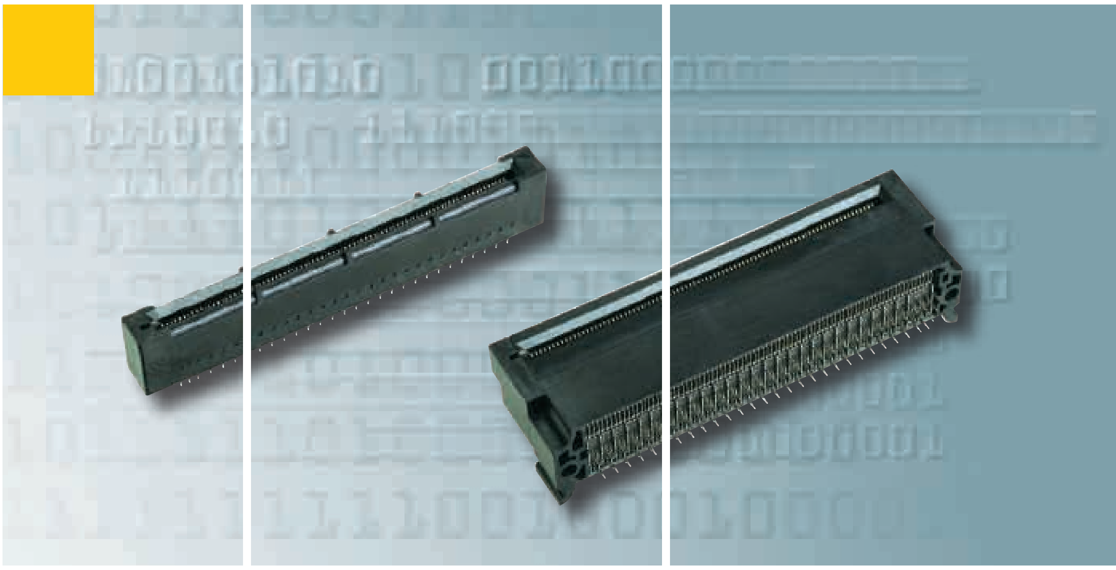
HARTING



TCA Connectors

People | Power | Partnership

Quality Connections Worldwide

HARTING was founded in 1945 by the family that still owns the company.

Today, HARTING employs around 2,000 people worldwide, including 150 qualified engineers. The sales team, including more than 100 sales engineers is in daily contact with our customers.

The company is one of the world's leading manufacturers of connectors, and currently have 34 subsidiary companies in Europe, the United States and Asia. In several product areas, HARTING is a market leader.

Great emphasis is placed on close links with customers, including the provision of a 'Just-in-Time'-Service to ensure rapid delivery to key customers.

HARTING products are designed and manufactured using the latest automated techniques, from CAD systems in the research and development department to automatic production techniques on the assembly lines.

Production and quality control is based on a 'zero-error' philosophy which can only be reached by the continuous successful implementation of fully automated production techniques. The organisation and procedures for quality assurance are based on the EN ISO 9001 standard. A total of 60 engineers and other employees, most of whom are trained and qualified to standards laid down by the DGQ (German Association of Quality) or the SAQ (Swiss Association of Quality), are employed solely on quality-assurance activities.

TCA Connectors

PICMG, formally known as the PCI Industrial ComputingManufacturing Group – is an industry consortium of over 450 companies. PICMG's purpose is to define standard architectures in an effort to reduce system costs and development cycles and since it's 1994 foundation, PICMG has been responsible for the establishment of several of successfully implemented, open, industrial standards. Open standards have proven themselves to be very advantageous for system manufacturers and end-user, because they create multiple vendors of similar parts, low prices at high volumes, and a shortened time-to-market.

Historically, PICMG has created several successful standards.

- PICMG 1.x Series – a passive backplane PCI specification
- PICMG 2.x Series – the CompactPCI® standard

Today, the AdvancedTCA® series of specifications (PICMG 3.x) targets the requirements of the next generation of carrier grade telecommunications equipment. AdvancedTCA®, short for Advanced Telecom Computing Architecture and sometimes simply abbreviated ATCA®, incorporates an impressive suite of recent technological advancements including the latest trends in high speed interconnect technologies.

Features of AdvancedTCA® include optimization for high-capacity, high-performance telecom and industrial applications, improved reliability, manageability, redundability, and serviceability. Encompassing a technological growth path valid for up to ten years, AdvancedTCA® has earned a solid position within the telecom systems market.

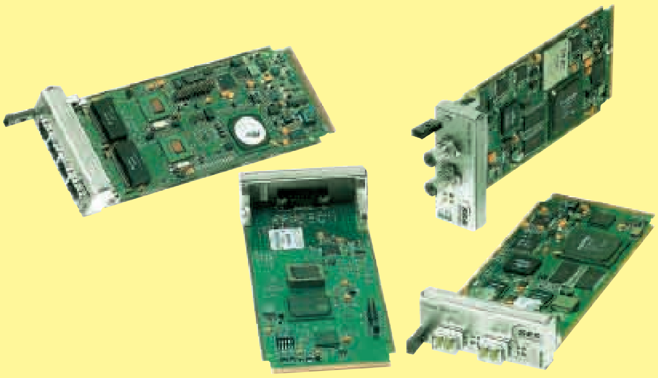
The rack or chassis, is responsible for housing the backplane and the daughtercards, as well as cooling and powering the system. From on the second quarter of 2007, HARTING offers the ATCA® power connector that energises the blades, both the straight backplane and the right angled daughtercard connector.

AdvancedTCA® chassis with backplane

The backplane, said to be passive, is merely a medium for the daughtercards to communicate with each other. And, the daughtercards, sometimes called blades or boards, provide the system with it's functionality and allow for an easy, hot-swappable module exchange from the front of the system.

Initially, many blades were designed with a fixed functionality, and they had to be replaced once their functionality became obsolete or the demands of the system changed. With the continuation of exponential technological growth, concept proved to be a costly endeavour for the end-user.

To extend the functionality and modularity of AdvancedTCA®, blade manufacturers conceived the idea of upgradeable daughtercards, and began to insert mezzanine cards onto the blades when needed. To achieve a common mezzanine concept, PICMG developed the Advanced Mezzanine Card (AdvancedMC™) standard AMC.0.



AdvancedMC™ modules for different applications

For the use of Advanced Mezzanine Cards, as well called AdvancedMC™ modules, a carrier is necessary. A carrier is an ATCA® blade with only little functionality beyond AdvancedMC™ management. It contains the mechanical environment for the AdvancedMC™ modules. Depending on their size, up to eight AdvancedMC™ modules can be hot-swapped in and out of a carrier, this enabled the creation of extremely scalable and upgradeable systems.

AdvancedTCA® carrier board with AdvancedMC™ modules

To connect AdvancedMC™ modules to carrier boards PICMG defined a new high-speed mezzanine connector: the AdvancedMC™ connector – a card edge connector mounted on the carrier board. It contacts directly with the module's pcb gold pads. Although PICMG defined four AdvancedMC™ connector types (B, B+, AB and A+B+), current market developments focus on type B+.

