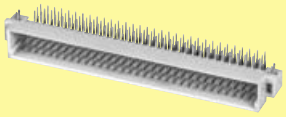
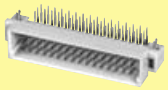
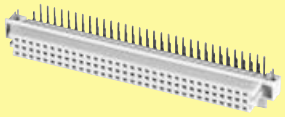
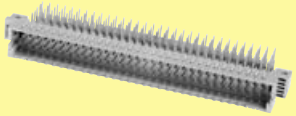
High temperature connectors **S**urface **M**ount **C**ompatible (SMC*)

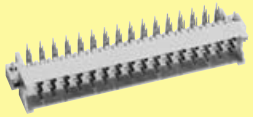
	Page
Introduction of the Pin in Hole Intrusive Reflow Process	**05.02**
Solder requirements	**05.03**
Requirements for SMC* connectors	**05.04**
Advantages of the Pin in Hole Intrusive Reflow technique	**05.04**
Technical characteristics types C, 2C and R (SMC*)	**05.10**
Type C male connectors	**05.11**
Type 2C male connectors	**05.12**
Type R female connectors	**05.13**
Technical characteristics type har-bus® 64 (SMC*)	**05.20**
Type har-bus® 64 male connectors	**05.21**
Technical characteristics type F (SMC*)	**05.30**
Type F male connectors	**05.31**











SMC*

* Also known as Pin-in-Paste or Through Hole Reflow (THR)

The continuing trend towards miniaturisation has revolutionised the assembly of electronic components. For the past 15 years, most components have been secured directly to the pcb surface by means of Surface Mount Technology (SMT). By dispensing with drilled holes on the pcb, a space saving of up to 70 percent is achieved.

Today, typical components such as resistors, ICs, capacitors, and connectors with straight terminal pins are almost exclusively fitted using SMD (Surface Mount Device) technology in mass production. In contrast, angled SMD connectors at the edge of the board have not been successful because of tolerance problems (co-planarity) and stresses during mating. Modified solder connectors for assembly with "Pin in Hole Intrusive Reflow" process offer a better solution. These can be mounted at low cost, utilising existing SMD production lines.

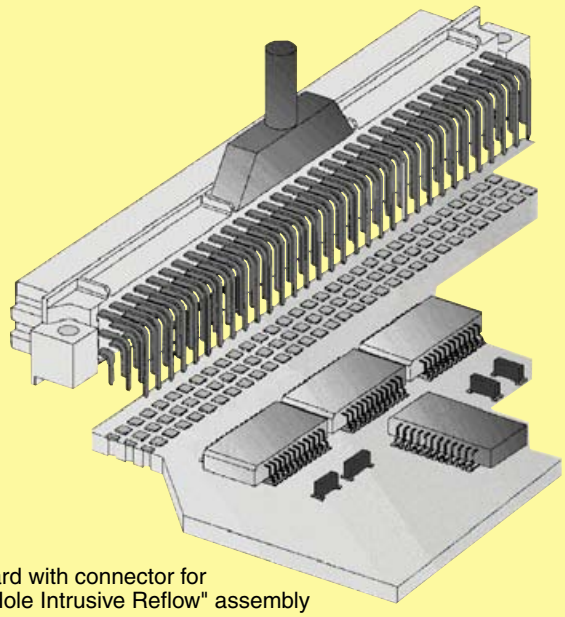


Fig. 1:
SMT board with connector for
"Pin in Hole Intrusive Reflow" assembly

"Pin in Hole Intrusive Reflow"

In this process, the connector is inserted into plated through holes in a comparable way to conventional component mounting. All other components can be assembled on the pcb surface.

The components are positioned using pick-and-place machines. These automatic assembly machines differ according to whether the components are small, lightweight or bulky. Connectors are considered bulky (odd form) because of their comparatively heavy weight and large volume which makes them more difficult to grip. Furthermore, machines for odd form components must have higher insertion power to fit the components into pcb holes, which are filled with solder paste. As a rule, modern SMC production lines are equipped with both types of machine, therefore the "Pin in Hole Intrusive Reflow" process generally entails no extra investment costs for the user.

Conventional assembly process:

1. Application of solder paste
2. Positioning the components
3. Positioning odd form components
4. Reflow soldering
5. Pressing in or partially dip soldering the connector at the board edge
6. Quality inspection

"Pin in Hole Intrusive Reflow" assembly:

1. Application of solder paste
2. Positioning the components
3. Positioning odd form components
4. Reflow soldering
5. ~~Pressing in or partially dip soldering the connector at the board edge~~
6. Quality inspection

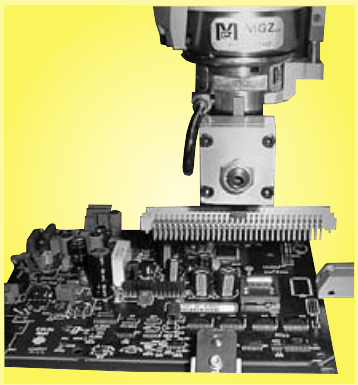


Fig. 2:
Pick-and-place machine for odd form components
(Courtesy of JOT Automation GmbH)

Application of solder paste

Before the components are assembled, solder paste must be applied to all the solder pads (for connecting surface-mount components) and the plated through contacts (pcb holes for "Pin in Hole Intrusive Reflow" insertion). Usually a screen printing process is used for this purpose. A squeegee moves across the pcb, which is masked with screens and presses the solder paste into all unmasked areas. To ensure that the plated through holes are completely filled, significantly more solder paste must be applied than traditional solder pads on the pcb surface. The required quantity can be set exactly via several parameters.

