har:bus® 64 / har:bus® 64 inverse

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

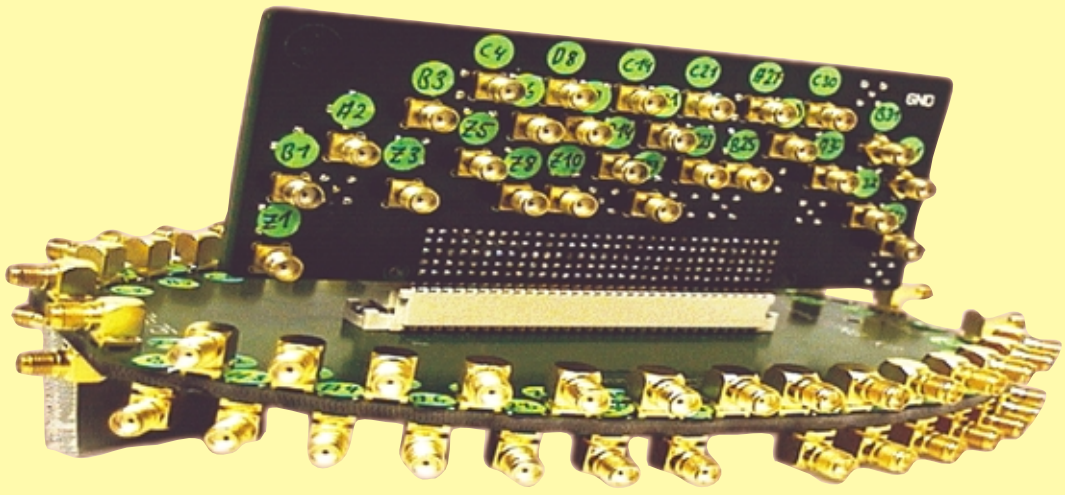
Despite numerous new bus systems based on the rapid changes in chip technology, VMEbus systems offer significant advantages such as their robustness, reliability and increased availability of processor, memory and I/O cards.

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

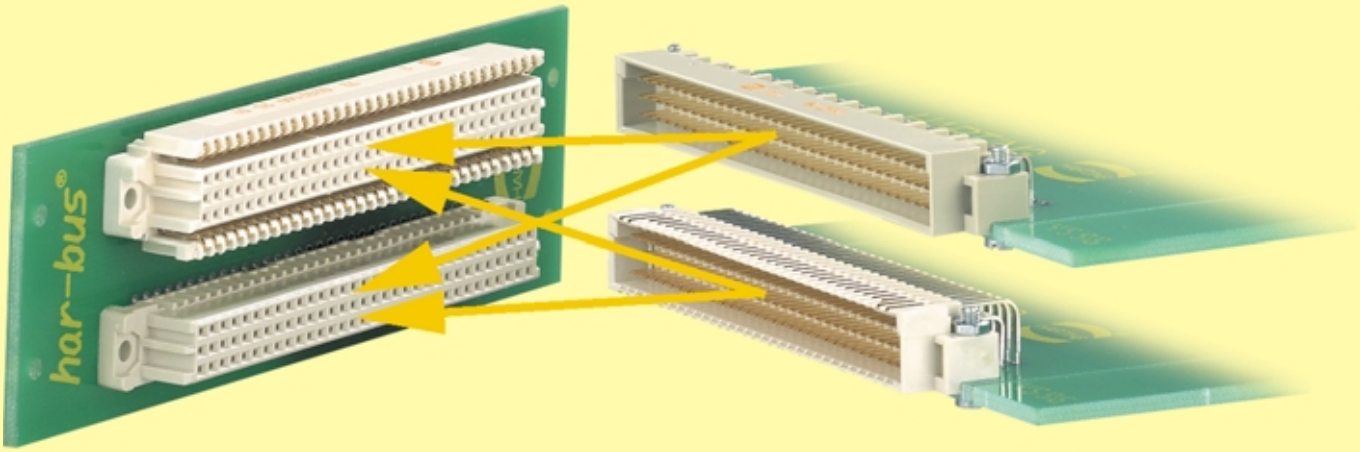
With the increase in processing speeds and data transmission rates, 3 row DIN 41 612 connectors have reached their limit, so the VME standard needs to be enhanced further.

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

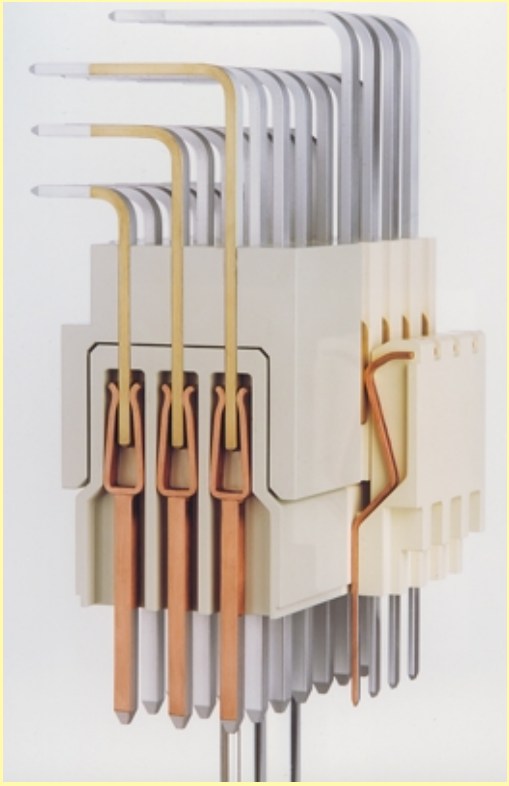
To offer the best design possible from the start, HARTING developed spice models that were later certified via signal integrity measurements of the connector.



High precision slot structure with VME pinning for connector characterisation.



