± 0.4  
4.0 ± 0.4

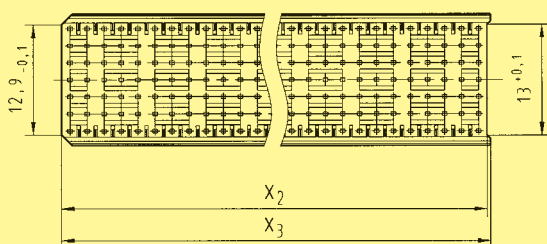
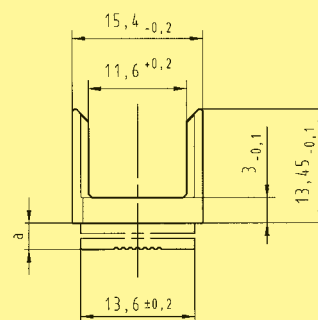
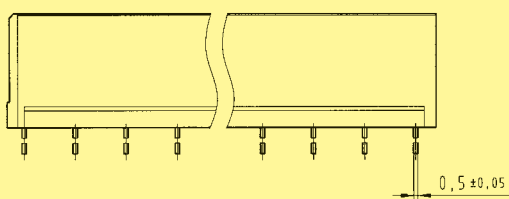
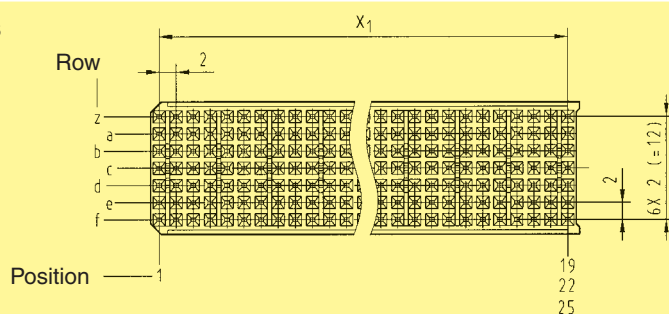
17 70 000 4001  
17 70 000 4002  
17 70 000 4003  
17 70 000 4004

19 positions

1.6 ± 0.4  
2.4 ± 0.4  
3.2 ± 0.4  
4.0 ± 0.4

17 70 000 5001  
17 70 000 5002  
17 70 000 5003  
17 70 000 5004

### Dimensions



Board thickness [mm]	a [mm]
1.6 ± 0.4	3.1 ± 0.05
2.4 ± 0.4	2.3 ± 0.05
3.2 ± 0.4	1.5 ± 0.05
4.0 ± 0.4	0.7 ± 0.05

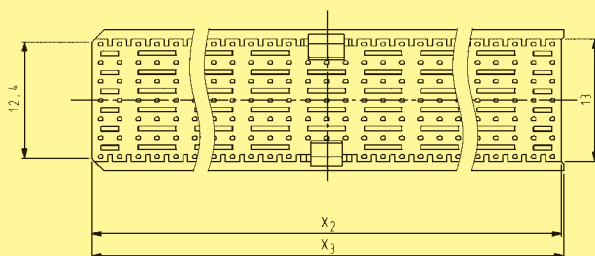
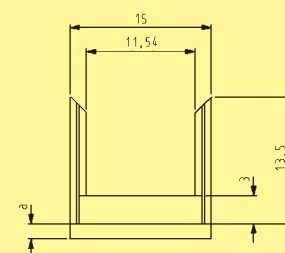
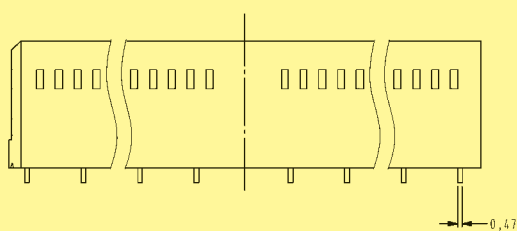
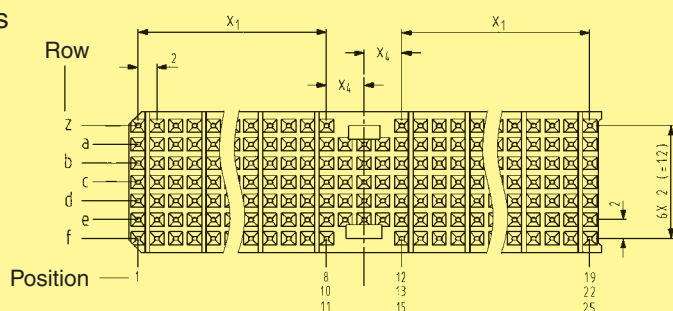
Contact positions	x <sub>1</sub> [mm]	x <sub>2</sub> [mm]	x <sub>3</sub> [mm]
19	18 x 2 (= 36)	38 – 0.2	38.4 – 0.2
22	21 x 2 (= 42)	44 – 0.2	44.4 – 0.2
25	24 x 2 (= 48)	50 – 0.2	50.4 – 0.2

Dimensions [mm]



Identification	Board thickness [mm]	Part number
Type AB shroud 25 positions	1.6 ± 0.4	17 70 000 8001
	2.4 ± 0.4	17 70 000 8002
	3.2 ± 0.4	17 70 000 8003
	4.0 ± 0.4	17 70 000 8004
22 positions	1.6 ± 0.4	17 70 000 7001
	2.4 ± 0.4	17 70 000 7002
	3.2 ± 0.4	17 70 000 7003
	4.0 ± 0.4	17 70 000 7004
19 positions	1.6 ± 0.4	17 70 000 6001
	2.4 ± 0.4	17 70 000 6002
	3.2 ± 0.4	17 70 000 6003
	4.0 ± 0.4	17 70 000 6004

### Dimensions



Board thickness [mm]	a [mm]
1.6 ± 0.4	3.1 ± 0.05
2.4 ± 0.4	2.3 ± 0.05
3.2 ± 0.4	1.5 ± 0.05
4.0 ± 0.4	0.7 ± 0.05

Contact positions	x <sub>1</sub> [mm]	x <sub>2</sub> [mm]	x <sub>3</sub> [mm]	x <sub>4</sub> [mm]
19	7 x 2 (= 14)	37.9	38.2	4
22	8 x 2 (= 16)	43.9	44.2	3
25	10 x 2 (= 20)	49.9	50.2	4

Dimensions [mm]



Identification

Board thickness [mm]

Part number

Type C shroud

11 positions

1.6 ± 0.4

2.4 ± 0.4

3.2 ± 0.4

4.0 ± 0.4

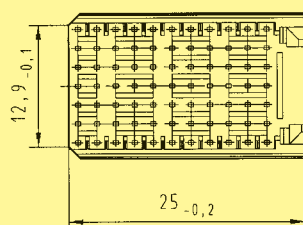
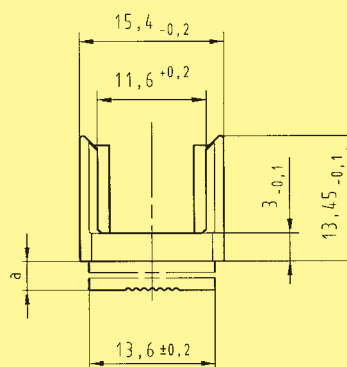
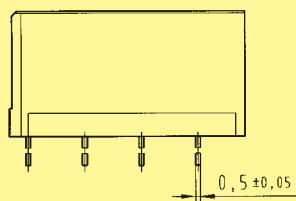
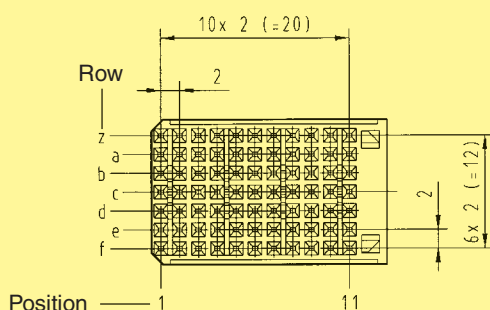
17 70 000 3001

17 70 000 3002

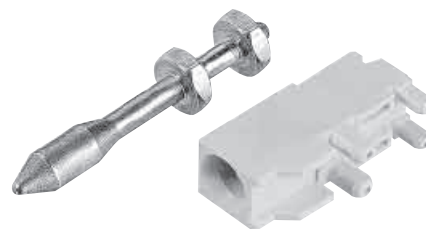
17 70 000 3003

17 70 000 3004

Dimensions



Board thickness [mm]	a [mm]
1.6 ± 0.4	3.1 ± 0.05
2.4 ± 0.4	2.3 ± 0.05
3.2 ± 0.4	1.5 ± 0.05
4.0 ± 0.4	0.7 ± 0.05



## Identification

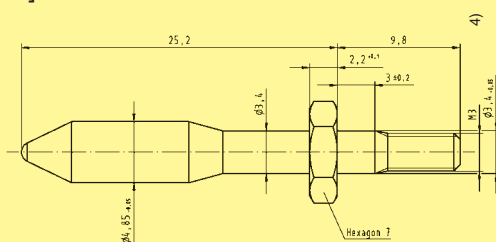
Part number

Guide pin

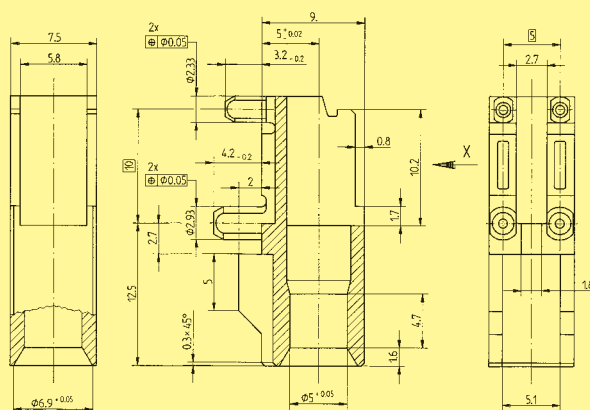
17 79 000 0080Receptacle for guide pin07 73 000 0280

Dimensions [mm]

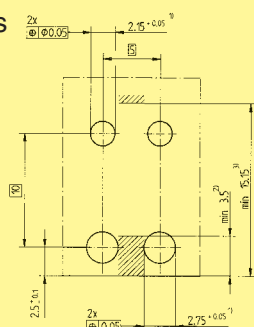
Guide pin



Receptacle  
for guide pin



Board drillings  
(View-X)



- 1) Non-metallised drillings
- 2) No tracks, except solder eyes
- 3) Limit area of components (valid for both pcb sides)
- 4) Recommended board drilling is 3.5 (-0.05) mm

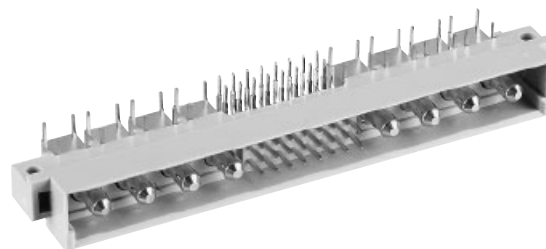
### General information

The guide pin solution from HARTING allows safe mating under sometimes extreme conditions. This might be large and heavy boards that bow under their own weight. Also insufficiently aligned or worn out rack systems can be tolerated better with the use of HARTING's guiding system, which also reduces the potential danger of damaging cards when being forced into flexing racks.

The guide pin and receptacle's design solution allows to overcome a 3 mm [.118"] offset between the backplane and the mating daughtercard. The reducing diameter of the pin (from 4.85 mm to 3.4 mm) ensures that its positioning task is smoothly transferred to the connectors as soon as they start to engage. Finally the thin diameter section of the guide pin is no longer positioned by the ferrule of the receptacle, ensuring that the pin is able to freely follow any movement imposed by the engaging connector. This ensures that there is no static stress between the connectors and the guiding system.

The rugged metal designed guide pin is screwed to the backplane with standard hexagon screws. Whereas the molded receptacle is designed with four press-in pegs that can be installed to the board together with the connectors.

The tooling can be ordered with the part numbers **07790000157** (top tool) and **07790000158** (bottom tool).



## Type M male connectors

Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60 603-2		
			3	2	1	
Male connector with angled solder pins	24 + 8		09 03 124 7901	09 03 124 6901	09 03 124 2901	

**Order** high current **contacts separately**, see page 00.44

Technical drawing of a PCB layout showing dimensions and drillings. The drawing includes a top view of the board with a grid of holes. Key dimensions and labels include:

- Overall width: 88.9
- Overall height: 5.08
- Top edge dimensions: 2.54 ± 0.1, 2.8 ± 0.1, 2.54
- Bottom edge dimensions: 5.3 ± 0.1, 2.54
- Internal dimensions: 31 × (2.54) = 78.74, 2, 1, 1.91, 2x, 2 × (2.54) = 5.08
- Labels: 'all holes', 'a', 'b', 'c', '32 31', '2.54', '1.91', '2x', '2 × (2.54) = 5.08'

Dimensions in mm

### Complementary type M-flat female connectors

Performance level 1  
on request

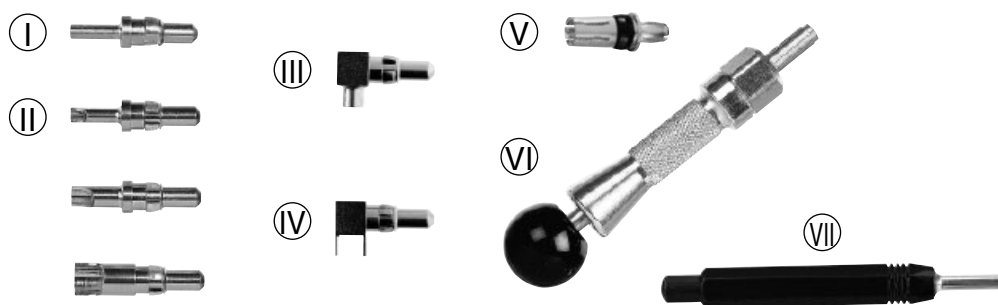
**Order high current contacts separately, see page 00.44**

Technical drawing of a rectangular plate. The drawing shows a top view of a plate with a central rectangular area and a surrounding border. The central area has a width of 85 and a height of 90. The total width of the plate is 95.01, and the total height is 95. The material is specified as M2.5 (62.8). The drawing includes dimension lines and arrows indicating the measurements.

Dimensions in mm



# Special connectors for VME64x



## High current contacts

Identification		Part No.	Performance level 1	Drawing	Dimensions in mm
High current male contacts for male connectors <sup>1)</sup>					
I for straight crimp termination	10 A	09 03 000 6113	acc. to DIN 41626		

<sup>1)</sup> Contact resistance max. 1.5 mΩ

## harbus® 64

### Male connectors



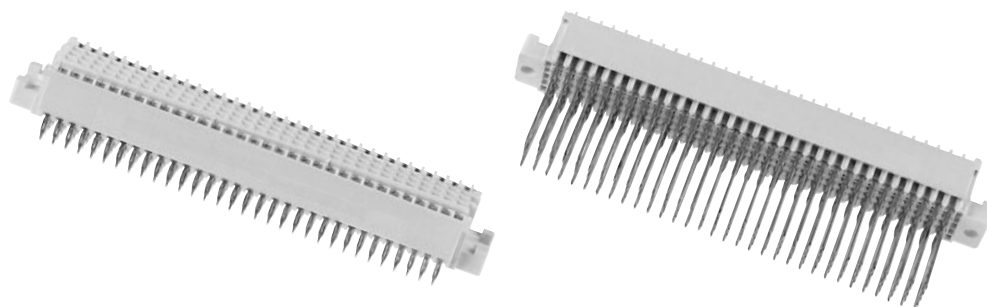
Identification	Number of contacts	Contact arrangement	Part No. Performance levels according to IEC 61076-4-113	
			2	1
Male connector* without retention clip	160	z, a, b, c, d	02 01 160 2101	02 01 160 1101 02 01 160 1105 <sup>2)</sup>
with retention clip	160	z, a, b, c, d	02 01 160 2102	02 01 160 1102 02 01 160 1106 <sup>2)</sup>
Dimensions				
Board drillings Mounting side				
Cross section of solder terminations	<div> <p>Row z: A = 0.21 - 0.25 mm<sup>2</sup></p> </div> <div> <p>Rows a, b, c: A = 0.29 - 0.33 mm<sup>2</sup></p> </div> <div> <p>Row d: A = 0.29 - 0.32 mm<sup>2</sup></p> </div> <p>A = cross area of contacts</p> <p>Dimensions in mm</p>			

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

<sup>1)</sup> Recommendation for variants with clip: Drillings can be enlarged up to 3.1 mm  $\phi$  to reduce standard mounting force

<sup>2)</sup> Special variant with min. 1.27  $\mu$ m (50  $\mu$ inch) Au and SnPb on termination

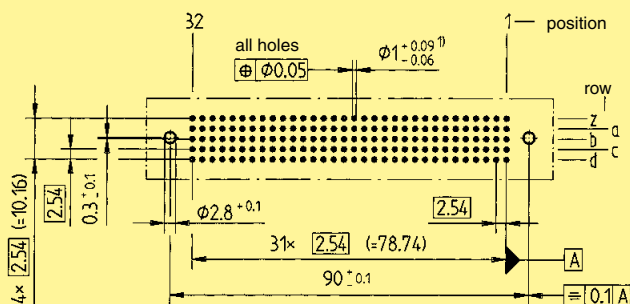
## Female connectors



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

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

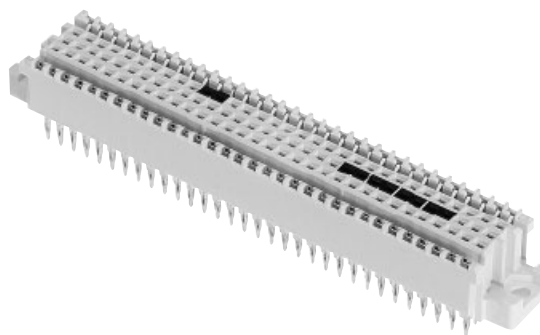
Mounting side



Dimensions in mm

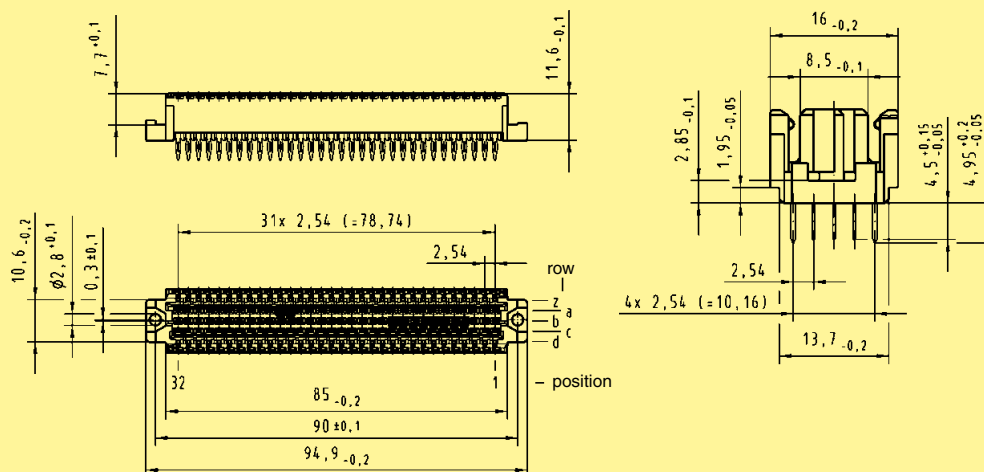
**harbus® 64**

Female connectors



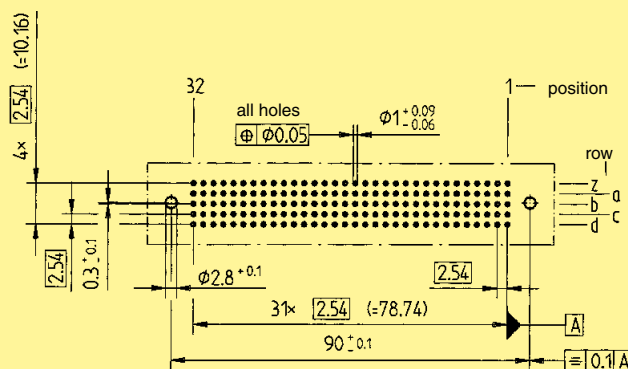
Identification	Number of contacts	Contact arrangement	Part No. Performance level 2 according to IEC 61 076-4-113
Female connectors, straight with switches <sup>1)</sup>			
with press-in terminations			
with flange 4.5/5 mm	160	z, a, b, c, d	02 03 160 2201

## Dimensions



## Board drillings

Mounting side



Dimensions in mm

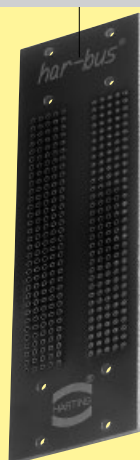
<sup>1)</sup> Switching elements at positions a21-22, b4-5, b6-7, b8-9 and b10-11  
Further types see DIN 41 612 catalogue

## 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

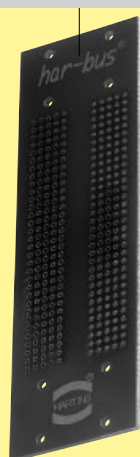
Locking lever  
left 09 02 000 9902  
right 09 02 000 9903

## 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



**harbus® HM** with 6 rows, 2.00 mm pitch

Page

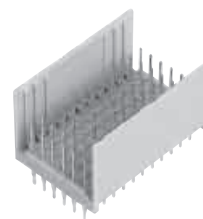
<b>harbus® HM</b> 6-row – general information . . . . .	<b>02.02</b>
Technical characteristics . . . . .	<b>02.03</b>
Straight male connectors with press-in termination . . . . .	<b>02.04</b>
Angled female connectors with press-in termination . . . . .	<b>02.08</b>
Angled female connectors with solder (SMC) termination . . . . .	<b>02.10</b>
Compatibility with OBSAI . . . . .	<b>02.12</b>





Design	: complementary to IEC 61 076-4-101 (2 mm hard metric specification)																
Number of contacts	: 72 or 144																
Contact spacing	: 2.00 mm (1.50 mm between contact rows on the termination side of female connectors)																
Working current	: 1.0 A (24 °C temp. raise) 1.5 A (52 °C temp. raise) 2.0 A (88 °C temp. raise)																
Test voltage $U_{r.m.s.}$	: min. 750 V																
Contact resistance	: < 20 mΩ																
Impedance (differential)	: 100 Ω																
Typical differential data rate	: 1.5 - 2.5 Gbps																
Temperature range during reflow soldering	: - 55 °C ... + 125 °C max. 260 °C (peak temperature)																
Performance level*	: performance level 2 = 250 mating cycles performance level 1 = 500 mating cycles																
Termination technique	: press-in for male and female connectors SMC for female connectors, compatible with lead-free solder process																
Pcb characteristics	: min. 1.4 mm for male and female connectors with press-in terminations 1.6 mm - 2.4 mm for female connectors with SMC terminations																
Recommended configuration of plated through holes	<table border="1"> <thead> <tr> <th></th><th>press-in</th><th>SMC</th></tr> </thead> <tbody> <tr> <td>Plated hole-Ø</td><td><math>0.6 \pm 0.05</math> mm</td><td><math>0.7^{+0.07}_{-0.05}</math> mm</td></tr> <tr> <td>Hole-Ø</td><td><math>0.7 \pm 0.02</math> mm</td><td><math>0.8 \pm 0.02</math> mm</td></tr> <tr> <td>Cu</td><td>30 - 50 µm</td><td>30 - 50 µm</td></tr> <tr> <td>Sn</td><td>5 - 15 µm</td><td>5 - 15 µm</td></tr> </tbody> </table>			press-in	SMC	Plated hole-Ø	$0.6 \pm 0.05$ mm	$0.7^{+0.07}_{-0.05}$ mm	Hole-Ø	$0.7 \pm 0.02$ mm	$0.8 \pm 0.02$ mm	Cu	30 - 50 µm	30 - 50 µm	Sn	5 - 15 µm	5 - 15 µm
	press-in	SMC															
Plated hole-Ø	$0.6 \pm 0.05$ mm	$0.7^{+0.07}_{-0.05}$ mm															
Hole-Ø	$0.7 \pm 0.02$ mm	$0.8 \pm 0.02$ mm															
Cu	30 - 50 µm	30 - 50 µm															
Sn	5 - 15 µm	5 - 15 µm															
Mating force	: < 0.75 N/pin																
Materials																	
Mouldings	: Thermoplastic resin, glass-fibre filled, UL 94-V0																
Contacts	: Copper alloy																
Contact surface	: Au/Ni																
Packaging																	
Tube	: Male connectors and female connectors with press-in terminations																
Tape & Reel	: Female connectors with SMC terminations																

\* Other platings on request

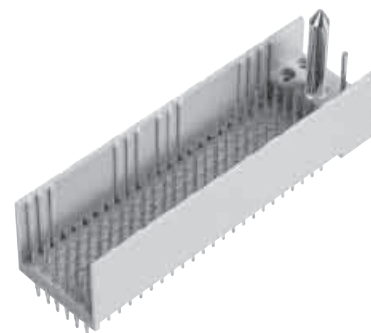


## Male connectors straight, with press-in termination

Identification	Number of contacts	Contact length [mm] mating side termination side	Part number	Contact configuration
Connectors without flange without coding without endwall	72	8.2	3.7 <b>17 41 072 1204</b> <b>17 41 072 2204</b>	
	144	8.2	3.7 <b>17 44 144 1205</b> <b>17 44 144 2205</b>	
Connectors without flange without coding <u>with</u> endwall	72	8.2	3.7 <b>17 42 072 1203</b> <b>17 42 072 2203</b>	
	144	8.2	3.7 <b>17 45 144 1204</b> <b>17 45 144 2204</b>	

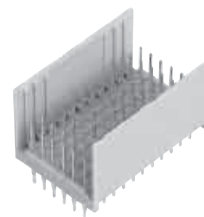
Connector dimensions see pages 02.06 and 02.07.  
The pin types A, B, C ... R, S, T can be mixed in any configuration.  
Please request the part number.

