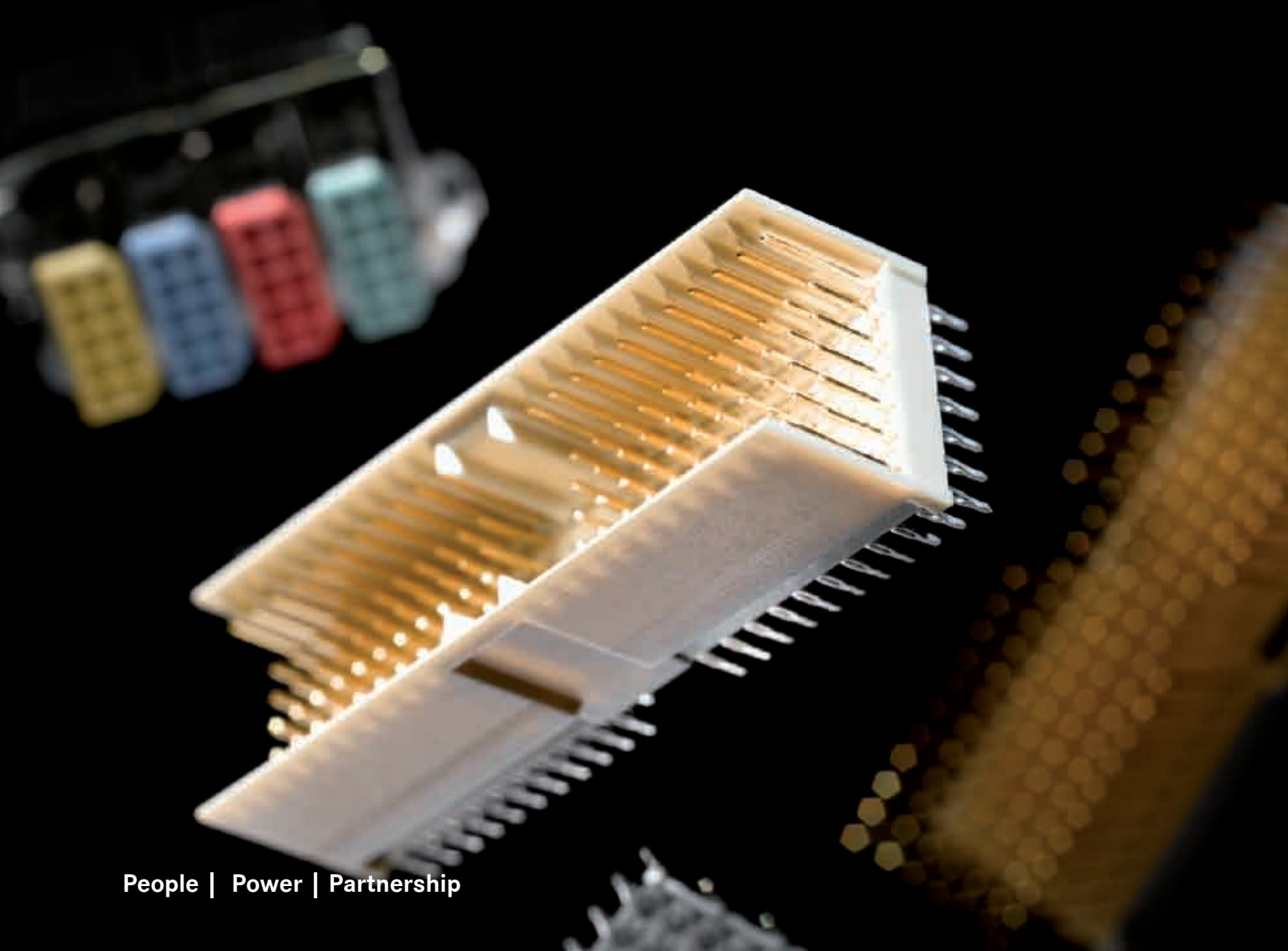




Pushing Performance

HARTING Coaxial and Metric Connectors





Pushing Performance

Quality Connections Worldwide

HARTING was founded in 1945 by the family that still owns the company. Its headquarters are situated in Espelkamp, in Eastern Westphalia.

Today, HARTING employs more than 2,700 people worldwide, including 300 engineers and scientists. Over 500 technical specialists are available to implement customer requirements.

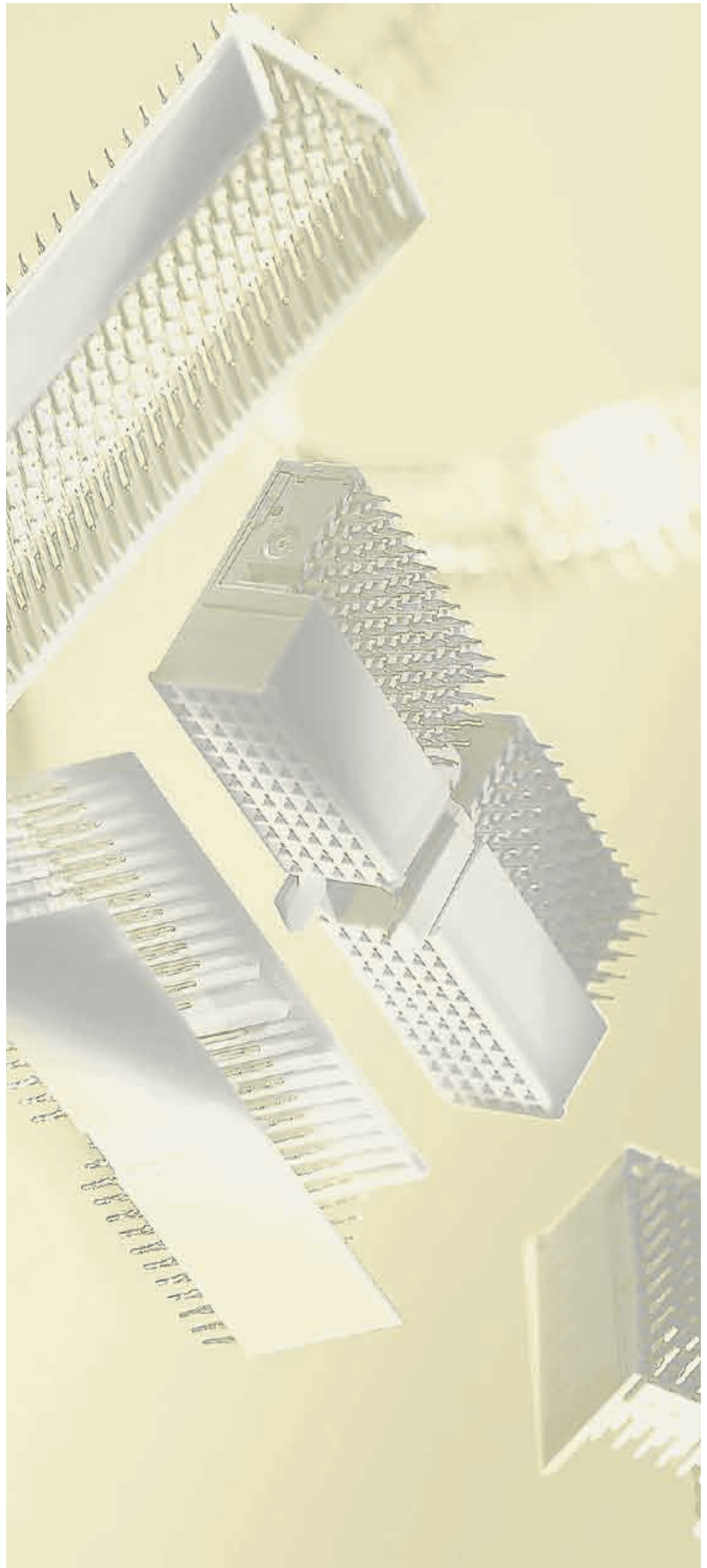
With subsidiaries in 27 countries and ten production plants, the company is one of the leading manufacturers of electrical and electronic connectors. The global HARTING network means that the company is always in close touch with the market and ideally placed to work together with its customers.

As the market leader HARTING offers the benefits of just-in-time service and maintains close business relations with all of its key customers in the global marketplace. In more than one of its product areas, HARTING leads the field.

HARTING products are manufactured using advanced, automated techniques, with CAD systems employed both in research and development and in tool-making.

In matters of quality, HARTING is convinced that zero-defect production can only be achieved through fully automated processes. Our quality assurance organization and procedures are documented in accordance with EN ISO 9001 in a quality assurance manual. In 2006 HARTING became the first company worldwide to receive the new IRIS quality certificate (the International Railway Industry Standard).

HARTING employs around 60 staff in quality assurance alone. The majority of these engineers and technicians are trained and qualified to standards laid down by the DGQ (German Association of Quality) or SAQ (Swiss Association of Quality).



Coaxial and metric connectors

harbus® HM Standard, 2.00 mm pitch



00

harbus® HM+ (SMC types), 2.00 mm pitch



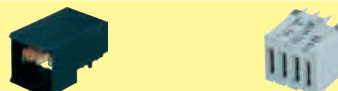
01

harbus® HM with 6 rows, 2.00 mm pitch



02

harbus® HM Power



03

harpak®, 2.50 mm pitch



05

Mini Coax Standard
low-profile
single-row



07

Mini Coax cable assemblies and accessories



08

Mini Coax+ modules (SMT/SMC)



09

harlink®



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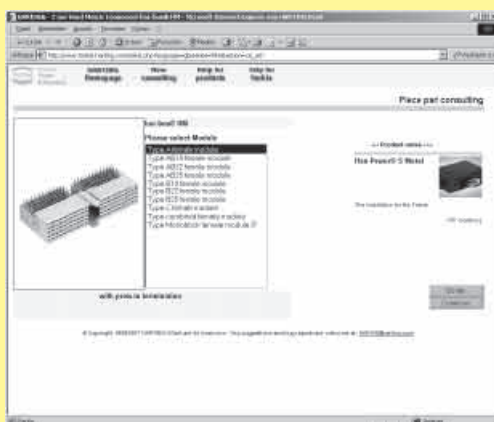
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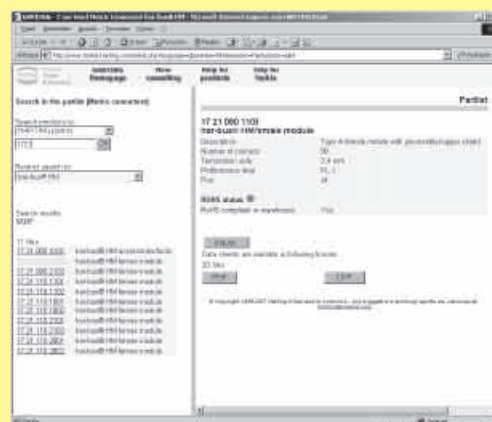
HARKIS® is the abbreviation for **HARTING-Katalog-Information-System** (HARTING catalogue information system).

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®** our homepage www.HARTING.com. It is also available on CD-Rom and DVD.



Part configuration



CAD library

Identification

HARKIS® CD-Rom
Basic product catalogue

HARKIS® DVD
Basic product catalogue
2D and 3D CAD files inclusive

Part number

98 40 000 0401

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

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Coding keys	00.35
Shrouds	00.36
Guiding system	00.41
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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	: Performance level 2 = <i>250 mating cycles</i> in total. <i>First 125 mating cycles</i>, then 4 days gas test using 0.5 ppm SO₂ and 0.1 ppm H₂S (at 25 ± 2 °C and 75 ± 3 % humidity). Measurement of contact resistance. 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. Performance level 1 = <i>500 mating cycles</i> in total. <i>First 250 mating cycles</i>, then 10 days gas test using 0.5 ppm SO₂ and 0.1 ppm H₂S (at 25 ± 2 °C and 75 ± 3 % humidity). Measurement of contact resistance. 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.
Termination technique	: compliant press-in
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[®] HM** press-in contacts, they can be easily and repeatedly removed in case of repairs without impairment to their functioning.

harbus[®] 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)</i> acc. EN 60352-5	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

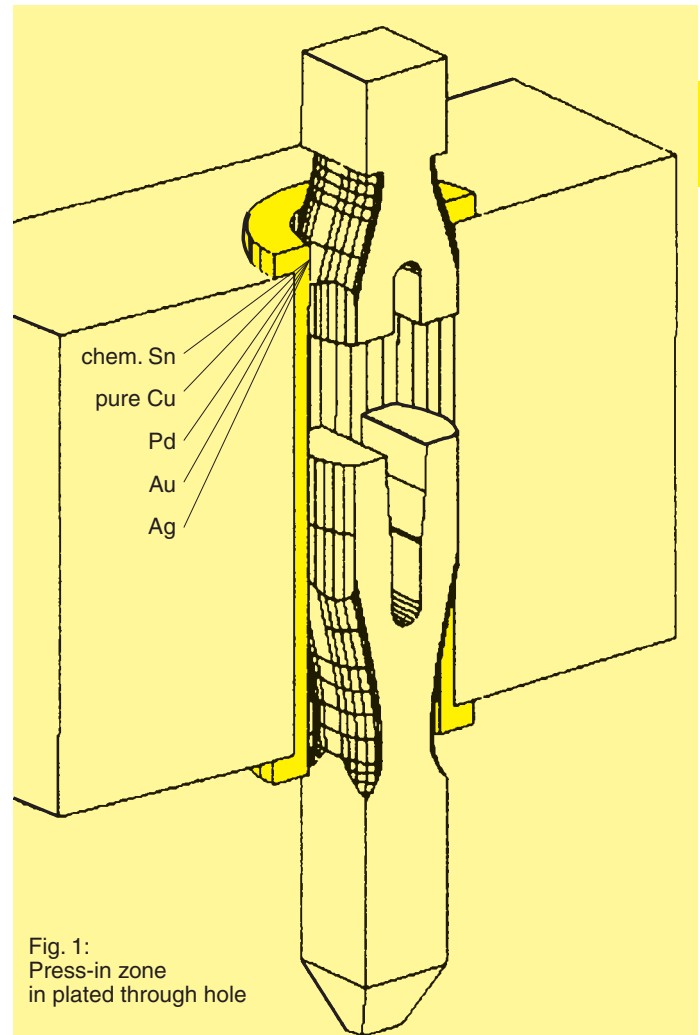


Fig. 1:
Press-in zone
in plated through hole

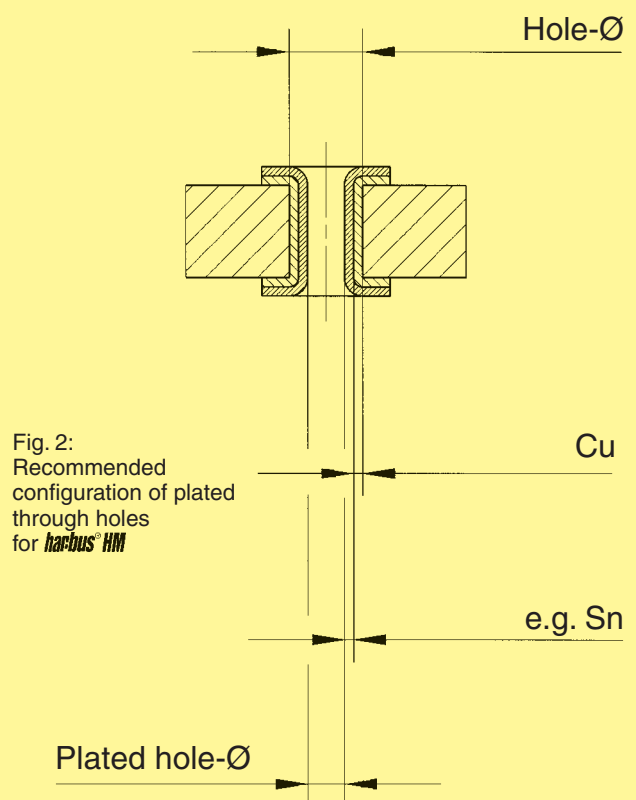


Fig. 2:
Recommended
configuration of plated
through holes
for **harbus[®] HM**

HARTING offers 13 contact lengths for *harbus® 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.

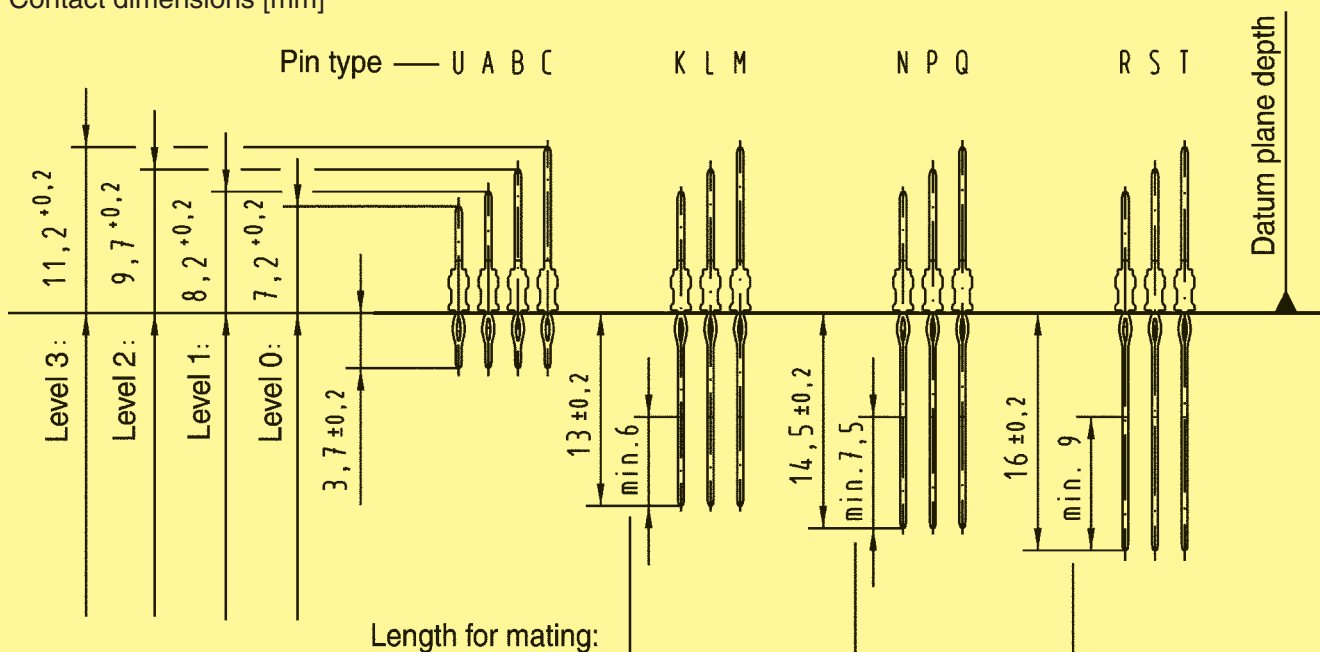
On the termination side the standard length is 3.7 mm. With the three termination lengths of 13.0, 14.5 and 16.0 mm even for rear I/O applications different mating levels are possible, depending on the pcb thickness and shroud height.

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.

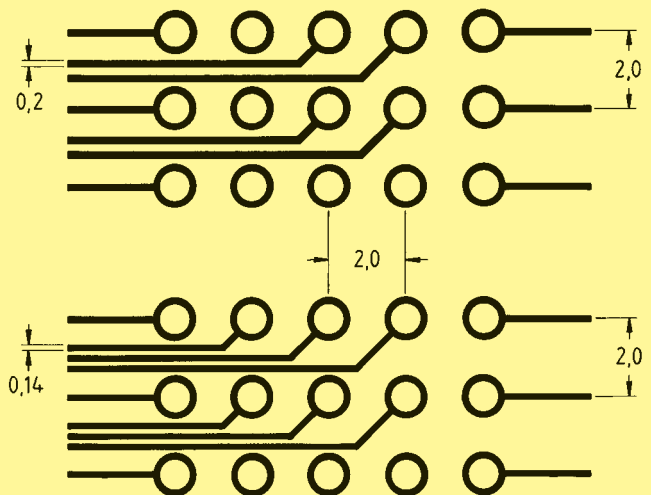
All contacts are offered with press-in termination 'eye of the needle'. In accordance with the application they can be delivered in performance level 1 or 2.

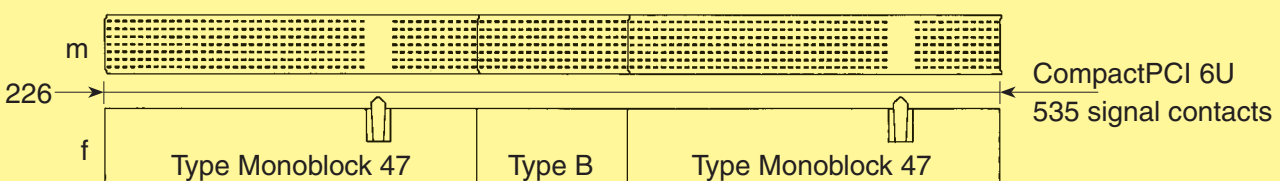
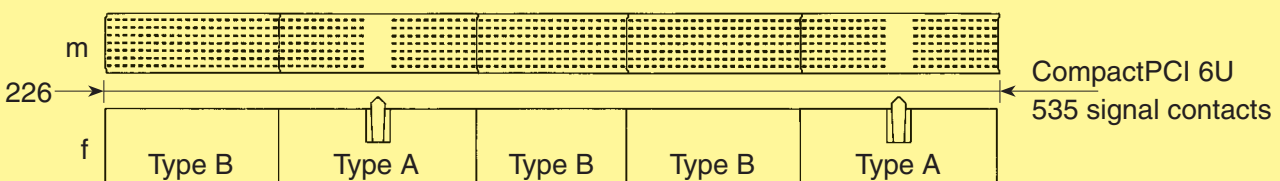
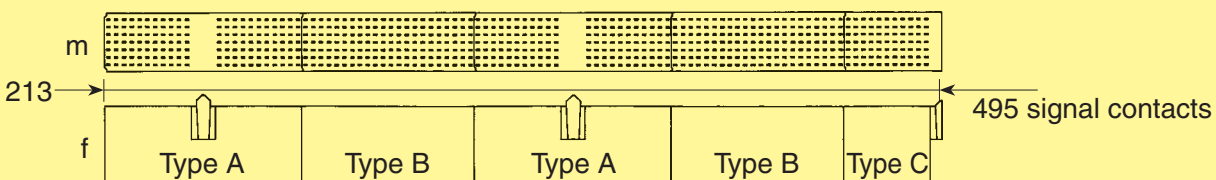
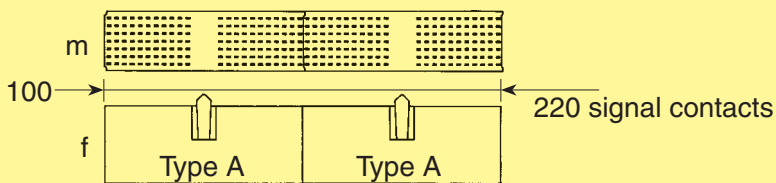
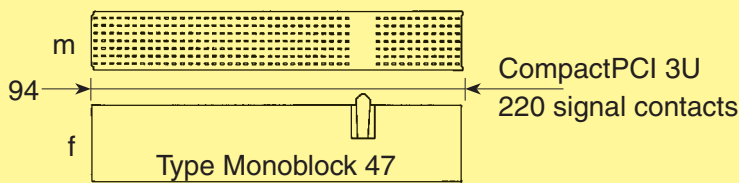
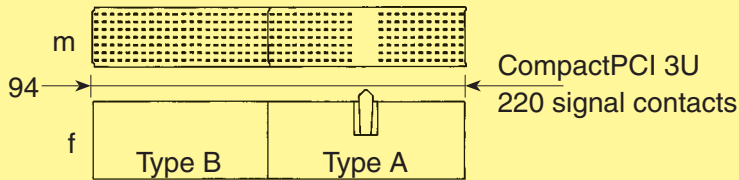
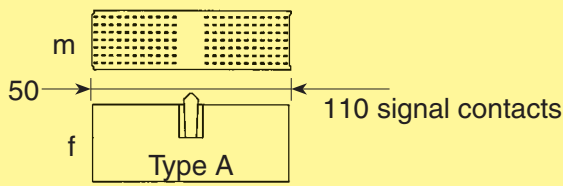
Contact dimensions [mm]



Circuit density

When using the specified diameter of the finished through hole according to IEC 61076-4-101 (0.6 ± 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.





m = male connector
f = female connector

All HARTING *harbus[®] 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).

Dimensions [mm]

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 ± 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 ± 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.

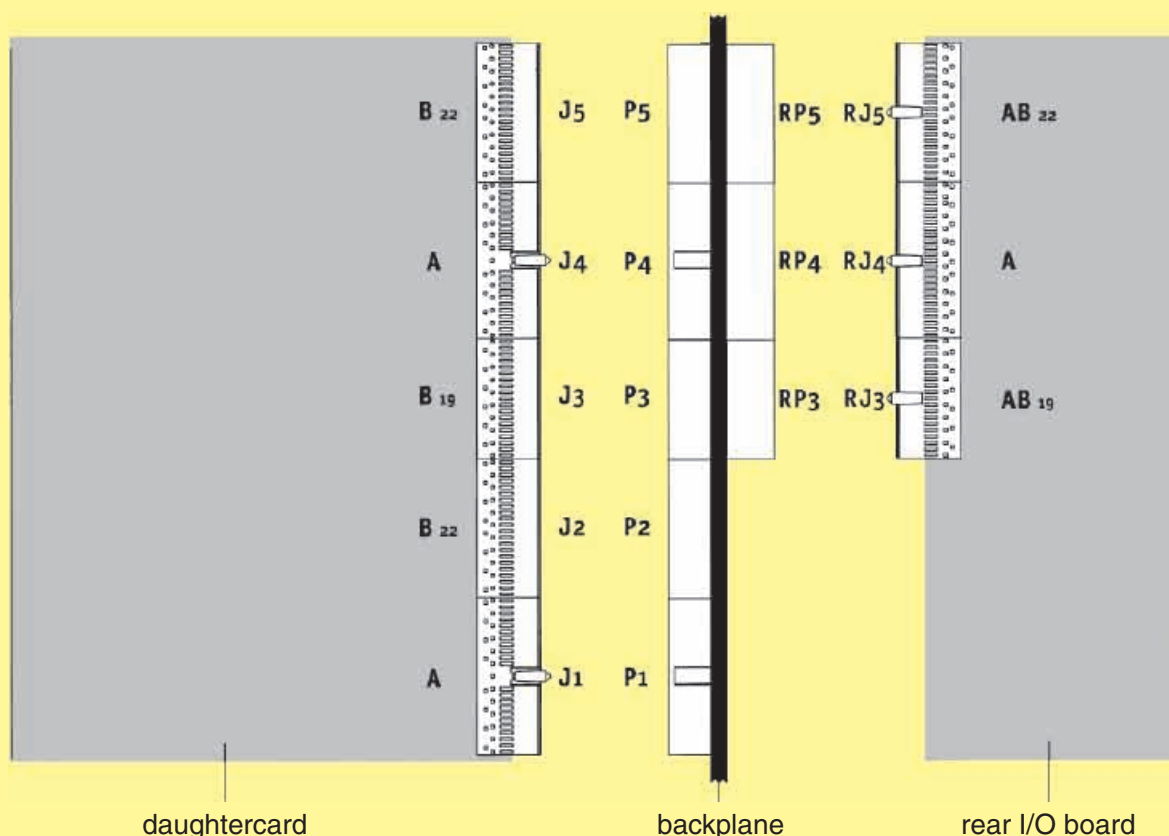
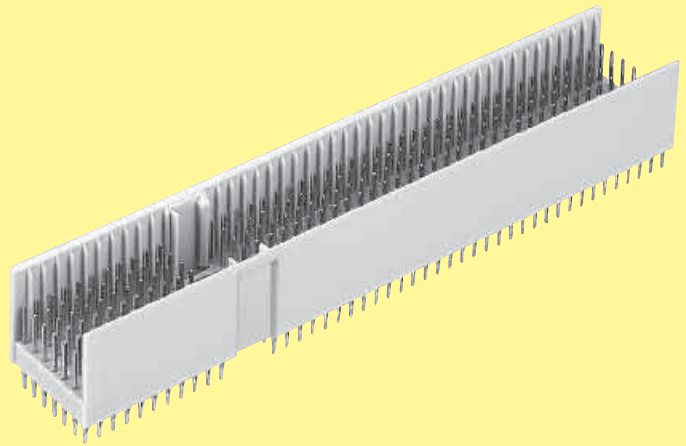


Fig. 3: CompactPCI 6U configuration

CompactPCI[®] as a standard is maintained and enhanced by the PCI Industrial Computer Manufacturers Group (PICMG[®]). 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[®] standard for environmental and related specifications. This gives CompactPCI[®]

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

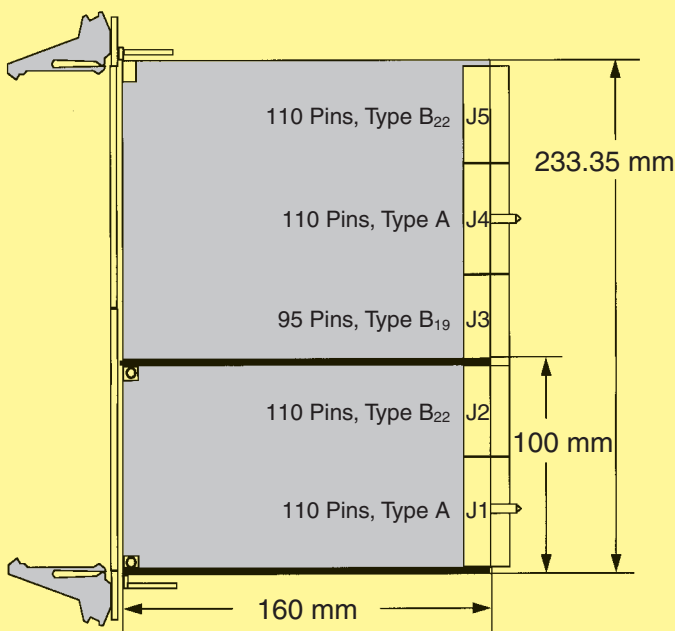


As opposed to the CPCI standard (pins numbered from bottom to top), the contact numbers on the connector are numbered from top to bottom (according to the IEC standard).

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	SBC#	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.