As an alternative to screen printing, the solder paste can be applied by means of a dispenser. A high- precision robot moves the dispenser to all required positions on the pcb. The dispensing method is particularly suitable for small pcb's or applications which demand high precision and flexibility in dispensing volumes.

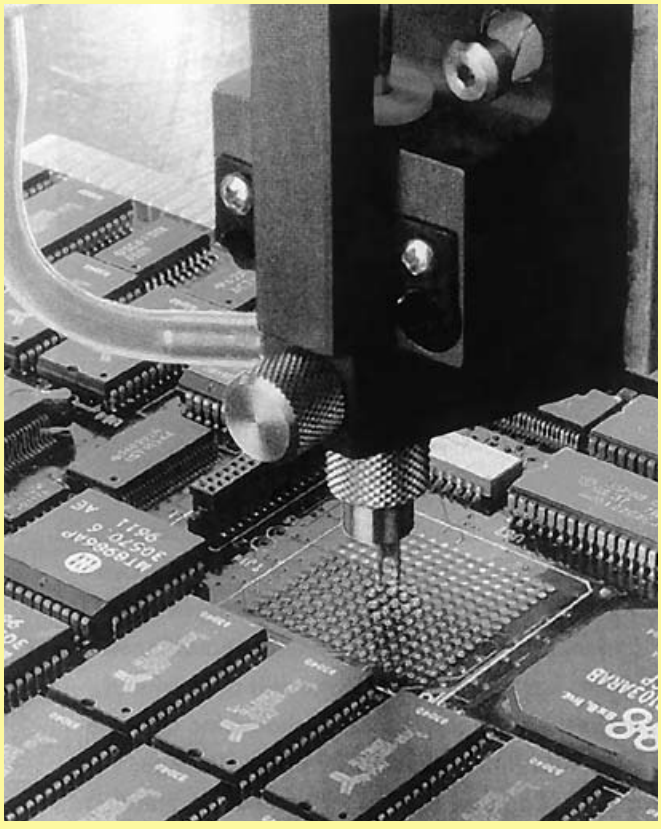


Fig. 3: Dispenser in operation

Requirements for the solder connection

There are numerous scientific studies dealing with calculation of the required quantity of solder paste. These studies use various parameters, e.g. the shrinking factor of the paste during soldering or the thickness of the screens used for masking the pcb. Since such calculation methods are complicated to apply, the following rule of thumb has proved valuable in practice:

$$V_{Paste} = 2(V_H - V_P)$$

in which:

V_{Paste} = Required volume of solder paste

V_H = Volume of the plated through hole

V_P = Volume of the connector termination in the hole

Comment: the multiplier "2" compensates for solder paste shrinkage during soldering. For this purpose, it was assumed that 50 % of the paste consists of the actual solder, the other 50 % being soldering aids.

At the beginning of a new production batch, the process parameters, such as quantity of solder paste and soldering temperature, can be set by interpreting simple cross-sections of the soldered connection. A reliable measure for achieving optimum parameters is the quantity of solder required to fill the hole. In soldered connections of high quality, the holes are filled to between 75 % and 100 %.

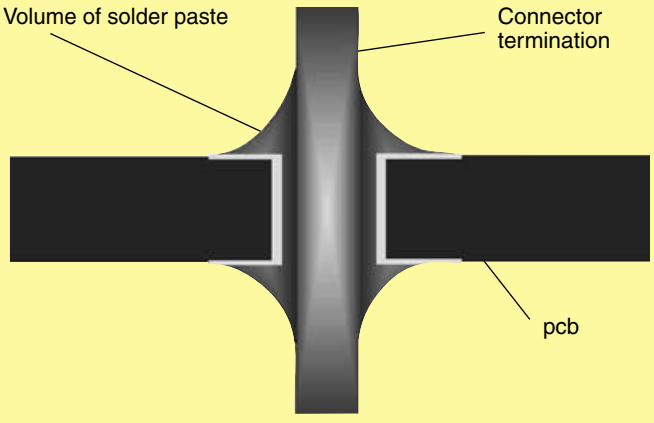


Fig. 4: Plated through hole with connector termination

SMC connectors

SMC (Surface Mount Compatible) connectors have to withstand temperatures of up to 225°C in the reflow oven for 10 to 15 seconds. Therefore, the moulding must be made from a dimensionally stable plastic which expands at the same rate as the pcb material when subjected to heat.

The length of the connector contacts should be such that they protrude by no more than 1.5 millimetres after insertion to the pcb. Each contact collects solder on its tip as it penetrates the solder paste in the hole. So if the contact was too long, this solder would no longer be able to reflow back into the plated through hole by capillary action during the soldering process, therefore the quality of the soldered connection would suffer as a result.

Connector design must permit both automatic assembly with pick-and-place machines and manual positioning for test and pre-production batches. It is also important for the packaging of the connectors to be suitable for automated assembly. Experience shows that deep-drawn film and reel packaging fed into the pick-and-place machines with the aid of a conveyor system is particularly suitable.

HARTING SMC technology

HARTING offers its customers a complete system concept for integrating SMC technology into existing production lines. We manufacture a wide range of SMC connectors (3 and 5 row) in compliance with IEC 60 603-2, D-Sub connectors in compliance with IEC 60 807 and connectors from the har-mik® series with contact spacing of 1.27 millimetres. In addition, HARTING supports the market with packaging and processing concepts, which have been developed in collaboration with renowned manufacturers of SMC soldering and assembly plants.