The HARTING AdvancedMC™ B+ connector features a new design element that supplements the standard – the GuideSpring. The GuideSpring significantly increases the mating reliability and prevents contact interruptions and surface wear when subjected to shocks or vibrations.

The press-fit termination technology provides significant cost and durability advantages over other termination technologies. The connector design allows for the use of a standard flat rock die. For more press-in process control, HARTING offers a special top and bottom tool (see page 16).

The AdvancedMC™ standard covers a wide range of applications:

- AMC.1 PCI Express and advanced switching
- AMC.2 Gigabit Ethernet / 10 Gigabit XAUI Ethernet
- AMC.3 Storage
- AMC.4 Serial RapidIO

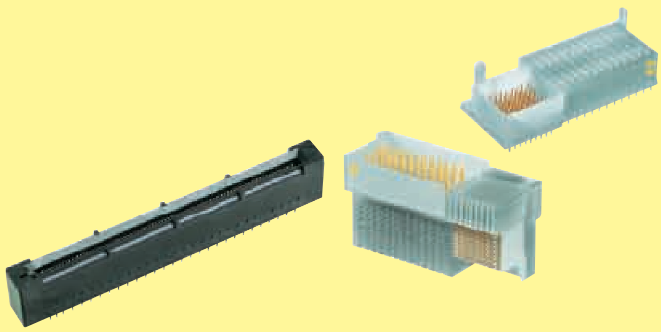
µTCA™

This revolutionary AdvancedMC™-based design concept has led to the recent development of a completely mezzanine-based system – MicroTCA™. MicroTCA™, short for Micro Telecom Computing Architecture, is a more cost-efficient platform than AdvancedTCA® when dealing with smaller applications, yet powerful enough to address the needs of telecom, enterprise and medical applications.

This newly-implemented PICMG standard, outlined in the MTCA.0 specification, presents a design-concept whereby AdvancedMC™s – the same kind used in ATCA® systems – plug directly into a passive backplane; this eliminates the need for carrier boards.

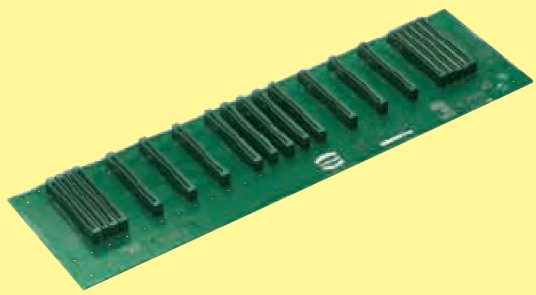
MicroTCA™ double cube system

Naturally the mating face of the AdvancedMC™ connector for MicroTCA™ is the same as for ATCA®, but with a right angled mating direction. It contains the new GuideSpring and is available in press-in termination. PICMG members voted HARTING's MicroTCA™ connector footprint as the new MicroTCA™ standard connector for press-fit termination technology.



AdvancedMC™ and power connectors for MicroTCA™

The MicroTCA™ backplane is typically powered by special, field replaceable, hot-swapable, redundant Power Supply Units (PSU). The PSU connects to the backplane through a MicroTCA™ power connector (press-fit termination) also available from HARTING.



MicroTCA™ backplane

The module management is performed by a MicroTCA™ Carrier Hub, or MCH. An MCH is connected to the backplane by up to four adjacent card-edge connectors. One MCH can control up to 12 AdvancedMC™ moduls, thus depending on redundancy requirements, workload, or both, one or two MCHs may be used within a single system.

*What is **con:**card**+**?*

con:card**+** is a quality seal for AdvancedMC™ connectors that helps to deliver a significant increase in the reliability of MicroTCA™ and AdvancedTCA® systems. In order to reach the target availability of 99.999 %, all system components must be carefully coordinated, and they must function reliably. The selection of suitable connectors is an essential, decisive factor here, as today it is virtually impossible for series production to meet the strict tolerances for the AdvancedMC™ modules as defined in the respective specifications. The so-called GuideSpring is ideally suited for compensating here, and represents just one of a total of five key advantages of the **con:**card**+** philosophy. All the advantages are introduced in the following.

Special contact material

*Unlike conventional mating systems with male and female connectors, the AdvancedMC™ has only one, not two, contact tongues per contact. In order to ensure a permanently reliable contact, this single contact tongue must press against the gold pad with sufficient force throughout the entire lifetime. In addition, the thickness of the AdvancedMC™ modules may fluctuate by ± 10 %. To meet this challenge, HARTING utilizes a special alloy with very low relaxation as the contact material for the **con:**card**+** connector.*

PdNi contact coating

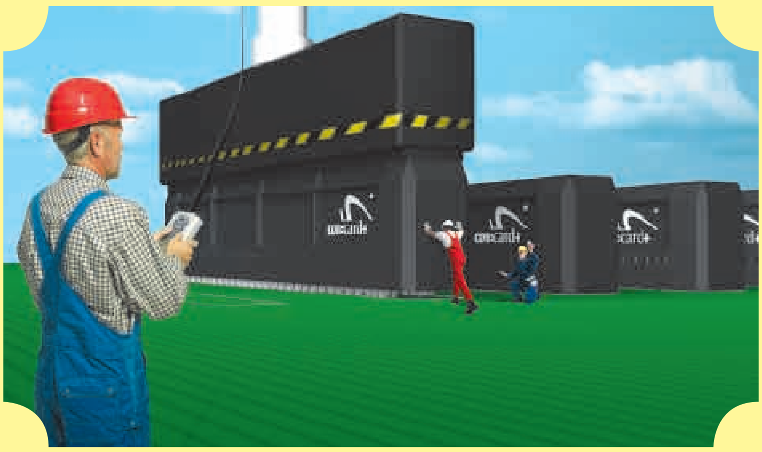
In order better to meet the high requirements placed on the connectors, a palladium-nickel surface (PdNi) with additional gold flash is used. As a result, wear resistance is increased by roughly 30 %. Even when applied very thinly, PdNi surfaces offer a quality and corrosion-resistant coating that meets the high requirements placed on the connection far better than pure gold.

Smooth contact surface

The specification for the AdvancedMC™ entails 200 mating cycles for a module. On the pcb, the nickel/hard gold layer on the relatively soft copper can only stand up to this high load if the contact surface is absolutely smooth.
*This is the case with the **con:**card**+** connector. With years of experience in stamping techniques and the utilization of high-performance stamping tools with special process components, HARTING is actively involved in minimizing gold pad wear.*

GuideSpring

Pcb manufacturers are not capable of meeting the AdvancedMC™ modules‘ tight tolerances with certainty in the series process today. Just a single card with tolerances slightly larger than allowed by the specifications can lead to a system breakdown.
*The **con:**card**+** GuideSpring offsets these tolerance deviations by constantly pressing the module against the opposite wall. As this is displaced somewhat towards the middle, the slot is optimally designed for the AdvancedMC™ module, and the mating reliability increases tremendously.*
In addition, the GuideSpring secures the module position in the case of shocks and vibrations. This prevents loss of contact and surface wear.