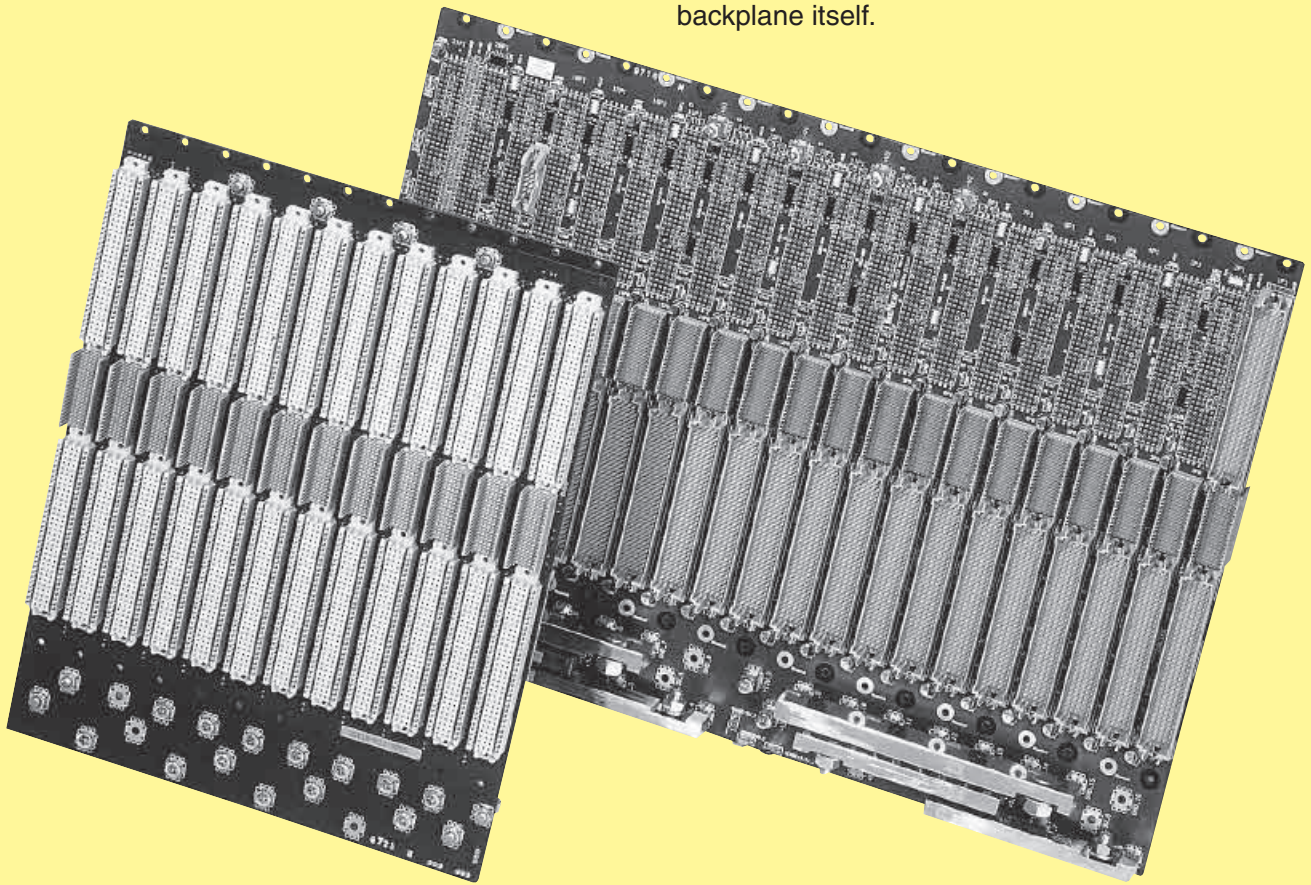
All connectors used for *CompactPCI[®]* are based on a 7 column pitch. The inner 5 columns are used for logic signals and power. The outer columns on either side are reserved for shielding or ground.



Executive Member

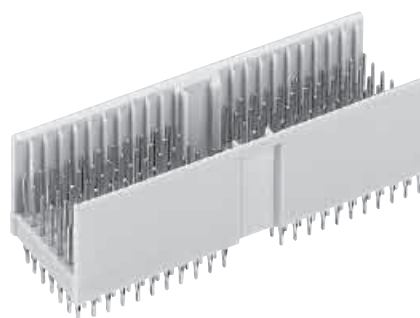
The VMEbus has evolved over a period of more than 25 years to become the leading bus architecture in open industrial applications. The specification is an ANSI norm, the original specification has been extended to become a draft standard VME64x ANSI/VITA 1.1-1997. This draft standard includes the specification 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.





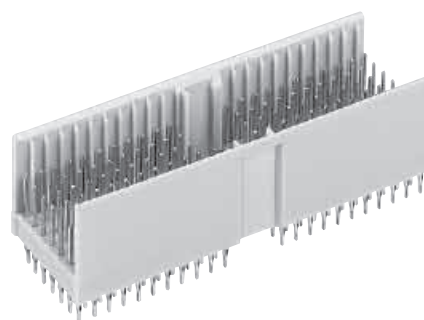
Male connectors, straight

Identification	Number of contacts	Contact length [mm] mating side 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	

Thin print part numbers: performance level 1

Bold print part numbers: performance level 2

Connector dimensions see page 00.14



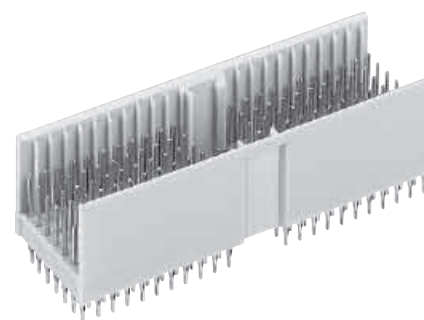
Male connectors, straight

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	

Thin print part numbers: performance level 1

Bold print part numbers: performance level 2

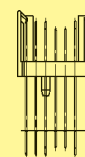
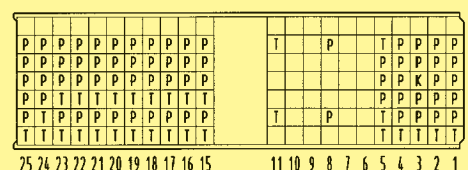
Connector dimensions see page 00.14



Type A
CompactPCI
computer
telephony
Position P4

Number of contacts	Contact mating side	length [mm] termination side
100	/ 8.2/ / 9.7/ 11.2	/13.0/ /14.5/ 16.0

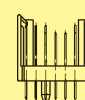
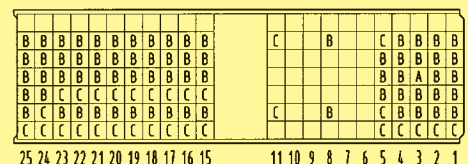
17 01 100 1001
17 01 100 2001



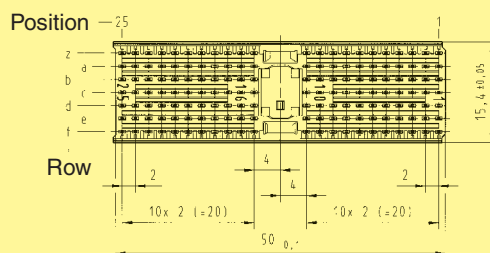
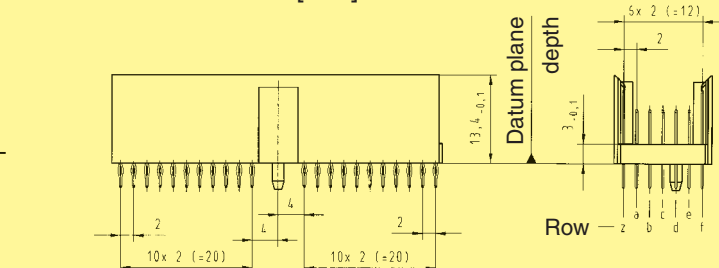
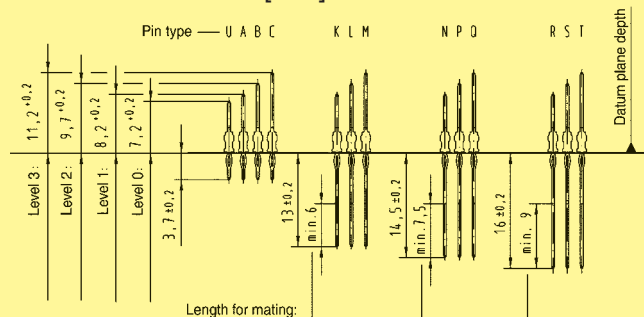
Type A
CompactPCI
computer
telephony
Position P4

100	/ 8.2/ / 9.7/ 11.2	3.7
-----	--------------------------	-----

17 01 100 1201
17 01 100 2201



Connector dimensions [mm]



Board drillings

Board drillings

Position — 25

Row

$\phi 2 \pm 0,1$

$\phi 0,6 \pm 0,05$

All holes $\phi \pm 0,05$

z

a

b

c

d

e

f

1

2

4

2

2

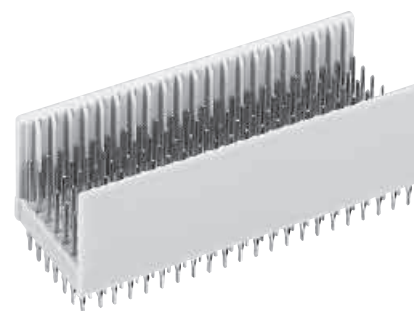
2

10 x 2 (=20)

10 x 2 (=20)

6 x 2 (=12)

00.
14



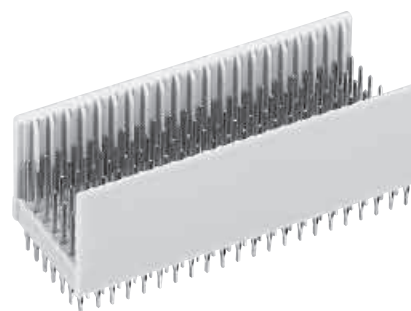
Male connectors, straight

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	

Thin print part numbers: performance level 1

Bold print part numbers: performance level 2

Connector dimensions see page 00.18



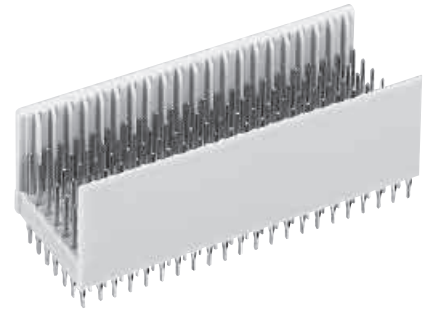
Male connectors, straight

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	

Thin print part numbers: performance level 1

Bold print part numbers: performance level 2

Connector dimensions see page 00.18

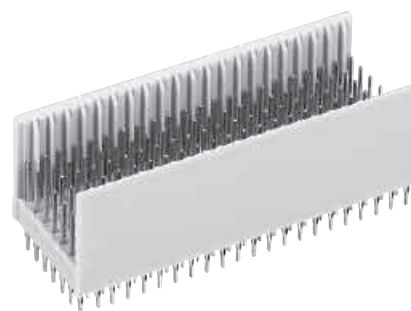


Male connectors, straight

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 17 05 095 2201	
Type B19 VME Position J0	133	8.2/ 11.2 3.7	17 05 133 1201 17 05 133 2201	
Type B19 VME Position J0	133	9.7/ 11.2 3.7	17 05 133 1203 17 05 133 2203	
Type B19 VME Position J0	95	8.2 13.0	17 05 095 1401 17 05 095 2401	
Type B19 CompactPCI AB friendly Position P3	133	9.7/ 11.2 3.7/ 16.0	17 05 133 1005 17 05 133 2005	
Type B19 Compact PCI Position P3 VME Position J0	133	8.2/ 11.2 16.0	17 05 133 1602 17 05 133 2602	

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

Connector dimensions see page 00.18

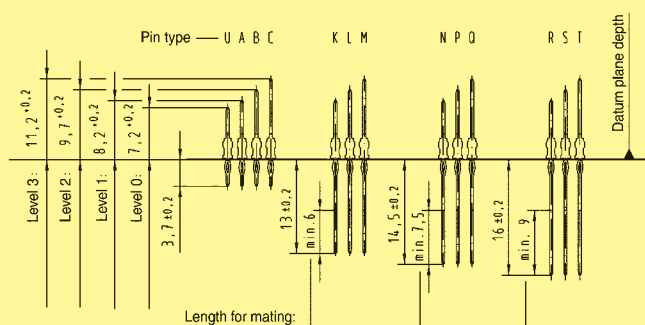


Male connectors, straight

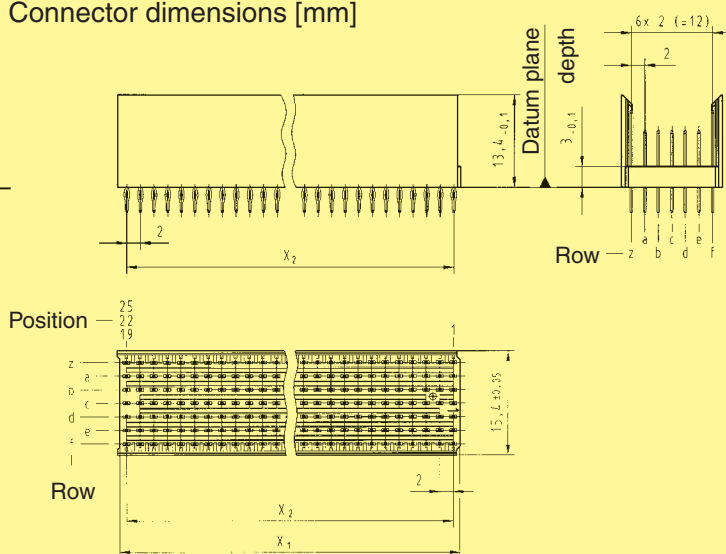
Drawing

Dimensions in mm

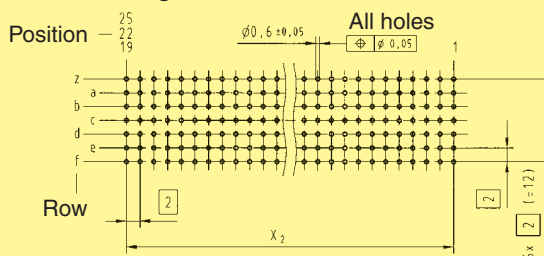
Contact dimensions [mm]



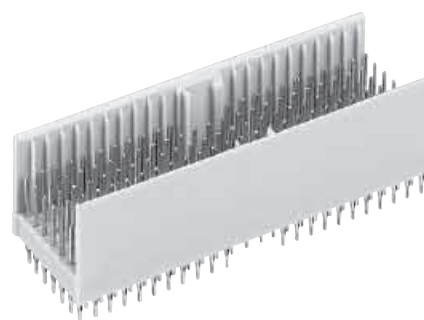
Connector dimensions [mm]



Board drillings



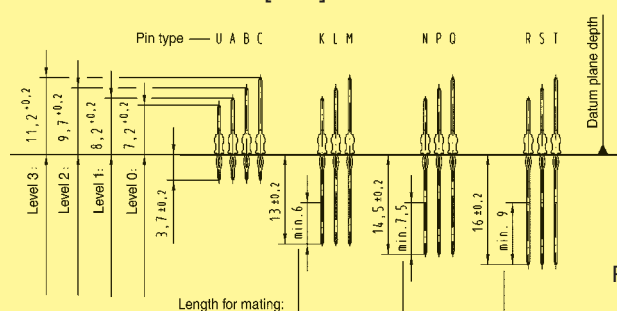
Contact positions	x ₁	x ₂
19	37.9	18 x 2 (= 36)
22	43.9	21 x 2 (= 42)
25	49.9	24 x 2 (= 48)



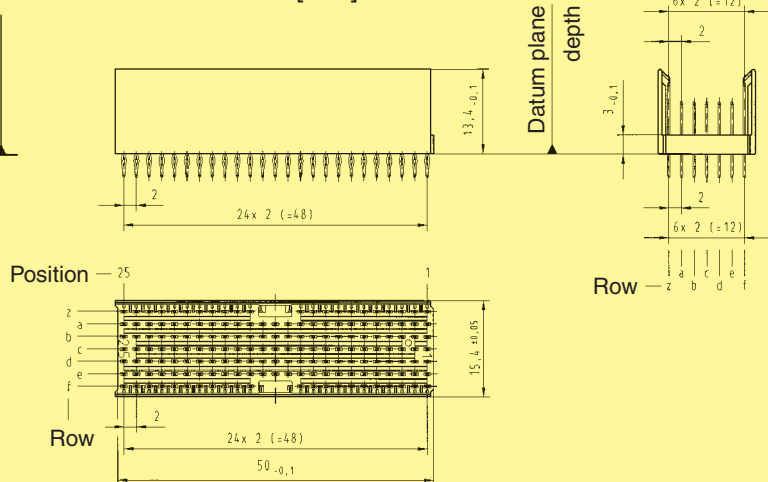
Male connectors, straight

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

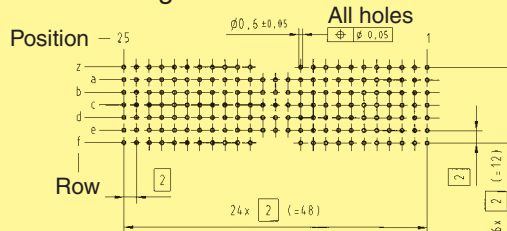
Contact dimensions [mm]

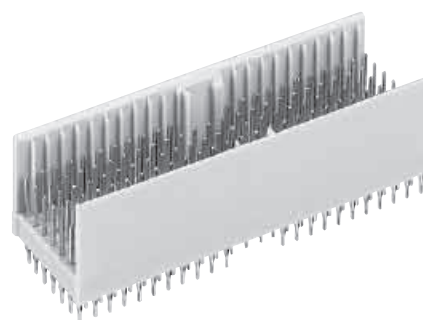


Connector dimensions [mm]



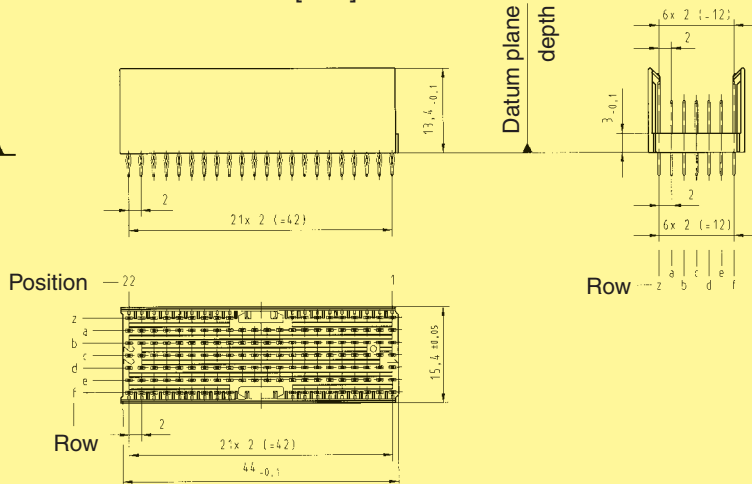
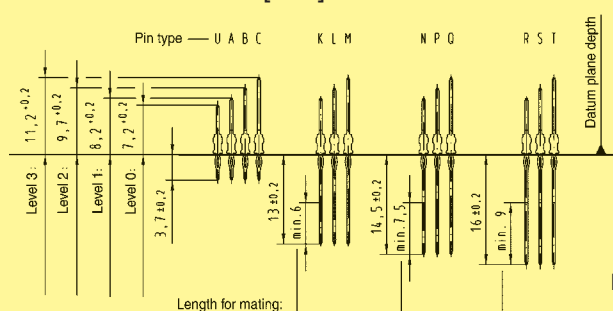
Board drillings



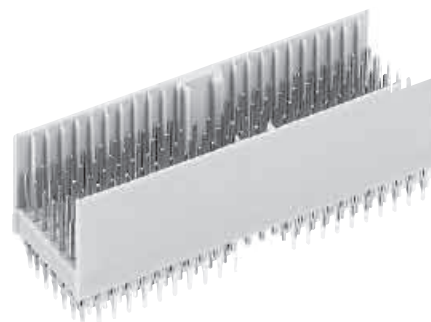


Identification	Number of contacts	Contact length [mm] mating side	termination side	Part number	Contact configuration
Type AB ₂₂	110	8.2	3.7	17 14 110 1201 17 14 110 2201	
Type AB ₂₂	146	8.2/ 11.2	3.7	17 14 146 1201 17 14 146 2201	
Type AB ₂₂	146	9.7/ 11.2	16.0	17 14 146 1601 17 14 146 2601	

Connector dimensions [mm]



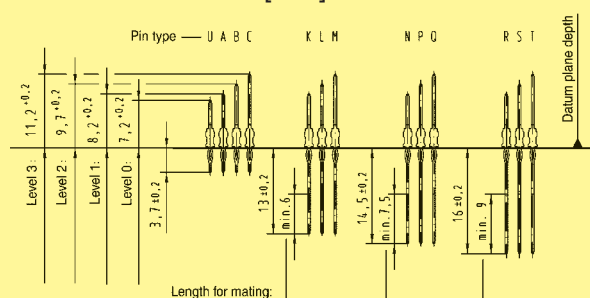
00
20



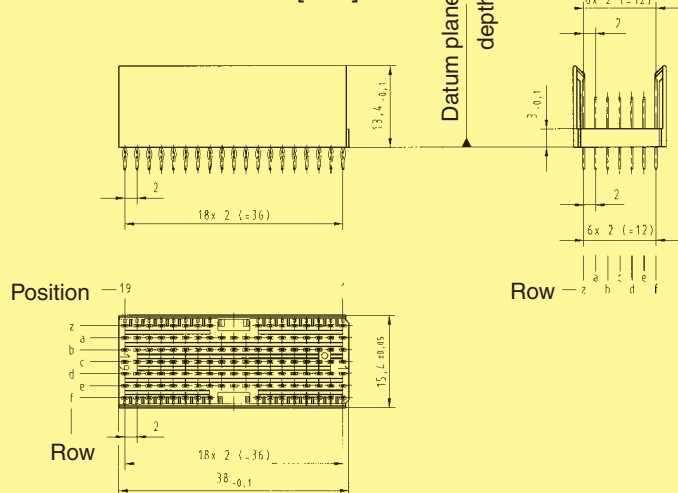
Male connectors, straight

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

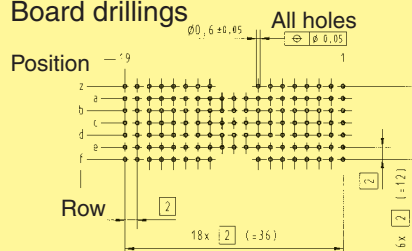
Contact dimensions [mm]

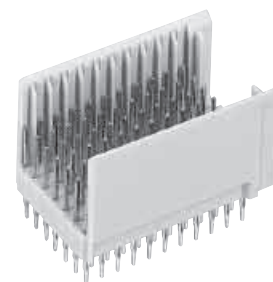


Connector dimensions [mm]



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	17 03 055 1201 17 03 055 2201
Type C	77	8.2/ 11.2	3.7	17 03 077 1201 17 03 077 2201
Type C	55	9.7	3.7	17 03 055 1202 17 03 055 2202
Type C	77	9.7/ 11.2	3.7	17 03 077 1202 17 03 077 2202
Type C	55	8.2	13.0	17 03 055 1401 17 03 055 2401
Type C	66	8.2/ 11.2	13.0/ 16.0	17 03 066 1001 17 03 066 2001

Thin print part numbers: performance level 1

Bold print part numbers: performance level 2

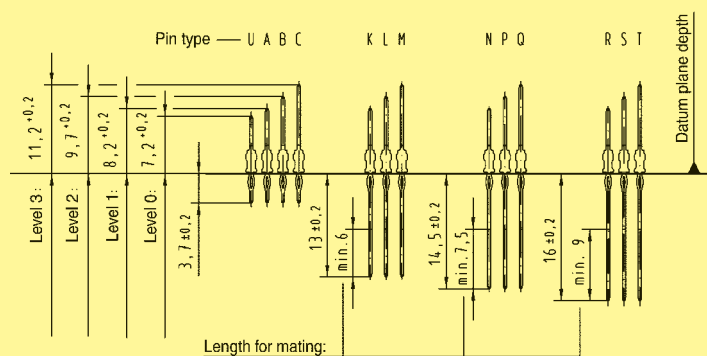
Connector dimensions see page 00.23



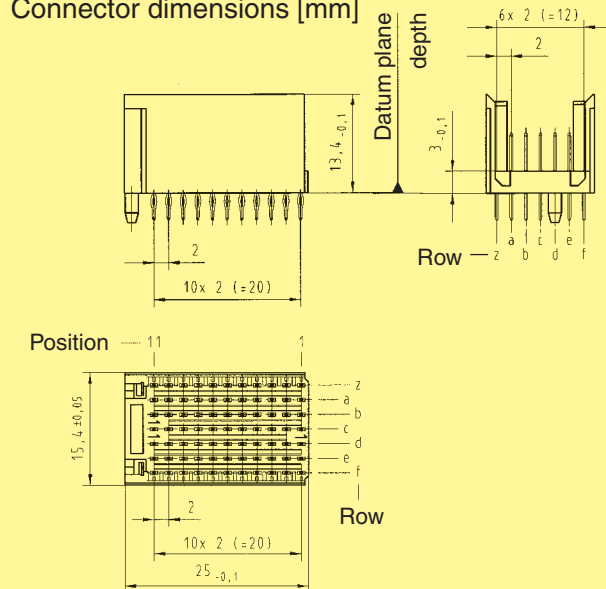
Male connectors, straight

Identification	Number of contacts	Contact mating side	Contact length [mm] 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	

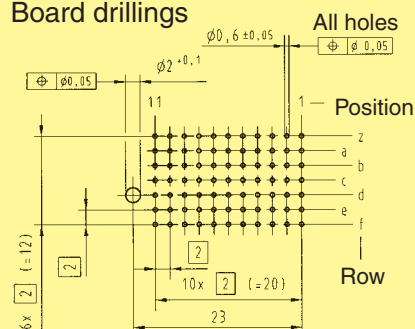
Contact dimensions [mm]

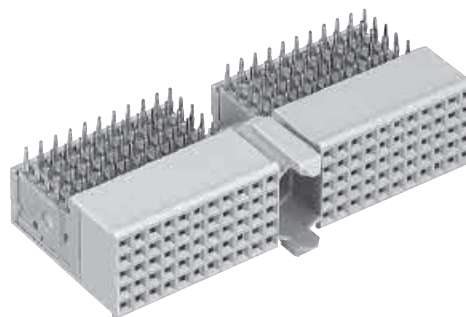


Connector dimensions [mm]



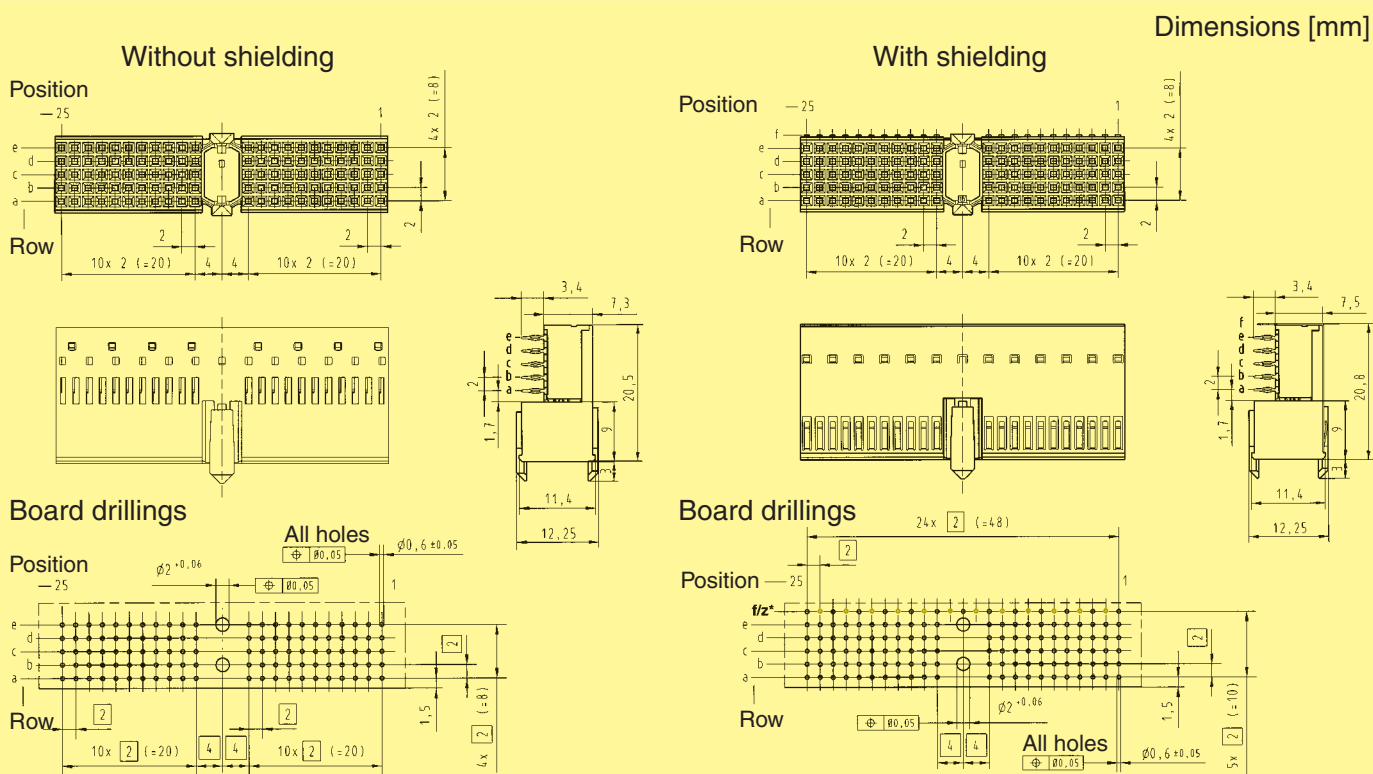
Board drillings





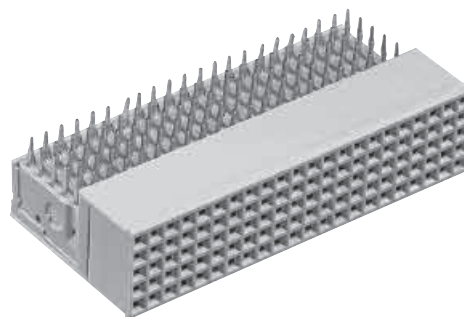
Female connectors, angled

Identification	No. of contacts	Contact length [mm] termination side	Part number	
Type A	110	3.4	17 21 110 1101 17 21 110 2101	
Type A with upper shield CompactPCI Positions J1, J4	110	3.4	17 21 110 1102 17 21 110 2102	
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 17 21 090 2103	
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

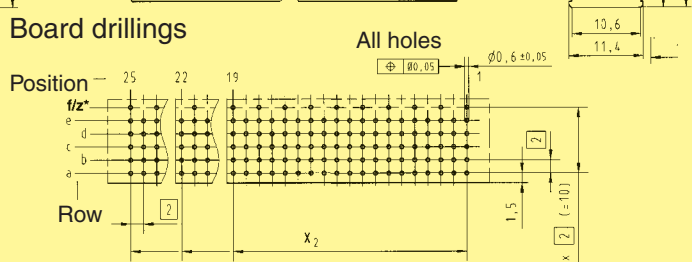
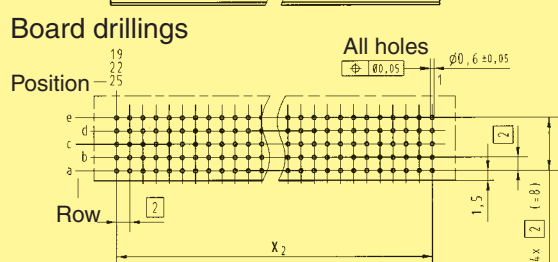
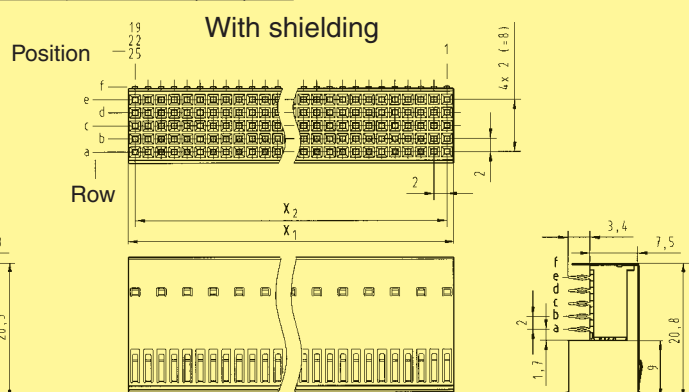
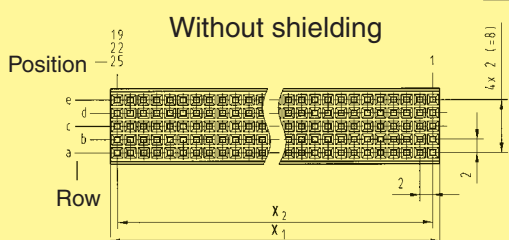


Female connectors, angled

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

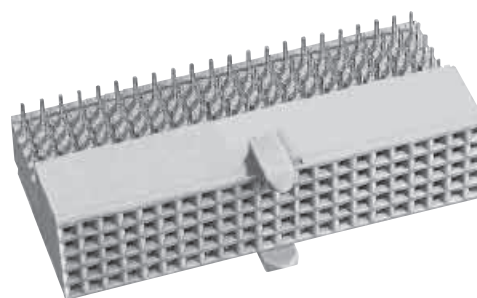
Contact positions	X ₁	X ₂
19	37.9	18 x 2 (= 36)
22	43.9	21 x 2 (= 42)
25	49.9	24 x 2 (= 48)

