

harbus® 64 / harbus® 64 inverse

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harbus® 64

System description **06.03**

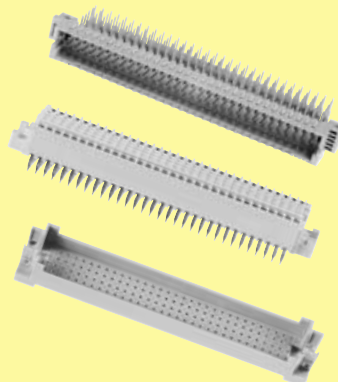
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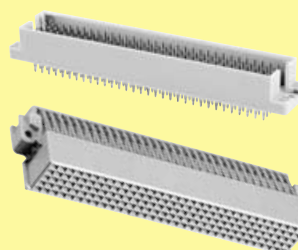
harbus® 64 inverse

System description **06.19**

Technical characteristics **06.20**

Male connectors **06.21**

Female connectors **06.22**



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

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

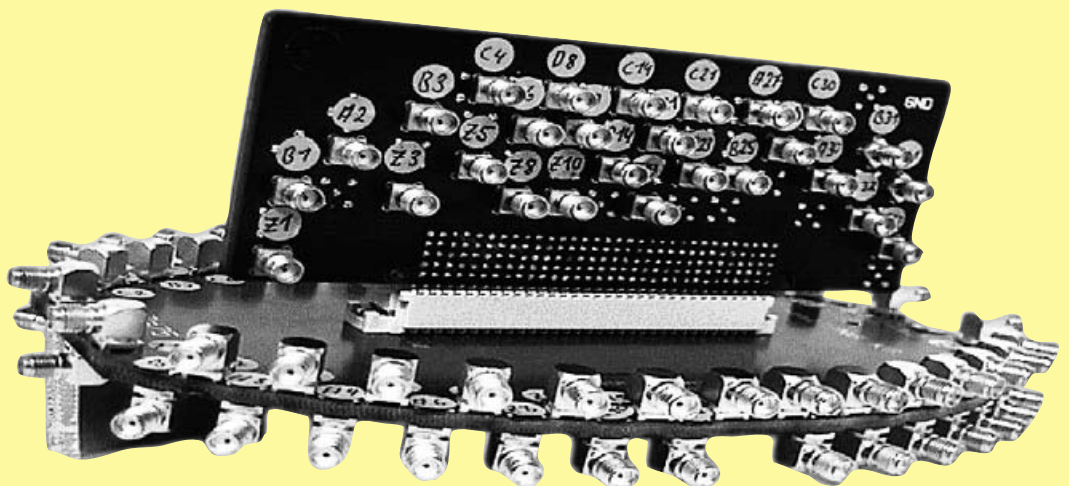
Additional advantages appear under real-time conditions, where unforeseen events have to be managed. This is realised with the program interrupt concept and variable control that closely monitors the bus system.



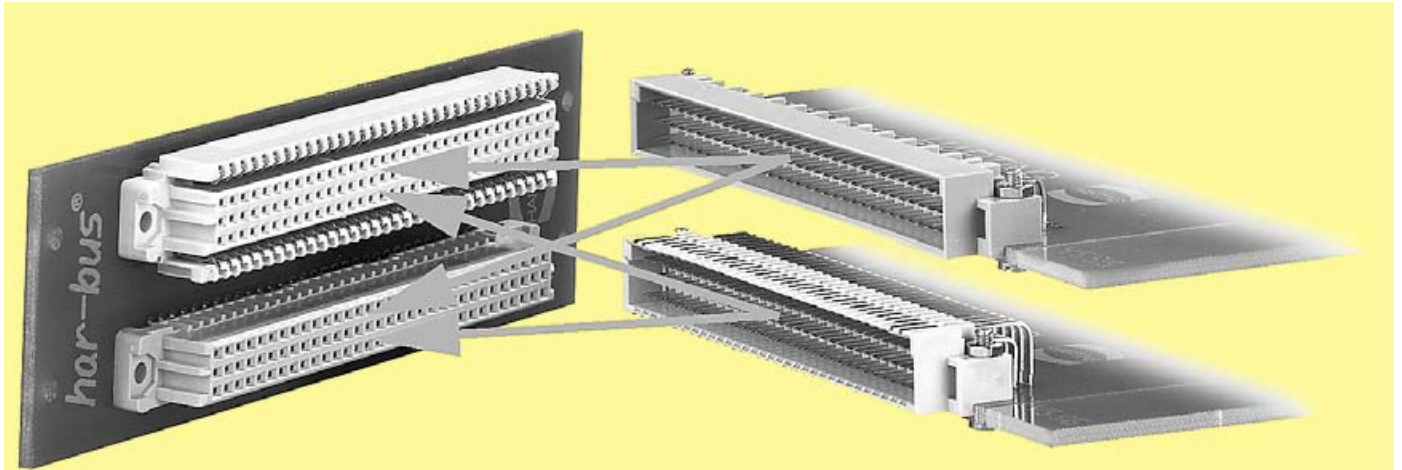
With the increase in processing speeds and data transmission rates, 3 row DIN 41612 connectors have reached their limit, so the VME standard needs to be enhanced further.

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

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



High precision slot structure with VME pinning for connector characterisation.