You will find more detailed information in our SMC catalogue, as well as in our hard metric connectors catalogue.

Advantages of the "Pin in Hole Intrusive Reflow" process:

- Partial dip soldering or press fitting is no longer required
- Complete compatibility with Surface Mount Technology
- Complete integration into the automated assembly process
- Reduced floor space in the production plant
- As a rule, no additional investment costs

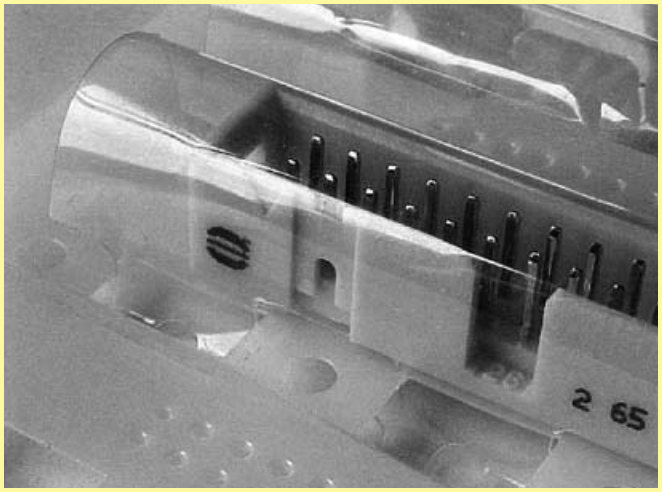
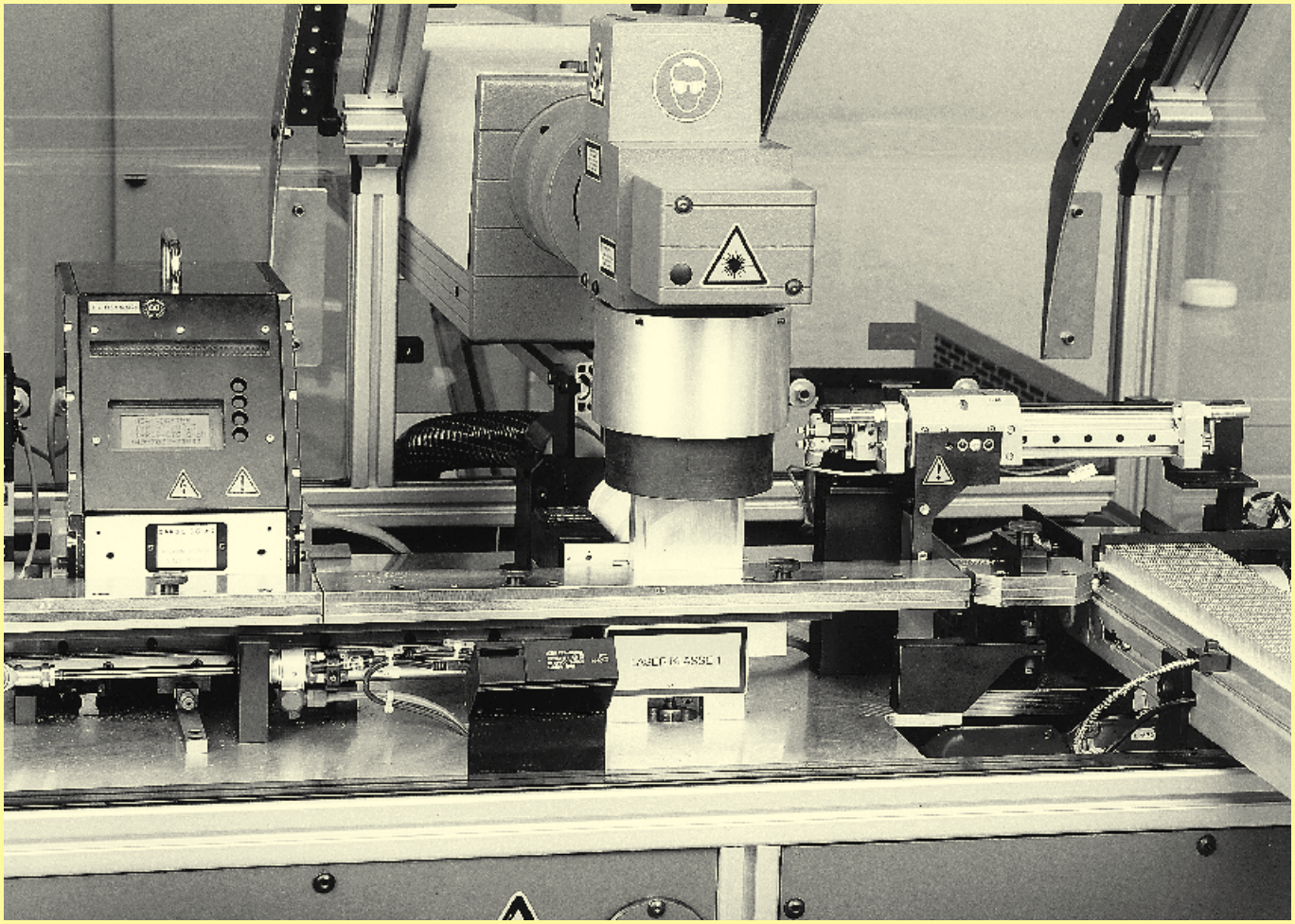
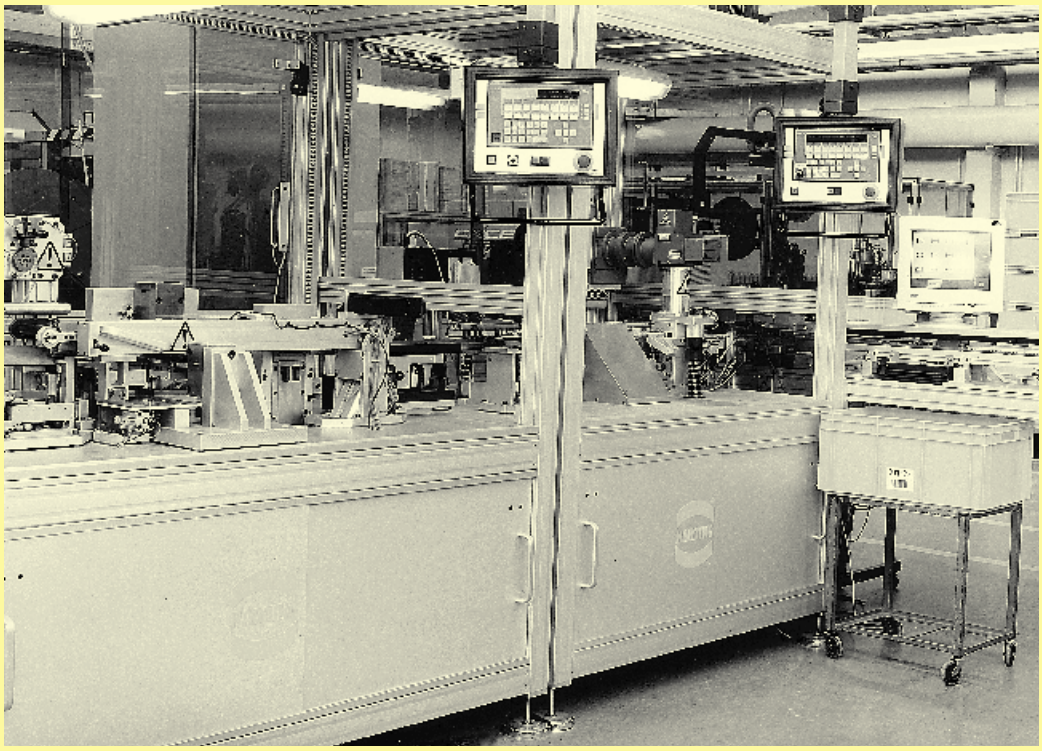