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

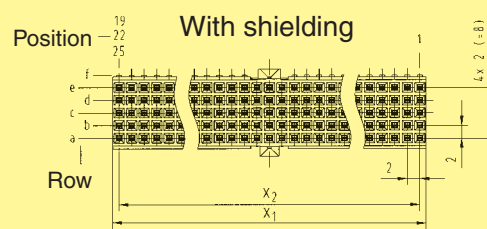
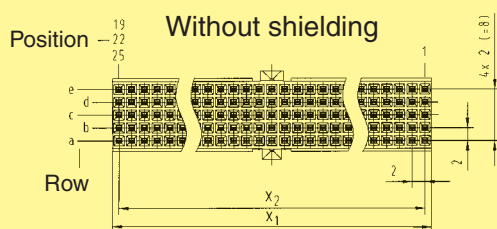


Female connectors, angled

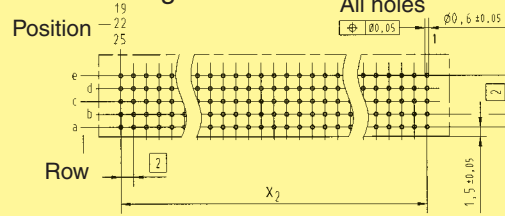
Identification	No. of contacts	Contact length [mm] termination side	Part number	
Type AB ₁₉	95	3.4	17 33 095 1101 17 33 095 2101	
Type AB ₁₉ with upper shield CompactPCI, Position RJ3	95	3.4	17 33 095 1102 17 33 095 2102	
Lower shield for type AB ₁₉ connectors			17 33 000 4102	
Type AB ₂₂	110	3.4	17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

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

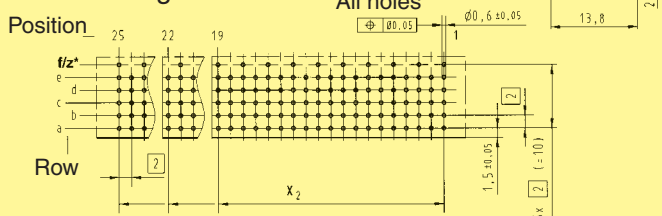
Dimensions [mm]



Board drillings

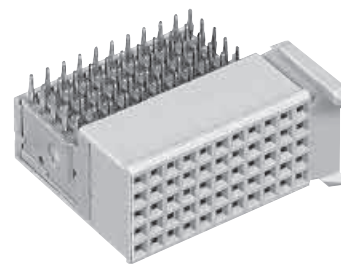


Board drillings



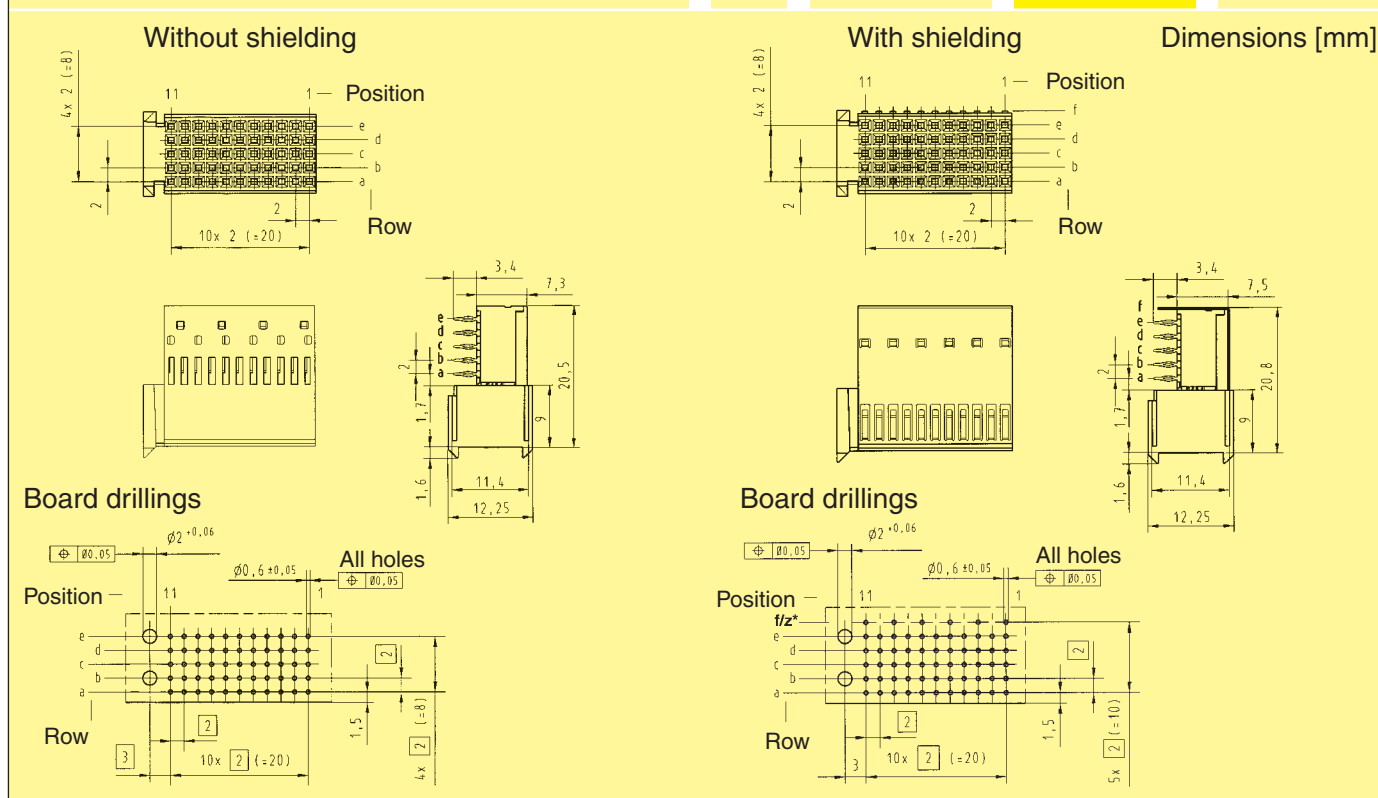
Thin print part numbers: performance level 1
Bold print part numbers: performance level 2

* hole on even contact numbers
 only needed for lower shielding



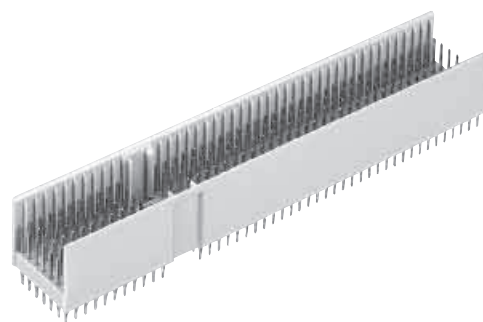
Female connectors, angled

Identification	No. of contacts	Contact length [mm] termination side	Part number	
Type C	55	3.4	17 23 055 1101 17 23 055 2101	
Type C with upper shield	55	3.4	17 23 055 1102 17 23 055 2102	
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



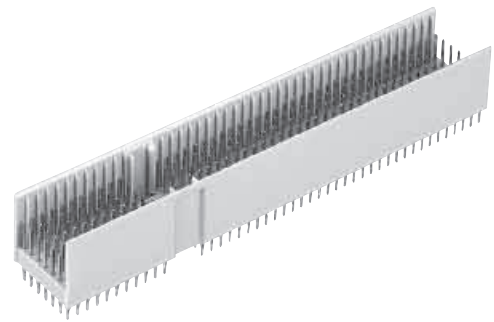
Male connectors, straight

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 17 06 220 2201	
Type Monoblock 47	308	8.2/ 11.2 3.7	17 06 308 1201 17 06 308 2201	
Type Monoblock 47	220	9.7 3.7	17 06 220 1202 17 06 220 2202	
Type Monoblock 47 CompactPCI Positions P1 and P2	308	8.2/ 9.7/ 11.2 3.7	17 06 308 1202 17 06 308 2202	
Type Monoblock 47 CompactPCI hot swap	308	8.2/ 9.7/ 11.2 3.7	17 06 308 1203 17 06 308 2203	
Type Monoblock 47 CompactPCI computer telephony	232	8.2/ 9.7/ 11.2 3.7	17 06 232 1201 17 06 232 2201	

Thin print part numbers: performance level 1

Bold print part numbers: performance level 2

Connector dimensions see page 00.29

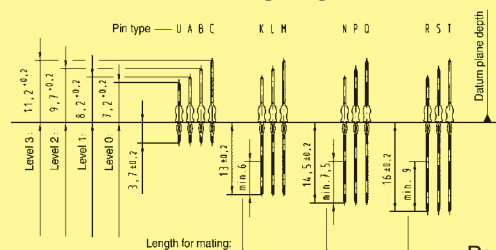


Wah Sing Lee

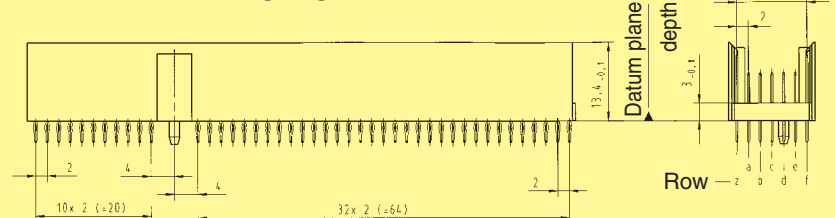
Male connectors, straight

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 17 06 308 2001	
Type Monoblock 47 CompactPCI AB friendly Positions P4 and P5	308	9.7/ 11.2	3.7/ 16.0	17 06 308 1005 17 06 308 2005	

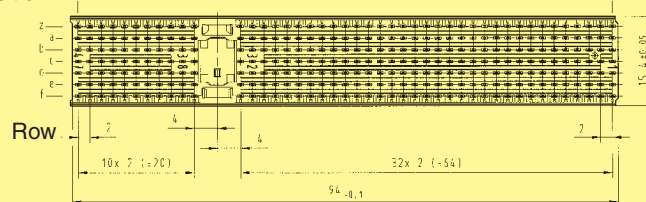
Contact dimensions [mm]



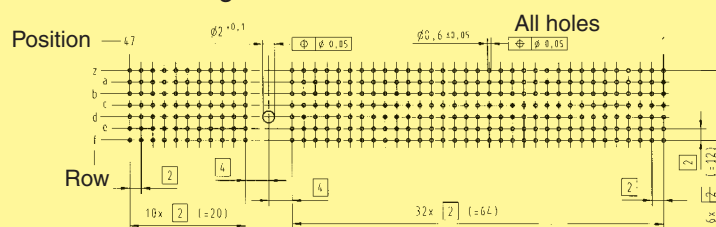
Connector dimensions [mm]



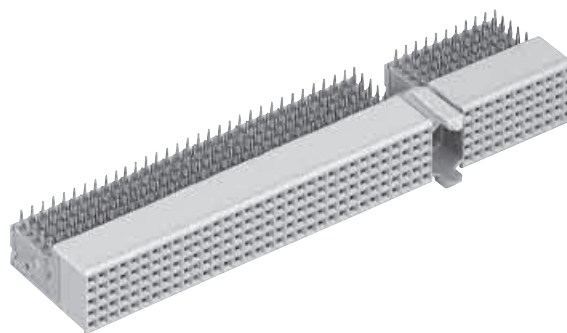
Position - 47



Board drillings



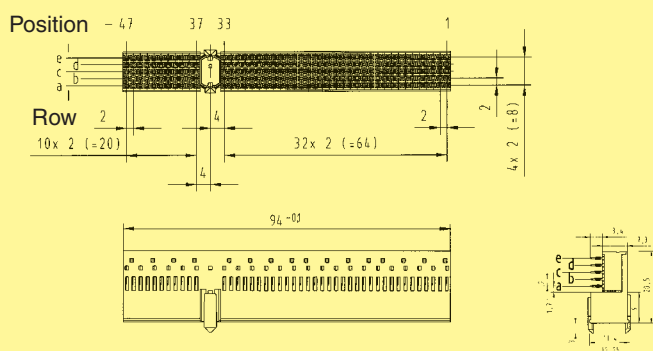
Thin print part numbers: performance level 1
Bold print part numbers: performance level 2



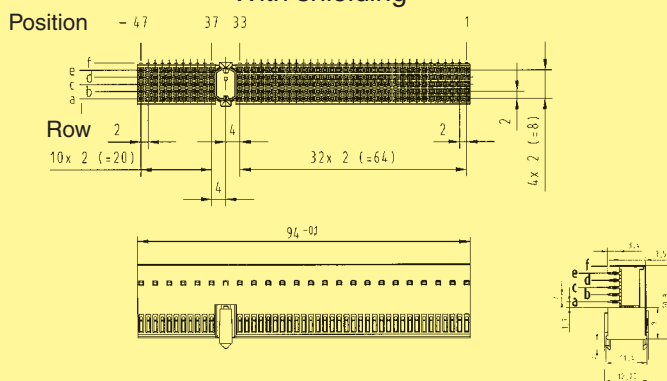
Female connectors, angled

Identification	No. of contacts	Contact length [mm] termination side	Part number	
Type Monoblock 47	220	3.4	17 26 220 1101 17 26 220 2101	
Type Monoblock 47 with upper shield	220	3.4	17 26 220 1102 17 26 220 2102	
Type Monoblock 47 with upper shield CompactPCI computer telephony	200	3.4	17 26 200 1103 17 26 200 2103	
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	

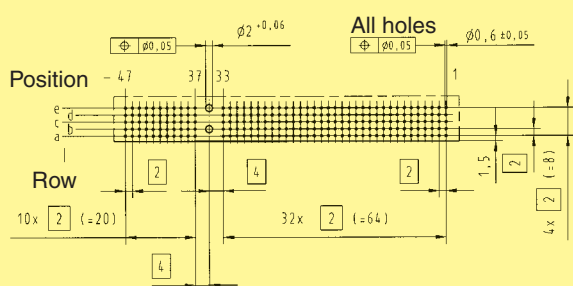
Without shielding



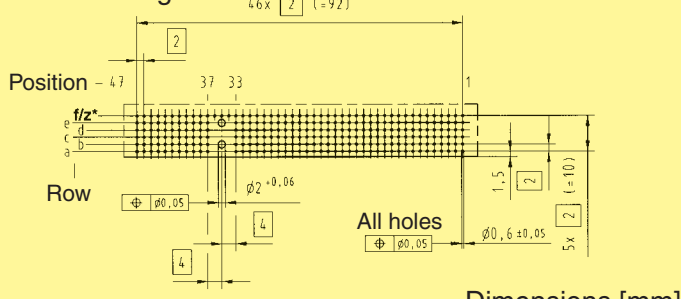
With shielding



Board drillings



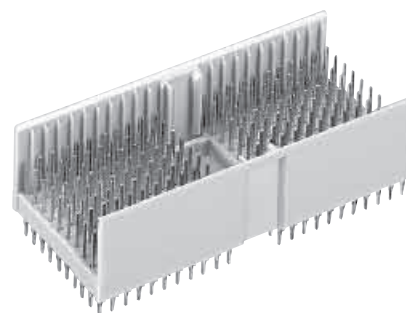
Board drillings



Dimensions [mm]

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

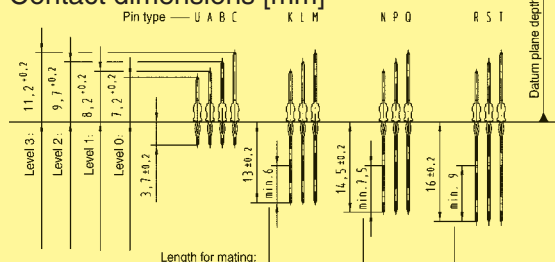
* hole on even contact numbers
 only needed for lower shielding



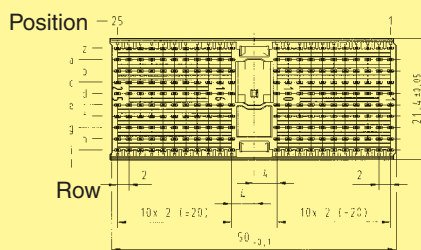
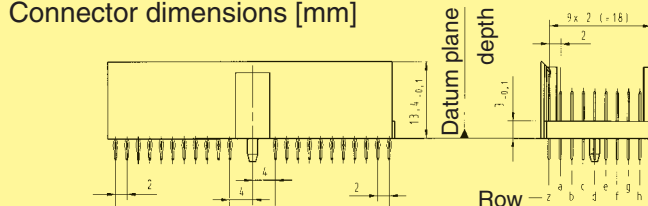
Male connectors, straight

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	

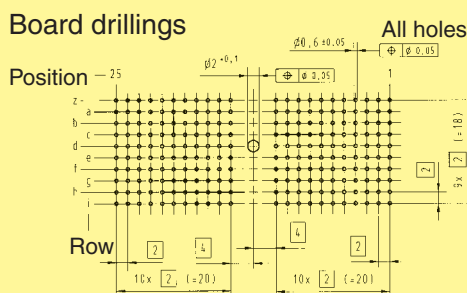
Contact dimensions [mm]



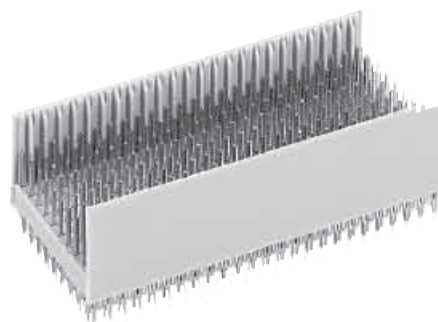
Connector dimensions [mm]



Board drillings



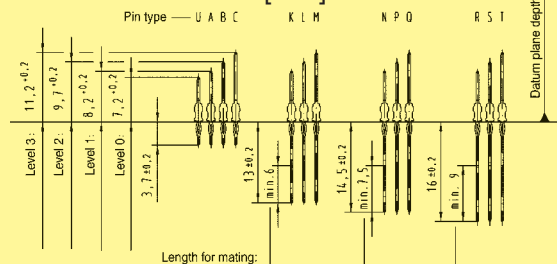
Thin print part numbers: performance level 1
Bold print part numbers: performance level 2



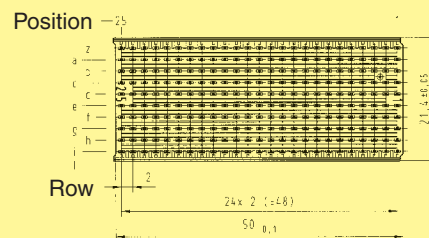
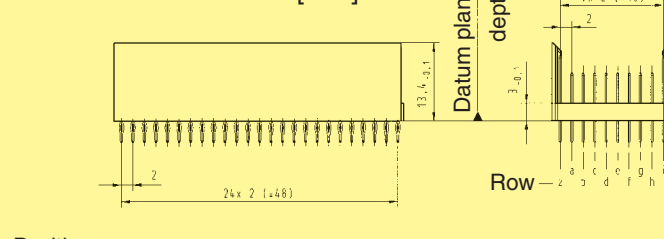
Male connectors, straight

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	

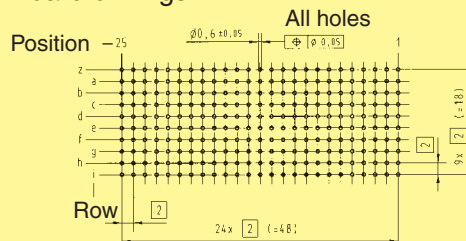
Contact dimensions [mm]



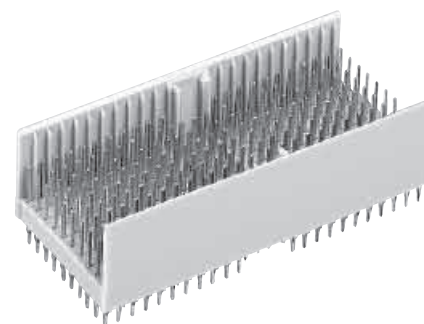
Connector dimensions [mm]



Board drillings



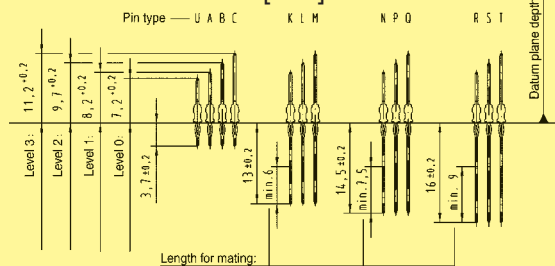
Thin print part numbers: performance level 1
Bold print part numbers: performance level 2



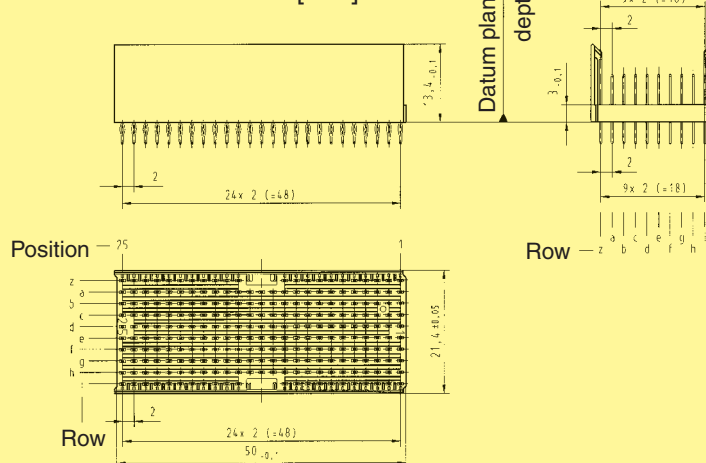
Male connectors, straight

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	

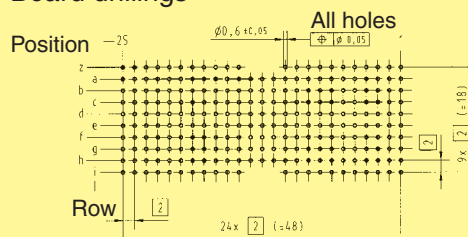
Contact dimensions [mm]



Connector dimensions [mm]



Board drillings



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

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
	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
	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

All codings are in acc. with the IEC 61076-4-101 specification

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

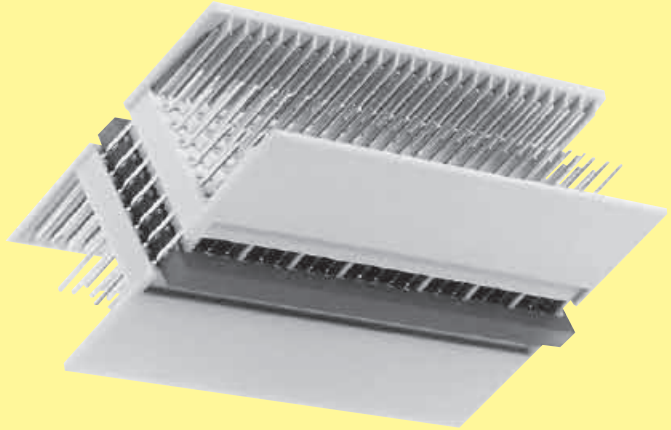
To accommodate pcb thickness, from 1.6 up to 4 mm nominal, the shrouds have integrated standoffs of corresponding height.

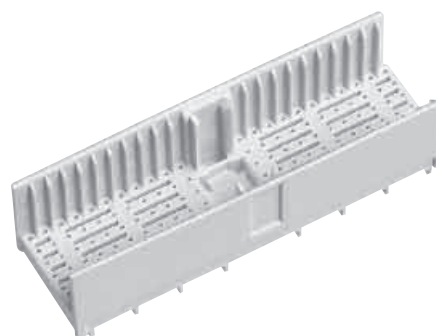
Thus forming a one piece solution that reduces assembling cost significantly.

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 ± 0.4

2.4 ± 0.4

3.2 ± 0.4

4.0 ± 0.4

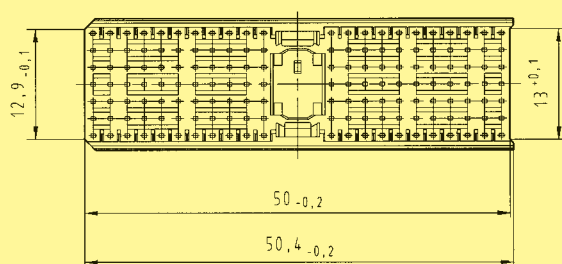
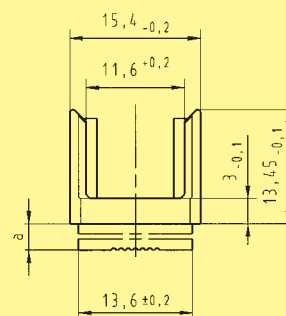
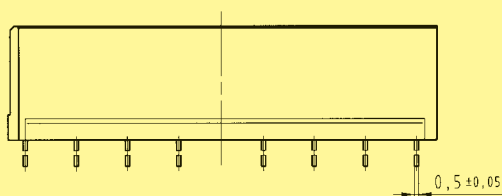
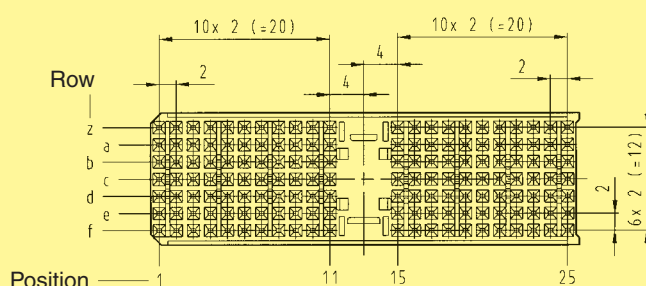
17 70 000 1001

17 70 000 1002

17 70 000 1003

17 70 000 1004

Dimensions



Board thickness [mm]	a [mm]
1.6 ± 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

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

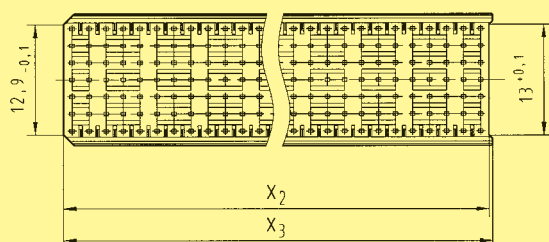
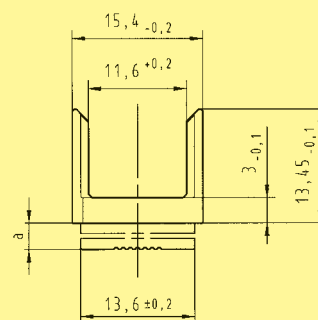
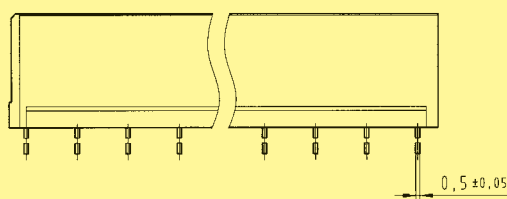
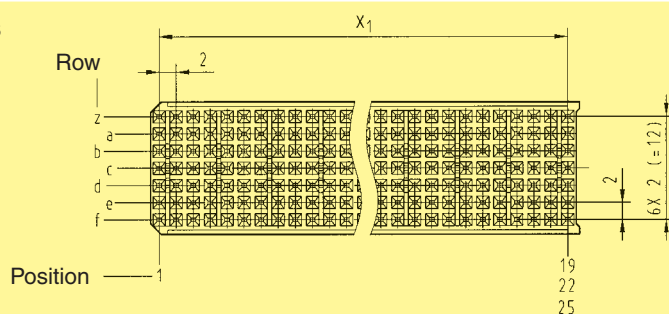
17 70 000 5001

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 ₁ [mm]	x ₂ [mm]	x ₃ [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
2.4 ± 0.4
3.2 ± 0.4
4.0 ± 0.4

17 70 000 8001
17 70 000 8002
17 70 000 8003
17 70 000 8004

22 positions

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

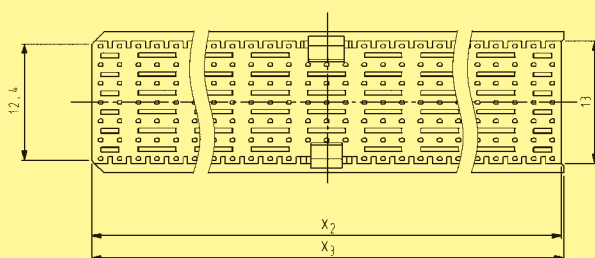
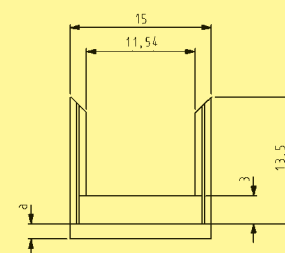
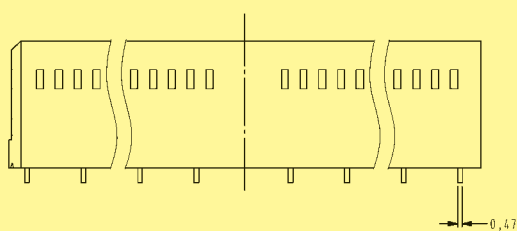
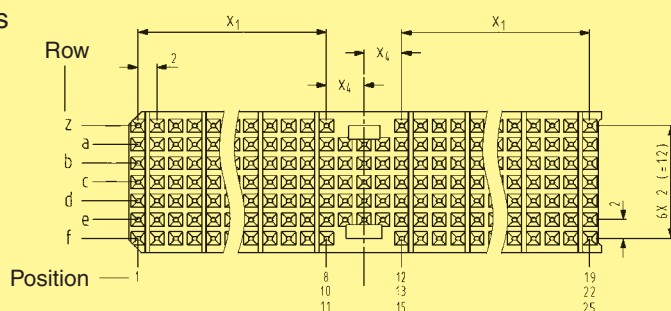
17 70 000 7001
17 70 000 7002
17 70 000 7003
17 70 000 7004

19 positions

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

17 70 000 6001
17 70 000 6002
17 70 000 6003
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 ₁ [mm]	x ₂ [mm]	x ₃ [mm]	x ₄ [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

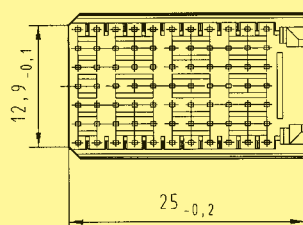
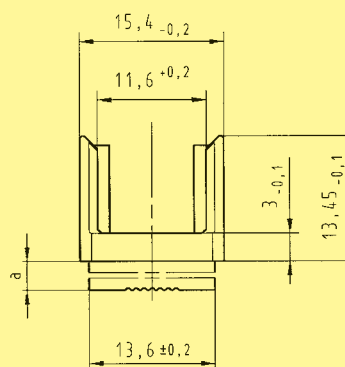
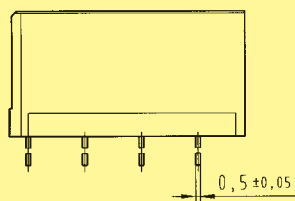
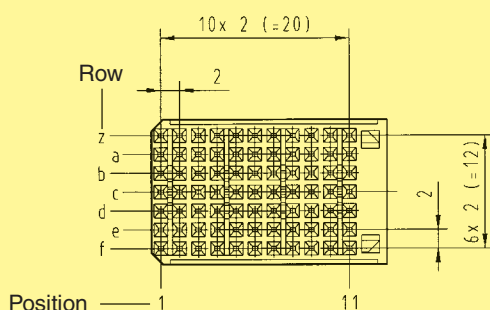
17 70 000 3001