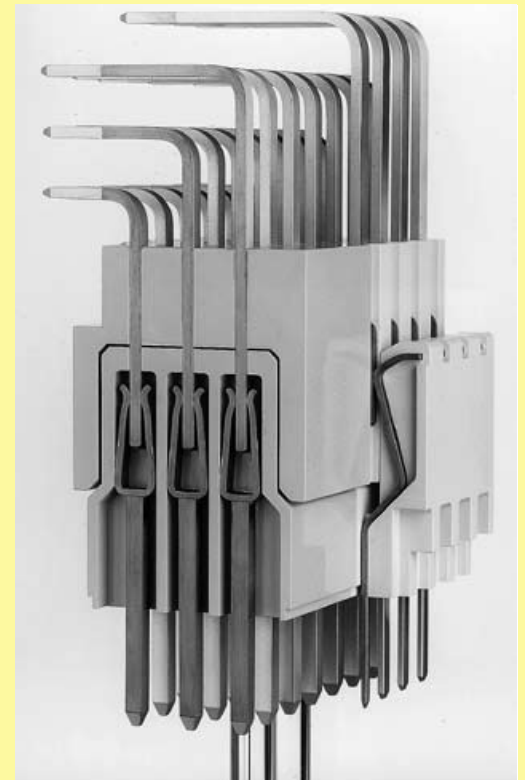


Backward compatibility

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

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

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



harbus 64

harbus® 64 – five rows – 160 poles

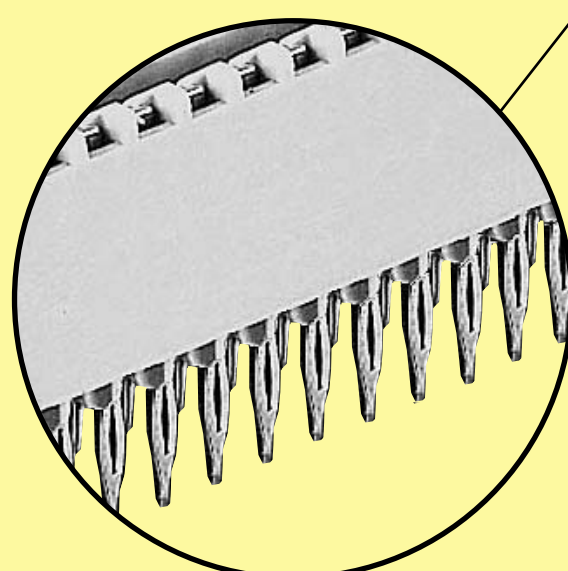
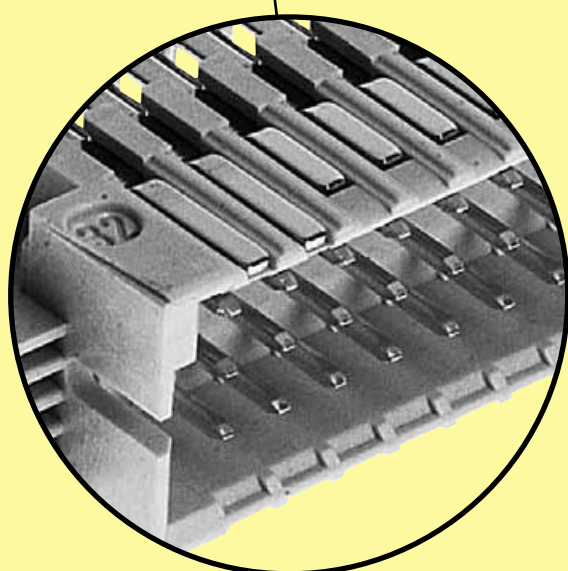
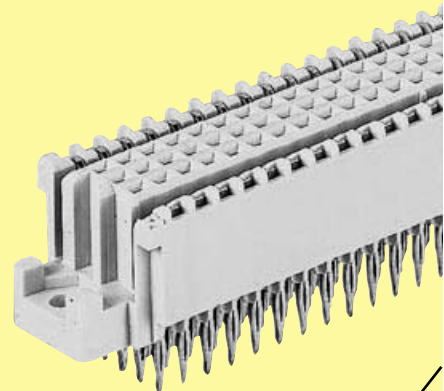
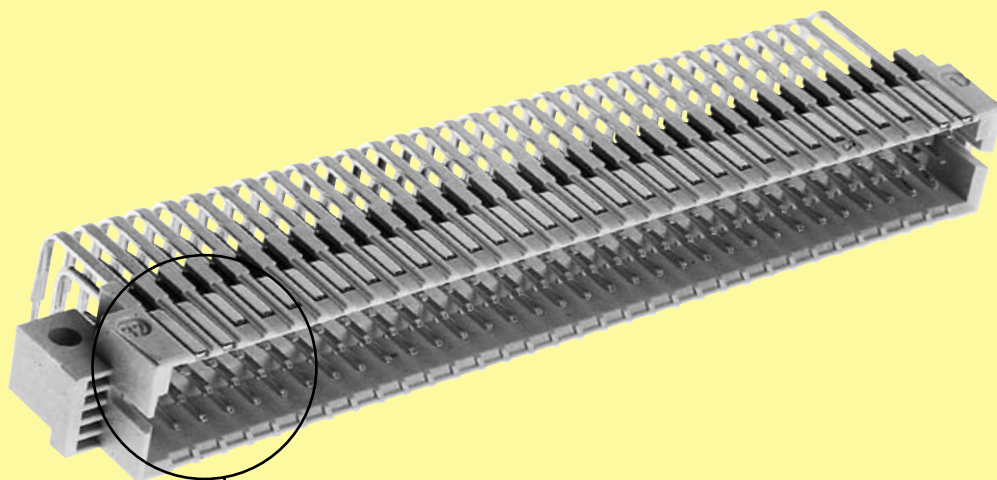
Two additional rows of contacts in the **harbus® 64** connector offer new system features:

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

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

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

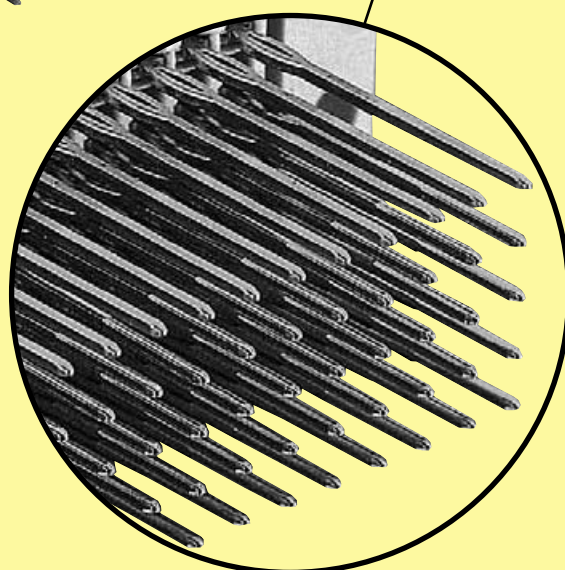
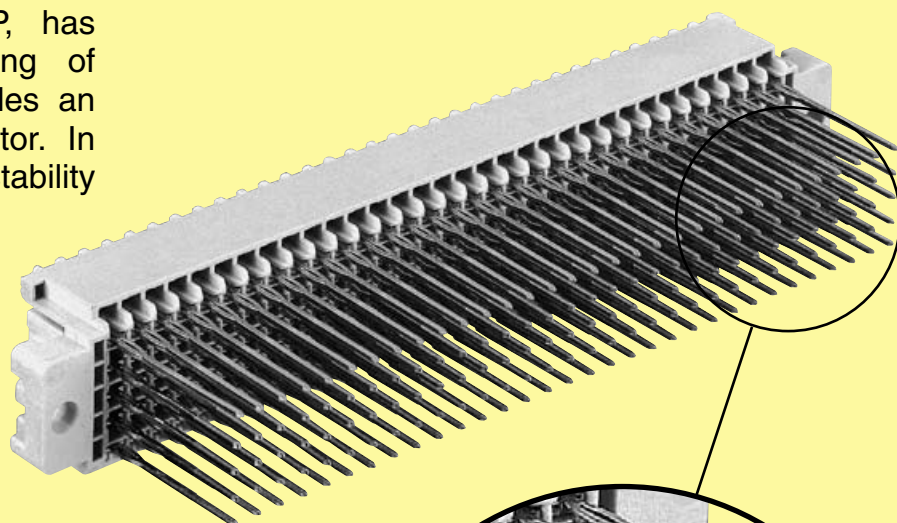
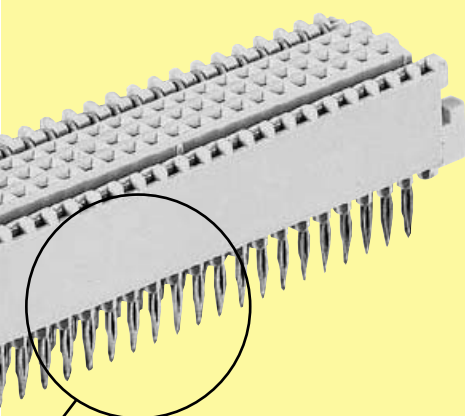