Backward compatibility



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

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

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

har:bus® 64 –five rows –160 poles

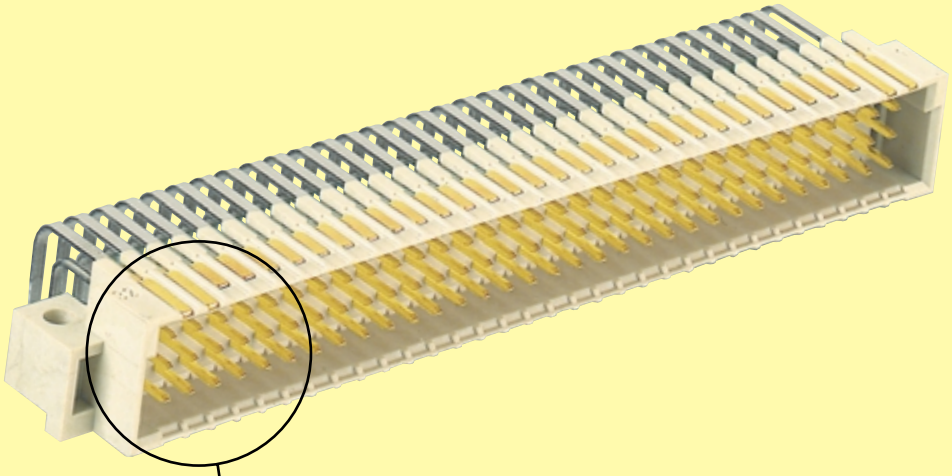
Two additional rows of contacts in the har:bus® 64 connector offer new system features:

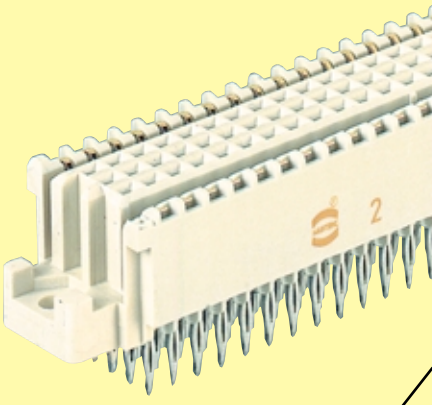
- Additional contacts for I/O and system upgrade
- New voltage supplies for 3.3 V and 48 V system components
- Identifying locations of system components and the bus length. “Plug & Play“
- Improved signal/ground ratio for reliable signal data transfer at rates up to 320 MByte/s
- Live Insertion for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

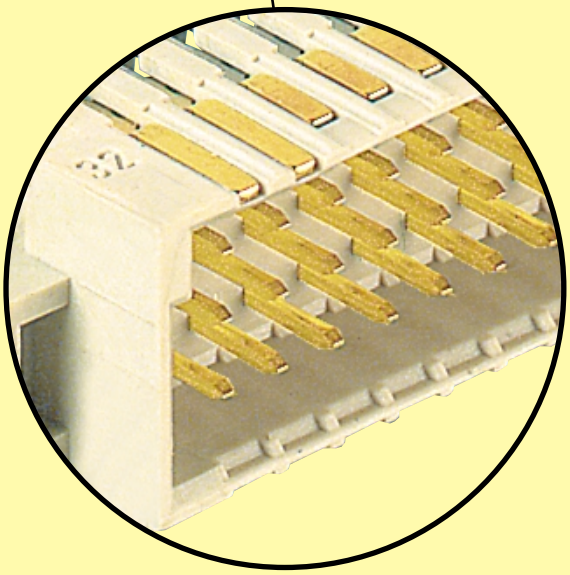
The advantages of har:bus® 64 in detail

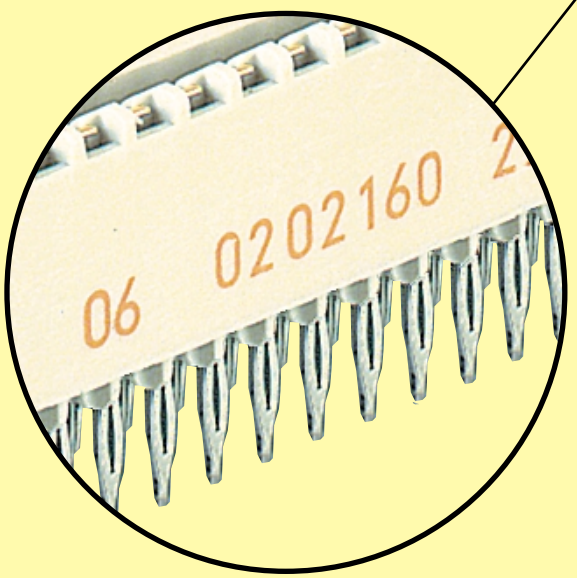
User-defined pins in the outer rows can be used for application specific functions such as **additional I/O**. Configured as a shield to provide larger ground return paths, they assure for **data transfer rates up to 320 MByte/s**.