Fig. 5: HARTING connector mounted in a tape ready for placement using an odd form assembly station.





Fully automated assembling and printing devices, monitored through video camera inspection systems and laser technology.

Our claim is quality

Our challenge is to improve quality from day to day.

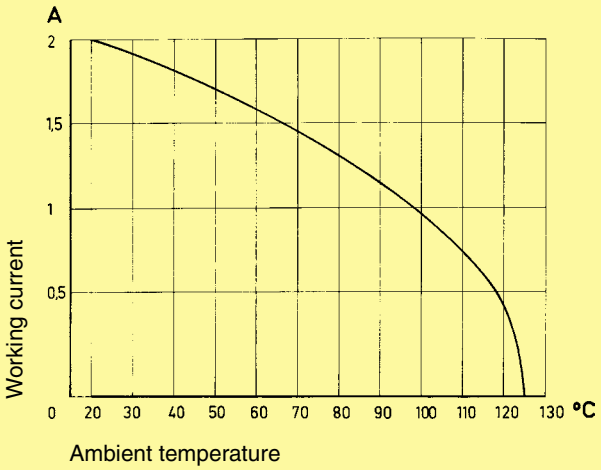
Number of contacts	32, 48, 64, 96
Contact spacing (mm)	2.54
Working current see current carrying capacity chart	2 A max.
Clearance	≥ 1.2 mm
Creepage	≥ 1.2 mm
Working voltage The working voltage also depends on the clearance and creepage dimensions of the pcb itself and the associated wiring	according to the safety regulations of the equipment Explanations see chapter 00
Test voltage $U_{r.m.s.}$	1 kV
Contact resistance	≤ 15 mΩ
Insulation resistance	≥ 10^{12} Ω
Temperature range during reflow soldering	– 55 °C … + 125 °C max. + 240 °C for 15 s
Electrical termination	
Male connector	Solder pins for pcb connection Ø 1.0 ± 0.1 mm according to IEC 60 326-3
Female connector	Solder pins for pcb connection Ø 1.0 ± 0.1 mm according to IEC 60 326-3
Insertion and withdrawal force	32 way ≤ 30 N 48 way ≤ 45 N 64 way ≤ 60 N 96 way ≤ 90 N
Materials	
Mouldings	Poly Cyclohexylene Terephthalate (PCT), UL 94-V0
Contacts	Copper alloy
Contact surface	
Contact zone	Selectively plated according to performance level[1)]