17 70 000 3002

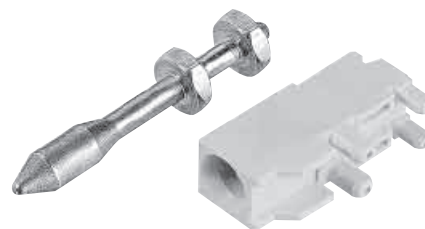
17 70 000 3003

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

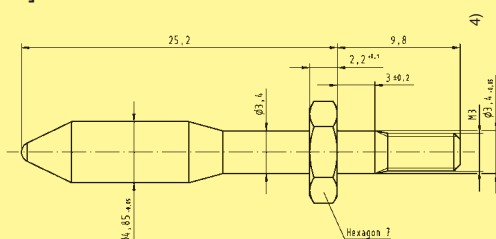
17 79 000 0080

Receptacle for guide pin

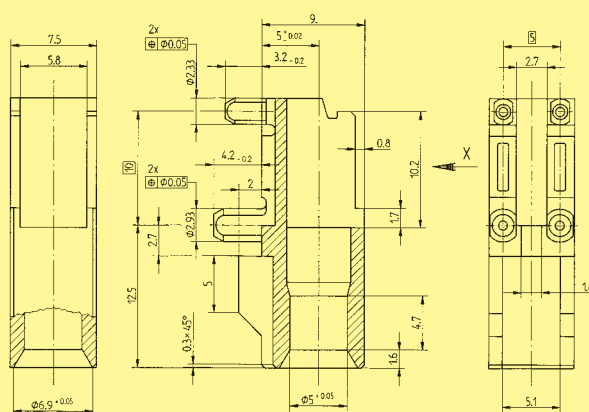
07 73 000 0280

Dimensions [mm]

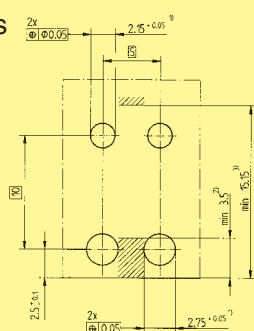
Guide pin



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

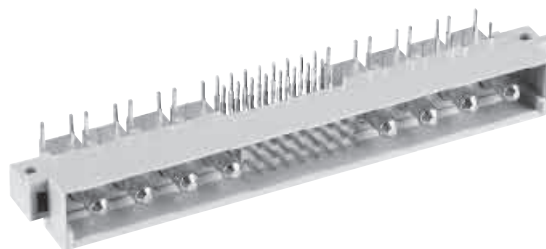
The guide pin solution from HARTING allows safe mating under sometimes extreme conditions. This might be large and heavy boards that bow under their own weight. Also insufficiently aligned or worn out rack systems can be tolerated better with the use of HARTING's guiding system, which also reduces the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

Recommended accessories: hexagon nut ISO 4032-M3-8
serrated lock washer DIN 6798-A-3.2 FSt



Type M male connectors

Identification	Number of contacts	Contact arrangement	Performance levels according to IEC 60603-2		
			Part No. 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, high voltage and coaxial **contacts separately**, see page 00.44

[illegible]

Dimensions in mm

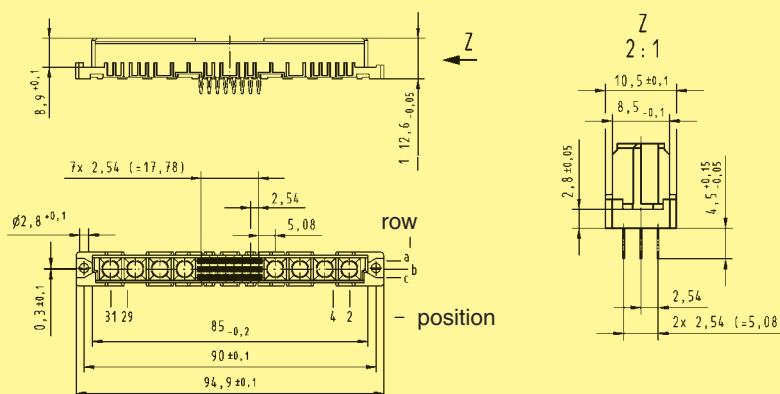


DIN 41 612

Complementary type M-flat female connectors

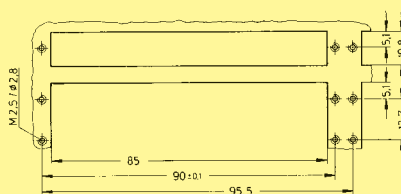
Identification	Number of contacts	Contact arrangement	Part No. 3	Performance levels according to IEC 60 603-2 2	1
Female connector with press-in terminations 4.5 mm	24 + 8		Performance level 3 on request	09 03 224 6830	Performance level 1 on request
High current female contact with press-in termination	30 A		09 03 000 6250		

Dimensions



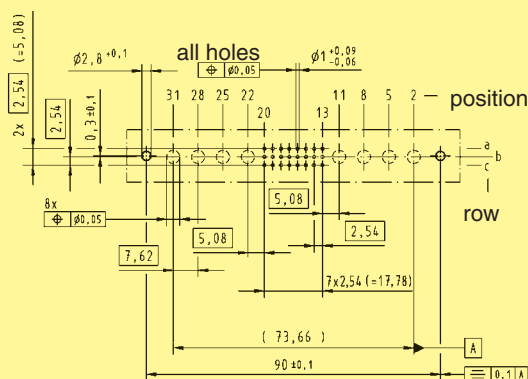
Order high current, high voltage and coaxial **contacts separately**, see page 00.44

Panel cut out



Board drillings

Mounting side



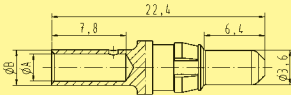
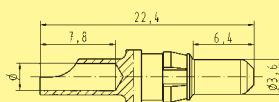
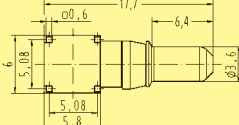
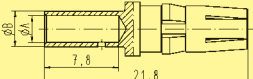
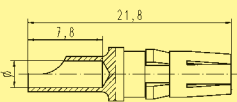
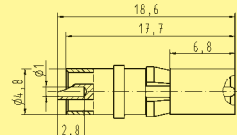
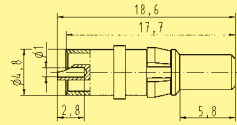
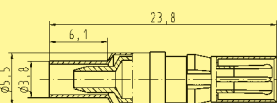
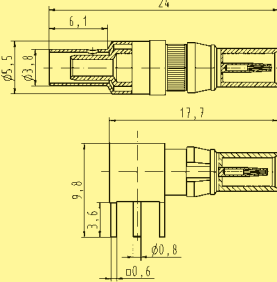
Recommended configuration of plated through holes (signal contacts) see chapter 05

Dimensions in mm

Pre-loaded with special contacts on request
Further types see DIN 41 612 catalogue

Contacts

harting® HM

Identification	Part No. Performance level 2	Drawing	Dimensions in mm																				
High current male contacts for female moulding angled for straight crimp termination  10 A 20 A 40 A for straight solder termination  10 A  20 A  40 A for angled pcb termination  40 A	 09 03 000 6113 09 03 000 6114 09 03 000 6115 09 03 000 6101 09 03 000 6102 09 03 000 6103 09 03 000 6104	 <table><tr><td></td><td>ø A</td><td>ø B</td></tr><tr><td>10 A</td><td>1.85</td><td>2.55</td></tr><tr><td>20 A</td><td>2.85</td><td>3.70</td></tr><tr><td>40 A</td><td>4.40</td><td>5.60</td></tr></table>  <table><tr><td></td><td>ø</td></tr><tr><td>10 A</td><td>1.7</td></tr><tr><td>20 A</td><td>2.8</td></tr><tr><td>40 A</td><td>4.8</td></tr></table> 		ø A	ø B	10 A	1.85	2.55	20 A	2.85	3.70	40 A	4.40	5.60		ø	10 A	1.7	20 A	2.8	40 A	4.8	
	ø A	ø B																					
10 A	1.85	2.55																					
20 A	2.85	3.70																					
40 A	4.40	5.60																					
	ø																						
10 A	1.7																						
20 A	2.8																						
40 A	4.8																						
High current female contacts for male moulding straight¹⁾ for straight crimp termination  10 A 20 A 40 A for straight solder termination  10 A  20 A  40 A	 09 03 000 6213 09 03 000 6214 09 03 000 6215 09 03 000 6201 09 03 000 6202 09 03 000 6203	 <table><tr><td></td><td>ø A</td><td>ø B</td></tr><tr><td>10 A</td><td>1.85</td><td>2.55</td></tr><tr><td>20 A</td><td>2.80</td><td>3.70</td></tr><tr><td>40 A</td><td>4.40</td><td>5.60</td></tr></table>  <table><tr><td></td><td>ø</td></tr><tr><td>10 A</td><td>1.7</td></tr><tr><td>20 A</td><td>2.8</td></tr><tr><td>40 A</td><td>4.8</td></tr></table>		ø A	ø B	10 A	1.85	2.55	20 A	2.80	3.70	40 A	4.40	5.60		ø	10 A	1.7	20 A	2.8	40 A	4.8	
	ø A	ø B																					
10 A	1.85	2.55																					
20 A	2.80	3.70																					
40 A	4.40	5.60																					
	ø																						
10 A	1.7																						
20 A	2.8																						
40 A	4.8																						
High voltage male contact for male moulding straight²⁾ for straight solder termination  2.8 kV	09 03 000 6140																						
High voltage female contact for female moulding angled²⁾ for straight solder termination  2.8 kV	09 03 000 6240																						
Male coaxial contact 50 Ω for male moulding straight for straight solder and/or crimp termination 	09 03 000 6160		for cables RG 174 A/U RG 188 A/U RG 316 U																				
Female coaxial contacts 50 Ω for female moulding angled for straight solder and/or crimp termination angled for pcb termination 	09 03 000 6274 09 03 000 6262		for cables RG 174 A/U RG 188 A/U RG 316 U																				
Crimping tool for high current contacts 	09 99 000 0196																						
Crimping tool for coaxial contacts 	09 99 000 0194																						

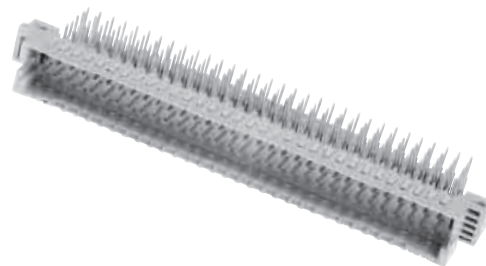
¹⁾ Contact resistance max. 1.5 mΩ

²⁾ Contact resistance internal wire max. 3 mΩ

Other contacts on request

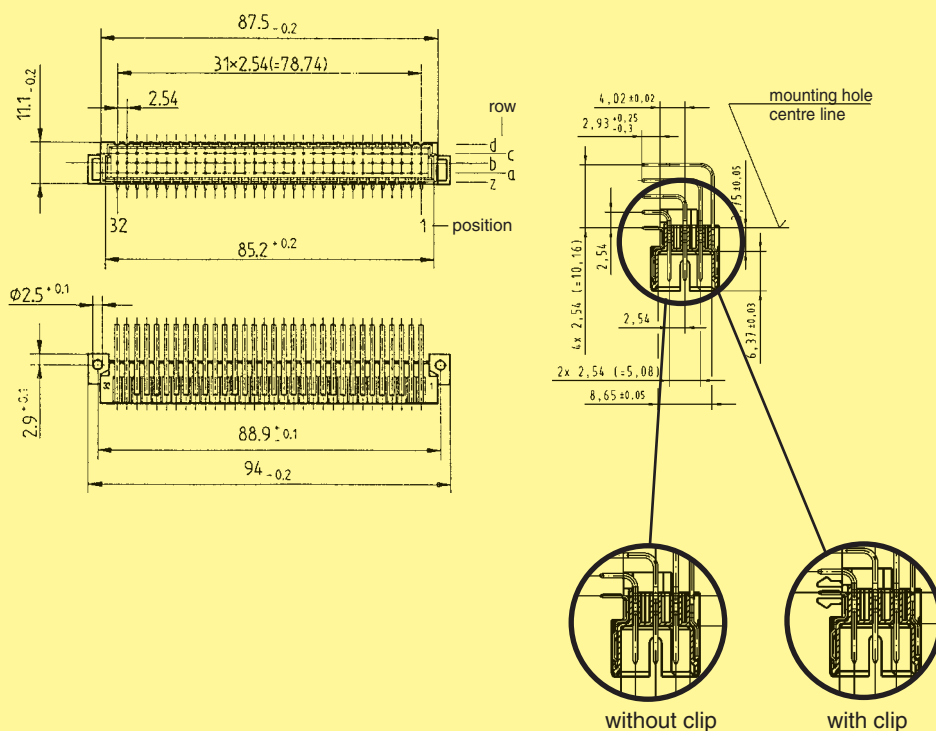
harbus® 64

Male connectors



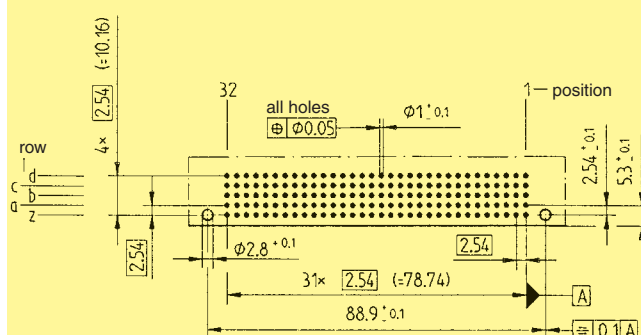
Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 61 076-4-113	
				2	1
Male connectors, angled ¹⁾					
SMC version with solder pins ²⁾					
without retention clip	160	z, a, b, c, d	02 01 160 2101		02 01 160 1101
with retention clip	160	z, a, b, c, d	02 01 160 2102		02 01 160 1102

Dimensions



Board drillings

Mounting side



Dimensions in mm

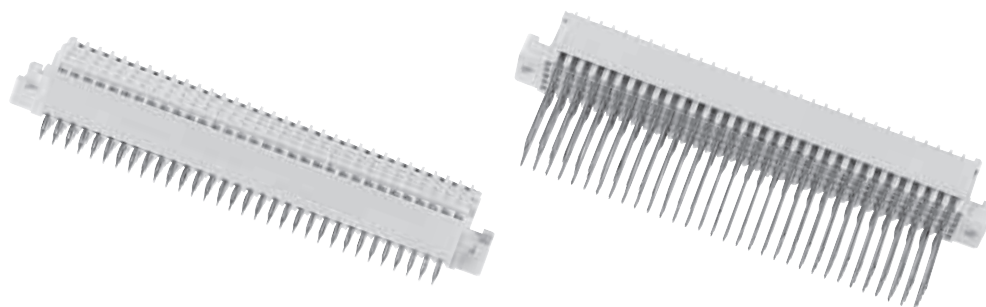
¹⁾ Pre-leading contacts at positions d1, d2, d31 and d32

²⁾ SMC see chapter 01

Further types see DIN 41 612 catalogue

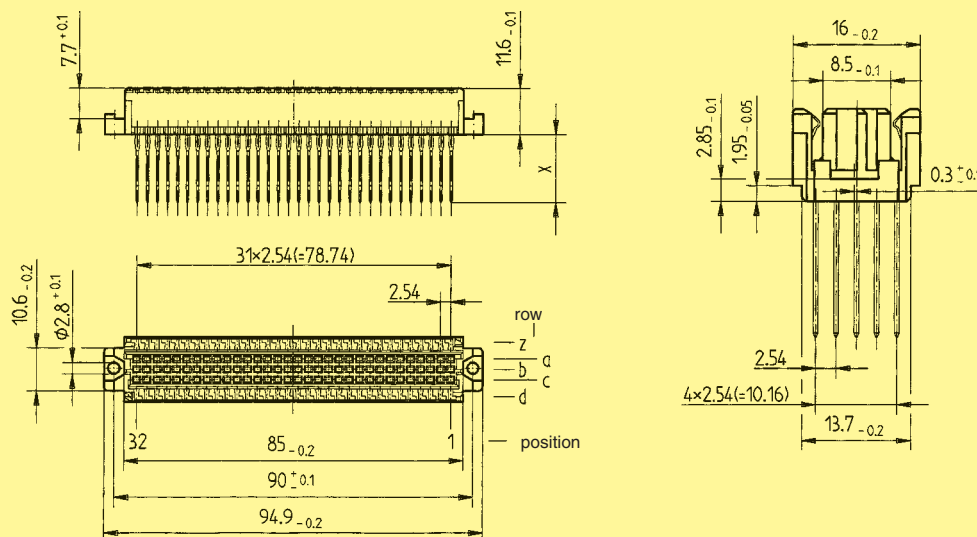
harbus® 64

Female connectors



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

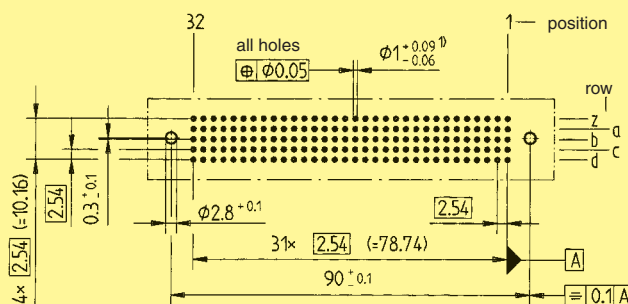
Dimensions



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

Board drillings

Mounting side



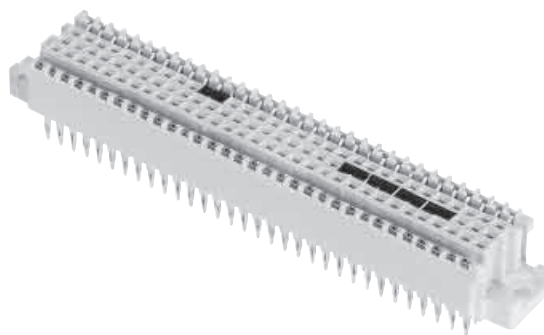
Recommended configuration of plated through holes see chapter 05

Dimensions in mm

1) Selectively gold-plated
Further types see DIN 41 612 catalogue

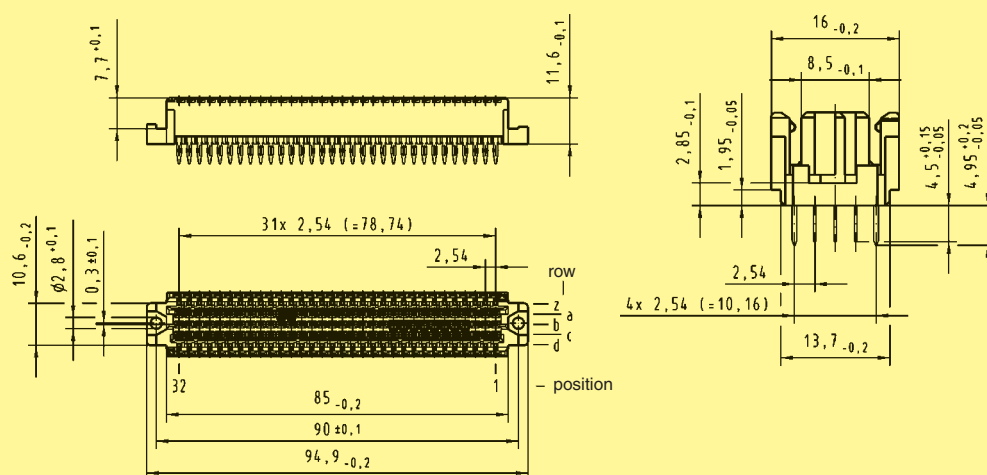
harbus® 64

Female connectors



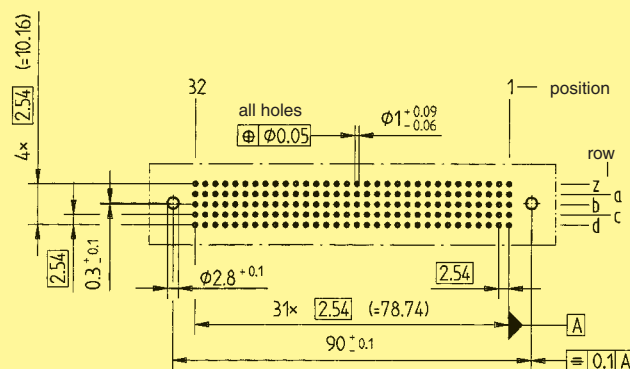
Identification	Number of contacts	Contact arrangement	Part No. Performance level 2 according to IEC 61 076-4-113
Female connectors, straight with switches ¹⁾			
with press-in terminations			
with flange 4.5/5 mm	160	z, a, b, c, d	02 03 160 2201

Dimensions



Board drillings

Mounting side



Recommended configuration of plated through holes see chapter 05

Dimensions in mm

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

harbus® HM with 6 rows, 2.00 mm pitch

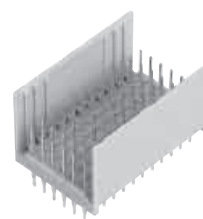
Page

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

harbus® HM
6-row

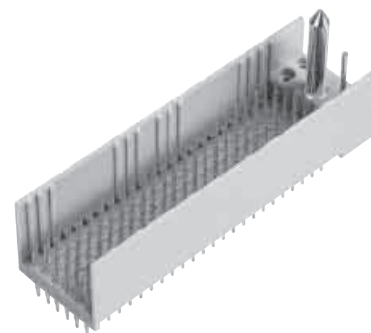
Design	: complementary to IEC 61 076-4-101 (2 mm hard metric specification)																
Number of contacts	: 72 or 144																
Contact spacing	: 2.00 mm (1.50 mm between contact rows on the termination side of female connectors)																
Working current	: 1.0 A (24 °C temp. raise) 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>0.6 ± 0.05 mm</td><td>0.7 ^{+0.07}_{-0.05} mm</td></tr> <tr> <td>Hole-Ø</td><td>0.7 ± 0.02 mm</td><td>0.8 ± 0.02 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 ± 0.05 mm	0.7 ^{+0.07} _{-0.05} mm	Hole-Ø	0.7 ± 0.02 mm	0.8 ± 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 ± 0.05 mm	0.7 ^{+0.07} _{-0.05} mm															
Hole-Ø	0.7 ± 0.02 mm	0.8 ± 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



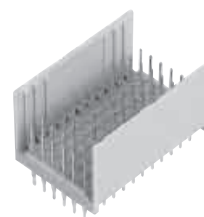
Male connectors straight, with press-in termination

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 17 41 072 1204 17 41 072 2204	
	144	8.2	3.7 17 44 144 1205 17 44 144 2205	
Connectors without flange without coding <u>with</u> endwall	72	8.2	3.7 17 42 072 1203 17 42 072 2203	
	144	8.2	3.7 17 45 144 1204 17 45 144 2204	



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 17 43 072 2209	optional coding 2 optional coding 1 f e d c b a 1 2 3 4 5 6 7 8 9 10 11 12
	144	8.2	3.7	17 46 144 1207 17 46 144 2207	
Connectors <u>with</u> flange <u>with</u> coding 1 without endwall	72	8.2	3.7	17 43 072 1211 17 43 072 2211	optional coding 2 optional coding 1 f e d c b a 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
	144	8.2	3.7	17 46 144 1209 17 46 144 2209	
Connectors <u>with</u> flange <u>with</u> coding 2 without endwall	72	8.2	3.7	17 43 072 1210 17 43 072 2210	
	144	8.2	3.7	17 46 144 1208 17 46 144 2208	
Connectors <u>with</u> flange <u>with</u> coding 3 (= coding 1 + 2) without endwall	72	8.2	3.7	17 43 072 1212 17 43 072 2212	
	144	8.2	3.7	17 46 144 1210 17 46 144 2210	

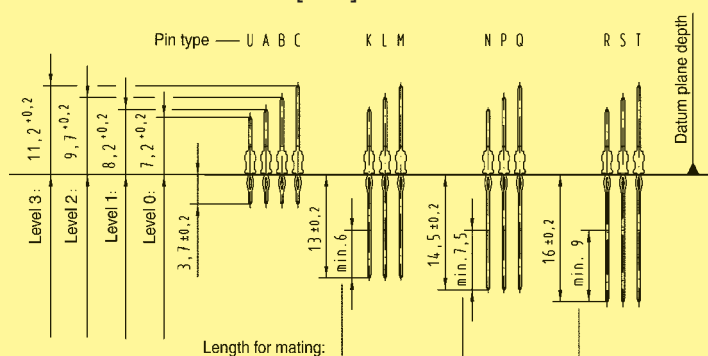


Male connectors straight, with press-in termination

Drawing

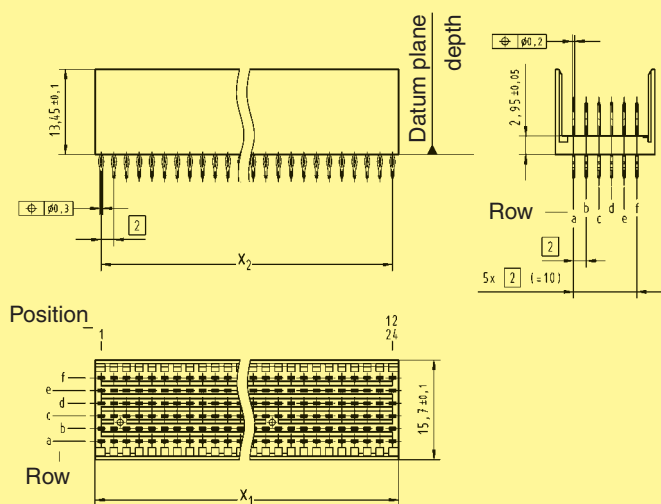
Dimensions in mm

Connector dimensions [mm]

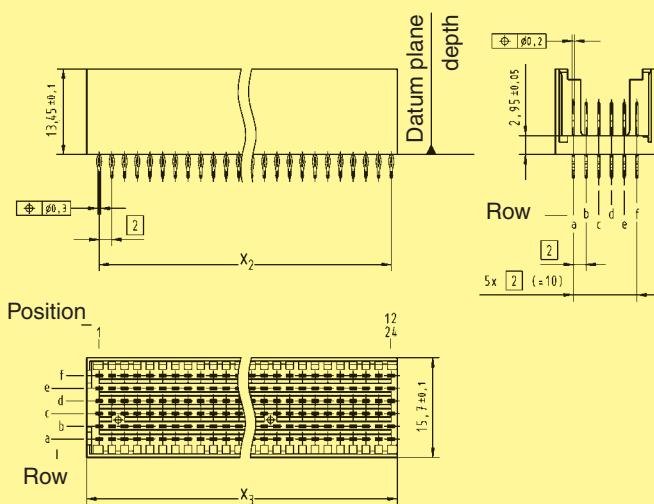


Contact positions	x ₁	x ₂	x ₃
72	23.9	11 x 2 (= 22)	24.9
144	47.9	23 x 2 (= 46)	48.9

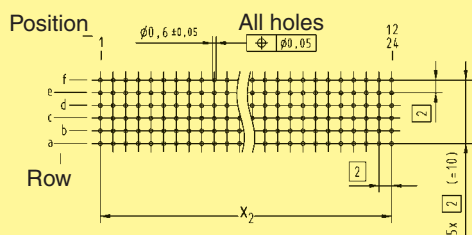
without flange
without coding
without endwall



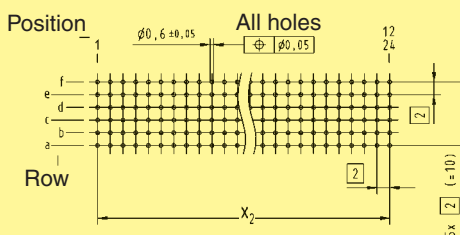
without flange
without coding
with endwall

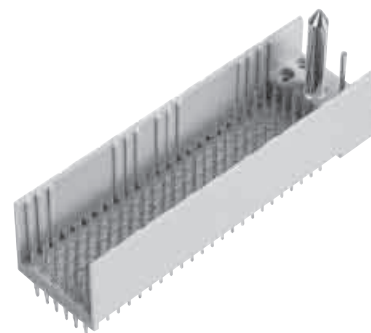


Board drillings



Board drillings



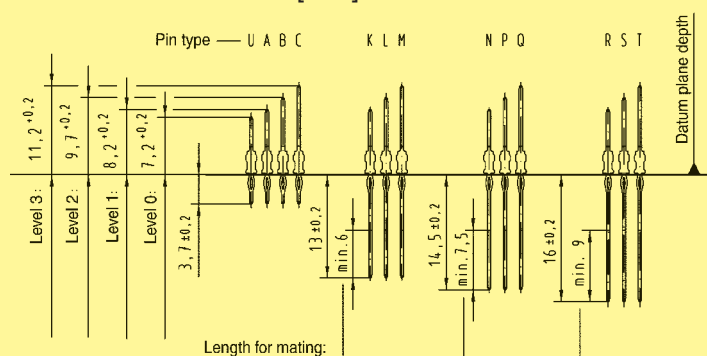


Male connectors straight, with press-in termination

Drawing

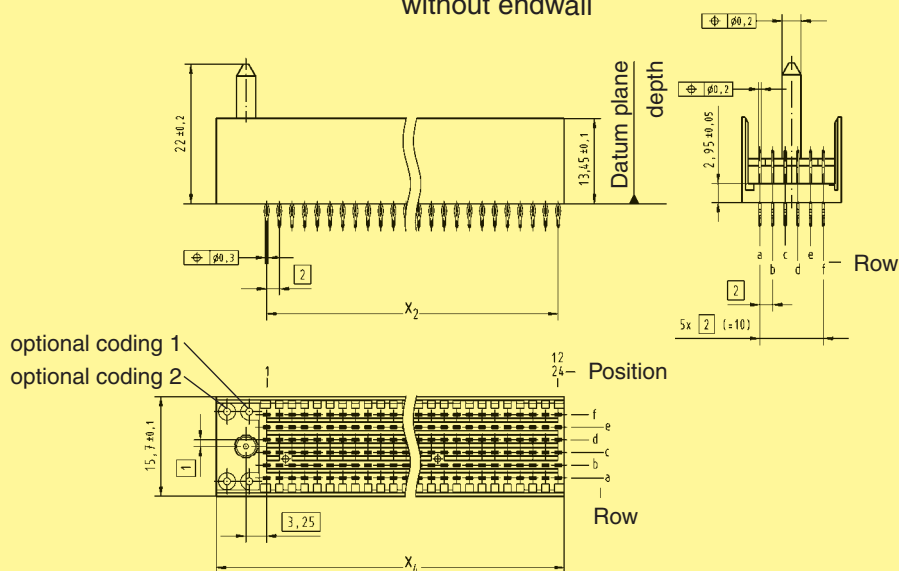
Dimensions in mm

Connector dimensions [mm]

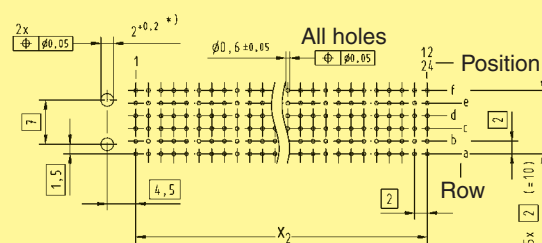


Contact positions	x ₂	x ₄
72	11 x 2 (= 22)	30.9
144	23 x 2 (= 46)	54.9

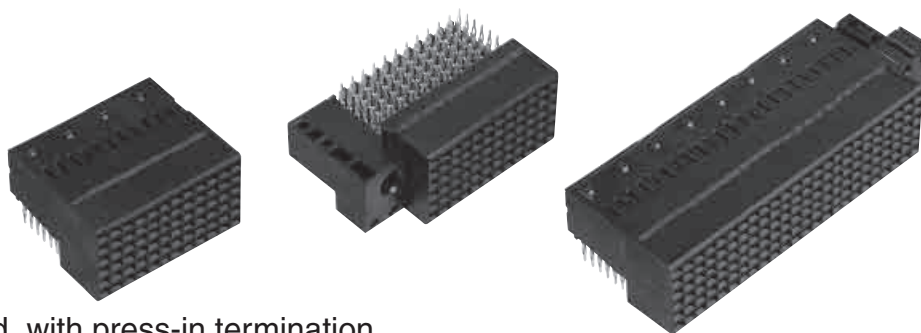
with flange
with coding
without endwall



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 17 51 072 2102	
	144	3.35	17 54 144 1102 17 54 144 2102	
Connectors with flange without coding	72	3.35	17 52 072 1105 17 52 072 2105	
	144	3.35	17 55 144 1105 17 55 144 2105	
Connectors with flange with coding 1	72	3.35	17 52 072 1106 17 52 072 2106	
	144	3.35	17 55 144 1106 17 55 144 2106	
Connectors with flange with coding 2	72	3.35	17 52 072 1107 17 52 072 2107	
	144	3.35	17 55 144 1107 17 55 144 2107	
Connectors with flange with coding 3 (= coding 1 + 2)	72	3.35	17 52 072 1108 17 52 072 2108	
	144	3.35	17 55 144 1108 17 55 144 2108	

Connector dimensions see page 02.09.

