

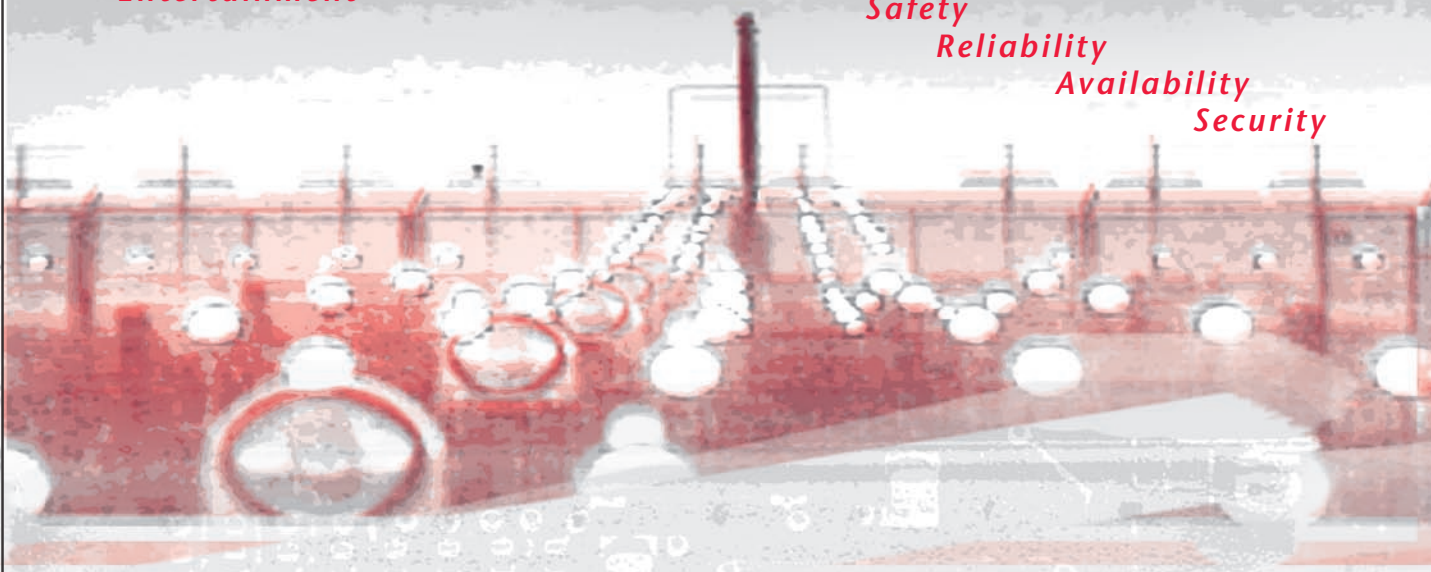
**Embedded Solutions**

***Rugged Computer Boards and Systems***  
***for Harsh, Mobile and***  
***Mission-Critical Environments***



*Control*  
*Supervision*  
*Communication*  
*Entertainment*

*Safety*  
*Reliability*  
*Availability*  
*Security*



**me**<sup>®</sup>  
mikro elektronik  
gmbh • nürnberg



**Control ...**

## **COTS Solutions and Custom Design**

*In accordance with market standards, for example DO-254 and DO-178B for avionics, EN 50155 for railways and ground transportation, German Lloyd for shipbuilding, E1 for automotive*

**Rugged and mission-critical computer boards and systems up to safety levels DAL A (aircraft in-flight equipment) and SIL 4 (onboard vehicle equipment).**

*“Founded in 1982 MEN Mikro Elektronik® develops and produces rugged computer boards and systems for control, measurement, test and simulation especially in harsh, mobile and mission-critical environments. With a strong focus on all kinds of mobile applications we cover in particular the market segments ground transportation, civil avionics, shipbuilding, commercial vehicles, as well as agricultural and construction machines.*

*More than 200 professional and highly motivated employees located in Germany, France and the USA are looking forward to partnering with you worldwide.”*