[1)] Explanation performance levels see chapter 00

Current carrying capacity chart

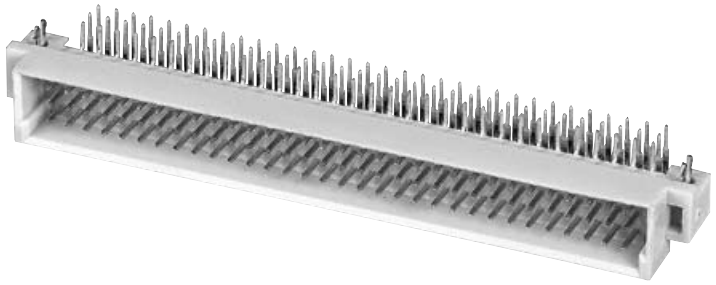
The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current loaded contacts of connectors when simultaneous power on all contacts is given, without exceeding the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

Control and test procedures according to DIN IEC 60 512



Number of contacts

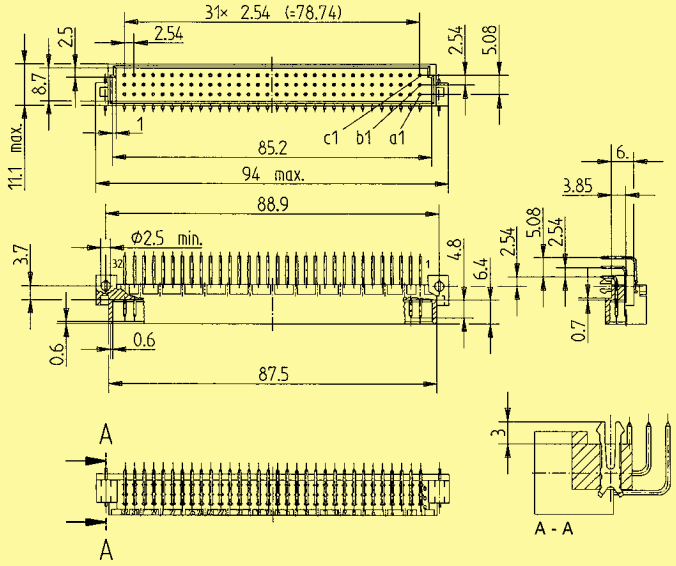
96, 64



Male connectors, angled

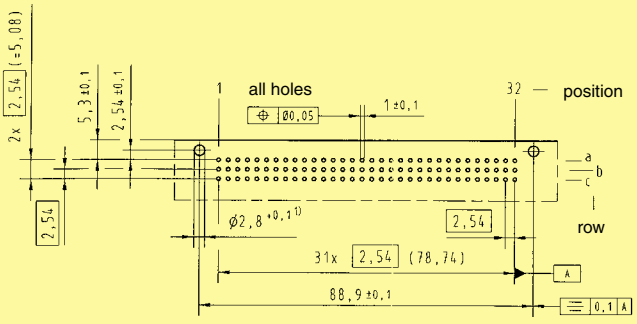
Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60 603-2. Explanation chapter 00	
				2	1
Male connector					
without retention clip	96			09 03 196 6919 09 03 696 6919 c)	09 03 196 2919
	64			09 03 164 6919	09 03 164 2919
with retention clip	96			09 03 396 6919	09 03 396 2919
	64			09 03 364 6919	09 03 364 2919

Dimensions

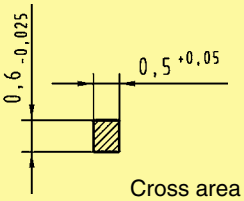


Board drillings

Mounting side



Cross section of solder terminations



Cross area (A) of contacts row a, b, c: A = 0.29 - 0.33 mm²

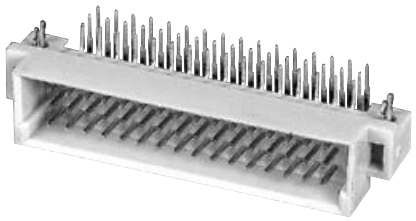
Dimensions in mm

SMC

1) Recommendation for variants with clip: Drillings can be enlarged up to 3.1 mm ø to reduce standard mounting force (see chapter 00)
c) Connectors with coding see chapter 01

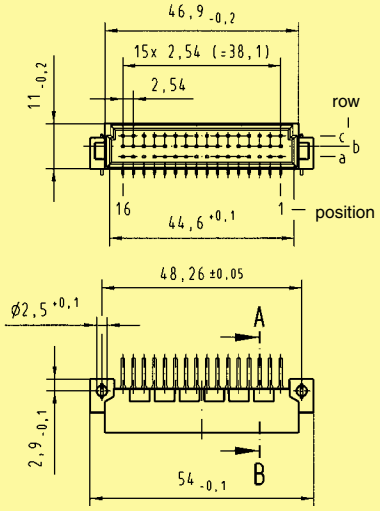
Number of contacts

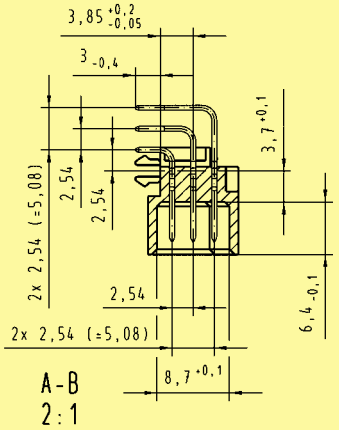
48, 32



Male connectors, angled

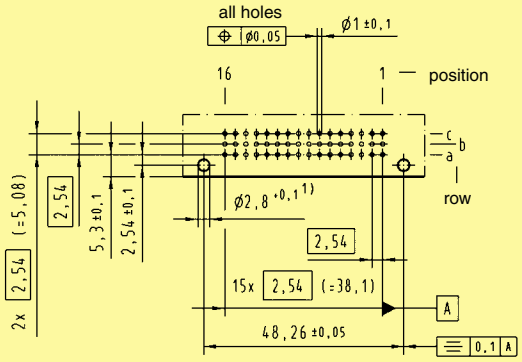
Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60 603-2. Explanation chapter 00	
				2	1
Male connector					
without retention clip	48			09 23 148 6919	09 23 148 2919
	32			09 23 132 6919	09 23 132 2919
with retention clip	48			09 23 348 6919	09 23 348 2919
	32			09 23 332 6919	09 23 332 2919
Dimensions					