Thin print part numbers: performance level 1  
**Bold print part numbers:** performance level 2



## Male connectors straight, with press-in termination

Identification	Number of contacts	Contact length [mm] mating side	termination side	Part number	Contact configuration
Connectors <u>with</u> flange without coding without endwall	72	8.2	3.7	17 43 072 1209 <b>17 43 072 2209</b>	
	144	8.2	3.7	17 46 144 1207 <b>17 46 144 2207</b>	
Connectors <u>with</u> flange <u>with</u> coding 1 without endwall	72	8.2	3.7	17 43 072 1211 <b>17 43 072 2211</b>	
	144	8.2	3.7	17 46 144 1209 <b>17 46 144 2209</b>	
Connectors <u>with</u> flange <u>with</u> coding 2 without endwall	72	8.2	3.7	17 43 072 1210 <b>17 43 072 2210</b>	
	144	8.2	3.7	17 46 144 1208 <b>17 46 144 2208</b>	
Connectors <u>with</u> flange <u>with</u> coding 3 (= coding 1 + 2) without endwall	72	8.2	3.7	17 43 072 1212 <b>17 43 072 2212</b>	
	144	8.2	3.7	17 46 144 1210 <b>17 46 144 2210</b>	

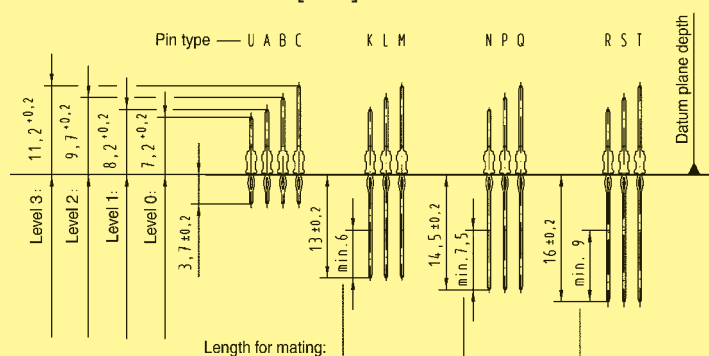


Male connectors straight, with press-in termination

Drawing

Dimensions in mm

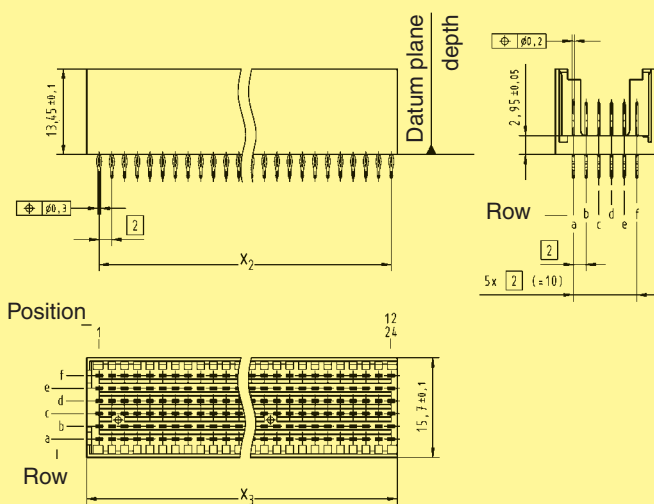
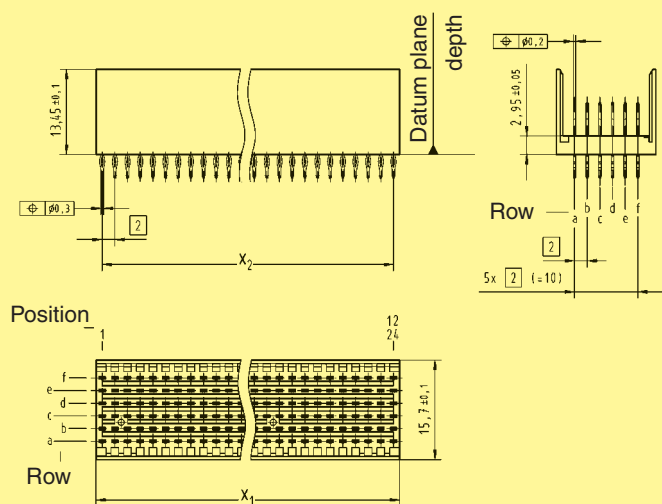
## Connector dimensions [mm]



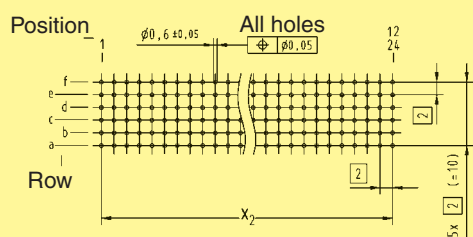
Contact positions	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>
72	23.9	11 x 2 (= 22)	24.9
144	47.9	23 x 2 (= 46)	48.9

without flange  
without coding  
without endwall

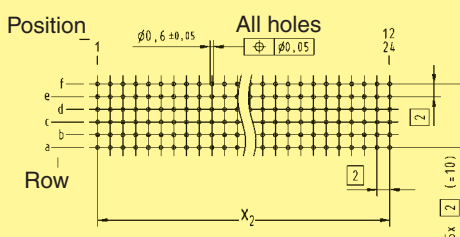
without flange  
without coding  
with endwall

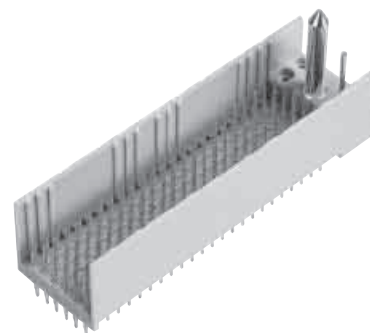


## Board drillings



## Board drillings



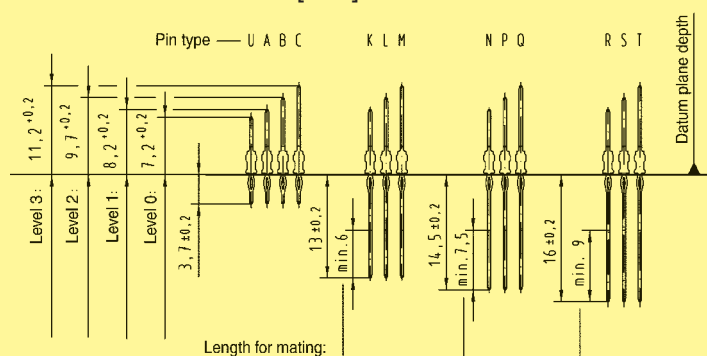


## Male connectors straight, with press-in termination

Drawing

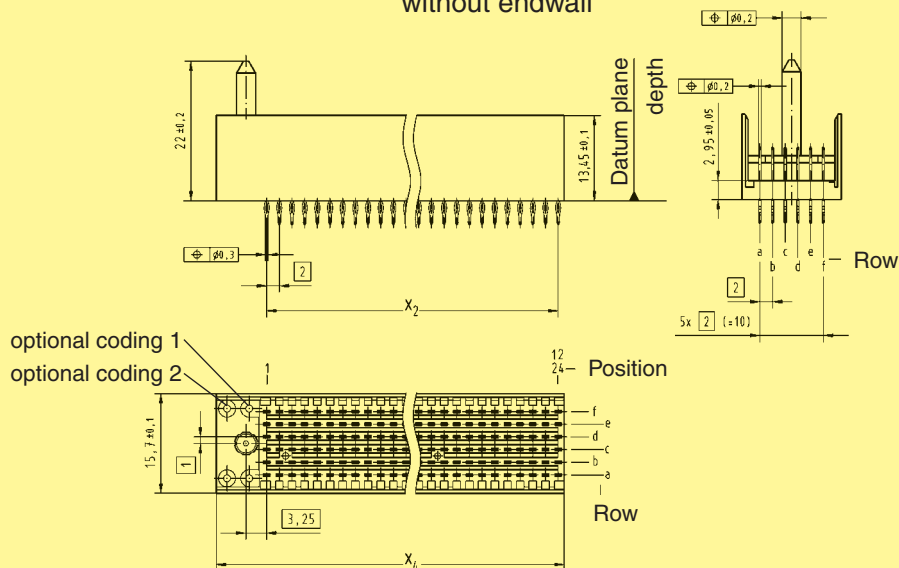
Dimensions in mm

### Connector dimensions [mm]

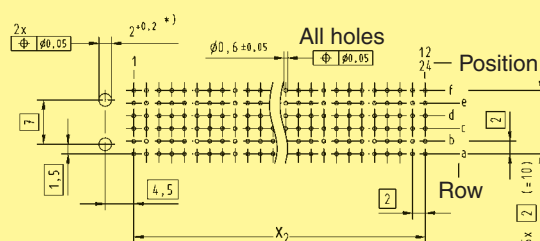


Contact positions	x <sub>2</sub>	x <sub>4</sub>
72	11 x 2 (= 22)	30.9
144	23 x 2 (= 46)	54.9

with flange  
with coding  
without endwall

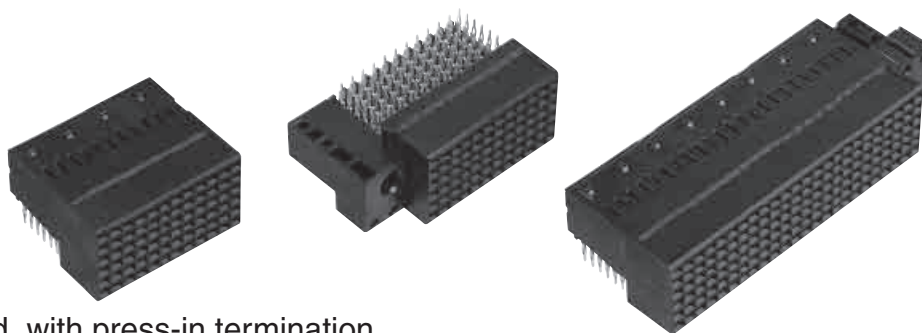


### Board drillings



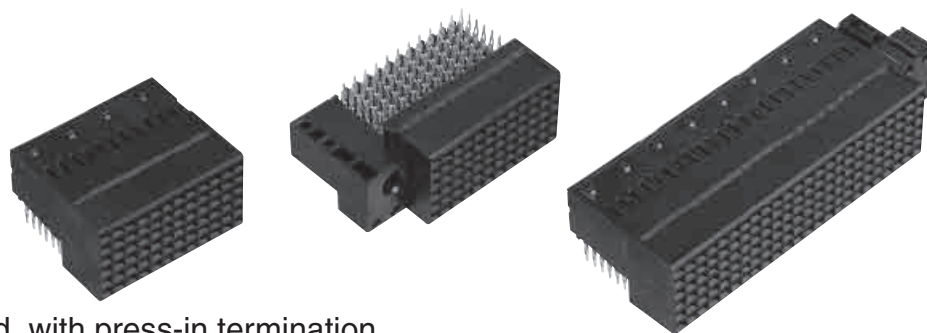
\* Non-metallized drillings





Female connectors angled, with press-in termination

Identification	Number of contacts	Contact length [mm] termination side	Part number	
Connectors without flange without coding	72	3.35	17 51 072 1102 <b>17 51 072 2102</b>	
	144	3.35	17 54 144 1102 <b>17 54 144 2102</b>	
Connectors with flange without coding	72	3.35	17 52 072 1105 <b>17 52 072 2105</b>	
	144	3.35	17 55 144 1105 <b>17 55 144 2105</b>	
Connectors with flange with coding 1	72	3.35	17 52 072 1106 <b>17 52 072 2106</b>	
	144	3.35	17 55 144 1106 <b>17 55 144 2106</b>	
Connectors with flange with coding 2	72	3.35	17 52 072 1107 <b>17 52 072 2107</b>	
	144	3.35	17 55 144 1107 <b>17 55 144 2107</b>	
Connectors with flange with coding 3 (= coding 1 + 2)	72	3.35	17 52 072 1108 <b>17 52 072 2108</b>	
	144	3.35	17 55 144 1108 <b>17 55 144 2108</b>	



Female connectors angled, with press-in termination

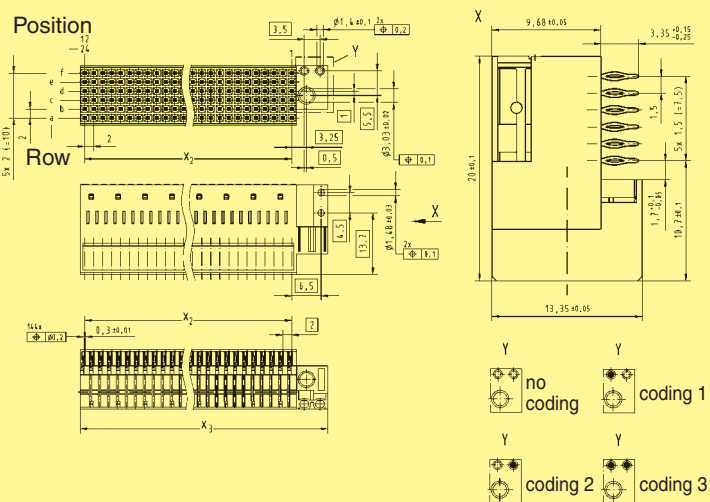
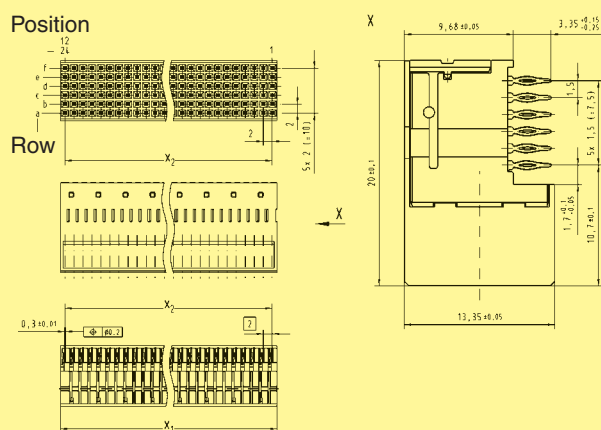
Drawing

Dimensions in mm

## Connector dimensions [mm]

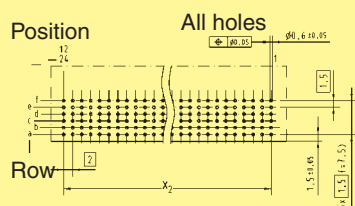
without flange  
without coding

with flange  
with coding

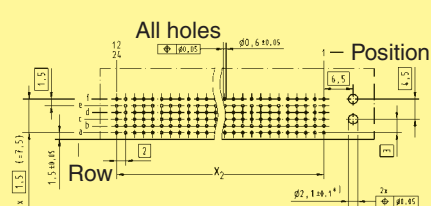


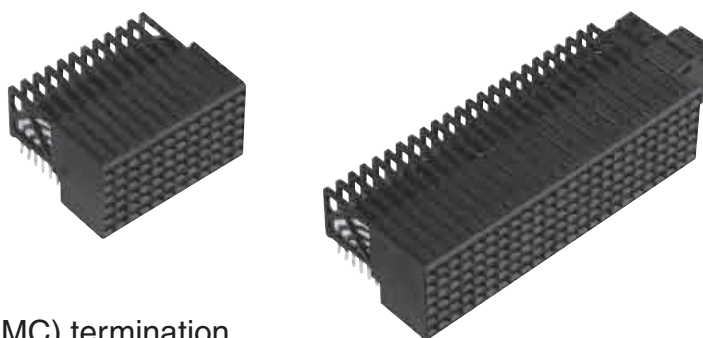
Contact positions	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>
72	24.0	11 x 2 (= 22)	31.0
144	48.0	23 x 2 (= 46)	55.0

## Board drillings



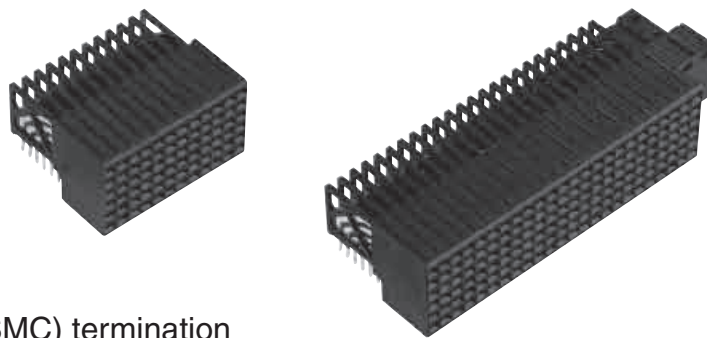
## Board drillings





## Female connectors angled, with solder (SMC) termination

Identification	Number of contacts	Contact length [mm] termination side	Part number	
Connectors without flange without coding	72	2.5	17 51 072 1802 <b>17 51 072 2802</b>	
	144	2.5	17 54 144 1802 <b>17 54 144 2802</b>	
Connectors with flange without coding	72	2.5	17 52 072 1805 <b>17 52 072 2805</b>	
	144	2.5	17 55 144 1805 <b>17 55 144 2805</b>	
Connectors with flange with coding 1	72	2.5	17 52 072 1806 <b>17 52 072 2806</b>	
	144	2.5	17 55 144 1806 <b>17 55 144 2806</b>	
Connectors with flange with coding 2	72	2.5	17 52 072 1807 <b>17 52 072 2807</b>	
	144	2.5	17 55 144 1807 <b>17 55 144 2807</b>	
Connectors with flange with coding 3 (= coding 1 + 2)	72	2.5	17 52 072 1808 <b>17 52 072 2808</b>	
	144	2.5	17 55 144 1808 <b>17 55 144 2808</b>	

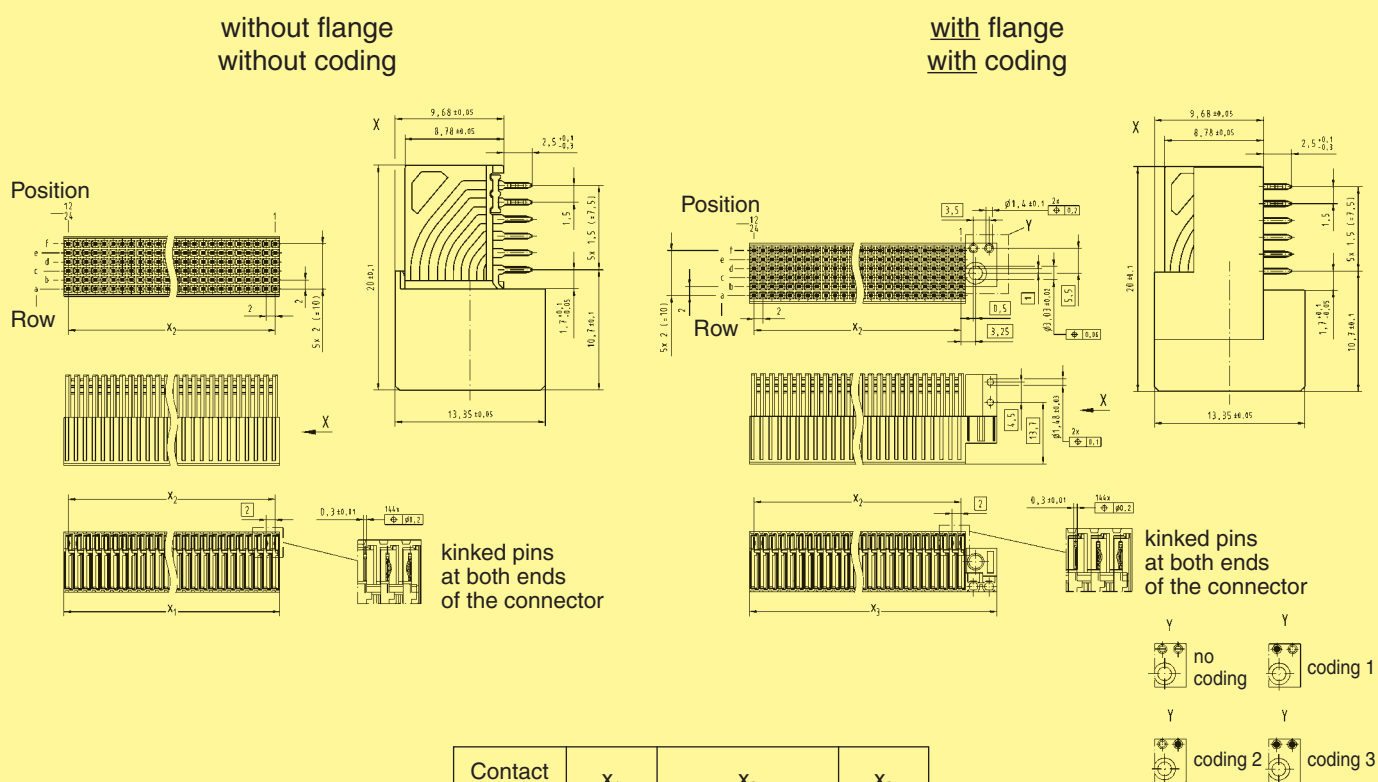


Female connectors angled, with solder (SMC) termination

Drawing

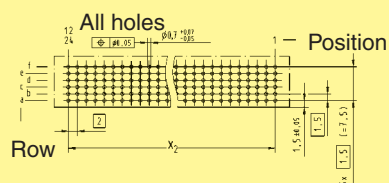
Dimensions in mm

## Connector dimensions [mm]

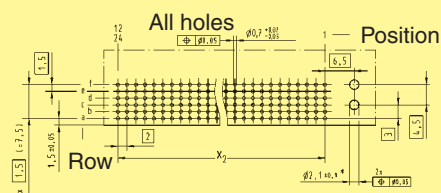


Contact positions	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>
72	24.0	11 x 2 (= 22)	31.0
144	48.0	23 x 2 (= 46)	55.0

## Board drillings



## Board drillings



HARTING is a supporter member of OBSAI since September 2003.