Four preleading contacts (1.5 mm) serve to pre-load the transmit and receive logic so that the bus will not experience glitches during **live insertion** of new cards into the backplane.

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.

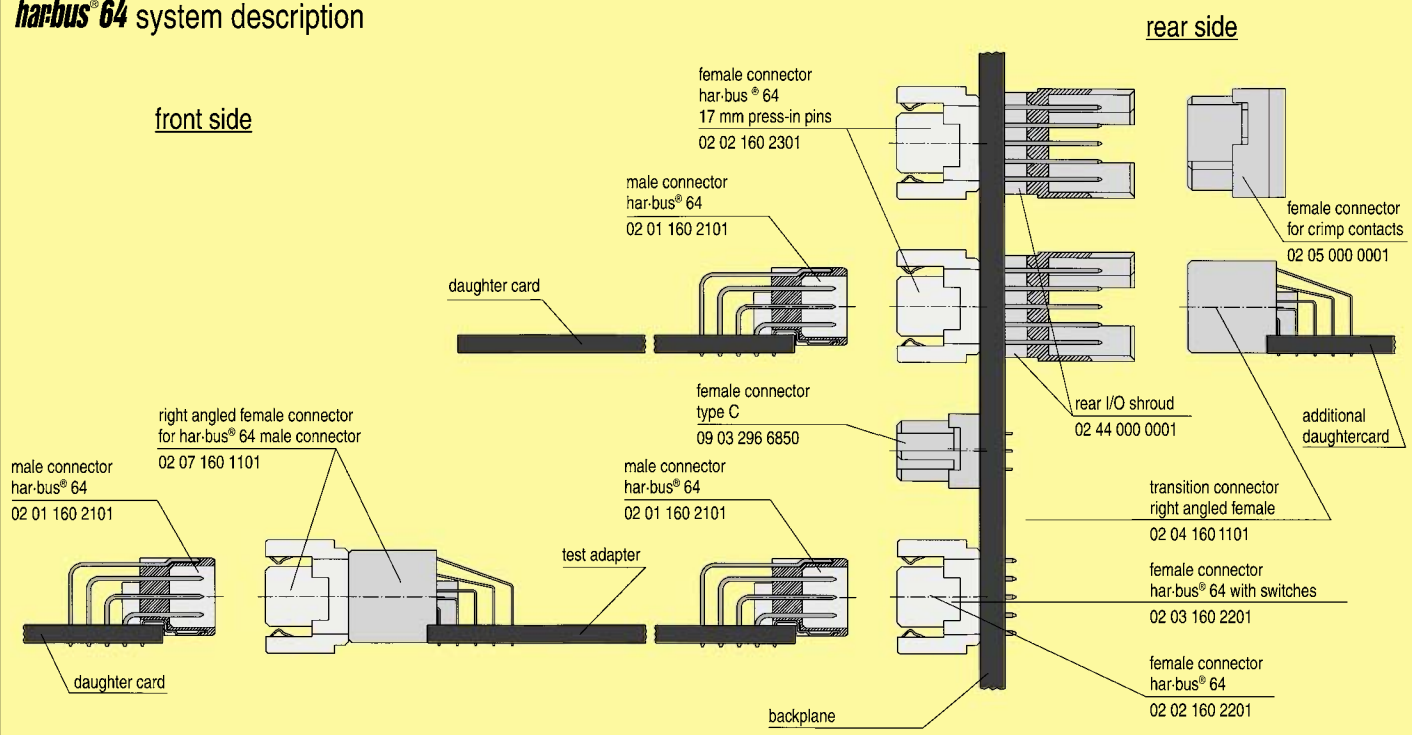
The insulator, made of LCP, has an inherent flammability rating of UL 94-V0 and therefore provides an **environment friendly** connector. In addition, the heat deformation stability of LCP makes the connector **surface-mount compatible** (see chapter 05).

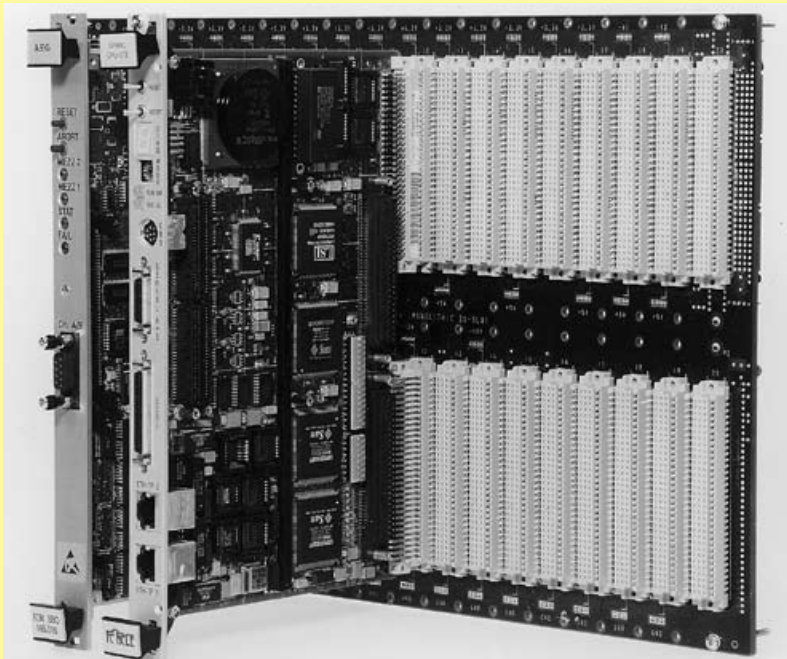


Partially gold plated terminations with precisely formed tips serve as contact area for **rear transition boards**.