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





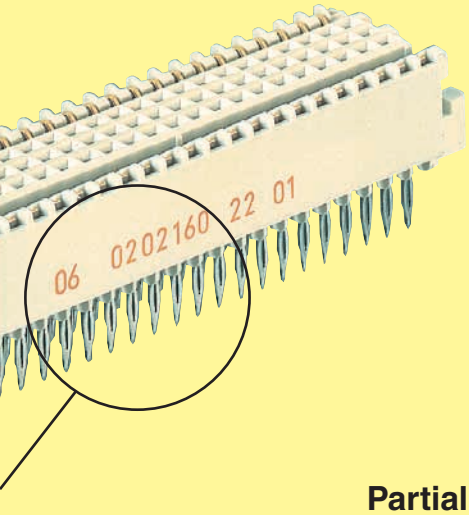


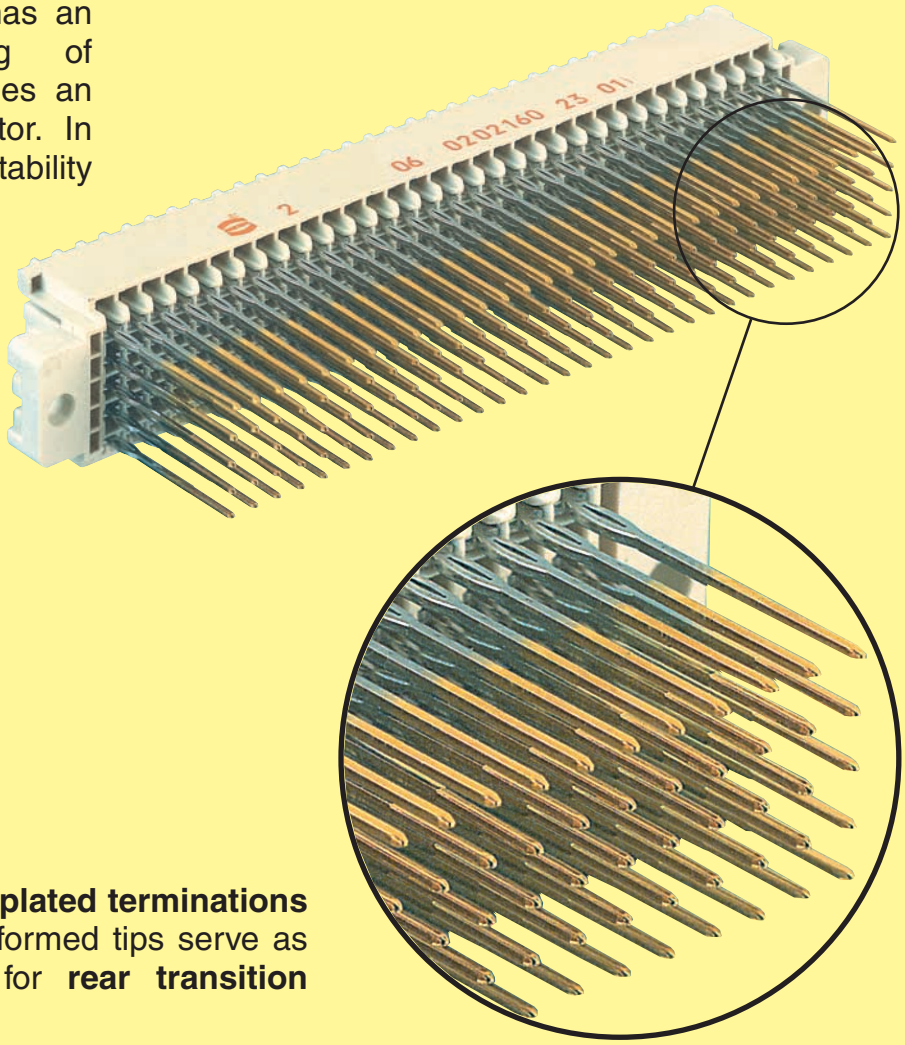


Four preleading contacts (1.5 mm) serve to pre-load the transmit and receive logic so that the bus will not experience glitches during **live insertion** of new cards into the backplane.

Backplane connector terminations are designed in solderless **press-in technology**.
The connector can be installed without any special tooling using economical **flat dies** for high speed insertion.

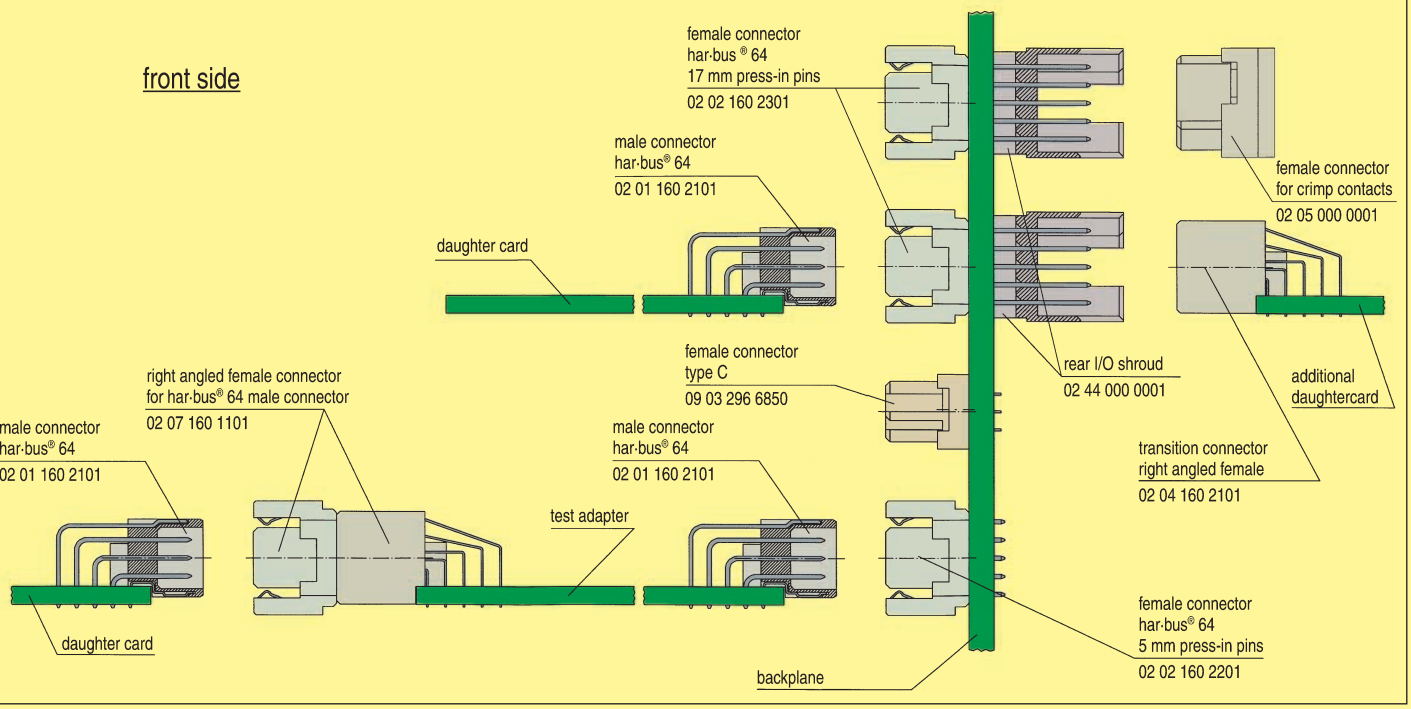
The insulator, made of LCP, has an inherent flammability rating of UL 94-V0 and therefore provides an **environment friendly** connector. In addition, the heat deformation stability of LCP makes the connector **surface-mount compatible** (see chapter 05).





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

har·bus® 64 system description



Number of contacts	160
Contact spacing (mm)	2.54
Working current	1 A at 70 °C and all contacts are loaded

see current carrying capacity chart

Clearance and creepage distances*

minimal clearance and creepage distance[1]		distance in mm	
		rows a, b, c	rows z, d
between two rows	clearance	1.2	1.2
	creepage	1.2	1.2
between two contacts (in a row)	clearance	1.2	1.0
	creepage	1.2	1.0

[1] valid for mated and unmated connectors

Working voltage

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

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

1 kV

Contact resistance

rows a, b, c: ≤ 20 mΩ
rows z, d: ≤ 30 mΩ

Insulation resistance

≥ 10^{10} Ω acc. to IEC 60512-2

Temperature range

–55 °C ..+ 125 °C

Electrical termination

Male connector	Solder pins for pcb termination Ø 1.0 ± 0.1 mm according to IEC 60 326-3
Female connector	Solder pins for pcb termination Ø 1.0 ± 0.1 mm according to IEC 60 326-3 Compliant press-in terminations
Diameter of pcb plated through holes	0.94 - 1.09 mm
pcb thickness	≥ 1.6 mm
Recommended pcb holes for press-in technology	Drilled hole : $1.15^{-0.03}$ mm Cu : 25 - 50 µm Sn : 5 - 15 µm