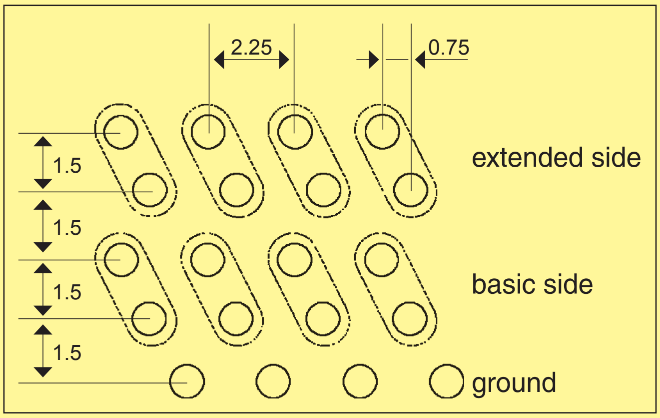
Press-fit technology

Press-fit technology results in a gas-tight, corrosion-resistant, low-ohm quality mechanical connection between the pin and the through contacting of the pcb. This remains reliably in contact and stable, even under conditions of high mechanical and thermal loads, such as vibration, bending and frequent temperature changes. This technology represents a tremendous advantage over other processing techniques. Measurements substantiate that the required transmission rates are easily attained.

Technical characteristics

Design according	PICMG AMC.0 (RoHS compliance)
Number of contacts	170
Contact spacing	0.75 mm
Clearance and creepage distance between contacts	0.1 mm min.
Working current of power contacts as defined in AMC.0 spec.	1.52 A @ 70 °C max. 30 °C temp. rise
Test voltage	80 $V_{r.m.s.}$
Contact resistance	
ground contacts	60 mΩ max.
signal, power, general purpose contacts	90 mΩ max.
Insulation resistance	10 MΩ

Nominal differential impedance	100 Ω ± 10 %	
Near end crosstalk (pair-to-pair) @ 30 ps risetime	basic-to-basic	< 0.6 %
	basic-to-extended	< 0.9 %
	extended-to-extended	< 0.6 %
	diagonal	< 0.3 %
	multiline	< 3.0 %

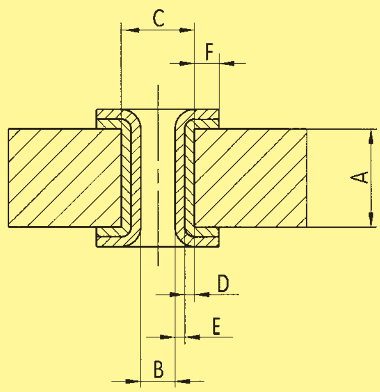


Differential propagation delay	Basic side:	125 ps
	Extended side:	145 ps
Differential skew	Between basic and extended side:	20 ps
	Within basic and extended side:	± 2 ps

Temperature range	-55 °C … +105 °C
Durability as per AMC.0 specification	200 mating cycles
Termination technique	Press-in termination
Mating force	100 N max.
Withdrawal force	65 N max.

Materials

Moulded parts	Liquid Crystal Polymer (LCP), UL 94-V0
Contacts	Copper Alloy
Contact surface	Palladium nickel plated
Packaging	Card box (other packaging on request)



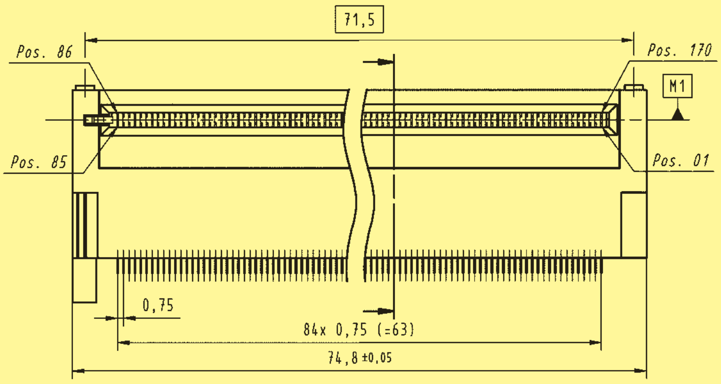
Plated through hole recommendations		
A	pcb thickness	min. 1.4 mm
B	Plated hole-Ø	0.55 ± 0.05 mm
C	Hole-Ø	0.64 ± 0.01 mm
D	Cu	min. 25 µm
E	Plating	- min. 0.8 µm chem. Sn - 0.05 - 0.12 µm Au over 3 - 7 µm Ni - 0.1 - 0.3 µm Ag
F	Pad width	min. 0.15 mm

con:card+®

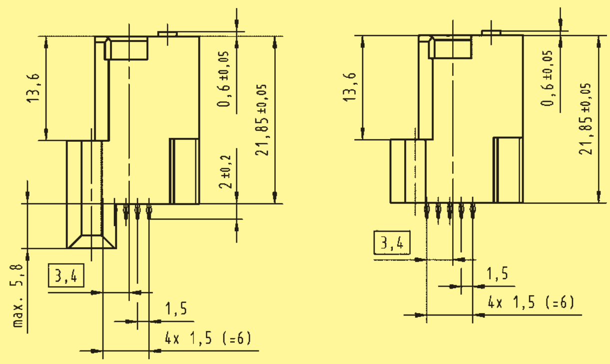
Card edge connectors, angled

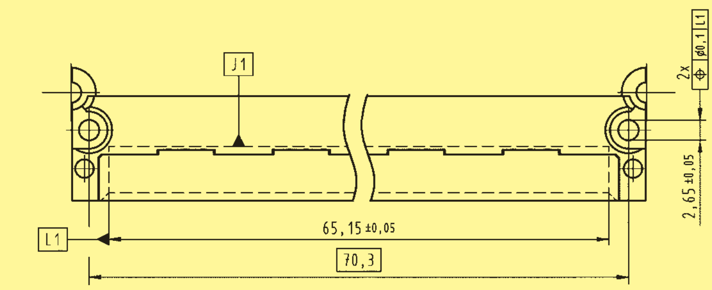
Identification	No. of contacts	Contact length [mm] termination side	Part number
AdvancedMC™ connector for ATCA®, type B+ with peg and with GuideSpring	170	2.0	16 04 170 5104 000
AdvancedMC™ connector for ATCA®, type B+ without peg and with GuideSpring	170	2.0	16 04 170 5106 000