The Open Base Station Architecture Initiative (OBSAI) has developed a comprehensive set of open specifications for key module interfaces within the base station architecture. This development will enable an open market of base station modules.

The OBSAI architecture provides a clear split in functionality and detailed internal interface specifications. This allows companies to create modules that are truly compatible in all OBSAI compliant base stations. OBSAI provides the entry for a new, competitive market for functionally standardized modules.

HARTING's *har-bus*® *HM* Signal and *HM* Power connectors meet OBSAI specifications and provide a reliable and cost effective solution for connecting plug-in units to the backplane. The connector solution available from HARTING technology group will offer full compatibility and intermateability with base station modules.

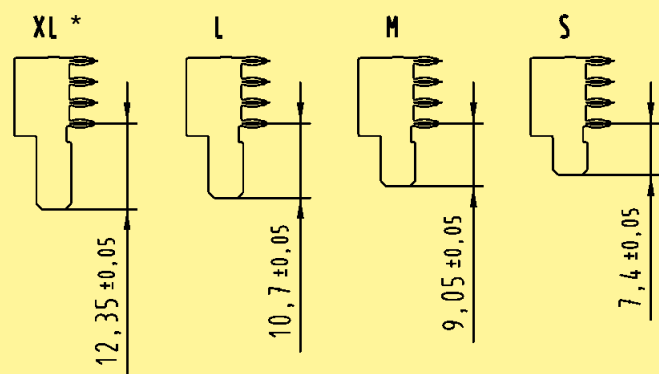
HARTING's activities in the wireless market are in line with those of OBSAI.

The OBSAI specifications allow HARTING the opportunity to support a large group of wireless base station manufacturers and module manufacturers with unified, state of art interconnection solutions.

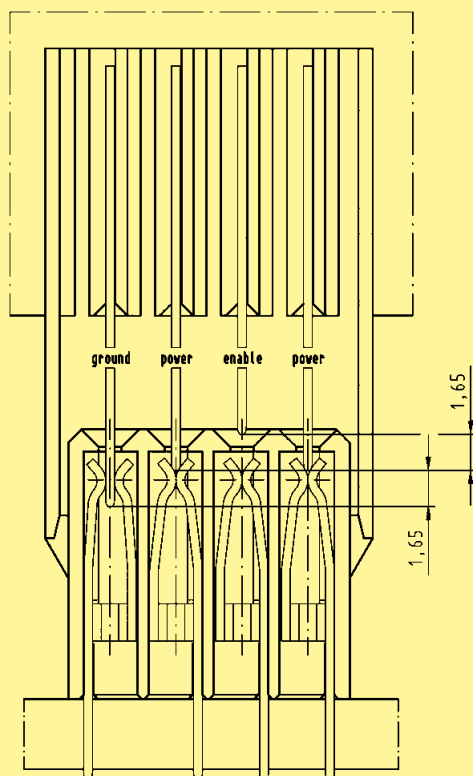
<b>harbus® HM</b> Power – general information . . . . .	<b>03.02</b>
Technical characteristics . . . . .	<b>03.03</b>
Angled male connectors with press-in termination . . . . .	<b>03.04</b>
Angled male connectors with solder (SMC) termination . . . . .	<b>03.05</b>
Straight female connectors with press-in termination . . . . .	<b>03.06</b>

The **harbus® HM** HM Power connector is designed according to the OBSAI Specification V 1.1. It is well-suited to be used in conjunction with 2 mm **harbus® HM** connectors. The durability is according to IEC 61076-4-101 (250 mating cycles).

The straight female connector for the backplane is fitted with press-in contacts, the right angled male connector for daughter cards can be supplied with either press-in or PIHIR (Pin In Hole Intrusive Reflow) termination.

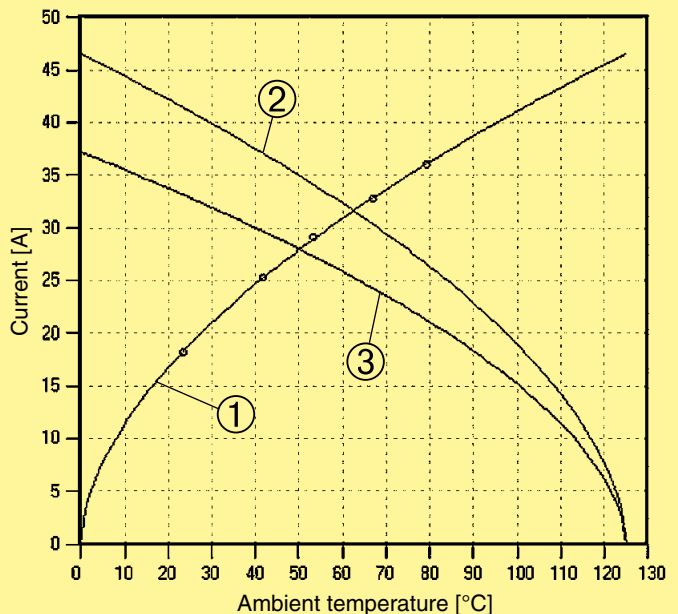


The compact, high temperature moulding can be loaded with up to four high current contacts. Four different contact lengths are available from 7.4 mm to 12.35 mm. This makes sequenced and non sequenced loadings possible (e.g. with GND and ENA). Any other contact assignments, also partially loaded, are available on request.



Loaded with four power contacts, each contact can carry up to 20 A @ 70 °C / 80 % derating.

**With a configuration of two power contacts, GND and ENA, the current carrying capacity is even up to 23 A @ 70 °C / 80 % derating per contact.**



- ① Temperature raise
- ② Derating
- ③ Derating curve at  $I_{max} \times 0.8$  (DIN EN 60512-5-2)


The distance between adjacent contacts is 3 mm, which enables wider pcb traces, larger solder paste areas and an improved heat dissipation. For the female backplane connector no special tooling is necessary due to the flatrock design. For the male connector HARTING offers a special press-in tool (see chapter 15).

HARTING's **harbus® HM** Signal and Power connectors meet OBSAI (Open Base Station Architecture Initiative) specifications and provide a reliable and cost effective solution for connecting plug-in units to the backplane. The connector solutions available from the HARTING technology group will offer full compatibility and intermateability with base station modules.

### Benefits:

- Small form factor
- High current rating up to 23 A per contact (OBSAI configuration)
- 3 level staggering (or even 4)
- Flatrock design
- Matched with **harbus® HM** 2 mm connectors



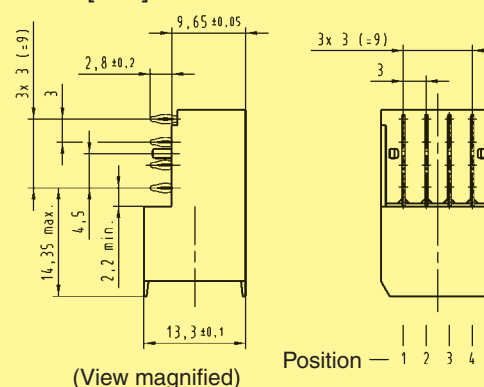
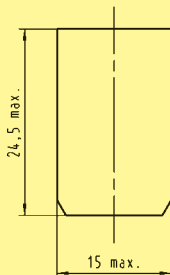
Design according	: OBSAI System Spezifikation V 1.1
Approvals	
Underwriters Laboratories Inc.®	:  us with their respective ratings documented in file E 102079
Number of contacts	: up to 4
Contact spacing	: 3.00 mm
Clearance and creepage distances between contacts	: > 2.3 mm
Working current	: 23 A max. (OBSAI configuration) 20 A max. (fully loaded with power contacts)
Test voltage $U_{r.m.s.}$	: AC 1500 V min.
Contact resistance	: < 1 mΩ
Insulation resistance:	: > 10 GΩ
Temperature range	: - 55 °C ... + 125 °C
during reflow soldering	220 °C for 2 minutes, 260 °C max. short-term
Durability as per IEC 61 076-4-101	: <i>Performance level 2 = 250 mating cycles in total.</i> First 125 mating cycles, then 4 days gas test using 0.5 ppm SO <sub>2</sub> and 0.1 ppm H <sub>2</sub> S (at 25 + 2 °C and 75 + 3 % humidity). Measurement of contact resistance. The remaining 125 mating cycles are subject to measurement of contact resistance and visual inspection. No abrasion of the contact finish through to the base material. No functional impairment.
Termination technique	
Male connectors	: Press-in or solder termination, suitable for (lead-free) pin-in-hole reflow soldering
Female connectors	: Press-in termination
Mating force	: max. 4 N / contact
Withdrawal force	: min. 0.5 N / contact
Materials	
Mouldings	: Thermoplastic resin, glass-fibre filled, UL 94-V0
Contacts	: Copper alloy
Contact surface	: Selectively gold plated (contact zone)
Contact styles	: Standard, leading, lagging
Packaging	
Tube	: Male and female connectors
Tape & Reel	: On request for male solder connectors



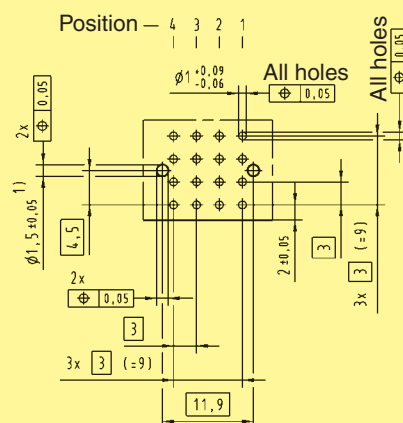
# harbus<sup>®</sup> HM Power

# harbus<sup>®</sup> HM Power

### Connector dimensions [mm]



Position — 4 3 2 1



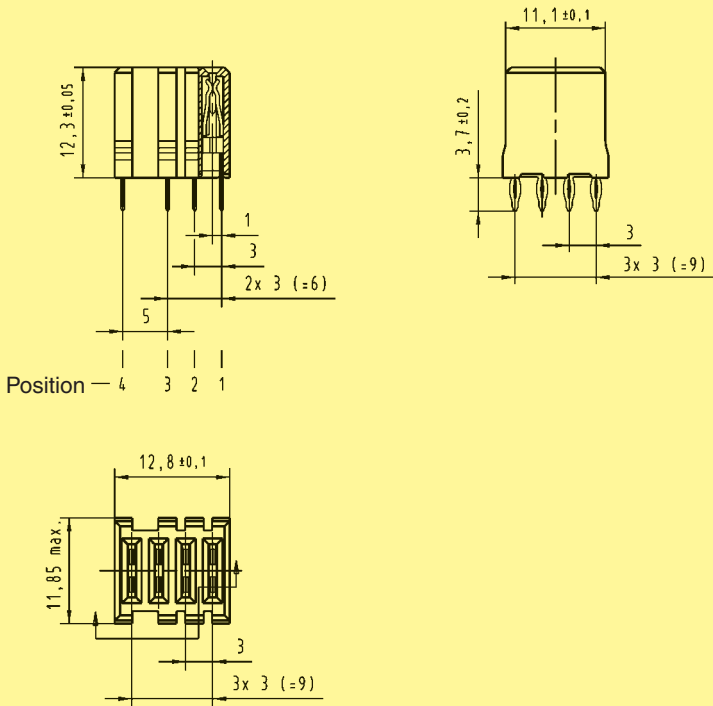




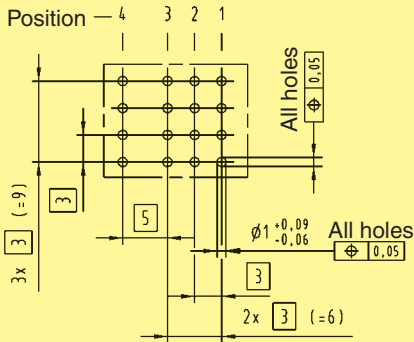
Female connector straight, with press-in termination

Identification	Number of contacts	Contact length [mm] termination side	Part number
Connector	4	3.7	17 66 004 2201

Connector dimensions [mm]



Board drillings



## Micro Card Edge connector, 0.8 mm pitch

Page

General information and features ..... **05.02**

Technical characteristics, board dimensions ..... **05.03**

40pin connector ..... **05.04**

100pin connector ..... **05.05**

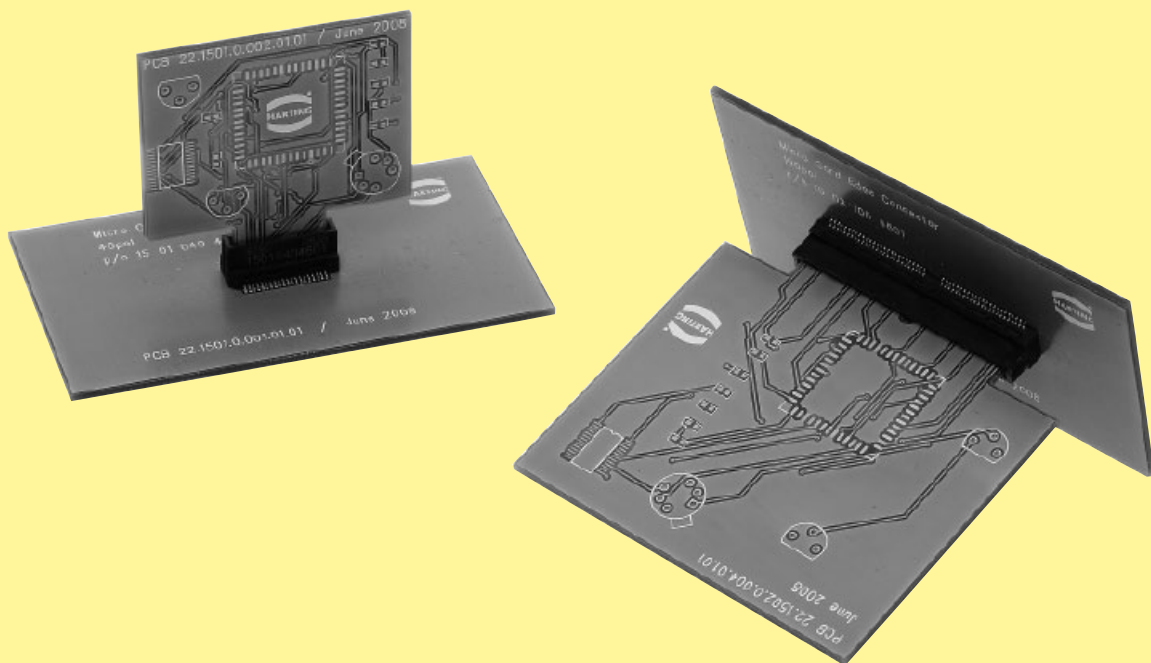
MCE

HARTING offers the new Micro Card Edge connector in surface mount technology for PCBs with the thickness of 1.6 mm. The new connector is suitable for board-to-board mezzanine as well as for small „pluggable daughter card” applications. The key feature of the new connector in mezzanine applications is the achievement of flexible staple heights of parallel boards.

The HARTING Micro Card Edge connector allows data transfer rates up to 14Gbps and is suitable for high-speed applications in the telecom, medical and industrial markets. The connector is available with 40 or 100 contacts in 0.8 mm pitch.

An extremely smooth contact surface achieved by the usage of high performance stamping tools and a special surface finish ensures low insertion forces and a high contact reliability.

HARTING's Micro Card Edge connector offers excellent features for high volume manufacturing like tape-and-reel packaging and a pad for nozzle in high volume productions.

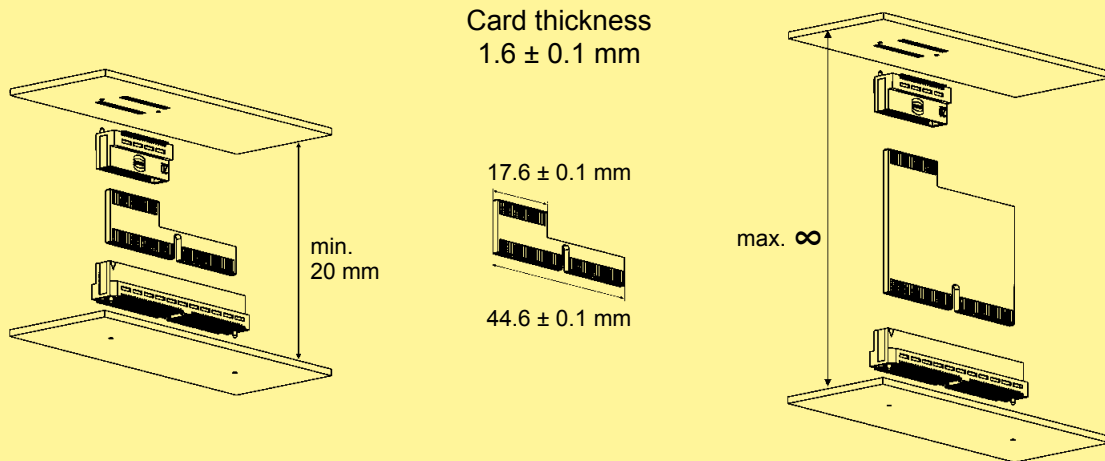


## Features

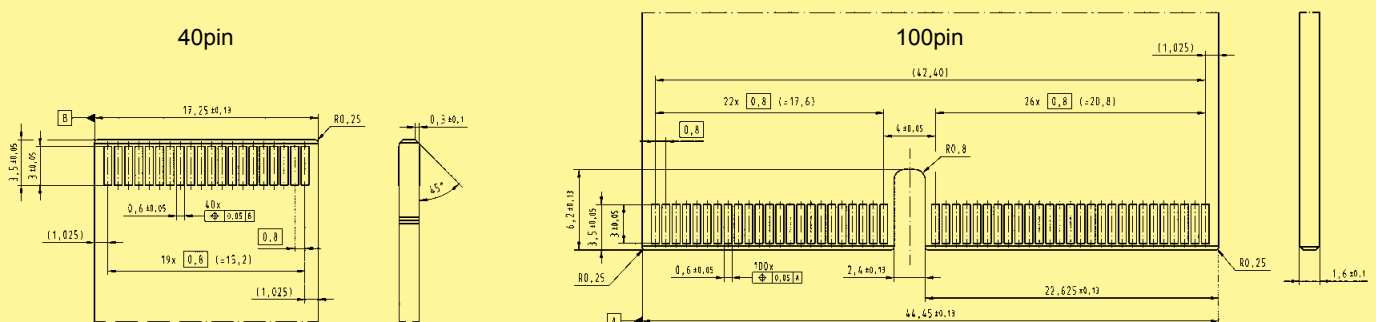
- High speed data transmission between mezzanine or daughter card boards in telecom, medical, datacom and industrial applications.
- The key feature for mezzanine application is that the distance between parallel boards is flexible by utilizing a small board between the connectors. This gives flexibility in the mechanical design of the system.
- SMT termination gives good signal integrity characteristics for the card edge connector.

Contact spacing	: 0.8 mm
Rated current	: 1.7 A at 80 °C ambient
Rated voltage	: 400 V AC
Mating cycles	: 200
Insertion depth	: 4.22 mm – 5.66 mm
Number of contacts	: 40, 100
Mating card thickness	: 1.6 + 0.1 mm
Operating temperature	: -55 °C up to +125 °C
Max processing temperature	: 230 °C for 60 sec. or 260 °C for 20 sec.
ROHS-compliance	: yes
Materials	
Mouldings	: LCP, glass-fibre filled, UL 94-V0
Contacts	: CuSn8 with Ni plating
Contact surface	
Contact zone	: Au/Ni plating
Termination zone	: Sn/Ni plating

## Board dimensions



## Recommended mating card layout





# Micro Card Edge connector



## 40pin connector

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
<b>Micro Card Edge connector</b> 2800 pieces in a "Tape and Reel" packaging (14 reels with 200 pcs.)  200 pieces in a "Tape and Reel" packaging	40	15 01 040 4601 040		
Single connector sample	40	15 01 040 4601 333		
Board layout	40	15 01 040 4601 333		
"Tape and Reel" packaging				
Reel dimensions				

# Micro Card Edge connector



100pin connector

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

## Micro Card Edge connector

1800 pieces in a "Tape and Reel" packaging (9 reels with 200 pcs.)

100

15 02 100 4601 040

200 pieces in a "Tape and Reel" packaging

100

15 02 100 4601 042

Single connector sample

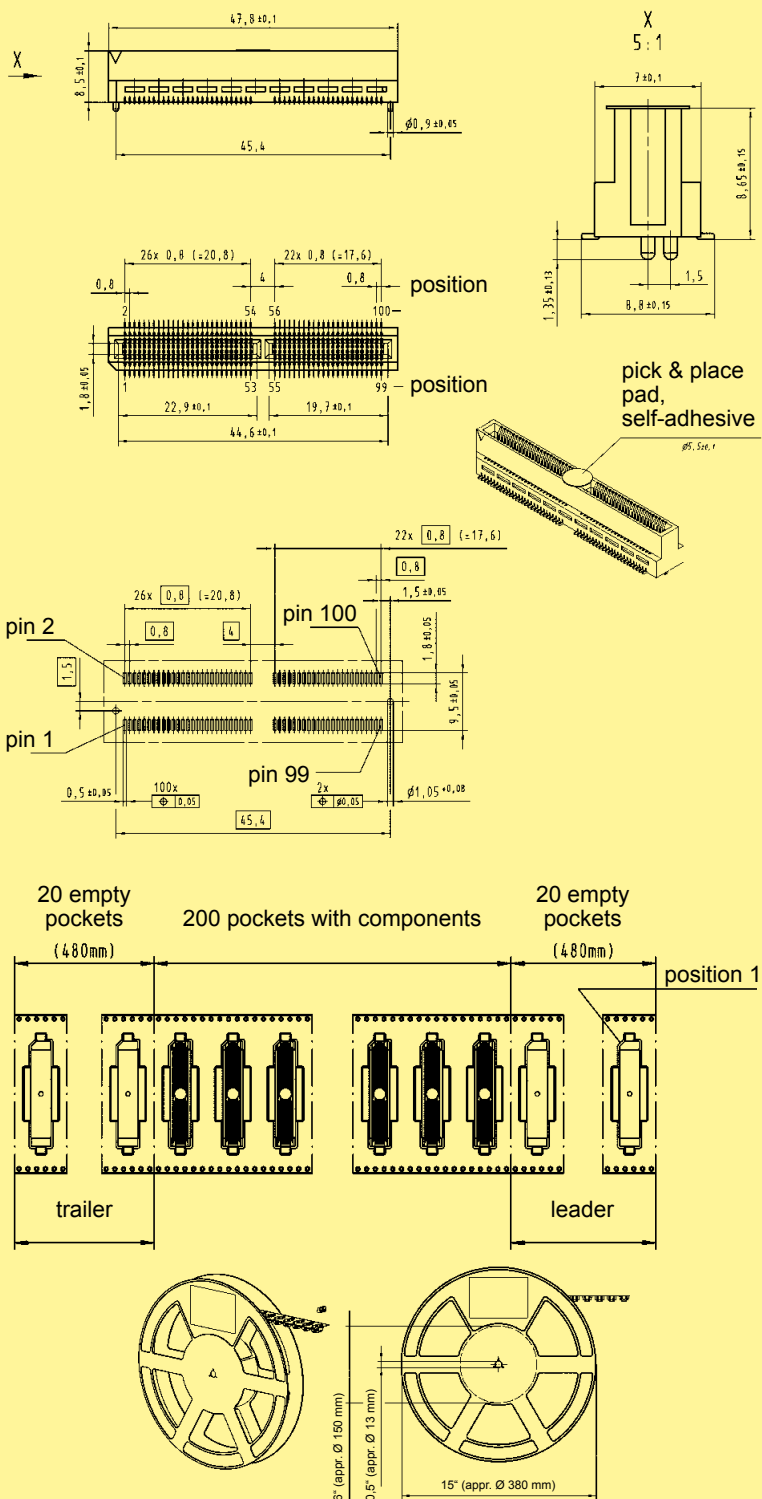
100

15 02 100 4601 333

## Board layout

## "Tape and Reel" packaging

## Reel dimensions



MCE

05  
05



**Mini Coax** modules (press-in)

Page

Mini Coax connector system – general information . . . . .	<b>07.02</b>
Technical characteristics . . . . .	<b>07.04</b>
Straight Mini Coax Standard modules for backplane assembly . . . . .	<b>07.06</b>
Angled Mini Coax Standard modules for daughtercard assembly . . . . .	<b>07.07</b>
Angled Mini Coax low-profile modules for daughtercard assembly . . . . .	<b>07.08</b>
Angled Mini Coax single-row modules for daughtercard assembly . . . . .	<b>07.09</b>

The Mini Coax connector is a multi line RF connector for blind mating of board-to-board, board-to-cable or cable-to-cable applications. The Mini Coax connector is mainly used in both RF (Radio Frequency) and IF (Intermediate Frequency) signal transmission and is specified for a frequency range from DC to 2.5 GHz and beyond. Thanks to its compact size (a 10 coaxial contacts' connector is as small as a PC's enter key) and excellent crosstalk features, this connector system is ideal for high end equipment within cellular telecom infrastructure.