Insertion and withdrawal force

≤ 160 N

Materials

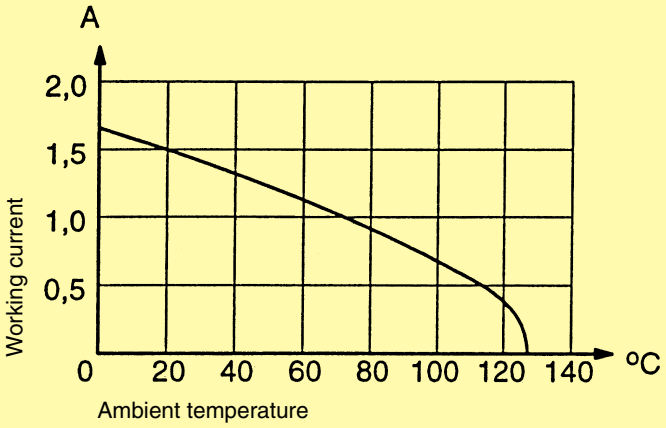
Mouldings	• Liquid Cristal Polymer (LCP), for male connectors, straight female connectors, UL 94-V0 • Thermoplastic resin glass-fibre filled, UL 94-V0
Contacts	Copper alloy
Contact surface	Contact zone: selectively plated[2] Termination zone: tinned selectively plated[2] similar to the performance level of the contact zone

[2] Explanation performance levels see chapter 00

Current carrying capacity chart

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

Control and test procedures according to DIN IEC 60 512



* for angled female connector see page 06.20

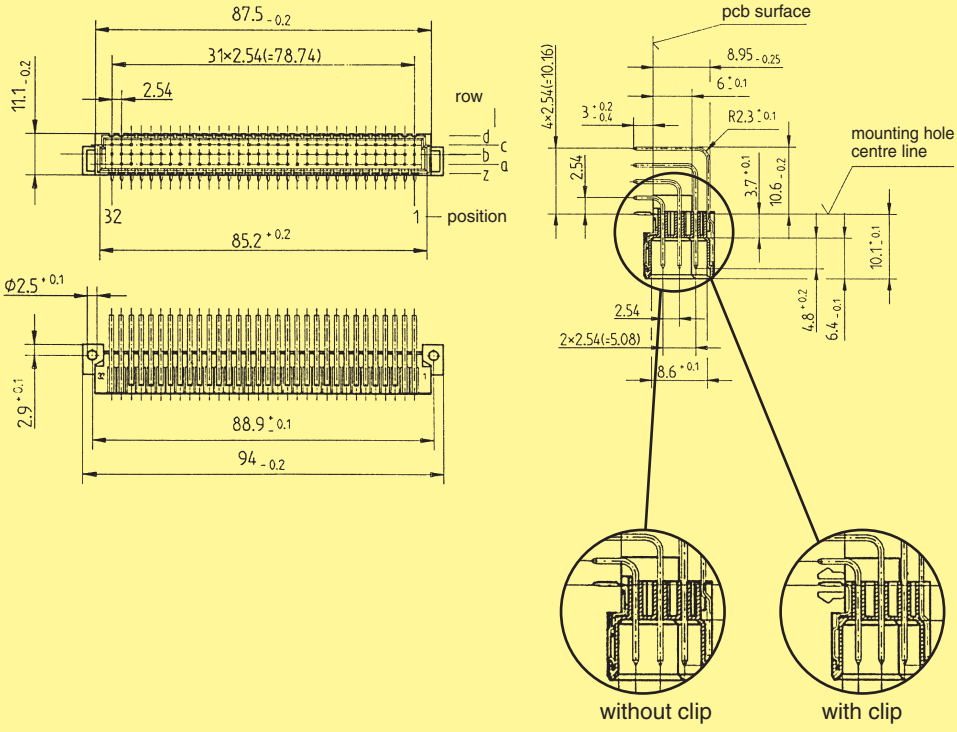
Number of contacts

160

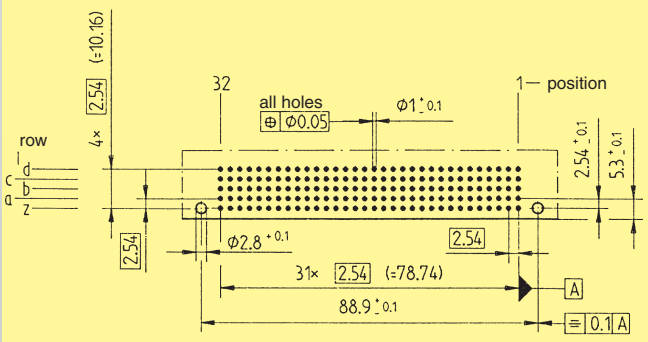
Male connectors

Identification	Number of contacts	Contact arrangement	Part No. Performance levels according to DIN 41 612 Explanation chapter 00 2	1
Male connectors, angled[1]				
with solder pins				
without retention clip	160	z, a, b, c, d	02 01 160 2101	02 01 160 1101
SMC version* with retention clip	160	z, a, b, c, d	02 01 160 2102	02 01 160 1102

