

# » Application Story «

## CompactPCI in Industrial Automation



## Industrial Measurement Technology with a CompactPCI Core

For its R&S CompactTSVP modular test system with embedded CPU, Rohde & Schwarz relies on 3U CompactPCI and rear I/O assemblies from Kontron



The application of industrial measurement technology in ATE systems (Automatic Test & Measurement) has changed continually over the years. Radical changes have been based primarily on the advent of new standardized components whose use is very commercially attractive.

The increasing use of ATE systems worldwide has led to more flexible modular systems that can be adapted to local requirements and offer cost-effective configuration and rapid implementation. In many applications, 'built-in' computer performance also represents a key factor for success. Rohde & Schwarz meet this requirement with their R&S CompactTSVP test platform, which employs a standard Kontron CompactPCI CPU board as the core of the system.

## Modular measurement technology for development, production and service

The major goal in the development of the new platform was to provide the user with the broadest possible range of measurement methods for modern testing technology. Besides the Rohde & Schwarz modules, other available CompactPCI and PXI hardware components (3U) can be integrated into the system.

With the new R&S CompactTSVP test platform, users in development, production and service receive a basic toolbox of measurement functionalities and communication interfaces for hardware and software.

The measurement and switching modules are designed for use in the function testing of electronic assemblies. This can optionally be expanded to a 'combo test' by an in-circuit test at the component level. Another important enhancement is the module for digital function testing. With a high-performance processor on board, complemented by a programmable FPGA, the module can also handle several standard firmware programming processes for the respective DUT (Device Under Test) components at the same time.

Embedded computer systems have earned a solid position at the system and device levels as the architecture upon which measurement and test devices are built. Until now, the range of performance, speed of execution and superior user interface that are required have not been obtainable using traditional microprocessor controls and a monitor with keyboard. One of the recognized, open standards for embedded CPUs is the CompactPCI bus established by PICMG(1).

PXI (PCI eXtensions for Instrumentation) is the expansion of the cPCI modular standard for PC-based measurement systems. Rohde & Schwarz combine properties that are important for measurement technology from both standards in their R&S CompactTSVP test system platform; they have further enhanced the internal functionality with an analog measurement bus, plus the proven CAN bus, which is included as a serial communication interface. All system components were modularly designed and can be exchanged easily for servicing purposes.

## Criteria for selecting the embedded computer

Following Rohde & Schwarz's decision to use the PXI and CompactPCI open standards, it was necessary to select the heart of the independent test system – the "embedded

controller' – from among the large number of CompactPCI CPUs available on the market. Fundamental to an embedded computer, of course, are the current performance benchmarks of the available chipsets since, from the user's point of view, most functionalities such as processor performance and memory size are assumed to be state-of-the-art.

In the systematic evaluation of different boards' properties, ease of integration into the test system was a particularly important criterion. After a detailed analysis of board providers, which included among others the criteria listed below, Rohde & Schwarz decided on a CompactPCI board from Kontron. The boards were judged against the following criteria:

### » Maximum performance in the minimum space

One criterion for measurement systems is compactness: the maximum system performance is needed in the smallest possible space. For that reason, it was important that the CPU board cover no more than 2 slots on the backplane so that 14 slots would remain available for measurement and switching modules. These application slots on the backplane are essential for system performance.

### » Intel Embedded Roadmap = 5-7 years of availability

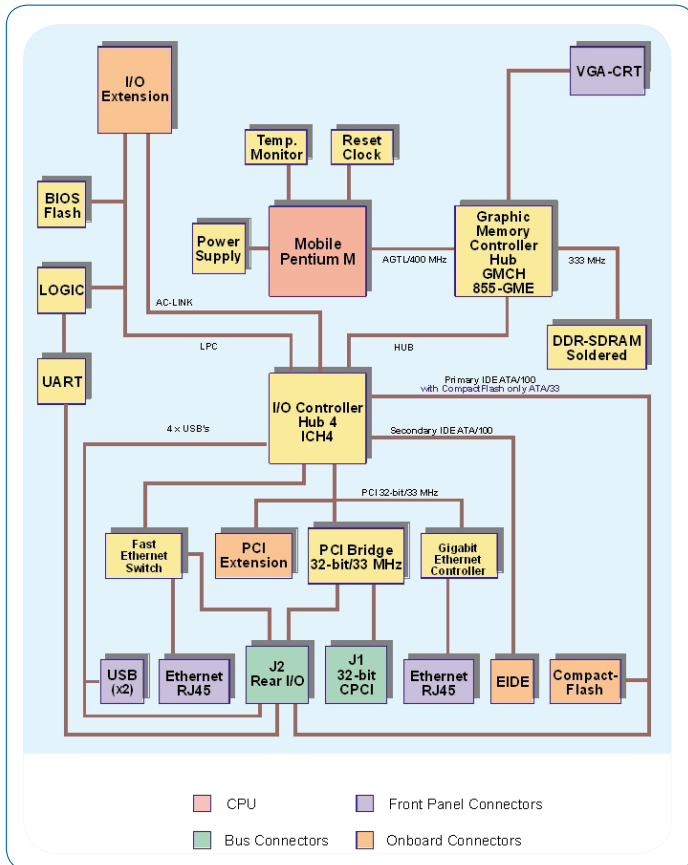
Future availability should be appropriate to the average lifespan of the test system, so that even previously shipped configurations should be reproducible 1:1 and obtainable later. Furthermore, changes to new CPU generations must already be supported in order to ensure functional replacement. Experience already gained in the generation change from the Kontron 3U CompactPCI CPU board CP302 to the CP304 demonstrates Kontron's customer-friendly service concept. Today, customers can replace a CP302 with an Intel® Mobile Pentium® III processor from the 'heyday' of Windows NT with the same CPU from service stock or with a higher performance CP304 with Intel® Pentium® 4 processor with Windows 2000 or Windows XP. With the coming CPU generation change to the CP306 with Intel® Pentium® M, sights are now set on ensuring the same kind of continuity so that users can always benefit from the technological advances that are being achieved.