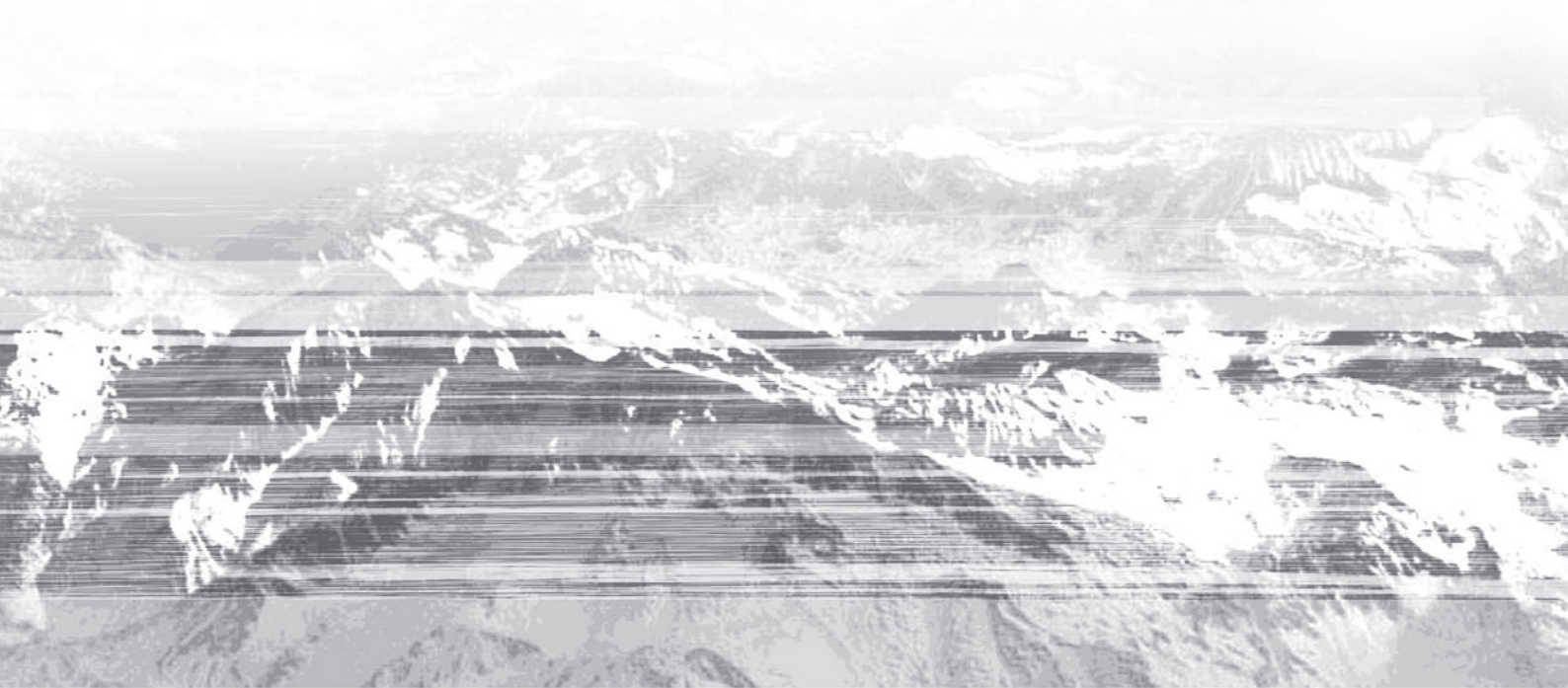
**Udo Fuchs, Chief Financial Officer, MEN Mikro Elektronik® Headquarters Nuremberg, Germany**



ISO 9001:2000  
ISO 14001:2005  
EN 9100:2003



**MEN Mikro Elektronik® is the first German company and one of only ten entities worldwide that is at the same time certified according to the EN 9100 (aerospace) and IRIS (transportation) quality management systems.**



## ***Safety-Critical Control Equipment for Airbus A400M***

The Airbus A400M is a new generation of freight planes which is predicted to become the backbone of the whole European air transport fleet. From a technical perspective and its entirely computer-controlled functions it is said to be state-of-the-art for the next three decades.

MEN Mikro Elektronik® provides the critical control computer for the cargo load system on board the A400M that is used for air dropping paratroops and equipment via parachute or gravity extraction. The so-called loadmaster workstation electronics unit is based on double Eurocard boards and requires design, test, verification and production in accordance with DO-254 level B and DO-178B level B.

**The system design provides the following certification-relevant key architectural concepts:**

- ⌋ *High operational safety:*
- ⌋ *Internal buses with error correction features*
- ⌋ *Triple redundant processors*
- ⌋ *Triple redundant dynamic memory*
- ⌋ *SEU tolerant FPGA implementation*
- ⌋ *All I/O implemented in FPGAs according to DO-254*
- ⌋ *Optimized for fast boot time (<1s)*
- ⌋ *Designed to facilitate worst case execution time analysis*
- ⌋ *Extensive BITE (built-in test equipment) features*

Additional boards from MEN are used in the A400M loadmaster control panels which are distributed across the aircraft.



Safety ...

## Triple-Redundant Lockstep Architecture on COTS SBCs

The CompactPCI® card D602 and the VMEbus card A602 described in the following come with advanced safety features that realize the functionality of three redundant systems on a single board. Their complex FPGA-based design helps dramatically lower software development costs as it automatically manages the system's triple-redundant processors and memory. The result: The system's redundant architecture is fully taken advantage of by software designed for a standard single-CPU board.