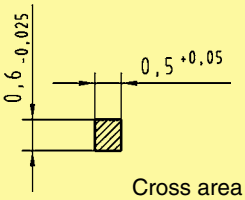


Board drillings

Mounting side



Cross section of solder terminations



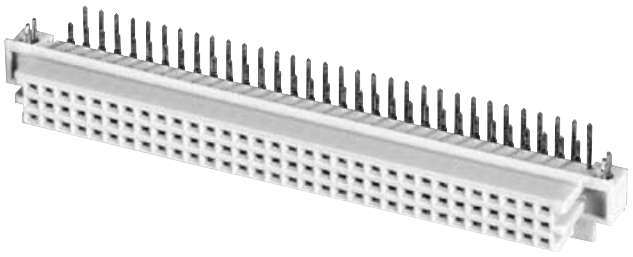
Cross area (A) of contacts row a, b, c: A = 0.29 - 0.33 mm²

Dimensions in mm

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

Number of contacts

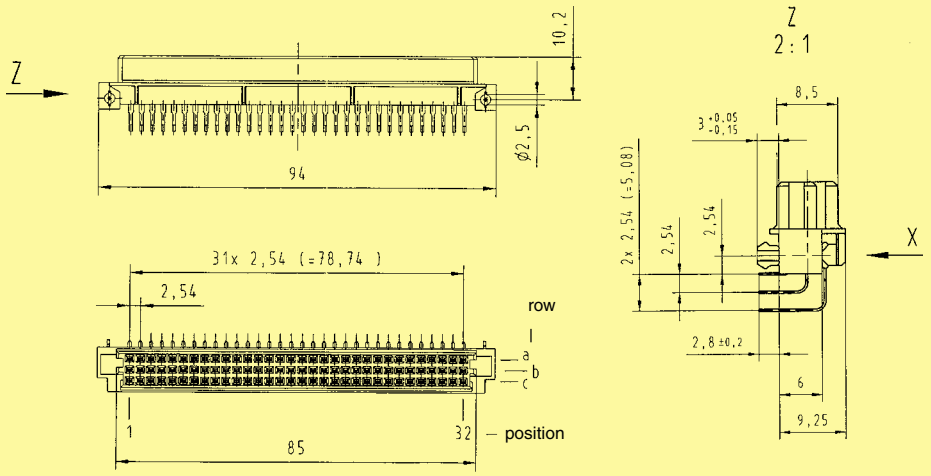
96, 64



Female connectors, angled

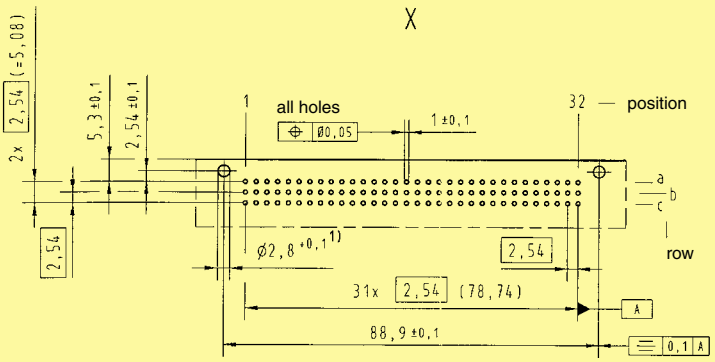
Identification	Number of contacts	Contact arrangement	Part No.	Performance levels according to IEC 60 603-2. Explanation chapter 00	
				2	1
Female connector					
without retention clip	96			09 73 296 6804	09 73 296 2804
	64			09 73 264 6804	09 73 264 2804
with retention clip	96			09 73 496 6804	09 73 496 2804
	64			09 73 464 6804	09 73 464 2804