Dimensions



Board drillings



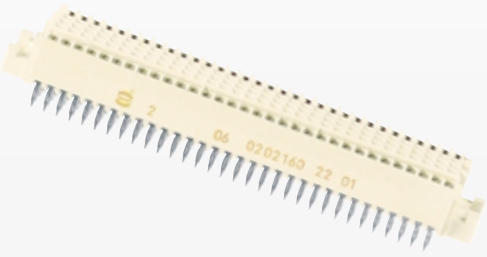
Dimensions in mm

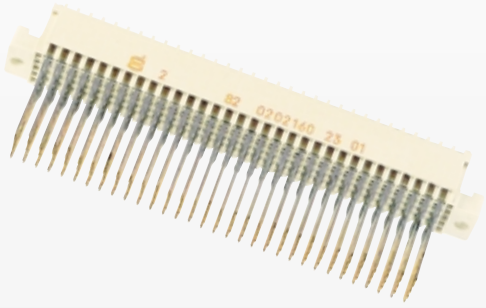
* SMC see chapter 05

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

Number of contacts

160

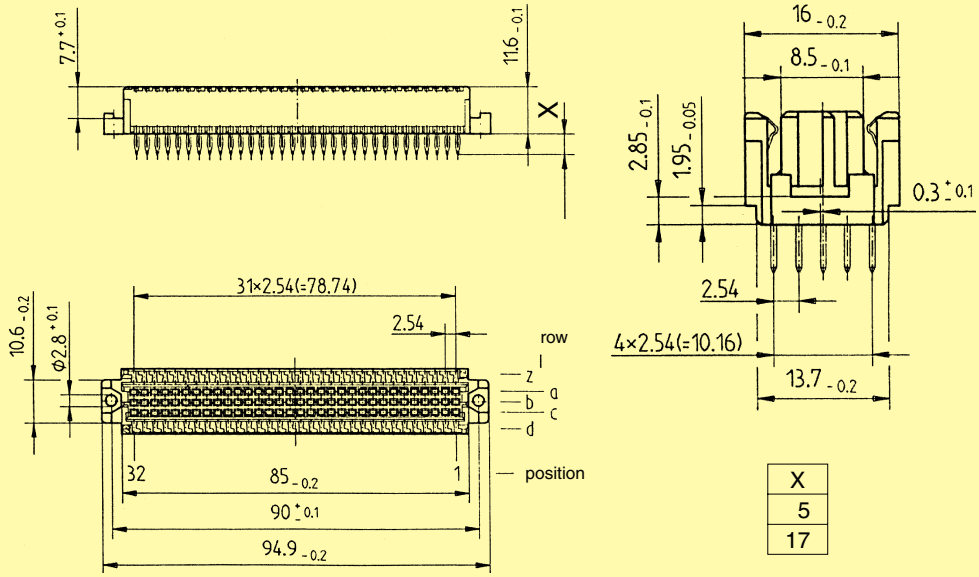




Female connectors

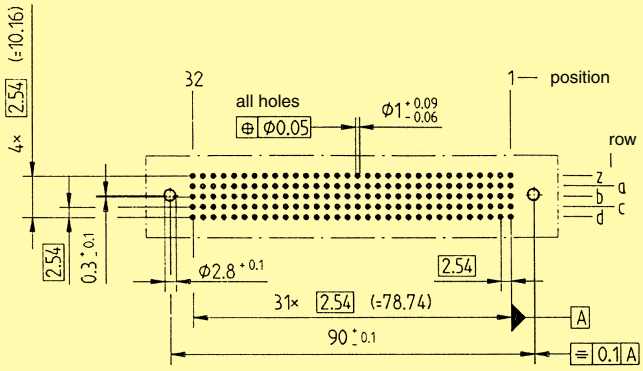
Identification	Number of contacts	Contact arrangement	Part No. Performance levels according to DIN 41 612 Explanation chapter 00 2	1
Female connectors, straight				
with press-in terminations				
with fixing flange 5 mm	160	z, a, b, c, d	02 02 160 2201	02 02 160 1201
17 mm*	160	z, a, b, c, d	02 02 160 2301	02 02 160 1301
without fixing flange 5 mm	160	z, a, b, c, d	02 02 160 2202	02 02 160 1202
17 mm*	160	z, a, b, c, d	02 02 160 2302	02 02 160 1302

Dimensions



X
5
17

Board drillings

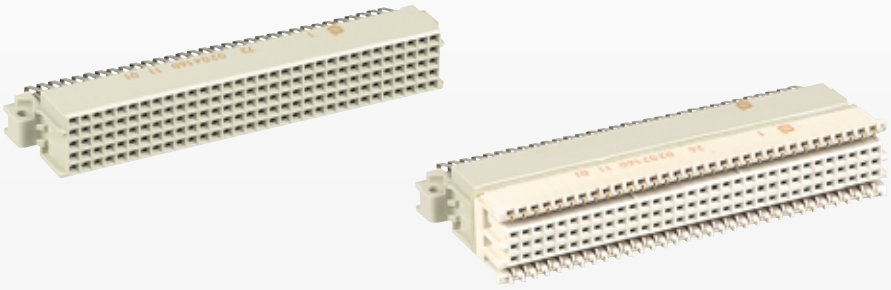


Dimensions in mm

* selectively gold-plated
Press-in technology see chapter 04
Tooling see chapter 30

Number of contacts

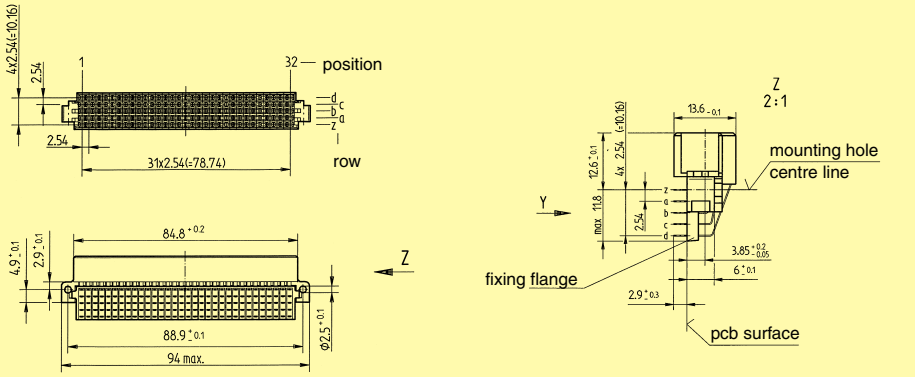
160



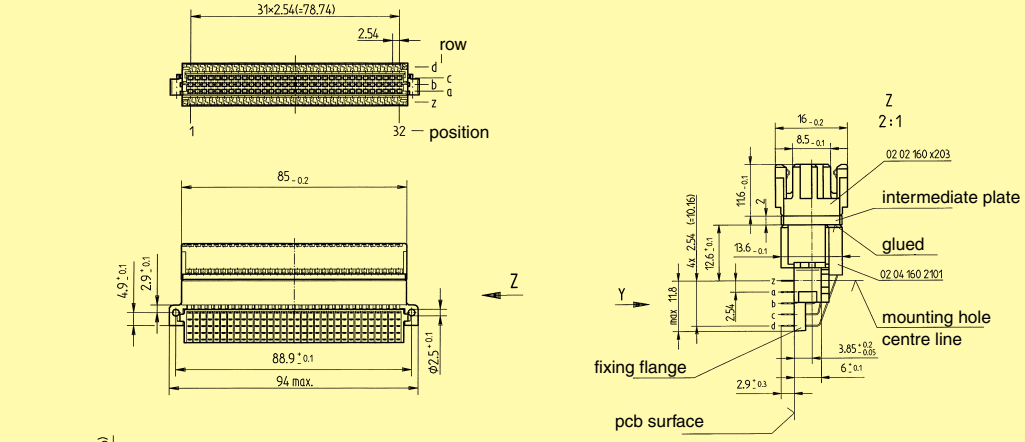
Female connectors

Identification	Number of contacts	Contact arrangement	Part No. 2	Part No. 1
Female connectors, angled			Performance levels according to DIN 41 612 Explanation chapter 00	
with solder pins				
for rear access and har-bus® 64 inverse male connector	160	z, a, b, c, d	02 04 160 2101	02 04 160 1101
for har-bus® 64 male connector	160	z, a, b, c, d		02 07 160 1101