The cards are designed for deterministic operation and offer extensive BITE features (e.g., ECC error counters for all types of memory, monitoring of all internal voltages), internal buses with error correction and fault-tolerant (fail-operational) implementation. Three processors run in lockstep mode with 2-out-of-3 voting implemented in FPGA and software-assisted resynchronization, while the triple redundant dynamic memory automatically corrects upsets caused by cosmic radiation (SEU) and hardware faults. The system is powered by redundant local power supplies with separate power supplies for the three CPUs and the three main memory banks.

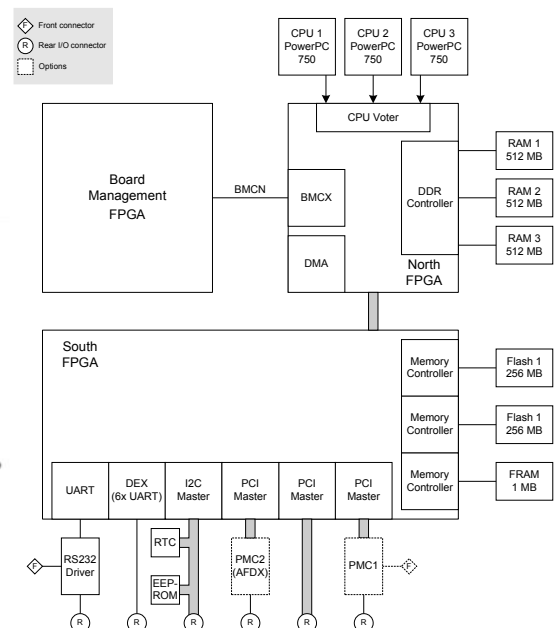
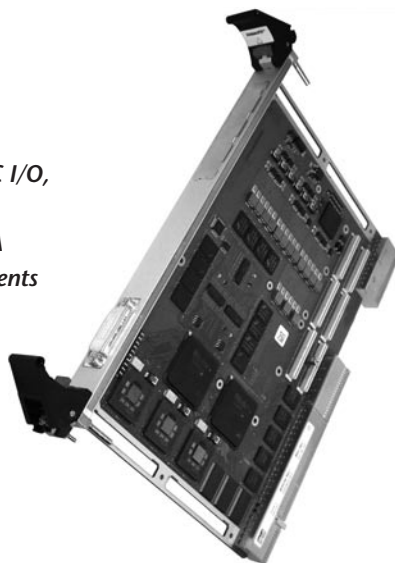
All I/O is realized in FPGAs (SEU-resistant, developed according to DO-254) and available on the system's rear connectors. Additionally, the cards offer two PMC slots.

A second SBC can be connected to build high-availability clusters. In that case the SBCs exchange data via a sextuple UART connection and a BMCX link.

→ Contact us under [info@men.de](mailto:info@men.de) to receive in-depth information about our safe hardware solutions.

### D602 – PowerPC®-based COTS SBC on 6U CompactPCI®

- 🔸 1-slot cPCI system slot card
- 🔸 Triple redundancy on a single board
- 🔸 3x redundant PowerPC® 750 CPU with up to 800 MHz
- 🔸 3x redundant 512 MB DDR RAM
- 🔸 2x redundant 256 MB Flash, ECC
- 🔸 1x 1 MB FRAM, ECC
- 🔸 Redundant local PSUs
- 🔸 2 PMC slots, e.g., for AFDX
- 🔸 All other I/O on rear: 1x RS232, PMC I/O, Board Management and more
- 🔸 Compliant with DO-254 up to DAL A
- 🔸 -40 to +55°C with qualified components
- 🔸 Versions for forced air cooling and conductive cooling environments
- 🔸 Running VxWorks, PikeOS

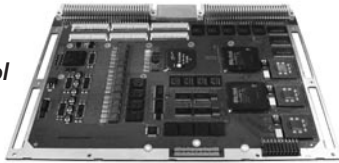




## AFDX – Ethernet for Mission-Critical Applications

### A602 – PowerPC®-based COTS SBC on 6U VMEbus

- ☛ 1-slot VMEbus system master
- ☛ 32-bit/33-MHz, 2eSST protocol
- ☛ All other features as D602