Thin print part numbers:

performance level 1

Bold print part numbers:

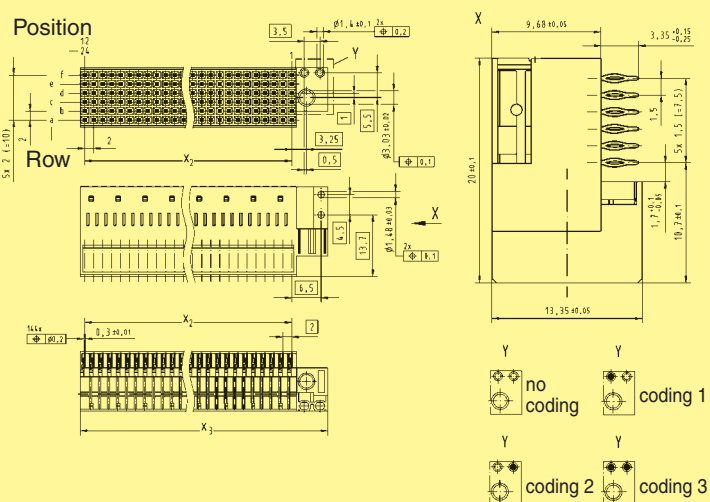
performance level 2



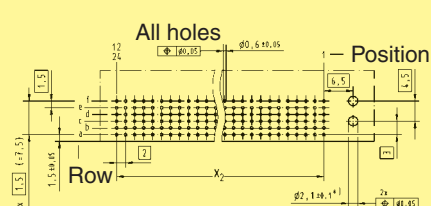
Dimensions in mm

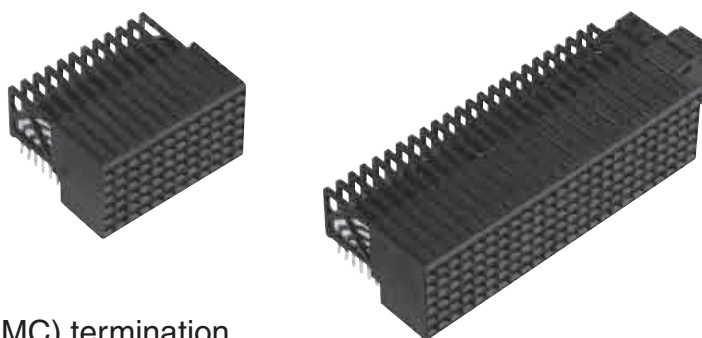
Harbus[®] HM 6-row

with flange
with coding



Board drillings

02
09



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 17 51 072 2802	
	144	2.5	17 54 144 1802 17 54 144 2802	
Connectors with flange without coding	72	2.5	17 52 072 1805 17 52 072 2805	
	144	2.5	17 55 144 1805 17 55 144 2805	
Connectors with flange with coding 1	72	2.5	17 52 072 1806 17 52 072 2806	
	144	2.5	17 55 144 1806 17 55 144 2806	
Connectors with flange with coding 2	72	2.5	17 52 072 1807 17 52 072 2807	
	144	2.5	17 55 144 1807 17 55 144 2807	
Connectors with flange with coding 3 (= coding 1 + 2)	72	2.5	17 52 072 1808 17 52 072 2808	
	144	2.5	17 55 144 1808 17 55 144 2808	

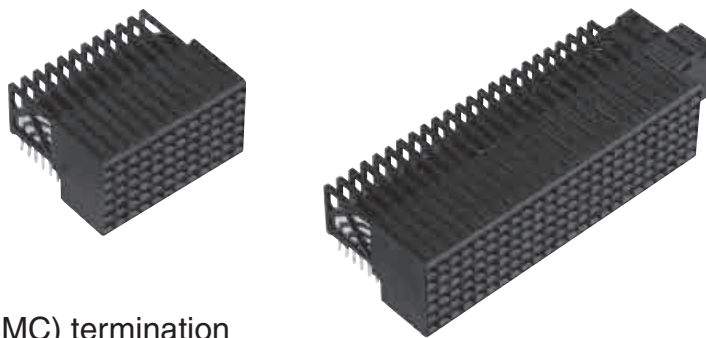
Connector dimensions see page 02.11.

Thin print part numbers:

performance level 1

Bold print part numbers:

performance level 2



Female connectors angled, with solder (SMC) termination

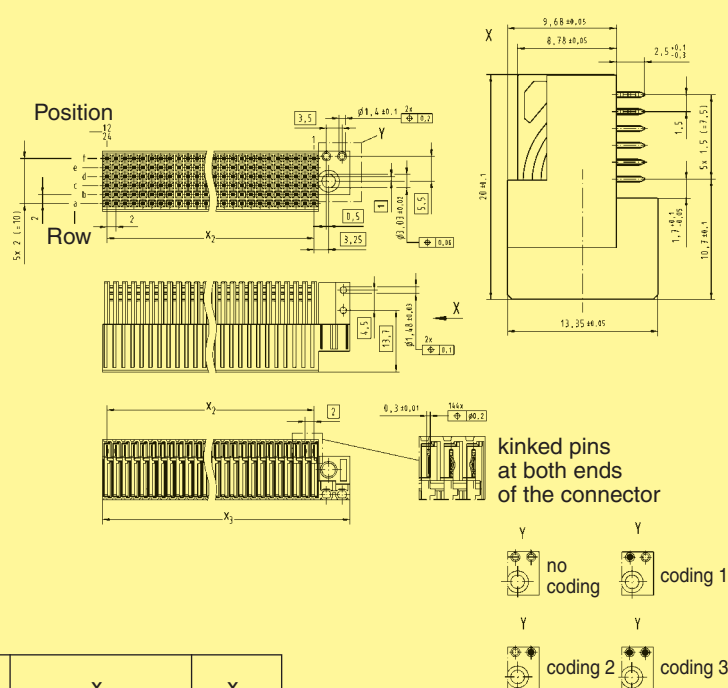
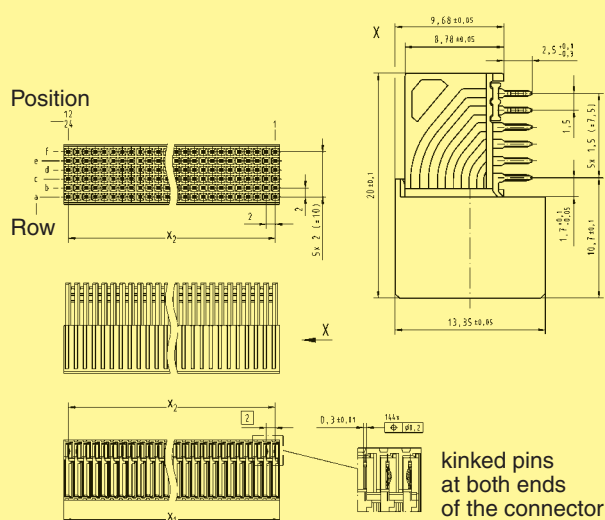
Drawing

Dimensions in mm

Connector dimensions [mm]

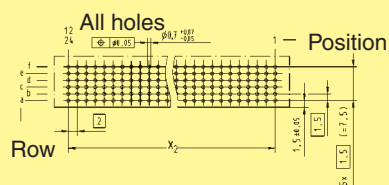
without flange
without coding

with flange
with coding

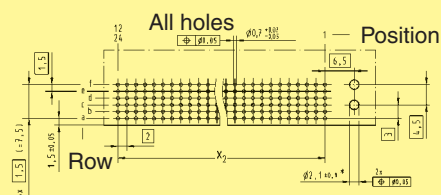


Contact positions	x ₁	x ₂	x ₃
72	24.0	11 x 2 (= 22)	31.0
144	48.0	23 x 2 (= 46)	55.0

Board drillings



Board drillings



* Non-metallized 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.



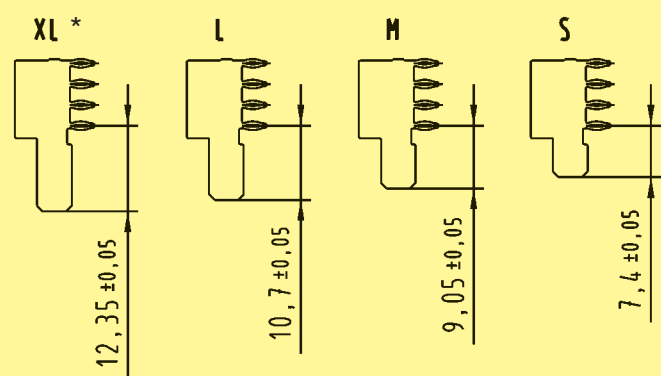
harbus® HM Power

Page

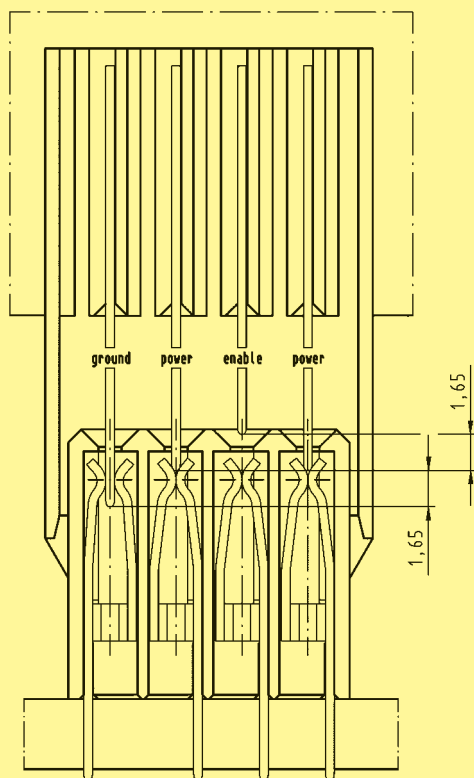
harbus® HM Power – general information	03.02
Technical characteristics	03.03
Angled male connectors with press-in termination.	03.04
Angled male connectors with solder (SMC) termination	03.05
Straight female connectors with press-in termination.	03.06

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.

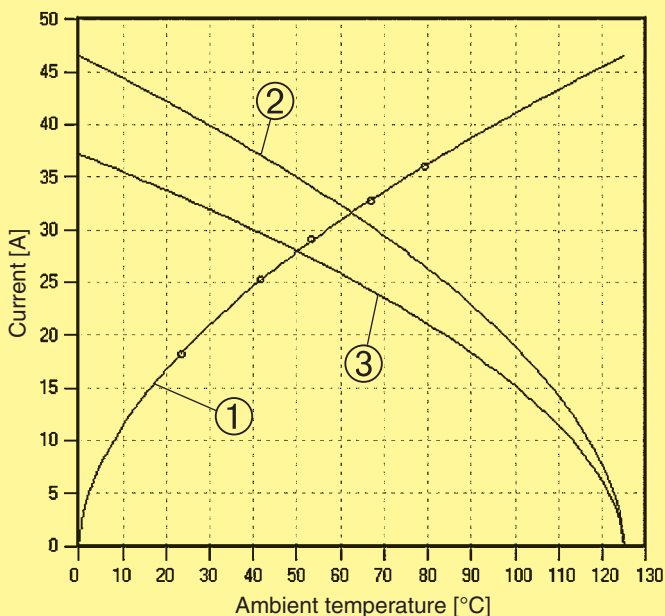


The compact, high temperature moulding can be loaded with up to four high current contacts. Four different contact lengths are available from 7.4 mm to 12.35 mm. This makes sequenced and non sequenced loadings possible (e.g. with GND and ENA). Any other contact assignments, also partially loaded, are 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 60 512-5-2)

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.

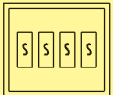
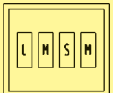
Benefits:

- 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

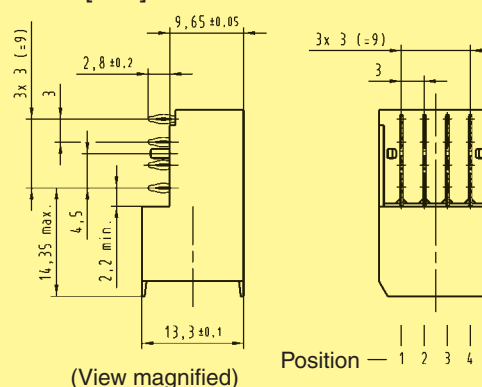
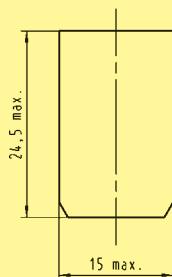
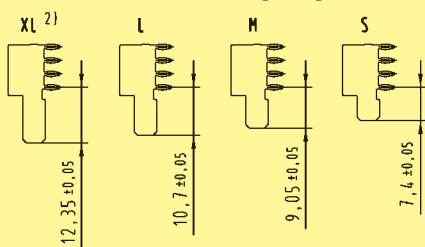
Design according	: OBSAI System Spezifikation V 1.1
Number of contacts	: up to 4
Contact spacing	: 3.00 mm
Clearance and creepage distances between contacts	: > 2.3 mm
Working current	: 23 A max. (OBSAI configuration) 20 A max. (fully loaded with power contacts)
Test voltage $U_{r.m.s.}$	: AC 1500 V 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 ₂ and 0.1 ppm H ₂ 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



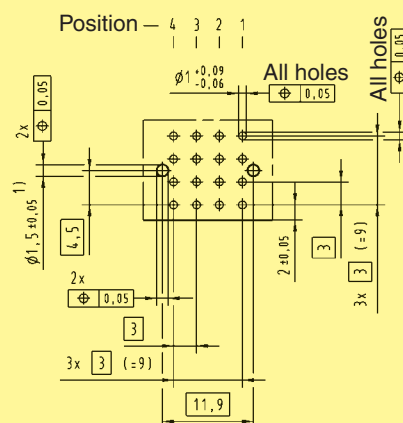
harbus[®] HM Power

Identification	Number of contacts	Contact length [mm] termination side	Part number	Contact loading
Connector with same sized contacts	4	2.8	17 61 004 2102	 Position — 4 3 2 1
Connector with same sized contacts	4	2.8	17 61 004 2103	 Position — 4 3 2 1
Connector with leading/lagging contacts OBSAI configuration	4	2.8	17 61 004 2101	 Position — 4 3 2 1
Connector with leading contact	4	2.8	17 61 004 2104	 Position — 4 3 2 1

Connector dimensions [mm]



Board drillings

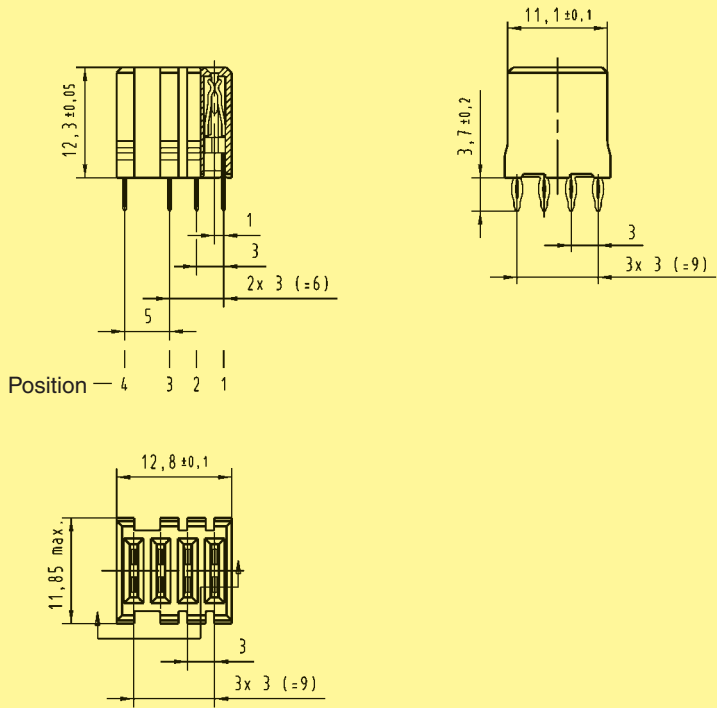




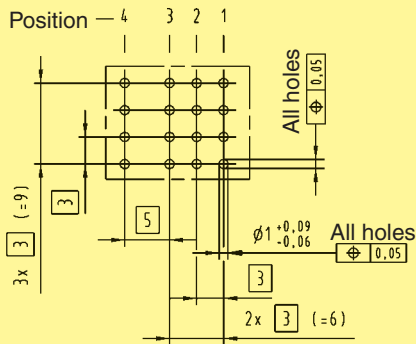
Female connector straight, with press-in termination

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

Connector dimensions [mm]



Board drillings



Mini Coax modules (press-in)

Page

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

Mini Coax tooling see chapter 15

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 lines' 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.

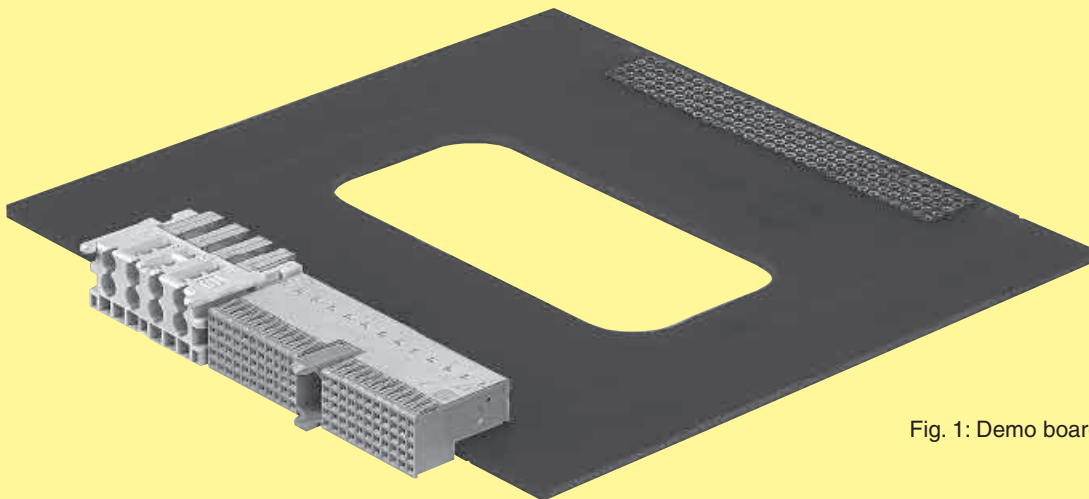


Fig. 1: Demo board

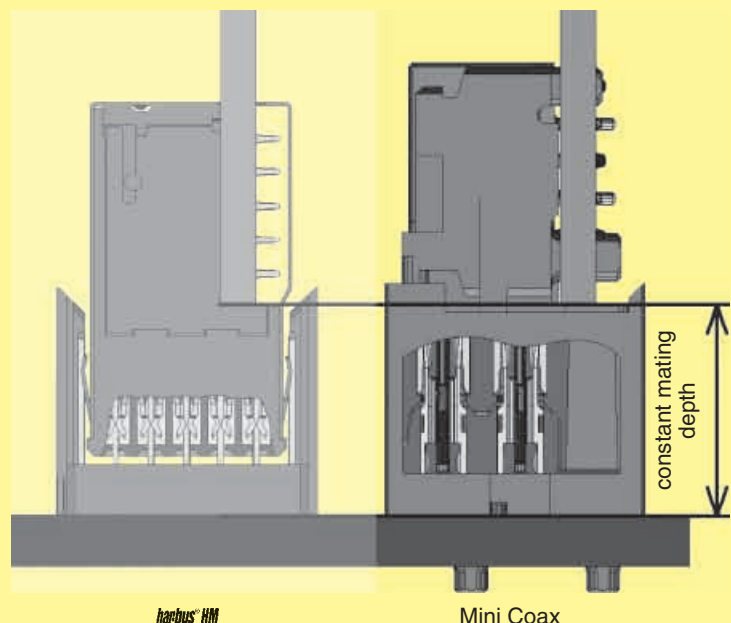


Fig. 2: Cross section of both connector types

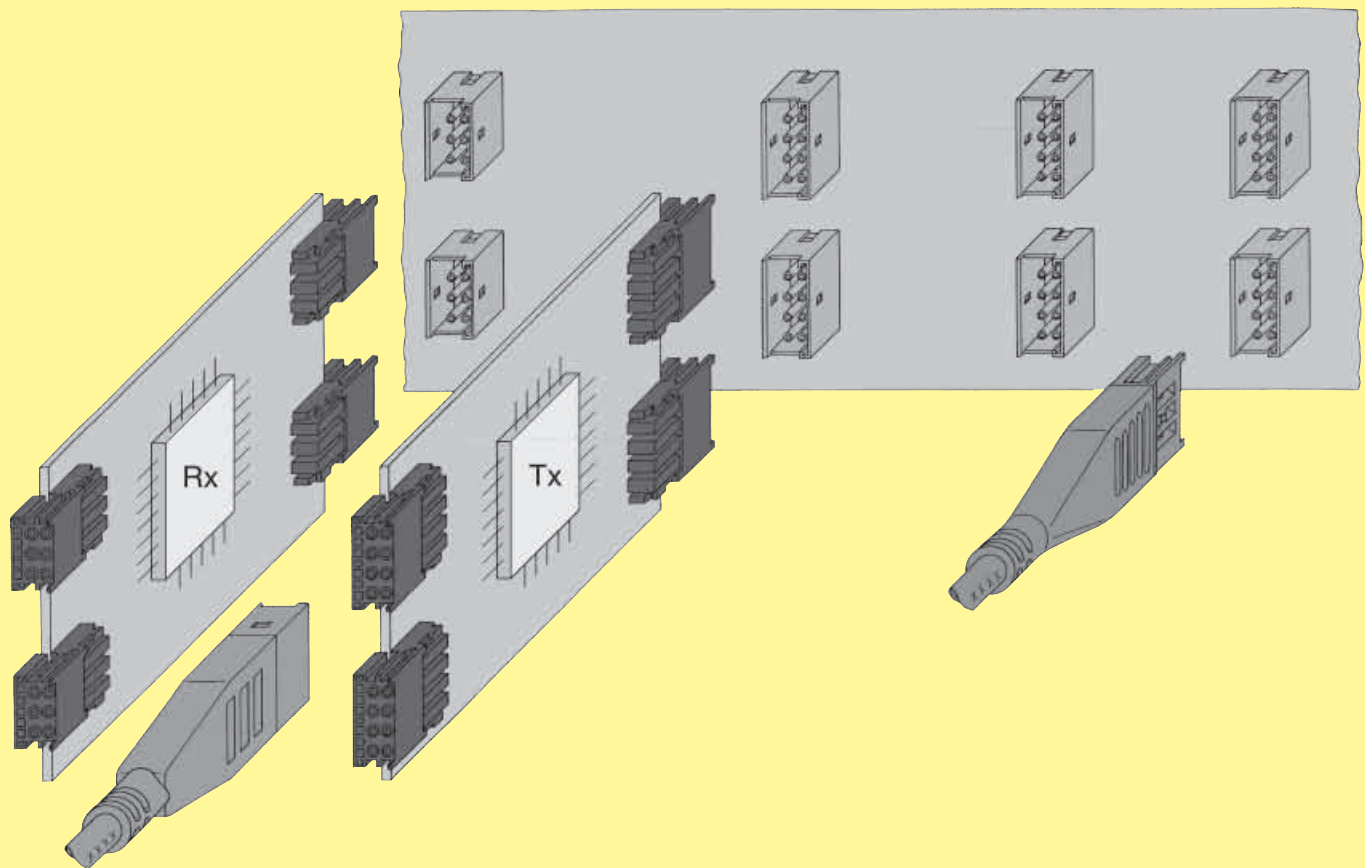


Fig. 3: Typical pcb configurations

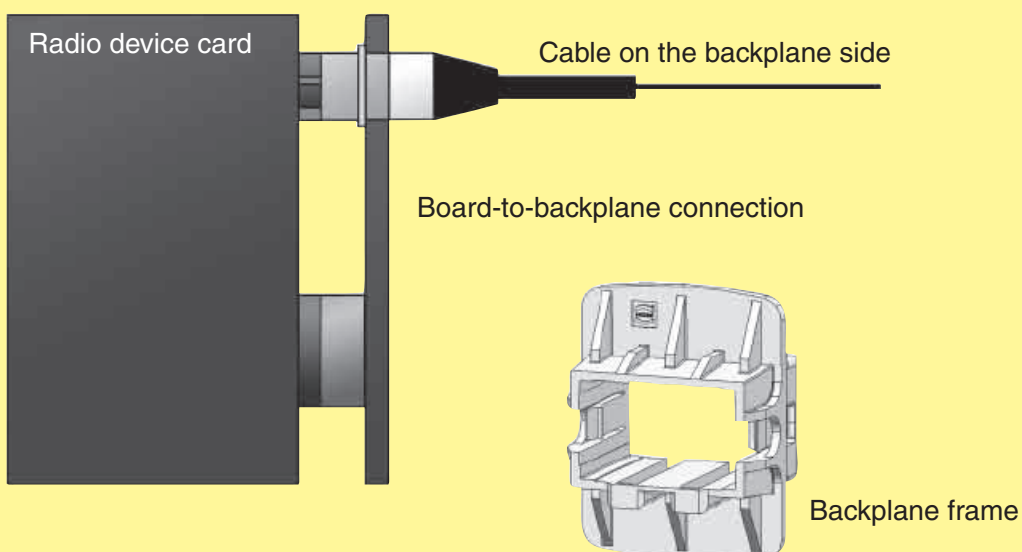


Fig. 4: Mini Coax backplane feed through

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 : $50\ \Omega$
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

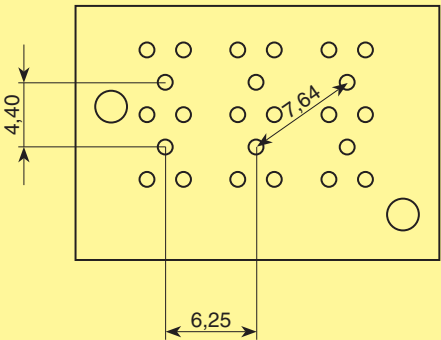


Fig. 5: Grid pattern
Mini Coax Standard

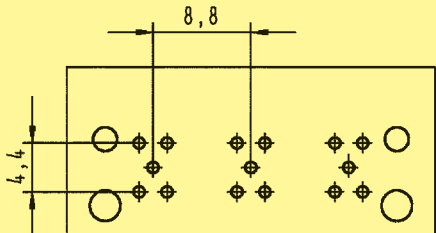


Fig. 6: Grid pattern
Mini Coax single-row

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: ≥ 1.6 mm

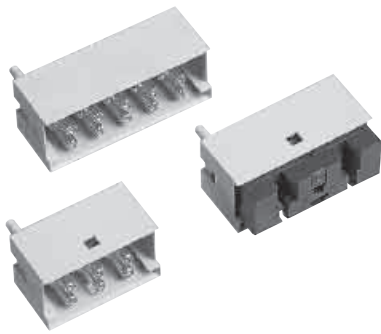
Mating force : ≤ 5 N/line

Withdrawal force : > 1 N/line

Mating distance : 12.5 ... 15 mm

Wiping length : 2.5 mm

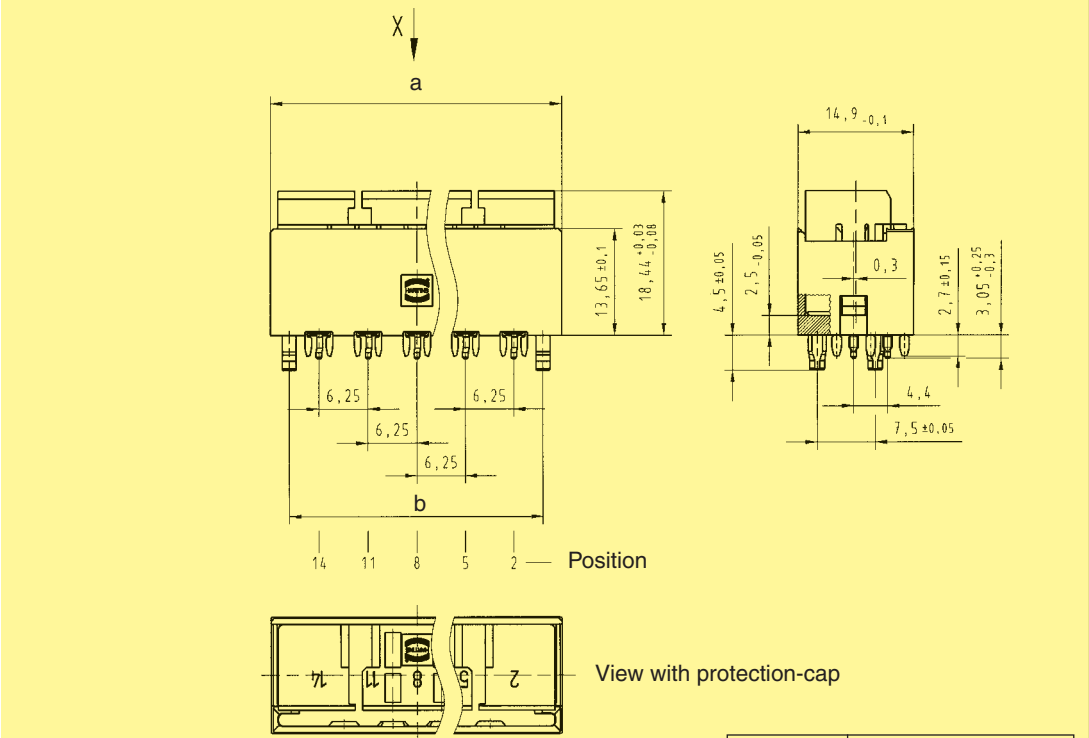
Acceptable radial mating offset : max. ± 1.5 mm



Straight modules

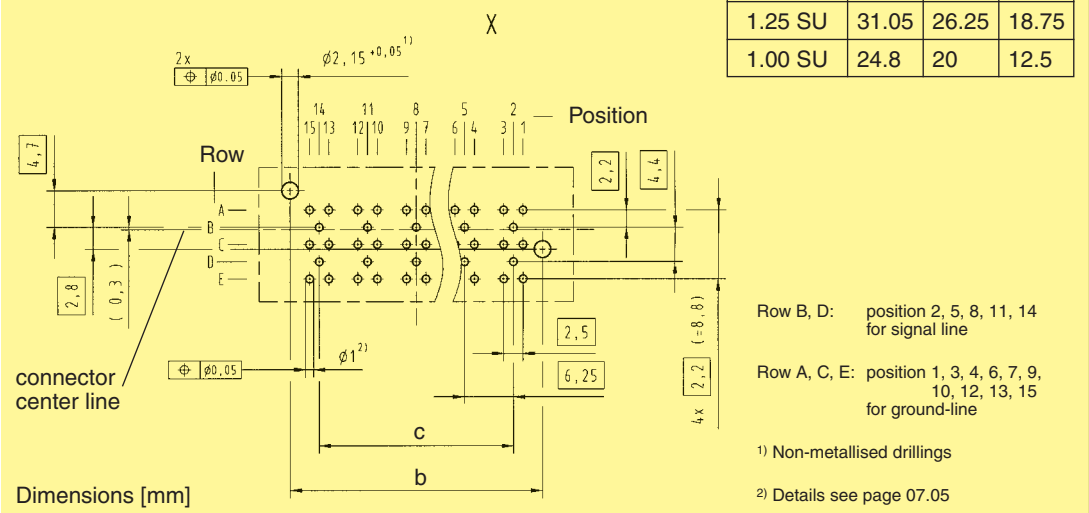
Identification	Number of contacts	SU	loaded positions	Part number
Mini Coax modules, press-in termination	10	1.50	2, 5, 8, 11, 14	07 11 100 0026
	8	1.25	2, 5, 8, 11	07 11 100 0024
	6	1	2, 5, 8	07 11 100 0023
	4	1	2, 8	07 11 900 0024
	2	1	2	07 11 900 0023