With peg   Without peg



With peg   Without peg



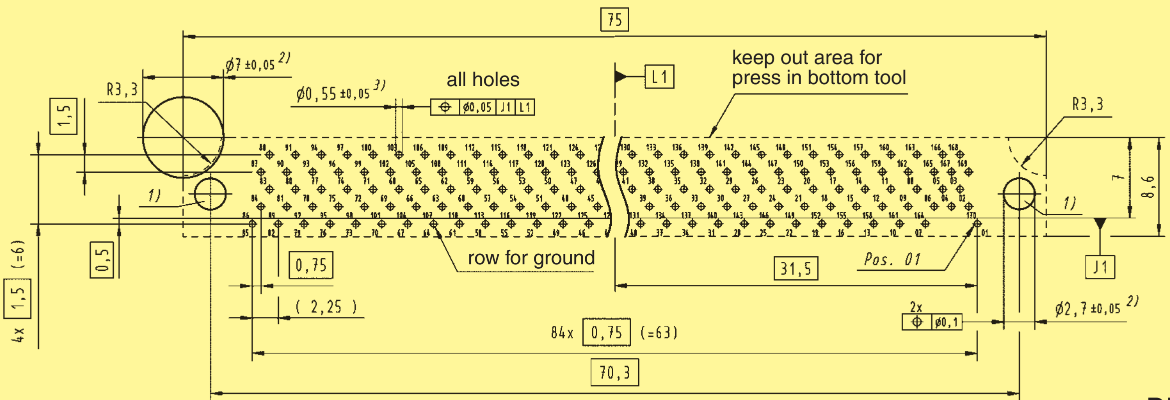


1) fixing-hole optional

2) non-metallized drillings

3) recommended drill hole diameter:
ø 0.64 ± 0.01 mm
through hole diameter (after plating):
ø 0.55 ± 0.05 mm (acc. to IEC 60352-5)

Board drillings (view magnified)



Dimensions [mm]

Technical characteristics

Design according	PICMG 3.0 R2.0
Total number of contacts	30, max. 34
Power contacts	8
Signal contacts	22, max. 26
Clearance and creepage distance between contacts	
Within group 5–16	0.7 mm min.
Within group 17–24	2.5 mm min.
25 to 26	5.5 mm min.
Within group 27–34	1.4 mm min.
13–16 to 17–20	3.0 mm min.
21–24 to 25–26	4.0 mm min.
25–26 to 27–29	2.0 mm min.
Sequential contact engagement	
1st	25, 26, 28, 29, 30, 31
2nd	33
3rd	5–24, 34
4th	27, 32
Working current	
Power contacts	16 A
Signal contacts	1 A
Test voltage	
Contacts 1–16	1000 $V_{r.m.s.}$
Contacts 17–34	2000 $V_{r.m.s.}$
Contact resistance	
Power contacts	≤ 3 mΩ
Signal contacts	≤ 10 mΩ
Insulation resistance	≥ 10^8 Ω

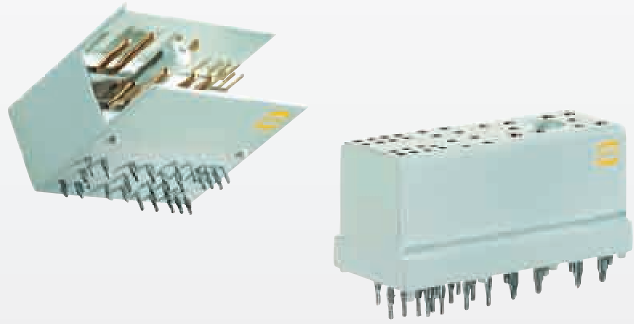
Temperature range	-55 °C … +125 °C
Durability	250 mating cycles
Termination technique	Press-in termination
Mating force	67 N max.
Withdrawal force	67 N max.

Materials

Moulded parts	PBT, glass-fibre filled, UL 94-V0
Contacts	Copper Alloy
Contact surface	Selectively gold plated

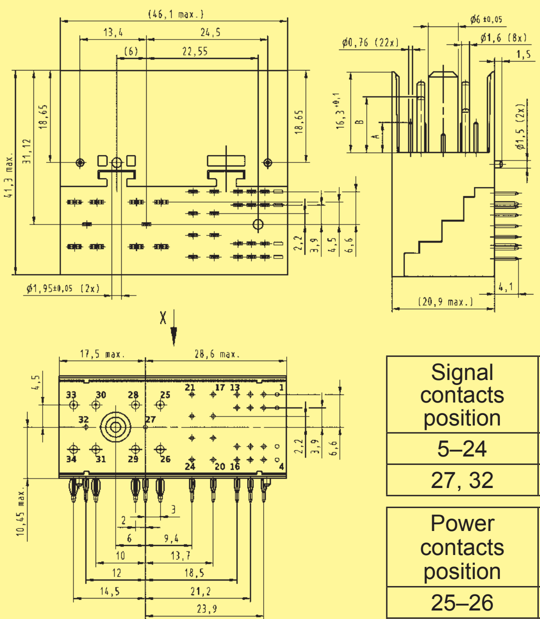
Packaging	Card box (other packaging on request)

Available Q2 / 2007



Identification	No. of contacts	Contact length [mm] termination side	Part number
Power connector for AdvancedTCA®, male	30	4.1	16 32 030 1101 000
Power connector for AdvancedTCA®, female	30	5.3	16 31 030 1201 000

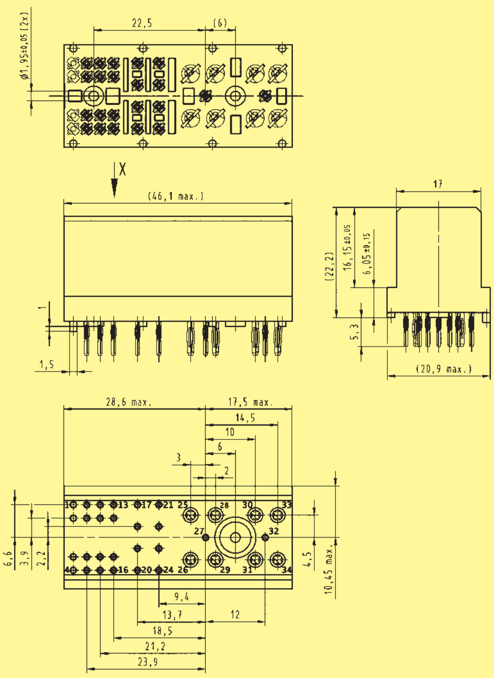
Male connector



Signal contacts position	Dimension A
5–24	6.1
27, 32	3.8

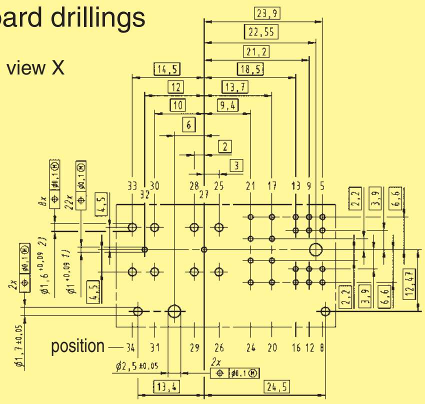
Power contacts position	Dimension B
25–26	14.3
28–31	14.3
33	11.3
34	8.8