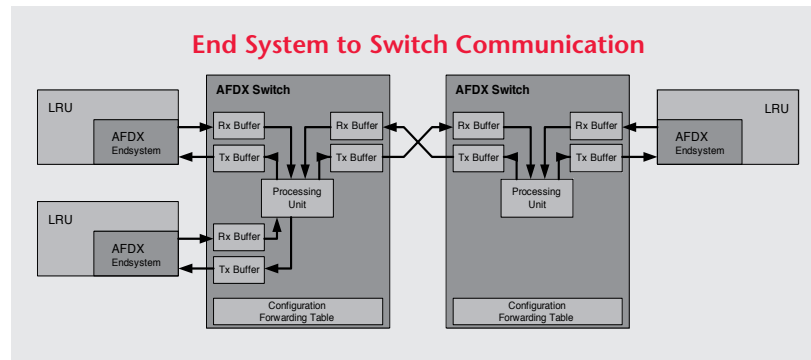
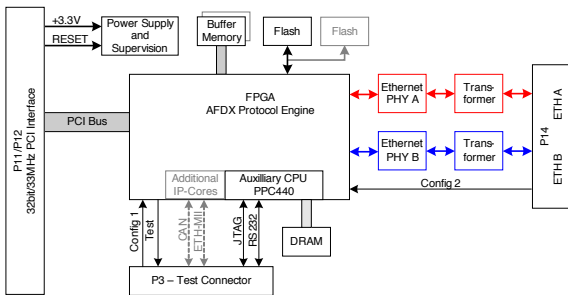
### P520 – AFDX Interface on PMC Module

- ☛ 32-bit/33-MHz PMC, 3.3V V(I/O)
- ☛ AFDX End System fully compliant to ARINC-664, Part 7
- ☛ Fully interoperable with Airbus AFDX
- ☛ SNMP and ICMP service on PMC
- ☛ ARINC-653 compliant host API
- ☛ Receive operation
  - ☛ Up to 255 virtual links
  - ☛ Up to 1023 ports
  - ☛ Up to 32 ports per VL
  - ☛ Up to four concurrent reassemblies per VL
- ☛ Transmit operation
  - ☛ Up to 63 virtual links
  - ☛ Up to 1023 ports
  - ☛ Up to 32 ports per VL



“Avionic Full Duplex Switched Ethernet” (AFDX), designated ARINC 664, is a specification for a deterministic aircraft data network for aeronautical, railway and military systems. The network architecture is based on standard IEEE 802.3 Ethernet technology. The benefits from using commercial-off-the-shelf (COTS) Ethernet components imply reduced overall costs, faster system development and less costly maintenance for the system network. Hardware components, cables and test equipment for Ethernet are field proven and much more affordable than “build-to-spec” avionics solutions. Standard commercial grade Ethernet however will not meet avionics network requirements. Therefore, AFDX extends the Ethernet standard by adding Quality of Service (QoS) and deterministic behavior with a guaranteed bandwidth. AFDX technology is currently being used in the Airbus A380 and A400M programs, as well as in the Boeing 787 aircraft.

→ Contact us under [info@men.de](mailto:info@men.de) to receive our AFDX technology white paper.



## Ethernet Switches

→ Find rugged standard product examples designed for mobile applications under [www.men.de/products/switches](http://www.men.de/products/switches)



RS1 – Rugged MIPIOS® Managed Ethernet Switch



## Rugged Electronics

... imply safe and reliable operation of a computer board or system in harsh environments.

Our boards and systems are developed to meet requirements like temperature ranges of up to -40 to +85°C, shock, vibration, chemical influence, the option of coating against humidity and others right from the start. To achieve the highest quality of the boards, fully automated production and most of the environmental testing is done in-house. All efforts are taken to deliver a perfectly reliable product for an operation period of theoretically up to 30 years.

→ Find more information about our rugged design expertise under [www.men.de/expertise/rugged-electronics](http://www.men.de/expertise/rugged-electronics)

## System Design Service

With our in-house mechanical design department we are an expert in complex system design, in particular for mission-critical applications.

The offer ranges from rugged stand-alone, wall-mount and DIN-rail standard box and display computers or Ethernet switches to individually configured 19" racks (CompactPCI® incl. PlusIO and Serial, and VMEbus) and entire custom developments.

We guarantee overall operability of each system, minimizing the integration effort and the handling cost on the client's side. The quality of our systems is assured by applying traceability through the V-model.

Qualification according to market standards is one of our key services. In close cooperation with certified test laboratories we prepare the systems to meet the standards of their final destination.

→ Find more information about our system design expertise under [www.men.de/expertise/system-design](http://www.men.de/expertise/system-design)

## Cooling Methods

... depend on the requirements of the application – whether on board a train, bus, airplane, ship, crane or truck. And even in smoothly conditioned fields of application it is essential to save power for the sake of the environment.

**Convection cooling** is the easiest method to cool board assemblies. It is done by guiding an air flow along the surface to be cooled. While the mechanical set-up is simple, there are some facts that may turn out to be serious drawbacks. Cooling fans, for example, have a limited lifetime, and with flowing air impurities and liquids can find their way into the device.