### » Power consumption in the system and passive cooling

The power supply had to be implemented as safely as possible, be maintenance-friendly and, at the same time, save space. For maintenance reasons, a mechanically closed 'power supply block' screwed to the back of the device was not acceptable. Therefore, the power supply was placed between the CPU and the left-hand wall. Most configurations can operate with one power supply slot, i.e. with a power input of 250 W. A second power supply slot is designed to accommodate higher power consumption requirements. There is a redundant circuit option for the power supply backplane; in the event of a failure report from the base power supply, the second power supply can take over immediately.

The power loss and heat balance in the CPUs, which are offered with passive cooling, has been technically resolved very well. The CP304 with Intel® Pentium® 4 processor

has a typical power consumption of 18 watts. The planned successor CPU CP306 with Intel® Pentium® M in the 1.6 GHz and 1.8 GHz versions will typically make do with 20 watts and offer significantly higher performance.



*Automated logic diagram of the Kontron CP306 embedded computer with the available interfaces.*

#### » Computer interfaces

PC-typical interfaces, such as USB and Ethernet, are also gaining widespread acceptance in measurement technology. In the development of new measuring devices, the traditional GPIB and RS232 interfaces are increasingly being replaced, mostly with USB 2.0 ports, as well as with Ethernet or Gigabit Ethernet offering standard services such as TCP/IP.

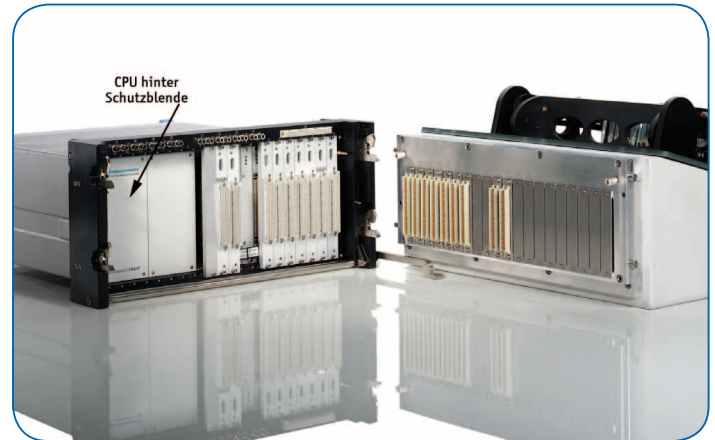
#### » Cooperative use of CompactPCI and PXI features

The basic R&S CompactTSVP device contains a bus circuit board with the industrial form of the PCI bus, the CompactPCI Bus. The measurement technology expansions of the PXI standard – the most important being 8 trigger lines and a highly precise 10 MHz synchronization frequency – are supported on 11 of the total of 14 peripheral slots.

#### » Rear I/O capability

Moreover, the CompactPCI standard 32-bit with rear I/O also offers the possibility of leading signals through the rear side of the test instrument via the rear I/O concept without additional cabling to the CPU connections on the front side. In practice, the rear side cabling via the rear I/O modules is

always a major advantage when a 19-inch cassette fixture is used on the front side to lead hundreds of measurement signals to the system, depending on the application. In this case, mass plug connections are lined up on the extension board, and the contacts are closed with a robust locking mechanism when the board is changed. The typical PC cabling for monitor, keyboard, and mouse would only interfere on the front side of the test system. Therefore, it is installed on the rear side via the rear I/O module available to the CPU.



*Test system and test adapter are easily connected.*

#### » Support for Windows and Linux operating systems

Microsoft Windows dominance of the market includes the measuring devices and test systems field. However, there is an increasing number of scientific and industrial applications which use the Linux operating system. The CPU for the test platform must therefore be available with pre-installed Linux, a requirement covered by the Kontron board. Thanks to the availability of important system components such as PXI kernel drivers, IVI Runtime and generic device API, it is also possible to operate the proven driver and self-test software from Rohde & Schwarz under this operating system.