The isolated coaxial lines are implemented in a plastic housing that defines the module size in a metric scale from 1.00, 1.25 and 1.50 SU (SU = System Unit = 25 mm). The Mini Coax connectors are available as straight sockets and right angled plugs. Both types are executed in press-in technology for the PCB (Printed Circuit Board) termination. The straight modules are delivered with an inserted plastic cap that protects the coaxial

contacts against dust and dirt, as well as being used as an upper press-in tool. In this way, an easy and safe flat rock process is guaranteed.

In addition to the coaxial modules, an angled power connector with press-in termination is available. It is assembled in the same board drillings as the coaxial configuration, and can be loaded up to 15 A working current at 70 °C.

The low-profile Mini Coax right angled board connector and matched cable assemblies have the same RF performance as the standard Mini Coax connectors. Their slim interfaces, which provide a board-to-cable solution for the slim cabinet, are suitable for a minimum 15.2 mm slot width.

The Mini Coax single-row is another new development. The coaxial contacts of the connector are single line, as opposed to the standard connector. This delivers enhanced performance, especially in terms of isolation, and is also suitable for slim cabinet applications.

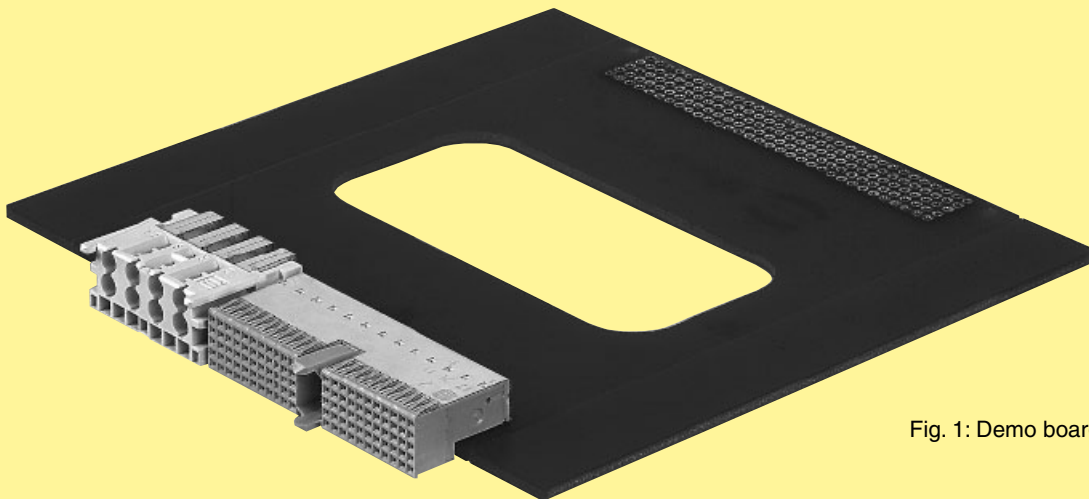


Fig. 1: Demo board

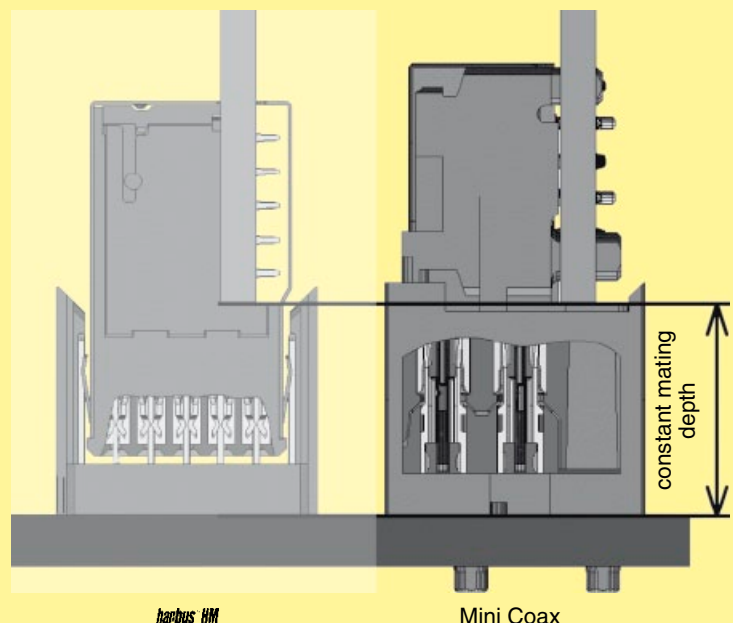


Fig. 2: Cross section of both connector types

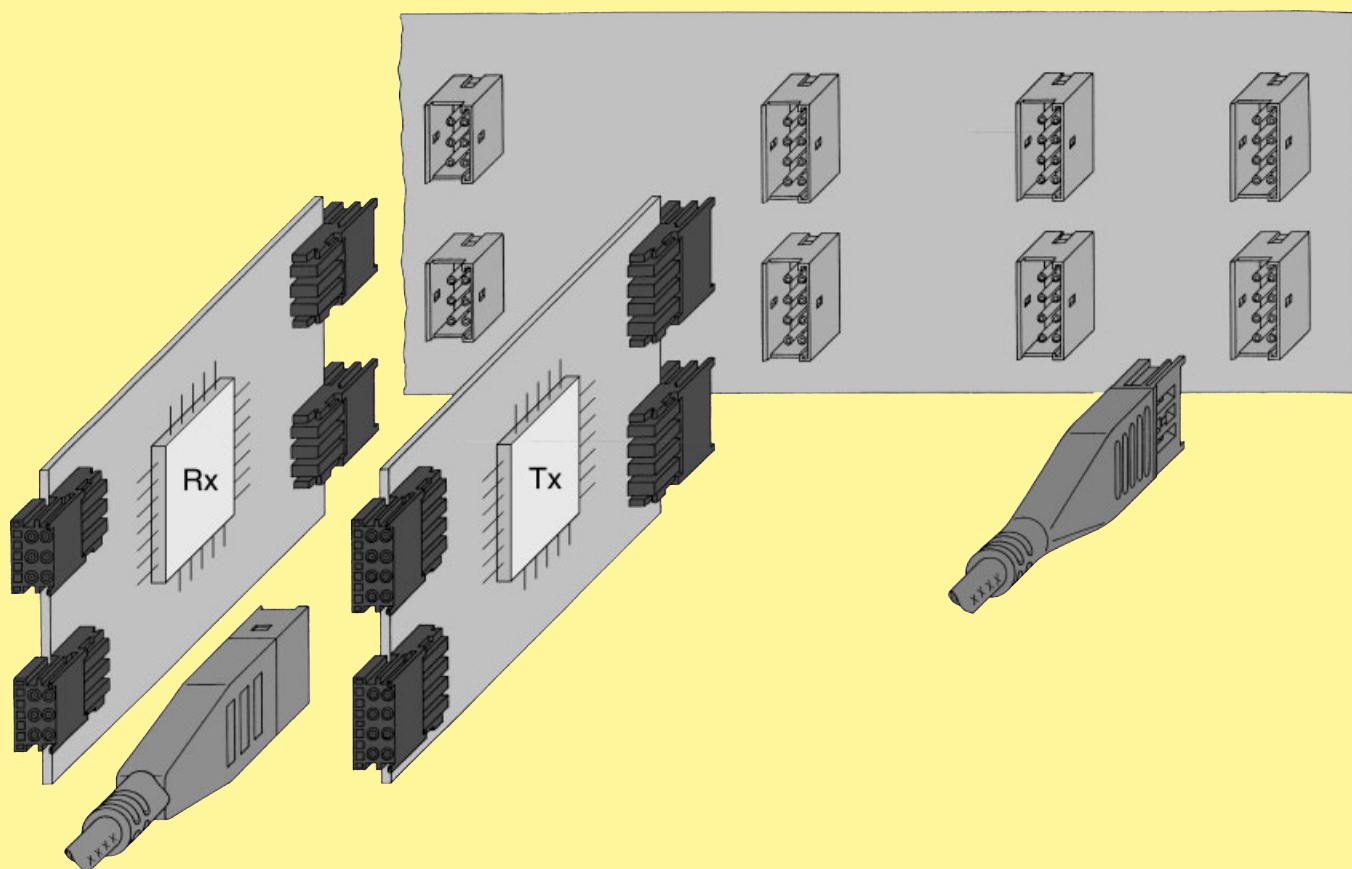


Fig. 3: Typical pcb configurations

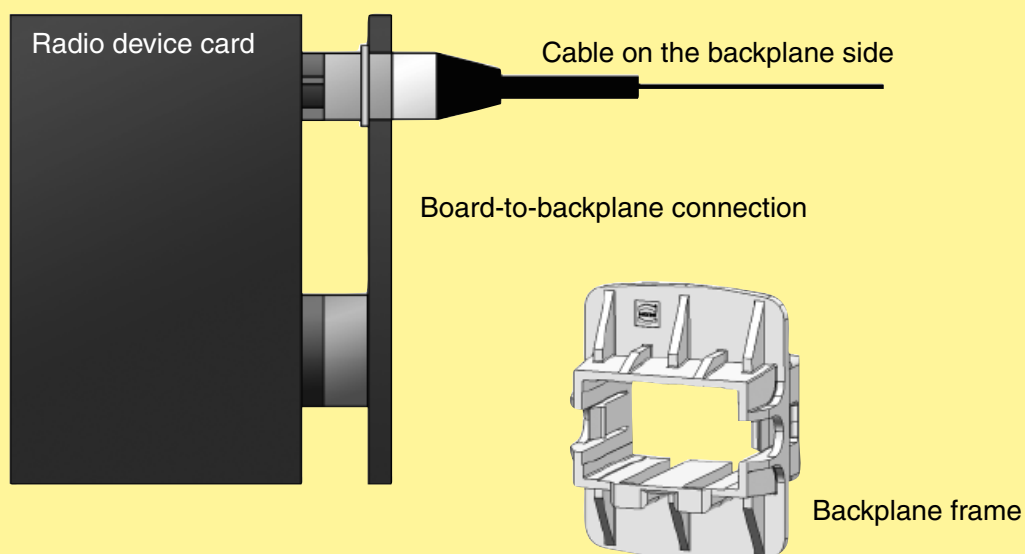


Fig. 4: Mini Coax backplane feed through

Number of contacts : 1, 2, 4, 6, 8 or 10 coaxial contacts  
Grid pattern : 4.40 x 6.25 mm (within a twin x between twins);  
8.80 mm for Mini Coax single-row connectors

Dielectric withstanding Voltage  $U_{r.m.s.}$  :  $\leq 1000\text{ V}$  (for 60 s)  
DC-contact resistance  
Centre contact :  $\leq 12\text{ m}\Omega$   
Ground contact :  $\leq 6\text{ m}\Omega$   
Insulation resistance :  $\geq 5000\text{ M}\Omega$

Power :  $\leq 40\text{ W}$  (at 2.5 GHz)  
Frequency range : DC ... 2.5 GHz  
Nominal impedance :  $50\text{ }\Omega$   
Return loss :  $< -20\text{ dB}$   
VSWR :  $< 1.22$   
Insertion loss :  $< 0.25\text{ dB}$

Near end crosstalk (NEXT) :

Pin distance	Board-to-Board	Board-to-Cable	Cable-to-Cable
$\Delta x = 4.40\text{ mm}$	50 dB	60 dB	90 dB
$\Delta x = 6.25\text{ mm}$	60 dB	70 dB	90 dB
$\Delta x = 7.64\text{ mm}$	75 dB	80 dB	90 dB
$\Delta x = 8.80\text{ mm}$	—	75 dB	—
$\Delta x = 12.50\text{ mm}$	90 dB	90 dB	90 dB

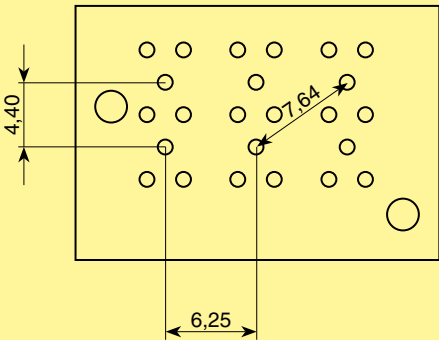


Fig. 5: Grid pattern  
Mini Coax Standard

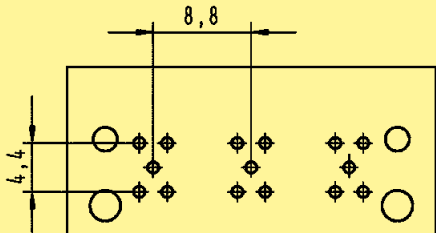


Fig. 6: Grid pattern  
Mini Coax single-row

Temperature range :  $-55\text{ }^{\circ}\text{C} \dots +125\text{ }^{\circ}\text{C}$

Moulding material : Liquid Cristal Polymer (LCP), UL 94-V0  
Contact surface : Au  
Contact zone : Au  
Termination area : Au  
Centre pin : Au  
Ground pin : Ni



Mating cycles : max. 500

Recommended configuration  
of plated through holes

<i>Tin plated PCB (HAL) acc. EN 60352-5</i>	Hole-Ø	1.15 $\pm$ 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 $\pm$ 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 $\pm$ 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 $\pm$ 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 $\pm$ 0.025 mm
	Cu	min. 25 µm
	Plated hole-Ø	1.00-1.10 mm

PCB board thickness:  $\geq 1.6$  mm

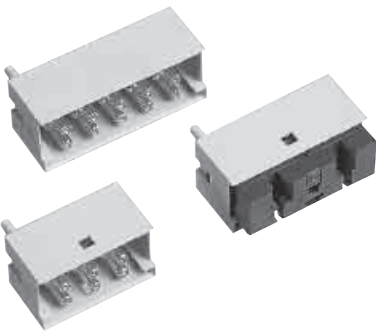
Mating force :  $\leq 10$  N/contact

Withdrawal force :  $> 1$  N/contact

Mating distance : 12.5 ... 15 mm

Wiping length : 2.5 mm

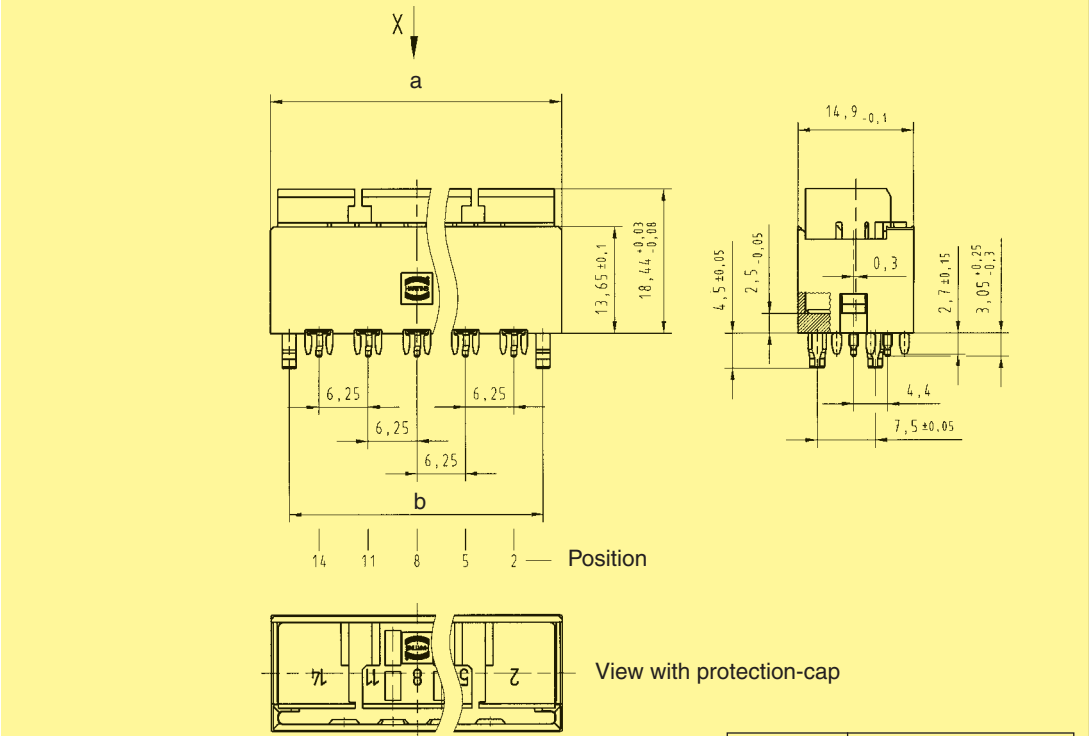
Acceptable radial mating offset : max.  $\pm 1.5$  mm



Straight modules

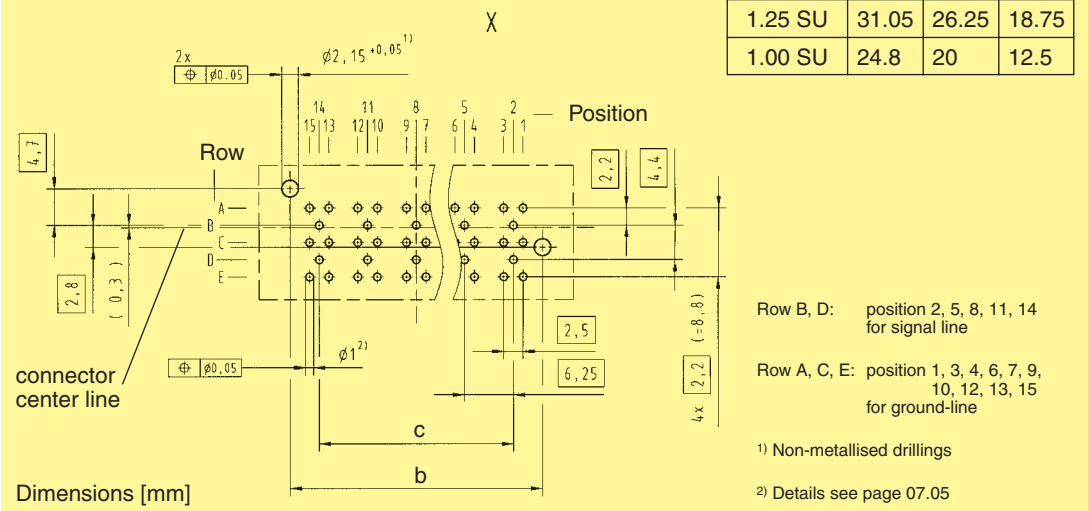
Identification	Number of contacts	SU	loaded positions	Part number
Mini Coax modules, press-in termination	10	1.50	2, 5, 8, 11, 14	07 11 100 0026
	8	1.25	2, 5, 8, 11	07 11 100 0024
	6	1	2, 5, 8	07 11 100 0023
	4	1	2, 8	07 11 900 0024
	2	1	2	07 11 900 0023

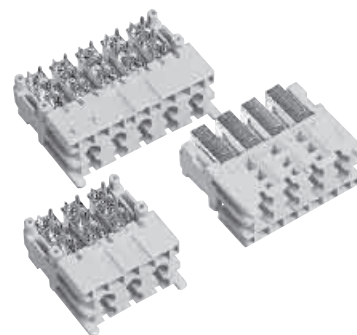
Dimensions



Straight module	Dimension [mm]		
	a	b	c
1.50 SU	37.3	32.5	25
1.25 SU	31.05	26.25	18.75
1.00 SU	24.8	20	12.5

Board drillings

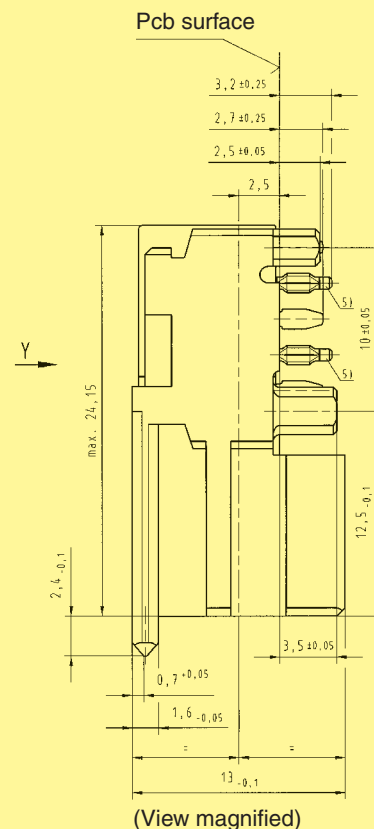
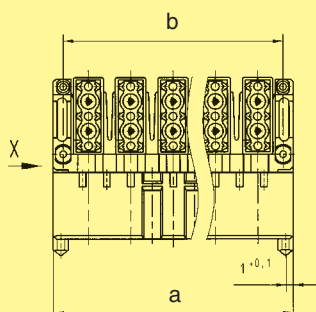
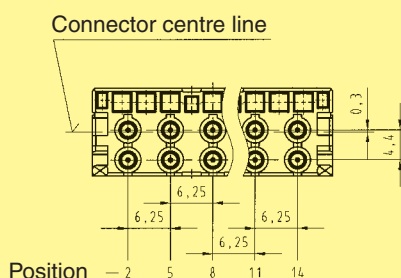