**Conduction cooling** optimizes the thermal contact to conduct the heat from the source to the outer wall of the enclosure. This makes the enclosure itself a heat radiator. Suitable measures must be taken to minimize the thermal transfer resistance from the electronic component to be cooled to the enclosure wall.

→ Find more information about our thermal management expertise under [www.men.de/expertise/thermal-management](http://www.men.de/expertise/thermal-management)

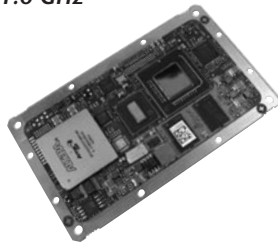
## Reliability ...

### Conduction Cooling with Computer-On-Modules (COMs)

Together with an application-specific carrier board, ESMexpress® and ESMini™ modules form semi-custom solutions for harsh environments. The modules are embedded in a covered frame to ensure EMC protection and efficient conduction cooling. Air cooling is also possible by applying a heat sink on top of the cover. The modules are firmly screwed to a carrier board and come with rugged industry-proven connectors supporting high frequency and differential signals. Only soldered components are used to withstand shock and vibration, and the design is optimized for conformal coating.

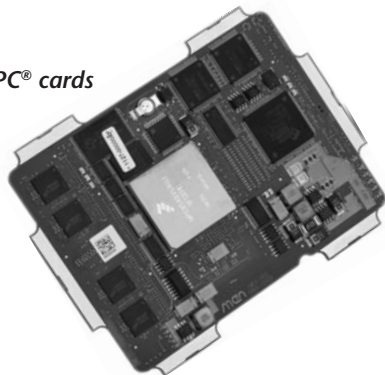
#### MM1 – ESMini™ with Intel® Atom™

- Intel® Atom™ Z530 or Z510, up to 1.6 GHz
- Up to 1 GB DDR2 SDRAM
- 1 PCI Express®
- Up to 2 Fast Ethernet interfaces
- 8 USB 2.0 (1 client)
- 2 UARTs
- Up to 2 CAN bus interfaces
- SDVO, LVDS
- Intel® HD Audio
- 40°C to +85°C screened
- 95x55mm form factor



#### XM50 – ESMexpress® with PowerPC® MPC8548

- MPC8548 (or MPC8543), up to 1.5 GHz
- Up to 2 GB (ECC) DDR2 SDRAM
- Up to 128 KB FRAM, 2 MB SRAM
- 3 (or 2) Gb Ethernet ports
- 6 USB 2.0, 1 USB client
- 3 SATA ports
- 1 PCI Express® x4
- MENMON™ BIOS for PowerPC® cards
- 40°C to +85°C screened
- 95x125mm form factor
- ANSI-VITA 59 in process



### Conduction Cooling with 3U CompactPCI®

The respective boards are based on the PICMG 2.0 standard for CompactPCI® and are embedded into a dedicated CCA frame for conduction cooling (CCA = conduction cooled assembly). The 9-HP assemblies can be used with a conduction-cooled subrack. It supports a thermal resistance of 0.4 Kelvin/Watt and temperature class Tx for 40 W maximum performance in combination with all boards designed for operation between -40°C and +85°C.

#### F50C – Conduction Cooled 3U CompactPCI® MPC8548 SBC


- 32-bit/33-MHz CompactPCI® system slot
- 1 slot, 9 HP front, rear I/O
- MPC8548 (or MPC8543), up to 1.5 GHz
- Up to 2 GB (ECC) DDR2 SDRAM
- Up to 128 KB FRAM, 2 MB SRAM
- Up to 16 GB SSD Flash
- FPGA for user-defined I/O functions
- MENMON™ BIOS for PowerPC® cards
- 40 to +85°C screened



#### CompactPCI® Rack with Conduction Cooling

- For standard 3U cards within CCA frames
- 3-slot 3U backplane
- System slot left, horizontal installation
- Outline 200 mm x 350 mm x 145 mm
- 4 MIL-C-38999 connectors (59 user I/O pins)
- PSU 18-32 V, 35 W
- 40 to +70°C operating temperature
- IP65 compliant
- For -40 to +85°C 3U CCA versions of MEN SBCs F12N, F13, F14, F15, F17, F18, F19P, F50C





*Supervision ...*

## **FPGA Technology in Mission-Critical Applications**

FPGAs – Field Programmable Gate Arrays – allow individual customization of the hardware at an attractive price even in low quantities. With an FPGA device on a computer board, it is possible to integrate additional I/O functions by means of IP cores without touching the board layout. FPGA-based solutions are flexible, offer long-term availability, support extended temperature operation and provide Flash structure to compensate for Single Event Upsets (SEU).