## CompactPCI CPU assembly takes over management

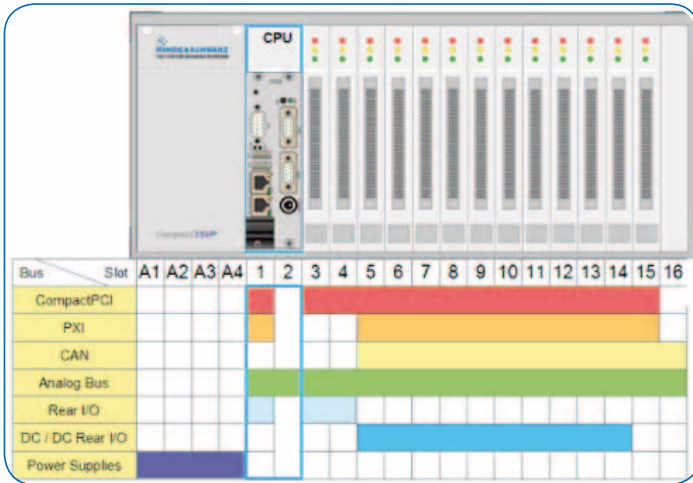
For the integrated management and control of their test platform, Rohde & Schwarz uses a 3U CompactPCI CPU assembly from Kontron. The fundamental know-how of Rohde & Schwarz lies in the measurement technology modules and the appropriate module software. Because the system is to be modular, easy to configure, and particularly robust, CompactPCI was identified as an ideal form factor for the CPU board.

The CP304 with Intel Pentium 4 processor, which has performed flawlessly for over three years in previously shipped systems, meets the system specification in every regard and also offers the required rear I/O support via the J2 plug in accordance with PICMG 2.0. There will soon be an update of the modular test platform as Windows 2000

will be replaced on the test platform by Windows XP. The Kontron CP306 CompactPCI CPU should further improve the performance of the system solution. The CP306 is equipped with an Intel Pentium M 745 processor. Thus, it provides the system with performance comparable to that of a 2.8 GHz Intel Pentium 4 processor, but due to the power consumption reduction of approximately 50 percent, it gets by with passive cooling and thus matches the CP304 in terms of power loss performance. These are prerequisites to meet the requirements of Rohde & Schwarz regarding the new processor board.

## Power loss or desire for performance?

With the CP306, Kontron now also offers, alongside the 1.1 GHz and 1.6 GHz Pentium M with passive cooling, a 1.4 GHz version with the LV (low voltage) Intel Pentium M 738, a 1.8 GHz version (Pentium M 745 processor), and even a 2.0 GHz version (Pentium M 755 processor). Because both the processor and the memory are directly soldered, the board is suitable for harsher environmental conditions. Compared to the 1.6 GHz Pentium version, the L2 cache has doubled to 2 MB, but the power loss has actually been significantly reduced by the new 90 nm manufacturing process. Besides the high-performance processor, 333 MHz memory frequency, and 400 MHz processor side bus, the CP306 is distinguished by its comprehensive communication interfaces: on-board are 1 x Gigabit Ethernet, 1 x Fast Ethernet, 4 x USB 2.0, and upto 4 COM ports. Additionally, Kontron expands the peripheral interfaces through standardized rear I/O assemblies as needed. Along with the CompactFlash socket, a dual ATA100 interface has also been integrated. The memory has a maximum size of 1GB DDR-SDRAM/PC333 (with ECC). The CPU is available as single slot (4HP) or dual slot (8HP). In the 8TE width, the CP306 offers legacy support (PS2, serial and parallel interfaces) and 2.5" HDD slots. The CP306 is also designed for an extended temperature range (from -40°C to +85°C). Software support is offered for Windows XP, XP Embedded and 2000, Linux and VxWorks, and more.



*The basic device and the embedded CPU form the core of the open system platform.*



# ROHDE & SCHWARZ

## Quotes

“The Kontron CompactPCI assemblies we use are fail-safe and robust to meet the industrial requirements in our demanding test systems,” says Daniel Seemann, Product Manager Systems and Projects with Rohde & Schwarz in Munich.

“The CompactPCI assemblies from Kontron are very carefully developed and produced. We have had nothing but good experiences so far. Moreover, Kontron also offers 3U rear I/O modules, which are particularly important for the ergonomic construction of our test system”, adds Dipl.-Ing. Michael Kammerer, team leader in the development of the R&S CompactTSVP test system, and responsible for the validation of the CompactPCI assemblies.

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## About Kontron

Kontron designs and manufactures standards-based and custom embedded and communications solutions for OEMs, systems integrators, and application providers in a variety of markets. Kontron engineering and manufacturing facilities, located throughout Europe, Americas, and Asia-Pacific, work together with streamlined global sales and support services to help customers reduce their time-to-market and gain a competitive advantage. Kontron's diverse product portfolio includes: boards and mezzanines, Computer-on-Modules, HMIs and displays, systems, and custom capabilities.

Kontron is a Premier member of the Intel® Embedded and Communications Alliance.

For half-a-decade now, Kontron has been named a VDC *Platinum Embedded Board Vendor*. Based entirely on user feedback, industry professionals evaluate vendors on over 45 non-product related criteria. Kontron is only one of two companies to receive the Platinum award 5-years running.

Kontron is listed on the German TecDAX stock exchange under the symbol „KBC“.

For more information, please visit: [www.kontron.com](http://www.kontron.com)

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