Dimensions

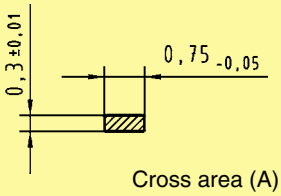


Board drillings

Mounting side



Cross section of solder terminations



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

Dimensions in mm

SMC

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

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

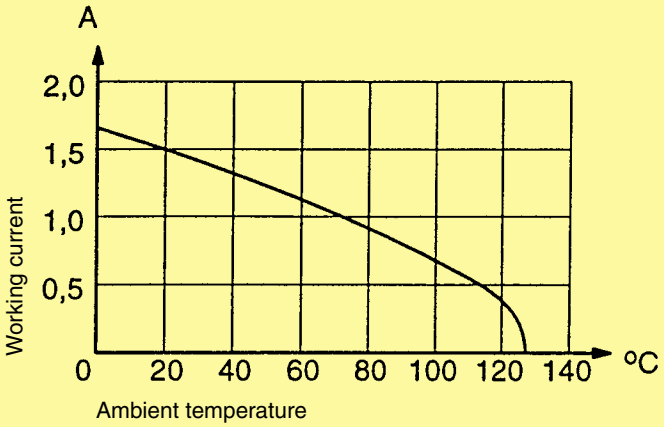
Working voltage	
The working voltage also depends on the clearance and creepage dimensions of the pcb itself and the associated wiring	according to the safety regulations of the equipment Explanations see chapter 00
Test voltage $U_{r.m.s.}$	1 kV
Contact resistance	
rows a, b, c	≤ 20 mΩ
rows z, d	≤ 30 mΩ
Insulation resistance	≥ 10^{10} Ω acc. to IEC 60512-2
Temperature range	– 55 °C … + 125 °C
during reflow soldering	max. + 240 °C for 20 s
Electrical termination	
Male connector	Solder pins for pcb connection Ø 1.0 ± 0.1 mm according to IEC 60326-3
Insertion and withdrawal force	≤ 160 N
Materials	
Mouldings	Liquid Cristal Polymer (LCP), UL 94-V0
Contacts	Copper alloy
Contact surface	
Contact zone	Selectively plated acc. to performance level[1)]

[1)] Explanation performance levels see chapter 00

Current carrying capacity

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

Control and test procedures according to DIN IEC 60512



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

SMC

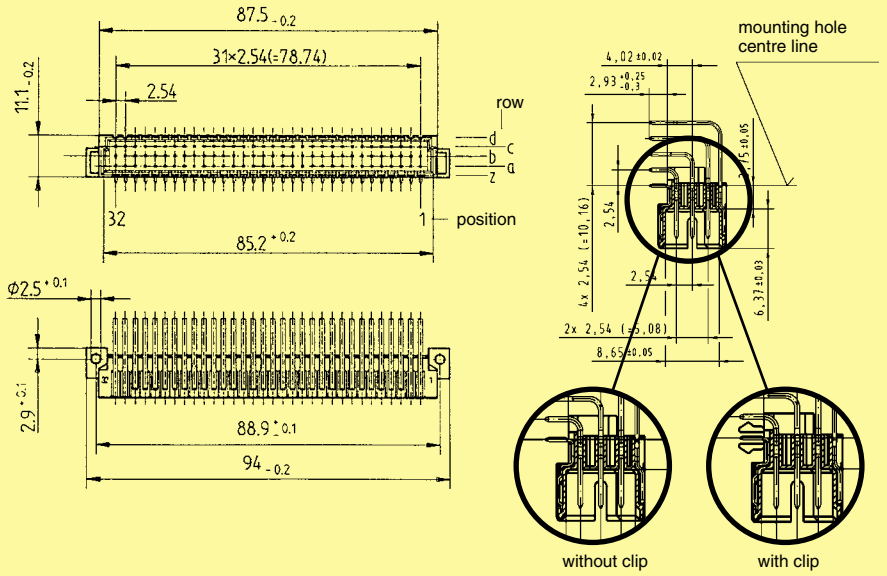
Number of contacts

160

Male connectors, angled

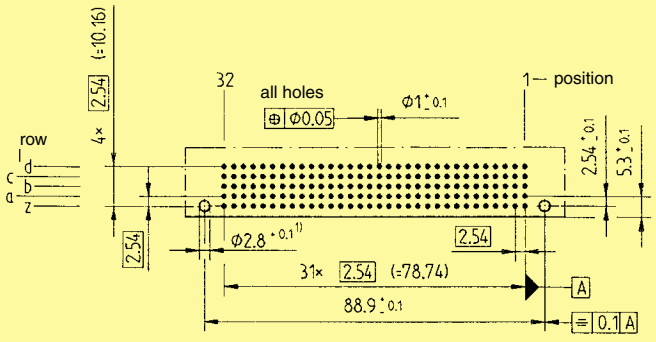
Identification	Number of contacts	Contact arrangement	Part No. Performance levels according to IEC 61 076-4-113 Explanation chapter 00 2	1
Male connector* without retention clip	160	z, a, b, c, d	02 01 160 2101	02 01 160 1101
with retention clip	160	z, a, b, c, d	02 01 160 2102	02 01 160 1102