### **FPGA Solutions from MEN**

Many of our standard computer boards use FPGAs to realize I/O functions. Our IP cores are built in VHDL on the standard Wishbone bus. As the software views the FPGA as only one PCI device, we have defined a ROM memory structure that allows recognition of the individual functions and their resources and subsequent design of driver software. For safety critical applications our design team is capable of assessing the intrinsic failure modes of FPGAs and either detect or correct errors.

#### **Our IP cores comprise**

- ☉ graphics controllers, touch
- ☉ fieldbus interfaces (e.g., CAN, MVB)
- ☉ Ethernet (e.g., for AFDX)
- ☉ UARTs
- ☉ memory controllers
- ☉ GPIO, binary I/O, etc.

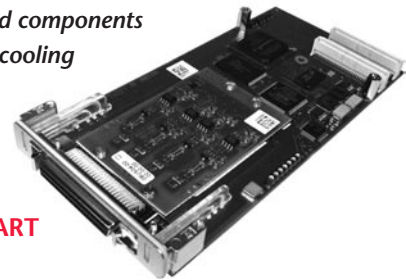
### **FPGA Development with Mezzanine Cards**

FPGA development kits based on the so-called USM™ concept are offered to users who like to write or implement specific IP cores on their own. Wishbone-based standard IP cores from MEN can be combined with the client's or third-party functions.

USM™ Universal Submodules make mezzanine cards flexible, cost and time-saving. A main PMC, XMC or M-Module gets its specific function through the IP cores implemented inside its onboard FPGA. This function can be changed at any time through implementation of different IP cores. The corresponding line drivers are realized on a USM™ adapter PCB which is plugged on the main mezzanine.

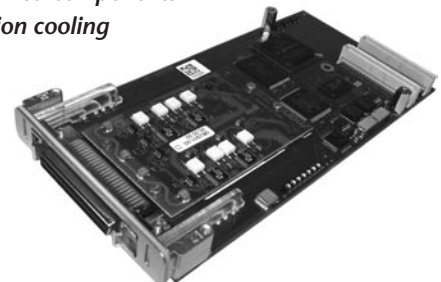
#### **Example P506 – Quad CAN Bus Interface PMC**

- ☉ Based on USM concept
- ☉ Full CAN/Extended CAN
- ☉ 4 independent isolated channels
- ☉ ISO high-speed coupling
- ☉ Up to 1 Mbit/s data transfer rate
- ☉ CANopen master, slave and Layer 2 support
- ☉ -40 to +85°C with qualified components
- ☉ Convection or conduction cooling



#### **Example P507 – Quad UART Interface PMC**

- ☉ Based on USM concept
- ☉ 4 high-performance UARTs
- ☉ Full and half duplex, software programmable
- ☉ Serial data rates up to 921,600 bits/s
- ☉ Isolation between channels
- ☉ -40 to +85°C with qualified components
- ☉ Convection or conduction cooling





## Availability ...

## High Demands on All Levels

Electronic components in mobile applications need to meet the most severe environmental requirements, and often with stringent safety criteria as well. Because of the potential danger to human life, high costs in the event of a failure, and the fact that maintenance may have to be done in irregular intervals, such systems have to provide a predictable reliability.

### Design Center

Quality in design is a deciding factor for reliability of the electronics in operation. Software, hardware and IP-core design are therefore done according to an adapted V-Model depending on SIL level – from requirement to architecture specification, from system level to component level, to development, implementation and validation. During the design process, the reliability of the electronics has to be defined under given environmental impacts and for a desired period of time.

Safety management tools including requirement tracing and obsolescence management are used.

Risk management – identification, analysis, prioritization and solution of all possible risks in technical, financial or personnel-related respects, is applied as well.

The configuration management and project controlling process is implemented in the in-Step project management software.

### In-House Production and Test

To guarantee the highest possible quality, the complete production process on our in-house line is fully automated. At the beginning of the manufacturing process, the solder paste print is subjected to a 100% automatic optical inspection (AOI), followed by a 3D inspection of components during the placement in the pick-and-place machine.

The soldering process in the vapor-phase reflow oven, which prevents the components from being overheated is followed by an optical inspection of the finished boards. During a boundary scan test, the digital components are tested and chips may be programmed. An automatic 100% function test ends the process.

Traceability of all components from incoming goods up to dispatch of the finished product is guaranteed by time stamps throughout the production process.

### Environmental Test Lab

We carry out the necessary preliminary qualifications in our own environmental test lab, high-voltage and EMC chambers.

Qualifications include temperature tests from -70°C to +180°C at a humidity of 10 % to 98 % and temperature variations up to 10 Kelvin per minute.

The standard parameters for shock and vibration tests are 15 g / 11 ms (shock), 10 g / 16 ms (bump) and 2 g / 10 to 150 Hz (vibration). Individual test parameters are used depending on the application.