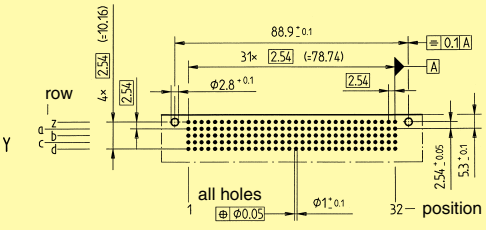
Dimensions
02 04 160 x101



Dimensions
02 07 160 1101



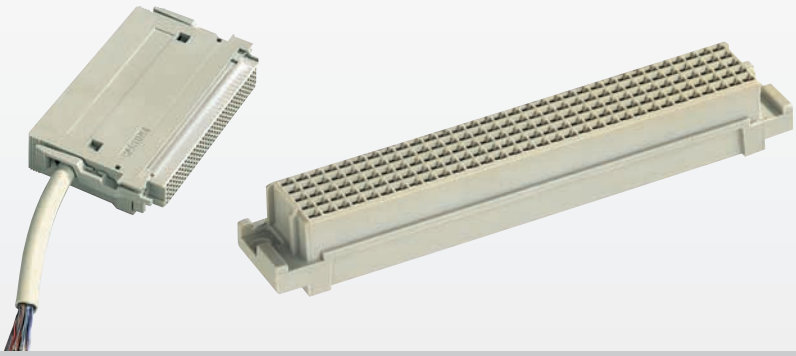
Board drillings



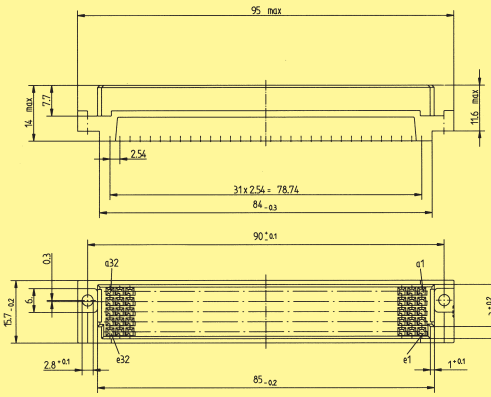
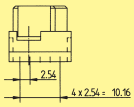
Dimensions in mm

Number of contacts

max. 160



Female connectors

Identification	Number of contacts	Part No.	Drawing	Dimensions in mm
Female connector for crimp contacts order contacts separately fits into shell housing C see chapter 20	160	02 05 000 0001		

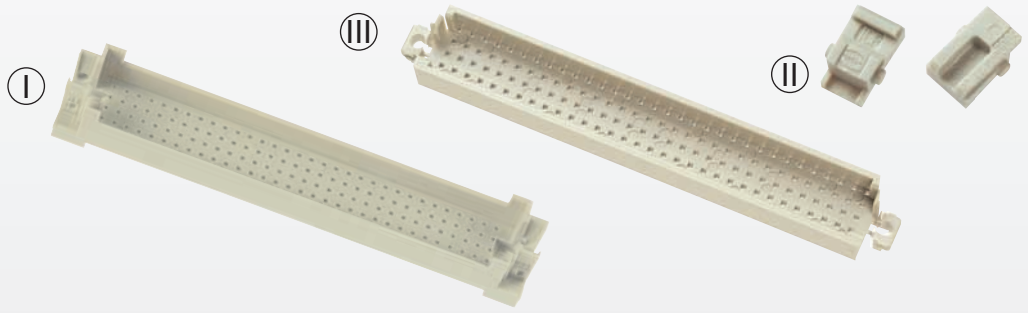
Identification Wire gauge	Performance level 2	Wire gauge mm²	AWG	Insulation-ø mm
Female crimp contacts Bandoliered contacts (approx. 500 pieces)				
1	02 05 000 2501	0.08 - 0.22	28 - 24	0.7 - 1.5
2	02 05 000 2502	0.14 - 0.56	26 - 20	0.8 - 2.0

HARTING crimping tool for bandoliered contacts (500 pieces)	02 99 000 0010	Wire gauge 0.08 - 0.5 mm²

Removal tool	02 99 000 0013

Number of contacts

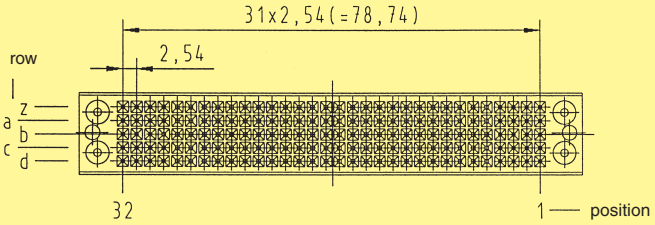
160

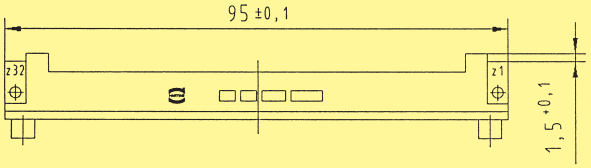


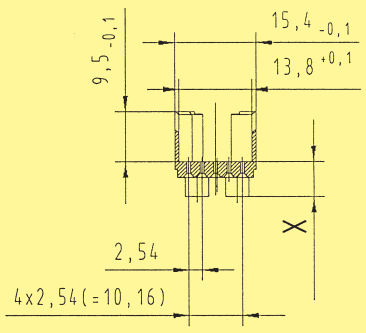
Pin shrouds

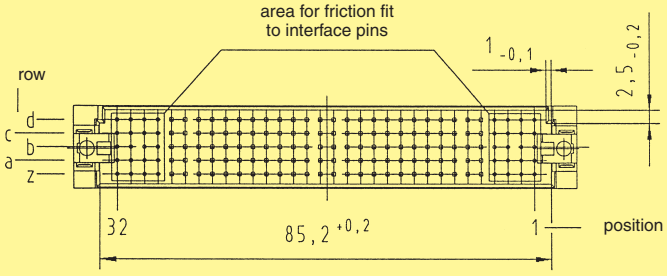
Identification	Number of contacts	Contact arrangement	Part No.	
Pin shrouds (I)	160	z, a, b, c, d	pcb thickness (± 0.3 mm)	
			02 44 000 0007	2.8
			02 44 000 0001	3.4
			02 44 000 0002	4.0
			02 44 000 0003	4.6
			02 44 000 0004	5.2
			02 44 000 0005	5.8
			02 44 000 0006	6.4
(II) Fixing brackets for shell housing C*			02 44 000 0009	
(III) Shroud insert for 3 row female connectors			02 44 000 0008	