har-bus 64

har-bus® 64 system description





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

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

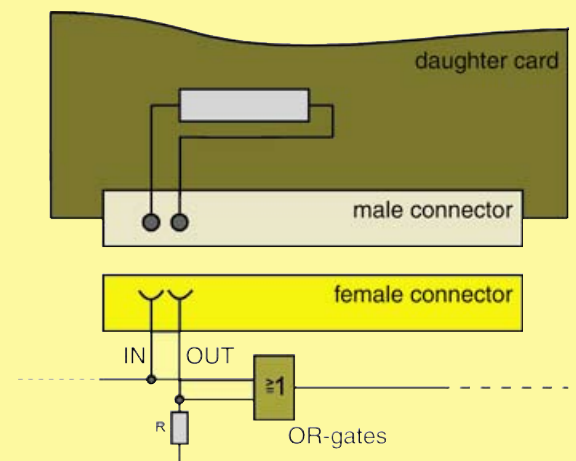
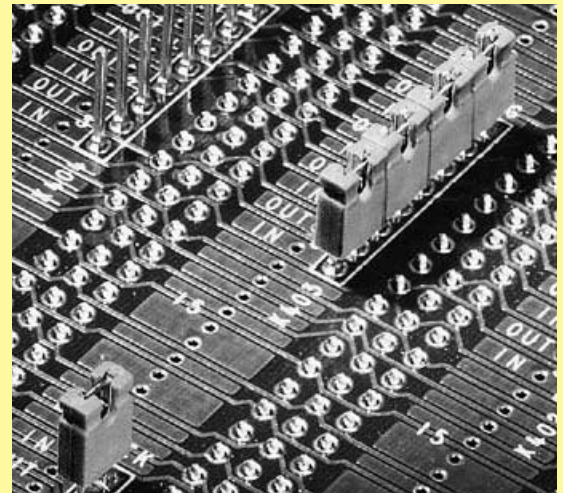
The VME protocol requests 5 daisy-chains on position 1 of every backplane.

These lines are defined to go through every daughter card.

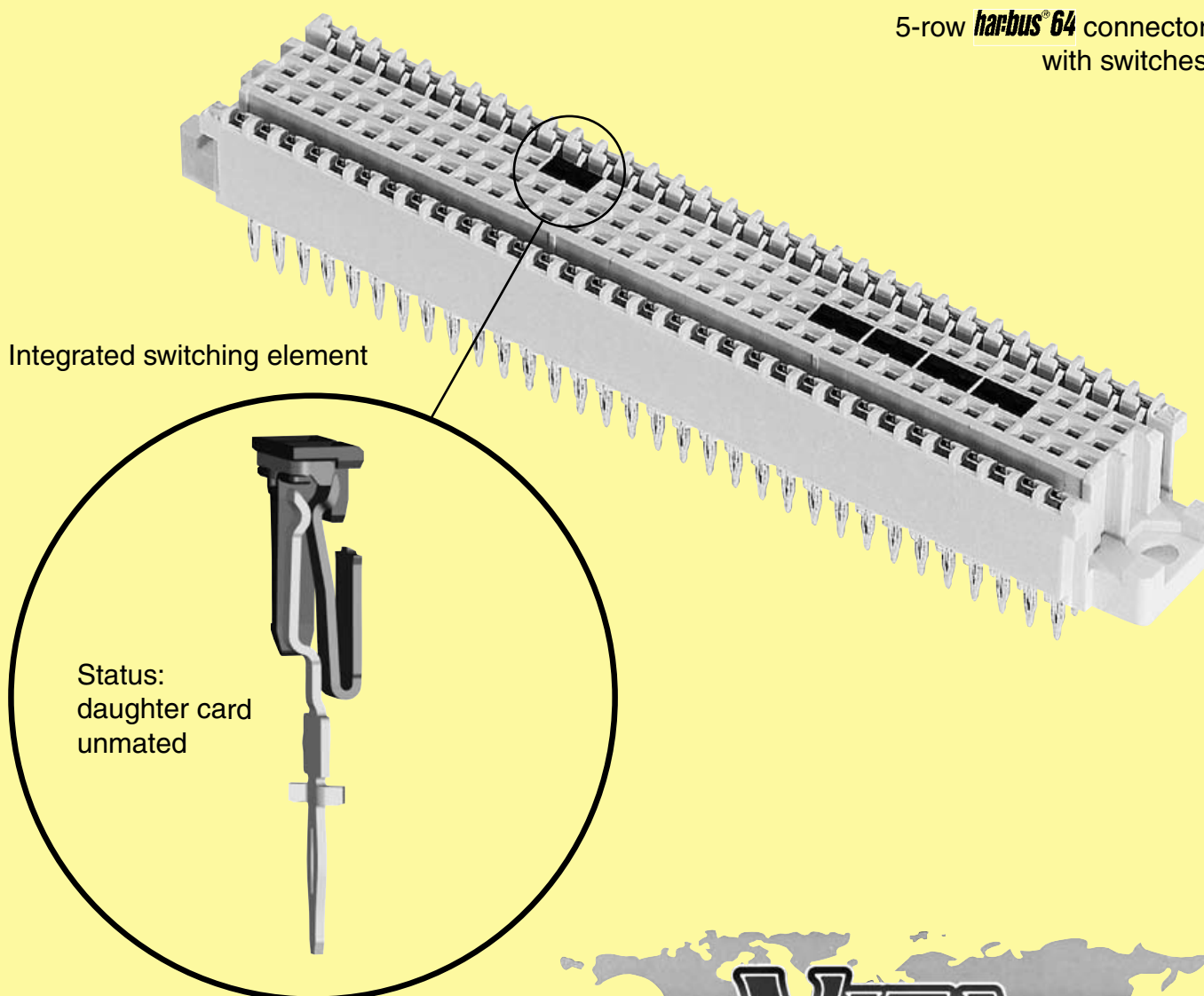
Therefore, in case of unloaded card slots the signal have to be bridged across the connector.