Female connector

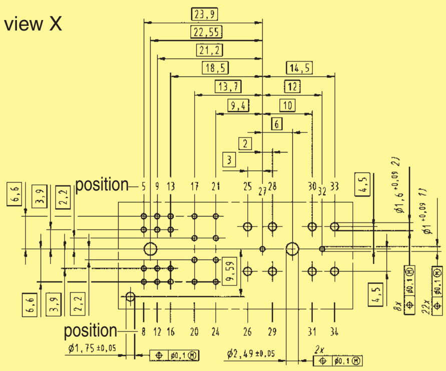


Board drillings

view X



view X



1) recommended drill hole diameter: ø 1.15 ± 0.025 mm
through hole diameter (after plating): ø 1.0 + 0.09 mm

2) recommended drill hole diameter: ø 1.75 ± 0.025 mm
through hole diameter (after plating): ø 1.6 + 0.09 mm

Dimensions [mm]

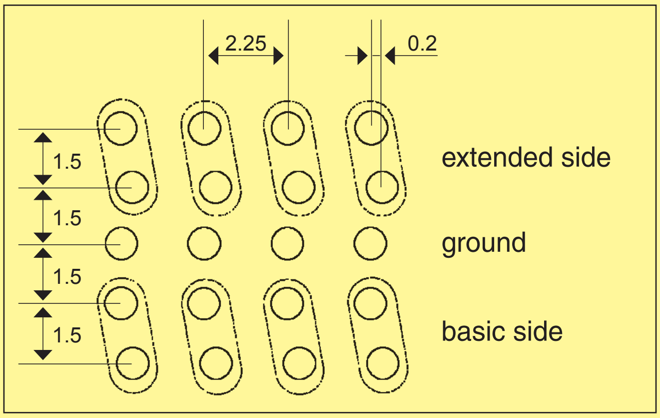
Technical characteristics

Design according	PICMG MTCA.0 R1.0 (RoHS compliance)

Number of contacts	170
Contact spacing	0.75 mm
Clearance and creepage distance between contacts	0.1 mm min.

Working current of power contacts as defined in MTCA.0 spec.	1.52 A @ 70 °C max. 30 °C temp. rise
Test voltage	80 $V_{r.m.s.}$
Contact resistance	25 mΩ max.
Insulation resistance	10 MΩ

Nominal differential impedance	100 Ω ± 10 %	
Near end crosstalk (pair-to-pair) @ 30 ps risetime	basic-to-basic	< 0.5 %
	basic-to-extended	< 0.2 %
	diagonal	< 0.1 %
	multiline	< 2.0 %



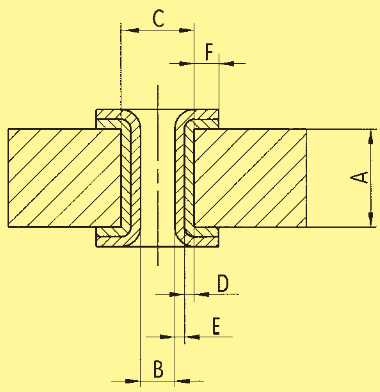
Differential propagation delay	Basic side:	75 ps
	Extended side:	75 ps
Differential skew	Between basic and extended side:	± 2 ps
	Within basic and extended side:	± 2 ps

Temperature range	-55 °C … +105 °C
Durability as per MTCA.0 spec.	200 mating cycles
Termination technique	Press-in termination
Mating force	100 N max.
Withdrawal force	65 N max.

Materials

Moulded parts	Liquid Crystal Polymer (LCP), UL 94-V0
Contacts	Copper Alloy
Contact surface	Palladium nickel plated

Packaging	Card box (other packaging on request)

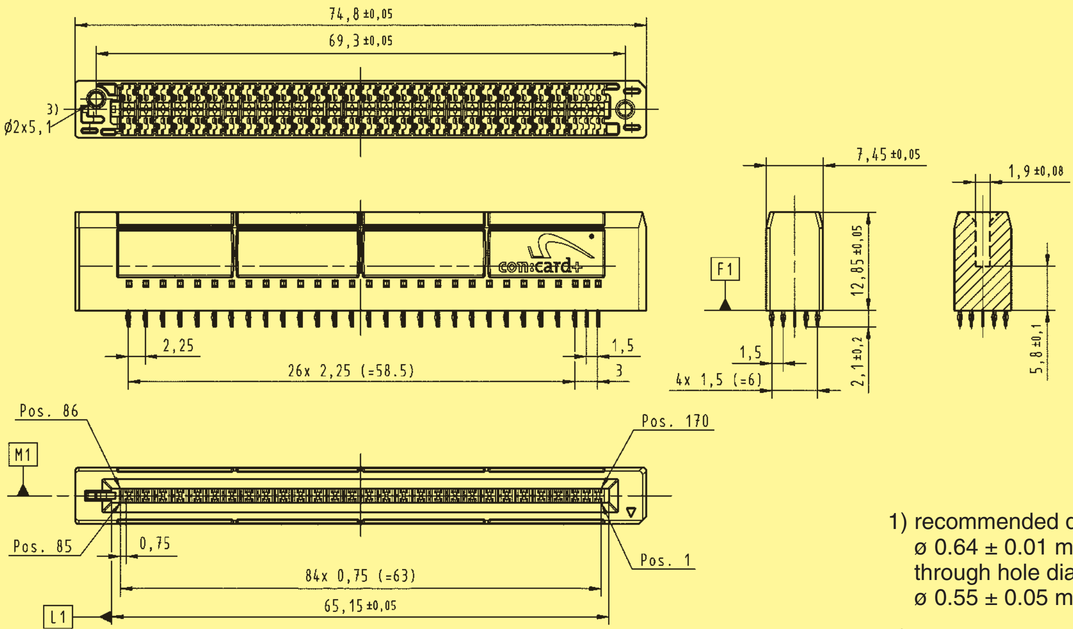


Plated through hole recommendations		
A	pcb thickness	min. 1.4 mm
B	Plated hole-Ø	0.55 ± 0.05 mm
C	Hole-Ø	0.64 ± 0.01 mm
D	Cu	min. 25 µm
E	Plating	- min. 0.8 µm chem. Sn - 0.05 - 0.12 µm Au over 3 - 7 µm Ni - 0.1 - 0.3 µm Ag
F	Pad width	min. 0.15 mm

con:card+®

Card edge connector, straight

Identification	No. of contacts	Contact length [mm] termination side	Part number
AdvancedMC™ connector for MicroTCA™ with GuideSpring	170	2.1	16 11 170 5202 000