Dimensions









pcb thickness	X
2.8 ± 0.3	6.6 –0.1
3.4 ± 0.3	6.0 –0.1
4.0 ± 0.3	5.4 –0.1
4.6 ± 0.3	4.8 –0.1
5.2 ± 0.3	4.2 –0.1
5.8 ± 0.3	3.6 –0.1
6.4 ± 0.3	3.0 –0.1

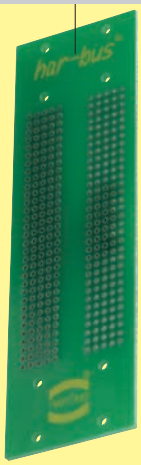
Dimensions in mm

* order 2 pieces per connector

Application 1*

Female connector
02 02 160 2301

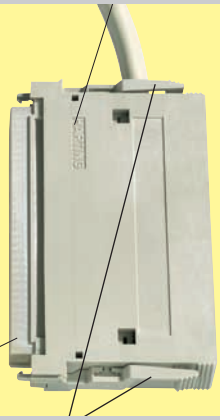
Backplane



Pin shroud
02 44 000 0007

Fixing brackets
02 44 000 0009

Shell housing C
09 05 048 0501



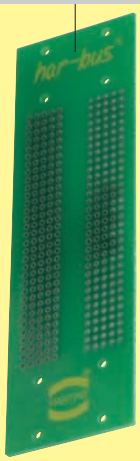
Female connector
with crimp contacts
02 05 000 0001

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

Application 2*

Female connector
02 02 160 2301

Backplane



Pin shroud
02 44 000 0007

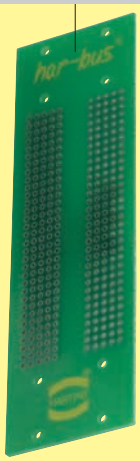
Locking lever
09 03 000 9913

Female connector
for crimp contacts
02 05 000 0001

Application 3

Female connector
02 02 160 2301

Backplane



Pin shroud
02 44 000 0007

Shroud insert
02 44 000 0008

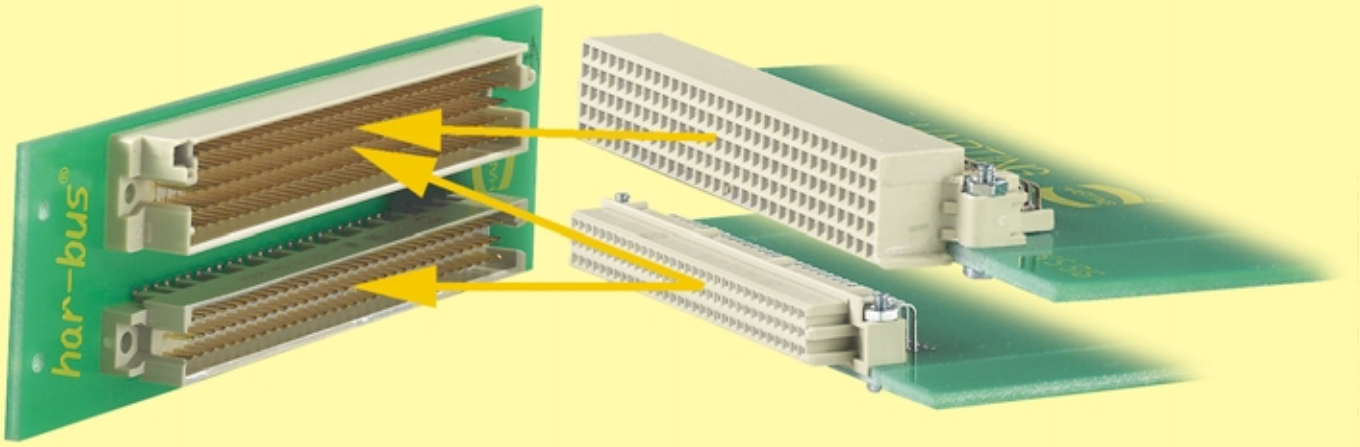
Female connector
09 73 296 6801

* Only for applications without rear PO-connector

Backward compatible system upgrade with inverse connectors

The inverse types of DIN 41 612 connectors, e.g. 3 row type R connectors, have a strong position in telecoms. However, the trend is for increasing data transfer rates and the demand for additional signal pins.

The 5 row inverse connector system allows a gradual enhancement of existing systems. The 5 row male connector is mateable with both daughter cards with 3 row female connectors and with innovative high-speed boards with 5 row female connectors.



har:bus® 64 inverse is a 5 row 160 pin connector that supplies additional rows d and z to type R connectors according to DIN 41 612.

Due to the special design of the moulding the male connectors are backwards compatible to 3 row type R female connectors. An internal coding system prevents the mismating of female connectors.

The male connector is fully compatible with all 3 row type R female connectors and the 5 row angled **har:bus® 64** female connector.

The additional contact rows d and z of **har:bus® 64** inverse offer following advantages to the user:

- **Additional contacts** for I/O or new functions yet to be defined
- **Improved signal/ground ratio** for reliable data transfer at rates up to 320 MByte/s
- **Backward compatibility** i.e. daughter cards with 3 row connectors can be upgraded without function loss
- **Secure mating** due to internal coding
- **Gradual system enhancement on demand**

Number of contacts	160
Contact spacing (mm)	2.54
Working current	1 A at 70 °C and all contacts are loaded

see current carrying capacity chart

Clearance and creepage

minimal clearance and creepage distance[1]		distance in mm	
		male connector	female connector
between two rows	clearance	1.4	0.6
	creepage	1.4	0.6
between two contacts (in a row)	clearance	1.2	0.8
	creepage	1.2	0.8

[1] valid for mated and unmated connectors

Working voltage

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

Test voltage $U_{r.m.s.}$	1 kV
Contact resistance	≤ 20 mΩ
Insulation resistance	≥ 10^{10} Ω acc. to IEC 60512-2
Temperature range	–55 °C ..+ 125 °C

Electrical termination

Male connector	Compliant press-in termination
Diameter of pcb plated through holes	0.94 - 1.09 mm
pcb thickness	≥ 1.6 mm
Recommended pcb holes for press-in technology	Drilled hole : $1.15^{-0.03}$ mm Cu : 25 - 50 µm Sn : 5 - 15 µm
Female connector	Solder pins for pcb connection Ø 1.0 ± 0.1 mm according to IEC 60 326-3
Insertion and withdrawal force	≤ 160 N