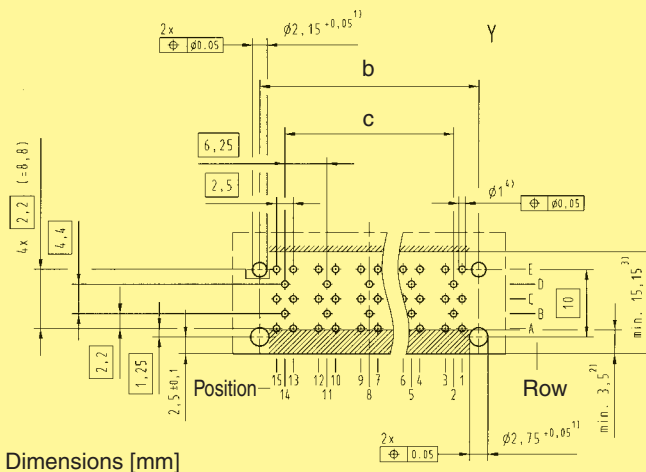
## Angled modules

Identification	Number of contacts	SU	loaded positions	Part number
Mini Coax modules, press-in termination	10	1.50	2, 5, 8, 11, 14	07 31 100 0021
	8	1.25	2, 5, 8, 11	07 31 100 0020
	6	1	2, 5, 8	07 31 100 0019
	4	1	2, 8	07 31 900 0022
	2	1	2	07 31 900 0021

## Dimensions



## Board drillings



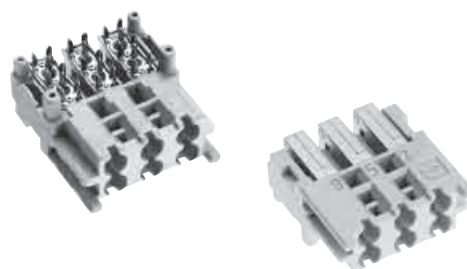
Angled module	Dimension [mm]		
	a	b	c
1.50 SU	35.45	32.5	25
1.25 SU	29.15	26.25	18.75
1.00 SU	22.9	20	12.5

Row B, D: position 2, 5, 8, 11, 14 for signal line

Row A, C, E: position 1, 3, 4, 6, 7, 9, 10, 12, 13, 15  
for ground-line

- 1) Non-metallised drillings
- 2) No tracks, except solder eyes
- 3) Limit area of components (valid for both pcb-sides)
- 4) Details see page 07.05

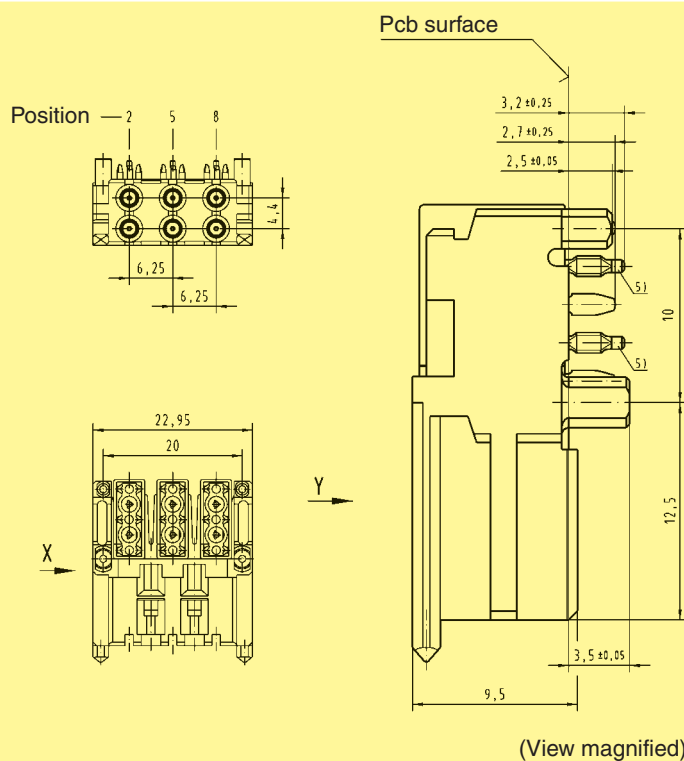
5) Press-in zone in any angular position related to it's longitudinal axis possible



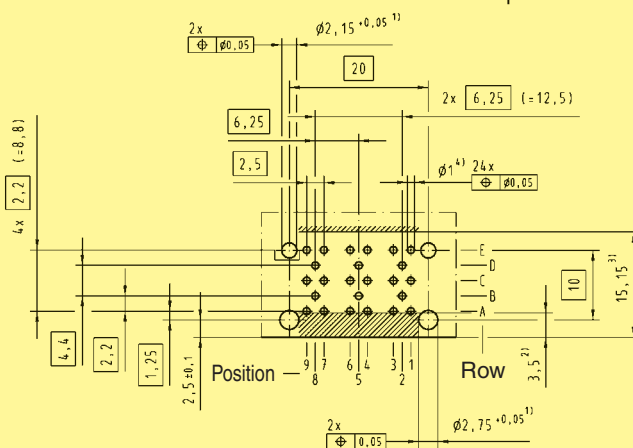
## Angled modules

Identification	Number of contacts	SU	loaded positions	Part number
Mini Coax low-profile module, press-in termination	6	1	2, 5, 8	07 31 100 0027

## Dimensions



## Board drillings



Row B, D: position 2, 5, 8 for signal line

Row A, C, E: position 1, 3, 4, 6, 7, 9 for ground-line

### 1) Non-metallised drillings

2) No tracks, except solder eyes

3) Limit area of components  
(valid for both pcb-sides)

4) Details see page 07.05

5) Press-in zone in any angular position related to it's longitudinal axis possible

Dimensions [mm]



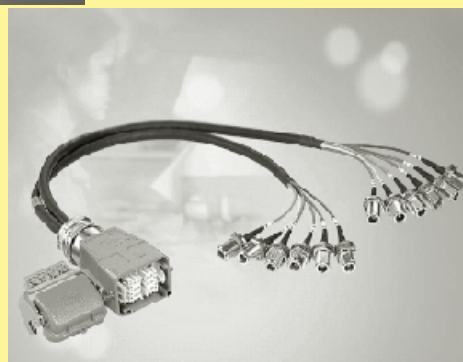
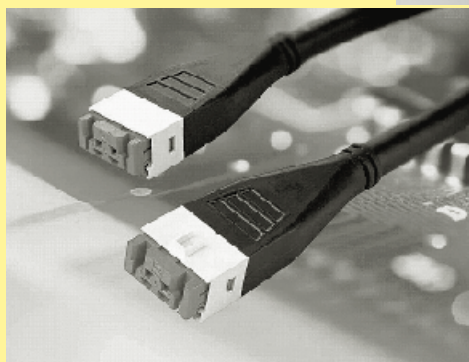
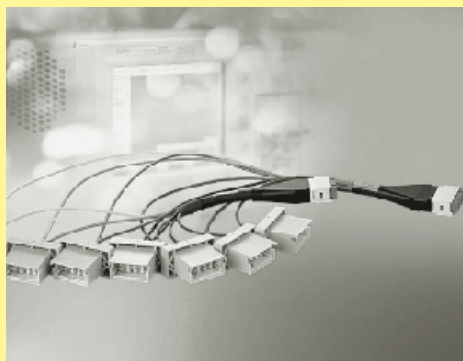


**Mini Coax** cable assemblies and accessories

Page

Mini Coax cable assemblies – general information . . . . .	<b>08.02</b>
Assemblies with standard and low-profile modules . . . . .	<b>08.03</b>
Assemblies with single-row modules and with heavy duty hoods/housings . . .	<b>08.04</b>
Accessories . . . . .	<b>08.05</b>





The Mini Coax product range also includes various cable assemblies and accessories, which provide customers with flexible application options.

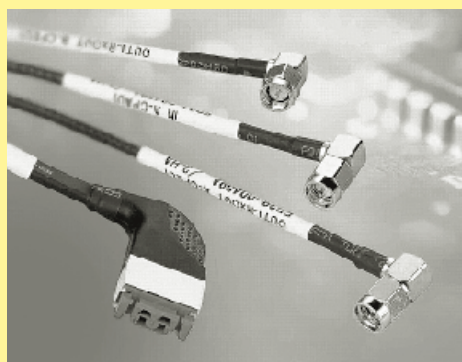
The Mini Coax cable connector is available as plug and socket and is crimped to a coaxial cable that can be individually assembled with RF-cable connectors (SMA, SMB, N-type ...). While delivering high RF transmission performance, the moulded Mini Coax cable assemblies provide robust connections. The various angle mould types meet different cable routing requirements according to the available space.

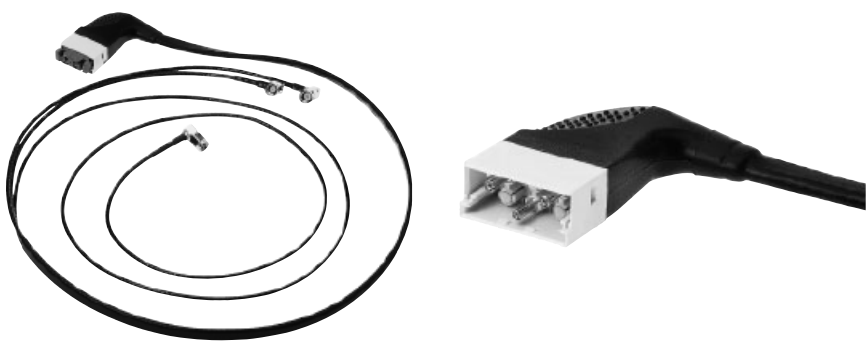
Thanks to various accessories, such as backplane frame, Han® housing insert and press-in cable housing ..., customized connecting requirements can be met.

Remark:

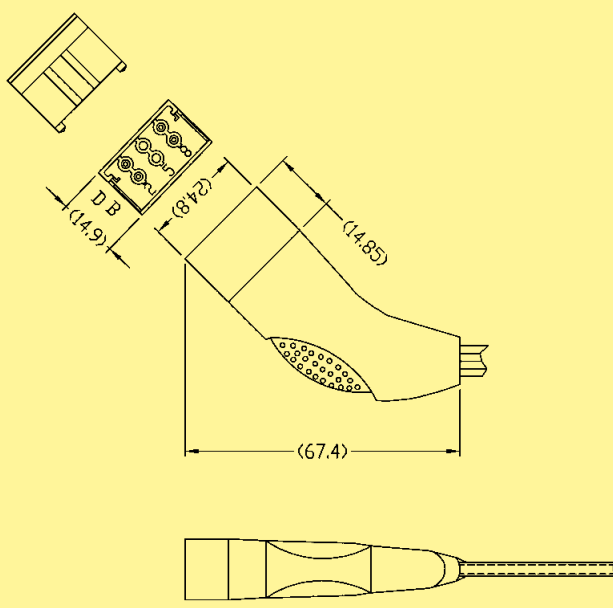
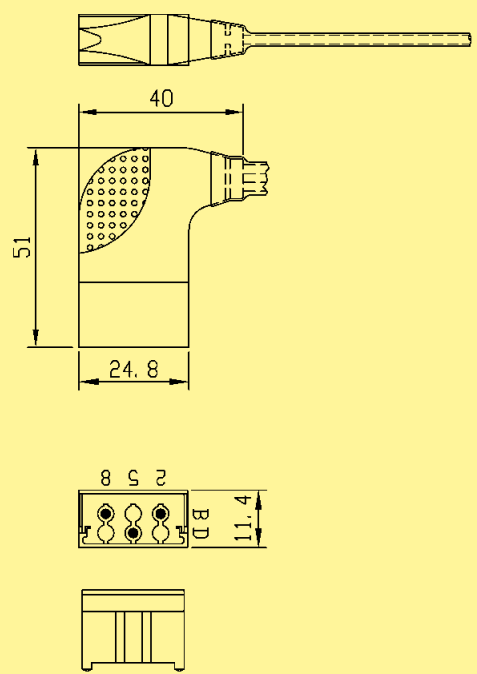
The cable assemblies and accessories shown are part of the overall product range.

**Additional, customized parts are available on request.**



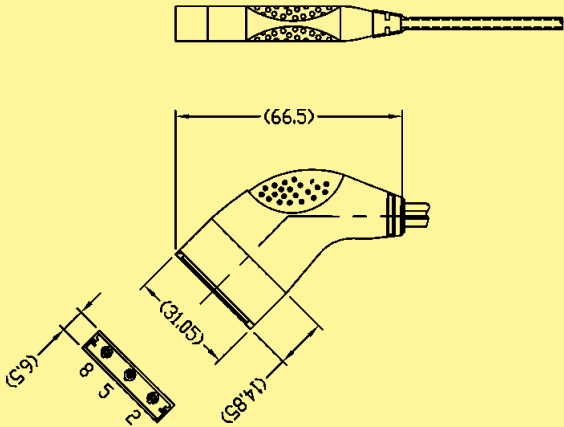
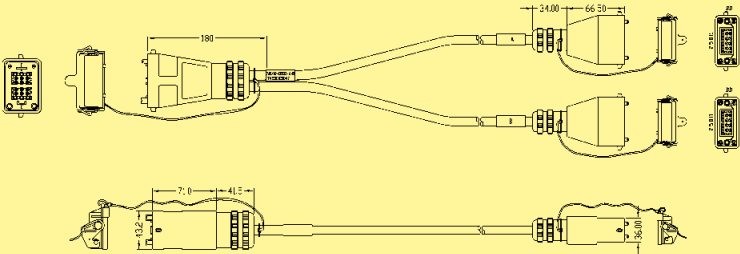


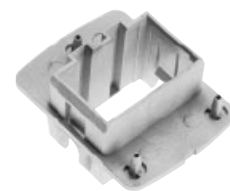
Cable assemblies

Identification	Number of contacts	Part No.	Drawing	Dimensions [mm]
Cable assembly for mating with the angled standard module	1–10	on request		
Cable assembly for mating with the angled low-profile module	1–6	on request		



Cable assemblies

Identification	Number of contacts	Part No.	Drawing	Dimensions [mm]
Cable assembly for mating with the angled single-row module	1–3	on request		
Cable assembly with heavy duty hoods/housings	1–10	on request		



## Accessories

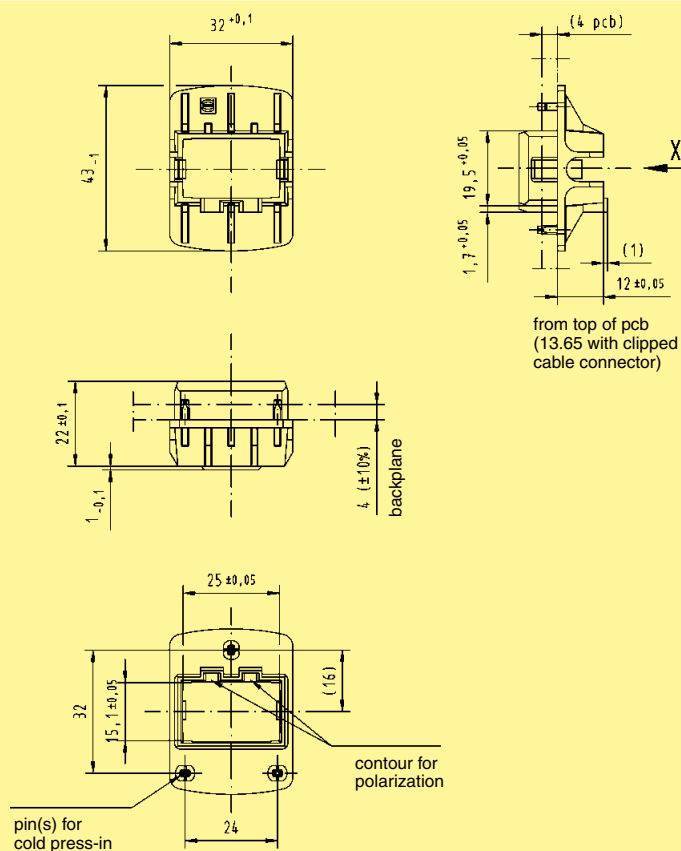
Identification

Part No.

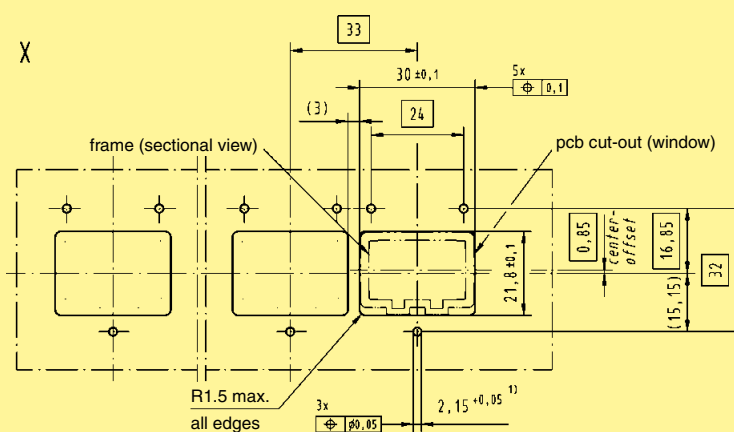
Backplane frame

07 71 100 0042

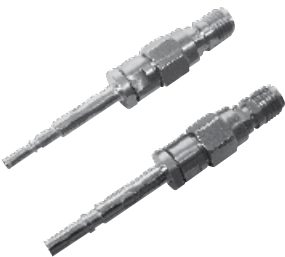
## Dimensions [mm]



## Board drillings



<sup>1)</sup> Non-metallized drillings

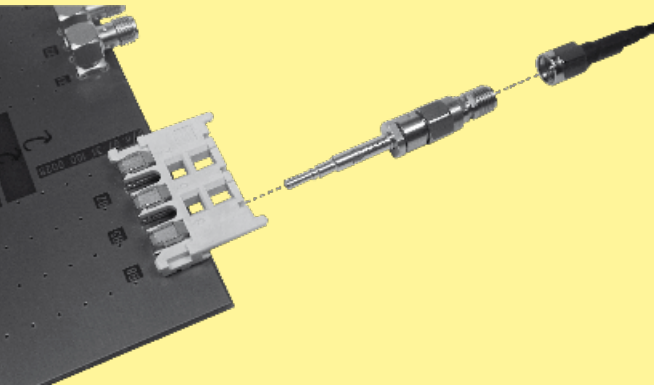


Accessories

Identification	Part No.
Test adapter SMA – Mini Coax	
male for straight modules	07 73 000 0394
female for angled modules	07 73 000 0393

General information

The Mini Coax-to-SMA Adapter can be directly connected to measurement instrument cables. This allows the precise RF transmission characterization of module cards, backplanes and cable assemblies.



Features:

- SMA connector directly attached to the Mini Coax
- Impedance deviations between adapters < 1.5 Ω
- Good reproducibility of test results
- Test results between different labs are comparable
- Precise measurements of Mini Coax connector system

Electrical characteristics

Mini Coax test adapter	Impedance values @ 31.5 ps rise time at reference plane (10% - 90%):		Max. impedance deviation [Ω]
	Max. [Ω]	Min. [Ω]	
SMA to male	52.5	47.5	1.5
SMA to female	53.5	48.0 40.5*	1.0

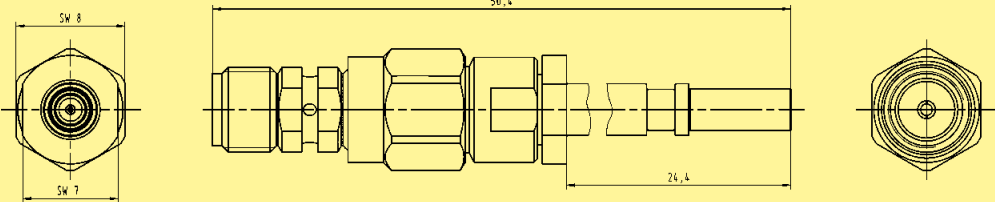
Connector	Electrical length [ps]
Mated SMA to male / female adapter	262.2

Frequency [GHz]	Return loss [dB]	Insertion loss [dB]
< 1	- 26.9	- 0.17
< 2	- 22.5	- 0.24
< 3	- 19.9	- 0.26
< 4	- 16.4	- 0.34
< 5	- 14.4	- 0.42

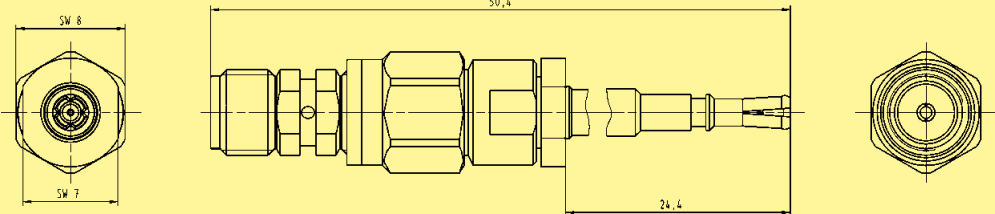
\*: This impedance drop is due to the connector design and typical for the female Mini Coax connector.

Dimensions [mm]

Male test adapter



Female test adapter



## **har-link®** Modular metric high speed connectors

Page

<b>har-link®</b> connector system – general information . . . . .	<b>11.02</b>
Technical characteristics . . . . .	<b>11.03</b>
Male and female connectors . . . . .	<b>11.04</b>
Accessories, cable assemblies and cables . . . . .	<b>11.05</b>

The **harlink®** connector system of HARTING complies with the requirements of IEC 61076-4-107 and is a compact and robust pcb-to-cable interface with excellent data transmission properties for high-speed networking and telecommunications.

All dimensions of the **harlink®** connector are in accordance with IEC 917 and IEEE P 1301 requirements, which allows for easy implementation into both metric and inch-based systems. In addition, **harlink®** supports hot plugging as required by modern bus systems such as CompactPCI, S-bus and VME.

**harlink®** allows data transmission up to 2 Gbit/s per pair and is therefore perfectly suited for modern transmission protocols such as Low Voltage Differential Signals (see Fig. 1). The design of the **harlink®** connector allows differential pairs to be placed horizontally (parallel to the pcb), thus reducing the skew at high frequencies and considering high signal integrity.

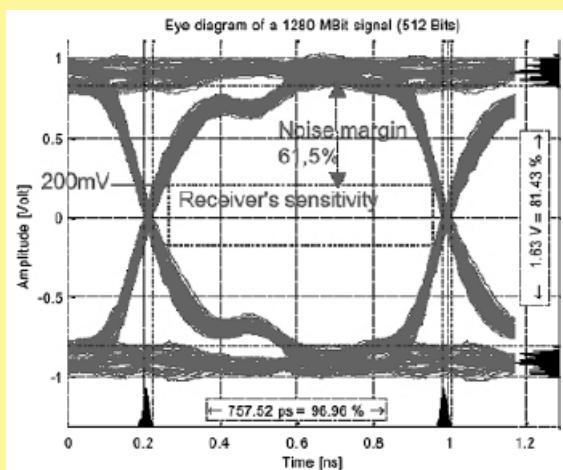


Fig. 1: Eye diagram of a 1280 MBit signal (512 Bits)

The metal shells of the **harlink®** connector are a guarantee for its superior performance in the EMI-polluted environment (see Fig. 2).



Fig. 2: 360° screened-can construction with locking levers

To reach a screening attenuation of more than 50 dB up to 1 GHz, HARTING offers brackets covering each connector in conjunction with a gasket, which is compressed between the bracket and the front panel (see Fig. 3).

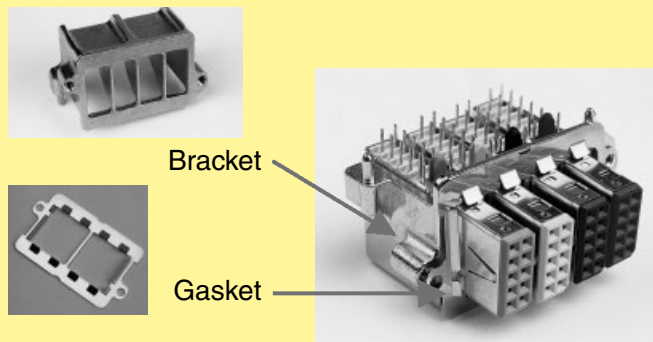


Fig. 3: 4 cavities bracket and gasket

Once plugged, the mated pair shows excellent mating safety. Due to the locking levers on both sides of the male connector, the connection withstands a pulling force of up to 80 N (see Fig. 2).