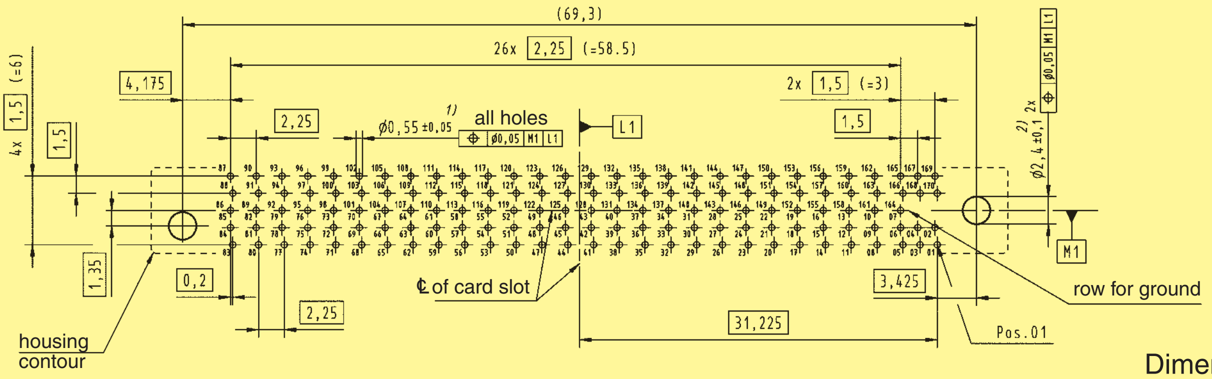


1) recommended drill hole diameter: ø 0.64 ± 0.01 mm (acc. to IEC 60352-5) through hole diameter (after plating): ø 0.55 ± 0.05 mm

2) fixing-hole optional non-metallized drillings

3) use fillister-head tapping screws 2.2 x length, shape C, acc. to ISO 7049 (length = pcb thickness + min. 4 mm)

Board drillings (view magnified)



Dimensions [mm]

Technical characteristics

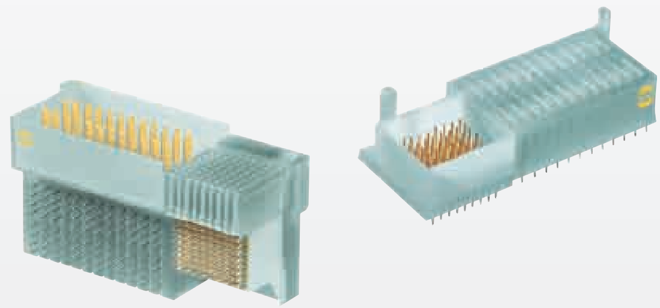
Design according	PICMG MTCA.0 R1.0 (RoHS compliance)
Total number of contacts	96
Power contacts	24
Signal contacts	72
Sequential contact engagement	
1st	Power 4–11
2nd	Power 1–3, power 12–24
3rd	Signal A2–H9
4th	Signal A1
Working current	
Power contacts	9.3 A @ 80 % derating acc. IEC 60512 and 70 °C ambient temperature and 30 °C temperature rise
Signal contacts	1 A @ 80 % derating acc. IEC 60512 and 70 °C ambient temperature
Contact resistance	
Power contacts	≤ 10 mΩ
Signal contacts	≤ 35 mΩ
Insulation resistance	≥ 10^8 Ω
Insulation resistance (after moisture)	≥ 10^7 Ω

Temperature range	-55 °C … +105 °C
Durability	200 mating cycles
Termination technique	Press-in termination
Mating force	145 N max.
Withdrawal force	110 N max.

Materials

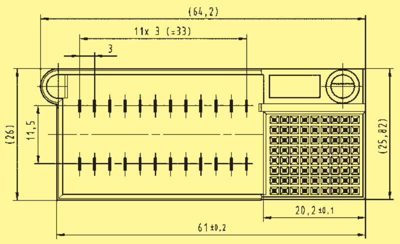
Moulded parts	PBT, glass-fibre filled, UL 94-V0
Contacts	Copper Alloy
Contact surface	
Module version	Power contacts: selectively gold plated Signal contacts: selectively palladium nickel plated
Backplane version	Selectively palladium nickel plated

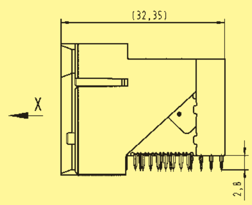
Packaging	Card box (other packaging on request)



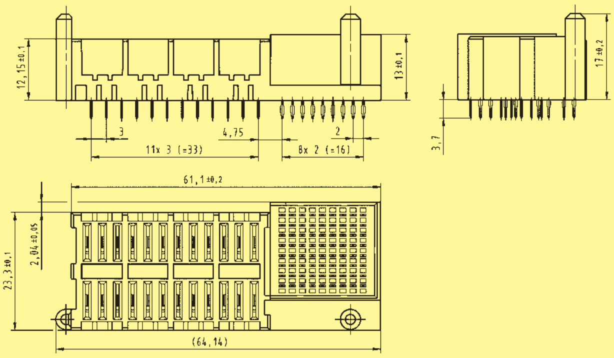
Identification	No. of contacts	Contact length [mm] termination side	Part number
Power output connectors for MicroTCA™			
module version	96	2.8	16 34 096 1101 000
backplane version	96	3.7	16 33 096 1201 000