Materials

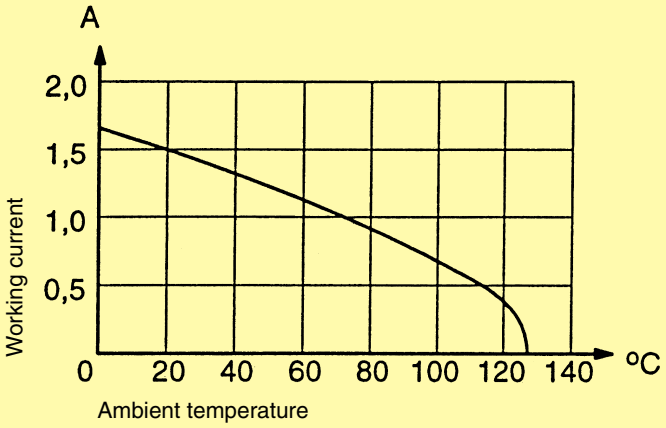
Mouldings	Thermoplastic resin, glass-fibre filled, UL 94-V0
Contacts	Copper alloy
Contact surface	Contact zone: selectively plated[2] Termination zone: tinned

[2] Explanation of performance levels see chapter 00

Current carrying capacity chart

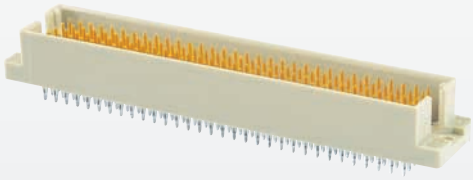
The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current loaded contacts of connectors when simultaneous power on all contacts is given, without exceeding the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

Control and test procedures according to DIN IEC 60 512



Number of contacts

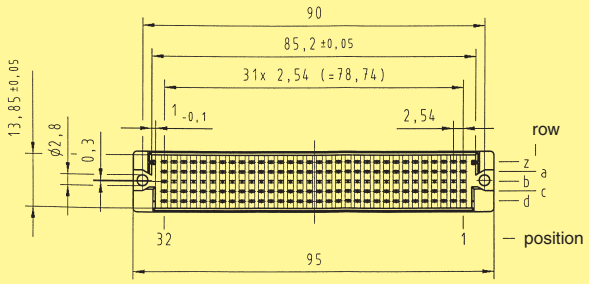
160

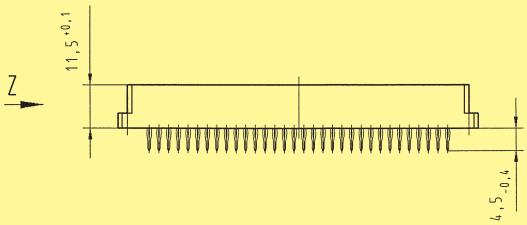


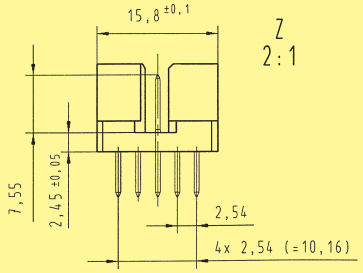
Male connectors

Identification	Number of contacts	Contact arrangement	Part No. Performance levels according to DIN 41 612 Explanation chapter 00 2	1
Male connectors, straight with press-in terminations	160	z, a, b, c, d	02 08 160 2601	02 08 160 1601

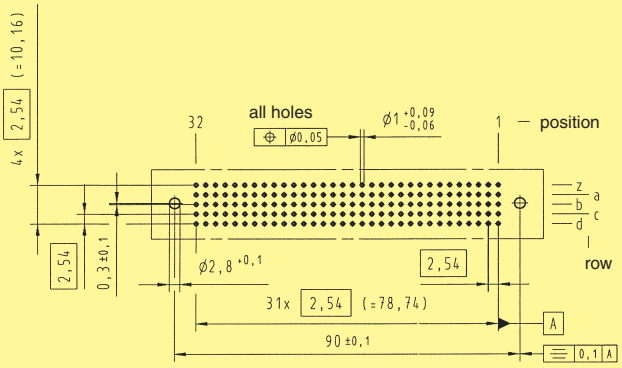
Dimensions







Board drillings

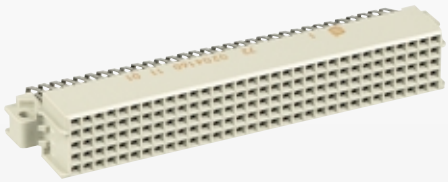


Dimensions in mm

Tooling see chapter 30
Press-in technique see chapter 04

Number of contacts

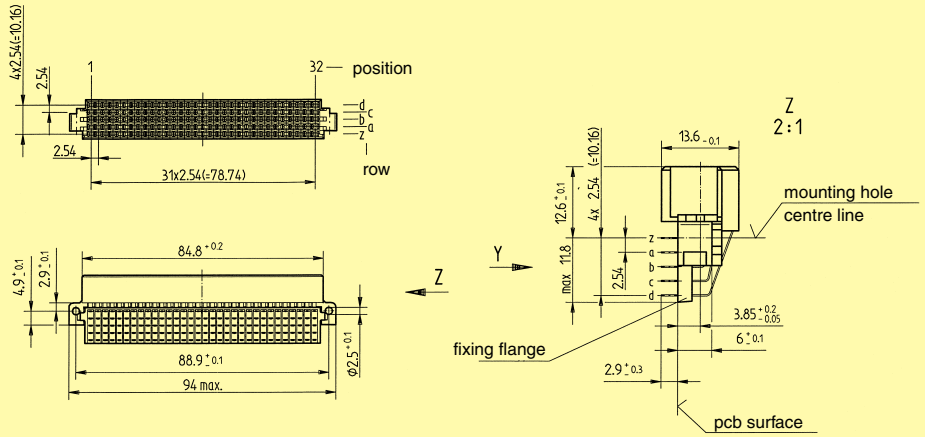
160



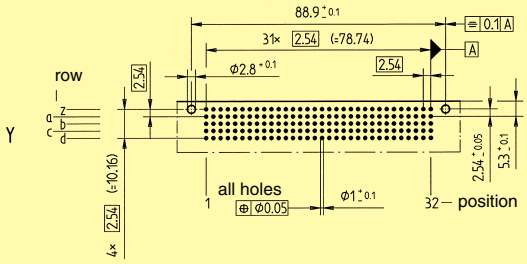
Female connectors

Identification	Number of contacts	Contact arrangement	Part No. Performance levels according to DIN 41 612 Explanation chapter 00 2	1
Female connectors, angled with solder pins for har-bus® 64 inverse male connectors and for rear access	160	z, a, b, c, d	02 04 160 2101	02 04 160 1101

Dimensions



Board drillings



Dimensions in mm