Standard EMC tests include ESD (IEC 1000-4-2), burst (IEC 1000-4-4) and radio disturbance (EN 55022).

MTBF values are calculated according to IEC TR 62380 and based on an operating temperature of +40°C.

Further calculations and risk analyses, according to models such as FMEA (Failure Mode and Effects Analysis), Hazard Tree or BITE (Built-In Test Equipment), are prepared individually.

Tests such as HASS (Highly Accelerated Stress Screening) and HALT (Highly Accelerated Life Test) to detect possible weaknesses in electronics and mechanics can also be carried out.

### Our Quality Management Systems

- ISO 9001:2000 since 1997
- ISO 14001:2005 (environmental standard) since 2003
- EN/AS 9100 (aerospace standard) since 2008
- IRIS (International Railway Industry Standard) since 2009
- GRESS (General Requirements for Equipment and System Suppliers from Airbus)
- EFQM (European Foundation for Quality Management – in preparation)

**We are a member of the UN Global Compact Initiative.**



ISO 9001:2000  
ISO 14001:2005  
EN 9100:2003





## Entertainment and Communication ...

### Standard Product Overview

#### **CompactPCI®, CompactPCI® PlusIO and CompactPCI® Serial**

CompactPCI® is an established standard for building cost-effective, reliable industrial computers. Today's users appreciate the modularity, robustness and economic efficiency of CompactPCI®. CompactPCI® Serial is going to offer all these advantages plus fast serial data transfer.

PICMG 2.30 CompactPCI® PlusIO constitutes the migration path between the basic CompactPCI® standard PICMG 2.0 and CompactPCI® Serial (PICMG CPCI-S.0). The basic standard is complemented by PICMG 2.30. This extension defines the J2 pin assignment and introduces at the same time a new, 100% compatible connector, which is also suited for transmission of high frequencies. For this, only a few additional ground signals are required, so that a high number of interfaces can be led to the backplane. The parallel PCI bus is not changed but is limited to a data bus width of 32 bits. PICMG 2.30 can be used for both single and double Eurocards. A board which supports CompactPCI® PlusIO remains 100% compatible to the CompactPCI® standard, so that it can be used without limitations in existing systems. The high-speed connector is also 100% compatible.

CompactPCI® Serial, in contrast to CompactPCI® PlusIO, is a new independent basic standard. It introduces a completely new connector, enables a much higher signal density and supports even higher transmission frequencies of 12 Gb/s and more. The CompactPCI® Serial architecture, a simple star combined with a full mesh for Ethernet, functions without switches and bridges.

#### **Computer-On-Modules**

ESMexpress® and ESMini™ modules are complete computers on a plug-on module. By configuring the I/O on an individual carrier board the functionality can be tailored to the application, thus saving costs and time-to-market. These COM standards have been developed for applications requiring highly robust electronics which ensure safe and reliable operation even in harsh environmental conditions, e.g. in the fields of railway and avionics. ESMexpress® (125 x 95 mm) and ESMini™ (95 x 55 mm) are screened and released for operating temperatures of -40°C to +85°C – with conduction or convection cooling. By standard, the modules are embedded in a covered frame which ensures complete EMC protection and allows efficient conduction cooling.

#### **Display Computers**

MEN's display computers are rugged, fanless and maintenance-free panel PCs for use in harsh, mobile and mission-critical applications in transportation, avionics, medical engineering and industrial automation. The robust stainless enclosure is protected against violent impacts and designed for a safeguarded use in direct contact with humans, e.g. for infotainment purposes in trains, public buses or airplanes, for human-machine-interfaces, for video control and ticketing.

#### **Box Computers**

Our box computers are designed for Ethernet connectivity, comply with the EN 50155 railway standard, fulfill IP67 and are certified to E1. They are housed in a rugged aluminum enclosure prepared for wall or DIN-rail mounting. Dust- and waterproofness

according to IP67 is achieved through the use of rugged M12 connectors. MEN's box computers are designed for extreme operating temperatures. The internal electronics are conformally coated.

#### **Ethernet Switches**

Whether managed or unmanaged, in CompactPCI® format or as stand-alone, rack- or DIN-rail-mountable units, MEN Ethernet switches are an easily customizable, open low-power platform for harsh environments and operating temperatures from -40 to +85°C. The rugged Ethernet switches were specifically designed for mobile communication systems. They are fully compliant with the EN 50155 railway standard and feature a wide-range power supply. They consume less than 7 W and need no cooling. The PCBs are ready for coating and there are no socketed components, hardening the product against shock and vibration.