Module version

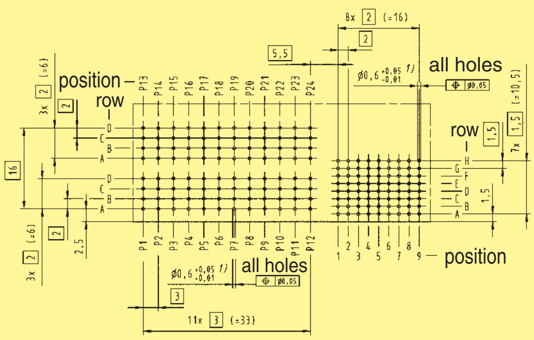


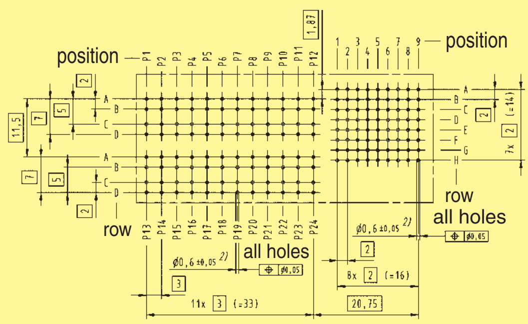


Backplane version



Board drillings





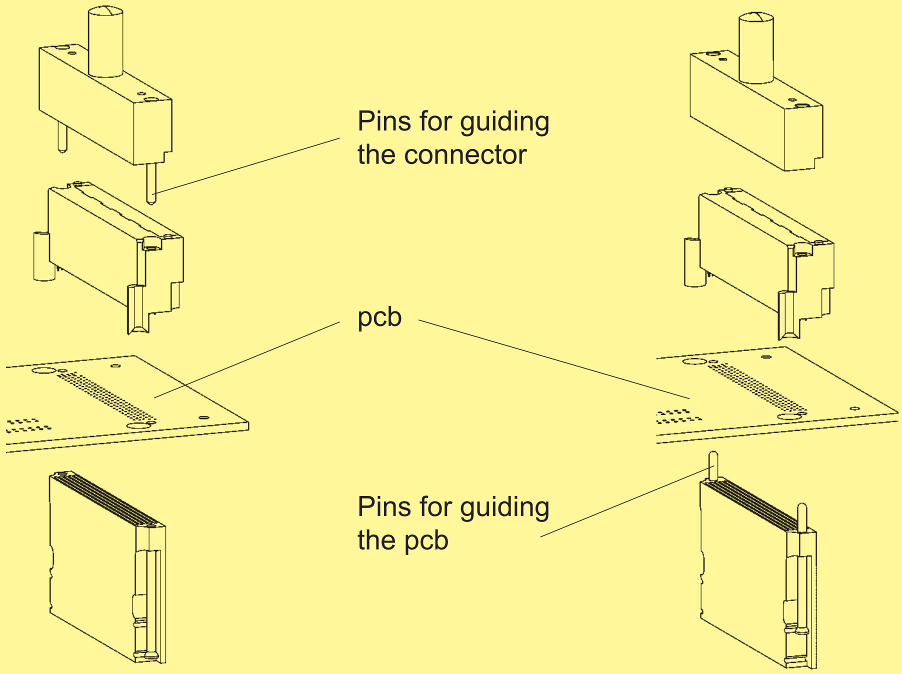
1) recommended drill hole diameter: ø 0.7 ± 0.02 mm
through hole diameter (after plating): ø 0.6 $^{+0.05}_{-0.01}$ mm

2) recommended drill hole diameter: ø 0.7 ± 0.02 mm
through hole diameter (after plating): ø 0.6 ± 0.05 mm

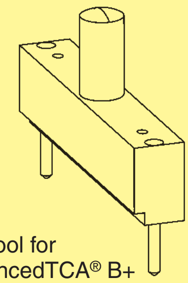
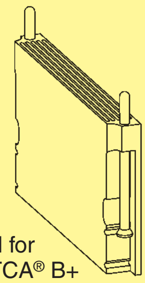
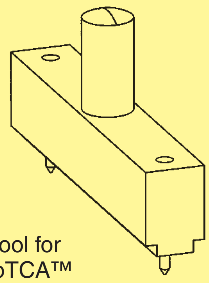
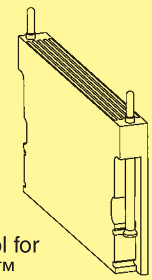
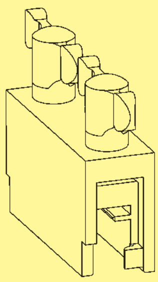
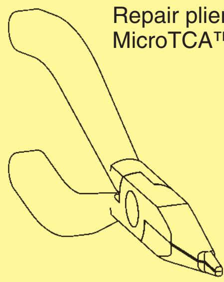
Dimensions [mm]

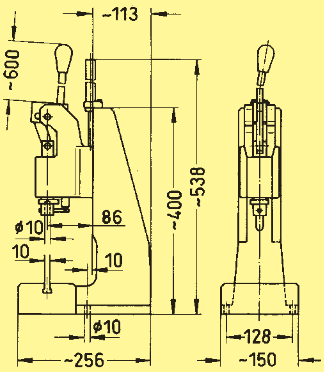
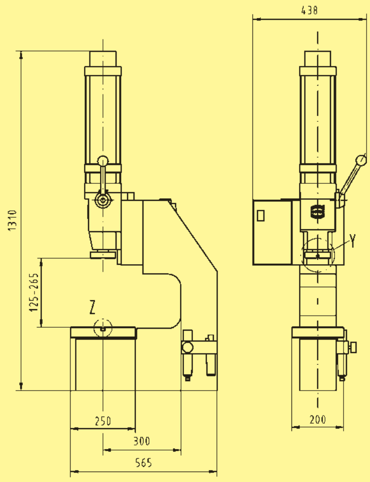
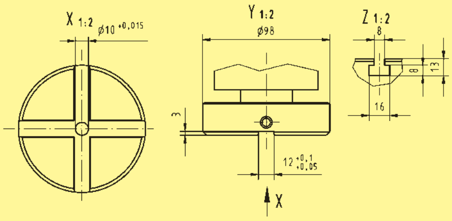
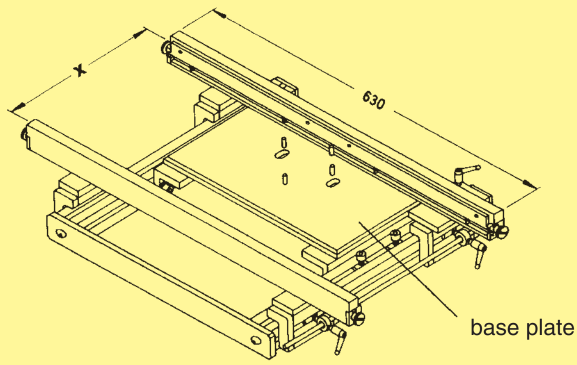
For a reliable and safe press-in process HARTING has developed a special tooling system.
Each tooling is adapted to the special requirements of the individual connector range, thus a good handling and quick adjustment is guaranteed.
The different demands of the system designs will be covered from the highly adaptable tooling system for AdvancedTCA® or MicroTCA™ with the following options:

- Guiding of the connector and alignment of the top and the bottom tool
- Guiding of the pcb and alignment of the top and the bottom tool



Example for different options to guide connector or pcb.

Top tool for AdvancedTCA® B+	16 99 000 0001 000	 Top tool for AdvancedTCA® B+
Bottom tool for AdvancedTCA® B+	16 99 000 0002 000	 Bottom tool for AdvancedTCA® B+
Top tool for MicroTCA™	16 99 000 0003 000	 Top tool for MicroTCA™
Bottom tool for MicroTCA™	16 99 000 0004 000	 Bottom tool for MicroTCA™
Removal tool for AdvancedTCA® B+	16 99 000 0005 000	 Removal tool for AdvancedTCA® B+
Repair pliers for MicroTCA™	16 99 000 0006 000	 Repair pliers for MicroTCA™

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 ø in the ram: ø 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 ø in the ram: ø 10 mm Net weight: 136 kg Power supply: 110 V / 220 V AC
CPM *prestige*	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
Adaptor for height compensation[1]	09 99 000 0279	
Guide frame with base plate Standard type for pcb size x = 123,5 - 309,5 mm	09 99 000 0244	
Long type[2] for pcb size x = 123,5 - 668,5 mm	09 99 000 0261	
Base plate	09 99 000 0255	

[1] suitable for 09 99 000 0282 and all CPM machines
[2] not suitable for hand bench press