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

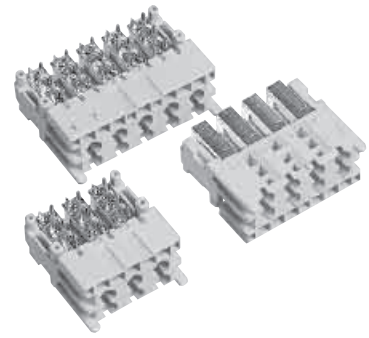


Row B, D: position 2, 5, 8, 11, 14 for signal line

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

1) Non-metallised drillings

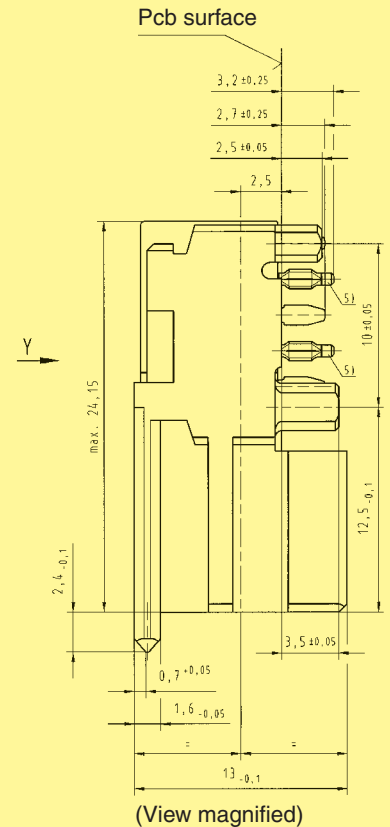
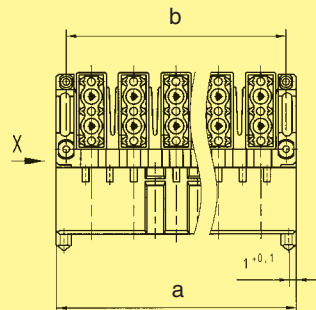
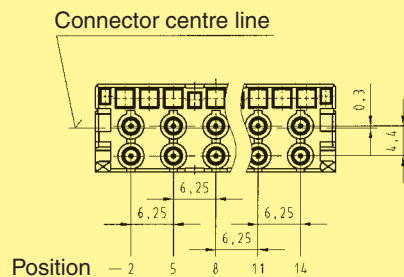
2) Details see page 07.05



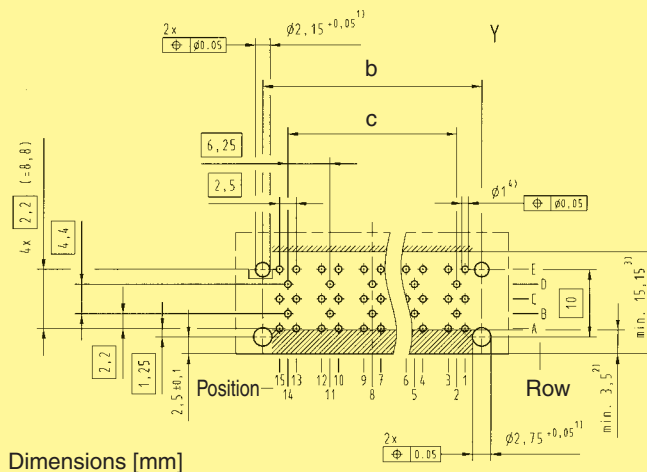
Angled modules

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



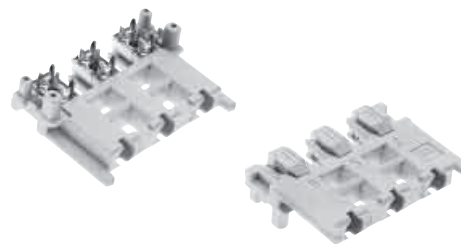
Angled module	Dimension [mm]		
	a	b	c
1.50 SU	35.45	32.5	25
1.25 SU	29.15	26.25	18.75
1.00 SU	22.9	20	12.5

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

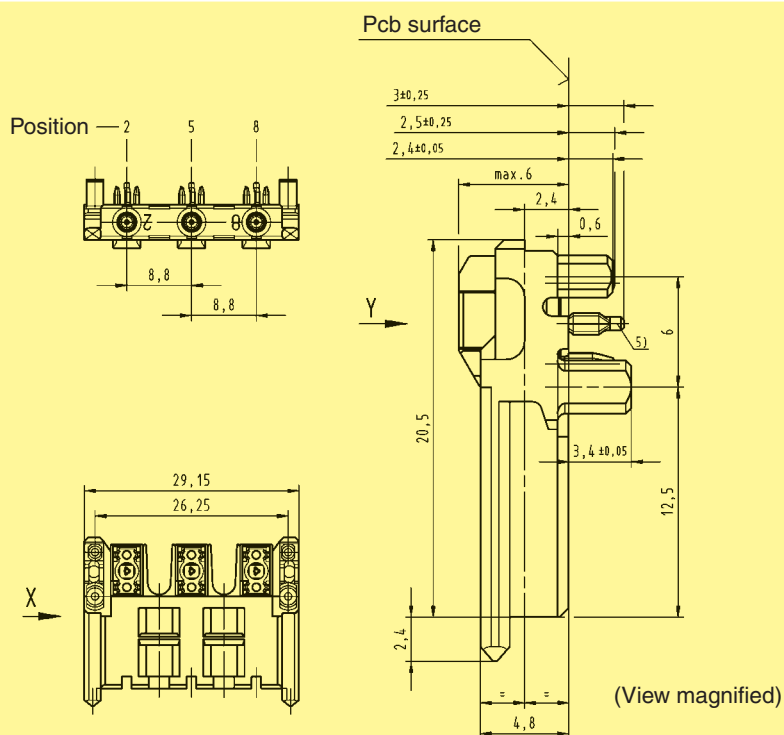




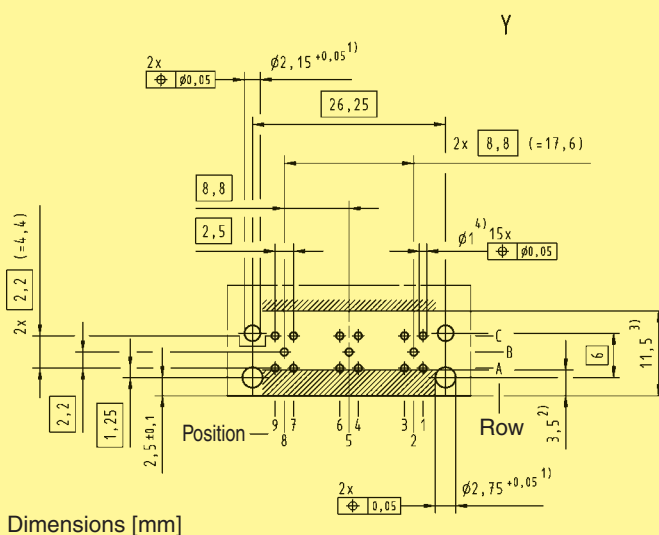
Angled modules

Identification	Number of contacts	SU	loaded positions	Part number
Mini Coax single-row module, press-in termination	3	1	2, 5, 8	07 31 100 0028

Dimensions



Board drillings

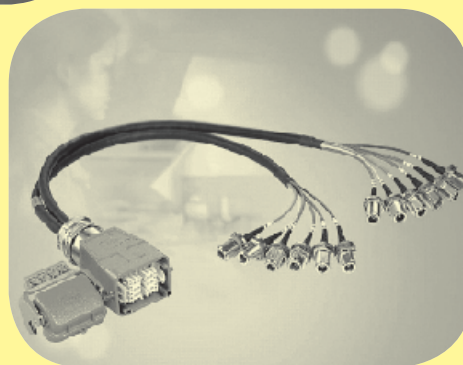
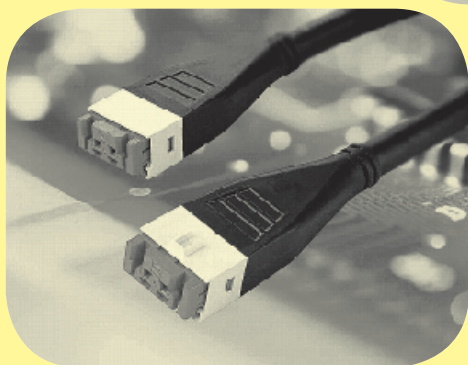
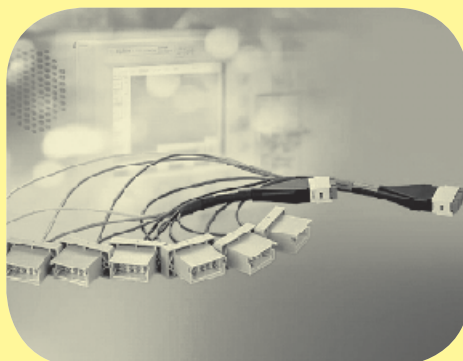


- Row B: position 2, 5, 8 for signal line
- Row A, C: position 1, 3, 4, 6, 7, 9 for ground-line
- 1) Non-metallised drillings
 - 2) No tracks, except solder eyes
 - 3) Limit area of components
(valid for both pcb-sides)
 - 4) Details see page 07.05
 - 5) Press-in zone in any angular position related to it's longitudinal axis possible

Mini Coax cable assemblies and accessories

Page

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



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

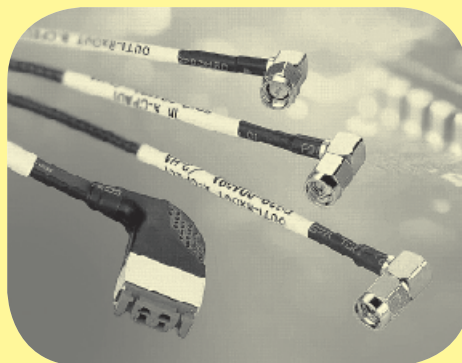
The Mini Coax cable connector is available as plug and socket and is crimped to a coaxial cable that can be individually assembled with RF-cable connectors (SMA, SMB, N-type ...). While delivering high RF transmission performance, the moulded Mini Coax cable assemblies provide robust connections. The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

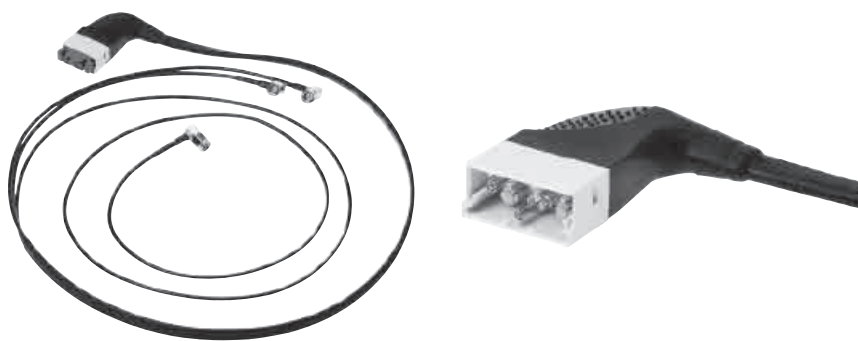
Thanks to various accessories, such as backplane frame, Han® housing insert and press-in cable housing ..., customized connecting requirements can be met.

Remark:

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

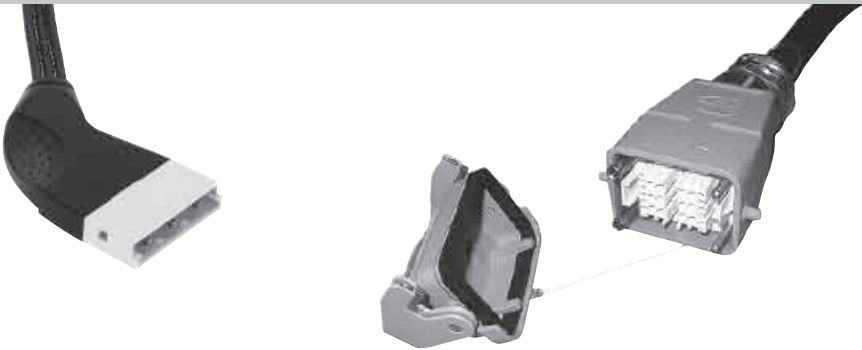
Additional, customized parts are available on request.



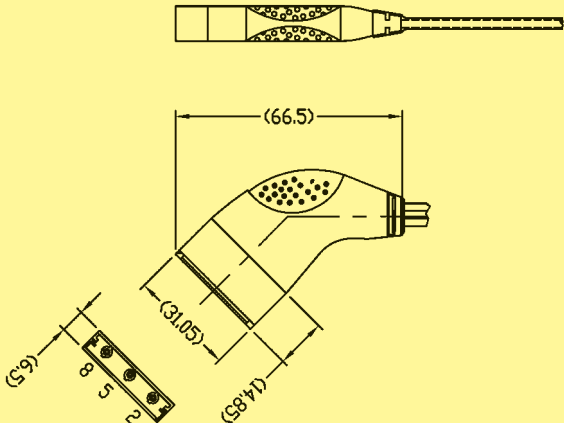
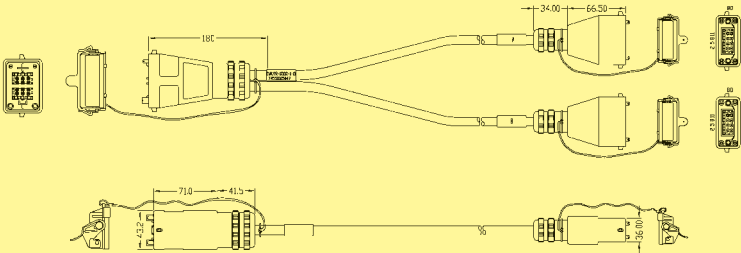


Cable assemblies

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		

Mini Coax
Cables



Accessories

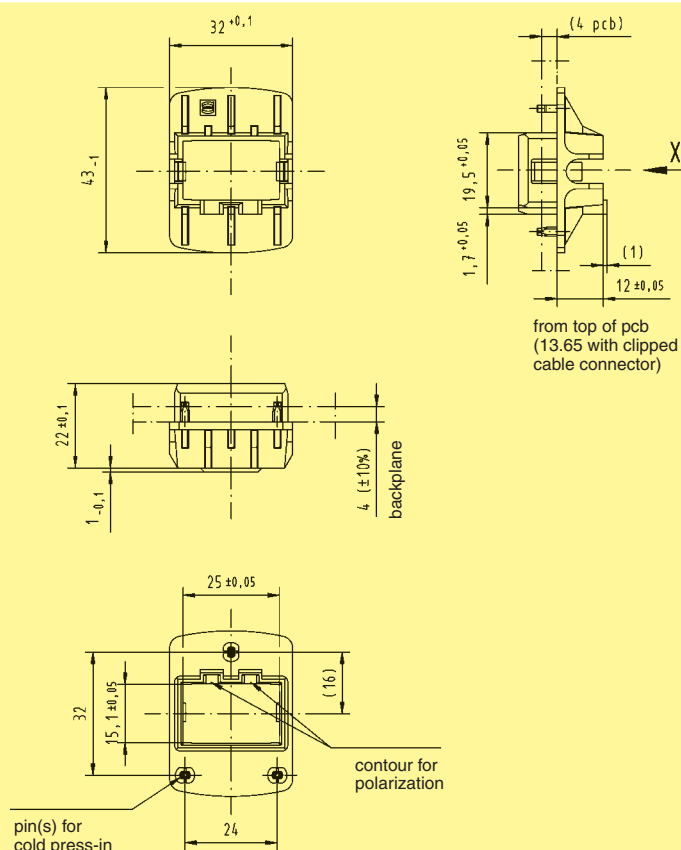
Identification

Part No.

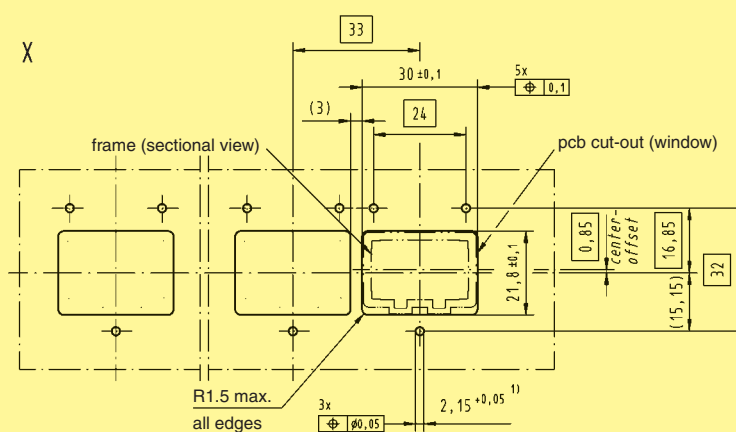
Backplane frame

07 71 100 0042

Dimensions [mm]



Board drillings



¹⁾ Non-metallized drillings

Mini Coax+ modules (surface mount, SMT/SMC)

Page

Mini Coax+ connector system – general information	09.02
Technical characteristics	09.03
Mini Coax+ straight modules for backplane assembly	09.04
Mini Coax+ angled modules for daughtercard assembly	09.05



Available
on request

The Mini Coax standard connector system is now further enhanced with the **Mini Coax+**. This new connector system has been originally developed for 3rd generation telecom base stations. Excellent transmission characteristics are realised by the lowest connector losses and matched impedances of all internal sections. The Mini Coax+ connector therefore offers best transmission characteristics for RF signals up to 4 GHz.

The modules are available in metric size 1.00 SU (SU = System Unit = 25 mm) with 2 to 6 coaxial lines. Mini Coax+ combines the advantages of both reflow soldering principles SMC and SMT. SMC stands for

'Pin in Hole' and therefore provides high mechanical strength and endurance against dynamic and static shearing forces. SMT stands for 'Pin on Pad' and therefore provides highest RF performance of board terminations (see Fig. 1). Both principles allow fully automated assembly which promotes HARTING's multi coax connector to a product which offers an all in one solution:

- Fully automated board assembly
- Robust design
- Excellent RF performance

signal termination SMT

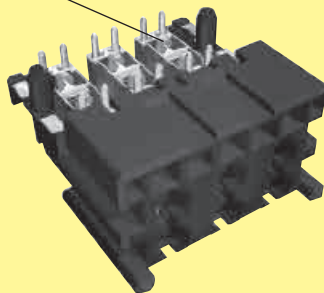


Fig. 1: Angled Mini Coax+ module

ground termination SMC

Based on available SPICE models for the connector customers' design-in can be supported by HARTING's in house RF competence centre with close co-operation. This guarantees optimised signal transmission in the target application. On this behalf our vision is to support the customer from the design-in phase to a real running application.

Mini Coax+ connectors are full mating compatible to standard Mini Coax connectors and offer a constant mating depth compared to product line *harbus* HM+. Therefore a simultaneous use on one board is possible in any mixed configuration (see Fig. 2).

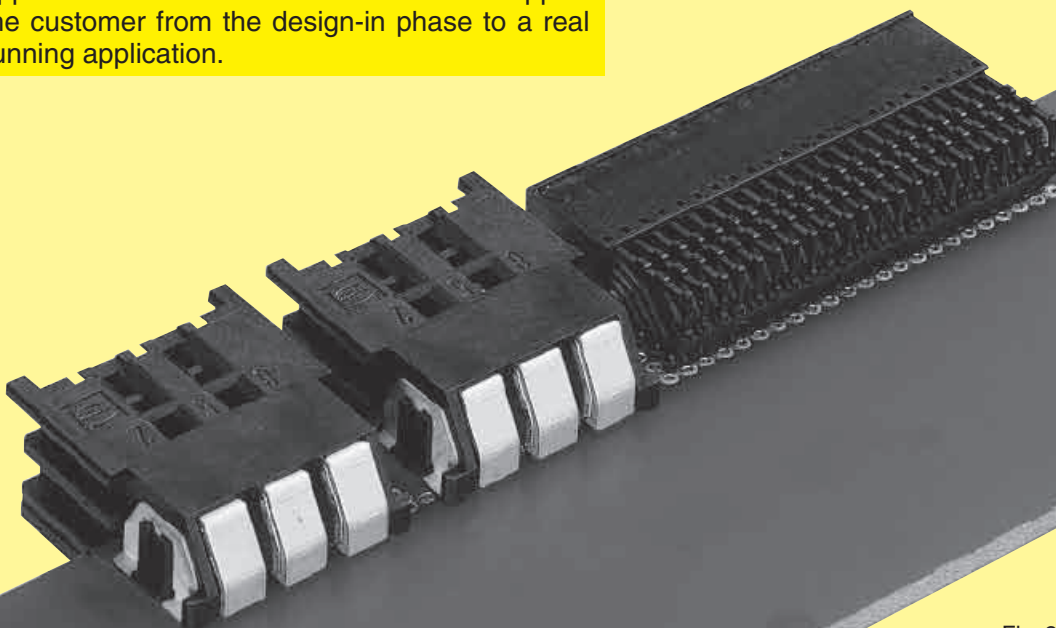


Fig. 2: Board with mixed connector configuration

Number of contacts	:	2, 4 or 6 coaxial contacts
Grid pattern	:	4.40 x 6.25 mm (within a twin x between twins)

Dielectric withstanding Voltage $U_{r.m.s.}$	:	≤ 450 V (for 60s)
DC-contact resistance	:	
Centre contact	:	≤ 15 m Ω
Ground contact	:	≤ 6 m Ω
Insulation resistance	:	≥ 5000 M Ω

Nominal impedance	:	50 Ω
Frequency range	:	0 – 4 GHz
Return loss*	:	≥ 20 dB ¹⁾ (0 ... 2.5 GHz) equal to VSWR ≤ 1.22 ≥ 20 dB ¹⁾ (0 ... 4.0 GHz) equal to VSWR ≤ 1.22
Insertion loss	:	≤ 0.23 dB ¹⁾ (0 ... 2.5 GHz) ≤ 0.75 dB ¹⁾ (0 ... 4.0 GHz)
Crosstalk attenuation	:	≥ 50 dB ²⁾ within a twin (0 ... 2.5 GHz) ≥ 60 dB ²⁾ between twins (0 ... 2.5 GHz) ≥ 35 dB ²⁾ within a twin (0 ... 4.0 GHz) ≥ 45 dB ²⁾ between twins (0 ... 4.0 GHz)

Mating cycles	:	max. 500
Termination technique	:	Surface Mount Technology (SMT / SMC)
Mating compatible	:	Mini Coax Standard modules
Mating force	:	≤ 5 N/line
Withdrawal force	:	> 1 N/line
Mating distance	:	12.5 ... 15 mm
Wiping length	:	2.5 mm
Acceptable radial mating offset:		max. ± 1.5 mm

Temperature range	:	-55 °C ... $+125$ °C
Reflow temperature	:	220 °C for 2 minutes, 260 °C max.

Moulding material	:	Liquid Cristal Polymer (LCP), UL 94-V0
Contact surface	:	
Contact zone	:	Au

Note: Measurements with development samples of the straight Mini Coax+

* Reference: short contact

¹⁾ Data of a separate Mini Coax+ mated connector pair including the microvias of pcb

²⁾ Data of Mini Coax+ connector pair including the whole test board environment

Identification

Number of contacts

SU

loaded
positions

Part number

Mini Coax+ modules, SMC termination

6
4
2

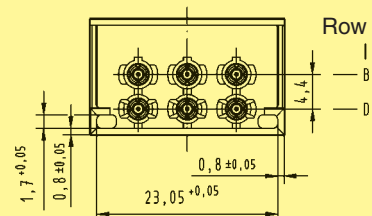
1
1
1

2, 5, 8
2, 8
2

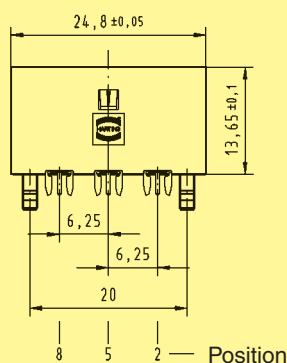
07 11 100 0027
07 11 900 0032
07 11 900 0031

Technical drawing of a connector assembly. The drawing shows a side view of a rectangular component with four circular ports labeled 1, 2, 5, and 8. Port 1 is on the left, and ports 2, 5, and 8 are on the right. A horizontal line represents the connector centre-line. Dimensions are indicated: 0.3 for the width of the component, 2.8 for the distance from the centre-line to the left edge, and 1.4 for the distance from the centre-line to the right edge. A vertical dimension of 1.4 is also shown on the right side. A label 'Connector centre-line' points to the horizontal line.

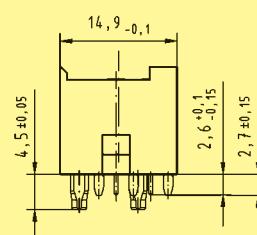
Connector centre-line



X



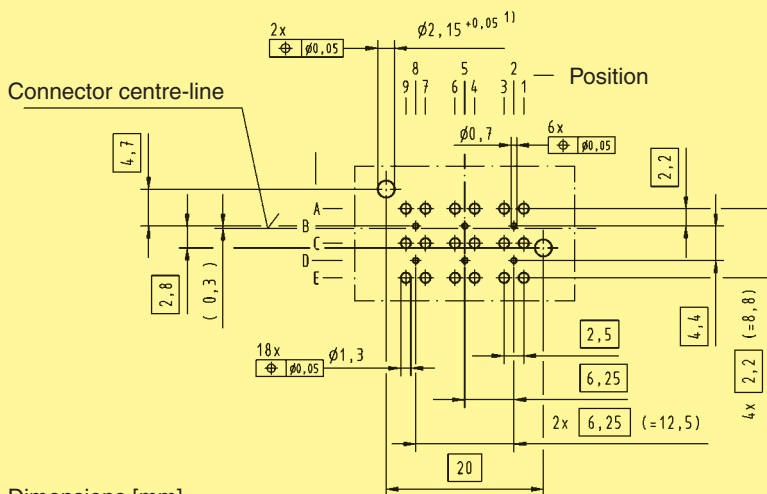
Position



X

Connector centre-line

Position



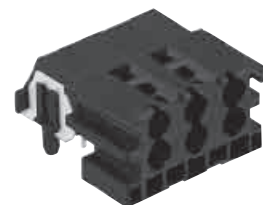
Dimensions [mm]

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

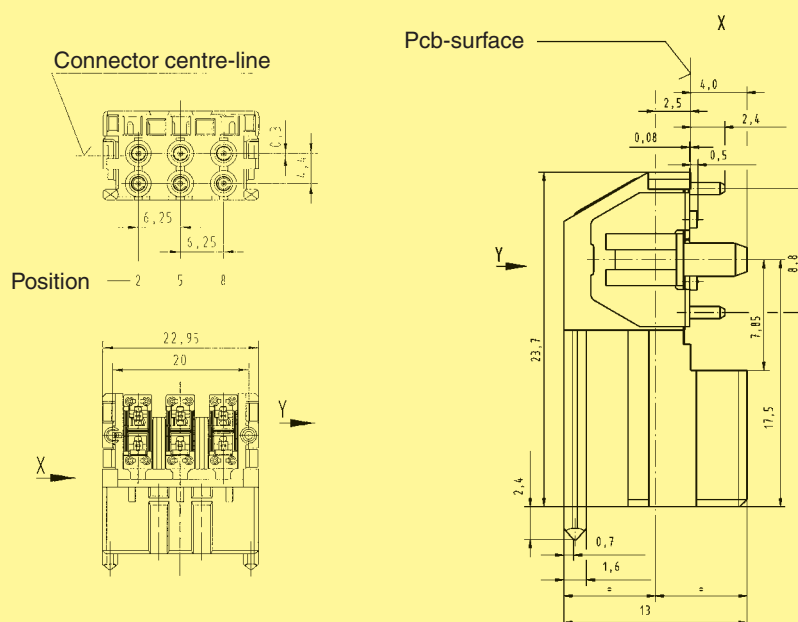
Available
on request



Angled modules

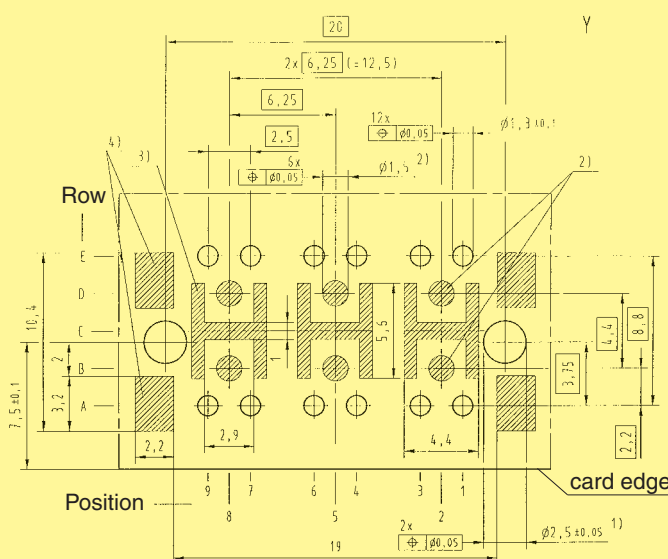
Identification	Number of contacts	SU	loaded positions	Part number
Mini Coax+ modules, SMT / SMC termination	6	1	2, 5, 8	07 31 100 0023
	4	1	2, 8	07 31 900 0032
	2	1	2	07 31 900 0031

Dimensions



(View magnified)

Board drillings



Dimensions [mm]

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) Solder pad for signal-line

3) Solder pad for ground-line

4) Solder pad for fixing anchor

har-link® Modular metric high speed connectors

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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.

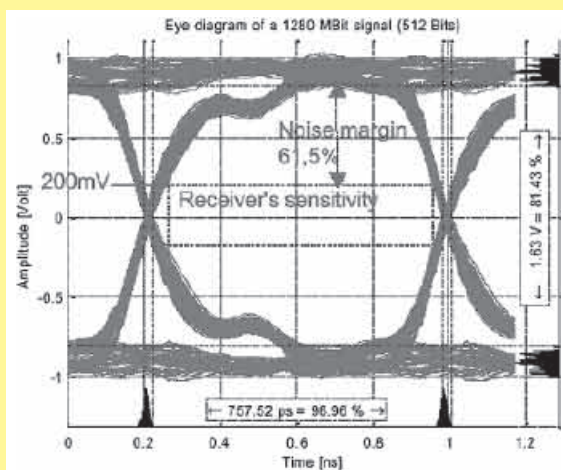


Fig. 1: Eye diagram of a 1280 MBit signal (512 Bits)

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).

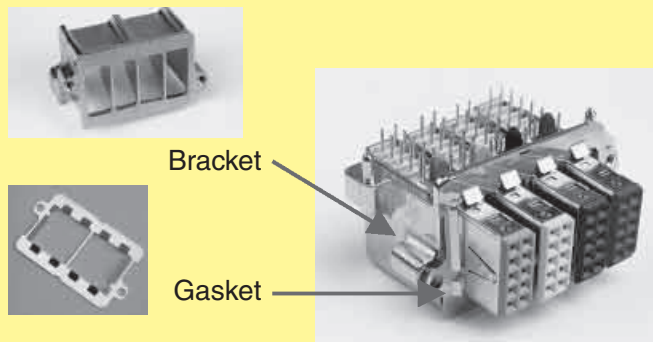


Fig. 3: 4 cavities bracket and gasket

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).