#### **Further standard products comprise**

- ☞ I/O cards for 3U CompactPCI®
- ☞ CompactPCI® and VMEbus cards in 6U form factor
- ☞ PMC and XMC mezzanine cards, also with conduction-cooled versions
- ☞ M-Module™ mezzanine cards with analog, binary, robotics, motion and instrument functions
- ☞ PSUs with dedicated features like 9 to 154 V wide-range input
- ☞ Selection of 19" racks

→ Find our complete range of standard boards and systems under [www.men.de/products](http://www.men.de/products).

## Challenging Applications

### Locomotive Drive Control

Computerized systems are used for safe and economical operation of modern rail vehicles. They control, monitor, and diagnose all vital functions inside the vehicle, optimize operation processes and relieve the train driver. Custom DIN rail computers (PLCs) have been developed for locomotive controls of different manufacturers that consist of one PowerPC® module each, a wide-range PSU, CAN-bus-to-MVB and CAN-bus-to-WTB gateways, and several analog and binary I/O modules.



### Automatic Train Operation

The demand to optimize mass transit is increasing rapidly, especially in the growing Asian markets. Driverless subway systems allow a journey from station to station that is optimized for energy consumption and speed as well as flexible in the use of vehicles and the vehicle density that meets demands in addition to enabling a stop at the station that is precise to the centimeter. Depending on the project, different platforms are used to control and monitor the ATO functions inside the vehicle. Typical projects are based on redundant standard CompactPCI® computers in 3U format with Intel® CPU boards, analog and digital I/O, pick-ups for the wayside sensors and optional fieldbus extensions like MVB.



### Control of Driverless Buses

There are some successful initial projects that involve driverless buses. The computers used here control the speed and direction of the bus, with the bus moving on an "invisible" lane. This application uses modified standard CompactPCI® boards based on PowerPC® in 3U format that are housed in a conduction-cooled enclosure.



### Railway Signaling Computers

Operation of switches requires 100% reliable electronics and is one of the most safety-critical applications in the railway area. Electronic signaling systems combine complex route information with modern communication and monitoring for efficient railway transport. All signaling computers have a multiple-redundancy set-up for safety and availability reasons. Intel® based Compact-PCI® computers in 3U and 6U format are currently in use.



### Ventilators for Intensive Care

Ventilation units in medical environments have direct influence on the health of the patient. They are used for patient monitoring, invasive and non-invasive care, and for adult, pediatric and infant therapy.

Parts of the control of these devices are safety-critical. The application is built around a Computer-On-Module concept – an ESM module based on PowerPC®, with the complete user-specific I/O realized in an FPGA (graphics, binary I/O, pulse width measurement, quadrature decoder, frequency counter, additional Ethernets and UARTs).



### Large Hadron Collider at CERN

Located in a circular tunnel of 27 km length situated 50 to 175 m underground the Large Hadron Collider has been developed to find extremely rare physical events by collision of two rotating proton beams and 600 million collision events per second. The huge magnets of the LHC are controlled by standard VMEbus PCs based on Intel® Core™ 2 Duo architecture.



# Embedded Solutions – Rugged Computer Boards and Systems for Harsh, Mobile and Mission-Critical Environments

## Technology Partners

FPGA Technology and Nios® Soft Processor Cores from Altera® Corporation



PowerPC® Processors from Freescale™ Semiconductor



Multi-Core, Pentium and x86 Processors from Intel®



QNX® Real-time Operating System from QNX®



19" Rack Technology from Schroff®



Profibus Protocol Stack from Softing



Embedded Linux from Sysgo Real-Time Solutions



CANopen Protocol Stack from Vector Informatik



VxWorks® Real-time Operating System from WindRiver



INTEGRITY® Real-time Operating System from Green Hills® Software Inc.



Semiconductor distributor for Intel® Atom™ and alliance "Smart µSolutions"



## Member of

CAN in Automation



Competence initiative CNA e.V.



Active as a cluster platform for innovative railway technology in Bavaria

Open Standards Alliance



PCI Industrial Computer Manufacturers Group



Peripheral Component Interconnect Special Interest Group



Universal Serial Bus Implementers Forum, Inc.



Our business ethics in the daily conduct with customers, partners and employees is determined by the ten principles in the areas of human rights, labor, environment and anti-corruption of the United Nations Global Compact Initiative.



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[www.menmicro.com](http://www.menmicro.com)

## Ordering and Shipping Information

- For product ordering numbers please refer to the corresponding data sheets on MEN's web sites.
- Hardware and software user manuals are ready for download from our web sites.
- Software packages are ready for download from our web sites.
- For technical support please refer to our web sites.
- Shipment is done ex works, excluding insurance, according to ZVEI (General Conditions of Supply and Delivery for Products and Services of the Electrical Industry).
- Minimum order value is EUR 100 or USD 200.
- Warranty on MEN products is 24 months.

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