Bridging variants:

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



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



Advantages:

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



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

see current carrying capacity chart

Clearance and creepage distances*

| minimal clearance and creepage distance | | distance in mm | |
|---|-----------|----------------|-----------|
| | | rows a, b, c | rows z, d |
| 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 |

Working voltage

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

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

Contact resistance

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

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

Temperature range $-55 \text{ }^\circ\text{C} \dots +125 \text{ }^\circ\text{C}$
acc. to IEC 60512-11

Electrical termination

Male connector Solder pins for pcb termination $\varnothing 1.0 \pm 0.1 \text{ mm}$ according to IEC 60326-3
Female connector Crimp terminal $0.08 - 0.56 \text{ mm}^2$
Solder pins for pcb termination $\varnothing 1.0 \pm 0.1 \text{ mm}$ according to IEC 60326-3
Compliant press-in terminations
Diameter of pcb plated through holes See recommendation chapter 04
pcb thickness $\geq 1.6 \text{ mm}$
Recommended pcb holes for press-in technology in acc. to EN 60352-5¹⁾

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

Materials

Mouldings

- Liquid Cristal Polymer (LCP), for male connectors, straight female connectors, UL 94-V0
- Thermoplastic resin glass-fibre filled, UL 94-V0

Contacts Copper alloy

Contact surface

Contact zone Plated acc. to performance level²⁾

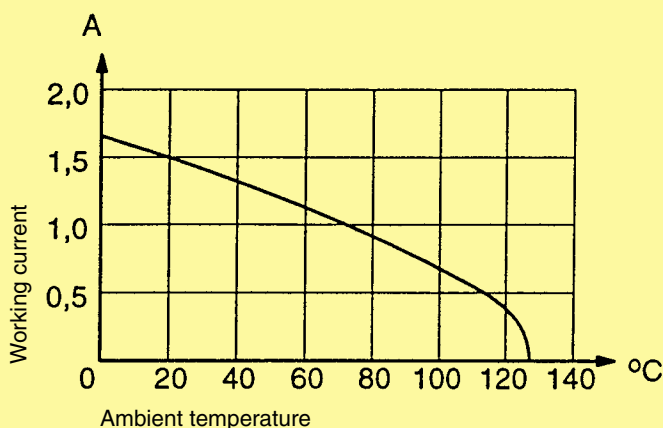
¹⁾ Details see chapter 04

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 60512



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

harbus® 64 with switches

Deviating technical characteristics for the switching elements.

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

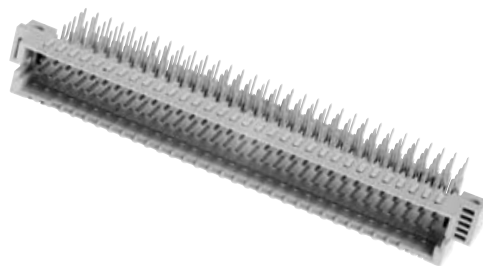
Contact resistance

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

Insertion and withdrawal force

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

160

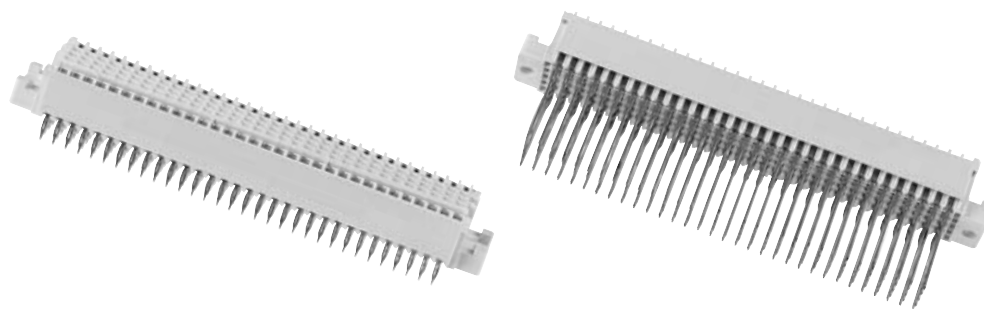


| Identification | | | Part No. Performance levels according to IEC 61 076-4-113 | |
|---------------------------------------|---------------------|----------------|---|--|
| Number of contacts | Contact arrangement | 2 | 1 | |
| Male connectors, angled ¹⁾ | | | | |
| SMC version with solder pins* |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

[illegible]

Dimensions in mm

160



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

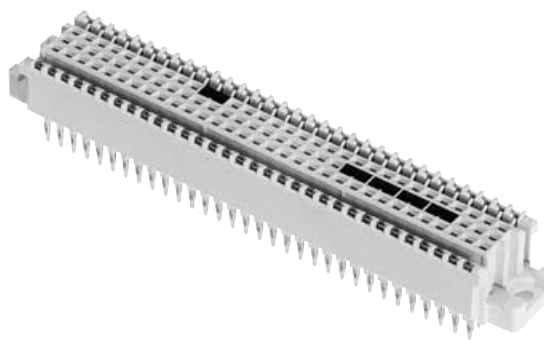
| Part number | Dimension "X" for row | | | | |
|---------------------------------|-----------------------|------|------|------|------|
| | z | a | b | c | d |
| 02 02 160 1601 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 |
| 02 02 160 2201 / 02 02 160 1201 | 5.0 | 4.5 | 4.5 | 4.5 | 5.0 |
| 02 02 160 2301 / 02 02 160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

Technical drawing of a rectangular plate with a grid of holes. The drawing includes dimensions for hole size, position, and overall plate size. Key features include:

- Grid of 32 holes in 4 rows.
- Hole diameter: $\phi 0.05$ with a tolerance of $+0.09/-0.06$.
- Hole position tolerance: ± 0.05 .
- Overall plate width: 2.54 .
- Overall plate height: 2.54 .
- Hole spacing: $31 \times 2.54 (=78.74)$.
- Overall plate dimensions: $4 \times 2.54 (=10.16)$ and 90 ± 0.1 .
- Section line 'A-A' is shown on the right side.

Dimensions in mm

160



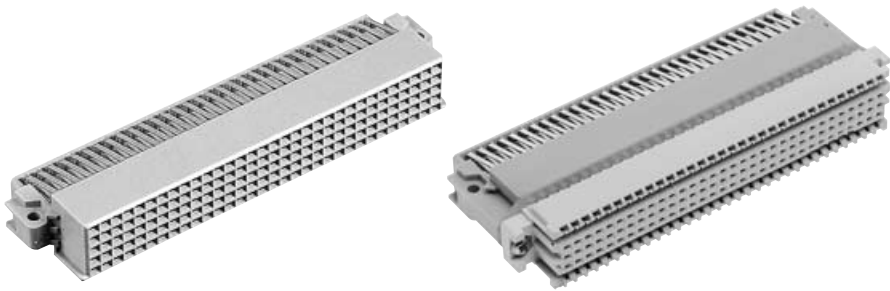
| Identification | | Number of contacts | Contact arrangement | Part No. | Performance level 2 according to IEC 61 076-4-113 | Explanation chapter 00 |
|---|----------|--------------------|---------------------|----------------|---|------------------------|
| Female connectors, straight with switches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

Technical drawing of a rectangular plate with a grid of holes. The plate has a width of 32 and a length of 90 ± 0.1. The grid of holes is 31x254 (78.74) in length and 2.8 ± 0.1 in width. The holes are spaced 0.3 ± 0.1 apart. The drawing includes various dimension lines, tolerances, and a row label 'row' with values '2', 'a', 'b', 'c', 'd'. A '1-position' label is also present.