Dimensions



Board drillings

Mounting side

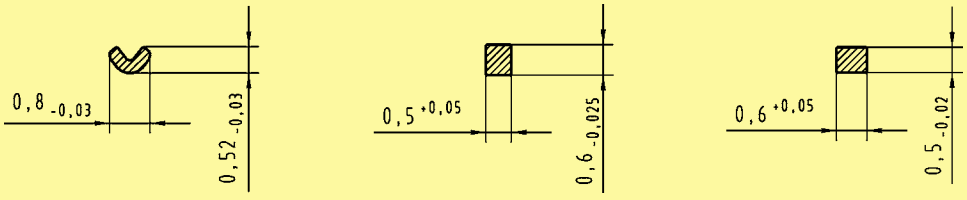


Cross section of solder terminations

Row z:
A = 0.21 - 0.25 mm²

Rows a, b, c:
A = 0.29 - 0.33 mm²

Row d:
A = 0.29 - 0.32 mm²



A = cross area of contacts

Dimensions in mm

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

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

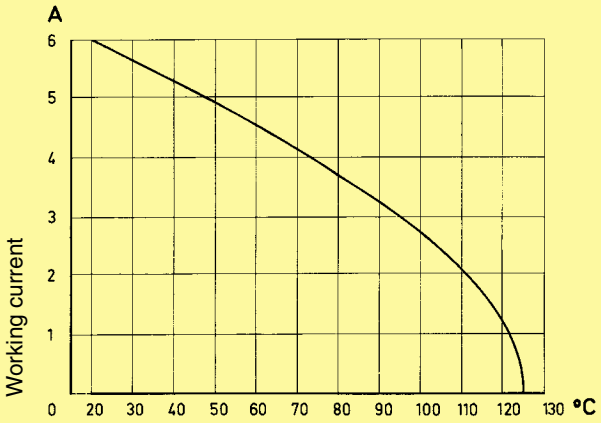
Number of contacts	48
Contact spacing (mm)	5.08
Working current see current carrying capacity chart	6 A max.
Clearance	≥ 1.6 mm
Creepage	≥ 3.0 mm
Working voltage The working voltage also depends on the clearance and creepage dimensions on the pcb itself and the associated wiring	according to the safety regulations of the equipment Explanations see chapter 00
Test voltage $U_{r.m.s.}$	1.55 kV (contact-contact) 2.5 kV (contact-ground)
Contact resistance	≤ 15 mΩ
Insulation resistance	≥ 10^{12} Ω
Temperature range	– 55 °C … + 125 °C
during reflow soldering	max. + 240 °C for 15 s
Electrical termination	
Male connector	Solder pins for pcb connections Ø 1 ± 0.1 mm according to IEC 60326-3
Insertion and withdrawal force	≤ 75 N
Materials	
Mouldings	Poly Cyclohexylene Terephthalate (PCT) UL 94-V0
Contacts	Copper alloy
Contact surface	
Contact zone	Selectively plated according to performance level[1)]

[1)] Explanation of performance levels see chapter 00

Current carrying capacity

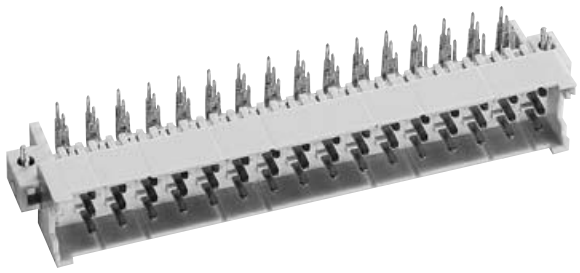
The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity curve is valid for continuous, non interrupted current loaded contacts of connectors when simultaneous power on all contacts is given, without exceeding the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

Control and test procedures according to DIN IEC 60512



Number of contacts

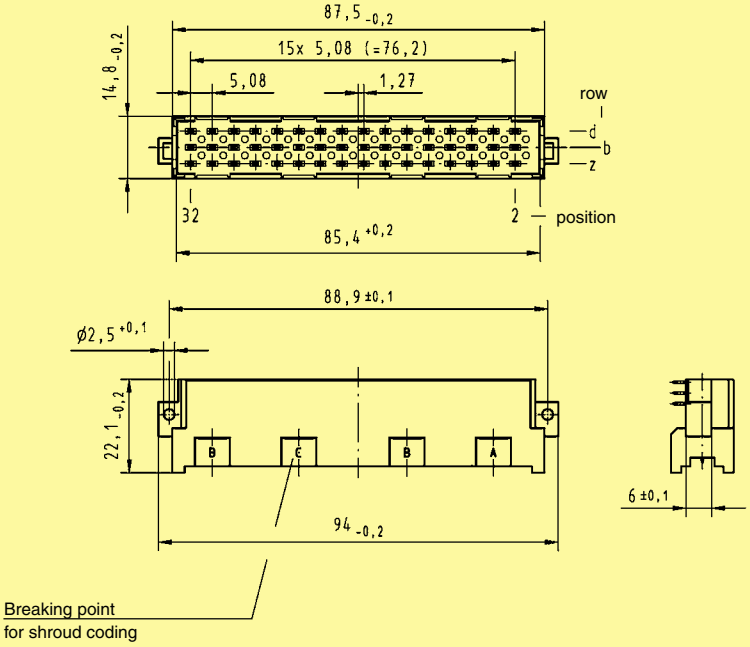
48



Male connectors, angled

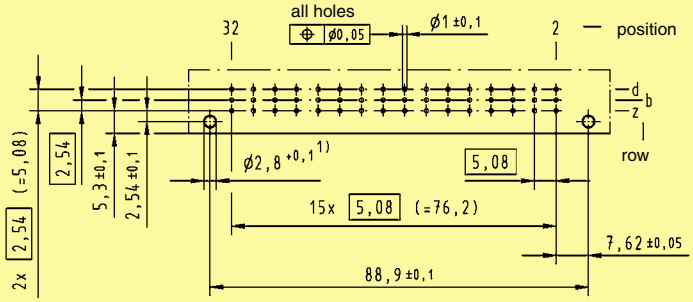
Identification	Number of contacts	Contact arrangement	Part No. Performance levels according to IEC 60 603-2. Explanation chapter 00 3	2	1
Male connector without retention clip	48		09 06 148 7951	09 06 148 6951	09 06 148 2951
with retention clip	48		09 06 348 7951	09 06 348 6951	09 06 348 2951

Dimensions

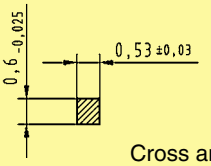


Board drillings

Mounting side



Cross section of solder terminations



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

Dimensions in mm

SMC

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


schiedener Me
Bilder, Grafiken,
Animationen,
nem System, in dem diese Infor-
Zusam
iedener
der, Grafiken,
imationen,
n System
vielen Staaten
ternehmen
MS, m. S.)