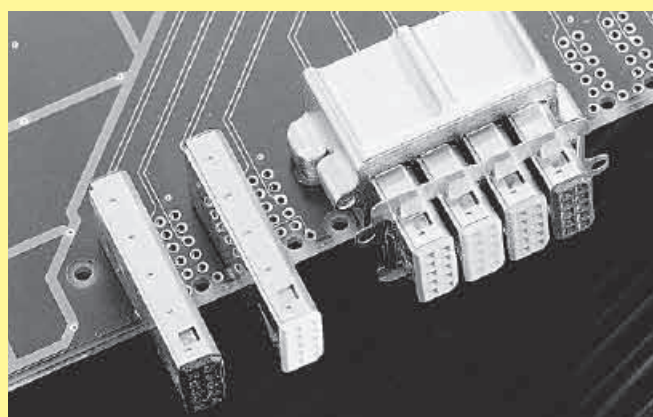
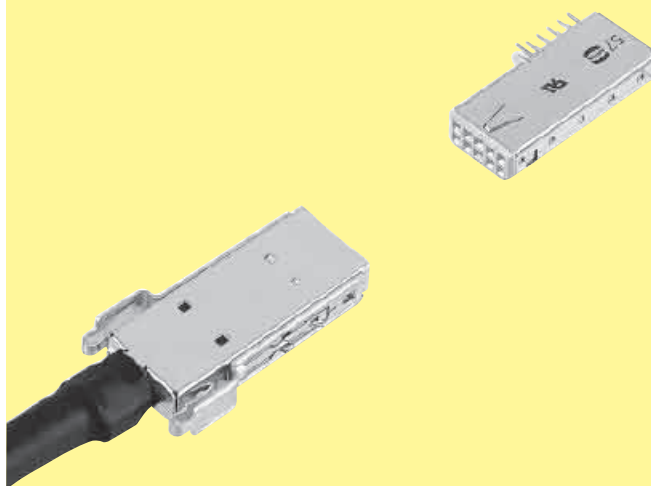


Fig. 4: Differently coloured female modules

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	≤ 30 mΩ ≥ 10 ¹⁰ Ω
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 ø 0.6 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

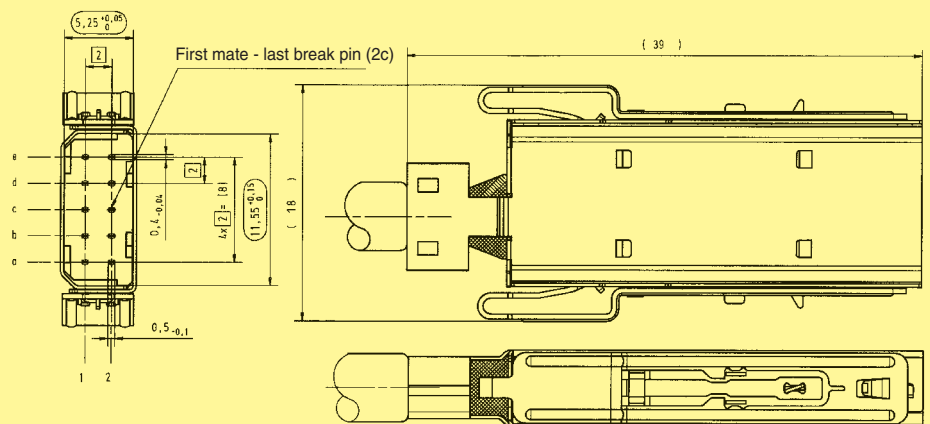




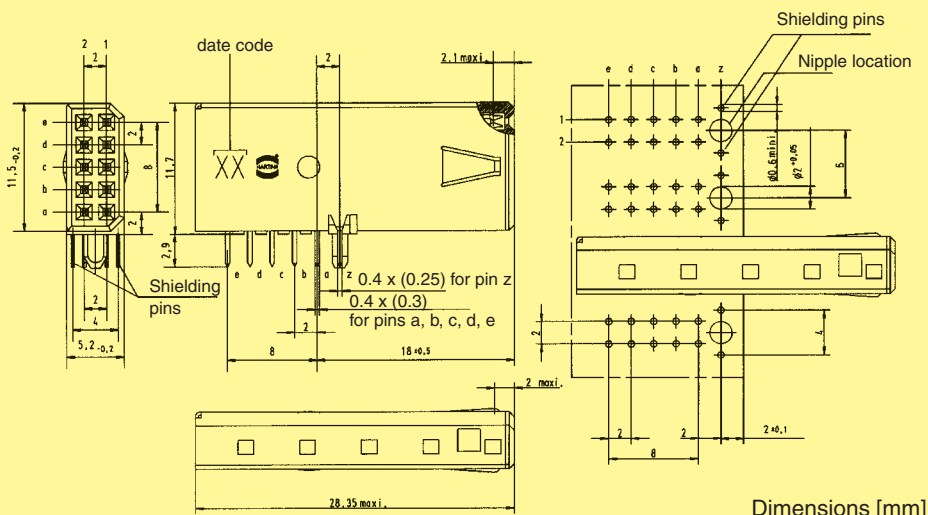
Male connectors, straight
Female connectors, angled

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

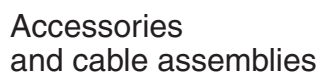
Male connector



Female connector



Dimensions [mm]



Tooling	Page
<i>harbus</i>[®] HM	
Discrete tooling system for volume production	15.02
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Mini Coax	
Discrete tooling system for volume production	15.08
<i>har-pak</i>[®]	
Discrete tooling system for volume production	15.09
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Hand bench presses / pneumatic presses	15.12
CPM press-in machine ¹⁾	15.13

¹⁾ See separate catalogue

For economical and safe press-in of **harbus[®] 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.

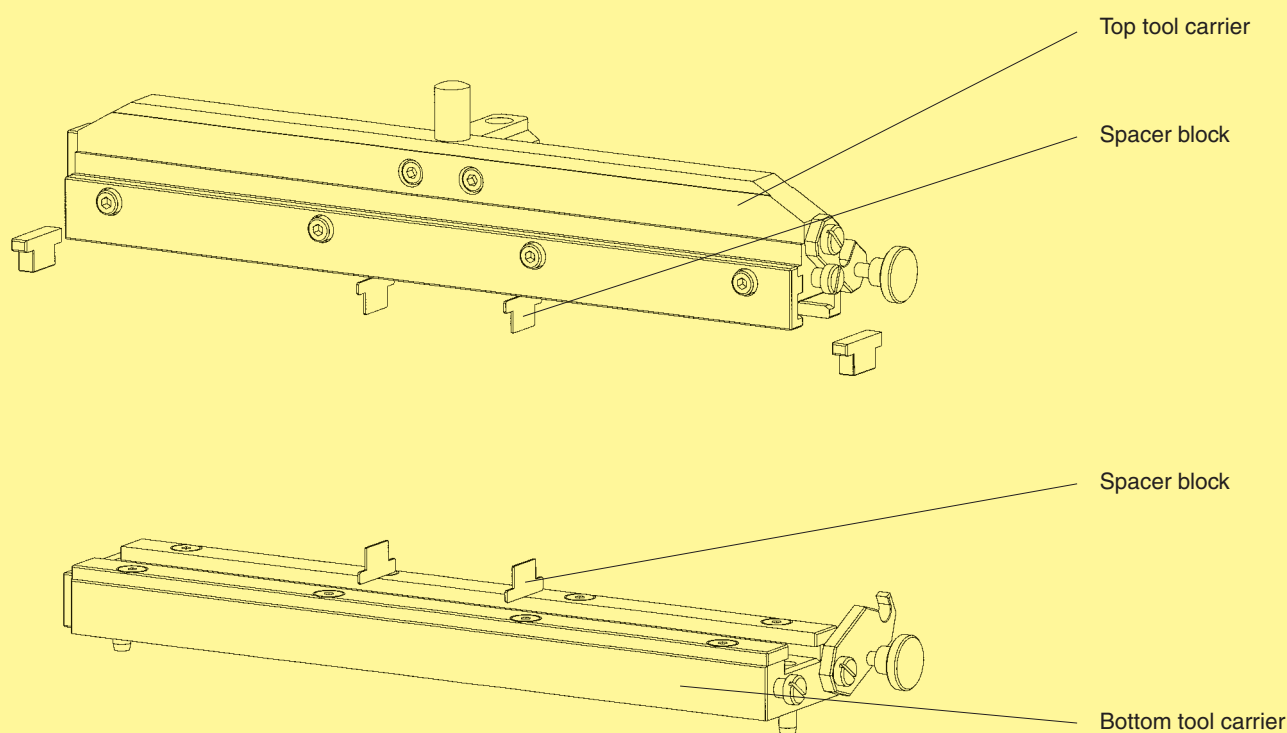


Fig. 1: Basis tools of the discrete tooling system

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 harbus[®] HM	17 99 000 0012	17 xx xxx xxxx	Spacer block 25 mm	17 99 000 0055
17 xx xxx xxxx	Bottom tool carrier harbus[®] HM	17 99 000 0013	17 xx xxx xxxx	Spacer block 38 mm	17 99 000 0054
17 xx xxx xxxx	Top tool carrier harbus[®] HM 3U	17 99 000 0073	17 xx xxx xxxx	Spacer block 44 mm	17 99 000 0053
17 xx xxx xxxx	Bottom tool carrier harbus[®] HM 3U	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

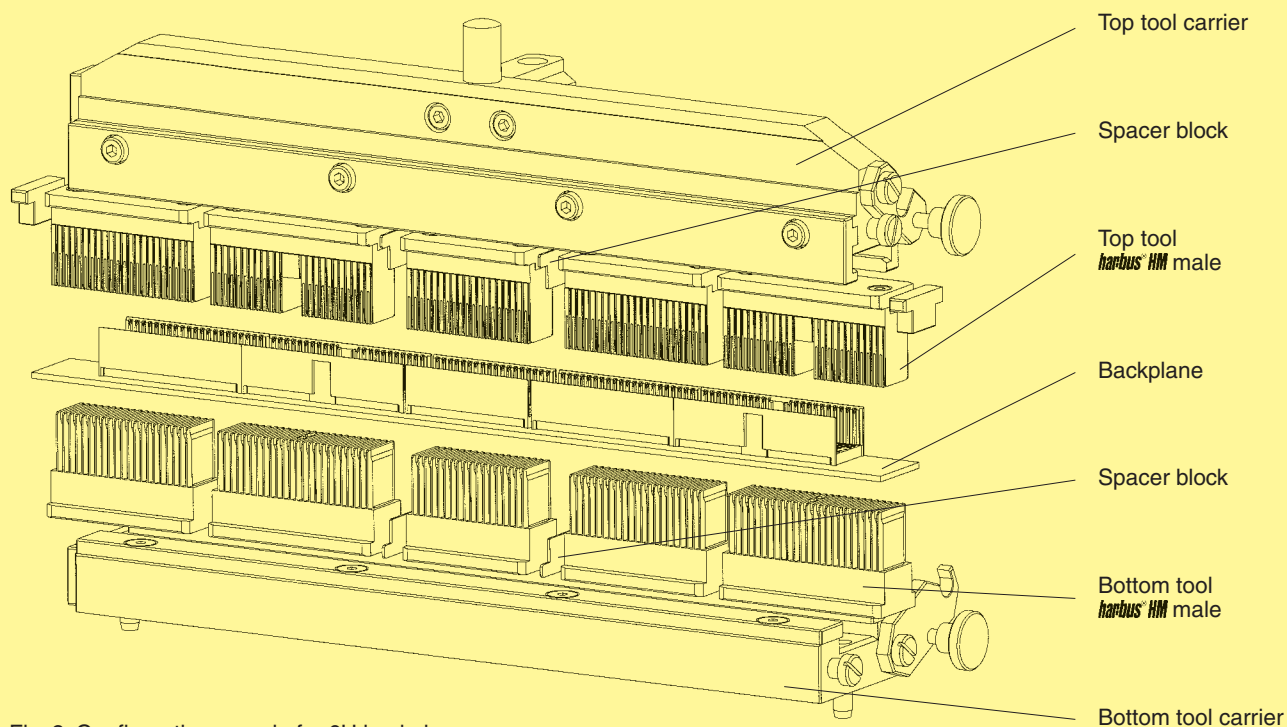


Fig. 2: Configuration sample for 6U backplane

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

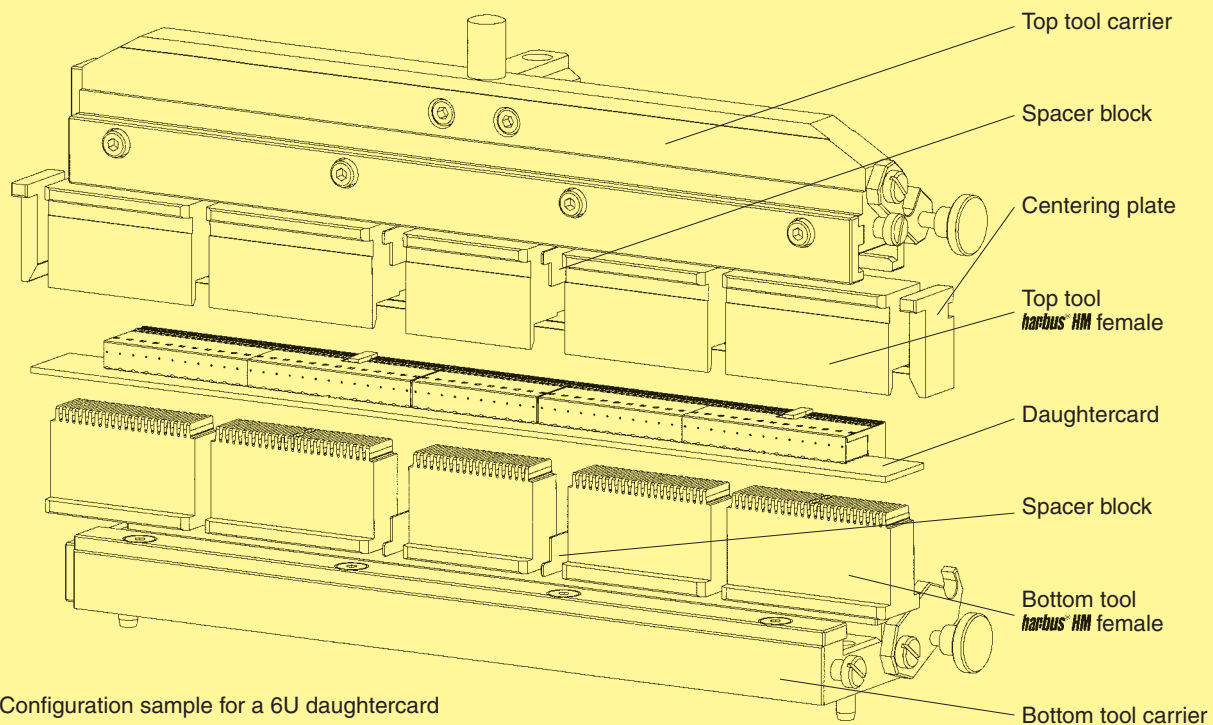


Fig. 3: Configuration sample for a 6U daughtercard

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.

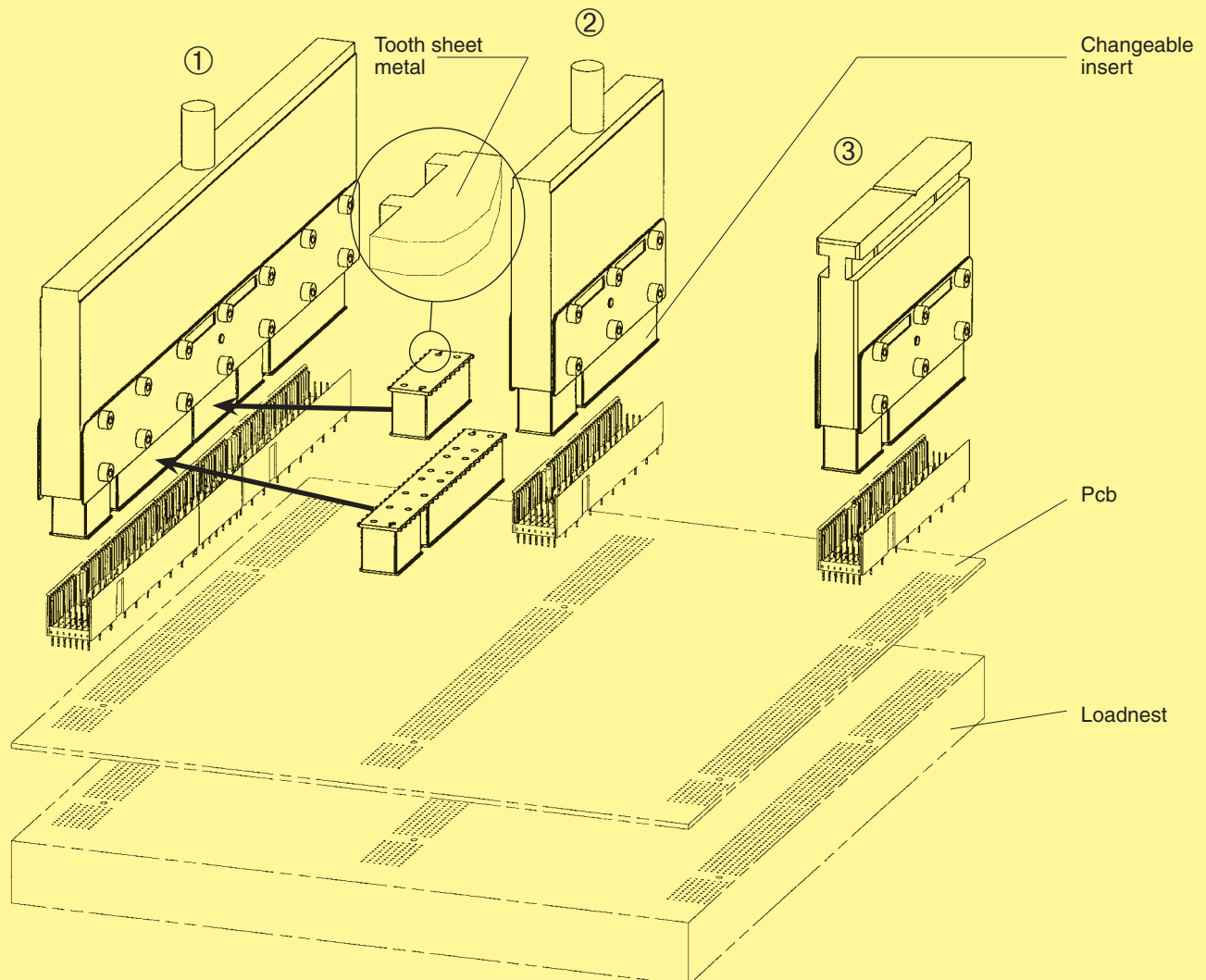


Fig. 4: Configuration samples for CompactPCI backplanes

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.

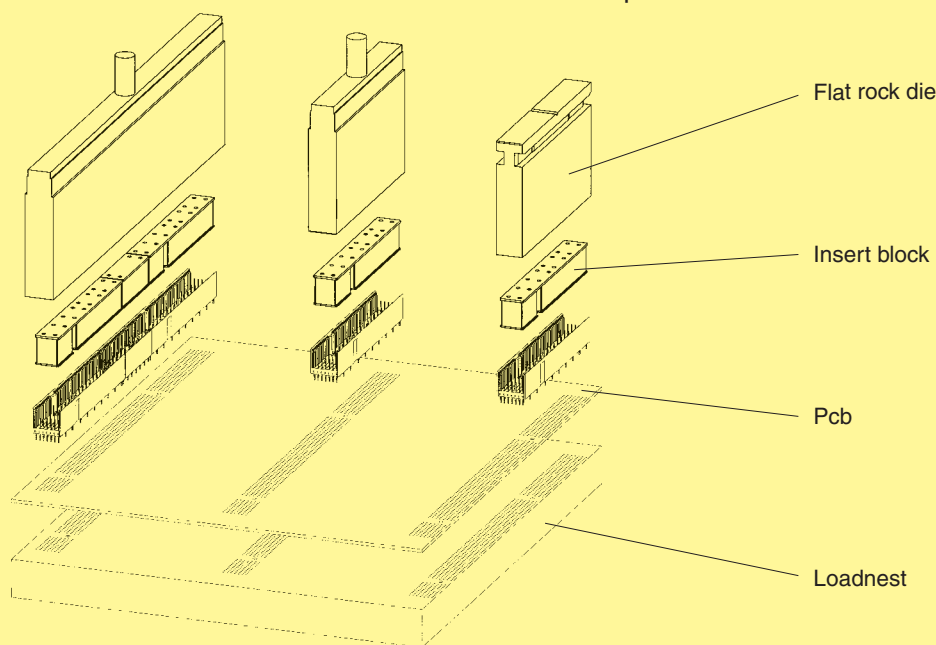


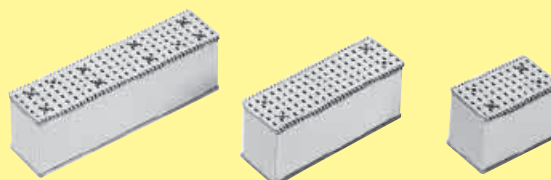
Fig. 5: Application samples for insert blocks

Insert blocks for straight male connectors

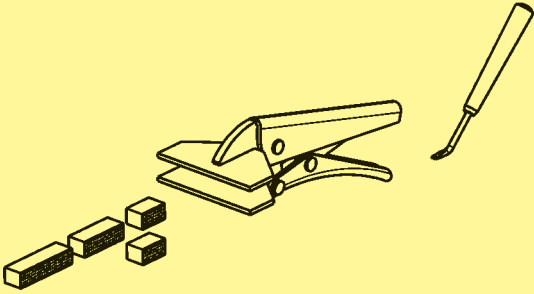
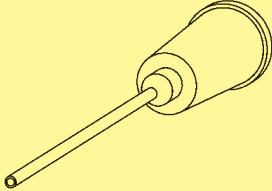
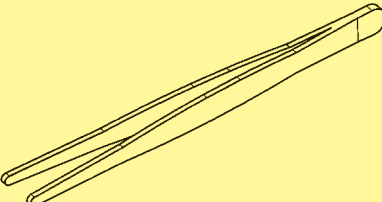
Part number connector	Tool identification	Quantity and part number tool
17 01 xxx xxxx	Insert block for type A	1 x 17 99 000 0009 or (2 x 17 99 000 0001)
17 04 xxx xxxx	Insert block for type B	1 x 17 99 000 0004
17 05 xxx xxxx	Insert block for type B	1 x 17 99 000 0002
17 02 xxx xxxx	Insert block for 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

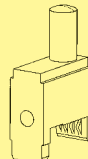
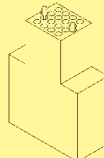
Flat rock dies

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	harbus [®] HM	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	harbus [®] HM Power	17 99 000 0102		
Bottom tool for angled male connectors	harbus [®] HM 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.

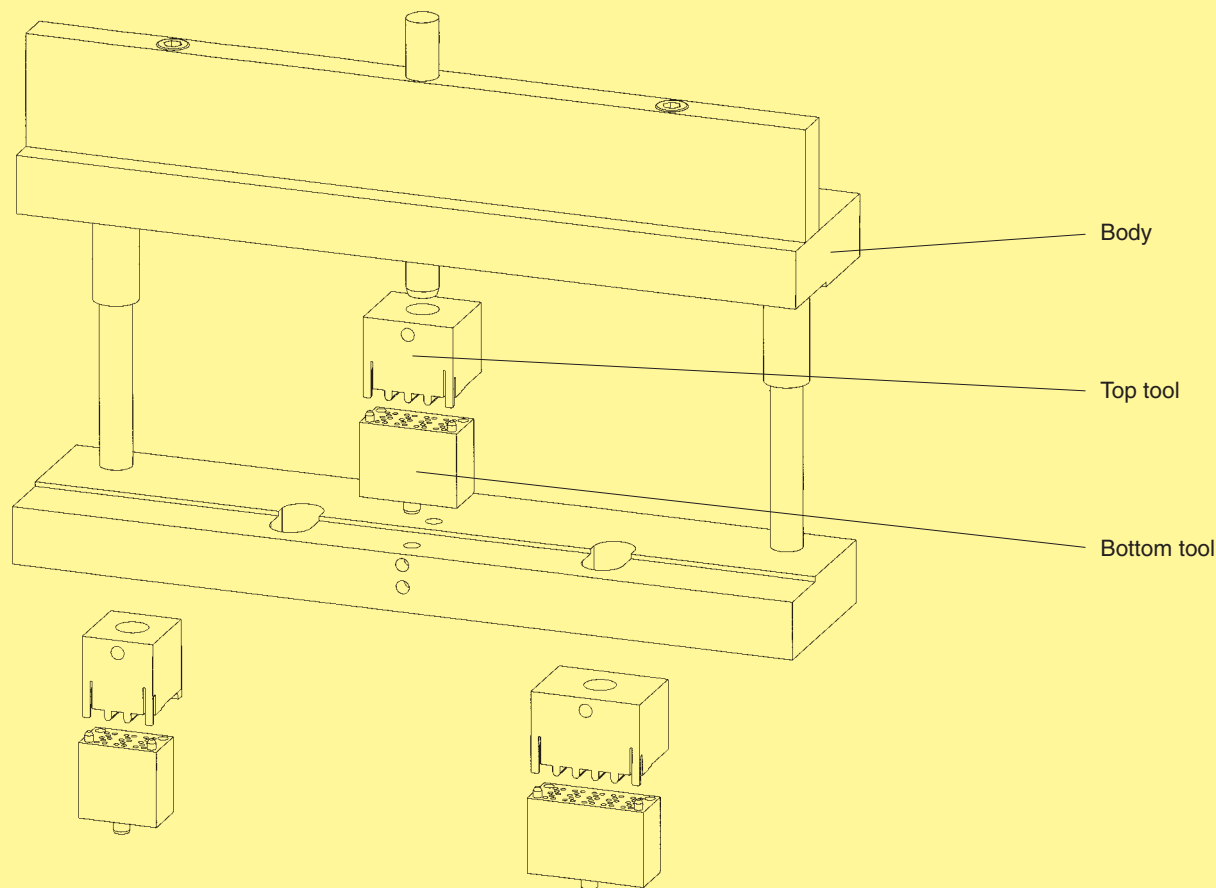


Fig. 6: Configuration for angled modules

15.08

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

For safe press-in of **har-pak®** connectors, HARTING has developed this 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. The top tool is inserted directly into the press and the bottom tool into a guide frame. This guide frame guarantees exact position of both the bottom tool and the pcb.

For detailed information please contact your local HARTING representative.

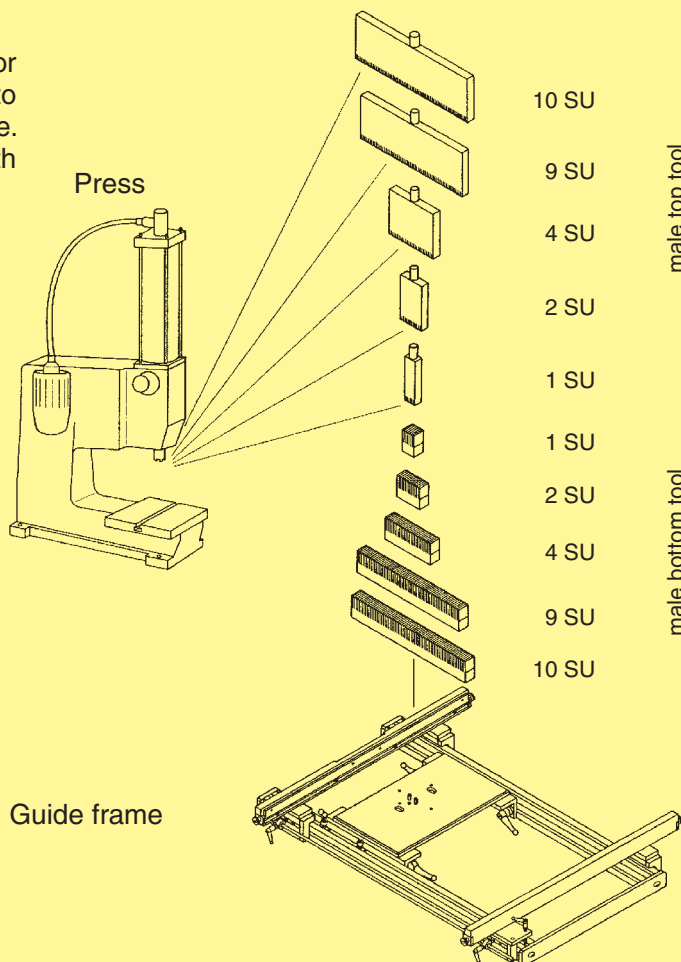


Fig. 7: Discrete tooling for straight male connectors

Tools for straight male connectors

Part number connector	Tool identification	Part number tool	Part number connector	Tool identification	Part number tool
07 01 xxx xxxx	1 SU top tool	07 79 000 0046	07 05 xxx xxxx	5.4 SU top tool	07 79 000 0051
07 01 xxx xxxx	1 SU bottom tool	07 79 000 0055	07 05 xxx xxxx	5.4 SU bottom tool	07 79 000 0060
07 02 xxx xxxx	2 SU top tool	07 79 000 0047	07 09 xxx xxxx	9 SU top tool	07 79 000 0049
07 02 xxx xxxx	2 SU bottom tool	07 79 000 0056	07 09 xxx xxxx	9 SU bottom tool	07 79 000 0058
07 02 xxx xxxx	2.3 SU top tool	07 79 000 0050	07 00 xxx xxxx	10 SU top tool	07 79 000 0052
07 02 xxx xxxx	2.3 SU bottom tool	07 79 000 0059	07 00 xxx xxxx	10 SU bottom tool	07 79 000 0076
07 04 xxx xxxx	4 SU top tool	07 79 000 0048	07 0x xxx xxxx	Guide frame large	09 99 000 0261
07 04 xxx xxxx	4 SU bottom tool	07 79 000 0057	07 0x xxx xxxx	Guide frame large for volume production	09 99 000 0289

Angled **harpak®** connectors will be pressed-in with separate lamellar and hole inserts, which will be mounted in a common body.

Implemented metal guides in the hole insert guarantee excellent pcb fixing, thus a lamellar insert fixation is not necessary.

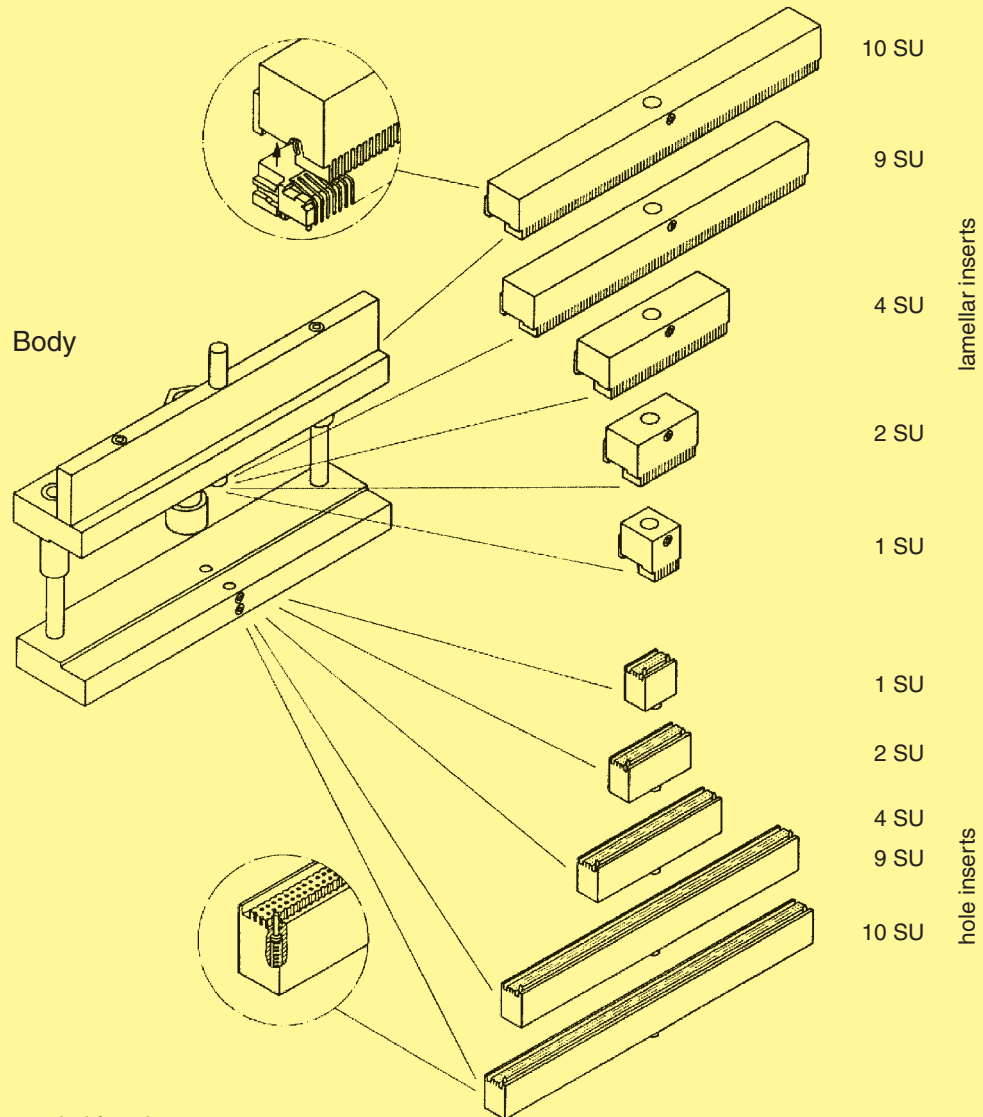


Fig. 8: Discrete tooling for angled female connectors

Tools for angled female connectors

Part number connector	Tool identification	Part number tool	Part number connector	Tool identification	Part number tool
07 21 xxx xxxx	1 SU lamellar insert	07 79 000 0062	07 25 xxx xxxx	5.4 SU lamellar insert	07 79 000 0031
07 21 xxx xxxx	1 SU hole insert	07 79 000 0070	07 25 xxx xxxx	5.4 SU hole insert	07 79 000 0032
07 22 xxx xxxx	2 SU lamellar insert	07 79 000 0063	07 29 xxx xxxx	9 SU lamellar insert	07 79 000 0065
07 22 xxx xxxx	2 SU hole insert	07 79 000 0071	07 29 xxx xxxx	9 SU hole insert	07 79 000 0073
07 22 xxx xxxx	2.3 SU lamellar insert	07 79 000 0029	07 20 xxx xxxx	10 SU lamellar insert	07 79 000 0066
07 22 xxx xxxx	2.3 SU hole insert	07 79 000 0030	07 20 xxx xxxx	10 SU hole insert	07 79 000 0074
07 24 xxx xxxx	4 SU lamellar insert	07 79 000 0064	07 2x xxx xxxx	Body 1-10 SU	07 79 000 0061
07 24 xxx xxxx	4 SU hole insert	07 79 000 0072			

The insert blocks can be used to press-in **har-pak®** male connectors without any special top tool.