Dimensions in mm

Number of contacts

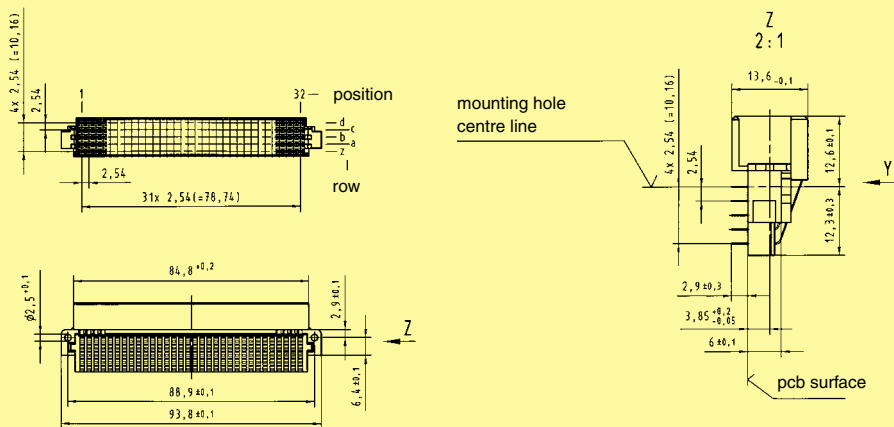
160



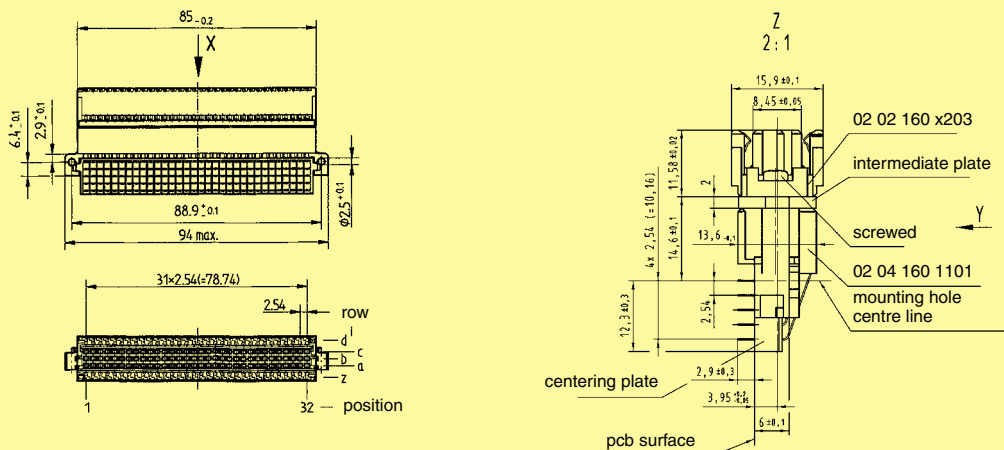
Female connectors

| Identification | Number of contacts | Contact arrangement | Part No. Performance level 1 according to IEC 61 076-4-113 Explanation chapter 00 |
|--|--------------------|---------------------|--|
| Female connectors, angled | | | |
| with solder pins | | | |
| for rear access and har-bus® 64 inverse male connector | 160 | z, a, b, c, d | 02 04 160 1101 |
| for har-bus® 64 male connector | 160 | z, a, b, c, d | 02 07 160 1101 |

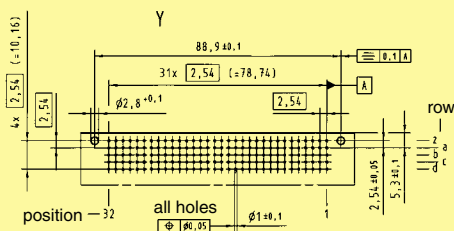
Dimensions
02 04 160 1101



Dimensions
02 07 160 1101



Board drillings
Mounting side



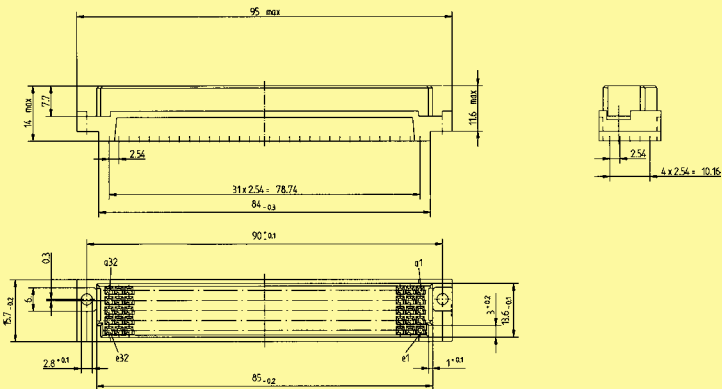


Dimensions in mm

Number of contacts

max. 160

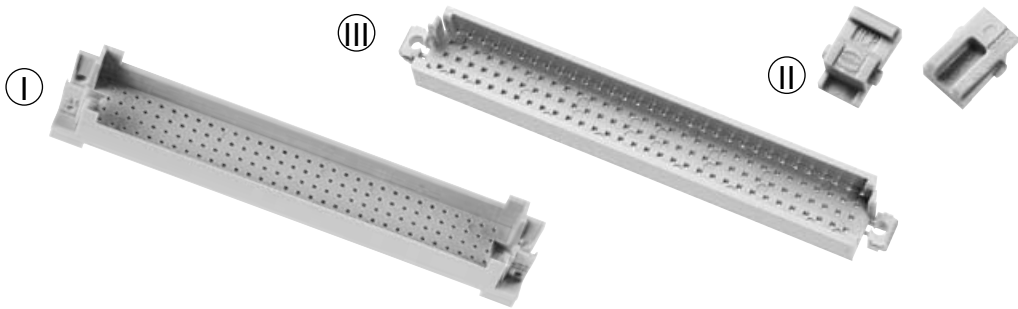
Female connectors



| Identification | Number of contacts | Part No. | Drawing | Dimensions in mm |
|--|--------------------|--|---|------------------|
| <div>Female connector for crimp contacts</div> <div>order contacts separately fits into shell housing C see chapter 20</div> | 160 | 02 05 000 0001 |  | |
| Identification Wire gauge | | | | |
| <div>Female crimp contacts</div> <div>Bandoliered contacts (approx. 500 pieces)</div> | 1 2 | <div>Performance level 2 acc. to IEC 60 603-2</div> <div>02 05 000 2501 02 05 000 2502</div> | <div>Wire gauge mm² AWG Insulation-ø mm</div> <div>0.08 - 0.22 28 - 24 0.7 - 1.5</div> <div>0.14 - 0.56 26 - 20 0.8 - 2.0</div> | |
| <div>HARTING crimping tool</div> <div>for bandoliered contacts (500 pieces)</div> | | 02 99 000 0010 | <div>Wire gauge</div> <div>0.08 - 0.5 mm²</div>  | |
| Removal tool | | 02 99 000 0013 |  | |