Signal integrity support – Introduction

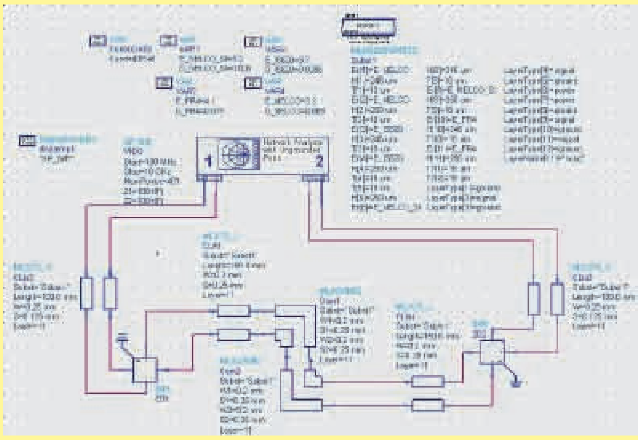
HARTING offers signal integrity support to the end customers. We provide simulation models and evaluation kits with our products for signal integrity investigations. The evaluation kits are assembled with SMA's to connect them directly with the measurement instruments. The benefit is that the customer saves time and costs for pre-evaluation of the connector. We offer test boards suitable for the connector evaluation itself and have built reference backplanes and test cards for measurements within applications like VME, CompactPCI®, AdvancedTCA® and MicroTCA™. Reference structures and well established measurement techniques allow a full de-embedding of the propagation characteristics of the interconnect itself for test and verification. Furthermore we developed several high-speed test backplane with different connector areas and pcb design topologies. We can provide footprint and routing recommendations for our products. A variety of testboards, simulation models and further technical data for different products are available on request.

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

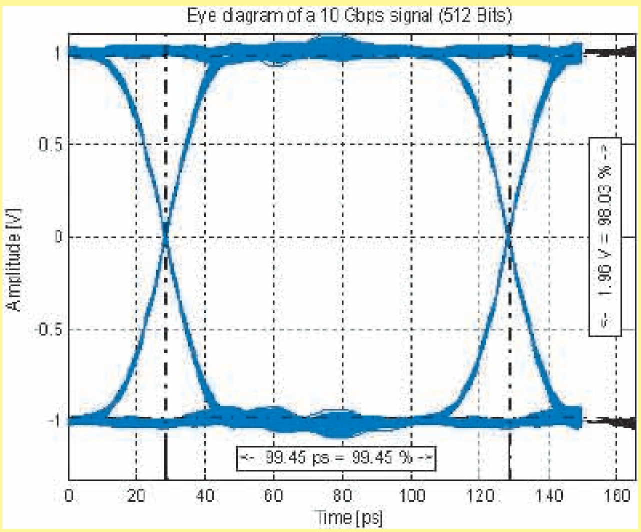
Signal integrity capabilities
- Simulation and modeling
- Measurement and verification
- Test fixture & reference backplane design
- Design-in support

Simulation and modeling

Capability to perform full 3D-FEM simulations of the CAD-geometry with different well established tools like CST Microwave Studio and Ansoft HFSS. Post-processing of the data for field-distribution and full S-parameter and time-domain analysis within the software packages themselves and additional Matlab tools.

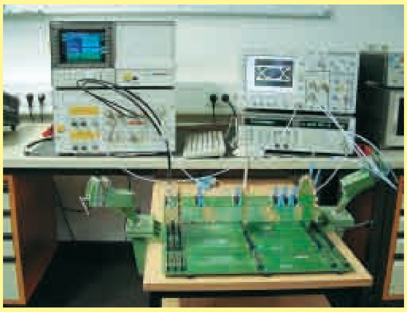


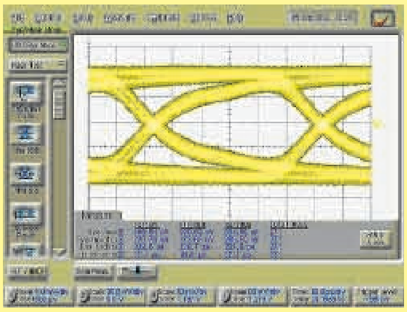
For SPICE-modeling, impedance calculation and field distribution analysis of the geometry S-parameter models are used in combination with static 3D-FEM, 2D-FEM and planar field solvers depending on the desired bandwidth of the signal. These models are used as library parts for channel simulations including particular chip, trace, vias and connector subcircuits. Eye-diagram, S-parameter and waveform analysis of the entire channel are performed with tools like HSPICE and ADS (Advanced Design System).



Signal integrity support – Measurement and verification

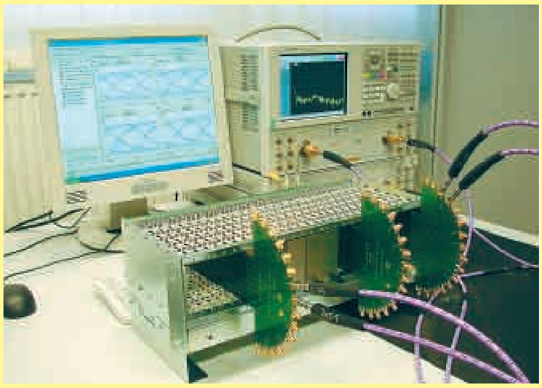
Time-domain measurements





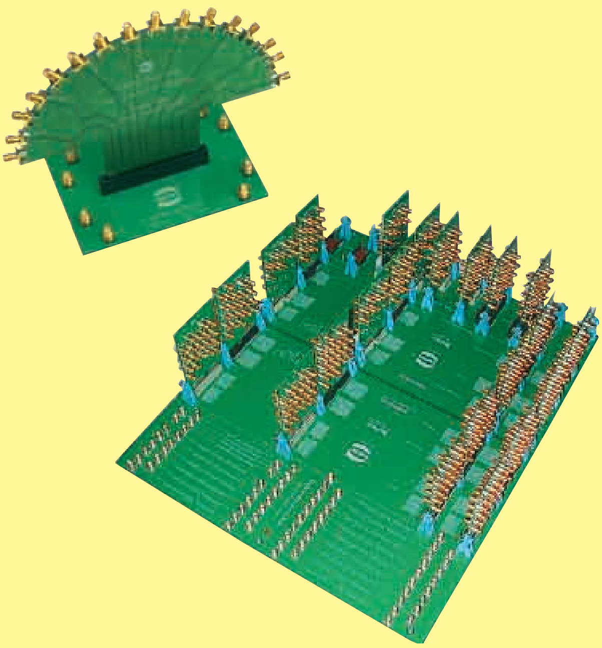
Parameters:
- Characteristic impedance
- Propagation delay
- Rise time degradation
- Reflection
- Crosstalk
- Eye-diagram and mask-test
- Bit-error rate testing (BERT) up to 12.5 Gbps per differential line

Frequency-domain measurements



Parameters:
- 4 port S-parameter analysis (up to 40 GHz)
- Insertion- and return loss, crosstalk, VSWR
- Fourier-transformation, gating, error-location
- PLTS software to calculated time-domain data, eye-diagrams, etc.

Test fixture & reference backplane design



Design-in support

- Customized pcb design close to the real application
- Footprint and routing recommendations
- Full measurement characterization and test report
- Simulation models