The high temperature resistant material of the **harlink®** female connector body supports the safe reflow soldering process. For easy identification of female modules, six different colours are available (see Fig. 4).

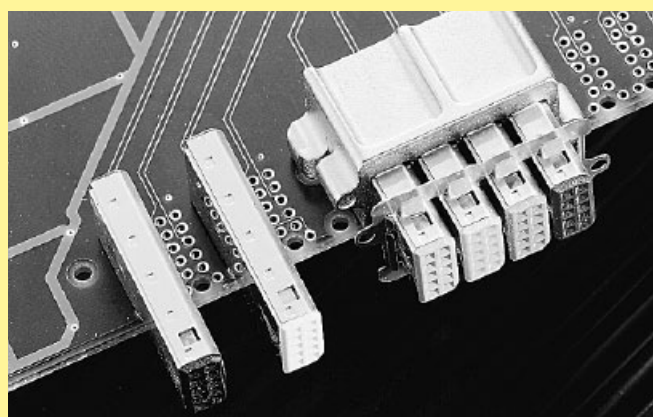
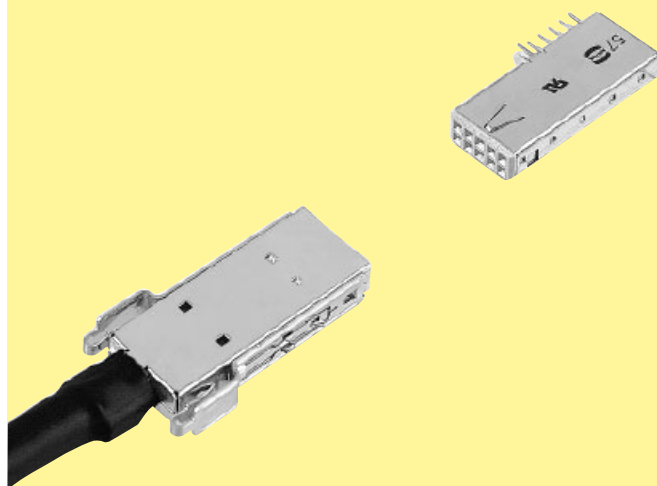


Fig. 4: Differently coloured female modules

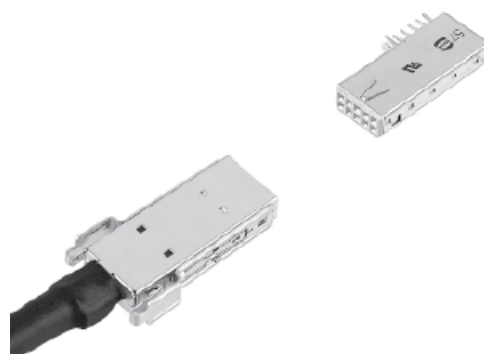
In addition to single connectors, HARTING provides cable assemblies with unshielded twisted pairs or with shielded twisted pairs for high speed applications such as IEEE 1355. A crimping tool range for terminating the male **harlink®** connectors is available.



Number of contacts	10
Approvals	IEC 61 076-4-107 UL recognized: E102079
Contact pitch Connector pitch	2 mm 6 mm
Working current	1.5 A at 70 °C
Test voltage $U_{r.m.s.}$	750 V
Contact resistance Insulation resistance	$\leq 30 \text{ m}\Omega$ $\geq 10^{10} \Omega$
Temperature range during reflow soldering	-55 °C ... + 125 °C female: max. + 260 °C for 60 s
Mating cycles	250, performance level 2
Terminations	Insulation displacement (male), AWG 28/7 - 30/7, AWG 30 solid Solder pins for $\varnothing 0.6 \text{ mm}$ min. (female)
Insertion force Withdrawal force	10 N max. / module 2 N min. / module (without locking levers)
Latching system	Locking levers
Materials Mouldings	Male connector: Polyester, UL 94-V0 Female connector: High temperature plastic material, UL 94-V0
Contacts Shells	Copper alloy Male connector: Stainless steel Female connector: Maillechort
Contact surface Contact zone	Selectively gold-plated

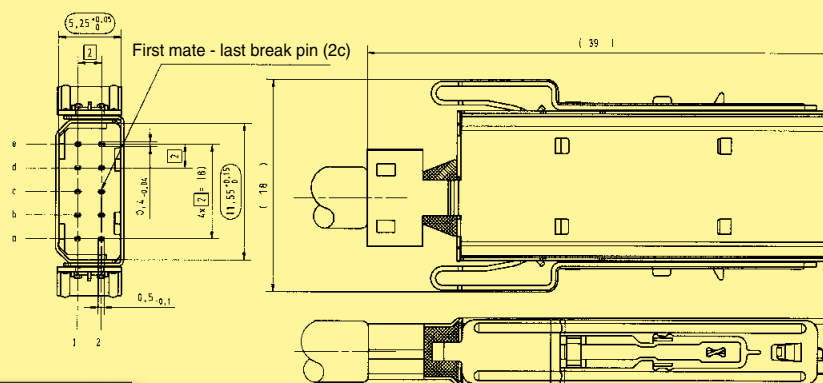


Male connectors, straight  
Female connectors, angled



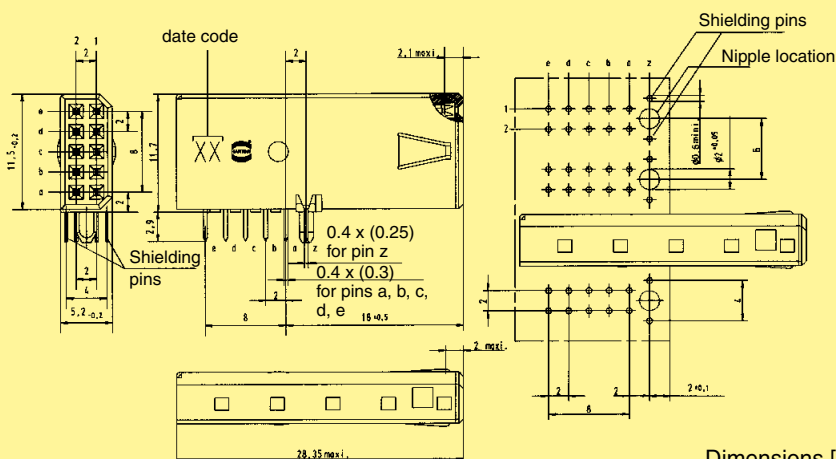
Identification	No. of contacts	Colour	Part No.
Male connector for insulation displacement	10	Black	27 11 161 8001
Female connector with solder pins	10	Beige (standard)	27 21 121 8000
	10	Red	27 21 121 8002
	10	Yellow	27 21 121 8004
	10	Green	27 21 121 8005
	10	Blue	27 21 121 8006
	10	Black	27 21 121 8010

Male connector  
(delivered in piece parts)

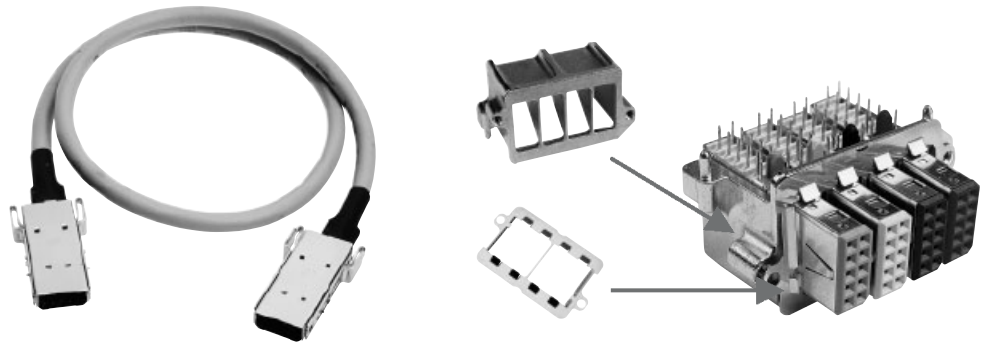


A manual for the har-link® cable free connector assembly is available in our online catalogue *HARKIS®* or on demand at your local HARTING representative.

Female connector



Dimensions [mm]

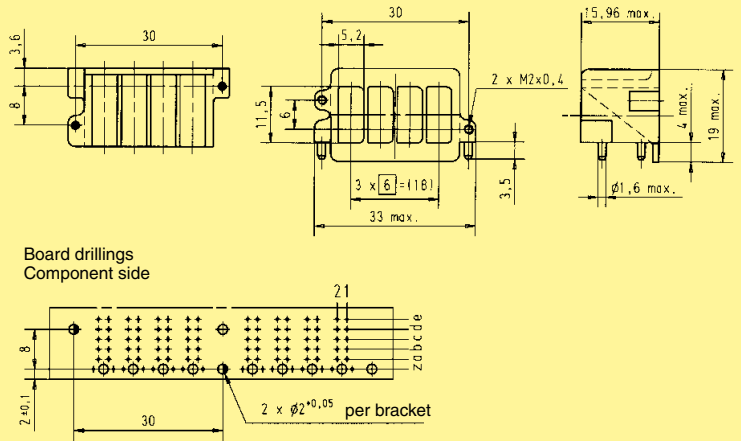


## Accessories and cable assemblies

Identification	Part No.	Drawing	Dimensions [mm]
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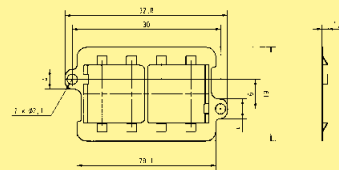
**Bracket**  
with four cavities

27 71 040 0001



**Gasket**  
with four cavities

27 71 040 0002



**High end cable assembly har-link® 10 pole**  
Cable: 5 twisted pairs,  
AWG 28, shielded, PVC  
Wiring: 1:1

Length: L = 0.5 m  
L = 1.0 m  
L = 2.0 m

33 27 243 0500 001  
33 27 243 1000 002  
33 27 243 2000 003

Cable: 5 twisted pairs,  
AWG 30, double  
shielded, PVC  
Wiring: 1:1

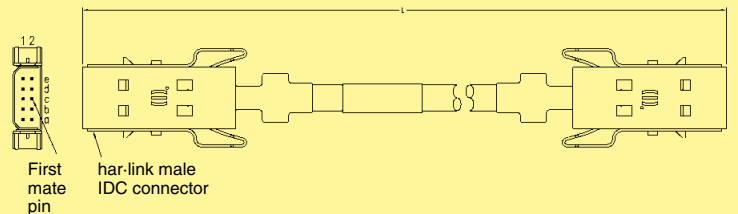
Length: L = 0.5 m  
L = 1.0 m  
L = 2.0 m

33 27 243 0500 006  
33 27 243 1000 007  
33 27 243 2000 008

Cable: 5 twisted pairs,  
AWG 30, double shielded,  
PVC  
Wiring: acc. to IEEE 1355

Length: L = 0.5 m  
L = 1.0 m  
L = 2.0 m

33 27 243 0500 015  
33 27 243 1000 016  
33 27 243 2000 017

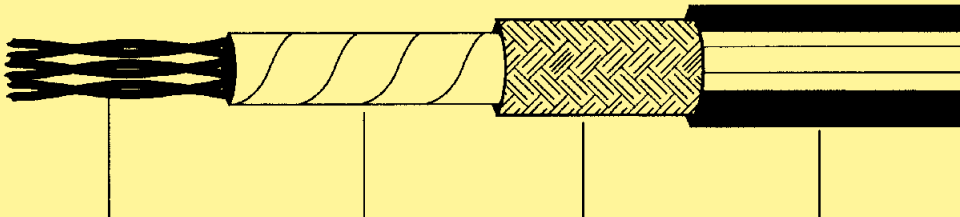




IEEE 1355  
wiring

Connector 1	Connector 2
2-e	1-a
1-e	2-a
2-d	1-b
1-d	2-b
2-c	2-c

Connector 1	Connector 2
1-c	1-c
2-b	1-d
1-b	2-d
2-a	1-e
1-a	2-e

## Cables for insulation displacement termination

Identification	No. of pairs	Standard version	Part No. <i>Halogen free version with screened pairs</i>												
Twisted pair cable with braid shield AWG 28 AWG 30 Length per reel: 100 m	5	60 90 005 6003	60 90 005 6009												
Drawing	<table><tr><th rowspan="2">No. of pairs</th><th colspan="2">Outside diameter</th></tr><tr><th>Nominal</th><th>Max</th></tr><tr><td>5</td><td>5.4</td><td>5.6</td></tr></table> <table><tr><th>No. of pairs</th><th>Outside diameter</th></tr><tr><td>5</td><td>5.5 ± 0.3</td></tr></table>  <p>Twisted pair Screened twisted pairs</p> <p>Separator</p> <p>Shield</p> <p>Jacket PVC Jacket FRNC</p> <p>Dimensions in mm</p>			No. of pairs	Outside diameter		Nominal	Max	5	5.4	5.6	No. of pairs	Outside diameter	5	5.5 ± 0.3
No. of pairs	Outside diameter														
	Nominal	Max													
5	5.4	5.6													
No. of pairs	Outside diameter														
5	5.5 ± 0.3														
Technical characteristics															
	Standard version	<i>Halogen free version with screened pairs</i>													
Number of pairs	5	5													
Voltage rating	30 V (style UL 2789)	100 V													
Maximum conductor resistance (20 °C)	233 Ω/km	350 Ω/km													
Minimum insulation resistance (20 °C)	1 MΩ/km	10 GΩ/km													
Nominal differential impedance (TDR)	85 Ω	95 Ω ± 5 Ω													
Nominal differential capacitance (1 kHz)	110 pF/m	45 pF/m													
Propagation velocity	60 %														
Temperature range	– 20 °C ... + 105 °C	– 25 °C ... + 80 °C													
Cable materials															
Conductor	7 x 0.13 mm stranded tinned copper	7 x 0.1 mm stranded tinned copper													
Insulation (except 50 pairs) (for 50 pairs)	PVC Ø 0.62 mm PVC Ø 0.65 – 0.80 mm	Polypropylene Ø 0.74 mm													
Shield	Tinned copper braid, covering ≥ 80 %	Tinned copper braid, covering ≥ 65 %													
Jacket	PVC	FRNC													
Flammability rating	IEC 332-1														
Sheath marking	 AWM 2789 60°C 30V VW1 36963	 AWM 21283 80°C 30V VW1													

Thin print: Standard version  
Italic print: Halogen free version

# Tooling

Page

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Discrete tooling system for volume production .....	15.02
Tooling for backplanes .....	15.05
Insert blocks for male connectors .....	15.06
Repair tooling .....	15.07

## **harbus® HM Power**

Tooling for angled male connectors .....	15.07
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## **Mini Coax**

Discrete tooling system for volume production .....	15.08
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## **Press-in machines**

Hand bench presses / pneumatic presses .....	15.09
CPM press-in machine <sup>1)</sup> .....	15.11

<sup>1)</sup> See separate catalogue

For economical and safe press-in of **harbus<sup>®</sup> HM** connectors with 5+2 and 8+2 rows, HARTING has developed a discrete tooling system.

Due to its modular structure it can be adapted to any connector configuration that needs to be pressed-in extremely quickly and securely.

Therefore a top and a bottom tool for each connector style is available. These tools are inserted in a top or bottom carrier tool with a groove, thus guaranteeing exact position of the top and bottom tools and the connectors.

To use identical carrier tools for all connector configurations, HARTING offer spacer blocks to fill gaps between adjacent top or bottom tools.

The carrier tool is either completely filled with top or bottom tools or respective spacer blocks, making it possible to press-in single modules.

To press-in female connectors with pre-installed upper shields, separate top and bottom tools are available.

For lower shield press-in the tooling can be changed easily.

For further information please check our operating instructions or contact your HARTING representative.

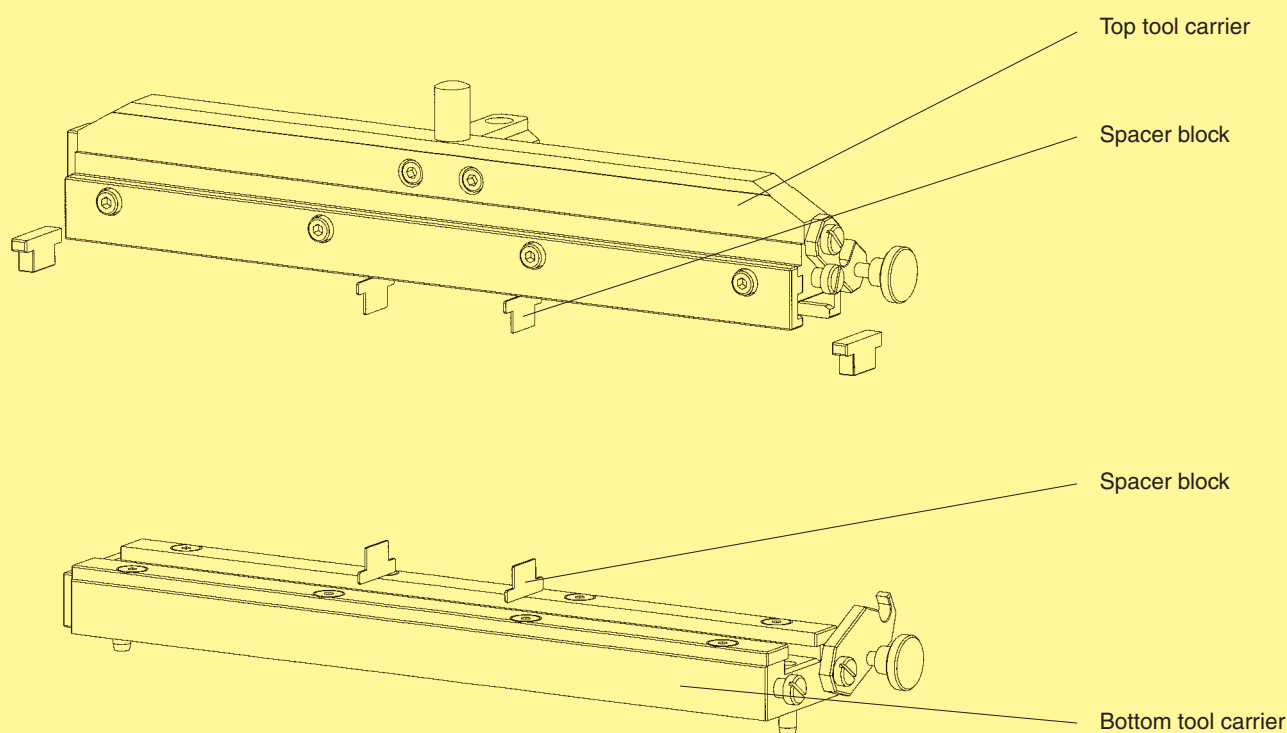


Fig. 1: Basis tools of the discrete tooling system

### Basis tools for all connector types

Part number connector	Tool identification	Part number tool	Part number connector	Tool identification	Part number tool
17 xx xxx xxxx	Top tool carrier <i>harbus<sup>®</sup> HM</i>	17 99 000 0012	17 xx xxx xxxx	Spacer block 25 mm	17 99 000 0055
17 xx xxx xxxx	Bottom tool carrier <i>harbus<sup>®</sup> HM</i>	17 99 000 0013	17 xx xxx xxxx	Spacer block 38 mm	17 99 000 0054
17 xx xxx xxxx	Top tool carrier <i>harbus<sup>®</sup> HM 3U</i>	17 99 000 0073	17 xx xxx xxxx	Spacer block 44 mm	17 99 000 0053
17 xx xxx xxxx	Bottom tool carrier <i>harbus<sup>®</sup> HM 3U</i>	17 99 000 0074	17 xx xxx xxxx	Spacer block 50 mm	17 99 000 0052
17 xx xxx xxxx	Spacer block 0.67 mm (CompactPCI)	17 99 000 0057	17 xx xxx xxxx	Centering plate female left	17 99 000 0060
17 xx xxx xxxx	Spacer block 5 mm	17 99 000 0056	17 xx xxx xxxx	Centering plate female right	17 99 000 0061

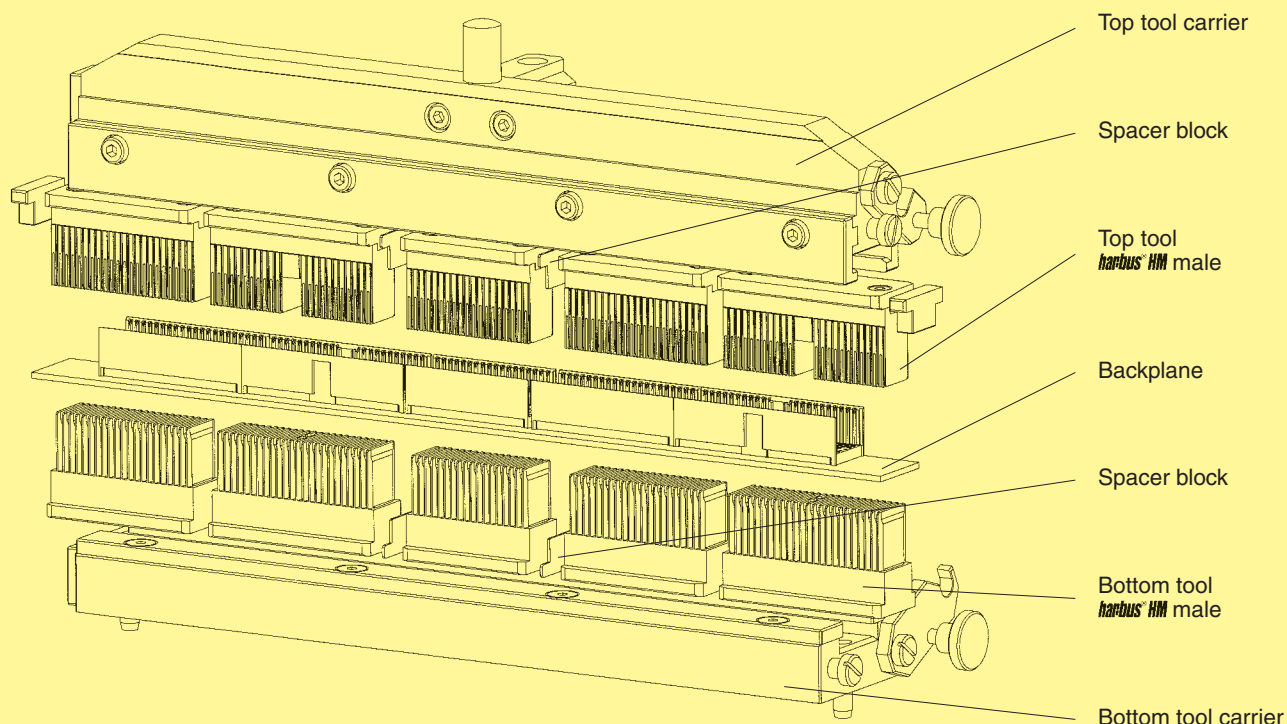


Fig. 2: Configuration sample for 6U backplane

## Tools for straight male connectors

Part number connector	Tool identification	Part number tool	Part number connector	Tool identification	Part number tool
17 01 xxx xxxx	Top tool, male, type A	17 99 000 0014	17 11 xxx xxxx	Top tool, male, type D	17 99 000 0022
17 01 xxx xxxx	Bottom tool, male, type A	17 99 000 0026	17 11 xxx xxxx	Bottom tool, male, type D	17 99 000 0028
17 02 xxx xxxx	Top tool, male, type B	17 99 000 0020	17 12 xxx xxxx	Top tool, male, type E	17 99 000 0023
17 02 xxx xxxx	Bottom tool, male, type B	17 99 000 0026	17 12 xxx xxxx	Bottom tool, male, type E	17 99 000 0028
17 04 xxx xxxx	Top tool, male, type B	17 99 000 0019	17 13 xxx xxxx	Top tool, male, type AB	17 99 000 0015
17 04 xxx xxxx	Bottom tool, male, type B	17 99 000 0025	17 13 xxx xxxx	Bottom tool, male, type AB	17 99 000 0024
17 05 xxx xxxx	Top tool, male, type B	17 99 000 0018	17 14 xxx xxxx	Top tool, male, type AB	17 99 000 0016
17 05 xxx xxxx	Bottom tool, male, type B	17 99 000 0024	17 14 xxx xxxx	Bottom tool, male, type AB	17 99 000 0025
17 03 xxx xxxx	Top tool, male, type C	17 99 000 0021	17 15 xxx xxxx	Top tool, male, type AB	17 99 000 0017
17 03 xxx xxxx	Bottom tool, male, type C	17 99 000 0027	17 15 xxx xxxx	Bottom tool, male, type AB	17 99 000 0026