Number of contacts

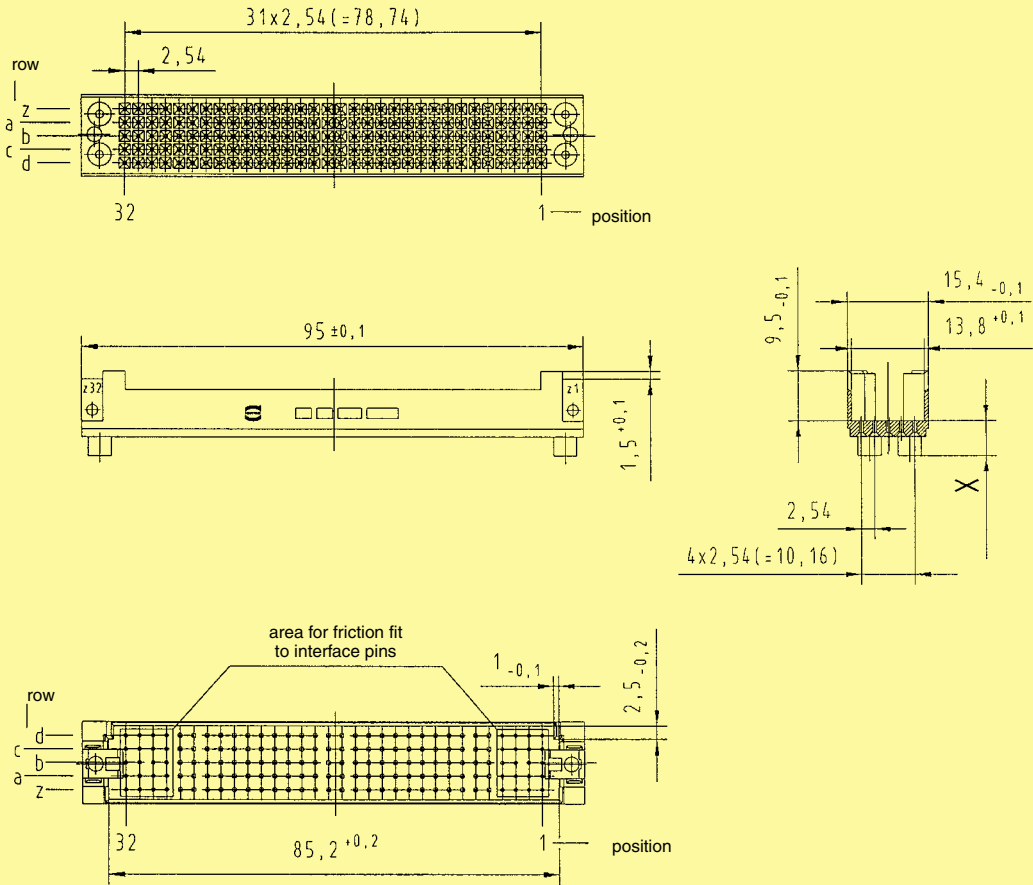
160



Pin shrouds

| Identification | pcb-thickness ± 0.3 | Dimension X - 0.1 | Part No. |
|---|---|---|--|
| Pin shrouds ¹⁾ I | 2.8 3.4 4.0 4.6 5.2 5.8 6.4 | 6.6 6.0 5.4 4.8 4.2 3.6 3.0 | 02 44 000 0007 02 44 000 0001 02 44 000 0002 02 44 000 0003 02 44 000 0004 02 44 000 0005 02 44 000 0006 |
| II Fixing brackets for shell housing C ²⁾ | | | 02 44 000 0009 |
| III Shroud insert for 3 row female connectors | | | 02 44 000 0008 |

Dimensions



Dimensions in mm

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

Application 1*

Female connector
02 02 160 2301



Backplane



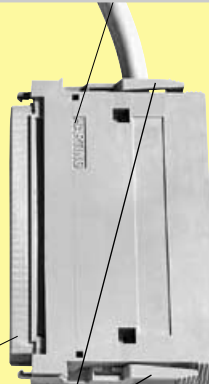
Pin shroud
02 44 000 0007



Fixing brackets
02 44 000 0009



Shell housing C
09 05 048 0501



Female connector
with crimp contacts
02 05 000 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



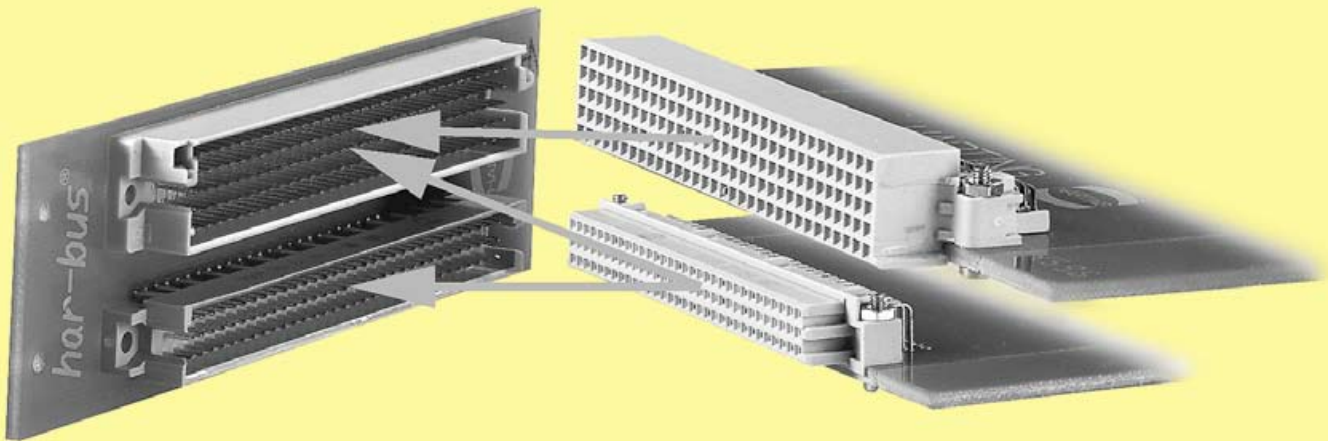
High quality contact surfaces require expertise and latest technological equipment.