These blocks will be put into the connector 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.

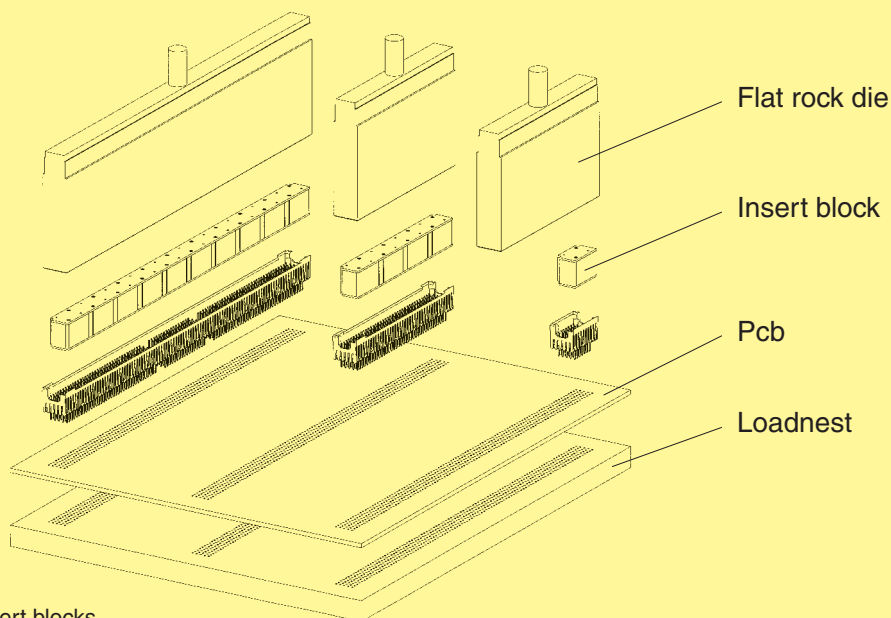


Fig. 9: Application samples for insert blocks

Insert blocks for straight male connectors

Part number connector	Tool identification	Part number tool
07 01 xxx xxxx	Insert block for 1 SU	07 79 000 0116
07 02 xxx xxxx	Insert block for 2 SU	07 79 000 0119
07 02 xxx xxxx	Insert block for 2.3 SU	07 79 000 0122
07 04 xxx xxxx	Insert block for 4 SU	07 79 000 0125
07 05 xxx xxxx	Insert block for 5.4 SU	07 79 000 0128
07 09 xxx xxxx	Insert block for 9 SU	07 79 000 0131
07 00 xxx xxxx	Insert block for 10 SU	07 79 000 0134

Flat rock dies

Part number connector	Tool identification	Part number tool
07 0x xxx xxxx	Flat rock die for 1-4 SU	07 79 000 0156
07 0x xxx xxxx	Flat rock die for 5.4-10 SU	07 79 000 0155

Repair and removal tools for straight male connectors

Part number connector	Tool identification	Part number tool
07 0x xxx xxxx	Press-in tool for male contacts (repair tool)	07 79 000 0040
07 0x xxx xxxx	Removal tool for male contacts length 6.0 mm	07 79 000 0041
07 0x xxx xxxx	Removal tool for male contacts length > 6.0 mm	07 79 000 0042

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

¹⁾ suitable for 09 99 000 0282 and all CPM machines (see page 15.13 pp.)

²⁾ not suitable for hand bench press

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

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

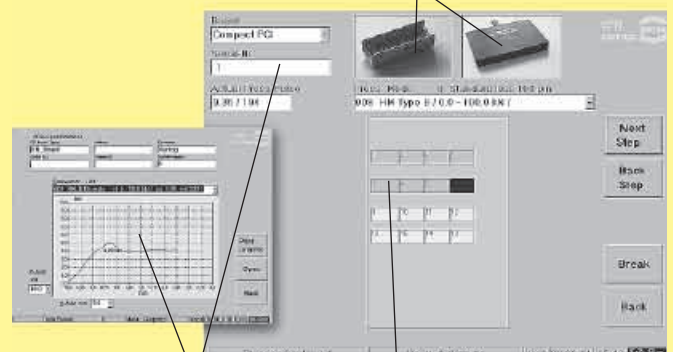
The visualisation of the entire press-in process (the position of the connector, press-in forces etc.) allows the rapid recognition and eradication of the possible error sources. With the addition of a barcode reader (1D and 2D)¹⁾ the parameters of every pcb layout can be stored, recalled and loaded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

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



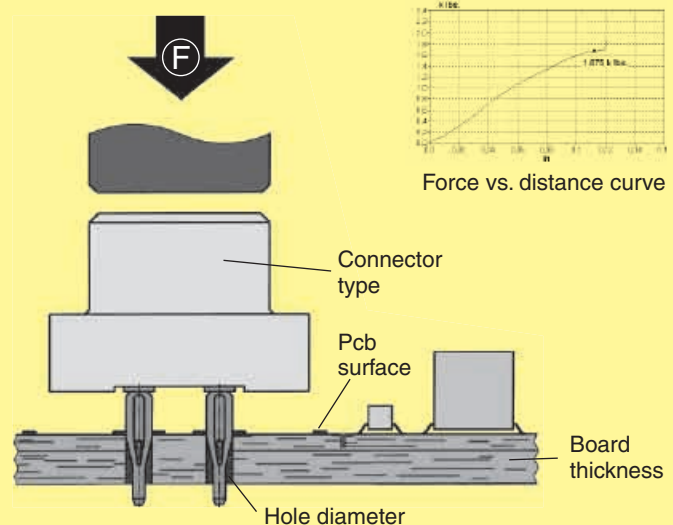
Visual guiding system via touch monitor

Real photos of connectors and tools



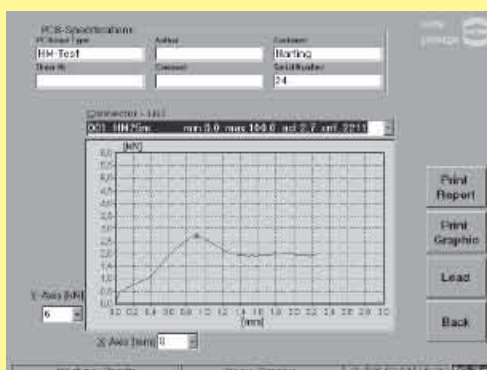
Process data

Layout with current position highlighted



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

¹⁾ 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. 10: **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

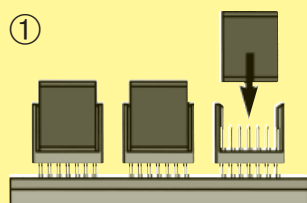


Power supply 220 V / 50 Hz
Air pressure 6 bar (15-16 l/min.)

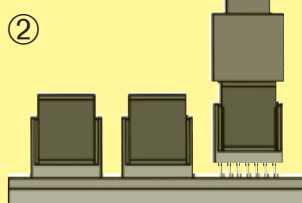
Part No. 09 89 040 3000
for pcb dimensions
of max.
710 mm x 540 mm

Fig. 11: Bestseller **CPM prestige** with insertion removal station, adaptable to all HARTING press-in machines.

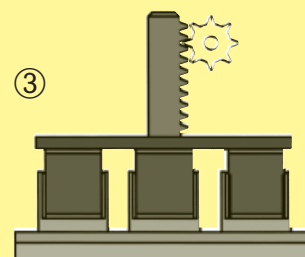
Principle:



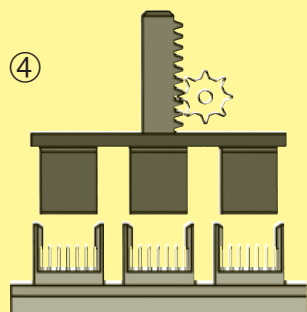
Load all headers with inserts for **one** press-in cycle



Press-in all connectors with a flat die



Position the magnetic plate

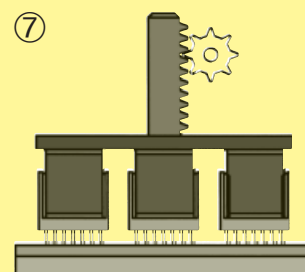


Remove all press-in inserts in one operation

Remove the processed pcb from the machine



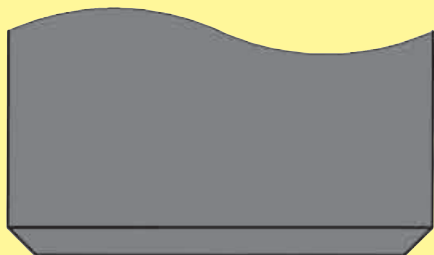
Move the next pre-assembled pcb to the insert station



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.

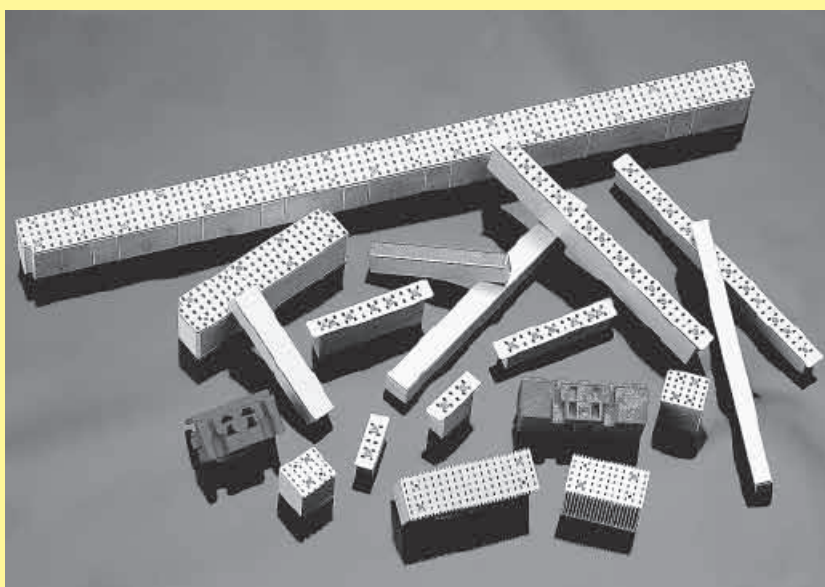
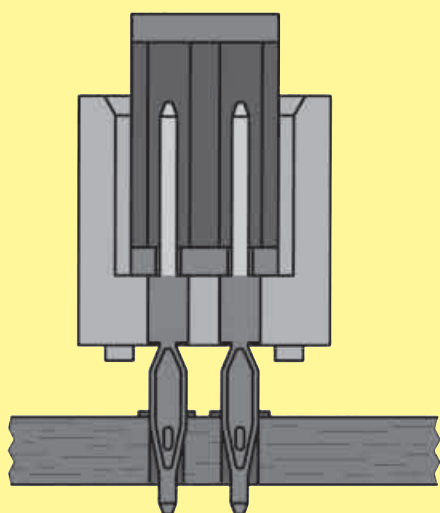


Advantages of press inserts

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 15.15).

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	16.02
Simulation and modeling	16.02
Measurement and verification	16.03
Test board design	16.03
Design-in support	16.03

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.

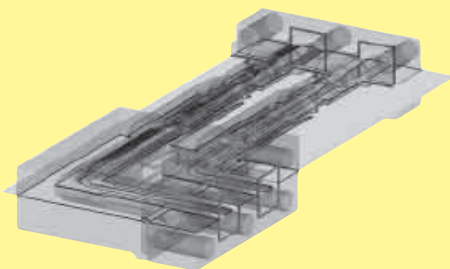
HARTING Electronics is also an active member in standardization groups such as VITA, PICMG, OBSAI and supports sub-committees for new interconnect solutions. We engage in close cooperation with universities and industrial partners for research activities.

Signal integrity capabilities

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

Simulation and modeling

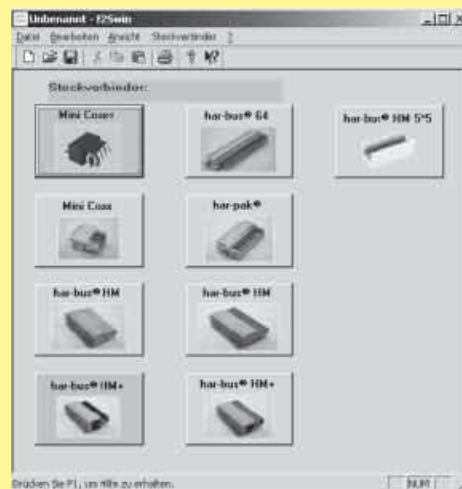
We have the capability to perform full 3D-FEM simulations of the CAD geometry with different well established tools such as CST Microwave Studio and Ansoft HFSS. This enables us to post-process the data for field distribution and full S-Parameter analysis.



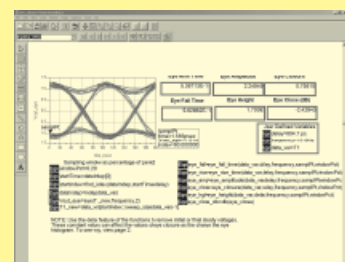
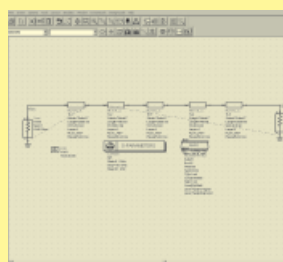
In conducting SPICE modeling, impedance calculation and field distribution analysis of the geometry, we draw on static 3D-FEM, 2D-FEM and planar field solvers.



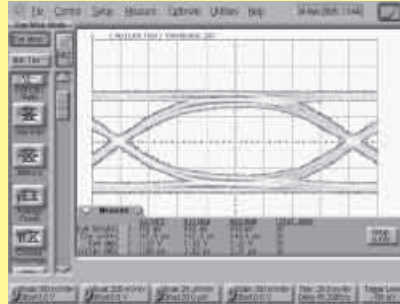
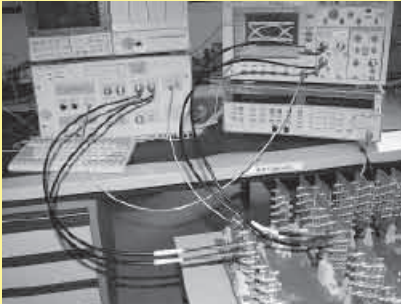
We have developed tools for SPICE netlist conversion based on R, L, C, G files for the post-processing of the data.



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



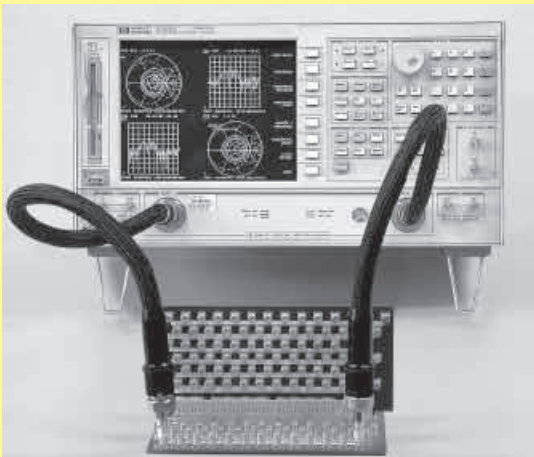
Time-domain measurements



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

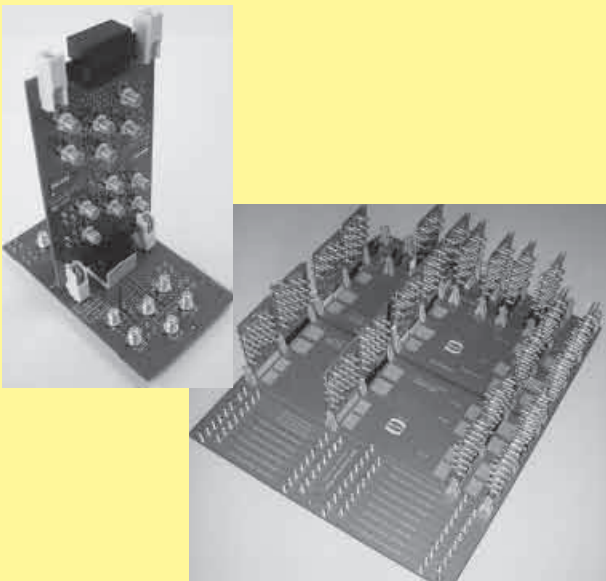
ISO/IEC 11801/CAT 5 measurements



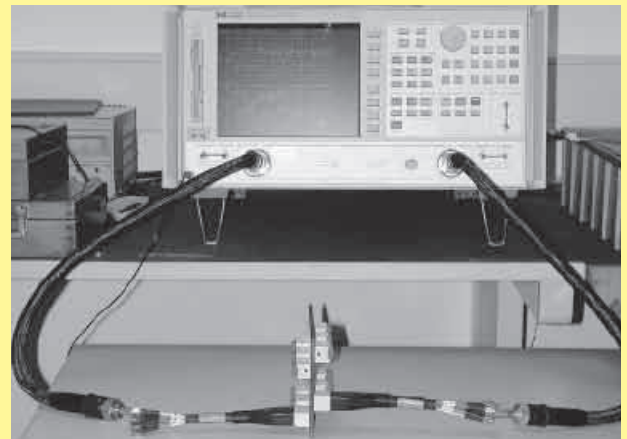
Parameters:

- 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).

[illegible]

										a
										b
										c
										d
										e
										f
11	10	9	8	7	6	5	4	3	2	1

[illegible]

Customer request form

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).

A large grid for writing answers, with columns numbered 1 to 22 from right to left and rows labeled a to f.

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			

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

Dimensions for mating length:
 U A B C: 3.7 ± 0.2
 K L M: 13 ± 0.2
 N P Q: 14.5 ± 0.2
 R S T: 16 ± 0.2

Minimum mating length: $\min. 6$, $\min. 7.5$, $\min. 9$

Datum plane depth

Length for mating:

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).

A large empty grid for drawing a picture. The grid is 25 columns wide and 10 rows high. Below the grid, the columns are numbered 25 to 1 from left to right. To the right of the grid, the rows are labeled with letters z to i from top to bottom.

A large grid for writing, with columns numbered 1 to 25 from right to left and rows labeled a to i from bottom to top.

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 ± 0.2

min. 6

14.5 ± 0.2

min. 7.5

16 ± 0.2

min. 9

Datum plane

Length for mating:

List of part numbers



Part
numbers

30
01

Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page
02 01 160 1101	00.45	07 01 711 7015	05.06	07 04 711 7015	05.09	07 20 119 7015	05.19
02 01 160 1102	00.45	07 01 711 8015	05.06	07 04 711 8015	05.09	07 20 219 7015	05.19
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02 02 160 1201	00.46	07 02 111 7015	05.07	07 05 111 7016	05.10		
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02 02 160 1301	00.46	07 02 111 8015	05.07	07 05 112 7015	05.10	07 21 219 7015	05.13
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02 02 160 2202	00.46	07 02 112 8015	05.07	07 05 412 7015	05.10		
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02 02 160 2302	00.46	07 02 411 7015	05.07	07 05 611 7015	05.10	07 22 119 7015	05.14
02 03 160 2201	00.47	07 02 411 7017	05.08	07 05 611 8015	05.10	07 22 119 7016	05.15
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		07 02 411 8017	05.08	07 05 612 8015	05.10	07 22 219 7016	05.15
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07 00 112 8015	05.12	07 02 611 7016	05.08	07 09 111 7015	05.11	07 24 119 7015	05.16
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07 00 611 8015	05.12	07 02 612 8016	05.08	07 09 412 7015	05.11	07 25 119 7015	05.17
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07 01 612 7015	05.06	07 04 612 7015	05.09				
07 01 612 8015	05.06	07 04 612 8015	05.09				

List of part numbers



Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page
07 31 900 0021	07.07	07 79 000 0155	15.11	17 01 100 1001	00.14	17 03 077 1001	00.23
07 31 900 0022	07.07	07 79 000 0156	15.06	17 01 100 1201	00.14	17 03 077 1201	00.22
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		07 79 000 0170	15.08	17 01 110 1402	00.13	17 03 077 2601	00.23
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				17 01 132 1203	00.12	17 04 132 1001	00.16
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				17 01 132 2203	00.12		
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07 79 000 0060	15.09	09 03 124 2901	00.42	17 02 125 2201	00.15	17 05 133 2203	00.17
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07 79 000 0063	15.10	09 03 224 6830	00.43	17 02 150 2201	00.15		
07 79 000 0064	15.10						
07 79 000 0065	15.10			17 02 175 1006	00.15	17 06 220 1201	00.28
07 79 000 0066	15.10			17 02 175 1201	00.15	17 06 220 1202	00.28
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07 79 000 0076	15.09	09 99 000 0194	00.44				
07 79 000 0080	15.08	09 99 000 0196	00.44			17 06 308 1001	00.29
07 79 000 0081	15.08	09 99 000 0201	15.12	17 03 055 1201	00.22	17 06 308 1005	00.29
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07 79 000 0128	15.11	09 99 000 0261	15.12	17 03 055 2401	00.22	17 06 308 2005	00.29
07 79 000 0131	15.11	09 99 000 0279	15.12			17 06 308 2201	00.28
07 79 000 0134	15.11	09 99 000 0282	15.12	17 03 066 1001	00.22	17 06 308 2202	00.28
07 79 000 0155	15.06	09 99 000 0289	15.09	17 03 066 2001	00.22	17 06 308 2203	00.28

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17 10 200 2201	00.34	17 21 110 1102	00.24	17 29 000 4102	00.30	17 46 144 1208	02.05
		17 21 110 1801	01.05			17 46 144 1209	02.05
17 10 244 1001	00.34	17 21 110 1802	01.05			17 46 144 1210	02.05
17 10 244 1201	00.34	17 21 110 2101	00.24			17 46 144 2207	02.05
17 10 244 2001	00.34	17 21 110 2102	00.24	17 33 000 4102	00.26	17 46 144 2208	02.05
17 10 244 2201	00.34					17 46 144 2209	02.05
		17 22 000 4102	00.25	17 33 095 1101	00.26	17 46 144 2210	02.05
				17 33 095 1102	00.26		
17 11 176 1201	00.32	17 22 125 1101	00.25	17 33 095 1801	01.07		
17 11 176 2201	00.32	17 22 125 1102	00.25	17 33 095 1802	01.07		
		17 22 125 1801	01.06	17 33 095 2101	00.26	17 51 072 1102	02.08
17 11 220 1001	00.32	17 22 125 1802	01.06	17 33 095 2102	00.26	17 51 072 1802	02.10
17 11 220 1201	00.32	17 22 125 2101	00.25			17 51 072 2102	02.08
17 11 220 2001	00.32	17 22 125 2102	00.25			17 51 072 2802	02.10
17 11 220 2201	00.32			17 34 000 4102	00.26		
17 12 200 1201	00.33	17 23 000 4102	00.24	17 34 110 1101	00.26	17 52 072 1105	02.08
17 12 200 2201	00.33	17 23 000 4102	00.27	17 34 110 1102	00.26	17 52 072 1106	02.08
		17 23 000 4102	00.30	17 34 110 1801	01.07	17 52 072 1107	02.08
17 12 250 1001	00.33			17 34 110 1802	01.07	17 52 072 1108	02.08
17 12 250 1201	00.33	17 23 055 1101	00.27	17 34 110 2101	00.26	17 52 072 1805	02.10
17 12 250 2001	00.33	17 23 055 1102	00.27	17 34 110 2102	00.26	17 52 072 1806	02.10
17 12 250 2201	00.33	17 23 055 1801	01.08			17 52 072 1807	02.10
		17 23 055 1802	01.08	17 35 125 1101	00.26	17 52 072 1808	02.10
		17 23 055 2101	00.27	17 35 125 1102	00.26	17 52 072 2105	02.08
		17 23 055 2102	00.27	17 35 125 1801	01.07	17 52 072 2106	02.08
17 13 095 1201	00.21			17 35 125 1802	01.07	17 52 072 2107	02.08
17 13 095 2201	00.21			17 35 125 2101	00.26	17 52 072 2108	02.08
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17 13 127 1201	00.21	17 24 000 4102	00.25			17 52 072 2806	02.10
17 13 127 1601	00.21	17 24 000 4102	00.30	17 41 072 1204	02.04	17 52 072 2807	02.10
17 13 127 2201	00.21			17 41 072 2204	02.04	17 52 072 2808	02.10
17 13 127 2601	00.21	17 24 110 1101	00.25				
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17 14 110 1201	00.20	17 24 110 2101	00.25			17 54 144 1102	02.08
17 14 110 2201	00.20	17 24 110 2102	00.25	17 42 072 1203	02.04	17 54 144 1802	02.10
				17 42 072 2203	02.04	17 54 144 2102	02.08
17 14 146 1201	00.20					17 54 144 2802	02.10
17 14 146 1601	00.20						
17 14 146 2201	00.20	17 25 000 4102	00.25				
17 14 146 2601	00.20						
		17 25 095 1101	00.25	17 43 072 1209	02.05		
		17 25 095 1102	00.25	17 43 072 1210	02.05	17 55 144 1105	02.08
		17 25 095 1801	01.06	17 43 072 1211	02.05	17 55 144 1106	02.08
17 15 125 1201	00.19	17 25 095 1802	01.06	17 43 072 1212	02.05	17 55 144 1107	02.08
17 15 125 2201	00.19	17 25 095 2101	00.25	17 43 072 2209	02.05	17 55 144 1108	02.08
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17 15 169 1003	00.19			17 43 072 2211	02.05	17 55 144 1806	02.10
17 15 169 1201	00.19			17 43 072 2212	02.05	17 55 144 1807	02.10
17 15 169 2003	00.19					17 55 144 1808	02.10
17 15 169 2201	00.19	17 26 000 4102	00.30			17 55 144 2105	02.08
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		17 26 200 1103	00.30	17 44 144 1205	02.04	17 55 144 2107	02.08
		17 26 200 2103	00.30	17 44 144 2205	02.04	17 55 144 2108	02.08
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17 21 000 4102	00.24	17 26 220 1101	00.30			17 55 144 2806	02.10
17 21 000 4102	00.26	17 26 220 1102	00.30			17 55 144 2807	02.10
		17 26 220 2101	00.30	17 45 144 1204	02.04	17 55 144 2808	02.10
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17 61 004 2104	03.04	17 79 000 0080	00.41	17 99 000 0059	15.04		
17 61 004 2801	03.05			17 99 000 0060	15.02		
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		17 99 000 0001	15.06	17 99 000 0063	15.05		
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17 66 004 2201	03.06	17 99 000 0003	15.06	17 99 000 0066	15.05		
		17 99 000 0004	15.06	17 99 000 0068	15.05		
		17 99 000 0005	15.06	17 99 000 0069	15.06		
17 70 000 1001	00.37	17 99 000 0006	15.06	17 99 000 0070	15.06		
17 70 000 1002	00.37	17 99 000 0007	15.06	17 99 000 0071	15.06		
17 70 000 1003	00.37	17 99 000 0008	15.06	17 99 000 0072	15.06		
17 70 000 1004	00.37	17 99 000 0009	15.06	17 99 000 0073	15.02		
17 70 000 2001	00.38	17 99 000 0012	15.02	17 99 000 0074	15.02		
17 70 000 2002	00.38	17 99 000 0013	15.02	17 99 000 0090	15.06		
17 70 000 2003	00.38	17 99 000 0014	15.03	17 99 000 0091	15.06		
17 70 000 2004	00.38	17 99 000 0015	15.03	17 99 000 0093	15.07		
17 70 000 3001	00.40	17 99 000 0016	15.03	17 99 000 0094	15.07		
17 70 000 3002	00.40	17 99 000 0017	15.03	17 99 000 0095	15.07		
17 70 000 3003	00.40	17 99 000 0018	15.03	17 99 000 0102	15.07		
17 70 000 3004	00.40	17 99 000 0019	15.03	17 99 000 0103	15.07		
17 70 000 4001	00.38	17 99 000 0020	15.03				
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17 70 000 4004	00.38	17 99 000 0023	15.03	27 11 161 8001	11.05		
17 70 000 5001	00.38	17 99 000 0024	15.03				
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17 70 000 5003	00.38	17 99 000 0026	15.03	27 21 121 8000	11.05		
17 70 000 5004	00.38	17 99 000 0027	15.03	27 21 121 8002	11.05		
17 70 000 6001	00.39	17 99 000 0028	15.03	27 21 121 8004	11.05		
17 70 000 6002	00.39	17 99 000 0029	15.04	27 21 121 8005	11.05		
17 70 000 6003	00.39	17 99 000 0030	15.04	27 21 121 8006	11.05		
17 70 000 6004	00.39	17 99 000 0031	15.04	27 21 121 8010	11.05		
17 70 000 7001	00.39	17 99 000 0032	15.04				
17 70 000 7002	00.39	17 99 000 0033	15.04				
17 70 000 7003	00.39	17 99 000 0034	15.04	27 71 040 0001	11.06		
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17 70 000 8001	00.39	17 99 000 0036	15.04				
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17 79 000 0010	00.35	17 99 000 0043	15.04	33 27 243 1000 007	11.06		
17 79 000 0012	00.35	17 99 000 0044	15.04	33 27 243 2000 003	11.06		
17 79 000 0013	00.35	17 99 000 0045	15.04	33 27 243 2000 008	11.06		
17 79 000 0014	00.35	17 99 000 0046	15.04				
17 79 000 0015	00.35	17 99 000 0047	15.04				
17 79 000 0016	00.35	17 99 000 0048	15.04				
17 79 000 0018	00.35	17 99 000 0049	15.04				
17 79 000 0019	00.35	17 99 000 0050	15.04				
17 79 000 0020	00.35	17 99 000 0051	15.04				
17 79 000 0022	00.35	17 99 000 0052	15.02				
17 79 000 0023	00.35	17 99 000 0053	15.02				
17 79 000 0024	00.35	17 99 000 0054	15.02				
17 79 000 0025	00.35	17 99 000 0055	15.02				