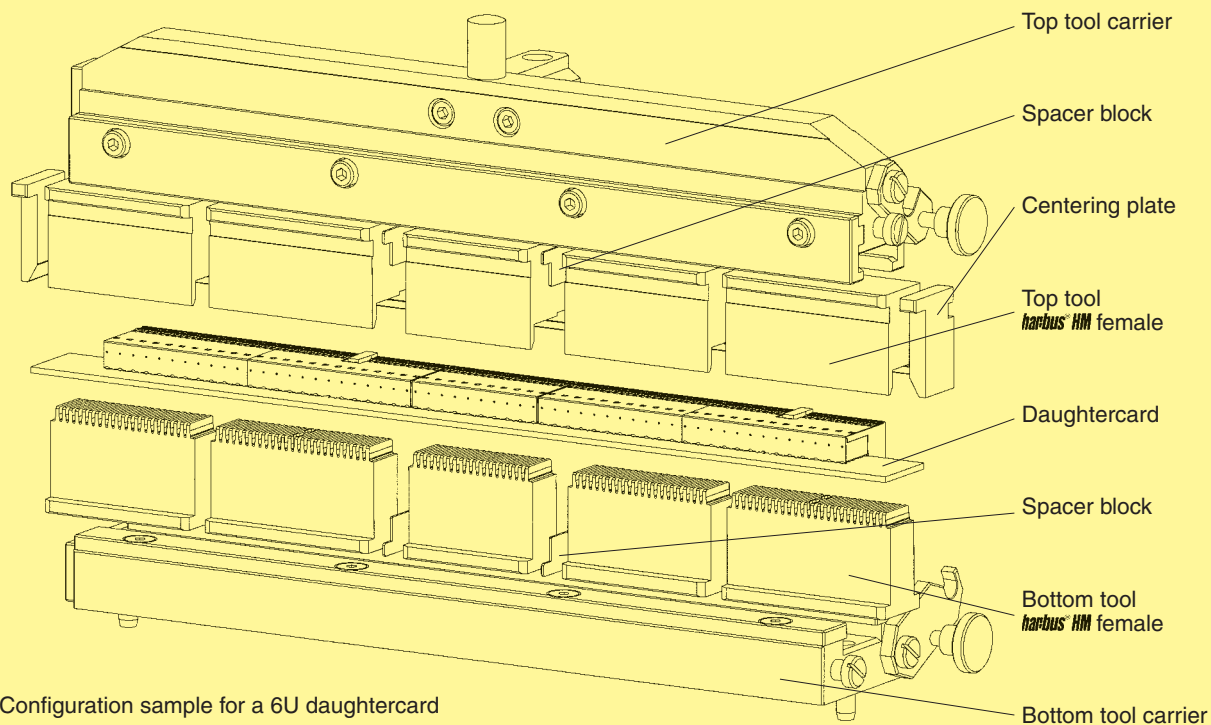


Fig. 3: Configuration sample for a 6U daughtercard

### Tools for angled female connectors

Part number connector	Tool identification	Part number tool	Part number connector	Tool identification	Part number tool
17 21 xxx xxxx	Top tool, female, type A	17 99 000 0029	17 31 xxx xxxx	Top tool, female, type D	17 99 000 0042
17 21 xxx xxxx	Bottom tool, female, type A	17 99 000 0046	17 31 xxx xxxx	Bottom tool, female, type D	17 99 000 0048
17 22 xxx xxxx	Top tool, female, type B	17 99 000 0038	17 32 xxx xxxx	Top tool, female, type E	17 99 000 0042
17 22 xxx xxxx	Bottom tool, female, type B	17 99 000 0046	17 32 xxx xxxx	Bottom tool, female, type E	17 99 000 0048
17 24 xxx xxxx	Top tool, female, type B	17 99 000 0036	17 33 xxx xxxx	Top tool, female, type AB	17 99 000 0032
17 24 xxx xxxx	Bottom tool, female, type B	17 99 000 0045	17 33 xxx xxxx	Bottom tool, female, type AB	17 99 000 0044
17 25 xxx xxxx	Top tool, female, type B	17 99 000 0034	17 34 xxx xxxx	Top tool, female, type AB	17 99 000 0058
17 25 xxx xxxx	Bottom tool, female, type B	17 99 000 0044	17 34 xxx xxxx	Bottom tool, female, type AB	17 99 000 0045
17 23 xxx xxxx	Top tool, female, type C	17 99 000 0040	17 35 xxx xxxx	Top tool, female, type AB	17 99 000 0029
17 23 xxx xxxx	Bottom tool, female, type C	17 99 000 0047	17 35 xxx xxxx	Bottom tool, female, type AB	17 99 000 0046

### Tools for angled shielded female connectors

Part number connector	Tool identification	Part number tool	Part number connector	Tool identification	Part number tool
17 21 xxx xxxx	Top tool, female, type A upper shield	17 99 000 0030	17 34 xxx xxxx	Top tool, female, type AB upper shield	17 99 000 0059
17 21 xxx xxxx	Top tool, female, type A divided shield computer telephony	17 99 000 0031	17 35 xxx xxxx	Top tool, female, type AB upper shield	17 99 000 0030
17 22 xxx xxxx	Top tool, female, type B upper shield	17 99 000 0039	17 21 xxx xxxx	Press-in die lower shield type A	17 99 000 0051
17 24 xxx xxxx	Top tool, female, type B upper shield	17 99 000 0037	17 22 xxx xxxx	Press-in die lower shield type B	17 99 000 0051
17 25 xxx xxxx	Top tool, female, type B upper shield	17 99 000 0035	17 24 xxx xxxx	Press-in die lower shield type B	17 99 000 0050
17 23 xxx xxxx	Top tool, female, type C upper shield	17 99 000 0041	17 25 xxx xxxx	Press-in die lower shield type B	17 99 000 0049
17 31 xxx xxxx	Top tool, female, type D upper shield	17 99 000 0043	17 31 xxx xxxx	Press-in die lower shield type D	17 99 000 0051
17 32 xxx xxxx	Top tool, female, type E upper shield	17 99 000 0043	17 32 xxx xxxx	Press-in die lower shield type E	17 99 000 0051
17 33 xxx xxxx	Top tool, female, type AB upper shield	17 99 000 0033	17 33 xxx xxxx	Press-in die lower shield type AB	17 99 000 0049
			17 34 xxx xxxx	Press-in die lower shield type AB	17 99 000 0050
			17 35 xxx xxxx	Press-in die lower shield type AB	17 99 000 0051

For 6U backplanes with CompactPCI configuration, HARTING has developed this start-up tooling.

The basis is a top tool carrier with tooth inserts, that are engaged alternately.

Therefore this tooling assembly can be used without any additional set-up time.

The tooth inserts are interchangeable, so that the tooling can be used for other connector configurations as well as for CompactPCI.

The bottom tool should preferably be a loadnest, which carries and aligns the pcb.

For detailed information please contact your local HARTING representative.

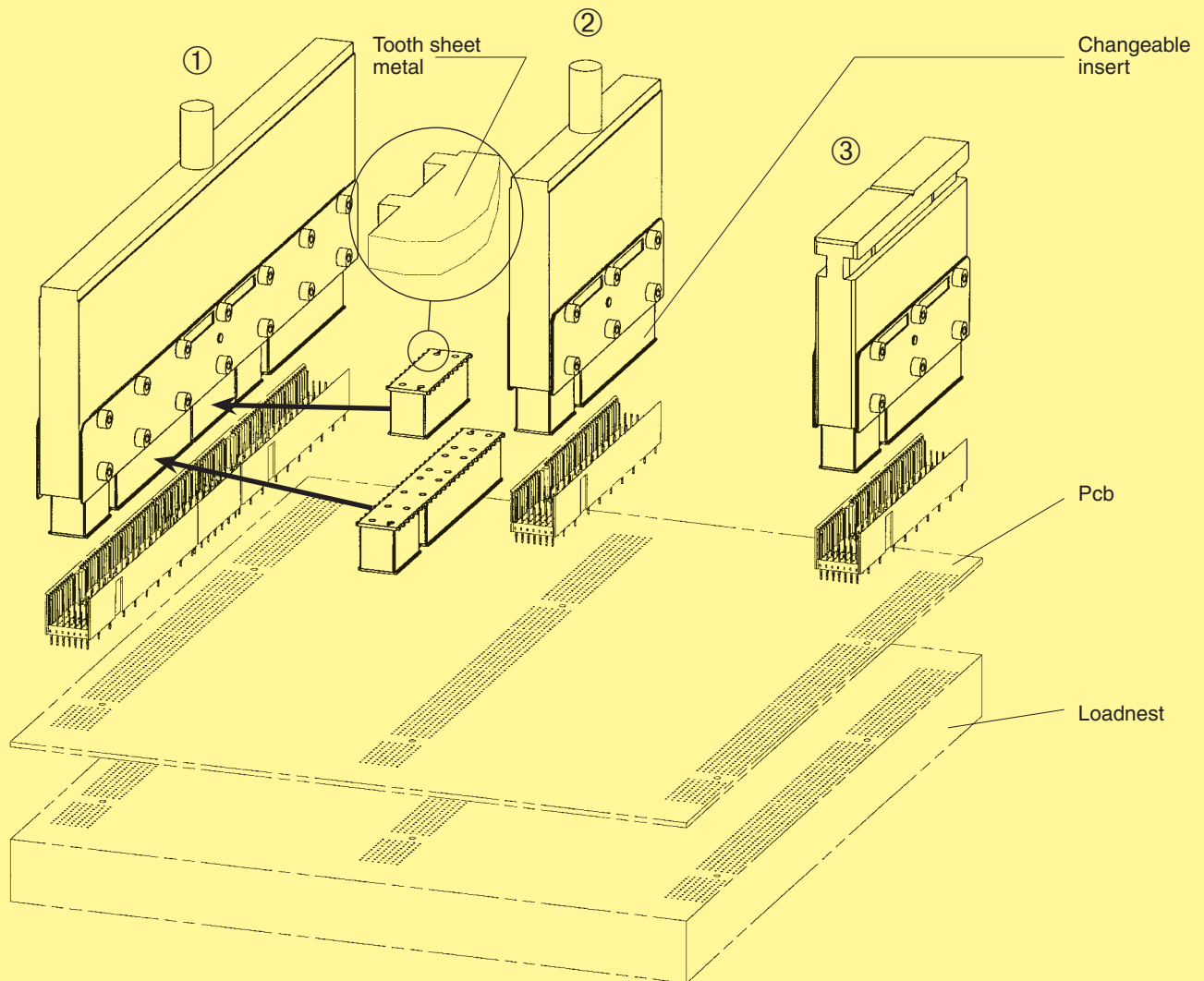


Fig. 4: Configuration samples for CompactPCI backplanes

### Tools for straight male connectors

Tool identification	Part number tool	Tool identification	Part number tool
① Insert top tool for 6U CompactPCI	17 99 000 0063	Tooth insert for type Monoblock 47	17 99 000 0066
② Insert top tool for 3U CompactPCI	17 99 000 0065	Tooth insert for type B 19 positions	17 99 000 0068
③ Insert top tool for rotatable tool changer	on request		

The insert blocks can be used to press-in **harbus® HM** male connectors without any special top tool. These blocks will be put into the connectors manually or automatically (using insertion removal station, see page 15.15).

To press-in the connector no precise position is needed and can be done by a simple flat rock die. This will accelerate the cycle time of the press-in process dramatically.

Insert blocks are developed for use with a loadnest.

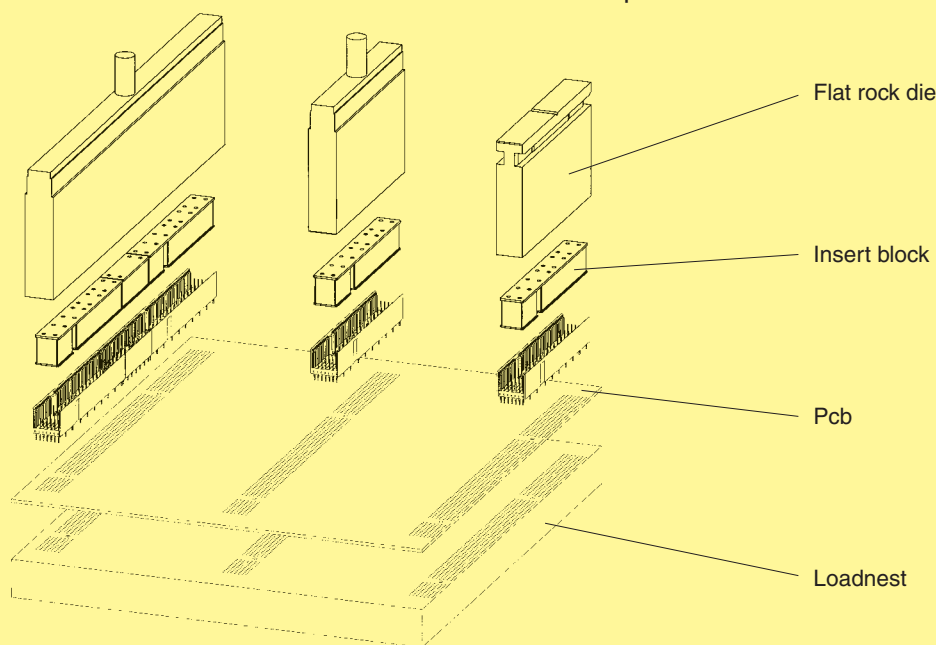


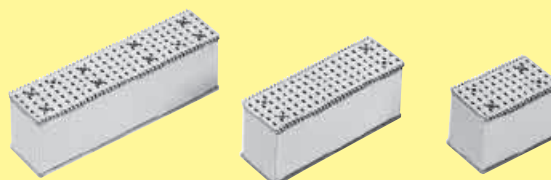
Fig. 5: Application samples for insert blocks

### Insert blocks for straight male connectors

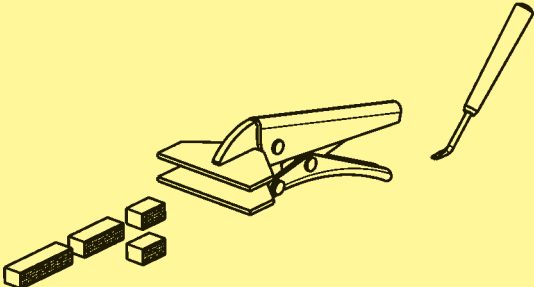
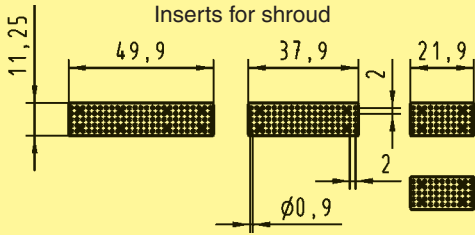
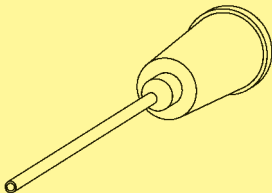

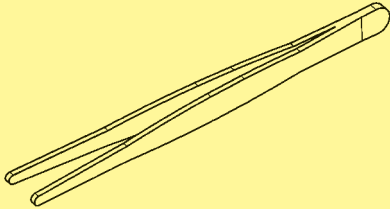
Part number connector	Tool identification	Quantity and part number tool
17 01 xxx xxxx	Insert block for type A	1 x 17 99 000 0009 or (2 x 17 99 000 0001)
17 04 xxx xxxx	Insert block for type B	1 x 17 99 000 0004
17 05 xxx xxxx	Insert block for type B	1 x 17 99 000 0002
17 02 xxx xxxx	Insert block for type B	1 x 17 99 000 0003
17 03 xxx xxxx	Insert block for type C	1 x 17 99 000 0001
17 06 xxx xxxx	Insert block for type Monoblock 47	1 x 17 99 000 0008 or (1 x 17 99 000 0001 and 1 x 17 99 000 0005)
17 11 xxx xxxx	Insert block for type D	2 x 17 99 000 0006
17 12 xxx xxxx	Insert block for type E	1 x 17 99 000 0007
17 13 xxx xxxx	Insert block for type AB	1 x 17 99 000 0069
17 14 xxx xxxx	Insert block for type AB	1 x 17 99 000 0070
17 15 xxx xxxx	Insert block for type AB	1 x 17 99 000 0071
17 10 xxx xxxx	Insert block for type DE	1 x 17 99 000 0072
17 4x xxx xxxx	Insert block for type 6-row with 72 contacts	1 x 17 99 000 0090
17 4x xxx xxxx	Insert block for type 6-row with 144 contacts	1 x 17 99 000 0091

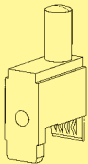
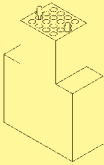
### Flat rock dies

Part number connector	Tool identification	Part number tool
17 xx xxx xxxx	Flat rock die for 6U	07 79 000 0155
17 xx xxx xxxx	Flat rock die for 3U	07 79 000 0156



The insert block 17 99 000 0001 e.g. can be used for the types A, C and Monoblock 47.

Identification	for use with	Part number	Drawing	Dimensions [mm]
Tool kit shroud removal	<b>harbus® HM</b>	17 99 000 0095	 	
Insertion and repair tool for single contact		17 99 000 0094		
Removal tool for single male contacts		09 99 000 0239		
Mounting tool for coding key		17 99 000 0093		

Identification	for use with	Part number	Drawing	Dimensions [mm]
Top tool for angled male connectors	<b>harbus® HM</b> Power	17 99 000 0102		
Bottom tool for angled male connectors	<b>harbus® HM</b> Power	17 99 000 0103		

Straight Mini Coax connectors can be pressed-in with a flat die and a top tool delivered with the connectors. This top tool can be used as contact protection and remains in the connector until the daughtercard is mated.

Angled Mini Coax connectors will be pressed-in with separate top and bottom tools, which will be mounted into a common body.

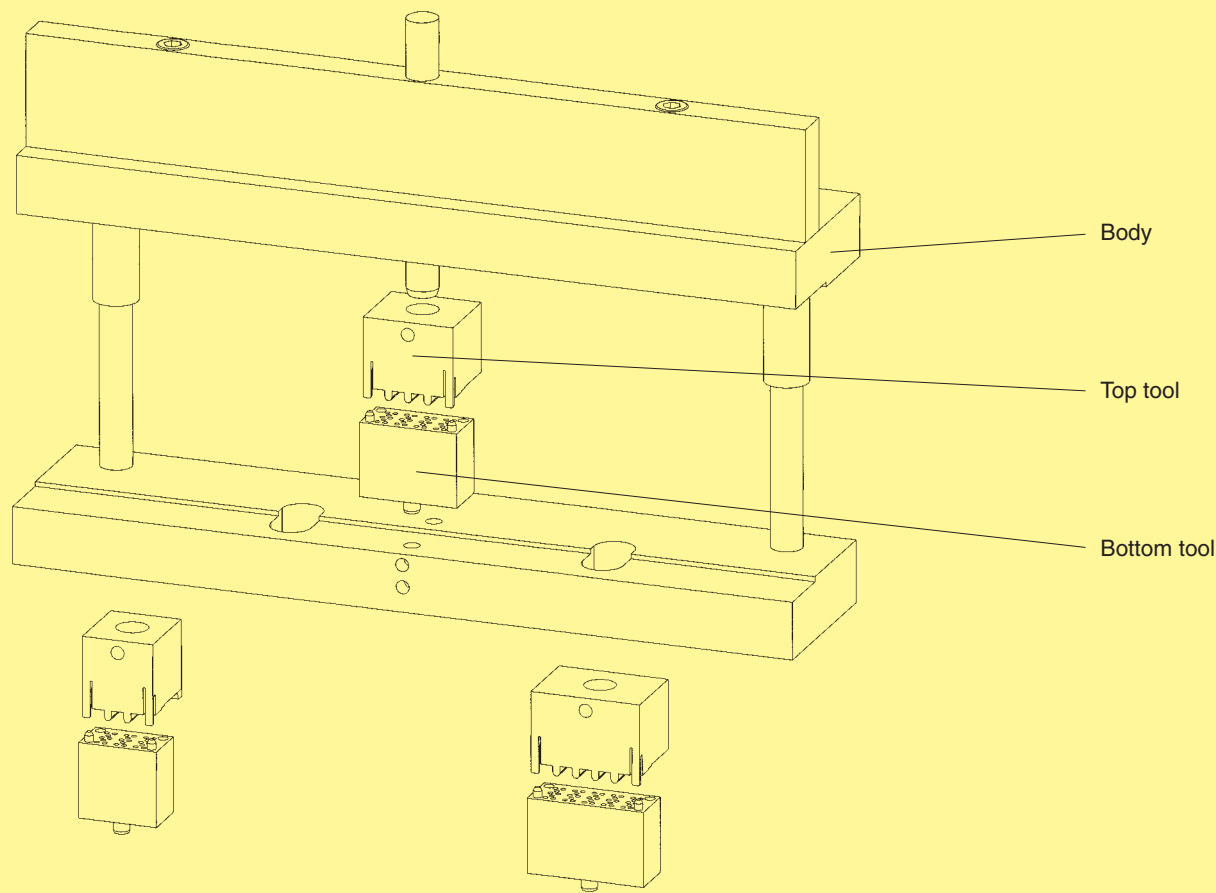


Fig. 6: Configuration for angled modules

Tooling	Tools for straight modules			Tools for angled modules		
	Part number connector	Tool identification	Part number tool	Part number connector	Tool identification	Part number tool
	07 11 xxx xxxx	1 SU Mini Coax Standard bottom tool	on request	07 31 xxx xxxx	Body	07 79 000 0061
	07 11 xxx xxxx	1.25 SU Mini Coax Standard bottom tool	on request	07 31 xxx xxxx	1 SU Mini Coax Standard bottom tool	07 79 000 0045
	07 11 xxx xxxx	1.50 SU Mini Coax Standard bottom tool	on request	07 31 xxx xxxx	1 SU Mini Coax Standard top tool	07 79 000 0080
				07 31 xxx xxxx	1.25 SU Mini Coax Standard bottom tool	07 79 000 0034
				07 31 xxx xxxx	1.25 SU Mini Coax Standard top tool	07 79 000 0081
				07 31 xxx xxxx	1.50 SU Mini Coax Standard bottom tool	07 79 000 0171
				07 31 xxx xxxx	1.50 SU Mini Coax Standard top tool	07 79 000 0170
				07 31 xxx xxxx	1 SU Mini Coax single-row bottom tool	07 79 000 0205
				07 31 xxx xxxx	1 SU Mini Coax single-row top tool	07 79 000 0204

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

<sup>1)</sup> suitable for 09 99 000 0282 and all CPM machines (see page 15.11 pp.)