Technology at HARTING preserves natural resources thus improving the environment.

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.



harbus® 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 mismatching of female connectors.

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

The additional contact rows d and z of **harbus® 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 | | 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 |

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 | $\leq 20\text{ m}\Omega$ |
| Insulation resistance | $\geq 10^{10}\text{ }\Omega$ 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 | See recommendation chapter 04 |
| pcb thickness | $\geq 1.6\text{ mm}$ |
| Recommended pcb holes for press-in technology | in acc. to EN 60 352-5 ¹⁾ |
| Female connector | Solder pins for pcb connection $\varnothing 1.0 \pm 0.1\text{ mm}$ according to IEC 60 326-3 |

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

Materials

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

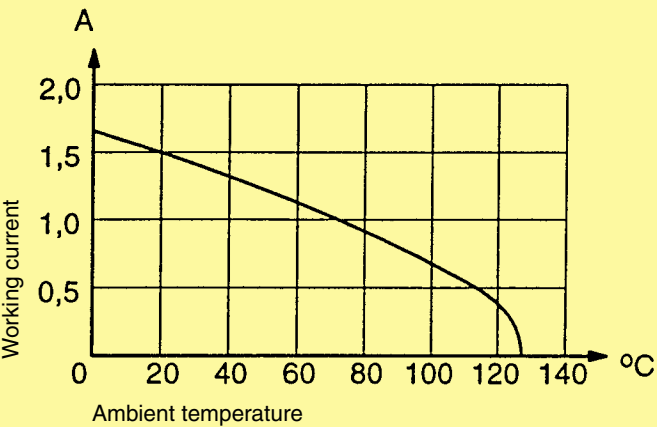
Contact surface

| | |
|--------------|--|
| Contact zone | Plated acc. to performance level ²⁾ |
|--------------|--|

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.

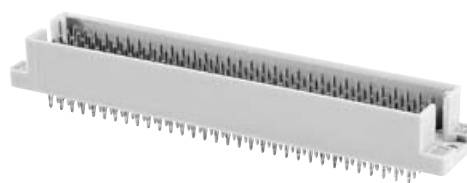
Control and test procedures according to DIN IEC 60 512



¹⁾ Details see chapter 04
²⁾ Explanation of performance levels see chapter 00

Number of contacts

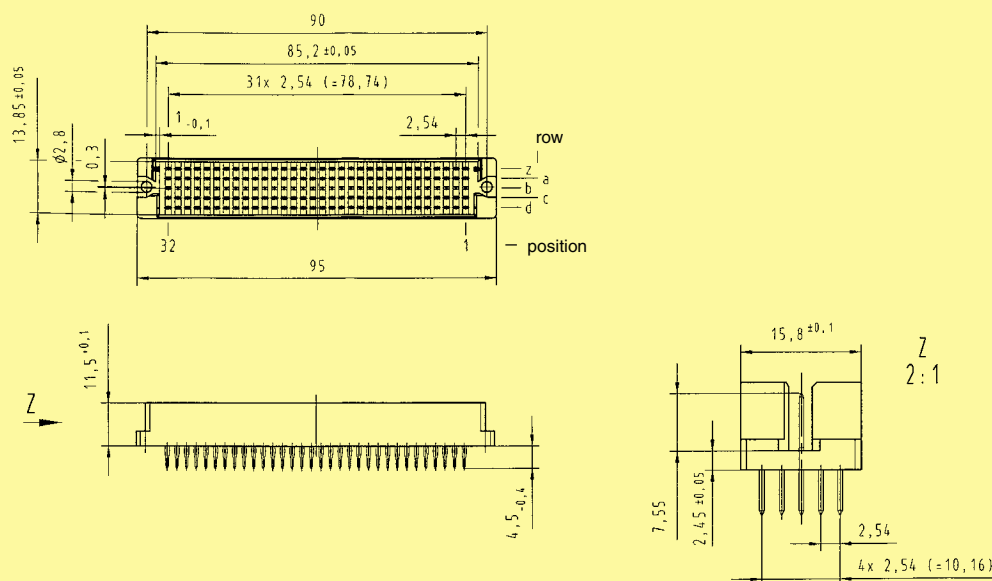
160



Male connectors

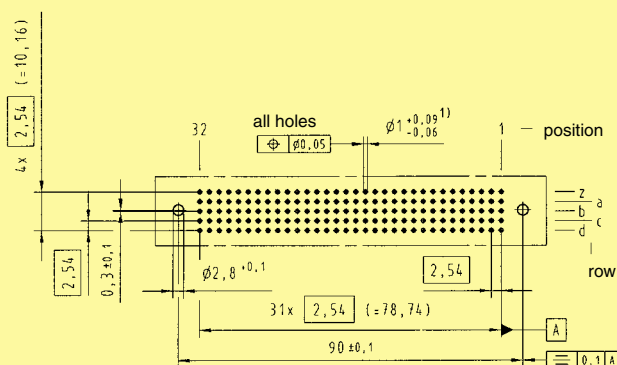
| Identification | Number of contacts | Contact arrangement | Part No. Performance levels according to IEC 61 076-4-113 Explanation chapter 00 | |
|---|--------------------|---------------------|---|----------------|
| | | | 2 | 1 |
| Male connectors, straight with press-in terminations | 160 | z, a, b, c, d | 02 08 160 2601 | 02 08 160 1601 |

Dimensions



Board drillings

Mounting side

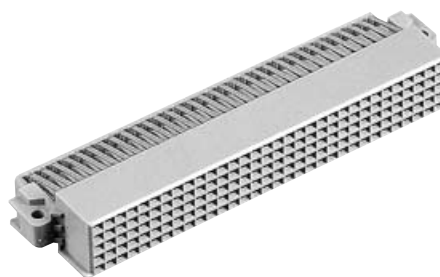


Dimensions in mm

Tooling see chapter 30

¹⁾ Press-in technique see chapter 04

160



| Identification | Number of contacts | Contact arrangement | Performance level 1 according to IEC 61 076-4-113 Explanation chapter 00 | Part No. |
|--|--------------------|---------------------|--|----------------|
| 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 1101 |

[illegible]