<sup>2)</sup> 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.

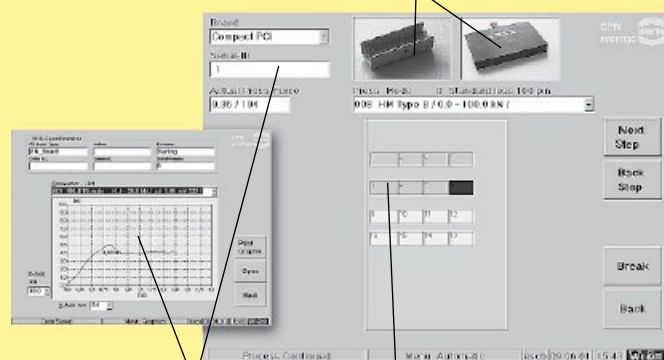
The visualisation of the entire press-in process (the position of the connector, press-in forces etc.) allows the rapid recognition and eradication of the possible error sources. With the addition of a barcode reader (1D and 2D)<sup>1)</sup> the parameters of every pcb layout can be stored, recalled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



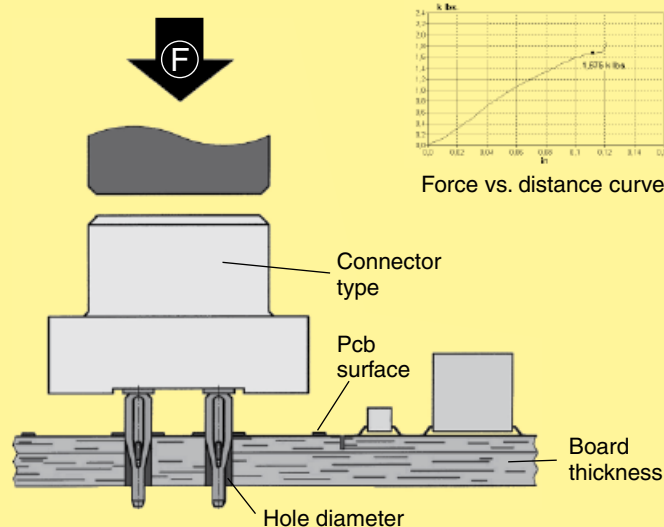
Visual guiding system via touch monitor

Real photos of connectors and tools



Process data

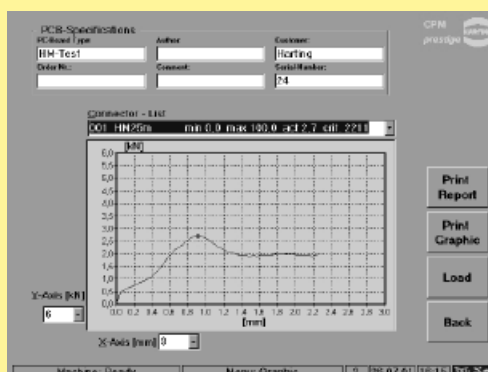
Layout with current position highlighted



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

<sup>1)</sup> optional





## 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

Fig. 7: **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

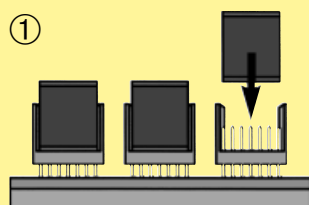


Power supply 220 V / 50 Hz  
Air pressure 6 bar (15-16 l/min.)

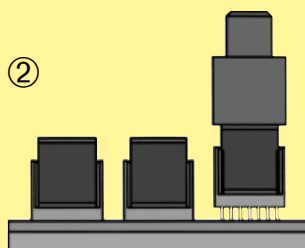
Part No. 09 89 040 3000  
for pcb dimensions of max.  
710 mm x 540 mm

Fig. 8: Bestseller **CPM prestige** with insertion removal station, adaptable to all HARTING press-in machines.

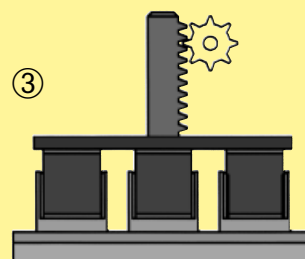
## Principle:



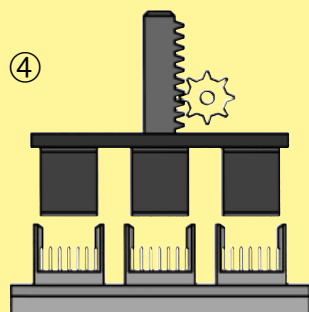
Load all headers with inserts for **one** press-in cycle



Press-in all connectors with a flat die

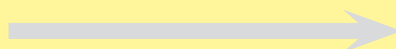


Position the magnetic plate

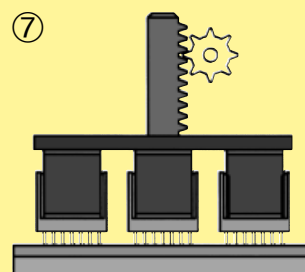


Remove all press-in inserts in one operation

Remove the processed pcb from the machine



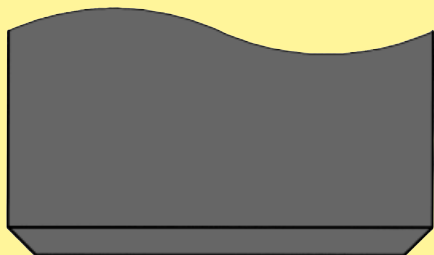
Move the next pre-assembled pcb to the insert station



Load all headers in one operation

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.

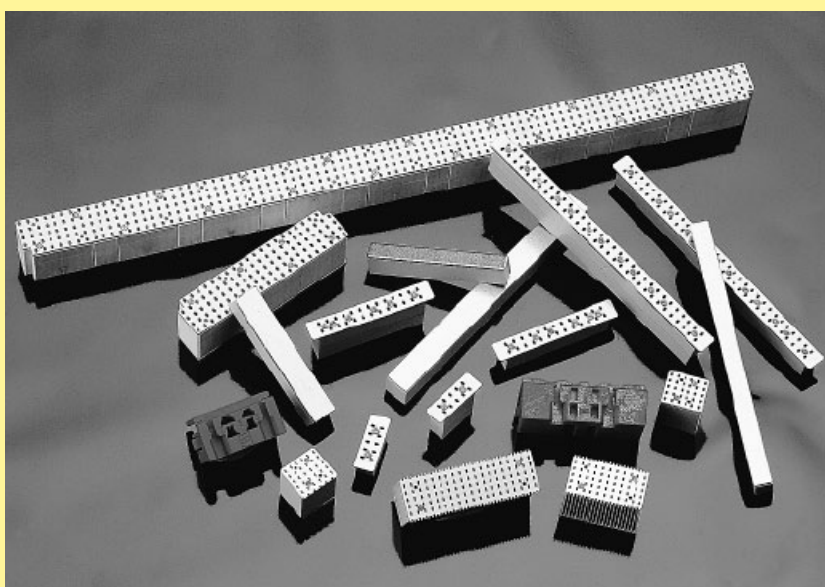
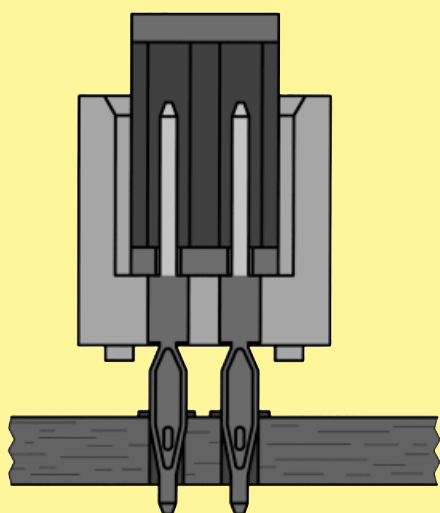


## Advantages of press inserts

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 15.13).

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.

## Signal integrity support

Page

Introduction .....	<b>16.02</b>
Simulation and modeling .....	<b>16.02</b>
Measurement and verification .....	<b>16.03</b>
Test board design .....	<b>16.03</b>
Design-in support .....	<b>16.03</b>

HARTING Electronics provides end customers with signal integrity support. We also deliver simulation models and evaluation kits along with our products for signal integrity investigations. The evaluation kits are assembled with SMA's in order to connect them directly with the measurement instruments. Customers benefit from savings in terms of time and the costs for the preliminary evaluation of the connector. We offer test boards suitable for the connector evaluation itself and have built backplanes for measurements within applications such as VME and CompactPCI. Reference structures and well established measurement techniques allow a full de-embedding of the propagation characteristics of the interconnect itself for testing and verification. Furthermore, we have developed a high-speed test backplane with different connector

areas and PCB design topologies. We can provide footprint and routing recommendations for each of our products. A variety of test boards and technical data for different products are available on request.

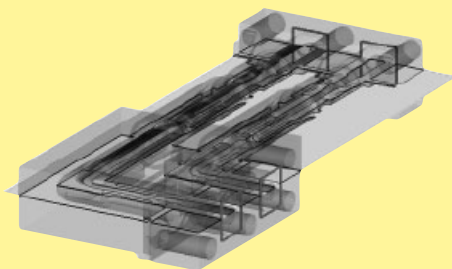
HARTING Electronics is also an active member in standardization groups such as VITA, PICMG, OBSAI and supports sub-committees for new interconnect solutions. We engage in close cooperation with universities and industrial partners for research activities.

## Signal integrity capabilities

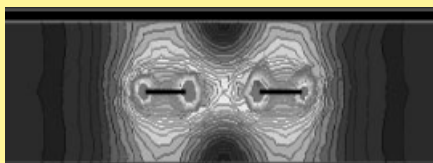
- Simulation and modeling
- Measurement and verification
- Test board design
- Design-in support

## Simulation and modeling

We have the capability to perform full 3D-FEM simulations of the CAD geometry with different well established tools such as CST Microwave Studio and Ansoft HFSS. This enables us to post-process the data for field distribution and full S-Parameter analysis.



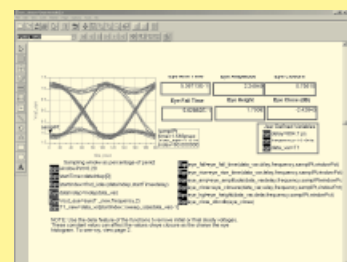
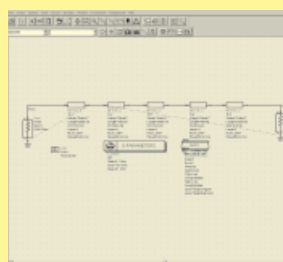
In conducting SPICE modeling, impedance calculation and field distribution analysis of the geometry, we draw on static 3D-FEM, 2D-FEM and planar field solvers.



We have developed tools for SPICE netlist conversion based on R, L, C, G files for the post-processing of the data.

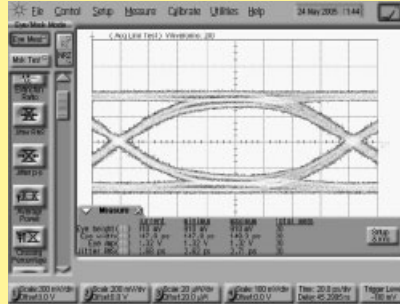


System simulation, including particular chip, trace, vias and connector sub-circuits are performed with tools such as HSPICE and ADS.





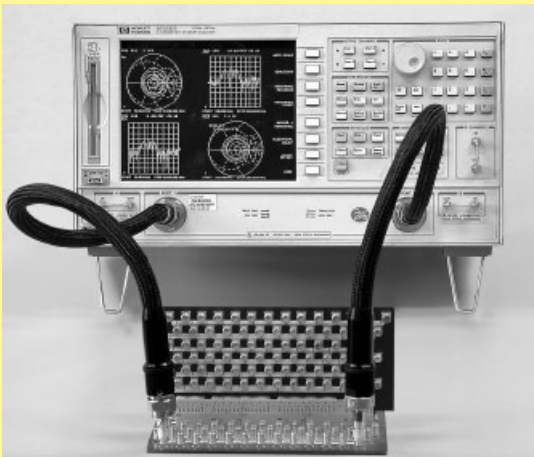
## Time-domain measurements



Parameters:

- Characteristic impedance
- Propagation delay
- Reflection
- Crosstalk
- Eye-diagram and mask-test
- Bit-error rate testing (BERT) up to 12.5 Gbps per differential line

## Frequency-domain measurements



Parameters:

- S-parameter analysis (up to 40 GHz)
- Insertion- and return loss, crosstalk
- Fourier-transformation, gating, error-location

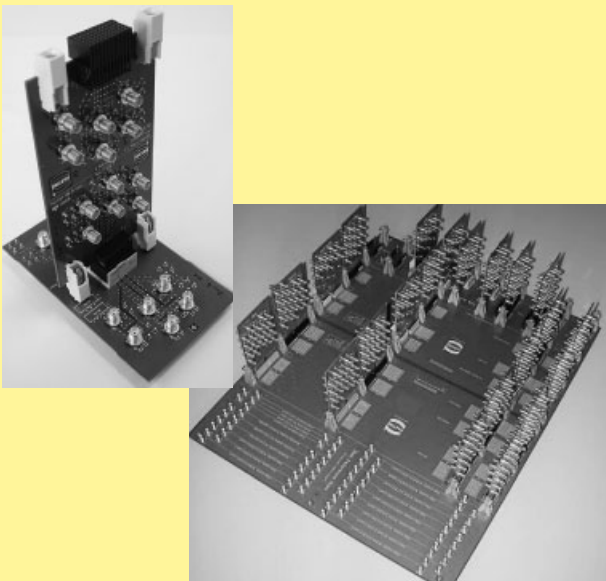
## ISO/IEC 11801/CAT 5 measurements



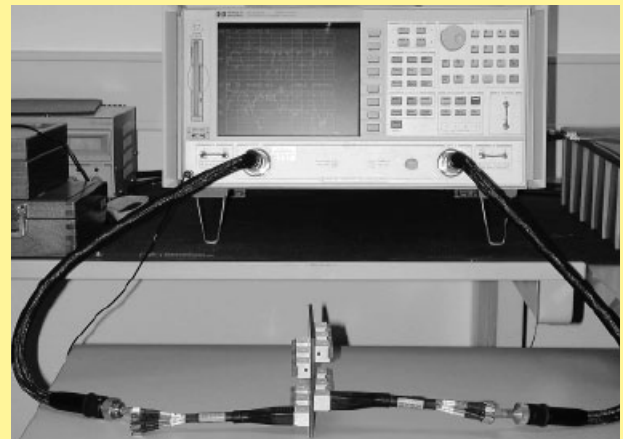
Parameters:

- Near-end crosstalk (NEXT)
- Power sum NEXT (PS NEXT)
- Far-end crosstalk (FEXT)
- Power sum FEXT (PS FEXT)
- Return loss
- Attenuation
- Attenuation to Crosstalk Ratio (ACR)
- Power sum ACR (PS ACR)

## Test board design



## Design-in support



- Customized PCB design close to the real application
- Footprint and routing recommendations
- Full measurement characterization



Should you need a specially loaded connector for your application, please use this request form. Fill out the drawing for the desired connector style and mark each position with the required contact length (A, B, ..., S, T).

Pin type — U A B C      K L H      N P Q      R S T

Level 3: 11.2 ± 0.2  
 Level 2: 9.7 ± 0.2  
 Level 1: 8.2 ± 0.2  
 Level 0: 7.2 ± 0.2

3.7 ± 0.2      min. 6      13 ± 0.2      min. 7.5      min. 9

Length for mating:      Datum plane depth


Columns: 1 2 3 4 5 6 7 8 9 10

Rows: a b c d e f g h i j

[illegible]



Should you need a specially loaded connector for your application, please use this request form. Fill out the drawing for the desired connector style and mark each position with the required contact length (A, B, ..., S, T).

19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

A large rectangular grid for writing answers, divided into two sections by a vertical gap. The columns are numbered at the bottom from right to left: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22. Each column contains five horizontal rows.

z  
a  
b  
c  
d  
e  
f

Pin type — U A B C K L M N P Q R S T

Level 3: 11.2 ± 0.2  
 Level 2: 9.7 ± 0.2  
 Level 1: 8.2 ± 0.2  
 Level 0: 7.2 ± 0.2

3.7 ± 0.2  
 13.0 ± 0.2  
 14.5 ± 0.2  
 16.0 ± 0.2

min. 0.6  
 min. 0.5  
 min. 0.9

Length for mating:

Datum plane depth

Should you need a specially loaded connector for your application, please use this request form. Fill out the drawing for the desired connector style and mark each position with the required contact length (A, B, ..., S, T).

z  
a  
b  
c  
d  
e  
f  
g  
h  
i

25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

a  
b  
c  
d  
e  
f  
g  
h  
i

# List of part numbers



Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page
02 01 160 1101	00.45	07 79 000 0170	15.08	17 01 100 1001	00.14	17 04 110 1201	00.16	17 12 200 1201	00.33
02 01 160 1102	00.45	07 79 000 0171	15.08	17 01 100 1201	00.14	17 04 110 2201	00.16	17 12 200 2201	00.33
02 01 160 1105	00.45	07 79 000 0204	15.08	17 01 100 2001	00.14	17 04 132 1001	00.16	17 12 250 1001	00.33
02 01 160 1106	00.45	07 79 000 0205	15.08	17 01 100 2201	00.14	17 04 132 2001	00.16	17 12 250 1201	00.33
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02 44 000 0008	00.48	09 03 124 2901	00.42	17 01 154 2205	00.12	17 05 133 2602	00.17	17 15 125 2201	00.19
02 44 000 0009	00.48	09 03 124 6901	00.42	17 01 154 2603	00.13			17 15 169 1003	00.19
		09 03 124 7901	00.42	17 01 154 2604	00.13			17 15 169 1201	00.19
		09 03 224 6830	00.43			17 06 220 1201	00.28	17 15 169 2003	00.19
						17 06 220 1202	00.28	17 15 169 2201	00.19
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				17 02 150 2201	00.15	17 06 308 1005	00.29	17 21 110 1101	00.24
07 31 100 0019	07.07	09 89 040 0000	15.12	17 02 175 1006	00.15	17 06 308 1201	00.28	17 21 110 1102	00.24
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						17 11 220 2201	00.32	17 24 000 4102	00.30

# List of part numbers



Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page
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17 24 110 1102	00.25	17 44 144 2205	02.04	17 61 004 2102	03.04	17 79 000 0028	00.35	17 99 000 0060	15.02
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		17 46 144 2207	02.05			17 99 000 0006	15.06	17 99 000 0073	15.02
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				17 70 000 3002	00.40	17 99 000 0018	15.03		
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17 33 000 4102	00.26	17 52 072 1108	02.08	17 70 000 4002	00.38	17 99 000 0022	15.03	27 21 121 8000	11.04
17 33 095 1101	00.26	17 52 072 1805	02.10	17 70 000 4003	00.38	17 99 000 0023	15.03	27 21 121 8002	11.04
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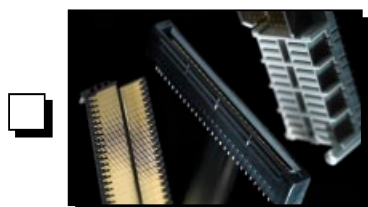
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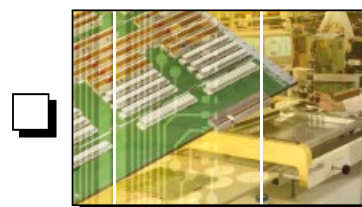
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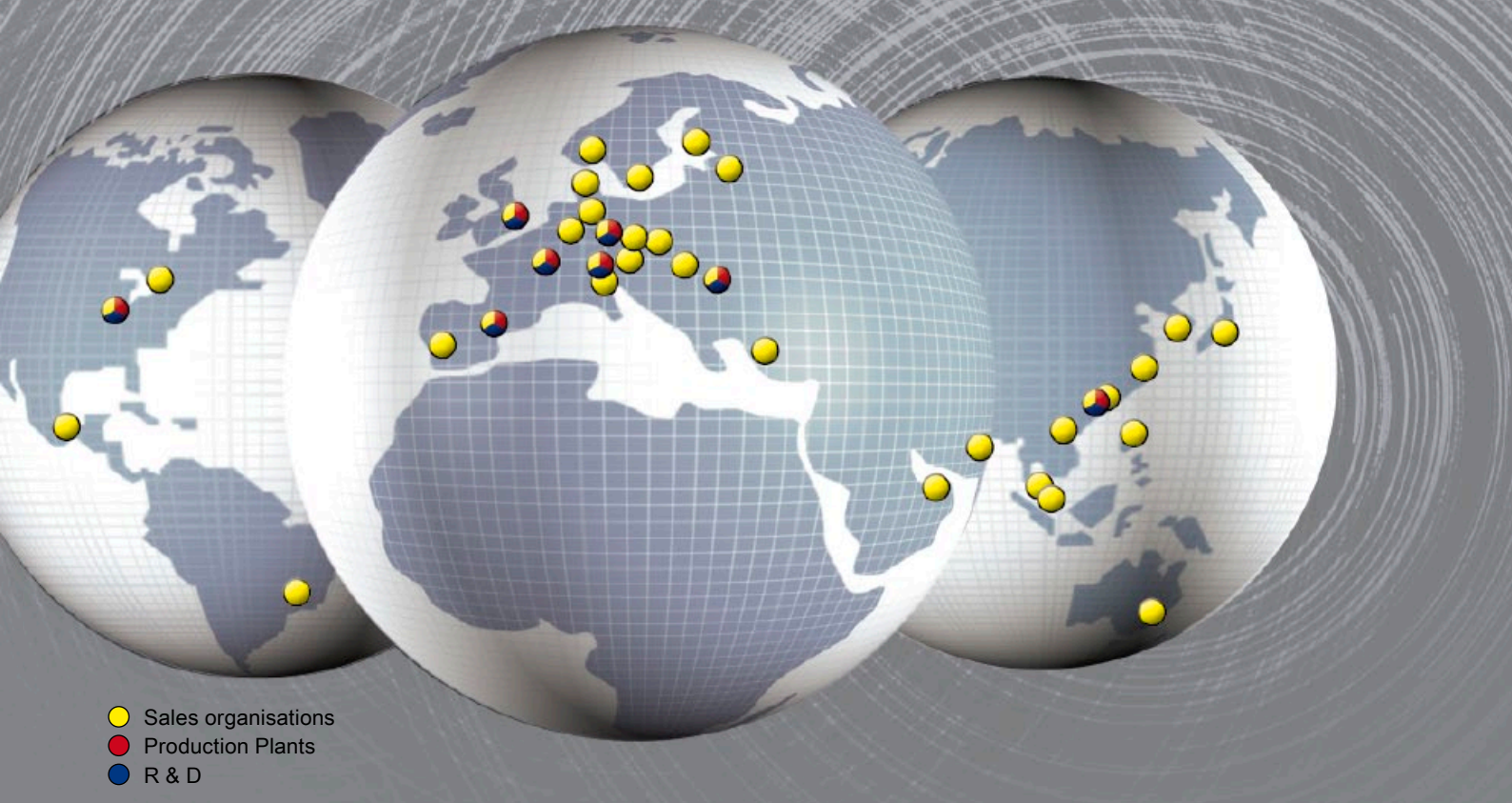
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